

2006~2007년도 대한의용생체공학회 제16대 임원

직 책	성 명	소 속	직 책	성 명	소 속
회장	오용석	서울의대	학술이사	김인영	한양대
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◎ 국제학술대회 조직위원회 임원 ◎

▶ 준비위원장: 윤행로

▶ 준비위원: 윤행로, 이운선, 이경중, 김동윤, 윤영로, 김영호, 신태민, 김법민, 김한성, 김경환, 정병조, 김지현, 이상우, 임창환

2007년도 대한의용생체공학회 춘계학술대회 프로그램

1. 춘계학술대회 일정 및 장소

| 일정 | 2007년 5월 11일(금요일) - 5월 12일(토요일)

| 장소 | 전북대학교 진수당

2. 세부 일정 개요

5월 11일 (금요일)					
시간/ 장소	A (1층 최명희홀)	B (3층 351호)	C (3층 352호)	D (3층 353호)	3층 복도
09:00 ~	등록				
09:30 ~ 10:30	튜토리얼				
10:30 ~ 11:30					
11:30 ~ 12:00	총 회				
12:00 ~ 13:30	점 심			학생논문경연	
13:30 ~ 15:30		특별강연 I	일반연제 I	헬스케어 I	포스터 I
15:30 ~ 16:00	휴 식				
16:00 ~ 18:00		특별강연 II	일반연제 II	헬스케어 II	포스터 II
18:00 ~	만찬				
5월 12일 (토요일)					
09:00 ~ 09:30				일반연제 IV	
09:30 ~ 11:30		특별강연 III	일반연제 III	대한의공협회 행사	포스터 III

- * 특별 강연 I : Neural Interface (좌장: 백주열, 남윤기)
- 특별 강연 II : Neural Signal Processing (좌장: 박해정, 김준식)
- 특별 강연 III : Neural Modulation (좌장: 장진우, 신형철)
- 일반 연제 I, 포스터 I : 의학영상시스템 및 신호처리
- 일반 연제 II, 포스터 II : 생체재료, 인공장기, 생체역학 및 재활공학
- 일반 연제 III, 포스터 III : 생체계측시스템 및 의공학신기술
- 일반 연제 IV : 임상공학

※ 논문 발표시 주의 사항

1. 모든 접수논문은 일반연제(구연)/포스터 구분을 확인한다.
2. 구두발표논문은 세션 10분전에 발표장소에 도착하여 진행요원에게 전달하도록 한다.
(모든 발표자료는 PPT file로 준비하며 개인 노트북 발표는 진행상 시간이 걸리므로 자제한다.)
3. 일반연제(구두발표) I, II, III 및 포스터 I, II, III 은 동시에 진행하며, 해당 분야의 연구자는 일반연제(1시간 소요)에 참석한 이후 참석자 모두가 포스터 게시물로 이동하여 토의(1시간 소요)하도록 한다.
4. 구두발표논문은 12분 발표 3분 질의응답으로 진행한다.
5. 포스터는 해당 세션 발표시간 전에 부착하고 발표시간 이후 즉시 탈착하도록 한다.
6. 포스터의 크기는 가로(폭방향) 120 cm, 세로(길이방향) 100 cm으로 한다.
6. 구두발표 논문 및 포스터발표 논문 중 우수 논문은 심사를 통하여 시상할 예정입니다.

※ 논문 선발

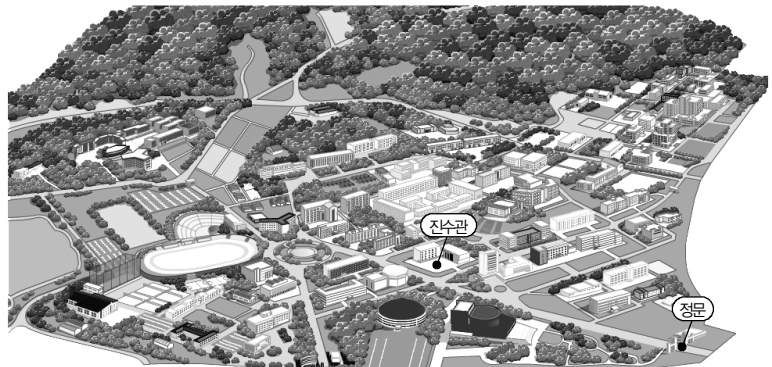
1. 학생논문 경연 (S1~S6): (좌장 - 신동익, 이상민, 김경섭)
S1 한지훈(O7S-131), S2 은혜인(O7S-103), S3 탁성희(O7S-101), S4 이인광(O7S-049), S5 김신애(O7S-042), S6 윤한빈(O7S-041)
2. 일반연제 I (O1-1~4): 의학영상시스템 및 신호처리(좌장 - 문치웅, 장동표)
O1-1 우동철(O7S-105), O1-2 류상백(O7S-107), O1-3 이연석(O7S-150), O1-4 정목근(O7S-015)
3. 일반연제 II (O2-1~4): 생체재료, 인공장기, 생체역학 및 재활공학(좌장 - 김영호, 이규백)
O2-1 김영호(O7S-002), O2-2 이규백(O7S-169), O2-3 이경수(O7S-036), O2-4 Yong-Jun Piao(O7S-095)
4. 일반연제 III (O3-1~4): 생체계측시스템 및 의공학신기술(좌장 - 김종원, 백주열)
O3-1 오정은(O7S-044), O3-2 김윤성(O7S-043), O3-3 김종원(O7S-168), O3-4 백주열(O7S-013)
5. 일반연제 IV (O4-1~6): 임상공학 (좌장 - 권혁남, 김서환)
O4-1 조성범(O7S-113), O4-2 김진만(O7S-112), O4-3 사은식(O7S-110), O4-4 이호석(O7S-01354), O4-3 변영석(O7S-040), O4-4 기선우(O7S-008) (뒤에 세 개는 기타로 접수하였음)
6. 학생경영논문 지원자 중 포스터로 보내는 것은 발표영역에 해당하는 곳으로 포스터를 보내주시기 바랍니다.
7. 포스터 할당: 다음분야를 임의로 poster 번호 할당
 - 포스터 I (P1-1~56): 의학영상시스템 및 신호처리 (47): 의학영상시스템(10), 의학영상처리(19), 신호처리(15), 학생논문 중 의학영상 관련(3) (029, 012, 005)
 - 포스터 II (P2-1~54): 생체재료, 인공장기, 생체역학 및 재활공학 (42): 생체재료(8), 인공장기(3), 생체역학(9), 재활공학(9), 학생논문 중 재활공학(1) (094), 기타 중(12) (145, 140, 120, 118, 115, 104, 089, 096, 069, 065, 047, 009)
 - 포스터 III (P3-1~49): 생체계측시스템 및 의공학신기술 (48): 생체계측(28), 생체시스템(8), 기타(11), 학생논문중 생체계측(1) (038)

※ 참가비 납부방법

2007 춘계	사 전	당 일
일 반	6 만원	7 만원
학 생	4 만원	5 만원
비회원 일반	9 만원	10 만원
비회원 학생	6 만원	7 만원

- 학술대회 논문발표자는 반드시 학회 회원으로써 연회비 납부와 사전등록비를 각각 따로의 계좌 번호 입금처리를 하여 주셔야만 하오니, 이점 착오 없으시길 바랍니다.
- 사전등록비 납부방법: 국민은행: 계좌번호: 031-01-0420-215(예금주: 대한의용생체공학회)
- 연회비 납부방법: 국민은행: 계좌번호: 031-25-0006-795(예금주: 대한의용생체공학회)

※ 학회장소: 전북대학교 진수당



고속버스 이용시

- 전주고속버스 터미널(약 1.5 km): 도보 15 ~ 20분
- 전주시외버스 터미널(약 1.8 km): 도보 20 ~ 25분
- 전주역(약 3.6 km): 택시 10 ~ 15분
- 익산역(철도, 고속철도)(약 25.5km): 시외버스 30분
- 광주공항(약 105.9km): 고속버스 1시간 20분

고속도로 이용시

- 호남고속도로 이용(8.2km) 전주 I.C부터:
전주 IC → 호남제일문 통과 → 팔달로 → 전북은행 본점 → 전북대학교
- 대전-통영 고속도로 이용(50km) 장수 J.C부터: 장수 톨게이트(우회전)
→ 장계에서 진안/전주 방향(좌회전) → 26번 국도 → 전주역(turn left) → 전북대학교
- 서해안고속도로 이용(31.2km) 군산 I.C부터: 군산 I.C → 자동차고속도로
→ 호남제일문 통과 → 팔달로 → 전북은행 본점 → 전북대학교

목 차 | 2007년도 대한의용생체공학회 춘계학술대회

특 강

Special Session I : Neuron-Computer Interface

좌장 | 남윤기, 백주열

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고려대 | 백주열
- Microelectrode array technology for neural recording and stimulation of patterned neural tissues in vitro 6
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- 감각, 운동기능 회복을 위한 신경보철시스템 및 신경접속 전극 7
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Special Session II : Neural Function Analysis

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- Magnetoencephalography : Acquisition, Analysis, and Applications 12
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- fMRI의 기본원리와 가상현실기술과의 융합 13
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- Application of Multimodal Neuroimaging 14
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Special Session III : Neural Modulation

좌장 | 장진우, 신형철

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Basics of Neural Engineering :
from Neuroscience to Neural Prosthesis

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Special Session I : Neuron-Computer Interface

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- Microelectrode array technology for neural recording and stimulation of patterned neural tissues in vitro
KAIST | 남윤기
- 감각, 운동기능 회복을 위한 신경보철시스템 및 신경접속 전극
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The development of the flexible microelectrode

백 주 열
고려대학교

지난 10여 년간 생체신호 측정을 위한 다양한 미세 전극들이 제작되고 보고되어 왔는데, 이러한 대부분의 전극들은 실리콘을 기반으로 한 미세 전자기계 시스템(micro electro mechanical system, MEMS) 기술을 이용하여 제작되었다. 하지만 아직까지의 실리콘 미세전극들은 MEMS 기술을 이용한 미세가공의 용이성, 생체적합성 등 여러 가지 장점과 함께 공존하는 재료의 특성 즉, 날카롭고 깨지기 쉬운 물질의 특성으로 유연성을 확보할 수 없기 때문에 생체에 삽입할 경우 운동 등에 의해 인접기관이나 조직에 상처를 줄 수 있는 단점을 안고 있었다. 이러한 문제점을 극복하기 위하여 최근에는 폴리이미드, 패럴린, SU-8, PDMS 등과 같은 유연한 기판을 사용한 다양한 종류와 목적의 삽입형 미세전극이 보고되고 있다. 유연한 전극은 사용목적에 따른 생체환경의 다양성으로 여러 가지 형상과 새로운 기관에 대한 연구가 다양하게 진행되고 있다. 이중 PDMS는 생체조직과 유사한 정도의 유연성을 갖는 폴리머로서, 투명하고, softlithography 공정에 의해 제작이 용이하여 미소유체 칩(microfluidic chip)의 재료로 광범위하게 사용되어 왔다. 특히 생체 적합성이 우수하고, 수분 및 공기에 대한 투과성이 좋아 최근에는 세포 배양용 마이크로 칩으로 많이 응용되고 있다. 따라서 이러한 재료를 기반으로 하여 전극을 제작할 수 있다면, 장기간 생체 내에 이식된 상태로 신호를 측정하거나 전기적인 자극을 가할 수 있는 전극으로의 충분한 활용가치가 있을 것으로 예상된다. 특히 인공 눈, 인공 귀 및 뇌세포와 연결하기 위한 이식형 전극의 경우 예민한 세포와 연결되어야 하기 때문에, 이식용 전극의 생체 적합성이 매우 중요하다. 그러나 PDMS의 이러한 장점에도 불구하고, 이를 기반으로 한 전극의 개발은 활발하지 않다. 그 이유는 실리콘계의 고무 형태인 PDMS와 금속 층간의 격자상수와 열팽창 계수의 차이 등 재료적 측면에서의 이질성으로 금속 층의 형성이 어렵고 부착력이 약하여 금속 층을 마이크로미터 단위의 선폭으로 패터닝 하면 쉽게 떨어지기 때문이다. 현재까지 알려진 PDMS 위에 금속 패터를 형성시키는 방법은 대략 두 가지로, 실리콘 기판 등에 금속 미세 패터를 형성하고 이것을 다시 PDMS로 전이 시키는 방법과, 증착조건을 최적화시켜 PDMS 위에 직접 금속 층을 형성시키고 패터닝하는 방법이 있지만 두 방법 모두 성공사례는 극히 드물고 각 연구실의 환경에 따른 최적화가 이루어져야 한다.

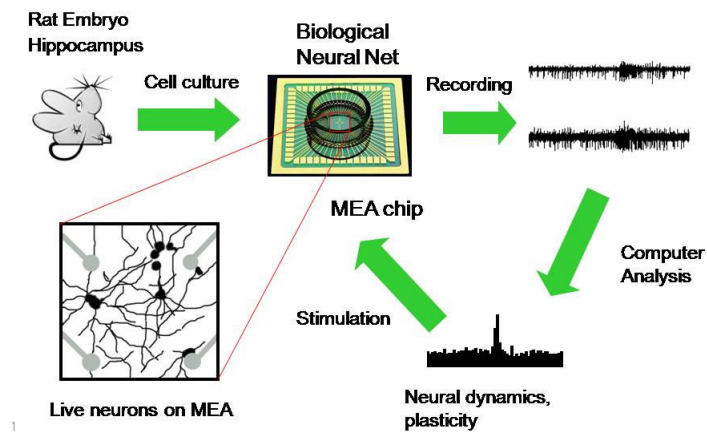
본 발표에서는 더 유연한 기판보다 더욱 유연하고 생체적합성이 뛰어난 PDMS를 기본 재료로 하는 미세전극의 제작과 평가에 관하여 수행한 연구를 소개하고자 한다. 금속 미세 패터의 형성은 PDMS 기판의 전처리와 증착조건을 최적화를 통해 수행하였고, 이후 PDMS 패키징과 전기도금 공정을 거쳐 미세전극을 완성하였다. 제작된 미세전극은 전기적 특성 측정과 HBSS 평가, ICR 마우스를 대상으로 생체적합성을 평가하였고, 이후 인공시각용 전극으로서의 가능성을 평가하였다.

Microelectrode array technology for neural recording and stimulation of patterned neural tissues *in vitro*

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Microelectrode array technology for neural engineering applications



Abstract

In neural science research, it is desirable to have an *in vitro* system that can serve as an inexpensive and controllable model of real brain tissues. For this purpose, engineers have developed a microelectrode array system for the purpose of studying neurophysiology of *in vitro* neural tissues. In the neural chip system, live neurons from embryonic rat hippocampus or cortex are cultured on a planar microelectrode array (MEA) and the MEA is connected with multichannel neural instruments (high gain amplifiers, stimulators). These cultured neurons spontaneously form a live neural network and generate synchronized periodic electric discharge ('burst') patterns throughout the culture period. In addition to multichannel recordings, these cultured networks can be stimulated by electrical pulses (voltage or current pulses) through the same electrodes used for recording and they show evoked responses to the stimuli. Recent advances in surface chemistry and micropatterning technique, neurons can be confined to a specific geometry to form a patterned neural network attempting to mimic the structured neural circuits in a real brain. This neuronal patterning technique allowed us to design geometrical defined neuronal networks on MEAs. In this talk, a recent progress in patterning neurons on an MEA will be presented with the demonstration of multichannel recording and stimulation. Seizure-like electrical activity that is generated in the matured cultures was routinely observed and the electrical activity could be induced by electrical pulses. The possible spin-off of the neural chip as a test-bed for neural modulation study of epilepsy treatment will be discussed.

감각, 운동기능 회복을 위한 신경보철시스템 및 신경접속 전극

박 세 익

초미세 생체전자 시스템 연구센터(NBS-ERC)

신경보철시스템 (Neural Prosthetics)이란 선천적, 후천적 원인으로 인해 발생하는 다양한 형태의 감각, 운동 장애를 극복하기 위해 인체의 일부를 대체하거나 손상된 신경 시스템 본연의 기능을 복원해주는 인공의 전자-기계공학 복합 시스템을 의미한다. 1950년대 인공 심박조절기(Pacemaker)가 시장에 소개된 이후, 현재 다양한 신경보철시스템이 연구, 개발되고 있다. 그 중 청각 기능 회복 장치인 인공와우(Cochlear Implant)와 파킨슨씨병 치료기인 심뇌자극기(DBS: Deep Brain Stimulation)는 상업화에 성공한 대표적인 사례로 꼽힌다. 이러한 신경보철기는 (1) 신경을 자극하는데 사용되는 자극칩기술, (2) 체내에 이식되는 전자 부품을 보호하는 완전 밀봉기술, (3) 신경과의 접속 기능을 하는 전극기술 등의 요소 기술들을 필요로 한다.

현재 NBS-ERC에서는 상업화를 목적으로 산(産)-학(學)-의(醫)의 협조 아래, 인공와우, 심뇌자극기, 치과보철기(Dental Implant), 시각보철기(Retinal Implant) 등이 연구, 개발되고 있다. 그리고 이들 장치의 효용성을 검증하기 위한 in-vivo, in-vitro, 전임상 실험이 진행되고 있다. 특히 인공와우의 경우, 초기 인공와우 환자들(Ineraid patients)을 대상으로 한 음성인지도 평가 실험에서 95% 이상의 성적을 얻었으며, 현재 상업화를 위한 준비를 진행 중에 있다. 이외에도 신경 신호 기록용 반도체 미세전극(Silicon-based Depth Probe)과 평판형 전극(Culture Plate) 등을 개발하여 뇌-컴퓨터 연결(BCI: Brain Machine Interface)를 위한 기초 연구에 활용하고 있다.

본 강연에서는 NBS-ERC를 중심으로 개발된 신경보철기들과 이들의 효용성을 검증한 실험 결과에 대해 발표하며, 생체-전자 장치를 접속하는데 있어 핵심적 역할을 하는 다양한 형태의 전극들의 응용 사례에 대해 소개하고자 한다.

주제어 : 신경보철시스템, 인공와우, 심뇌자극기, 치과보철기, 뇌-컴퓨터 연결, 반도체 미세전극, 평판형 전극

Special Session II : Neural Function Analysis

좌장 | 박해정, 김준식

- 뇌파 데이터의 획득, 분석방법 및 사례
한양대 | 이보름
- Magnetoencephalography : Acquisition, Analysis, and Applications
서울대 | 김준식
- fMRI의 기본원리와 가상현실기술과의 융합
한양대 | 구정훈
- Application of Multimodal Neuroimaging
연세대 | 박해정

뇌파 데이터의 획득, 분석방법 및 실례

이 보 름
한양대학교 의공학교실

1. 뇌파의 측정

뇌파는 일반적으로 대뇌피질의 시냅스 후 전위의 동기화에 의해 발생되어 두피에서 측정된 신호라고 알려져 있다. 일반적으로 두피전극은 Ag-AgCl 원판으로 구성되어 있다. 전위를 측정하기 위해서는 기준전극(reference)이 필요한데 공통의 기준전극을 이용하는 단극측정법과 인접한 전극 사이의 전위를 측정하는 양극측정법이 있다. 전극의 부착은 일반적으로 International 10-20 system을 따르게 되고 뇌파 측정시 전극의 저항을 낮게 유지하기 위하여 전도성 전극풀을 이용하게 된다. 두피 전극으로부터 연결된 증폭기를 통해서 인식 가능한 수준으로 뇌파신호를 증폭하게 된다. 또 뇌파 측정시 외부의 전기적 잡음, 특히 60Hz 교류전원 잡음을 줄이기 위하여 전기적 차폐를 하게 된다. 증폭기 내의 저역통과 필터의 차단 주파수가 60Hz 이하이면 효과적으로 전원잡음을 감소시킬 수 있으나 그 이상인 경우는 60Hz notch필터를 이용한다. 증폭된 뇌파 신호는 A/D 변환기에 의해 샘플링하여 저장한다. 뇌파 측정시 안구운동이나 눈깜박임의 영향을 제거하기 위하여 EOG전극을 같이 부착한다. 최근들어 컴퓨터 성능의 향상에 따라 전극수 128개나 256개 이상의 고해상도 뇌파측정이 가능하게 되었고 전극들이 부착된 모자를 피험자가 쓰고 검사에 임하게 된다.

2. 뇌파의 분석방법

뇌파의 분석은 크게 시간영역과 주파수영역에서 이루어진다. 일반적으로 뇌파는 주파수성분별로 특성과 기능이 달라짐이 알려져 있다. 주로 델타(0.5-4 Hz), 세타(4-8), 알파(8-15), 베타(15-30), 그리고 감마(30-) 대역으로 분류가 된다. 이들 주파수 성분의 분석을 위해서 power spectrum을 이용할 수 있고 주파수 성분의 시간적 변화추이를 관찰하기 위해서 short-time Fourier Transform이나 wavelet transform을 통한 시간-주파수 분석을 할 수 있다. 많은 경우 뇌파연구에 있어 자극에 의해 유발된 전위를 측정하게 된다. 이의 분석을 위해서 전통적으로 시간영역에서 신호의 평균을 구하여 얻어진 ERP(Event-Related Potential) 분석을 많이 시행하였고 또한 자극에 의해 유발된 주파수 성분의 변화양상을 관찰하는 ERD/ERS(Event-Related Desynchronization/Synchronization) 연구들이 시행되어 왔다. ERD/S의 초창기 연구에서는 instantaneous power나 intertrial variance를 이용한 방법이 제시되었고 최근에 power spectrum이나 시간-주파수 분석을 이용한 분석들이 시도되었다. 이러한 뇌파, ERP 그리고 ERD/S 양상의 공간적 분포를 관찰하기 위하여 두피에서의 2차원 또는 3차원 topography 분석을 할 수 있으며, 최근에는 뇌 신호원 국소화 기법(source localization)의 발달에 따라 대뇌 피질에서의 신호원의 분포를 복원할 수 있어 뇌파를 이용한 뇌 기능의 더욱 효과적인 연구가 가능하게 되었다.

3. 뇌파분석의 실례

Oddball paradigm의 뇌파 데이터 분석을 통하여 ERP와 ERD/S의 분석 사례를 살펴본다.

Magnetoencephalography : Acquisition, Analysis, and Applications

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Abstracts

The human brain is an extremely complex system and rapidly performs processing tasks. The way in which the brain accomplishes cognitive and perceptive tasks are largely unknown, and discovering these is presently one of the most intriguing challenges of science. Magnetoencephalography (MEG), which measures magnetic flux produced from electrical neuronal activity, has been a popular tool to diagnose and analyze neural systems. Compared to functional magnetic resonance imaging (fMRI) measuring the changes of the blood flow or oxygenation, MEG gives precise timing of the neural events. Since tissues in the scalp and skull are magnetically transparent, MEG has an advantage to analyze electrical source compared to electroencephalography (EEG). Therefore, MEG can be utilized to analyze rapidly varying neural sources during cognitive, perceptive, and movement tasks.

This presentation includes basic instrumentation, acquisition of MEG data, several analysis methods, and clinical applications. MEG system employs superconducting quantum interference devices (SQUIDs) and pickup coils to acquire very low magnetic flux emitted from the brain. To improve signal-to-noise ratio (SNR), various types of magnetometers, axial- and planar gradiometers have been developed. Digitized magnetic flux is preprocessed with filtering and noise reduction to remove environmental and biological artifact. After building a conduction model of brain, an inverse solution is applied to analyze MEG source.

MEG is clinically used for presurgical planning (i.e. the estimation of epileptogenic focus by localizing inter-ictal spikes, and identifying the locations of crucial brain functions to determine resection margin). MEG is also applied to various neuroscientific researches such as auditory/visual/sensory perception and various cognitive studies of language, memory, pain, and fear.

fMRI의 기본원리와 가상현실기술과의 융합

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fMRI (functional magnetic resonance imaging)는 뇌를 절개하지 않고 비침습적으로 뇌의 구조뿐만 아니라 특정 상황이나 과제의 수행 시 특정영역의 활성 정도를 관찰할 수 있어 뇌 기능을 영상화 하는 연구에 널리 쓰이고 있다.

fMRI의 원리는 뇌 속의 뇌신경과 더불어 뇌신경전달물질 (Neurotransmitter) 및 이들 수용체 (Receptor)들의 활동을 직간접적으로 반영하는 신경세포의 활성도에 의한 산소소모량 (BOLD: Blood Oxygenation Level Dependent)을 측정하는 것이다. BOLD 신호는 뇌의 어느 부위가 활성화되면 그 부위의 세포에서 산소를 헤모글로빈으로부터 제공받아 사용하게 되고, 혈액 속의 헤모글로빈은 산소를 빼앗기게 된다. 이러한 산소 소비에 이어서 그 부위에서는 산소를 가지고 있는 헤모글로빈을 포함하는 혈류의 증가가 일어나게 되는데, 이러한 갑작스런 혈류의 증가로 인한 미세한 자기장의 변화를 MRI를 통해 검출하여 이를 시간 순으로 배열하게 되면 BOLD 신호를 얻을 수 있게 된다. 그리고 이러한 BOLD 신호의 특성을 이용하여, 특정한 자극 제시 블록과 이와 비교할 수 있는 컨트롤 블록과의 통계 분석을 통해 수행 과제와 관련된 BOLD 신호의 변화가 생긴 뇌의 부위를 검출할 수 있게 된다. 이러한 기술을 기반으로 많은 연구자들에 의해 인간의 뇌기능을 활발히 연구되어왔다.

fMRI 연구는 이러한 자극 블록을 어떻게 만들어내고 디자인하는지가 연구의 질을 결정한다. 하지만, 기존의 자극들은 2차원적이거나 스크립트 기반의 자극으로 실제적인 사건, 특히 사회적인 사건을 대변하지 못한다는 단점이 있다. 이는 정확히 인간의 뇌 활성화를 대변하지는 못한다. 또한 뇌 영상 연구가 계속 진행됨에 따라 단순한 자극에 대해서는 많은 연구가 진행되었고, 그로 인해 단일 자극에 대한 사람의 뇌의 특징은 어느 정도 밝혀지고 있는 실정이다. 따라서 뇌 과학에 대한 연구의 깊이가 깊어지면서 복잡적이고 사회적인 인지 및 지각에 대한 연구의 필요성이 증가하고 있다. 이는 실험 환경에 있어서도 좀더 실제적이고 복합적인 상호작용이 가능한 가상현실의 구현을 요구하게 되었다. 가상현실은 사용자로 하여금 컴퓨터가 만든 세계에 들어가 시각, 청각, 그리고 촉각 등의 감각을 통하여 컴퓨터와 상호작용하게 하는 기술로, 사용자는 더 이상 컴퓨터 화면상의 정보나 이미지를 단순히 외적으로 관찰하지 않고 컴퓨터가 생산한 3차원의 가상 세계 안에 존재감을 느끼며 몰입되어 적극적으로 참여하게 된다. 따라서 가상현실을 이용하면 사람의 뇌 기능을 실제적인 환경에서 연구할 수 있다. 하지만 fMRI 실험 환경은 일반적인 실험 환경과 다른 환경으로 일반적인 가상현실 장비 사용의 제약과 피험자 움직임의 제약등이 존재하기 때문에, fMRI 연구를 위한 실제적인 환경을 위해서는 기존의 가상현실 상호작용 기술이나 장비와는 다른 새로운 기술의 개발과 장비 기술이 필요하다. 따라서 본 강의에서는 fMRI의 기본원리와 fMRI와 가상현실기술을 융합하는 기술에 대해서 간략히 살펴보고자 한다.

Application of Multimodal Neuroimaging

박 해 정

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뇌는 두개골이라는 단단한 물체로 쌓여 있어서 활동하고 있는 사람에게 있어서 뇌의 구조 및 기능적 변화를 살펴볼 수 있는 데에는 한계가 있다. 뇌신경영상 기법의 발전은 이러한 한계를 극복하고 뇌의 이해와 임상 진단에 진전을 가져다주어 주목을 받고 있다. 뇌신경영상 기법에는 뇌의 해부학적 정보를 제공하는 자기공명영상(MRI)을 위시하여 뇌신경의 전기 생리적 특성을 보는 뇌자도(MEG/EEG), 뇌의 혈류량과 물질 대사 등의 정보를 제공하는 양전자방출단층촬영(PET), 혈액의 산화과정과 관련된 기능적 자기공명영상(fMRI) 등이 이용되고 있다. 삼차원 뇌기능 분포를 추정할 수 있는 고해상도 뇌파(EEG), 뇌자도(EMG)나 최근에 등장하여 소아 연구에 응용되기 시작하는 광학용 NIRS(Near Infrared Spectroscopy) 등이 있으나 뇌기능을 측정할 수 있는 대표적 영상 기법은 양전자방출단층촬영영상(PET)과 자기공명영상(MRI)이다. 1980년대 초부터 뇌기능 매핑을 활발히 담당해 오던 양전자방출영상촬영기법은 1990년대 초반 기능성 자기공명영상(functional MRI)의 등장으로 뇌인지 기능 연구 분야 보다는 수용체-리간드 결합 등의 분자 수준의 활동을 영상화하는데 핵심 역할을 담당하고 있다. 자기공명영상을 이용한 뇌영상 기법은 발전속도가 빨라서 다양한 영상 대비를 주는 구조 영상, 조직의 화학적 구성물을 탐지할 수 있는 자기공명분광영상(Magnetic Resonance Spectroscopy), 혈류 변화를 검출하여 뇌기능을 살펴보는 fMRI, ASL(arterial spin labeling) 등의 기능 영상, 그리고 신경다발을 측정할 수 있는 확산텐서영상(diffusion tensor imaging)에 이르기까지 다양하게 사용되고 있다. 이러한 각각의 영상 기법은 영상 기법의 속성에 따라 뇌 기능의 단면적인 정보를 제공하는 측면이 강해서 뇌의 복잡한 구조와 기능을 총체적으로 파악하기에는 한계가 있다. 예를 들면 뇌의 인지과정은 1초 미만에 이루어지게 되는데 fMRI나 PET영상은 시간해상도가 충분하지 못함으로 인지과정의 직접적인 연구에는 한계가 있는 반면 수 ms 단위의 영상을 얻을 수 있는 뇌자도등은 공간 해상도가 좋지 않다. 그러므로 뇌기능의 시공간적 분석을 위해서는 뇌의 표면에서 측정된 뇌자도와 기능성 자기공명영상을 통해 얻어진 정보를 고해상도 해부학적 자기공명영상의 3차원 좌표에 표시하여 뇌기능 연구를 수행하고 있다. 이와 같이 단면적인 각각의 정보를 통합하여 분석하게 되면 뇌기능에 대한 정보를 해석하는데 매우 유용하다. 최근 들어서는 지난 수년간의 주 연구 주제인 뇌기능의 국재화(localization) 연구에서 나아가서 뇌의 각 부위간의 연결성(connectivity)에 대한 관심이 증대되어 가는 추세에 있다. 뇌의 연결성 연구는 fMRI나 PET을 이용하여 주어진 과제에 따라 발생하는 뇌 부위의 기능적 연결성 연구로 주로 진행되었다가 확산텐서 자기공명영상(DTI)의 도입으로 해부학적 연결성 연구와 결합하여 더욱 활발해졌다. 이와 같은 다면적 뇌 영상 기법의 목표는 뇌기능 연구 방법의 통합을 통해 뇌 정보처리 기전을 규명하고 뇌기능장애나 질환에 대해 보다 효과적인 진단과 치료에 가능하게 하는데 있다. 뇌기능과 신경정신질환, 인지과학연구등 뇌영상기법은 치명적인 손상이 오기 전에 질환을 발견해서 조기 진단하는 분야와 유사한 징후를 보이는 질환의 차별화된 정확한 진단, 간질, 뇌종양등의 신경외과적 수술, 뇌종양 방사선 치료 평가, 약물의 효과 분석에 중요한 도구가 될 수 있다. 본 발표에서는 기능성 자기공명영상, 양전자방출단층촬영, 뇌자도등에서 얻을 수 있는 기능성 정보와 구조적 자기공명영상, 확산텐서영상 등의 해부학적 정보의 통합 기법에 대한 소개와 정신분열증, 뇌성마비, 선천성 맹인에 응용한 연구를 소개함으로써 다면적 영상 기법의 중요성을 제시하고자 한다.

Special Session III : Neural Modulation

좌장 | 장진우, 신형철

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뇌-컴퓨터접속을 통한 슈퍼독의 개발

신 형 철

한림대학교 의과대학 생리학교실

1. 주요연구내용

본 연구는 인간생활 속에서 오랜 역사를 통해 같이 살아온 반려동물인 강아지에게 BCI (Brain-Computer Interface, 뇌-기계접속) 기술을 접목하여 동물과 인간이 새로운 정보소통의 채널을 가질 수 있도록 하였다. 즉, 인터넷을 통하여 접속한 여러 명의 사람들이 BCI 접속된 반려동물과 원격 실시간 게임을 즐길 수 있도록 하였다. 본 연구에서는 해마, 전 전두엽 등의 신경핵들에서 단일 신경세포의 활동들에 실험자가 정해진 기계제어 명령들을 200 ms 마다 전환 알고리즘을 통하여 할당시키는 BCI 접근방법을 택하였다. 요크셔 테리어 성견의 좌우반구에 8개의 미세전극을 장기적으로 이식하여 사용 하였다. 신경세포활동 ($n > 2$)을 활용한 1, 2 차원 운동을 하는 로봇기계 제어를 위해 BCI 기계장치와 소프트웨어를 개발하였다.

인터넷게임을 위하여 BCI 장치를 통해 로봇을 조절하는 모습을 실시간 인터넷에 보여주는 웹 카메라 서버를 가동시켰다. 인터넷에서 작동되는 게임은 2가지 종류를 개발하였으며 게임서버에 의해 작동되었다. 첫 번째 게임 (Raviduel)은 2차원 운동 로봇조절을 하여 동물이 목표물을 입으로 가져오는 모습을 웹 카메라와 연동시켜 보여 주면서 동시에 로봇의 움직임을 목마른 두더지가 샘물을 찾아가는 그래픽으로 표출시켰다. 접속한 사람들이 본 BCI 장치의 시연과 두더지의 움직임을 보면서 서로 대화를 나눌 수 있는 대화 창도 마련하였다. 두 번째 게임 (Raviduel+)은 사람과 동물사이에 정해진 시간 안에 점수를 많이 따도록 경쟁을 시키는 게임이다. 인터넷에 접속한 사람들은 컴퓨터 마우스를 조절하여 공을 쏘아 앞 쪽의 오징어들을 맞추도록 하여 점수를 올리게 하였다. 반려동물은 두 신경세포의 활동을 조절하여 나온 7개의 값들로 (+3, +2, +1, 0, -1, -2, -3) 공을 쏘아 앞 쪽의 오징어들을 맞추도록 하여 점수를 올리게 하였다.

현재 인터넷에서 사람과 BCI 반려동물 사이에서 게임이 완전 자동화되도록 수정 작업을 하고 있다. 이를 위해 반려동물이 신경 신호의 활동상태에 의해 조절되는 로봇의 움직임을 소리의 2차원 좌표 (강도와 주기) 형태로 인식하도록 하였다. 소리의 2차원 좌표는 9 개 또는 36개의 창으로 구분이 되도록 하였으며 접속한 사람의 마우스 움직임이 직접적으로 신경신호 변환 알고리즘과 연동되도록 하였다. 이러한 2차원 소리공간의 창들에 기능을 할당함으로써 우리는 반려동물인 강아지의 뛰어난 후각인지능력을 활용하여 다양한 물체들(송이버섯, 산삼, 환자의 소변, 환자의 호흡 등등)의 인식을 인간의 언어로 표현하도록 훈련시키고 있다.

2. 주요성과

- (1) 학술적 의의: 쥐에서 성공적으로 개발된 1, 2차원 로봇운동 조절 BCI 장치를 소리의 2차원 공간좌표 제어를 통하여 반려동물인 강아지에게 적용함으로써 Super Companion Dog의 개발을 가능하게 하였다.
- (2) 경제적 의의: 본 기술개발은 BT와 IT를 융합한 기술의 하나로서 현재 세계적으로 장애인 재활에만 초점이 맞춰져 있는 BCI 산업화를 인간과 같이 생활하는 반려동물에 적용함으로써 BCI 기술이 다양한 산업에 활용될 수 있는 새로운 경제적 가치창출의 모델을 제시하였다.
- (3) 사회적 의의: 반려동물과 사람 사이의 새로운 정보소통의 길을 열었다. BCI 기술에 의한 반려동물의 능력 제고는 곧 인간능력과 삶의 질 향상을 의미한다.

3. 기대효과

본 게임들은 2006년 9월 28일~10월 1일 COEX에서 개최된 제2회 미래성장동력연구성과 전시회 및 2006년 11월 2일 제2회 춘천 바이오 페스티벌에서 원격시연 되었다 (그림 4). BCI 반려동물과 사람 사이의 원격 인터넷 게임의 개발은 곧 다양한 인터넷을 활용한 엔터테인먼트사업화와 경제적 이윤 창출을 의미한다. 전 세계의 네티즌을 대상으로 한 네트워크 게임에 BCI 동물들이 게임의 Player로 진입함을 뜻한다. 또한 BCI 동물과 BCI 동물들 사이의 다양한 게임들이 개발되어 사업화 될 수 있으며 BCI 동물과 소유주인 주인 둘 사이의 게임들이 개발될 수 있다. 2차원 소리공간과 연동된 다양한 물체의 인식 면에서는 유방암, 방광암, 폐암 등의 조기 진단 (95% 이상의 확률) 등에 활용될 반려동물 의료사업화가 가능하다고 본다. 그 외에 다양한 냄새인식에 기초한 냄새산업에 BCI 반려동물이 등장하여 경제적 이윤을 추구하리라 본다. 반려동물에 의한 언어표현 능력 부여 또한 다양한 산업들 (농산, 화장품, 국방, 화공, 영화, 교육, 장애인 재활 및 보조, 노인, 엔터테인먼트 등)에 큰 영향을 주리라 본다.

Cortical stimulation : potential tool for neuromodulation

김 형 일
예수병원 신경외과

뇌졸중 환자 중 약 80%는 혈관이 막혀서 생기는 허혈성 뇌졸중이고 20%는 혈관의 파열로 인한 뇌출혈 환자이다. 우리나라에서는 전체 사망율의 14.8%, 사망 원인에서 랭킹 2위를 차지하고, 30세 이상 장애인의 1/3의 원인질환이다. 유병율로 살펴보면 1000명 중 5.7명 정도가 되는데, 나이가 증가할수록 발생율이 급격히 증가한다.

우리나라가 고령화 사회로 이환되어 감에 따라 뇌졸중과 그로 인한 장애를 가진 사람 수도 급격히 증가 하고 있으며, 이로 인한 의료비 지출 및 간병에 소요되는 인력문제는 단순히 가정 내 문제를 넘어서서 사회문제로 부각되었다. 근자에 준비되고 있는 뇌졸중 환자의 간병 지원에 대한 사회보장제도의 개편 및 사회서비스 제도의 도입은 그 중요성을 잘 보여준다.

현재까지 뇌졸중의 치료는 주로 예방과 급성기 치료에 집중되어 있으며, 뇌손상으로 인한 언어장애 혹은 마비에 대해서는 일반적인 약물 및 재활치료 외엔 방법이 없어서 초기 치료의 결과에 따라 평생이 결정된다는 것이 상식이었다. 이 상식은 중추신경은 한번 손상 받으면 재생되지도, 그 기능이 돌아오지도 않는다고 알려진 뇌신경의 특성에 기인한다.

그러나 태아와 영아기에 신경계가 형성되고 뇌의 기능이 분화되고 발달하는 것처럼, 성인의 뇌도 발전의 가능성이 다소 남아있다. 다만 그 정도가 미미하여 없는 것처럼 알려진 것이다. 이 특성은 뇌가 손상되었을 때 잠깐이나마 향상 되어 뇌의 수복과 기능의 회복을 가능하게 한다. 이러한 뇌에서 일어나는 기능의 재배치와 회복을 뇌의 가소성이라 부르는데, 뇌졸중 환자가 재활치료로 어느 정도 기능을 회복하는 것은 이 뇌의 가소성으로 인해 가능케 되는 것이다. 그러나, 뇌손상 후 증가되는 뇌 가소성은 6개월후면 다시 감소하여 재활치료도 효과를 보지 못한다. 결국 장기간에 걸친 기능의 회복은 기대할 수 없고 1년 내 회복되지 못하면 장애는 고착화된다.

뇌의 가소성을 극대화 시키고 장기간 지속시키기 위한 연구가 여러 분야에 걸쳐 진행되어왔다. 주로 약물을 사용하는 방식과, 줄기세포를 이용하는 방식 그리고 전기 자극을 이용하는 방식으로 나누어지는데, 줄기세포를 이용하는 방식은 아직 연구가 더욱 필요하고 이중 환자의 기능 회복에 효과가 입증된 것 중 가장 뛰어난 효과를 나타낸 것이 전기 자극을 이용하는 방법이다. 이러한 가능성을 확인해준 동물실험들이 발표되기 시작하였고 최근 임상실험 결과들이 문헌에 나타나기 시작하였고 유용한 결과를 보여주고 있다. 본 연제도 뇌졸중에 대한 실험적 그리고 임상적 시도의 결과를 제시할것이다. 장시간의 뇌의 가소성의 극대화를 목적으로 하는 이 연구진의 새로운 전극과 그 기술은 고착상태에 있던 뇌졸중 환자의 장애에 대한 매우 효과적인 치료 방법이 될 수 있을 것이다.

Neuromodulation Therapy for Parkinson's Disease

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The problems of Parkinson's disease (PD) have stimulated neuroscientists and clinicians for close to half a century. The first major surge of interest in surgical therapy for PD arose from the introduction of stereotactic techniques in the 1950s. However, the discovery of the L-dopa in the late 1960s led to a precipitous decline in the use of surgery and made the spectrum of medically intractable PD changed. Although the L-dopa is still the first choice in the treatment of PD, in the long-term, limitation of its usage occurs due to loss of efficacy, fluctuations in motor performance, and appearances of other side effect. For years, a series of scientific discoveries has led to dramatic therapeutic advances, but each of these has posed new problems and given rise to new scientific questions. PD patients are now more elderly, have more advanced disease, and suffer more side effects of their medications than those of the pre L-dopa era. However, increased understanding of basal ganglia pathophysiology underlying PD and discovery of MPTP which could cause parkinsonism in primates, including man have provided a rationale for new surgical techniques of the treatment of PD. It was in this atmosphere that therapeutic need the landmark paper of Laitinen in 1992 thrust pallidotomy back into the mainstream of treatment for otherwise intractable symptoms of PD. Since then, there are increasing interests in the various types of surgical treatment of PD. At the present time, thalamotomy, pallidotomy and deep brain stimulation (DBS) are useful in certain well-defined PD. At this moment, broader treatment options promised by the development of novel surgical approaches of PD are tantalizing, but each treatment options has a definite benefit in patients with advanced PD. In the near future, this new era of surgical treatment of PD will surely define future roles of surgery in the battle against PD. Clearly, more intensive basic and clinical researches should be done before their full potential is realized. I will discuss the problems, limitations, and therapeutic potentials of PD based on my experiences at Yonsei University.

인공시각전달장치

서 중 모

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인간의 눈에 들어온 외부의 빛은 망막에서 전기신호로 바뀌며, 이것이 시신경을 통해 뇌로 전달되면 물체를 인식할 수 있게 된다. 눈의 질병은 시력의 소실로 이어지며, 인간이 외부 세계를 지각하는 데 심각한 장애를 초래하여 생활에 큰 지장을 주게 된다. 눈의 가장 외층인 각막은 장기기증자의 각막을 이식하거나, 이것이 불가능할 경우 인공소재로 제작된 인공각막을 이식하여 시력을 되찾을 수 있게 되었고, 수정체의 혼탁은 백내장 수술의 발전과 인공수정체의 개발로 해결이 되었다. 그러나, 카메라의 필름에 해당하는 망막의 병변은 일부 수술이 가능한 병을 제외하고는 일단 시력을 상실한 경우에는 회복시킬 수가 없다. 이러한 질병으로는 망막색소변성과 연령관련황반변성이 대표적이고, 각각 정상인에서 1/4000, 1/20 정도의 확률로 발생하며, 선진국에서는 성인 시력 상실의 원인 중 약 30%를 차지한다. 특히, 갈수록 노령화되는 현대 사회에서는 연령관련 황반변성의 빈도가 점차 증가하는 추세에 있어서, 이들 질환으로 인한 사회적, 경제적 손실 역시 점차 증가하고 있다.

현재 미국, 일본, 독일 등에서는 ‘뇌의 10년’ 이후 가장 중요한 연구로 인공시각전달장치 개발에 대한 연구를 이야기하는 데 주저하지 않으며, 이는 30여년간의 연구 끝에 현재 널리 보급되고 있는 인공 와우의 성공에 힘입음은 주지의 사실이다. 현재까지의 연구 동향은 시신경세포들을 전기적으로 자극하여 망막의 기능을 대신시키는 것인데, 크게 망막앞, 망막밑, 맥락막밑, 시신경, 시피질 자극기 형태로 시도되고 있으며, 각각 장단점을 가지고 있다. 망막앞 자극기 연구는 미 국립 보건원(NIH)과 미 과학재단(NSF)의 지원하에 Harvard- MIT, Doheny-SecondSight 팀이, 독일 연방교육연구부(BMBF)의 지원하에 Bonn-Duisburg-Koeln팀이 연구하고 있고, 망막밑 자극기는 미국의 Optobionics사와 독일의 Tuebingen-Stuttgart 팀이, 맥락막밑 자극기는 일본의 Osaka University-Nidek 팀이, 시신경 자극기는 European Commission(Esprit project)의 지원을 받는 벨기에 Universite Catholique de Louvain팀이, 시피질 자극기는 Dobelle Lab과 Utah University가 연구를 진행하고 있다. 우리나라에서는 한국과학재단의 지원을 받은 초미세생체전자시스템 연구센터에서 시각자극용 미세전극을 개발하고 있으며, 보건복지부의 지원을 받은 나노인공시각개발센터에서 인공시각장치 시스템 개발과 전임상 실험을 진행하고 있다.

인공시각전달장치에 대한 연구는 영상 획득부, 영상 처리부, 영상 전달부, 신경세포 자극부, 되먹임 조절부 등의 연구가 같이 이루어져야 하는 다학제간 연구로, 이에 는 영상 획득 및 처리 기술, 신호 변환 기술, 신호 전송 기술, 신경 세포 자극 기술, 생체 신호 측정 및 분석 기술, 세밀한 망막 수술 및 뇌수술 등의 다양한 기반 기술들이 요구된다. 과거의 연구는 미세 반도체 및 미세 생체 전자 시스템 구현의 어려움으로 인하여 그동안 발전 속도가 느릴 수밖에 없었으나, 최근의 눈부신 반도체 기술 발전은 이러한 장벽을 서서히 극복 가능한 것으로 만들어주고 있다. 전자공학과 의학의 만남으로 이루어지는 바이오닉스 기술은 인공시각장치의 개발에서 그 의의를 더욱 확실히 드러낼 수 있을 것이라고 생각한다.

Tutorial

Introduction to Neural Engineering

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Neural Engineering은 크게 engineering과 neuroscience를 합친 학문이며, medical science, neurobiology, electrophysiology, experimental neuroscience, theoretical and computational neuroscience, electronics, biomaterial and tissue engineering, nano science, imaging 분야를 포함한다. Neural Engineering의 주된 목적은 다양한 분야의 원리와 기술을 적용하여 신경 시스템의 구조와 기능을 모델링하고 이해하며, 신경학적 질병의 치료 및 손상된 그 기능을 회복하는 것이다. 오늘날의 신경 시스템에 접근 할 수 있는 과학과 기술의 발전은 예전에 비하여 보다 용이하게 신경 시스템에 접근할 수 있어 neural engineering이 많은 주목을 받고 있다. 나노기술에 기반한 나노전극은 신경들 사이의 전기적, 화학적 신호의 국소적 정밀한 측정과 특정한 뇌 일부분에 자극을 할 수 있어, 기존에 접근하기 어려웠던 신경 시스템에도 접근을 가능하게 하며 새로운 뇌 메커니즘을 연구하는데 훌륭한 도구로써 활용된다. 이식 가능한 나노전극과 외부장치와의 중간 역할을 하는 신경인터페이스 기술은 손상된 신경을 대체하여 그 기능을 수행하는 것과 실제 신경시스템을 조절 가능하게 하여 과거에 포기하였던 신경학적 질병의 증상을 개선, 치료를 가능하게 한다. Neural engineering의 급속한 발전은 산업적으로 많은 가치를 창출하게 되었다. 그 중 의약 및 의료 산업분야에서는 neural engineering을 통하여 새롭게 밝혀진 신경질환의 메커니즘을 기반으로 신약 개발이 되었고, 개발된 신약은 다시 neural engineering의 기술을 통하여 그 효과 및 효능을 검증 받는다. 또한 청각, 운동, 통증 등의 이상을 대상으로 한 cochlear implant, deep brain stimulator, spinal cord stimulator, artificial pacemaker, sacral anterior root stimulator, functional electrical stimulator 등의 neuroprosthetics은 손상된 신경계를 보완, 회복 및 치료하여 인류의 복지에 많은 공헌을 하며 미래 지향 첨단 산업에 영향을 주고 있다. Neural engineering은 neuroscience의 일부분이란 인식에서 벗어나 학문의 한 분야로 명백히 자리를 잡고 있으며, 관련된 많은 분야에서 기존의 틀을 깨고 기술적 학문적으로 더욱 진보하는데 큰 영향을 주고 있다. 학제간의 상호 발전적 관계를 통한 neural engineering은 과거에 공상으로만 여겨졌던 인류의 꿈들을 실현하는데 중심적 역할을 하는 학문이 될 것이다.

신경인터페이스 및 신경계 연구를 위한 신경신호의 측정 및 분석 기법

김 경 환

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뇌를 비롯한 신경계의 활동을 측정하는 방법은 시공간적인 해상도, 침습적/비침습적 장/단점, 비용 등 여러 측면에서 매우 큰 다양성을 보인다. 최근 관련 기술의 눈부신 발전에 힘입어 신경전달 물질 등의 분자 수준에서의 신경계 활동 측정에서부터 사람의 뇌 활동을 높은 해상도를 갖는 시공간적 영상으로 재구성하는 것까지 가능해졌다. 기존의 응용분야였던 신경계연구 및 신경정신관련 질환의 진단뿐만 아니라 최근에는 공학적 방법에 의해 손상된 신경관련기능의 회복을 도모하는 신경인터페이스를 위해서도 매우 활발하게 적용되고 있다. 특정한 측정방법의 적용여부는 전적으로 연구 혹은 응용 목적에 따라 결정되며 측정된 신호는 여러 단계의 신호분석 및 신호처리 방법을 적절하게 수행한 이후 목표로 하는 정보가 추출된다. 본 강의에서는 다양한 신경신호 측정 방법 중 주로 전기생리학적 기법에 기초한 방법들을 중심으로 하여 측정원리 및 응용분야를 소개하며, 각 목적에 따른 전형적인 신호분석 및 신호처리 방법을 설명하고자 한다.

구체적으로 다음 사항들을 포함한다.

- 신경신호 발생원리 및 미세전극을 이용한 신경신호의 세포외기록방법 (extracellular recording)
- 신경계 연구, 인공신경 (neural prosthesis), 임상적 응용을 위한 신경신호의 측정 및 분석방법 사례 소개
- 다중유닛 세포외기록 신경신호로부터 단일신경으로부터의 spike train 추출기법
- 단일 신경발화율 기반 뇌-기계 인터페이스를 위한 spike train decoding
- 뇌파의 발생원리 및 두피 뇌파의 측정방법
- 유발뇌전위의 측정방법 및 처리 방법
- 뇌파기반 뇌-기계 인터페이스를 위한 뇌파 신호처리 방법 소개

Neuroprosthetics

김 영 수

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Neuroprosthetics는 사고나 질병 때문에 신경의 기능을 잃었을 경우 신경 시스템과 그 기능을 조절할 수 있도록 연결해주는 장치를 의미한다. Neuroprosthetics는 sensory prosthetics, motor prosthetics, cognitive prosthetics로 다음과 같이 분류할 수 있다.

1. Sensory prosthetics

- Visual prosthetics, auditory prosthetics, prosthetics for pain relief

2. Motor prosthetics

- Heart pacemaker, deep brain stimulator, controller for movement, bladder control implants

3. Cognitive prosthetics

- Hippocampal implant

현재 제품화되어 시술되고 있는 neural prosthetics로서는 상, 하지의 손상으로 인하여 움직임에 장애가 있을 경우 장애 부분을 대체하거나 보완하는 functional electric stimulator가 있다. 그리고 청각 이상자를 대상으로 개발된 cochlear implant는 전 세계적으로 시술되어 손상된 청각을 보완 및 대체하고, 파킨슨, 근긴장이상증, 간질, 우울증 환자를 대상으로는 deep brain stimulator와 vagus nerve stimulator가 개발되어 환자가 안정된 생활하는데 큰 도움을 주고 있다. 또한 만성 통증환자를 위해 개발된 spinal cord stimulator는 간단한 시술로 고통의 괴로움을 잊고 생활을 하는데 도움을 준다. 오늘날, 미국의 neurology device 시장은 1,291.6(\$ million)에 이르고 있으며, neuroprosthetics 시장 중 대부분을 차지하는 neurostimulation device는 52.8% (\$682.0 million)를 이루는 큰 시장이다. 의료기기 시장 전문가들은 2011년까지 spinal cord stimulators의 경우 697.3(\$ million), deep brain stimulators의 경우 293.4(\$ million), vagus nerve stimulators의 경우 344.2(\$ million), sacral nerve stimulators의 경우 134.0(\$ million)와 gastric electric stimulators의 경우 238.8(\$ million)로 neurostimulation device 시장이 꾸준히 성장할 것으로 기대하며 neuroprosthetics산업을 미래 지향적 첨단 산업의 핵심으로 생각한다. Neuroprosthetics는 센서와 자극을 위한 생체 적합전극기술, 신경신호처리기술, 신경과 인터페이스장치기술 등의 첨단기술을 바탕으로 Neural engineering이 추구하는 미지의 신경 시스템의 구조, 기능 이해와 신경 질병의 치료 및 기능 회복의 목적을 이루는데 중요한 역할을 하고 있다.

제35회

대한의용생체공학회 추계학술대회

발표논문초록

학생논문경연 5월 11일, 12:00~13:30, D (3층 353호)

좌장 : 신동익, 이상민, 김정섭

- S-1 피부에 의한 음성 고주파 신호 감쇠 보상을 위한 FEA 시뮬레이션 기반의 이식형 마이크로폰 설계 및 구현
한지훈¹, 김민우¹, 김동욱¹, 성기웅¹, 박일용², 조진호^{1,2}
¹경북대학교 전자전기컴퓨터학부, ²경북대학교 첨단 감각기능 회복장치 연구센터
- S-2 불안정한 자세에서 하지에 인가한 진동자극이 자세 안정성 개선에 미치는 영향
은혜인¹, 유미², 김동욱³, 권대규^{3,4}, 김남균³
¹전북대학교 대학원 헬스케어공학과, ²전북대학교 대학원 의용생체공학과
³전북대학교 공과대학 생체정보공학부, ⁴전북대학교 실버공학연구소
- S-3 FOCUSS 알고리즘을 이용한 고해상도 Projection 및 Dynamic MR 영상 복원
탁성호, 정홍, 유재홍, 예종철
한국과학기술원 바이오 및 뇌 공학과
- S-4 의복 착용형 무선 호흡모니터의 일회용적 계측 특성
이인광, 최성수, 김성식, 김정아, 이태수, 차은종
충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단
- S-5 신경신호 측정을 위한 SPR(표면플라즈몬공명) 시스템 개발
김신애^{1,2}, 박형원², 김성준^{1,2}
¹서울대학교 공과대학 전기컴퓨터공학부, ²초미세생체 전자시스템연구소
- S-6 CT data를 이용한 CAD 파일 추출과 Medical RP가공
윤한민¹, 김성식², 김호경¹
¹부산대학교 기계공학부, ²부산대학교 치과대학 치의학전문대학원

특별강연 Special Session I : Neuron-Computer Interface | 좌장 | 남윤기, 백주열

- The development of the flexible microelectrode | 고려대 | 백주열
- Microelectrode array technology for neural recording and stimulation of patterned neural tissues in vitro | KAIST | 남윤기
- 감각, 운동기능 회복을 위한 신경보철시스템 및 신경접속 전극 | 서울대 | 박세익

일반연제 I : 의학영상시스템 및 신호처리 5월 11일, 13:30~15:30, C (3층 352호)

좌장 : 문치웅, 장동표

- O1-1 고자장 MRI에서 작은 대상체의 고해상도 영상을 위한 솔레노이드형 RF코일 개발
우동철¹, 이홍석², 민광홍³, 김용권³, 이홍규³, 최보영¹
¹가톨릭대학교 의과대학 의공학교실, ²가톨릭대학교 의과대학 의학과, ³아이솔테크놀로지(주)
- O1-2 망막신경절세포의 응답을 이용한 시각 자극 세기 변화 추정 및 감수야 구성
류상백¹, 김두희¹, 김경환¹, 예장희², 구용숙²
¹연세대학교 보건과학대학 의공학과, ²충북대학교 의과대학 생리학 교실
- O1-3 생체 표면 측정을 위한 Stereo Image의 경사도 오차 감소 방법
이연석¹, 박상용¹, 하승한¹, 이건우¹, 김민기³, 문종섭⁴, 오철환^{1,2}
¹고려대학교 의과대학 영상의학연구소, ²고려대학교 의과대학 피부과
³고려대학교 3D 신호처리 Lab., ⁴고려대학교 신경망 Lab.

- O1-4 초음파 의료 영상시스템에서 탄성 영상의 구현
 정목근, 권성재, 배무호¹, 현동규², 이기종²
 대전대학교 전자 및 통신공학과
¹한림대학교 정보통신공학부, ²메디슨

특별강연 Special Session II : Neural Function Analysis | 좌장 | 박해정, 김준식

- 뇌파 데이터의 획득, 분석방법 및 사례 | 한양대 | 이보름
- Magnetoencephalography : Acquisition, Analysis, and Applications | 서울대 | 김준식
- fMRI의 기본원리와 가상현실기술과의 융합 | 한양대 | 구정훈
- Application of Multimodal Neuroimaging | 연세대 | 박해정

일반연제 II : 생체재료, 인공장기, 생체역학 및 재활공학 5월 11일, 16:00~18:00, C (3층 352호)

좌장 : 김영호, 이규백

- O2-1 Analysis of Mechanical Loading on Small Rigid Intramuscular Implants
 Young-Ho Kim¹, Gerald E. Loeb², Raymond A. Peck², Jasspreet Singh²
 Sudeep Deshpande², Lucinda L. Baker³, Tim Bryant⁴
¹Yonsei University, Wonju, Korea
²Alfred Mann Institute for Biomedical Engineering, University of Southern California, Los Angeles, CA
³Dept. of Biokinesiology and Physical Therapy, University of Southern California
⁴Clinical Mechanics Group, Queen's University, Kingston, Canada
- O2-2 피브로넥틴 대면적 나노패턴 방법의 개발
 이원배¹, 고유진¹, 박용두^{1,2}, 이상훈^{1,2}, 선경^{1,2}, 이규백^{1,2}
¹고려대학교 의과대학 의공학교실, ²한국 인공장기 센터
- O2-3 확산에 의한 물질전달을 향상 시킨 투석필터에 대한 연구
 이경수, 이사람, 문초혜, 민병구
 서울대학교 의과대학 의공학교실
- O2-4 A Study on Muscle Activities in Lower Limbs of Different Movement Patterns on an Unstable Platform
 Yong-Jun Piao¹, Mi Yu¹, Youn-Jung Choi², Tae-Kyu Kwon^{3,4}, Mun-Ho Ryu^{3,4}
 Ji-Hye Hwang⁵, Jung-Ja Kim³, Dong-Wook Kim³, Nam-Gyun Kim³
¹Department of Biomedical Engineering, Chonbuk National University
²Department of Healthcare Engineering, Chonbuk National University
³Division of Bionics and Bioinformatics, Chonbuk National University
⁴Bioengineering Research Center for the Aged, Chonbuk National University
⁵Department of Physical Medicine and Rehabilitation, Samsung Medical Center & Center for Clinical Medicine, Sungkyunkwan University School of Medicine

특별강연 Special Session III : Neural Modulation | 좌장 | 장진우, 신형철

- 뇌-컴퓨터접속을 통한 슈퍼독의 개발 | 한림대학교 | 신형철
- Cortical stimulation : potential tool for neuromodulation | 예수병원 | 김형일
- Neuromodulation Therapy for Parkinson's Disease | 연세대 | 장진우
- 인공시각전달장치 | 동국대학교 | 서종모

일반연제 III : 생체계측시스템 및 의공학신기술

5월 12일, 09:30~11:30, D (3층 352호)

좌장 : 김종원, 백주열

- O3-1 적외선 투과 광섬유를 이용한 호흡 측정
오정은, 유옥재, 조동현, 장경원, 신상훈, 이봉수, 탁계태
건국대학교 의료생명대학 의공학부
- O3-2 군용헬멧을 이용한 다중생체신호 측정
김윤성¹, 최종민¹, 김정수¹, 이햇빛¹, 백현재¹, 류명석², 손량희²
¹서울대학교 바이오엔지니어링 협동과정,
²생체계측신기술연구센터
- O3-3 자성 비드를 이용한 소형 유전자 추출기의 자동제어 시스템의 설계 및 구현
김종대¹, 김상호², 김종원²
¹한림대학교 정보통신공학부, ²(주)바이오메드랩
- O3-4 장기간 ECG 모니터링을 위한 유연한 PDMS 건성전극
백주열^{1,2}, 최종민³, 박광석³, 이승하⁴, 신경^{1,2}, 이상훈^{1,2}
¹고려대학교 의과대학 의공학교실, ²고려대학교 한국인공장기센터
³서울대학교 의과대학 의공학교실, ⁴단국대학교 의과대학 의공학교실

일반연제 IV : 생체계측시스템 및 의공학신기술

5월 12일, 09:00~11:30, D (3층 353호)

좌장 : 권혁남, 김서확

- O4-1 수술장 환경에서의 Mobile Digital C-arm X-Ray System 영상 전송방식의 개선방법 연구
조성범, 진경원, 김종순, 김서확, 신동익, 허수진
서울아산병원 의공학과, 울산대학교 의과대학 의공학교실
- O4-2 투석기 보수유지를 통한 부품 개선 활동 Process tool 소개
김진만, 김만기, 김서확, 신동익, 허수진¹
서울아산병원 의공학과, ¹울산대학교 의과대학 의공학교실
- O4-3 의료기관평가와 BME 역할
사은식, 김서확, 허수진¹
서울아산병원 의공학과, ¹울산대학교 의과대학 의공학교실
- O4-4 RO 시스템의 중앙 공급방식과 단독 공급방식에 대한 비교 고찰
이호석, 서현원, 하창훈, 김원규, 김홍규, 권혁남, 김병태¹
삼성서울병원 의공학과, ¹성균관대학교 의과대학
- O4-5 의료용 멸균기의 Preventive Maintenance 주기 변화 적용에 따른 가동률 향상에 관한 고찰
변영석, 전석봉, 천승민, 김승엽, 권혁남, 김병태¹
삼성서울병원 의공학과, ¹성균관대학교 의과대학
- O4-6 초음파 탐촉자 테스트를 이용한 영상초음파기기 탐촉자 관리
기선우¹, 정현애¹, 김종철¹, 정석범¹, 서기홍¹, 권혁남¹, 김병태^{1,2}
¹삼성서울병원 의공학과, ²성균관대학교 의과대학
- O4-7 국제 의료기관 평가에 따른 의료기기 분야의 대응
송인석, 김묘원, 임희석, 김희숙, 최재석
세브란스병원 의료장비 팀

O4-8 Endoscopic image system 관리에 따른 업무 manual(기초편)

이선재, 방영호, 김희숙, 강창욱, 송인석, 김묘원
세브란스병원 의료장비팀

헬스케어 I : 의학영상시스템 및 영상처리

5월 11일, 13:30~15:30, D (3층 353호)

좌장 : 길명섭

O5-1 Omi 와 Oligomeric A β 의 특이적 결합 A β 의 세포 분비에 미치는 영향

유맹루, 박진오, 류명걸, 심안비, 김현진, 홍성출
미생물유전학 헬스케어발사업단기술개

O5-2 Intraction of Poly(caprolactone) Grafted Dextran(PGD) Nanoparticles with Cancer Cell

P. Prabu¹, Atul A. Chaudhari², S. Aryal³, J.H. Park⁴, S. Y. Park², H.Y. Kim⁴

¹Department of Bionanosystem Engineering, Chonbuk National University, Jeonju, Republic of Korea.

²College of Veterinary Medicine, Chonbuk National University, Jeonju, Republic of Korea.

³Center for Healthcare Technology Development, Chonbuk National University, Jeonju, Republic of Korea.

⁴Department of Textile Engineering, Chonbuk National University, Jeonju, Republic of Korea.

O5-3 Layer-by-Layer 자기 조립을 이용하여 나노 코팅된 나일론 6 나노섬유

박종훈, 김병석¹, 이운수², 길명섭, 김학용

전북대학교 섬유공학과, ¹서강대학교 화공생명공학과, ²전북대학교 바이오나노시스템공학과

헬스케어 II : 생체재료 및 인공장기

5월 11일, 16:00~18:00, D (3층 353호)

좌장 : 김동욱

O6-1 전신마비 환자를 위한 EOG 및 마커인식 기반 사용자 인터페이스

강선경, 소인미, 김영운, 정성태
원광대학교 공과대학 컴퓨터공학과

O6-2 경사침대를 이용한 자세균형 훈련시스템에 관한 연구

유창호¹, 유문호^{1,2}, 권대규^{1,2}, 김남균²

¹전북대학교 실버공학연구센터

²전북대학교 생체정보공학부

O6-3 DISS : 웹서비스를 이용한 헬스케어 문서 통합 시스템

유재규, 송은하, 정영식, 한성국
원광대학교 공과대학 전기전자 및 정보공학부

O6-4 3차원 동작분석 기술과 3차원 모델링을 토대로 한 소프트골프 스윙의 동적 분석

김용욱¹, 김성현², 김동욱³, 김남균³

¹전북대학교 헬스케어기술개발센터

²전북대학교 의용생체공학과

³전북대학교 생체정보공학부

- P1-1 합성구경집속 구현을 위한 다중주사방식의 초음파 빔포머 구조
 성지빈, 이유화, 송태경
 서강대학교 전자공학과
- P1-2 컴프턴 카메라의 회전 각도 샘플링에 대한 연구
 김수미^{1,2}, 이재성², 이미노³, 이주환⁴, 김찬형⁵, 이춘식⁴, 이수진³
¹서울대학교 방사선응용생명과학 협동과정, ²핵의학교실, ³배재대학교 전자공학과
⁴중앙대학교 물리학과, ⁵한양대학교 원자력공학과
- P1-3 삼중 헤드 SPECT 시스템에서 기하학적 보정 기법의 개발
 김중현, 이재성
 서울대학교 의과대학 핵의학교실, 서울대학교 방사선응용생명과학 협동과정
- P1-4 PET/MRI에서 동시계측을 위한 SSPM 소자 특성 연구
 권순일, 이재성, 홍성중, 이또우 미끼꼬, 송인찬
 서울대학교 의과대학 핵의학교실, 서울대학교 방사선응용 생명과학 협동과정
 가천의과학대학교 생명과학부, 뇌과학연구소
 고려대학교 물리학과
 서울대학교 병원 진단방사선과
- P1-5 나노 엑스선 토모그래피 시스템의 생물학적 적용
 김경우^{1,2}, 최규실¹, 김규검², 김재희², 윤권하¹
¹원광대학교 의과대학 방사선과 익산방사선영상과학연구소, ²주식회사나노포커스레이
- P1-6 Dual Isotope SPECT imaging을 위한 simulation을 이용한 산란 보정
 박민재, 이재성, 박광석
 서울대학교 협동과정 의공학교실
 서울대학교 의과대학 핵의학교실
- P1-7 유방촬영용 antiscatter grids의 성능평가: 실험식과 Monte Carlo 모의실험에 관한 연구
 장도윤, 김도일, 박천주, 이형구
 가톨릭대학교 의공학교실
- P1-8 Comparing of the B₁ Homogeneity Between Birdcage Coil and Phase Array Coil Using FDTD Method at High Field MRI
 J. H. Seo, H. Y. Heo, B. H. Han, and S. Y. Lee
 Department of Biomedical Engineering, Kyung Hee University, Korea
- P1-9 산화철 나노입자를 이용한 쥐 뇌에서의 줄기세포 추적
 이 춘형, 유승완, 서 혜영, 이 수열
 경희대학교 일반 대학원 동서의료공학과, 아주대학교 의과대학 해부학교실
- P1-10 Half-size 디텍터를 이용한 fan-beam 재구성 알고리즘
 이동현, 최정민, M. A. Yousuf, 조민형, 이수열
 경희대학교 동서의료공학과
- P1-11 Active Contour model을 이용한 링거의 외곽 윤곽선 추출
 김창욱¹, 지아 모이 우딘², 우상효³, 이정현³, 박일용⁴, 원철호⁵, 조진호^{1,4}
¹경북대학교 전자전기컴퓨터학과, ²경북대학교 의과대학 의공학교실
³계명대학교 동산의료원 의료정보학교실,
⁴경북대학교 첨단 감각기능 회복장치 연구센터, ⁵경일대학교 제어계측공학과

- P1-12 A Study on the Gradient Descent Method for Matrix-valued Median Filter in Diffusion Tensor MRI
 김성희, 권기운, 박인성, 이진수, 한봉수¹, 김동윤
 연세대학교 보건과학대학 의공학과, ¹방사선학과
- P1-13 FPGA를 이용한 소형 디지털 주사선 변환기
 윤창한, 조규현, 송태경
 서강대학교 공과대학 전자공학과
- P1-14 A Study on the Gradient Descent Method for Matrix-valued Median Filter in Diffusion Tensor MRI
 김성희, 권기운, 박인성, 이진수, 한봉수¹, 김동윤
 연세대학교 보건과학대학 의공학과, ¹방사선학과
- P1-15 단일 TMS320C6416 DSP를 이용한 디지털 주사선 변환기의 구현
 이충, 한동훈, 송태경
 서강대학교 공과대학 전자공학과
- P1-16 현장 진단 응용을 위한 단일 FPGA 기반의 초소형 혈류 영상장치 설계
 강현, 손왕영, 장두희, 송태경
 서강대학교 공과대학 전자공학과
- P1-17 악성흑색종 진단을 위한 dermoscopy 영상의 정량적 분석
 이건우¹, 박상용¹, 하승한¹, 이연석¹, 김민기³, 문종섭⁴, 오칠환^{1,2}
¹고려대학교 의과대학 영상의학연구소, ²고려대학교 의과대학 피부과
³고려대학교 3D 신호처리 Lab., ⁴고려대학교 신경망 Lab.
- P1-18 내시경 영상에서의 출혈부위 자동검출 : Capsule Endoscopy 적용을 위한 예비 연구
 정윤섭¹, 김종효², 김광기², 박상준³, 한연주²
¹연세대학교 의공학부, ²서울대학교 의과대학 방사선학교실
³서울대학교 의과대학 방사선응용생명협동과정
- P1-19 디지털 손 영상에서의 정량적 뼈 특징 추출과 통계분석
 송정주, 이상호, 김영재, 김광기, 김종효
 서울대학교 의과대학 방사선응용생명과학협동과정
- P1-20 Geometric features를 이용한 유방영상의 미세석회화 군집 검출
 이화정, 이준구, 김종효, 김광기, 송지연
 서울대학교 의과대학 방사선응용생명과학협동과정
- P1-21 Quantitative Analysis with Magnetization Transfer by phase sensitive method in Osteoarthritis
 M.H. Yoon¹, M.S. Sung², B.Y. Choe¹
¹Department of Biomedical Engineering, College of Medicine, The Catholic University of Korea
²Department of Radiology, College of Medicine, The Catholic University of Korea, Holy Family Hospital
- P1-22 LVOOP를 이용한 전립선암의 분포 지도 분석
 박필준, 신동익, 조영미, 허수진
 울산대학교 의과대학, 서울아산병원 의공학과
- P1-23 DTI에서의 Eddy Current 측정과 데이터 처리
 윤성익¹, 강현수², 김영주³, 최보영¹
¹가톨릭대학교 의과대학 의공학과, ²서울보건의대학교 방사선과
³가톨릭대학교 의과대학 방사선과
- P1-24 Registration of MR molecular images using micro beads
 H. C. Kim, B. H. Han, M. H. Cho, S. Y. Lee
 Department of Biomedical Engineering, Kyung Hee University, Korea

- P1-25 모바일 환경에서 의료영상 무선전송
이상복¹, 홍주현¹, 안병주², 김경아¹, 차은종¹, 이태수¹
충북대학교 의과대학 의공학교실¹, 전남대학교병원 진단방사선과²
- P1-26 초음파 의용 영상 시스템에서 평균 음속도 추정
정목근, 권성재, 조성민, 배무호¹, 이한우²
대전대학교 전자공학과, ¹한림대학교 정보통신공학부, ²메디슨
- P1-27 Abdominal Aortic Aneurysm의 3차원 정량분석을 위한 Morphological Gradient Edge Function 기반의 Geometric Active Contour Model 개발에 관한 연구
김호철^{1,6}, 최석윤², 설윤환³, 김민기³, 선 경^{4,5,6}
¹고려대학교 두뇌한국21의생명과학계열 의공학과과정, ²고려대학교 의공학협동과정, ³고려대학교 전자 정보 공학과
⁴고려대학교 의과대학 흉부외과학교실, ⁵고려대학교 의과대학 의공학교실, ⁶고려대학교 한국인공장기센터
- P1-28 공간 및 언어 과제 수행 시 소녀의 편측화에 관한 연구
안성환, 이행운, 정순철
건국대학교 의학공학과
- P1-29 스트림튜브를 이용한 빠른 트랙토그래피의 방법과 그의 구현
황진영, 한예지, 박현욱
한국과학기술원 전기및전자공학과
- P1-30 Extreme Learning Machine 및 주성분 분석법을 이용한 부정맥 검출 알고리즘
김진권, 신항식, 이연욱¹, 이명호
연세대학교 전기전자공학과
¹연세대학교 전기전자공학부
- P1-31 뇌파 기반 실시간 뇌활동 모니터링 시스템의 개발
황한정, 채희재, 임창환
연세대학교 의공학과
- P1-32 초기 치매환자 진단을 위한 qEEG 변수 추출
채희재¹, 정영진¹, 임창환¹, 이승환²
¹연세대학교 의공학과
²연세대학교 일산백병원 신경정신과
- P1-33 다중해를 갖는 함수에서 최적 개수의 해를 찾는 방법
이정훈, 양용주, 심훈, 송상하, 이경중, 윤영로
연세대학교 보건과학대학 의공학과
- P1-34 병적인 음성에 대한 기존 피치 트래킹 방법들의 성능 비교 분석
¹장승진, ²최성희, ¹김효민, ³최홍식, ¹윤영로
¹연세대학교, 보건과학대학 의공학과
²위스콘신대학 이비인후/두경부 전문외과
³연세대학교 의학대학 이비인후과
- P1-35 Spike train decoding을 이용한 인공와우 어음처리기용 주파수분석기의 성능평가
김두희, 김진호, 김경환
연세대학교 보건과학대학 의공학부
- P1-36 폴반저근의 압력을 이용한 정량적 뇌실금 진단 알고리즘 개발에 관한 연구
민혜기¹, 노시철¹, 박문규¹, 유우진¹, 민권식², 최홍호¹
¹연세대학교 의생명공학대학 의용공학과
²연세대학교 부산백병원 비뇨기과

- P1-37 자기공명분광법 후처리 소프트웨어 개발
홍승탁, 최보영
가톨릭대학교 의과대학 의공학교실
- P1-38 2-channel PPG를 사용한 PWV 측정방법
전아영¹, 예수영², 최병철³, 노정훈¹, 김윤진⁴, 전계록¹
¹부산대학교 의학전문대학원 의공학교실
²부산대학교 의학전문대학원 BK21 고급의료인력양성사업단
³춘해대학 의료공학과
⁴부산대학교 의학전문대학원 가정의학교실
- P1-39 실시간 Bispectrum 분석을 통한 마취심도 평가에 관한 연구
박준모¹, 예수영², 김인철¹, 윤상화¹, 전계록³
¹부산대학교 의학전문대학원 의공학협동과정,
²부산대학교 의학전문대학원 BK21 고급의료인력양성사업단
³부산대학교 의학전문대학원 의공학교실
- P1-40 동맥 압력-용적 모델을 이용한 동맥 오실레이션의 위상 분석
윤상화¹, 예수영², 전아영¹, 박준모¹, 전계록³
¹부산대학교 대학원 의공학협동과정, ²부산대학교의학전문대학원 BK21 사업단, ³부산대학교 의공학교실
- P1-41 심박 변이도 (HRV) 의 주파수 도메인 분석에서 Interpolation 방법들의 결과 비교
김고근^{1,3}, 박광석^{2,3}
¹서울대학교 대학원 협동과정 의용생체공학전공
²서울대학교 의과대학 의공학교실
³서울대학교 생체계측 신기술 연구센터 (ABRC)
- P1-42 PPG 신호처리를 이용한 두가지 호흡수 측정 기법
김내현, 김종명, 차은중, 이태수
충북대학교 의공학교실
- P1-43 비침습적 압전 Film 센서를 이용한 무선 생체신호 모니터링 장치
김종명, 홍주현, 차은중, 이태수
충북대학교 의과대학 의공학교실
- P1-44 비선형 유사성에 기반한 간질 발작 예측 방법 개발
김진희¹, 송인호², 김인영², 김선일², 권오경¹
¹한양대학교 공과대학 전자전기컴퓨터공학부, ²한양대학교 의과대학 의공학교실
- P1-45 수압측정 방식의 요류검사 진단매개변수의 정확도 분석
최성수, 이인광, 김경아, 이태수, 차은중
충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단
- P1-46 CT 시뮬레이션을 위한 그래픽 유저 인터페이스 개발
정민호, 임창휘, 김호경
부산대학교 기계공학부
- P1-47 엑스선 직접 흡수에 기인한 간접변환방식 검출기의 픽셀 노이즈의 해석
윤승만, 김호경
부산대학교 기계공학부
- P1-48 치과 영상을 위한 제한된 각도 내 부족한 데이터 기반의 역투사 후 여과법
조민국, 김호경
부산대학교 기계공학부

- P1-49 Effects of Roselle(*Hibiscus sabdariffa* L.) Flower Extract and Its Fractions on Skin Microorganisms and Oxidation
P. S. Kang, J. H. Seok, Y. H. Kim, J. S. Eun¹, S. H. Oh
Department of Biotechnology, Woosuk University, Jeonju 565-701, Korea
¹College of Pharmacy, Woosuk University, Jeonju 565-701, Korea
- P1-50 Stimulation of Melanogenesis by *Poria cocos* Extract in B16 Melanoma Cells
J. H. Koo, H. Y. Yoon, B. H. Park and J. W. Park
Department of Biochemistry, Medical School, Chonbuk National University, Jeonju, 561-756, Jeonbuk, Korea
- P1-51 대장 샘암종에서 Claudin-1, β -catenin과 E-cadherin의 발현
최하나, 백현아, 김희진, 차은정, 장규윤, 김경열, 박호성, 문우성
전북대학교 의학전문대학원 병리학교실, 의과학 연구소,
전북대학교 헬스케어기술개발사업단
- P1-52 고강도 수영이 혈중 이온 마그네슘 및 칼슘에 미치는 영향
전설희, 이문영, 미자놀 라호만, 김학용, 김성주, 김진상, 강형섭
전북대학교 수의과대학 수의학과, 의과대학, 공과대학
- P1-53 감국이 MDCK 세포의 기저막 단백질 합성에 미치는 영향
전 훈, 임종필, 신태용, 오찬호¹, 나호정, 이지영, 백 설, 차동석
우석대학교 약학대학, ¹우석대학교 식품생명공학과
- P1-54 초음파를 이용한 Piroxicam의 경피흡수 및 소염효과
양재현, 김대근, 윤미영, 조경주, 박현규
우석대학교 약학대학
- P1-55 신경세포 특이적 HtrA2/Omi 과발현 형질전환 마우스 개발
심안비, 유양, 류명걸, 유맹루, 박진오, 홍성출
미생물유전학 헬스케어기술개발사업단
- P1-56 젤라티나마이신이 베타 아밀로이드 전구단백질의 대사에 미치는 영향
은제순, 이경아, 이일화, 공동균, 이충수, 최부진, 임재운
우석대학교 약학대학 약학과

포스터 II : 생체재료, 인공장기, 생체역학 및 재활공학

5월 11일, 16:00~18:00, 3층 복도

- P2-1 Hard Anodization Anodic Aluminum Oxide(HAAAO) Superhydrophobic 연구
김은혜^{1,2}, 신경², 이규백^{1,2}
¹고려대학교 의과대학 의공학교실, ²한국인공장기센터
- P2-2 전기방사 방법을 이용한 3D 세포배양용 나노화이버의 제작방법 및 결과
신예숙^{1,2}, 신경², 이규백^{1,2}
¹고려대학교 의과대학 의공학교실, ²한국인공장기센터
- P2-3 온열 치료용 발열체로서의 듀플렉스 스테인리스 스틸과 니켈-구리 합금의 발열 특성 비교 평가
박재근¹, 최성민¹, 황은미¹, 조현설², 박주환³, 정용권³, 김영곤¹
¹인제대학교 의생명대학 의용공학과 의용재료연구실
²광양보건대학, ³고려상사(주)
- P2-4 광학적 지문센서 제작을 위한 CuPc FET 전기적 특성 연구
이호식, 양승호, 천민우, 박용필
동신대학교 보건복지대학 병원의료공학과

- P2-5 Eicosanoic Acid LB 박막을 이용한 의용 소자로의 전기적 특성
이호식¹, 박용필¹, 양승호¹, 천민호¹, 김영표²
¹동신대학교 보건복지대학 병원의료공학과, ²동신대학교 공과대학 전기전자공학과
- P2-6 Effect of Different Bone Substitutes on the Concentration of Platelet-derived Growth Factor and Transforming Growth Factor β -1 in Platelet-rich Plasma
H. S. Cho¹, S.Y. Park², H.M.Byun², S.Y. Kim³, S. K. Bae⁴, D. S. Kim⁴, D. S. Shin⁴, M.W.Ahn.⁴
¹Department of Laboratory Medicine, College of Medicine, Yeungnam University, 317-1, Daemyungdong, Namgu, Daegu, Korea, 705-717, ²Department of Physiology, College of Medicine, Yeungnam University, 317-1, Daemyungdong, Namgu, Daegu, Korea, 705-717, ³School of Materials ScienceEngineering, Yeungnam University, 214-1, Daedong, Gyeongsan, Gyeongbuk, Korea, 712-749, ⁴Department of Orthopedic surgery, College of Medicine, Yeungnam University, 317-1, Daemyungdong, Namgu, Daegu, Korea, 705-717
- P2-7 말초동맥 스텐트용 Zwitterionic PEG로 그래프트된 Nitinol-DLC 의 세포독성 및 혈액적합성 평가
신흥섭^{1,2}, 손준식¹, 박귀덕¹, 정홍희¹, 김지홍², 김재진¹, 안광덕¹, 한동근¹
¹한국과학기술연구원 생체재료연구센터, ²성균관대학교 화학공학과
- P2-8 미세유체칩을 이용한 신경세포 유도용 PLGA 생분해성 microfiber 제작
황창모¹, 신경^{1,2}, 이상훈^{1,2}
고려대학교 한국인공장기센터, 고려대학교 의공학교실
- P2-9 Pulse Push Pull 혈액투석에서 polysulfone 투석기의 Hydraulic permeability 평가
이사람^{1,5}, 이경수^{1,5}, 민병구^{2,3,4,5}
¹서울대학교 대학원 협동과정 의용생체공학전공, ²서울대학교 의과대학 의공학교실
³서울대학교 의학연구원 의용생체공학연구소, ⁴서울대학교 삼성 압연구소, ⁵한국인공장기센터
- P2-10 단일 교류 주파수를 이용한 전도도 탐지의 요소 청소율 측정
강우현^{1,4}, 이승민^{1,4}, 최대석^{1,4}, 임기무^{1,4}, 민병구^{1,2,3,4}
¹서울대학교 대학원 협동과정 바이오 엔지니어링전공, ²서울대학교 의과대학 의공학교실
³서울대학교 의과대학 의학연구원, ⁴한국 인공장기 센터
- P2-11 투석 시 Fluid Warmer 개발을 위한 열전달 해석
정미진^{1,5}, 이승민^{1,5}, 최대석^{2,5}, 이정찬^{1,5}, 민병구^{2,3,4,5}
¹서울대학교 대학원 협동과정 의용생체 공학전공, ²서울대학교 의과대학 의공학 교실
³서울대학교 의학연구원 의용생체공학연구소, ⁴(주)뉴하트바이오, ⁵한국 인공장기 센터
- P2-12 3차원 동작분석 기술과 모델링을 토대로 한 소프트골프 스윙의 동적 분석
김용욱, 김성현, 김동욱, 김남균
전북대학교 헬스케어기술개발사업단, 전북대학교 의용생체공학과, 전북대학교 생체정보공학부
- P2-13 LCP를 이용한 근위부 관절외 경골 고정술의 생체역학적 안정성 분석
권경제¹, 오종건², 이재원¹, 유창훈¹, 이성재^{1,3}
¹인제대학교 의용공학과, ²고려대학교 의과대학 정형외과
³인제대학교 백인제기념 임상의학연구소
- P2-14 압력분포와 편안함의 변화를 통한 기능성 보행화의 평가
송동물¹, 전성철¹, 김현동², 이성재^{1,3}
¹인제대학교 의용공학과, ²인제대학교 백병원 재활의학과
³인제대학교 백인제 기념 임상의학 연구소
- P2-15 3축 가속도계를 이용한 낙상 검출 알고리즘 구현
강동원, 최진승, 이강휘, 박수준¹, 이정환, 정순철, 탁계태
건국대학교 의학공학부, ¹한국전자통신연구원 라이프인포매틱스팀

- P2-16 신발의 종류와 보행 속도에 따른 하지의 협응과 호흡변인에 대한 연구
최진승, 강동원, 탁계래
건국대학교 의학공학부
- P2-17 고령자와 젊은 성인의 등속성 족관절 모멘트의 남녀차이 비교
김지원, 김나영, 엄광문
건국대학교 의학공학부
- P2-18 편마비 보행의 개선을 위한 능동형 단하지 보조기의 개발
김정윤¹, 황성재¹, 이영희², 김영호³
¹연세대학교 대학원 의공학과, ²연세대학교 원주의과대학교 재활의학교실, ³연세대학교 의료공학연구원
- P2-19 근골격계 모델을 이용한 편마비 보행 시 하지 근 길이 변화
황성재¹, 신유진², 손종상², 박정미³, 김영호⁴
¹연세대학교 대학원 의공학과, ²연세대학교 의공학부, ³연세대학교 원주의과대학교 재활의학교실
⁴연세대학교 의료공학연구원
- P2-20 Quantitative Analysis of EMG Activity for Evaluation of Hand Function
Ki-Sik Tae¹, Sung Jae Song², Young-Ho Kim^{3,4}
¹Dept. of Biomedical Engineering, Konyang University, ²Dept. of Mechanical Engineering, Kangnyung University
³Dept of Biomedical Engineering, ⁴Institute of Medical Engineering, Yonsei University
- P2-21 Praat script를 이용한 음성치료 프로그램의 개발
권순복¹, 조두상¹, 권순우², 노정훈³, 전계록³, 왕수건⁴
¹부산대학교 언어정보학과, ²위덕대학교 특수교육학부, ³부산대학교 의공학교실, ⁴부산대학교 이비인후과학교실
- P2-22 DSP를 이용한 디지털 보청기 모듈 설계에 관한 연구
양동권, 방동혁, 이상민
인하대학교 전자공학과
- P2-23 MR 회전형 브레이크를 이용한 하지 근력 증진용 헬스 자전거 개발
윤영일, 박용근, 권대규, 허민, 김동욱, 김정자
전북대학교 대학원 헬스케어공학과, 전북대학교 대학원 의용생체공학과,
전북대학교 공과대학 생체정보공학부, 전북대학교 실버공학연구원
- P2-24 트레드밀 위에서 하지 보조기를 착용한 보행 운동 시 하지 근력 특성
김 경¹, 홍경주¹, 유문호^{2,3}, 권대규², 김동욱², 김남균²
¹전북대학교 대학원 의용생체공학과, ²전북대학교 공과대학 생체정보공학부
³전북대학교 실버공학연구원
- P2-25 공압 고무 액츄에이터를 장착한 주관절 보조기 착용에 따른 상지근력 특성
홍경주¹, 김 경¹, 권대규², 유문호^{2,3}, 김동욱², 김남균²
¹전북대학교 대학원 의용생체공학과, ²전북대학교 공과대학 생체정보공학부
³전북대학교 실버공학연구원
- P2-26 뇌졸중 환자치료용 뇌자극 원격 치치 프로그램 개발에 관한 연구
윤효정¹, 김국화¹, 양윤석², 김남균³
¹전북대학교 대학원 헬스케어공학과
²전북대학교 공과대학 생체정보공학부 & 전북대 실버공학연구원
³전북대학교 공과대학 생체정보공학부
- P2-27 장애인을 위한 중앙관리 기반의 무선 의사소통보조기기
김창걸, 박종명, 최미나, 송병섭
대구대학교 재활과학대학 재활공학과

- P2-28 Development of An Electric Pegboard using RFID with Multiple Reader Antennas
Hyunho Choi¹, Munho Ryu^{2,3}, Yoonseok Yang², Namgyun Kim²
¹Dept. of Healthcare Engineering, Chonbuk National Univ.
²Division of Bionics and Bio-informatics, Chonbuk National Univ.
³Bioengineering Research Center for the Aged, Chonbuk National Univ.
- P2-29 MR 댐퍼가 적용된 불안정판을 이용한 하지근력훈련 특성 분석
최윤정¹, 박용근², 권대규^{3,4}, 유문호^{3,4}, 김정자³, 김동욱³, 김남균³
¹전북대학교 대학원 헬스케어공학과, ²전북대학교 대학원 의용생체공학과
³전북대학교 공과대학 생체정보공학부, ⁴전북대학교 실버공학 연구센터
- P2-30 자동차 심폐소생기의 개발을 위한 체형분석
정집민, 김효민, 송상하, 황성오, 윤영로
연세대학교 의공학학과
- P2-31 플라즈마 표면 개질처리된 나노 파이버 지지체를 기반의
간염줄기세포 배양을 위한 미세유체 세포 칩의 개발
이광호¹, 권구한², 신수정², 이진영², 김민영², 박용두², 한동근³, 이상훈², 민병구⁴
¹서울대학교 대학원 협동과정 바이오엔지니어링
²고려대학교 의과대학 의공학교실
³한국과학기술원, 생체재료센터
⁴서울대학교 의과대학 의공학교실
- P2-32 의료용 센서 제작을 위한 초전도 박막의 온도특성 평가
양승호¹, 이호식¹, 김대식¹, 박용필¹
¹동신대학교 보건복지대학 병원의료공학과
- P2-33 의료용 능동소자 적용을 위한 BSCCO 박막의 상안정 영역에 관한 연구
양승호¹, 이호식¹, 천민우¹, 박용필¹
¹동신대학교 보건복지대학 병원의료공학과
- P2-34 정상망막과 변성망막의 전기자극 파라미터 비교
예장희, 구용숙
충북대학교 의과대학 생리학교실
- P2-35 강박장애 환자의 평가를 위한 가상현실 시스템
김광욱¹, 김찬형², 차경렬², 박준영², 한기완¹, 구정훈¹, 김재진², 김인영¹, 김선일¹
¹한양대학교 의용생체공학과, ²연세대학교 의과대학 정신과학교실
- P2-36 미세유체 칩을 이용한 칼슘 알지네이트 파이버의 제작을 통한 세포의 캡슐화
신수정¹, 이진영¹, 이광호², 이상훈¹
¹고려대학교 의과대학 의공학교실, ²서울대학교 대학원 협동과정 바이오 엔지니어링 전공
- P2-37 통증조절을 위한 척수강내 약물주입 이식형 펌프
이철한, 홍소영, 백두진, 송승준, 조영호
국립암센터 연구소 의공학연구과
- P2-38 수술 로봇 1축 Translation의 힘 반향제어에 관한 연구
이덕희¹, 박준우¹, 송승준¹, 김윤호¹, 최재순¹
국립암센터 의공학연구과
- P2-39 수술로봇을 위한 무센서 힘반향 제어
박준우¹, 이덕희¹, 송승준¹, 신정욱¹, 김윤호¹, 이정주², 이정찬^{2,3}, 조영호¹, 최재순¹
¹국립암센터 연구소 의공학연구과, ²고려대학교 한국인공장기센터, ³서울대학교 대학원 협동과정 의용생체공학전공

- P2-40 이층구조 다엽콜리메이터 개념 설계와 유용성 평가
오승중¹, 정원균¹, 정광호^{1,2}, 서태석¹
¹가톨릭대학교 의과대학 의공학교실, ²한림대학교 의과대학 방사선 중앙학교실
- P2-41 전립선암 근접치료시 완벽하게 중복된 방사선원 위치 재구성에 관한 연구
홍주영, 라정은, 서태석
가톨릭대학교 의과대학 의공학교실
- P2-42 재택건강관리시스템에서의 권역응급센터 시스템 설계
송상하, 양용주, 정집민, 김효민, 이주환, 윤영로
연세대학교 보건과학대학 의공학과
- P2-43 맞춤형 체형 진단 및 처방을 위한 웹 기반 유비쿼터스 건강 증진 시스템
사디아 말릭, 박승훈
경희대학교 전자정보대학 동서의료공학과
- P2-44 EMR 연동 모니터의 화면 장애 -증례 보고-
안원식, 김희찬¹, 서종모²
서울대학교 의과대학 마취과학교실, ¹의공학과, ²동국대학교 의과대학 안과학교실
- P2-45 실시간 몸동작 인식 시스템의 설계 및 구현
김영운, 강선경, 소인미, 정성태
원광대학교 공과대학 컴퓨터공학과
- P2-46 모바일 협업을 위한 분산객체그룹 컴팩트 프레임워크
김동석, 정창원, 주수종
원광대학교 전기전자및정보통신공학부
- P2-47 반신욕이 인체 생리특성에 미치는 영향
김형지¹, 황민지², 윤성애², 유 미¹, 권대규², 김남균²
¹전북대학교 대학원 의용생체공학과, ²전북대학교 공과대학 생체정보공학부, ³전북대학교 실버공학연구소
- P2-48 헬스 자전거 시스템을 이용한 근육과 호흡의 분석
정우석^{1,2}, 김기범², 김진호³, 박창주³, 송이슬³, 강형섭⁴, 김성종⁵, 김민호⁶, 홍철운³
¹전북대학교 대학원 의용생체공학과, ²전북대학교 의과대학 임상연구소
³전북대학교 공과대학 생체정보공학부, ⁴전북대학교 수의과대학 약리학 교실
⁵익산대학 의용화학계열
⁶전북대학교 의과대학 흉부외과학교실
- P2-49 Mechanical Properties of Alignment Nyong 6 Nanofibers
K. W. Kim, C. K. Kim¹, H. Y. Kim¹, K. H. Lee², and S. J. Park³
Dept. of Bionano System Eng., Chonbuk National University, Jeonju 561-756, South Korea
¹Dept. of Textile Eng., Chonbuk National University, Jeonju 561-756, South Korea
²Dept. of materials Sci. & Eng., University of Delaware, Newark, DE 19716, USA
³College of Physical Chemistry, Inha University, Incheon 402-751, South Korea
- P2-50 전기방사된 산화 티타늄 나노섬유를 이용한 하이드로시아파타이트 결정의 합성
김철기¹, 레만트², 길명섭¹, 김학용¹, 김익수³
¹전북대학교 섬유공학과, ²전북대학교 바이오나노시스템공학과, ³신슈대학교 섬유과학부
- P2-51 Multi-walled carbon nanotubes/TiO₂ composite nanofiber by electrospinning
Santosh Aryal¹, Chul Ki Kim², Kwan-Woo Kim², Myung Seob Khil³, Hak Yong Kim³
¹Center for Healthcare Technology Development, ²Department of Bionanosystem Engineering
³Department of Textile Engineering, Chonbuk National University

P2-52 Modified Chitosan Stabilized Magnetic Nanoparticles :
 Implication for Cellular Labeling and Magnetic Resonance Imaging
 S. R. Bhattarai¹, S. Y. Kim², M. S. Khil³, P. H. Hwang², G. H. Chung⁴, H. Y. Kime⁵
¹Department of Bionanosystem Engineering,
²Department of Pediatric and Clinical Research Center, School of Medicine,
³Center for Healthcare Technology Development,
⁴Department of Radiology, School of Medicine,
⁵Department of Textile Engineering, Chonbuk National University, Jeonju, South Korea

P2-53 Encapsulation of Fe₃O₄ in Gelatin Nanoparticles :
 Effect of Different Parameters on Size and Stability of the Colloidal Dispersion
 Babita Gaihre¹, Santosh Aryal², Myung Seob Khil³, Hak Yong Kim³
¹전북대학교 바이오나노시스템공학과, ²전북대학교 헬스케어기술개발사업단, ³전북대학교 섬유공학과

P2-54 Synthesis, Characterization, and Self-Assembled Aqueous Dispersion of PCL-Dextran Nanoparticles
 Madhab Prasad Bajgai¹, Santosh Aryal², Douk Rae Lee³, Soo-Jin Park⁴, Hak Yong Kim³
¹전북대학교 바이오나노시스템공학과,
²전북대학교 헬스케어기술개발사업단
³전북대학교 섬유공학과, ⁴인하대학교 신소재공학부

포스터 III : 생체계측시스템 및 의공학신기술

5월 12일, 09:30~11:30, 3층 복도

P3-1 Small Low Power ECG Telemetry System
 Z. Mohy-Ud-Din¹, S. H. Woo², C. W. Kim², J. H. Lee³, Y. K. Moon², H. J. Park³
 C. H. Won⁴, Y. Y. Kim³, H. C. Choi², J. H. Cho^{1,2}
¹Dept. of Medical & Biological Engineering, Kyungpook National University, Daegu, Korea,
²School of Electrical Engineering and Computer Science, Kyungpook National University,
³Dept. Of Medical Informatics, School of Medicine, Keimyung University,
⁴Department of Control Instrumentation Engineering, Kyungil University.

P3-2 실험자에 따른 자침에 대한 뇌기능 자기공명영상을 이용한 뇌활성화 변화의 재현성 연구
 김영환^{1,2}, 김영진^{1,2}, 박재현^{1,2}, 류경환^{1,3}, 장건호⁴, 임사비나^{1,2,3}
¹경희대학교 동서의학연구소 WHO전통의학연구협력센터 통증및 신경의학연구팀
²경희대학교 기초한의학과 경혈학교실, ³경희대학교 한의과대학 한방응용의학과
⁴경희대학교 동서신의학병원 진단방사선과

P3-3 Changes of Heart Rate Variability during the Day Measured by Mobile ECG Sensors
 Lizawati Salahuddin, Sook-hyun Kim, Desok Kim
 School of Engineering, Information and Communications University, Daejeon, Korea

P3-4 연하장애의 진단 시스템 개발
 신동익¹, 박필준², 최경효³, 허수진⁴
 서울아산병원 의공학과¹, 울산대학교 의과대학 의과학과², 재학의학교실³, 의공학교실⁴

P3-5 컴퓨터 기반 비만관리를 위한 체중계의 설계와 제작
 허창, 장대근, 서상진, 곽현민, 박승훈
 경희대학교 전자정보대학 동서의료공학과

- P3-6 가상현실을 이용한 사회적 상황에서의 알코올 갈망감 유발 및 측정 시스템 개발
 조상우¹, 구정훈¹, 박진식¹, 한기완¹, 최유경², 남궁기², 정영철², 김재진², 김인영¹, 김선일¹
¹한양대학교 의용생체공학과
²연세대학교 정신건강병원 행동과학 연구실
- P3-7 모의 맥파 시뮬레이터 개발 및 그 유효성에 관한 연구
 한승신, 박미경, 김은근, 허영
 한국전기연구원
- P3-8 Synchrotron x선을 이용한 피부암의 영상법 연구
 박상용¹, 하승환¹, 이연석¹, 이견우¹, 손상욱², 휴유광⁴, 제정호³, 오칠환^{1,2}
¹고려대학교 의과대학 영상의학 연구소, ²피부과, ³포항공대 신소재공학과, ⁴대만 신니카대학 물리학과
- P3-9 골프 퍼팅 스트로크시의 초보자과 숙련자간의 악력 분석
 김형식, 최진승, 임영태¹, 이정환, 탁계래
 건국대학교 의료생명대학 의공학학과
¹건국대학교 스포츠과학부 골프지도학과
- P3-10 발-발 경로로 체임피던스를 측정하는데 있어서 방광안의 소변의 영향
 홍기환^{1,2}, 최종민^{1,2}, 박광석³
¹서울대학교 협동과정 의용생체공학전공
²서울대학교 생체계측 신기술 연구센터
³서울대학교 의과대학 의공학교실
- P3-11 피부 각질층의 임피던스 추정값 보정을 위한 연구
 최한윤, 심명현, 정인철, 김기원, 윤형로
 연세대학교 보건과학대학 의공학과
- P3-12 PPG 신호의 형태학적 분석에 의한 연속적인 혈압 추정에 관한 연구: 임상실험
 이동희, 정인철, 진석환, 박신우, 윤형로
 연세대학교 의공학과
- P3-13 크롬천화세포의 외포작용을 광학적, 전기적으로 동시에 계측하기 위한ITO 기반의 미세 전기화학 검출기(ECD)의 제작
 김남기¹, 카산드라 키슬러², 맨프레드 린다우²
¹한양대학교 공과대학 전자통신컴퓨터공학부
²코넬대학교 공과대학 응용 및 공학물리학과
- P3-14 The Effects of Somatosensory Input for the Postural Control in Human Standing
 Mi Yu¹, Hey In Eun², Yong-Jun Piao¹, Dong Wook Kim³, Tae Kyu Kwon^{3,4} and Nam Gyun Kim³
¹Dept. of Biomedical Engineering, Chonbuk National Univ.
²Dept. of Healthcare Engineering, Chonbuk National Univ.
³Division of Bionics and Bio-informatics, Chonbuk National Univ.
⁴Bioengineering Research Center for the Aged, Chonbuk National Univ.
- P3-15 모션 아티팩트 저감을 위한 손톱위에서의 광전용적맥파 검출 센서
 전용욱¹, 김철한², 예수영³, 노정훈³, 전계록³
¹부산대학교 대학원 의공학협동과정
²동아대학교 전자공학과
³부산대학교 의과대학 의공학교실
- P3-16 다채널 다주파수 임피던스 영상 시스템의 보정 방법
 구환, 김상민, 이경현, 우응제
 경희대학교 동서의료공학과

- P3-17 다주파수 EIT 시스템을 이용한 시간차 및 주파수차 영상의 획득과 분석
 김상민, 우응제
 경희대학교 전자정보대학 동서의료공학과
- P3-18 실제 자동차 운전 중 무구속 심전도 측정 시스템 및 실험
 이햇빛¹, 최종민¹, 김정수¹, 김윤성¹, 백현재¹, 류명석², 손량희², 박광석³
¹서울대학교 공과대학 협동과정 의용생체공학전공, ²서울대학교 생체 계측 신기술 연구 센터
³서울대학교 의과대학 의공학교실
- P3-19 주파수차 도전을 영상법을 위한 물질의 도전을 스펙트럼 측정
 이경현, 김영태, 우응제
 경희대학교 전자정보대학 동서의료공학과
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²경북대학교 첨단 감각기능 회복장치 연구센터
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- P3-33 암의 비대칭적 성장 및 혈관생성에 대한 수치적 연구
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¹한림대학교 의공학연구소, 한림대학교 제어응용연구소
- P3-35 바이오피드백과 경쟁심리를 이용한 동기부여방식의 체중관리시스템
장대근, 이고은, 서상진, 박승훈
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- P3-36 3축 가속도 센서를 이용한 인체활동 모니터링 시스템 구현
예수영¹, 윤상화², 박현², 전이영², 전계록³
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충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단
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¹성균관대학교 물리학과, ²가톨릭대학교 의과대학 의공학교실
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¹서울대학교 협동과정의용생체, ²서울대학교 의과대학 의공학교실

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²경희대학교 기초한의학과 경혈학교실, ³경희대학교 한의과대학 한방응용의학과
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¹건국대학교 의료생명대학 의공학부
²연세대학교 보건과학대학 방사선학과,
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 장지나¹, 서태석¹, 지영훈²
¹가톨릭대학교 의과대학 의공학교실, ²원자력의학원 방사선종양학과
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 장경원¹, 조동현¹, 유욱재¹, 신상훈¹, 이봉수¹, 조효성², 김신³
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학생논문경연

피부에 의한 음성 고주파 신호 감쇠 보상을 위한 FEA 시뮬레이션 기반의 이식형 마이크로폰 설계 및 구현

한지훈, 김민우, 김동욱, 성기웅, 박일용, 조진호
경북대학교 전자공학과, 경북대학교

Abstract

이식형 청각보조 장치의 연구가 활발히 진행됨에 따라 이식형 마이크로폰의 연구가 필요하게 되었다. 이식형 마이크로폰은 공기 중에서는 평탄한 주파수 응답 특성을 보이지만 피하에 이식되어진 후에는 피부에 의한 고주파 음성 신호의 감쇠가 일어나게 된다. 본 논문에서는 이를 보상하기 위하여 유한 요소 해석을 통한 결과를 바탕으로 이식형 마이크로폰 진동막에 실리콘 코팅을 처리함으로써 이식형 마이크로폰의 공진 주파수를 피부에 의하여 감쇠되어지는 주파수 대역에 생성시켜 음성 신호의 전달 대역을 증가시켜 줄 수 있도록 설계하였다. 시뮬레이션 결과를 바탕으로 제작된 이식형 마이크로폰의 주파수 응답 특성 조사 결과, 피부에 의하여 감쇠되어지는 주파수 대역에 이식형 마이크로폰의 공진 주파수를 형성시킬 수 있음을 확인하였고, 이를 사용하여 돼지 피부를 이용한 피하 실험 결과, 실리콘 코팅 처리가 되지 않은 이식형 마이크로폰에 비하여 피부에 의해 감쇠되는 음성 2-3 kHz 대역에서 감도가 개선됨을 확인하였다.

불안정한 자세에서 하지에 인가한 진동자극이 자세 안정성 개선에 미치는 영향

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Abstract

We studied the effect of vibratory stimulation of different leg muscles [tibialis anterior(TA), triceps surae(TS)] and plantar zones [right, left] in ten healthy subjects during 1) quiet standing, 2) forward inclination of body, 2) backward inclination of body, 3) right inclination of body, and 4) left inclination of body. The experiments were performed on the force platform. The effect of vibration were measured on COP(Center Of Pressure). The subjects wore vibration stimulator system on foot and were given the instruction not to resist the applied perturbation. The results show that all vibration of leg muscles and plantar zones reduced COP Area and this occurred partial vibration during quiet standing. In forward inclination of body, vibration of TA reduced COP Area. During backward inclination of body, vibration of TS reduced COP Area. When the subject was tilted right, vibration of left plantar zone reduced COP Area. During left inclination of body, vibration of right plantar zone reduced COP Area. Thus the influence of leg muscle and plantar zones vibration differed significantly from on quiet standing and inclination of different body direction. We suggest that the vibration stimuli from leg muscles and plantar zones may used to maintain postural balance stably.

FOCUSS 알고리즘을 이용한 고해상도 Projection 및 Dynamic MR 영상 복원

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Abstract

This paper is concerned about high resolution reconstruction MR imaging from under-sampled k-space data. A similar problem has been recently addressed in the framework of compressed sensing theory. Unlike the existing algorithms used in compressed sensing theory, this paper employs the FOCal Underdetermined System Solver(FOCUSS). We show that FOCUSS is very effective for projection reconstruction MRI. Furthermore, FOCUSS is very nice fit to dynamic MRI with cartesian and radial k-space trajectory by exploiting the sparsity in spectral domain. Extensive results confirm that high resolution reconstruction with virtually free of aliasing artifacts can be obtained from severely under-sampled k-space data.

의복 착용형 무선 호흡모니터의 일회용적 계측 특성

이인광, 최성수, 김성식, 김경아, 이태수, 차은종
충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

Abstract

Respiration is induced by muscular contraction of the chest and abdomen, resulting in the abdominal volume change. Thus, continuous measurement of the abdominal dimension enables to monitor breathing activity. Conductive rubber belt has been introduced and tested to develop wearable application for respiratory measurements. The present study implemented wireless wearable respiratory monitoring system with the conductive rubber belt in patient's pants in purpose of quantitative estimation of tidal volume. Air mixed with 0~5% CO₂ was inhaled and the respiratory air flow rate, abdominal dimension change, and end tidal CO₂ concentration were simultaneously measured in steady state. CO₂ inhalation increased the tidal volume in normal physiological state with a correlation coefficient of 0.89 between the tidal volume and the end tidal CO₂ concentration. The tidal volume estimated from the abdominal dimension change lineally correlated with the tidal volume measured by pneumotachometer with a correlation coefficient of 0.96. Therefore, the tidal volume was accurately estimated by measuring the abdominal dimension change.

신경신호 측정을 위한 SPR(표면플라즈몬공명) 시스템 개발

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Abstract

This study aims to develop a new effective extracellular recording system for detecting neural signal using Surface Plasmon Resonance (SPR). The SPR can directly detect electrochemical signals at the metal-electrolyte interface. In addition, this method has no time limit in measurement and no artifact noise during electrical stimulation compared with conventional electrophysiological methods. However, the low sensitivity of SPR has been known as a problem for detecting a subtle ionic changes like action potentials. To overcome this problem, we improved several parts of a conventional SPR system; i) introduction of a multi-cell photo-detector with a mask, ii) introduction of a ultra-low noise laser diode, iii) electrical shielding of the whole optic system using a custom-made faraday cage. Consequently, evoked Compound Action Potentials (CAPs) from rat sciatic nerves were successfully recorded. These recordings are the first time of detecting neural signal using SPR biosensor. These data indicate that the SPR system can be used as a valuable tool for the study of neural networks.

CT data를 이용한 CAD 파일 추출과 Medical RP가공

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Abstract

CT(Computed Tomography) is very useful equipment for medical application. But because of it's high cost, only university hospital used it. However in these days enlargement of national income and increasement of concern of well-being makes that dental CT equipments are developing and spreading. We can observate inner geometry by nondestructive method using CT. CT offers 3D volume data. Hence we can use it variety ways that includes visualization, measurement and medical RP(Rapid prototyping). In this research we suggests a tool box what can extract CAD(Computer aided design) file from CT data. It contains all process of application of CT data. We suggests the common file that calling by STL(Standard Triangulation Language) for CAD/CAM (Computer aided manufacturing) machine.

일반연제 I
의학영상시스템 및 신호처리

고자장 MRI에서 작은 대상체의 고해상도 영상을 위한 솔레노이드형 RF코일 개발

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Abstract

The purpose of the present study was to develop and optimize solenoid coil for animal-model in 3T MRI system and investigate the image quality with the various parameters such as SNR and Q-factor. This study will provide the basic understanding the possibility of solenoid coil for an animal model in horizontal 3T MRI magnetic bore.

Solenoid coil for animal-model was made on the acryl round column structure (diameter 4cm, length 10cm) 3 times-winding cooper tape of width 2cm, thickness 0.05 cm and length 10 cm with 2 cm interval between winded tapes around the column. And the round column was designed to be maintained by two supports at both edges of column structure. One variable capacitor and capacitors from 2-pF to 100-pF were used with passive decoupling circuit, and the solenoid coil was designed for receiver only coil.

Simulation of the designed solenoid coil was conducted by using finite difference time domain method. A rat after induction of euthanasia was used as a subject animal for imaging. As a MRI imaging machine, Forte II (ISOL-HITACHI™) 3T MRI/MRS was used.

SNR of the developed solenoid was 96-1010 in solution of CuSO₄ 0.7 g/L as a phantom. And SNR in rat experiment was 970-1020. Q-factor were 89 and 84 in the phantom experiment and rat experiment respectively in unloaded condition. And 205.8 and 203.4 were also obtained respectively in loaded condition.

The homogeneity of RF field by coil simulation was significantly excellent. And the resolution of the image obtained from solenoid was great to distinguish one internal organ from other organ in the abdomen of a rat. In addition, the present study demonstrated that the solenoid coil could have possibility to obtain small animal images with good contrast, resolution and visibility.

망막신경절세포의 응답을 이용한 시각 자극 세기 변화 추정 및 감수야 구성

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Abstract

As a preliminary study for the development of electrical stimulation strategy of artificial retina, we set up a method for the reconstruction of input intensity variation from retinal ganglion cell (RGC) responses. In order to estimate light intensity variation, we used an optimal linear filter trained from given stimulus intensity variation and multiple single unit spike trains from RGCs. By applying ON/OFF stimulation repetitively, the type of a specific RGC was determined. The result of reconstructing 11 Hz Gaussian and binary random stimulus was not satisfactory and showed low correlation between the original and reconstructed stimulus. In the case of ON/OFF stimulus in which temporal variation is slow, very successful reconstruction was achieved and the correlation coefficient was as high as 0.8.

생체 표면 측정을 위한 Stereo Image의 경사도 오차 감소 방법

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Abstract

Disparity is the difference of the distance between right image and left image through stereo matching that uses a pair of images of the same object obtained by two CCD cameras. Because disparity concept contains the information of depth, we can measure x, y and z axis, and know three dimensional information which makes measurement of morphological changing in human body character possible.

The purpose of this paper is to establish a scientific assessment using reduced method of gradient error at Stereo image system.

초음파 의료 영상시스템에서 탄성 영상의 구현

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Abstract

The strain imaging mode of a medical diagnostic ultrasound imaging system enables the visualization of a tumor or cancer that is harder than the surrounding tissue. It determines the displacement between two complex baseband echoes received before and after applying compression, and produces an image of the strain by spatially differentiating the displacement. The displacement is estimated from the phase difference obtained using an autocorrelation method. In this paper, we have implemented the strain imaging technique operating in real time. In order to decrease the dependence on the hand movement of an operator, we applied an algorithm for normalizing the displacement of every scanline, and could obtain more uniform strain images.

일반연제 II

생체재료, 인공장기, 생체역학 및 재활공학

Analysis of Mechanical Loading on Small Rigid Intramuscular Implants

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Abstract

Several studies have been made to develop different versions of a new leadless, permanently implanted small electronic devices that allows to be injected into muscles (BIONs™). Their circuitry should be protected from body fluids by thin-walled hermetic capsules of rigid and brittle materials such as glass or ceramic to include feedthroughs for their electrodes. These packages experience repetitive stresses due to the muscle contraction from their excitations. This study provides a worst-case analysis of such stresses and methods to test and validate devices intended for such usage, along with the failure analysis and remediation strategy for a design that experienced unanticipated failures in vivo.

피브로넥틴 대면적 나노패턴 방법의 개발

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Development of a Large Area Nanopatterning Method of Fibronectin

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Abstract

We present in this paper that the successful immobilization of a well-known ECM protein, fibronectin, onto the well-defined imprinting nano-patterns of polystyrene (PS) substrates by anodized aluminum oxide (AAO) molds which have under controls for their pore sizes in nanometer scale; 70 nm, 200 nm and 400 nm for the widths and 110 nm and 500 nm for the pitches. The incubation and the labeling of the immobilized fibronectin was carried out using corresponding 1° and 2° antibodies, and the discrete changes on the surface images during the protein-incubation on the patterns are demonstrated by scanning electron microscope (SEM), and the effect of the patterning features on the immobilization has been investigated.

확산에 의한 물질전달을 향상 시킨 투석필터에 대한 연구

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서울대학교 의용생체공학 협동과정, 서울대학교 의과대학 의공학교실

Diffusion-Enhanced Modified Hemodialyzer

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Abstract

Flow mismatch between blood and dialysate is invariably encountered during conventional hemodialysis, and this deteriorates diffusive mass transfer. A modification of a conventional dialyzer was conceived to prevent this mismatch. The modified dialyzer includes two independent blood flow regions, which were achieved by redesigning the dialyzer cap. Blood stream was divided into two concentric dialyzer regions. Solutes clearances obtained using the modified dialyzers were compared with those of conventional dialyzers. Solute clearances by modified dialyzers were found to be dependent on the blood split into dialyzer central and peripheral regions. Maximal clearances using the modified dialyzer were improved by up to approximately 7.6% for urea and 7.3% for creatinine, as compared with those of conventional dialyzers.

A Study on Muscle Activities in Lower Limbs of Different Movement Patterns on an Unstable Platform

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Abstract

We performed experimental studies on the muscle activities in the lower limbs of different movement patterns on an unstable platform. To study the muscle activity, the electromyography of the muscles in lower limb was recorded and analyzed into the time and frequency domain. The experimental results showed that the significant difference of the muscle activities in different movement pattern. Especially, the spectral energy of muscle of the movement pattern in anterior-posterior direction significant higher than the other patterns. The experimental result suggest that, through the choice of different movement pattern, the training for lower extremity strength could be performed on different muscle in different intensity, and to enhance the ability of postural control.

일반연제 Ⅲ

생체계측시스템 및 의공학신기술

적외선 투과 광섬유를 이용한 호흡 측정

오정은, 유욱재, 조동현, 장경원, 신상훈, 이봉수, 탁계래
 건국대학교 의료생명대학 의학공학부

Exhalation Measurements Using an Infrared Optical Fiber

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 School of Biomedical Engineering, College of Biomedical & Health Science, Konkuk University

Abstract

The aim of this study is to measure exhalations under high electro-magnetic field environments such as taking a MRI (Magnetic Resonance Imaging) using an infrared optical fiber. We have detected exhalations using an infrared heat source, chalcogenide optical fiber and thermopile sensor. It is expected that the fiber-optic exhalation sensor which can be used during MRI procedure will be developed.

군용헬멧을 이용한 다중생체신호 측정

김윤성¹, 최종민¹, 김정수¹, 이햇빛¹, 백헌재¹, 류명석², 손량희²
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Measurement of Biomedical Signals From An Army Helmet

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Abstract

To monitor the health condition of worker is important data. And there are many studies about worker's mental, physical state during their work. And these days some research which studied of soldier's health condition have been presented.

But most of these research used Ag-AgCl as a electrode or some adhesive tape to affix the devices. These devices may interfere the normal life. And it can cause skin rash or itch in case of long term monitoring.

We intend to develop the system that can monitor the soldier's biomedical signals unconst- rainedly. In this paper we introduce the prototype of our helmet based system. This system measured the ECG, EOG and Eye Blink, EEG(Alpha wave)succesfully

자성 비드를 이용한 소형 유전자 추출기의 자동제어 시스템의 설계 및 구현

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Automatic control system design and implementation for a miniaturized DNA extraction system using magnetic beads

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²Biomedlab Co., Ltd.

Abstract

An automatic control system is proposed and implemented for a miniaturized DNA extraction system using magnetic bead. A local-host system is employed for the accommodation of the graphical user interface and the basic control function. The functional partitioning into the local and the host system is discussed. The control functions are classified and formalized for the flexible control scenario, which is the input of the proposed system. The system can be applied for the system in from the development stage to the early stage of the commercial product. The implemented system is currently being utilized for the development of the DNA extraction system only changing scenario, without any alteration of the system.

장기간 ECG 모니터링을 위한 유연한 PDMS 건성전극

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Flexible PDMS Dry Electrodes for the Long-term Monitoring of ECG

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Abstract

In this paper, we present a novel polymeric dry electrode that (1) changes its shape in a way that supports the electrode's contact with the skin and (2) that does not cause skin irritations or allergic reactions. For a polymeric substrate of electrodes, we have used the elastomer poly(dimethylsiloxane ; PDMS), We have established a process by which one can deposit a metal layer on the PDMS substrate, etch the electrode patterns chemically and with good resolution, and package the electrode so that it is easily wearable on the forearm. We measured the impedance according to the frequency change and compared the results with those of Ag/AgCl electrodes. Afterward, we measured the ECG signal and investigated the motion artifact. For the feasibility of long-term monitoring, we examined the influence of surface electrodes on the skin after 7 days' ECG monitoring. In conclusion, our PDMS-based dry electrode measured the ECG signals with comparatively good fidelity, but showed better skin compatibility after long-term tests. We expect that our method for the production of a PDMS-based dry electrode will be broadly applicable to the field of ubiquitous biosignal monitoring.

일반연제 IV

임상공학

수술장 환경에서의 Mobile Digital C-arm X-Ray System 영상 전송방식의 개선방법 연구

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 서울아산병원 의공학과, 울산대학교 의과대학 의공학교실

Improvement method development of Image Transmission Method of Mobile Digital C-Arm X-Ray System in Operating Room Environment.

S. B. Cho, K. W. JIN, J. S. KIM, S. H. Kim, D. I. Shin, S. J. Huh
 Department of Biomedical Engineering, ASAN Medical Center University of Ulsan, College of Medicine

Abstract

Currently, in patient data , PACS(Picture Archiving and Communications System) and EMR(Electronic Medical Record) system has large portion in general hospitals. Imaging X-ray digital use LAN(Local Area Network) in Operating Room Environment. We draw improvement method development of image transmission method of Mobile Digital C-Arm X-Ray System in Operating Room Environment. It improve operator's convenience and reduce image transmission time in operating room environment. It is expected to get a better result with data transmission mobile device in operating room.

투석기 보수유지를 통한 부품 개선 활동 Process tool 소개

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 서울아산병원 의공학과, 울산대학교 ¹의과대학 의공학교실

Process tool introduction in part improvement through maintenance of hemodialysis machine

oJ.M.Kim,M.G.Kim,S.H.Kim,D.I.Shin,S.J.Huh¹
 Department of Biomedical Engineering, Asan Medical Center, ¹University of Ulsan, College of Medicine

Abstract

If some machine is down because of a defective part, we are using replacement part.
 We developed a process tool ourself to apply a replacement part in our hospital and applied improvement part of motor fixing mount in hemodialysis machine.
 In a result, machine performance was increased and it was not performance difference between improvement part and original part.
 If you use this process tool In future, it helps find a reason and solution in problem.

의료기관평가와 BME 역할

사은식, 김서확, 허수진¹
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Hospital Service Evaluation and BME's active role

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Abstract

Modern medical treatment has been evolved from curing the disease for patient to lay emphasis on efficiency of medical device and service mind. Especially, medical device maintenance is gradually getting managed efficient schedule and shared, so BMET's role is very important.

But, this time is not medical device maintenance standard rule yet. So author would like to indicate that method of medical device maintenance and BME's active role at this document.

RO 시스템의 중앙 공급방식과 단독 공급방식에 대한 비교 고찰

이호석, 서현원, 하창훈, 김원규, 김홍규, 권혁남, 김병태¹
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A comparison study of a central type and a single type of RO system

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Abstract

Since 2000, an analyzer(Chemistry, Immuno system) of SMC(Samsung Medical Center) has been rapidly changed from an existing dry type to a wet type used by water and it has become multi-functional, processed in volume and getting larger in size.

On this account demand for RO system according to each analyzer has been rapidly increased in laboratory and the SMC has used R/O supply system that was changed from a single type to a central type since 2004.

This paper aimed at comparison and consideration for single and central types of RO supply system by using SMIS(Samsung Medical Information System) data for 6 years.

의료용 멸균기의 Preventive Maintenance 주기 변화 적용에 따른 가동률 향상에 관한 고찰

변영석, 전석봉, 천승민, 김승엽, 권혁남, 김병태¹
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A study of the PM period for the medical sterilizer availability improvement

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Abstract

According to the increasing cases of operation and use of instruments, the use of sterilizer is also increasing. Therefore, we have many systems to prevent malfunction of medical equipment. For example, scheduled PM, UDC(User Daily Check) and Part management. However, the increasing use and the obsolete can increase malfunction of sterilizer. We can analysis the availability of sterilizer by repairing data. And we found the availability of sterilizer decreased. The purpose of this paper is to show the increased availability by the application of an efficient method to calculate PM period.

초음파 탐촉자 테스트를 이용한 영상초음파기기 탐촉자 관리

기선우¹, 정현애¹, 김종철¹, 정석범¹, 서기홍¹, 권혁남¹, 김병태^{1,2}
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A study on Ultrasound Imaging System Transducer Maintenance with the Ultrasound probe testing device

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Abstract

In diagnostic ultrasound studies, the condition of the transducer(also referred probe or scan-head) is a key component to overall clinical quality and efficacy of the study.

A dead or degraded element in central to probe fundamentally affects the operation of the entire ultrasound imaging system and therefore can have a negative impact on clinical results. A tissue mimicking phantom(QA phantom) is general examining tool for QA of image in ultrasound imaging system, but we cannot generate a certain evidence of detective elements in transducer in using QA phantom.

Recently we have equipped with the new ultrasound probe testing device(The Nickel) that can directly check an element in a probe quantitatively. In this paper, we report its usefulness and limitation in some ultrasound image samples.

헬스케어 I

Omi 와 Oligomeric A β 의 특이적 결합 A β 의 세포 분비에 미치는 영향

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¹미생물유전학, ²헬스케어기술개발사업단

Omi binds preferentially to oligomeric A β and reduces extracellular A β secretion

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Abstract

Generation of toxic metabolites and failure of clearance could result in uncontrolled accumulation of toxic metabolites which can cause disease. In this study we show that endogenous Omi is an intraneuronal binding partner to A β . Further, Omi binds more strongly with oligomeric A β than monomeric A β . The neuronal expression level of the proapoptotic serine protease Omi is up-regulated in a similar pattern to the generation of neurotoxic A β . The interaction of Omi and intracellular A β leads to reduction of extracellular A β secretion. The significant reduction of extracellular levels of A β will logically lead to relieving of the extracellular A β -induced stress on neuron. However, it remains to be determined what is the physiological role underlying the specific interaction of Omi with oligomeric A β and whether this interaction could be linked to the neuroprotective function of a proapoptotic serine protease Omi.

Intracellular Interaction of Poly(caprolactone) Grafted Dextran(PGD) Nanoparticles with Cancer Cell

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Abstract

This study involved in the preparation and characterization of poly(caprolactone) grafted dextran (PGD) nanoparticles and evaluation of their cellular uptake by using SNU-638 cells, a human gastric cancer cell line, as an in-vitro model, with the aim to apply biodegradable polymeric nanoparticles in drug delivery field. The Coumarin-6 loaded PGD nanoparticles were prepared by a modified water/oil emulsion method and characterized by laser light scattering for particle size and size distribution, atomic force microscopy (AFM) to analyse surface morphology, zeta-potential for surface charge, and fluorescence plate reader quantified the effects of particle size, and particle surface coating on the cellular uptake of the nanoparticles. Confocal laser scanning microscopic images clearly showed the internalization of nanoparticles by the SNU-638 cells. From the results of cell line studies, we strongly felt that these nanoparticles of biodegradable polymers have potential to be applied and promote as drug carriers for drug release application.

Layer-by-Layer 자기 조립을 이용하여 나노 코팅된 나일론 6 나노섬유

박종훈, 김병석¹, 이운수², 길명섭, 김학용

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Nano-coated Nylon 6 nanofibers via a Layer-by-Layer Self-Assembly

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Abstract

We report the mechanical properties of the polyelectrolyte multilayer nano-coated electrospun fiber mats with different number of layers. Multilayer nano-coatings were successfully deposited onto electrospun Nylon 6 fibers via Layer-by-Layer self-assembly. Compared to pure Nylon 6 fibers, the morphology of polyelectrolyte multilayer coated Nylon 6 fibers was uniform and smoother. The mechanical properties of polyelectrolyte multilayer coated random and aligned Nylon 6 fibers were remarkably enhanced. It was found that the higher degree of alignment resulted in higher tensile strength, suggesting the combined effects of the alignment, the surface nanocoating and the formation of internal networks of polyelectrolytes on Nylon 6 fibers.

헬스케어 II

전신마비 환자를 위한 EOG 및 마커인식 기반 사용자 인터페이스

강선경, 소인미, 김영운, 정성태
원광대학교 공과대학 컴퓨터공학과

User Interface Based on EOG and Marker Recognition for General Paralytic

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Abstract

In this paper, we present a marker detection and recognition method from camera image and by using EOG(electrooculogram) sensing circuit for a disabled person to interact with a server system which can control appliance of surrounding environment. Control operations on an appliance is represented as markers. From camera images, markers are detected automatically by using geometrical features. When markers are detected, they are overlaid to the camera image and displayed to the head mounted display. When an user selects a marker, it is recognized by using artificial neural network. The control operation for the recognized marker is transferred to the server and control command is generated. By using the proposed method, a general paralytic can manipulate appliance for himself by using eye movement only.

경사침대를 이용한 자세균형 훈련시스템에 관한 연구

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Study on a Training System for Postural Balance Using a Tilting Bed

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Abstract

We propose a new training system for postural balance rehabilitation training using a force plate and a visual display in the tilting bed. Conventional rehabilitation system for postural control cannot be applied to the patients lying in bed because the rehabilitation training using those systems is possible only after the patient can stand up by himself or herself. Moreover, there did not exist any device that could provide the sense of balance or sensation of walking to the patients in bed. However, by using tilting bed, it is possible to compensate the disadvantage of conventional rehabilitation systems in this study. The software developed for system consists of training program and analysis program. The training program is designed to improve the ability of postural control of the subjects by repeated moving the center of pressure(COP) applied to force plate. The training program consists of COP maintaining training and COP movement training in horizontal and vertical directions. The analysis program consists of COP moving time analysis module and COP maintaining time analysis module. We evaluated this system for 10 adults. The results showed that this system was effective for postural balance training.

DISS : 웹서비스를 이용한 헬스케어 문서 통합 시스템

유재규, 송은하, 정영식, 한성국
원광대학교 공과대학 전기전자 및 정보공학부

DISS : Healthcare Document Integrated System with Web Service

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Abstract

Recently, there is a craze for introducing a document integration system focusing on large medical institutions. This aims to minimize repetitive data inputs while preparing documents only that are supposed to occur additionally to basic data prepared by a certain institution. However, since the existing integration systems have used mutually different data exchange methods, developers implemented duplicated systems, and the interoperability was absent between systems. Therefore, this thesis proposes DISS(Document Integrated Sharing System) that can integrate healthcare documents and disseminate documents according to purpose upon the standard data exchange method by using SOAP established by W3C as a standard. DISS supports functions that allow the integration of scattered documents, the conversion of integrated documents into desired type of documents, and document search. Also, it implements a web service-based heterogeneous model client environment.

3차원 동작분석 기술과 3차원 모델링을 토대로 한 소프트골프 스윙의 동적 분석

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¹전북대학교 헬스케어기술개발센터
²전북대학교 의용생체공학과
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Kinematic and Kinetic Analysis of the Soft Golf Swing Using Realistic 3D Modeling Based on 3D Motion Tracking

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Abstract

Kinematic and kinetic analysis has been performed for Soft Golf swings utilizing realistic three dimensional computer simulation based on three dimensional motion tracking data. The soft golf is a newly developed recreational sports in South Korea aimed to be a safe and easy-to-learn sport for all ages. The advantage of Soft Golf stems from lighter weight of club and much larger area of sweet spot. This paper try to look into kinematic and kinetic aspects of soft golf swings compared to regular golf swing and find advantages of lighter Soft Golf club. The results showed that mechanical loadings to major joints reduced with soft golf club.

포스터 I

합성구경집속 구현을 위한 다중주사방식의 초음파 빔포머 구조

성지빈, 이유화, 송태경
서강대학교 공과대학 전자공학과

Multi-scanning Ultrasound Beamformer Architecture for Implementing Synthetic Aperture Focusing

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Abstract

합성구경기법이 적용된 초음파 영상은 우수한 해상도를 제공하지만 하드웨어 복잡도가 큰 빔집속기를 필요로 하기 때문에 실제 시스템에 적용되지 못하고 있다. 본 논문에서는 상용 초음파 영상장치에 적용하기 위한 효율적인 합성구경 빔집속기의 구조를 제안한다. 제안한 빔집속기에서는 중복되는 근접한 채널과 영상점들의 시간지연 계산값을 동시에 출력하여 기존의 단일 출력 시간지연 계산기와 비슷한 하드웨어 복잡도를 갖는 M 출력 시간지연 계산기를 설계하였다. 기존의 빔집속기에서 M개의 2-port SRAM을 사용하였던 입력 데이터 버퍼를 하나의 2-port SRAM과 소용량 (M+1)-port 저장부 한 개로 설계하였다. 64채널 64 다중주사 방식의 합성구경 빔집속기의 경우 기존의 빔집속기로 병렬처리 하였을 때 보다 90%이상 하드웨어 복잡도가 감소한다.

컴프턴 카메라의 회전 각도 샘플링에 대한 연구

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³배재대학교 전자공학과, ⁴중앙대학교 물리학과, ⁵한양대학교 원자력공학과

Study for Angular Sampling Strategy of Rotating Compton Camera

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Abstract

The Compton camera which consists of two detectors, scatterer and absorber is an imaging modality based on Compton scattering effect and provides a 3-dimensional image for the source distribution. In this study, we proposed the rotating Compton camera for z-axis to obtain a multi-directional acquisition and satisfy a completeness of the angular sampling. All conical surfaces were sampled into rays and the directional vector of the rays was used to calculate in the spherical coordinates. The 2-D histogram of the shows that the rotating Compton camera with 30° of rotating angle was most suitable and efficient system to compromise the tradeoff between the quality of the reconstructed image and the speed of computation.

삼중 헤드 SPECT 시스템에서 기하학적 보정 기법의 개발

김중현, 이재성

서울대학교 의과대학 핵의학교실
서울대학교 방사선응용생명과학 협동과정

Development of a Geometric Calibration Method for Triple Head Pinhole SPECT System

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Interdisciplinary Programs in Radiation Applied Life Science Major, Seoul National University

Abstract

Micro-pinhole SPECT system with conventional multiple-head gamma cameras has the advantage of high magnification factor for imaging of rodents. However, several geometric factors should be calibrated to obtain the SPECT image with good image quality. We developed a simplified geometric calibration method for rotating triple-head pinhole SPECT system and assessed the effects of the calibration using several phantom and rodent imaging studies. Trionix Triad XLT9 triple-head SPECT scanner with 1.0 mm pinhole apertures were used for the experiments. Approximately centered point source was scanned to track the angle-dependent positioning errors. The centroid of point source was determined by the center of mass calculation. To verify the improvements by the geometric calibration, we compared the spatial resolution of the reconstructed image of Tc-99m point source with and without the calibration. SPECT image of micro performance phantom with hot rod inserts was acquired and several animal imaging studies were performed. Exact sphere shape of the point source was obtained by applying the calibration and axial resolution was improved by ~10%. Lesion detectability and image quality was also much improved by the calibration in the phantom and animal studies. Serious degradation of micro-pinhole SPECT images due to the geometric errors could be corrected using a simplified calibration method.

PET/MRI에서 동시제측을 위한 SSPM 소자 특성 연구

권순일, 이재성, 홍성중, 이또우 미끼꼬, 송인찬

서울대학교 의과대학 핵의학교실, 서울대학교 방사선응용 생명과학 협동과정
가천의과학대학교 생명과학부, 뇌과학연구소
고려대학교 물리학과
서울대학교 병원 진단방사선과

Analysis of Solid State Photomultipliers for PET and Simultaneous PET/MRI

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Division of Biological Sciences and Neuroscience Research Institute, Gachon University of Medicine and Science
Department of Physics, Korea University
Department of Diagnostic Radiology, SeoulNationalUniversity

Abstract

In this paper, we have investigated Solid State Photomultiplier(SSPM) with an emphasis to be used in simultaneous PET/MRI scanners. To estimate essential characteristics of the SSPM-LYSO coupling, we measured an energy resolution of the SSPM-LYSO coupling exposed to a ^{22}Na positron source. We measured an energy resolution of the SSPM-LYSO coupling under six different experimental setups : outside magnet, under the 3-T static magnetic field inside MRI, simultaneous data acquisitions during gradient echo, T1, T2, T2* weighted sequence.

We obtained a 20% FWHM energy resolution and 2.5 ns time resolution in non-magnetic environment and a ~24% FWHM energy resolution and ~3.3 ns time resolution during various MRI pulse sequences. The SSPMs showed steady performance during various MRI sequence inside the 3-T magnetic field and did not affect the MRI images. Consequently we conclude that solid state devices would have a good potential to be used for the simultaneous PET/MRI scanners.

나노 엑스선 토모그래피 시스템의 생물학적 적용

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²주식회사나노포커스레이

Nano X-ray Computed Tomography System for Biological Research

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¹Department of Radiology and Institute for Radiological Imaging Science, Wonkwang University School of Medicine

²NanoFocusRay Co., Ltd

Abstract

A nano computed tomography(nano-CT) system has been developed for biomedical imaging with sub-micrometer resolution. The nano-CT system allows the imaging of previously unattainable details of internal 3-D micro-architecture in a wide range of applications. The nano-CT scanner consists of a nanofocus x-ray source, a precision object manipulator and high resolution x-ray detectors. We will present the reconstructed images using the developed nano-CT system for 3-D noninvasive biomedical imaging.

Dual Isotope SPECT imaging을 위한 simulation을 이용한 산란 보정

박민재, 이재성, 박광석

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서울대학교 의과대학 핵의학교실

Down-scattering correction using simulation for dual isotope SPECT imaging

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Interdisciplinary Program in Medical and Biological Engineering Major, Seoul National University

Department of Nuclear Medicine, College of Medicine, Seoul National

Abstract

Though acquisition time can be reduced by simultaneous dual isotope imaging protocol in SPECT, there is no common method to remove contamination of down-scatter of high energy source. As a prior study, we suggest a simple matrix calculation of each energy band based on scatter count is related with primary count. To find out the matrix calculation is effective, we simulated with Jaszak phantom in SIMIND.

유방촬영용 antiscatter grids의 성능평가: 실험식과 Monte Carlo 모의실험에 관한 연구

장도윤, 김도일, 박천주, 이형구
가톨릭대학교 의공학교실

Evaluation of Antiscatter Grids Performance in Mammography: Empirical Formula and Monte Carlo Simulation studies

D. Y. Jang, D. I. Kim, C. J. Park, H. K. Lee
Department of Biomedical Science, College of Medicine, Catholic University

Abstract

The purpose of present study was to predict the performance of anti-scatter grid through by deriving empirical formula of Transmission of primary radiation(T_p), and Transmission of total radiation(T_t) which are necessary to valuate its performance. Designing parameters for deriving the empirical formulae were grid height, inter-space width, and septa width. T_p and T_t values were measured through by monte-Carlo simulation, and 61 different types of grids were used to derive the empirical formula. The range of designing parameters were 0.6~1.8mm, 100~300 μ , 20~40 μ for grid height, inter-space width, and septa width respectively. X-ray spectrum used in Monte Carlo simulation was attained from SPEC-78 and was almost correspondent to the experiments from the real X-ray equipment. The empirical formula was derived by fixing one of designing parameters and illustrating the relationship of other two. The correlations of each were verified and taken into account. The empirical formula derived from 61 grids had relative errors of 0.212% in T_p , and 3.109% in T_t to the result from Monte Carlo simulation. The present empirical formula can compute Contrast improvement factor(CIF) and Bucky factor(BF) which are frequently used in valuating the performance of anti-scatter grid, easily in hand. Thus the empirical formula can substitute the bored, complex grid test and simulation. Also it is expected to help in predicting the performance of grid to be produced.

xFDTD Simulation을 이용한 Birdcage Coil과 Phase Array Coil의 B1(RF Magnetic field) 비교

서증훈, 허혜영, 한병희, 이수열
경희대학교 동서의료 공학과

Comparing of the B1 Homogeneity Between Birdcage Coil and Phase Array Coil Using FDTD Method at High Field MRI

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Department of Biomedical Engineering, Kyung Hee University, Korea

Abstract

RF coils played an important role to acquire MR images with the maintenance of high homogeneity in high field MR system more than 3.0 T. Many kinds of RF coils such as birdcage coil, STR, surface coil, phase array coil have been used, however, the good uniformity of a coil has always been an issue. In this paper, comparing the B1 field between birdcage coil and 8-channel phase array coil was investigated at 3.0 T MRI environment in order to develop RF coils with the high uniformity. [1] Three different configurations of the FDTD simulation were performed using a free space configuration, water phantom, and head mesh model, and calculated to the case of birdcage coil and 8-channel phase array coil in each configuration of simulation. [4], [5].

산화철 나노입자를 이용한 쥐 뇌에서의 줄기세포 추적

이춘형, 유승완, 서해영, 이수열
경희대학교 일반 대학원 동서의료공학과, 아주대학교 의과대학 해부학교실

Stem cell tracking using Ferumoxides MR contrast agent in the rat brain

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Department of Biomedical Engineering, Kyung Hee University, Korea
Department of Anatomy, Ajou University School of Medicine, Korea

Abstract

Molecular and cellular MR imaging is a rapidly growing field that aims to visualize targeted macromolecules or cells in living organisms. In order to get a single cell image in the rat brain, we make a small RF coil with the high performance and use mesenchymal stem cells labeling Ferumoxides nanoparticles. In this paper, we present images which are bundle of stem cell using small STR coil.

Half-size 디텍터를 이용한 fan-beam 재구성 알고리즘

이동현, 최정민, M. A. Yousuf, 조민형, 이수열
경희대학교 동서의료공학과

Fan-beam image reconstruction algorithm using half-size detector

D. H. Lee, J. M. Choi, M. A. Yousuf, M. H. Cho, and S. Y. Lee
Department of Biomedical Engineering, Kyung Hee University, Korea

Abstract

Fan-beam CT represents third generation system. That CT system is very popular in medical fields as well as industrial fields. In this paper, will be introduce how to develop a limited system, detector size, with an algorithm. A factor of detector provides FOV(Field of view) with a limitation, for instance the FOV can't be larger than the detector. General method of CT scan, we apply full-size detector to obtain complete projection data and reconstruct the data to the image. Big size FOV, bigger than detector, has effect on the reconstruction image. However, this paper will show an algorithm. FOV of half-size detector using algorithm will be equal FOV of full-size detector.

Active Contour model을 이용한 링거의 외곽 윤곽선 추출

김창욱¹, 지아 모이 우딘², 이상효¹, 이정현³, 박일용⁴, 원철호⁵, 조진호^{1,4}

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Active Contour Model for extraction of the ringer's external contour

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³Dept .of Medical Informatics, School of Medicine, Keimyung University

⁴Advanced Research Center for Recovery of Human Sensibility

⁵Department of Control Instrumentation Engineering, Kyungil University

Abstract

When a patient is under the conditions of injecting ringer's solution, a nurse must carefully check the residual quantity of the ringer's solution because if the nurse misses the exact time to change the ringer's solution, sometimes dangerous moments can be occurs, such as influx of air bubbles could enter blood vessels or the blood could be regurgitated into the ringer. Therefore, it is necessary to develop a method to detect residual quantity of the ringer's solution. In this paper, a active contour (Kass)[1] was used for detecting the external contour of the ringer's bottle. This algorithm utilized a CCD camera that was applied as a sensor to obtain the image of the ringer's bottle. As a result, was found the external contour of the ringer's bottle automatically.

A Study on the Gradient Descent Method for Matrix-valued Median Filter in Diffusion Tensor MRI

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Department of Radiological Science¹, Yonsei University¹

Abstract

Diffusion Tensor Magnetic Resonance Imaging (DT-MRI) is a method which makes it possible to study non-invasively the architecture of axonal fibers in the central nervous system. Since eigenvectors obtained from DT-MRI usually contain noise, the calculated vector directions may be deviated from the real fiber orientation. Therefore, noise errors can be accumulated as fiber tract becomes longer in tractography of DT-MRI.

We used two algorithms for computing matrix medians which are the Simple Median Method and the Gradient Descent Method because matrix-valued median filters show excellent capabilities for structure-preserving denoising. The results of the Gradient Descent Method give better than those of the Simple Median Method.

FPGA를 이용한 소형 디지털 주사선 변환기

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Design of a Hardware-Efficient Digital Scan Converter using FPGA

C. H. Yoon, K. H. Cho, T. K. Song
Department of Electronic Engineering, Sogang University

Abstract

We propose a hardware-efficient digital scan converter(DSC) architecture for portable ultrasound scanners. Conventional DSCs use a LUT to improve processing speed for coordinate transformation and coefficient generation. In the proposed method, both the coordinate transformation and coefficient generation are performed with hardwired logics implemented in a FPGA. The total memory size for input echo data is reduced by half compared to that of the conventional DSCs by using a single time-multiplexing buffer. The overall hardware complexity is further reduced by performing video display operation in software by the main CPU. The Proposed DSC was implemented on FPGA of a portable ultrasound scanner for verification of real-time operation up to the frame rate of 30.

A Study on the Gradient Descent Method for Matrix-valued Median Filter in Diffusion Tensor MRI

S. H. Kim, K. W. Kwon, I. S. Park, J. S. Lee, B. S. Han¹, D. Y. Kim
Department of Biomedical Engineering, Yonsei University
Department of Radiological Science¹, Yonsei University¹

Abstract

Diffusion Tensor Magnetic Resonance Imaging (DT-MRI) is a method which makes it possible to study non-invasively the architecture of axonal fibers in the central nervous system. Since eigenvectors obtained from DT-MRI usually contain noise, the calculated vector directions may be deviated from the real fiber orientation. Therefore, noise errors can be accumulated as fiber tract becomes longer in tractography of DT-MRI.

We used two algorithms for computing matrix medians which are the Simple Median Method and the Gradient Descent Method because matrix-valued median filters show excellent capabilities for structure-preserving denoising. The results of the Gradient Descent Method give better than those of the Simple Median Method.

단일 TMS320C6416 DSP를 이용한 디지털 주사선 변환기의 구현

이충, 한동훈, 송태경
서강대학교 공과대학 전자공학과

Implementation of a Single TMS320C6416 Based Digital Scan Converter

C. Lee, D. H. Han, T. K. Song
Department of Electronic Engineering, Sogang University

Abstract

We present a efficient method for real time implementation of digital scan converter for medical ultrasound imaging with a commercial TI DSP, TMS320C6416.

The typical LUT(Look-Up Table) for storing memory addresses of data sets for each display points and the interpolation coefficients is implemented with a external SDRAM. The LUT is optimized in size and organized such that the LUT data can be read into the DSP at any time without causing memory stall by using the EDMA channels.

Experimental results show that the highest frame rate achievable with the single DSP-based DSC is 416 frames/second.

현장 진단 응용을 위한 단일 FPGA 기반의 초소형 혈류 영상장치 설계

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서강대학교 공과대학 전자공학과

Design of a hand-held ultrasound colorflow system with a single FPGA for POC applications

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Department of Electronic Engineering, Sogang University

Abstract

Ultrasound color flow imaging is used to detect a heart or a circulatory organ disease. We present a single FPGA based color flow system for point-of-care applications. In the proposed design, input data buffer which is typically composed of a large number of dual port SBRAMs, is replaced with an external SDRAM and two internal small FIFOs. Specifically, the input data manipulation is performed using a burst mode read operation for all imaging points based on the proposed multi-bank uniform interleaving scheme. For future hardware reduction, a CORDIC unit for blood flow phase estimator is modified and used for keyhole filtering in a time-multiplexing manner.

악성흑색종 진단을 위한 dermoscopy 영상의 정량적 분석

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Objective Evaluation of Dermoscopic Image for Malignant Melanoma Detection

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Abstract

Generally, Malignant Melanoma (M.M.) is diagnosed by biopsy and examination with the naked eye; however, there are problems that a biopsy is an invasive technique and the naked eye has low diagnostic accuracy. Dermoscopy that is a non-invasive and in vivo technique being developed for the diagnosis of M.M., this also has a low diagnostic accuracy when performed by an inexperienced clinician.

The purpose of this study is to improve the diagnostic accuracy using an objective evaluation of the dermoscopic features.

내시경 영상에서의 출혈부위 자동검출: Capsule Endoscopy 적용을 위한 예비 연구

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Bleeding region auto detection in endoscopy image : Research for Capsule Endoscopy Application

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Abstract

In this paper, we present the method for the detection of bleeding in Wireless Capsule Endoscopy (WCE). A tiny capsule is swallowed, and transmitting two images per second to small data receiver during more 8-hour. Over than 55,000 images are recorded to receiver. Typically, a medical clinician spends more than two hours to analyse a WCE images. Another research has been attempted to automatically find bleeding to reduce the time needed to analyze the images, but its accuracy is not high enough to replace human examination. To improve this problem, we propose a technique to detect the bleeding automatically utilizing spectrum analysis. Our experimental results show that proposed method achieves 90.9% and 72.2% of sensitivity and specificity.

디지털 손 영상에서의 정량적 뼈 특징 추출과 통계분석

송정주, 이상호, 김영재, 김광기, 김종효
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Quantitative bone feature extraction for accurate assessment of bone age in digital hand radiograph

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Interdisciplinary Program in Radiation Applied Life Science major.

Abstract

Atlas matching and Tanner-Whitehouse method are the most widely used methods for bone age assessment in clinical diagnosis. However those methods are based on a doctor's subjective clinical decision and visual comparison with reference images. And most of the statistical values for bone age assesment are based on the American standards, but there is no quantitative measures for Korean people. In this study, we attempted to find quantitative features and obtain statistical values which are useful for skeletal maturity and height prediction. We used 157 normal cases from age 6 to 17 in epiphyseal diameters and 279 normal cases from age 6 to 16 in phalanx length. The quantitative features were drawn from phalanx lengths and epiphyseal diameters and these features showed statistically significant correlation with bone age. We could get statistical values for bone age assesment from trends of the feature values changed as age sequence,

Geometric features를 이용한 유방영상의 미세석회화 군집 검출

이화정, 이준구, 김종효, 김광기, 송지연
서울대학교 의과대학 방사선응용생명과학 협동과정

Computer-Aided Diagnosis Scheme Using Geometric features For Detection of Microcalcification Clusters in Mammograms

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Abstract

Mammography is considered the most effective method for early detection of breast cancers. However, it is difficult for radiologists to detect microcalcification clusters. Therefore, we have developed a computerized scheme for detecting early-stage microcalcification clusters in mammograms. we used 71 clinical cases with micocalcifications. Classified regions were color mapped and compared to the mask images drawn by clinician. our approach shows good performance. Our computerized scheme was shown to have the potential to detect microcalcification clusters with a clinically acceptable sensitivity and low false positives.

Quantitative Analysis with Magnetization Transfer by phase sensitive method in Osteoarthritis

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Abstract

The proton density (PD) and T2-weighted SE MR images allow the depiction of knee structures and can demonstrate defects and gross morphologic changes. The PD- and T2-weighted images also show the cartilage internal pathology due to the more intermediate signal of the knee joint in these sequences. Suppression of fat extends the dynamic range of tissue contrast, removes chemical shift artifacts, and decreases motion-related ghost artifacts. Like fat saturation, phase sensitive methods are also based on the difference in precession frequencies of water and fat. In this study, phase sensitive methods look at the phase difference that is accumulated in time as a result of Larmor frequency differences rather than using this difference directly. Although how Magnetization Transfer (MT) work was given with clinical evidence that leads to quantitative model for MT in tissues, the mathematical formalism used to describe the MT effect applies to explaining to evaluate knee disorder, such as anterior cruciate ligament (ACL) tear and meniscal tear.

LVOOP를 이용한 전립선암의 분포 지도 분석

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A Mapping Analysis of Prostate Cancer using LVOOP

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Abstract

The knowledge of distribution of prostate cancer could be helpful to understand pathophysiology of prostate cancer and improve detection of prostate cancer.

The patients underwent radical prostatectomy and specimens were step-sectioned and whole-mounted. Cancer and the prostate capsule were outlined on the slides and the regions transferred to a computer software program developed by LabVIEW Object Oriented Programming(LVOOP).

DTI에서의 Eddy Current 측정과 데이터 처리

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Eddy Current measurement and data processing in DTI

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Abstract

A newly developed post-processing method of diffusion tensor imaging (DTI) is proposed with preliminary results in both phantoms and in vivo brain scans. The standard DTI modality, echo-planar imaging (EPI) provides high speed but suffers from susceptibility artifacts. To eliminate corresponding errors, a new correction algorithm is applied in which the diffusion gradient's polarity is alternated in successive cycles of the sequence. By appropriately registering the direction of diffusion weighting, 3D diffusion-weighted images can be obtained in a single scan. It corrected EC-induced image distortions in both DTI data more effectively than commonly used techniques.

Registration of MR molecular images using micro beads

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Abstract

The concern on MR molecular imaging is increasing since researches about stem cell got issued. Experiments on stem cell-tracking is required to acquire many images and make the image registration of these images in order to improve the performance of cell tracking and verify the movement of loading cells. In this paper, we used the Fe₂O₃-composite micro-beads which were the substitute for stem cells and injected micro-beads to the sheep brain as a marker of registration.

모바일 환경에서 의료영상 무선전송

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Wireless Transmission of Medical Images on Mobile Devices

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Abstract

The purpose of this study was to survey a development of the wireless transmission system of medical images for ubiquitous medicine. It is difficult to use these automated medical systems unless they are within hospital and in case of rapid image reading in the emergency cases or in absence of doctor, it is difficult to perform it immediately. To complement these shortages, system with remote CDMA network which can examine patients' pictures and images from image system within hospital with PDA supplied to each doctor was implemented. For this, server system which can assign patients' images received from image acquisition system to doctors was also implemented and patients' images can be examined by connecting to server with PDA. For certification of system access individually, access to server database can be done in PDA with RDA (Remote Data Access) and FTP(File Transfer Protocol) is used for downloading patients' pictures from server.

초음파 의용 영상 시스템에서 평균 음속도 추정

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Estimation of Average Speed of Sound in Medical Ultrasound Imaging System

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Abstract

An effective method is presented for estimating in reflection mode the speed of sound in medical ultrasound imaging. It finds an optimal focusing time delay profile which maximizes the brightness in a region of interest based on continuous dynamic focusing in receive with one-point fixed transmit focusing. We evaluated the method on point targets as well as tissue-mimicking phantoms, in which the change of brightness is computed by varying the speed of sound for compounded images. The resolution of compounded images degrades greatly if an incorrect estimate of the speed of sound is used. We were able to estimate accurately the speed of sound in the cyst phantom using the method.

Abdominal Aortic Aneurysm의 3차원 정량분석을 위한 Morphological Gradient Edge Function 기반의 Geometric Active Contour Model 개발에 관한 연구

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A Study of a Geometric Active Contour Model with Morphological Gradient Edge Function for 3-D Quantitative Analysis of Abdominal Aortic Aneurysm

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Abstract

The purpose of this research is to develop and evaluate an improved image segmentation method for surface rendering (SR) of abdominal aortic aneurysms (AAAs). In order to obtain accurate SR for three-dimensional AAAs, precise image segmentation had to be carried out for the interested area of each CT slice. In this research, an improved image segmentation method (It is called a new model for SR) was proposed and was compared to other preexisting image segmentation methods for objective evaluation of its performance. For this purpose, we used three noised synthetic images with different shapes. For the test of performance, we evaluated the following three values: normalized minimum distance error (NMSE), mismatched area (MA), and execution time (ET). We were able to verify through objective testing that for obtaining precise SR of AAAs the newly proposed image segmentation method is better than other image segmentation methods. This study presents a feasible method to obtain an accurate image segmentation of the AAA from CT data. The SR of AAAs using the proposed method can overcome the various problems experienced by preexisting SR and Volume rendering, and therefore is a good alternative method.

공간 및 언어 과제 수행 시 소녀의 편측화에 관한 연구

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건국대학교 의학공학부

A Study on the Cerebellar Lateralization during Visuospatial and Verbal Tasks

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Abstract

본 연구에서는 공간 및 언어 과제를 수행하면서 뇌기능 영상을 획득한 후, 활성화 voxel 수를 이용하여 소녀의 편측화를 계산하고자 한다. 총 16명의 대학생(공간 및 언어 과제 각각 8명)을 실험 참여자로 선정하였다. 3T ISOL Technology FORTE를 사용하여 single-shot echo planar imaging 방법으로 뇌 영상을 획득하였다. 두 과제 모두 소녀의 활성화 영역은 선행연구와 유사하였다. 대뇌에서는 언어 과제 수행 시 좌반구가, 공간 과제 수행 시 우반구가 우세했던 선행 연구와는 달리, 소녀에서는 이러한 편측화의 차이를 발견할 수 없었다.

스트림튜브를 이용한 빠른 트랙토그래피의 방법과 그의 구현

황진영, 한예지, 박현욱
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A Fast Streamtube-based Tractography and Its Implementation

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Abstract

Diffusion Tensor Imaging (DTI) provides useful information of white matter in human brain. Using fiber tractography, fiber tracts in white matter can be visualized. In general, the tracking results are visualized by either streamline or streamtube technique, which models underlying fiber structures. Streamline technique is limited in the analysis of tractography due to the constant width and gap between voxels. In order to solve this problem, the streamtube-based visualization was proposed, however, it needs a heavy computation. In this study, we implement the streamtube-based visualization with fast rendering using a vertex program.

Extreme Learning Machine 및 주성분 분석법을 이용한 부정맥 검출 알고리즘

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Algorithm for Detecting Arrhythmia Using Extreme Learning Machine and Principal Component Analysis

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Abstract

In this paper, we developed the novel algorithm for cardiac arrhythmia classification. Until now, back propagation neural network was used frequently for these tasks. However, general gradient based learning method is far slower than what is required for their application. The proposed algorithm adapts Extreme Learning Machine(ELM) that has the advantage of very fast learning speed and high accuracy. In this paper, we classify beats into normal beat, left bundle branch block beat, right bundle branch block beat, premature ventricular contraction, atrial premature beat, paced beat, and ventricular escape beat. Experimental results show that we can obtain 97.71% in accuracy, and 8.031 seconds in processing time at learning phase.

뇌파 기반 실시간 뇌활동 모니터링 시스템의 개발

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Development of an EEG-based Real-time Cortical Rhythmic Activity Monitoring System

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Abstract

This paper introduces an electroencephalography (EEG)-based, real-time, cortical rhythmic activity monitoring system which can monitor spatiotemporal changes of cortical rhythmic activity on a subject's cortical surface, with a high temporal resolution. In the monitoring system, a frequency domain inverse operator is preliminarily constructed, based on the subject's anatomical information and sensor arrangement, and then spectral current power at each cortical vertex is calculated for the Fourier transforms of successive sections of continuous data, when a particular frequency band is given. The first pilot system was applied to two human experiments: (1)cortical alpha rhythm changes induced by opening and closing eyes and (2) cortical mu rhythm changes originated from arm movements, demonstrating the feasibility of the system.

초기 치매환자 진단을 위한 qEEG 변수 추출

채희제, 정영진, 임창환, 이승환
연세대학교 의공학과, 인제대학교 일산백병원 신경정신과

Extraction of qEEG Variables to Diagnose Early Dementia

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Abstract

Although it is difficult to definitely diagnose dementia with noninvasive methods such as EEG and MEG, early detection of subjects with probable dementia is of importance to apply currently available treatment strategies. In the present study, we have extracted featured qEEG variables, which can be potentially used to diagnose early dementia, from resting eyes-closed continuous EEGs of 22 early dementia patients and 27 age-matched healthy controls. Among 1680 candidate qEEG variables, about 160 variables showed statistically significant difference ($p < 0.01$) between early dementia group and control subject group, when mean phase coherence as well as EEG coherence was evaluated for all possible combinations of electrode pairs. Some preliminary trials to discriminate the two groups with the extracted qEEG variables demonstrated that the use of mean phase coherence as a supplementary or alternative measure for the EEG coherence may enhance the accuracy of diagnosis of early dementia.

다중해를 갖는 함수에서 최적 개수의 해를 찾는 방법

이정훈, 양용주, 심훈, 송상하, 이경중, 윤영로
연세대학교 보건과학대학 의공학과

Number of solutions optimized method in multimodal functions

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Department of Biomedical Engineering, College of Health Science, Yonsei University

Abstract

In this paper, a new algorithm to optimize number of solutions in multimodal functions is proposed, base on the concept of the survival of the fitness rule of evolution. The proposed algorithm has common criteria not to be invaded by each other. Thus, there is only one survivor in a partial solution space in which oneoptimal point locates. To verify the proposed algorithm, three multimodal functions - Alex function 5, six-hump camel back function, and Rastrigin's function - are tested.

병적인 음성에 대한 기존 피치 트래킹 방법들의 성능 비교 분석

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Comparative Analysis of Performance of Several Established Pitch Tracking Methods in Pathological Voices

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Abstract

In voice pathology, diverse statistics extracted form pitch estimation were commonly used to test voice quality. In this study, we compared several established pitch detection algorithms (PDAs) for verification of adequacy of the PDAs. In the database of total pathological voices of 99 and normal voices of 30, an analysis of errors related with pitch detection was evaluated between pathological and normal voices, or among the types of pathological voices.

According to the results of pitch errors, gross pitch error showed some increases in cases of pathological voices; especially excessive increase in PDA based on nonlinear time-series. In an analysis of types of pathological voices classified by aperiodicity and the degree of chaos, the more voice has aperiodic and chaotic, the more growth of pitch errors increased. Consequently, it is required to survey the severity of tested voice in order to obtain accurate pitch estimates

Spike train decoding을 이용한 인공와우 어음처리용 주파수분석기의 성능평가

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Performance Evaluation of Frequency Analyzer for Cochlear Implant Speech Processor Using Spike Train Decoding

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Abstract

Acoustic simulation is adopted most studies to evaluate frequency analyzer for cochlear implant speech processor, but it is criticised by many researchers in its capability of accurately predicting actual performance. We propose a new evaluation method based on spike train decoding. We compared a novel strategy based on nonlinear time-varying filter with a conventional linear-filter-based strategy. In the case of nonlinear time-varying filter bank based strategy, information of input speech was conveyed more faithfully under noisy situations. This confirms the superiority observed from other evaluation methods.

골반저근의 압력을 이용한 정량적 뇨실금 진단 알고리즘 개발에 관한 연구

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The Study for the Quantitative Diagnostic Algorithm in Urine Incontinence Using the Pressure of the Pelvic-Floor Muscle

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Abstract

Urinary incontinence is the disease with leaked out of urine when intravesical pressure is higher than contraction pressure of the pelvic floor muscle. These abnormal pressure increasing is caused by sudden changing of the abdominal pressure such as cough and muscle or nervous tension in daily life. Incontinence can be diagnosed by a medical examination by interview, the physical test and urodynamic test and so on. These diagnostic methods are possible to do misdiagnosis because that is doctor's subjective opinion, and it is short of foundation to support doctor's diagnosis. For these reasons, in this paper, the bio-signal measurement system which measures and analyzes that contraction pressure of the pelvic-floor muscle is proposed. The suggested system is comprised of the acquired contraction pressure using balloon sensor. And pressure data of the pelvic-floor muscle is transmitted to PC with the DAQ pad. The developed real-time monitoring S/W using LabVIEW 8.0 analyze acquired signal to abstract the diagnostic parameter. To confirm the utility of system, The contraction pressure of the pelvic floor muscle are measured and diagnostic parameters are abstracted for each two patients who diagnosed normal and urinary incontinence. It is confirmed that the difference of parameters like as pressure difference, the maximum pressure continuous duration, space area at result of experiment, quantitative diagnosis of incontinence is able to do by using the result of parameters.

In this paper, it is proposed that the development and estimation of the bio-signal measurement system for quantitative diagnosis of the urinary incontinence with foundation research. It is possible to make diagnostic algorithm for quantitative diagnosis of the urinary incontinence by analyzing the correlation of between diagnostic parameters and result of the doctor's diagnosis.

자기공명분광법 후처리 소프트웨어 개발

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Development of Matlab-based in vivo MR Spectroscopy processing program

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Abstract

We successfully demonstrate a usefulness of a home-made program specializing MRS data processing under the Window environment. As a result, this program represents a possibility to process MRS data easily based on the Window environment of a personal computer without an expensive workstation or commercial MRS processing programs.

2-channel PPG를 사용한 PWV 측정방법

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PWV Measurement Method using 2-channel PPG

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Abstract

Arterial stiffness is an important determinant of cardiovascular risk and can be assessed by a number of methods, including measurement of the PWV (pulse wave velocity) and arterial distensibility. Many researches have reported significant correlations between PWV and atherosclerosis. However, expensive equipment and professional operation are necessary for the high-cost methods above. While measuring, the 3-leads of ECG (Electrocardiogram) are needed, which is the amount of the data and makes the procedure of measurement more complex.

The purpose of the present study is the PWV measurement method using 2-channel PPG (Photoplethysmography). Each PPG were measured by Physiolab P400. The pulse transition time (PTT) was the average of all time differences between the finger-PPG peak and toe-PPG peak. Finger-to-toe distance was the difference between the distance from sternal notch to toe and the distance from sternal notch to finger. PWV can be calculated from the distance between these two sites divided by transition time.

PWV measurement method using 2-channel PPG demonstrated that the results were correlated well with transitional method. The reproducibility of the method was demonstrated by the experimental result of this study. Furthermore, the implemented algorithm has advantages. It is cost-reduced as timing acquisition can be obtained without 3 electrocardiogram leads. PWV is a reliable indicator among various indices of arterial stiffness.

실시간 Bispectrum 분석을 통한 마취심도 평가에 관한 연구

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The Study of Bispectrum Analysis Method to EEG for Development of Anesthesia depth

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Abstract

In this paper, the distributed characteristics on the bispectrum, the type of nonlinear signal processing, as a result of the coupling of EEG were presented according to depth of anesthesia. In this paper, noise and saturated signals occurring by electronic surgeon device or other external factors in surgery using EEG signals have been automatically removed. And in order to analyze EEG signals, the tendency of the Depth of Anesthesia have been tried to evaluate on real-time, as brain wave was analyzed in surgery using bispectrum, a nonlinear method.

동맥 압력-용적 모델을 이용한 동맥 오실레이션의 위상 분석

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The Phase Analysis of the Arterial Oscillation using Arterial Pressure-volume Model

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Abstract

The computer simulation on oscillometric method was performed using arterial pressure-volume model. The systolic and diastolic pressure estimation method was proposed regardless of the maximum amplitude algorithm and characteristic ratio. Arterial pressure pulse and cuff pressure was used as input of arterial pressure-volume model. The output pulse of model was perform by FFT. The phase spectrum was obtained by increasing cuff pressure from 1mmHg to 200mmHg(1mmHg per second). As a results, phase shift was then only observed between the systolic and diastolic blood pressures. The systolic and diastolic pressure was estimated using existence and nonexistence of phase shift.

심박 변이도 (HRV) 의 주파수 도메인 분석에서 Interpolation 방법들의 결과 비교

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Comparison of Interpolation Methods for Heart Rate Variability Analysis in Frequency Domain

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Abstract

심박율(heart rate, HR) data는 주로 time domain 및 frequency domain에서 heart rate variability(HRV)로써 분석된다. Frequency domain에서는 분석과정 중 irregular 한 심박율 신호를 interpolation 및 re-sampling 하여 regularly-sampled data로의 변환 과정이 필요하게 되는데, 여러 interpolation 방법에 따라, 그리고 spectral estimation 방법에 따라 그 결과값은 달라질 수 있다. 본 연구에서는 nearest-neighbor re-sampling, linear, cubic spline, piecewise cubic hermite interpolation 방법들을 사용하여, non-parametric 및 parametric spectral estimation에 적용하였을 경우, 그 error 값들을 비교한다. Non-stationary HR model을 사용하였으며, HRV의 비교 지표로써, LF/HF ratio를 사용하였다.

PPG 신호처리를 이용한 두가지 호흡수 측정 기법

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Two respiratory rate measurement techniques using PPG signal processing

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Abstract

In this paper, we proposed two methods for respiratory rate detection using PPG(photo- plethysmography) signal processing. Photo- plethysmography is noninvasive cardiovascular monitoring technique, by measuring the variation of light absorption in peripheral tissue caused by heart beat. The first is the peak-to-peak method, that detects the magnitude of PPG signal envelop. The second is the shape based method that detects the difference between rising and falling time of PPG signal. In peak-to-peak method, two types of filter kernels were used, that are, Gaussian filter kernel and moving average filter kernel. Four subjects participated at this laboratory experiment. By using the proposed methods, respiratory rate could be measured successfully. But more sophisticated signal processing algorithm is thought to be required to apply in daily living environment for ubiquitous healthcare.

비침습적 압전 Film 센서를 이용한 무선 생체신호 모니터링 장치

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Wireless Biomedical Signal Monitoring Device on chair using Noncontact Electro-mechanical Film Sensor

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Abstract

The present study purposed to measure the BCG (Ballistocardiogram) of subjects on a chair using a noncontact electro-mechanical film sensor (EMFi sensor) and detect the respiratory rate from BCG in real-time. In order to measure wirelessly the BCG of subjects on a chair, we made a seat-type noncontact EMFi sensor and developed a transmitter and a receiver using Zigbee wireless RF communication technology. Signal obtained from the sensor is converted to digital data and recorded in the SD (Secure Digital) card in PDA (Personal Digital Assistance) with a receiving part. We also developed a PC (Personal Computer) data analysis program, analyzed data recorded in the SD card using the program, and presented the results in graph.

Our experiment was carried out with three subjects, healthy male and female adults in their 20s who volunteered to help this research. The results of analyzing collected data will show that the respiratory rate can be measured in real-time on a chair.

비선형 유사성에 기반한 간질 발작 예측 방법 개발

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Development of New Nonlinear Similarity Method for Predicting Epileptic Seizure

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Abstract

Dynamic similarity index method which employs the Heaviside function has been used to predict the preictal state in epileptic EEGs. This method, however, is sensitive to radius r due to the sharp boundary of the Heaviside function. Thus dynamic similarity index method is not suitable to deal with irregular and non-stationary signal such as EEG signal. To eliminate the effect of sharp boundary of the Heaviside function, we propose a new dynamic similarity index method which replaces the Heaviside function by a composite function. We evaluated the sensitivity and the predictability of the proposed method with Hénon, Rössler and EEG data. The results show that the proposed method is less sensitive to the variation of radius r and has higher performance in predicting epileptic seizure.

수압측정 방식의 요류검사 진단매개변수의 정확도 분석

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Validation of diagnostic parameters evaluated by urinary flowmetry technique with hydraulic pressure measurement

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Abstract

Uroflowmetry is of great convenience to diagnose benign prostate hypertrophy common in aged men. The urinary flow rate is obtained by weight measurement using load cell, however, sensitive to impact noise. An alternative technique was recently proposed to measure hydraulic pressure instead of weight and demonstrated to introduce significantly reduced noise. The present study compared the diagnostic parameters between the weight and pressure measuring techniques in 10 normal men. The weight and pressure signals were simultaneously acquired during urination, converted into urine volumes, then differentiated to obtain flow rate signals, which showed very similar waveforms. Diagnostic parameters evaluated by pressure measuring technique were well correlated with the standard weight measuring technique (correlation coefficient > 0.99). Therefore, the new uroflowmetry based on hydraulic pressure measurement can provide accurate diagnostic parameters, which would be clinically valid.

CT 시뮬레이션을 위한 그래픽 유저 인터페이스 개발

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Development of graphic user interface for CT simulation

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Abstract

It needs much time and efforts to develop the medical imaging system from the design to the development. Therefore, the simulation which describes the real system accurately before developing the system is very important stage. But, in the case of CT, the development of the simulator which is just for CT is essential. In our development, the developer of CT can execute the simulation easily by developing the graphic-user interface for the CT simulation based on MCNPX. The graphic user interface research provides the convenience to create various parameters to execute the simulation. Geometric structure of input data that users want can be checked by visualizing the geometrical structure of the object and the detector created. And geometrical structure of input data that users want can be checked by visualizing the geometrical structure of the object and the detector created. It has been developed to generate the input data for CT simulation automatically so that it can obtain the output of result and tomography. We demonstrates the usefulness of the CT simulator developed in this study by comparing with the experimental data.

엑스선 직접 흡수에 기인한 간접변환방식 검출기의 픽셀 노이즈의 해석

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Noise Analysis of Direct X-ray Absorption in The Pixel Array of Indirect-Detection Detectors

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Abstract

In order to characterize noise transfer in indirect-detection imaging devices, we have applied a cascaded linear-systems model. The model incorporates an additional cascaded branch parallel to the typical model of the indirect-detection scheme to account for direct X-ray photon absorption unattenuated through the overlying phosphor within the photodiode layer. This new approach can assess the direct x-ray induced noise in the pixel array, which has not been tried before. The measurement and analysis obtained from the CMOS photodiode array coupled with Min-RTM screen under 45-kV x-ray spectrum revealed that even though the direct quantum absorption efficiency within the photodiode was only $\sim 0.16\%$, contribution to the induced noise was equivalent to that of ~ 7 times of the total electronic noise.

치과 영상을 위한 제한된 각도 내 부족한 데이터 기반의 역투사 후 여과법

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Backprojection Filtering Method with Insufficient Views in Limited Angle Geometry for Dental Imaging

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Abstract

We have developed digital tomosynthesis algorithm with insufficient data in limited scan-angle geometry based on the conventional back-projection filtering method. The usefulness of the developed algorithm is demonstrated by applying to dental imaging. The algorithm will be very helpful to image-guided implant procedure with largely reduced patient dose.

Effects of Roselle(*Hibiscus sabdariffa* L.) Flower Extract and Its Fractions on Skin Microorganisms and Oxidation

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Abstract

Antimicrobial and antioxidative effects of 14 different herbal flower extracts on skin microorganisms and oxidation were tested in this research. Herbal flower extracts were prepared with 70% ethanol. Among the herbal flower extracts, roselle(*Hibiscus sabdariffa* L.) flower extract showed the highest antimicrobial activity against *Staphylococcus epidermidis* as determined by a paper disc method. The seventy percent ethanol extract of roselle flower was fractionated by sequential hexane, chloroform, ethyl acetate, n-butanol and water fractionation. The growth of *Staphylococcus epidermidis*, *Streptomyces collinus*, *Streptomyces coeruleoprunus*, *Salmonella enteritidis*, *Vibrio parahaemolyticus* and *Malassezia pachydermatis* was most efficiently inhibited by ethyl acetate fraction of roselle flower extract as determined by a paper disc method and growth inhibition curves. In addition, the ethyl acetate fraction, water fraction and butanol fraction showed free radical scavenging and DNA cleavage inhibition activities. These results demonstrate that roselle flowers hold antimicrobial and antioxidative activities against skin microorganisms and oxidants.

Stimulation of Melanogenesis by *Poria cocos* Extract in B16 Melanoma Cells

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Abstract

Aim : The effect of *Poria cocos*(PC) ethanolic extract on melanogenesis was investigated in B16 murine melanoma cells. **Methods :** Melanin content and tyrosinase activity were analyzed spectrophotometrically and cellular cytotoxicity was assayed by MTT assay. The expression of tyrosinase, tyrosinase-related protein TRP-1, and TRP-2 were measured either by RT-PCR or Western blot. **Results:** The melanin content was greatly increased by PC extract in a dose-dependent manner and there was no cytotoxicity at the effective concentrations. PC extract increased enzyme activity as well as protein and mRNA expression of tyrosinase. In addition, mRNAs of TRP-1 and -2 were also increased after treatment with PC extract. Treatment of cells with PC extract also increased the expression of MITF, a major transcription factor of melanogenic enzymes. H-89, an inhibitor of protein kinase A, completely inhibited the PC extract-induced increase of melanogenesis and tyrosinase protein. **Conclusion:** These results suggest that PC extract-induced stimulation of melanogenesis is likely to occur at the transcriptional level of melanogenesis-related enzymes through the protein kinase A signaling.

대장 샘암종에서 Claudin-1, β -catenin과 E-cadherin의 발현

최하나, 백현아, 김희진, 차은정, 장규윤, 김경열, 박호성, 문우성
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Expression of Claudin-1, β -catenin and E-cadherin in Adenocarcinoma of the Colon

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Abstract

Disruption of the cell to cell junction with changes in the expression of the junctional proteins was a hallmark of cancer invasion and metastasis. To investigate the roles of claudin-1, β -catenin, and E-cadherin in colonic adenocarcinoma, the relationship of their expression with clinicopathologic factors were examined. The expression of claudin-1, β -catenin and E-cadherin were examined in 47 cases of adenocarcinoma of the colon by immunohistochemical staining. The reduced claudin-1 expression was associated with advanced lymph node metastasis ($p=0.019$) and histologic dedifferentiation in the invasive front ($p=0.030$). The reduced expression of β -catenin and E-cadherin were correlated with histologic dedifferentiation ($p=0.012$, $p=0.010$, respectively). Reduced expression of two or more proteins was correlated with histologic dedifferentiation ($p=0.030$). These results suggest that loss of claudin-1, β -catenin and E-cadherin expression may be correlated with the progression of the colon adenocarcinoma and advanced histologic grade.

고강도 수영이 혈중 이온 마그네슘 및 칼슘에 미치는 영향

전설희, 이문영, 미자놀 라흐만, 김학용, 김성주, 김진상, 강형섭
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High-Intensive Swimming Exercise Affect Blood Ionized Magnesium and Calcium

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Abstract

In sports medicine, very little attention has been given to magnesium compared with potassium and calcium. To ensure maximal physical output, a large significance is particularly attached to maintenance of biochemical water and electrolyte homeostasis. Magnesium ions (Mg^{2+}) play a central role of neuronal activity, cardiac excitability, neuromuscular transmission, muscular contraction, vasomotortone, and blood pressure significantly related to physical performance. Recent researches have shown that magnesium deficiency may reduce physical performance and magnesium status may have an effect on exercise capacity. It was well known that the magnesium intake of the general population including athletes may be suboptimal. Exercise is a potent stress or that appears to lead to magnesium depletion through alterations on blood magnesium levels as well as increased sweat and urine excretion. In this study, we attempted to determine the changes of whole blood ionized Mg^{2+} (iMg^{2+}), Ca^{2+} (iCa^{2+}), and ratio of iCa^{2+}/iMg^{2+} during high-intensive exercise by forced swimming of rats, using ion-selective electrodes (Nova StatProfile).

After exhausted swimming (3-5 hrs) in rats, the blood pH, glucose, total CO_2 , partial O_2 tension, O_2 content, O_2 saturation, alveolar O_2 , HCO_3^- , standard HCO_3^- , base excess of extracellular fluid, base excess of blood, and iCa^{2+}/iMg^{2+} were significantly decreased ($n=13$, $P<0.01$, paired t-test). The blood partial CO_2 tension, lactate, Na^+ , iCa^{2+} , iMg^{2+} , and anion gap were significantly increased ($P<0.01$), although the blood osmolarity, hematocrit, hemoglobin, arterial alveolar O_2 tension ratio, arterial O_2 tension gradient, partial O_2 tension/fraction of inspired O_2 , K^+ , and Cl^- were not significantly changed.

These data suggest that exercise could alter blood iMg^{2+} , iCa^{2+} and the ratio of iCa^{2+}/iMg^{2+} and point to important uses for iMg^{2+} and the ratio of iCa^{2+}/iMg^{2+} during the training and examination of athletic performance in sports medicine.

감국이 MDCK 세포의 기저막 단백질 합성에 미치는 영향

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Effect of Chrysanthemum morifolium on the Synthesis of Basement membranes of Madin-Darby Canine Kidney Cells

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Abstract

Basement membranes (BM) are extracellular matrices associated with epithelia, endothelia, muscle, fat and peripheral nerve. They are involved in cell survival, migration, differentiation. BM functions also include tissue formation and provide mechanical stability as a selective barriers. Type-IV collagen and laminin are glycoproteins found in BM and have a crucial role in cell adhesion and signalling. Madin-Darby canine kidney (MDCK) cells are the best established mammalian model for studying epithelial cell biology. The cells form an epithelial monolayer, with tight junctions separating an apical surface from a basolateral membrane facing the filter support and neighbouring cells. In this study, using MDCK cells, the synthesis of the BM proteins such as type-IV collagen and laminin with or without methanol extract of Chrysanthemum morifolium (CM) stimulation was analyzed by immunoblotting and CM showed significant increased cell density and enhanced synthesis of BM proteins.

초음파를 이용한 Piroxicam의 경피흡수 및 소염효과

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Transdermal Delivery and Anti-inflammatory Effects of Piroxicam using Phonophoresis

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Abstract

Piroxicam is one of the NSAID, it is used in the systemic and topical treatment of a variety of inflammatory conditions. Conventionally, for topical use, the drug is formulated in gel. We designed an phonophoretic drug delivery system to investigate the piroxicam permeability and the influence of ultrasound application (continuous mode, pulsed mode), frequency (1.0 MHz, 3.0 MHz) and intensity (1.0 w/cm², 1.5 w/cm², 2.0 w/cm²) with 0.5% piroxicam gel. Anti-inflammatory activity was determined using carrageenan induced foot edema model in rat. Ultrasound was carried out 10 hours. The highest permeation was observed at an intensity 2.0 w/cm², frequency 1.0 MHz and continuous output. In carrageenan-induced edema model, the anti-inflammatory activity of phonophoresis was better than non-treatment and only gel application group. The inclusion of phonophoresis was found to improve significantly the skin permeation in vitro and the anti-inflammatory activity *in vivo*.

신경세포 특이적 HtrA2/Omi 과발현 형질전환 마우스 개발

심안비, 유양, 류명걸, 유맹루, 박진오, 홍성출

미생물유전학 헬스케어기술개발사업단

Transgenic mouse model with neuron specific overexpression of HtrA2/Omi

Y.F. Shen , Y.Yu, M.J. Liu, M.L. Liu, J.N. Park and S.T. Hong

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Abstract

HtrA2/Omi is a pro-apoptotic mitochondrial serine protease to activate caspase- dependent as well as caspase-independent cell death. However both null and knockout mice models suggested that HtrA2/Omi might play a role as a neuronal protector. It is essential to establish a transgenic mouse model with neuron-specific overexpression of HtrA2/Omi to completely understand the physiological function of mammalian HtrA2/Omi in neuron. In this study, a constructed plasmid containing HtrA2/Omi cDNA under the control of neuron specific NSE promoter was microinjected into the pronuclei of fertilized zygotes from FVB mice to establish the transgenic animals. In brain of these mice, HtrA2/Omi was overexpressed clearly at least 2-3 fold higher than control mice, but no overexpression of HtrA2/Omi was observed in the non-neuronal tissue of the mouse. Transgenic animal showed normal phenotype similar with normal mice, suggesting that HtrA2/Omi is most likely play a protective function but not proapoptotic role in neuron.

젤다나마이신이 베타 아밀로이드 전구단백질의 대사에 미치는 영향

은재순, 이경아, 이일화, 공두균, 이충수, 최부진, 임재운

우석대학교 약학대학 약학과

The effects of geldanamycin on the metabolism of β -amyloid precursor protein

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Abstract

Alzheimer's disease(AD) is characterized pathologically by the presence of intracellular neurofibrillary tangles and deposition of b-amyloid(Ab) peptides of 40-42 residues, which are generated by processing of amyloid precursor protein (APP). It is urgent to develop effective therapies to treat AD, since our society rapidly accelerate aging. Ab has been believed to be neurotoxic and now is also considered to have effects on the mechanism of memory formation. We has screened the several hundred natural products using in vitro cell system. In this study, HSP inhibitor geldanamycin from Streptococcus sp. was analyzed to check its effect on the metabolism of APP. It inhibited the secretion of Ab 42 from the APP swe overexpressing Neuro2a cell line. We suggest that HSPs regulate APP trafficking and Ab 42 generation.

포스터 Ⅱ

Hard Anodization Anodic Aluminum Oxide(HAAAO) Superhydrophobic 연구

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Superhydrophic Study of Hard anodization anodic aluminum Oxide

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Abstract

The wetting of roughness honeycomb nanoporous anodic aluminum oxide has been widely used for the development of various functional nanostructures. So This Structure could be prepared Self-Organized. This Hard anodization process established a new self-ordering design with interpore distances 70-300nm. Which have not been achieved by mild anodization processor. HA Process takes conventional anodization process in terms of processing time more faster oxide growth than MA Process. This paper focuses two main experiments. One is fabrication of HAAAO(Hard Anodization Anodized Aluminum Oxide) substrates and exhibits Superhydrophobic properties.

전기방사 방법을 이용한 3D 세포배양용 나노화이버의 제작방법 및 결과

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fabrtcation of 3D nanofiber scaffold for cell culture using electrospinning method

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Abstract

In this paper, we report the method which is fabrication nanofiber mesh for cell culture and observation using electrospinning. we make 3D scaffold for observing vaious cell responses. for example, differentiation, adsorption, proliferation and migration which cell's reaction will be changed depends on the scaffold type. if we can control cell's response through the scaffold, we will develop the new biomaterials for tissue engineering and drug delivery system.

온열 치료용 발열체로서의 듀플렉스 스테인리스 스틸과 니켈-구리 합금의 발열 특성 비교 평가

박재근¹, 최성민¹, 황은미¹, 조현설², 박주환³, 정용권³, 김영곤¹
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The Evaluation of Exothermic Characteristics of Duplex Stainless Steel and Ni-Cu alloy for hyperthermia

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Abstract

Hyperthermia using self-regulating thermo-rods with magnetic induction system can be treated for selective tumor therapy without severe damage of normal tissue. Since the structure of blood vessels are so complicate that they show lower blood flow rate, lower pH, Hypoxia, and nutrient deficiency. Therefore, tumor tissues are more sensitive to heat than normal tissues, so induce more thermal damage than normal tissue. Thermo-rod of duplex stainless steel(DSS) or Ni-Cu alloy can generate heat within the induction magnetic field without any electrical connection by eddy current loss. Using this phenomenon, thermo-rods can be used for repeatable hyperthermia without any further surgical treatments. The exothermic characteristics of thermo-rods can be differed by material or the chemical composition.

In this experiment, we used three kinds of wire-shaped specimens. These are DSS, 72% Ni- Cu alloy, and 70% Ni-Cu alloy.

This study was investigated the exothermic characteristics of a 0.9mm diameter of DSS and Ni-Cu alloy wire such as maximum heating temperature and heating power within the electromagnetic field. A 35mm long DSS and Ni-Cu wire was immersed on the bottom of the \varnothing 35mm transparent receptacle containing 3ml distilled water. Three T-type thermocouples were fixed at the position 0 mm, 8.5mm and 17mm apart from the center of specimens and temperature data were stored in the computer at every 0.5 second during 30min.

As a result, it was found that DSS thermo-rod reached about 50°C was better choice for hyperthermia

광학적 지문센서 제작을 위한 CuPc FET 전기적 특성 연구

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Electrical Properties of CuPc FET for Fabrication of Optical Finger Printer sensor

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Abstract

Organic field-effect transistors(OFETs) are of interest for use in widely area electronic applications. We fabricated a copper phthalocyanine(CuPc) based field-effect transistor with varying channel length. The CuPc FET device was made a top-contact type and the channel length was a 100 μ m, 50 μ m, 40 μ m and 30 μ m and the channel width was a fixed at 3mm. We observed a typical current-voltage(I-V) characteristics in CuPc FET and we calculated the effective mobility.

Eicosanoic Acid LB 박막을 이용한 의용 소자로의 전기적 특성

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Electrical Properties of Eicosanoic Acid LB Thin Film for Biomedical Device

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Abstract

We used an eicosanoic acid material and the material was very famous as an thin film bio and insulating material. Eicosanoic acid monolayer was deposited by Langmuir-Blodgett(LB) technique and a subphase was a CdCl₂ solution as a 2×10^{-4} mol/l. Also, we used a bottom electrode as an Al/Al₂O₃ and a top electrode as a Al. When the positive and negative bias applied to the molecular device, the behavior shows that a tunnel switching characteristics. This results were analyzed regarding various mechanisms.

혈소판풍부혈장에서 골대체물질이 성장인자에 미치는 영향

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Effect of Different Bone Substitutes on the Concentration of Platelet-derived Growth Factor and Transforming Growth Factor β -1 in Platelet-rich Plasma

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Abstract

This study was conducted to determine the effect of different kinds of bone substitutes and collagen on the concentration of platelet-derived growth factor (PDGF) and transforming growth factor β -1 (TGF β -1) in platelet-rich plasma (PRP). PRP was treated with thrombin, hydroxyapatite(HA) and thrombin, HA alone, collagen-grafted HA, calcium metaphosphate(CMP), and collagen-grafted CMP. The concentrations of PDGF-AB and TGF β -1 were measured. After PRP treated with HA and CMP, the concentrations of PDGF and TGF β -1 were not significant different from the concentration of them in PRP alone. The concentrations of PDGF in PRP with collagen-grafted HA and collagen-grafted CMP were significantly higher than that of PRP with HA and CMP. The concentrations of PDGF and TGF β -1 in PRPwith collagen-grafted CMP was higher than with collagen-grafted HA. The results of multiple regression analysis, PDGF increased with the use of collagen and thrombin, and was higher in native whole blood with higher platelet counts. However PDGF decreased with the use of HA. In conclusion, HA and CMP did not seem to be able to activate platelets by themselves. However, if they had collagen grafted onto them, they could activate platelets and release growth factors.

말초동맥 스텐트용 Zwitterionic PEG로 그래프트된 Nitinol-DLC의 세포독성 및 혈액적합성 평가

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Cytotoxicity and blood compatibility tests of Nitinol-DLC grafted with Zwitterionic PEG for Peripheral Arterial Stents

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Abstract

Poly(ethylene glycol) (PEG) was blood compatible due to the steric stabilization and chain motion effects. Furthermore, sulfobetaines(-N⁺-SO₃⁻) were one of the blood compatible structures in the well-identified class of zwitterionic polymer materials. Because of the strongly dipolar structure of their zwitterionic lateral groups, these linear polymers display the specific properties, such as high chain rigidity and very unusual and unique antipolyelectrolyte behaviors.

In this study, synthesized zwitterionic PEG was grafted on Nitinol-DLC using oxidation treatment. Its surface property, blood compatibility and cytotoxicity of surface-modified Nitinol-DLC was examined. The results of surface analysis showed that the contact angle and the ratio of oxygen to carbon significantly decreased with PEG-grafted Nitinol-DLC. The total amount of albumin (0.08 μl/cm²) adsorbed onto TiN-DLC-PEG2K-N⁺-S⁻ was lower than that of TiNi-DLC control (0.12 μl/cm²). The platelet adhesion increased in the order of TiNi-DLC-PEG2K-N⁺-S⁻<TiN-DLC-PEG2K<TiNi-DLC control. The order of cell adhesion was TiNi-DLC-PEG2K-N⁺-S⁻>TiNi-DLC-PEG2K>TiNi-DLC control. Particularly, zwitterionic PEG with PEG2K was better than any others. The results indicated that zwitterionic PEG surface could significantly suppress platelet adhesion and protein adsorption as compared to other samples. The present study suggested that grafted zwitterionic PEG structure may possess improved blood compatibility and cell compatibility

미세유체칩을 이용한 신경세포 유도용 PLGA 생분해성 microfiber 제작

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PLGA biodegradable microfiber for neural cell guidance scaffold with microfluidic chip system

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Abstract

Biodegradable poly lactic-co-glycolic acid(PLGA) fiber is generated with microfluidic chip based fiber spinning device. Cell culture scaffolds for tissue engineering application, PLGA is mainly formed sponge structure for three dimensional application. Recently, fiber spinning by electrostatic force is introduced, but microfluidic chip based fiber generation is not frequently reported. In our system, the polymer PLGA solution is supplied to micro glass tube tip for core flow and sheath fluid surrounds the polymer solution for coagulation and fiber size control. Fiber size is controlled by varying flow rate of core and sheath flow rate and in experimental condition, the fiber diameter is about 20um to 200um. In cell growth result, fibroblast cultured on the fiber and cell proliferated normally without protein or additional surface treatment.

Pulse Push Pull 혈액투석에서 polysulfone 투석기의 Hydraulic permeability 평가

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In vitro evaluation of the hydraulic permeability of polysulfone dialyser for Pulse Push Pull hemodialysis

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Abstract

Renal replacement therapy has been widely studied to provide high efficiency. In chronic renal replacement therapy, especially, middle to large size molecule removal is important factor to the mortality for chronic renal failure patients. Therefore, many methods to high middle molecule remove efficiency suggested such as high flux hemodialysis, hemodiafiltration and push pull hemodiafiltration.

The aim of own in vitro study was to evaluate the hydraulic permeability of dialyser for Pulse push pull hemodialysis(PPPHD) versus hemodialysis(HD).

After in vitro PPPHD and HD, volumetrical flow(Quf) and Total cell volume(TCV) of the dialyser was measured respectively. Total cell volume(TCV) change was not observed. Quf, however, was improved by 5.2% as compared with those of conventional hemodialysis.

단일 교류 주파수를 이용하여 투석 액의 전도도 탐지에 의한 독소 청소율 예측

강우현^{1,4}, 이승민^{1,4}, 최대석^{1,4}, 임기무^{1,4}, 민병구^{1,2,3,4,5}

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Prediction of toxin clearance by detecting conductivity of dialysis solution using single alternating current frequency voltage

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Abstract

In this paper, we present the method to predict toxin clearance by detecting conductivity of dialysis solutions using single alternating current frequency voltage. As the living condition is improved, All age groups showed a similar increase in life expectancy and medical treatments become valuable lately. Dialysis is one of the most important medical care for the old people. When people are under dialysis, they get their blood clean. Toxins such as urea and creatine are purified by dialyzer. After the dialysis solution went under diffusion and convection, it is appeared to contains toxins. Our purpose is to predict clearance in the dialysis solution using electrical electrodes. We made a alternative current voltage circuit to detect solution elements. XR-2206, a chip of "Alternating current function generator" produce sine wave to detect specific ions' resistance. Conductivity meter is made by 3/8 connector by joining alloy of Copper and Nickel electrodes together. Dialysis solutions' components such as NaCl, Urea, Creatine are classified according to the frequencies of gaussian functions. We calculated the differences of gaussian functions and organized the elements distribution in total dialysis solutions according to their frequencies.

투석 시 Fluid Warmer 개발을 위한 열전달 해석

정미진^{1,5}, 이승민^{1,5}, 최대석^{2,5}, 이정찬^{1,5}, 민병구^{2,3,4,5}

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Analysis of Heat Transfer for Fluid Warmer Device in hemodialysis

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Abstract

The purpose of this study is to stimulate the heat transfer by designed fluid warmer device to deliver normothermic fluids for various applications of hemodialysis treatments. Considerable amounts of heat may be gained or lost through the extracorporeal circuit during hemodialysis and this effect could result in hemodynamic instability for the patient. Replacement fluids should be heated by fluid warmer with fast flow. Hence, we evaluated the efficient of heat transfer using commercial ANSYS Ed(10.0). After 1 minute, replacement fluid reached 42 degree celsius and the temperature of heater was not uniformly distributed. For this reason, I believe because the heater was forced to heat its components and this right have resulted in uniform temperature distribution. These results indicated that our device needed to be modified in order to support constant thermal energy and careful consideration must be taken place on heating up each component of the warmer

3차원 동작분석 기술과 모델링을 토대로 한 소프트골프 스윙의 동적 분석

김용욱, 김성현, 김동욱, 김남균

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Abstract

Kinematic and kinetic analysis has been performed on the Soft Golf swing utilizing realistic three dimensional computer simulation based on three dimensional motion tracking data. The soft golf is a newly developed recreation sports in South Korea aimed to be a safe and easy-to-learn sport for all ages. The advantage of Soft Golf stems from lighter weight of club and much larger area of sweet spot. This paper try to perform kinematic and kinetic analysis on the swing of soft golf swing and assess mechanical loadings to major joints of human body to find the difference and advantages compared to regular golf club.

LCP를 이용한 근위부 관절외 경골 고정술의 생체역학적 안정성 분석

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Static and Dynamic Stability Analysis of the LCP for the Treatment of Proximal Extraarticular Tibia Fracture

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Abstract

Surgical management of proximal extraarticular tibia fractures presents are very challenging. Currently, locking compression plates(LCP) have been introduced as the instrumentation that is capable of being minimally invasive using unilateral surgical approach. However, its biomechanical studies on its biomechanical stability still remain very sparse. In this study, stiffness and fatigue characteristics of LCP were investigated to understand its clinical feasibility. Strain gages were also employed to find the stress distribution in the system.

Two composite tibiae were prepared with 3 cm defect regions to simulate proximal extraarticular tibia fractures that was reduced with 13-hole LCP. One specimen was subjected to axial compression load at 0.2 mm/sec until failure. During the testing, axial strains were simultaneously recorded. The other specimen was subjected to axial cyclic load of 50-500 N for 5×10^5 cycles(5 Hz) to simulate 10 months in vivo.

Stiffness and failure load of the LCP were 141.6 N/mm and 1032.5 N, respectively and displacement at 600 N was 4.39 mm. The stiffness of LCP in this study was 2.3 times higher than the traditional buttress plate found in literature. There was no failure due to fatigue after 5×10^5 cycles. The highest axial strain(ϵ) was presented at the defect region and the second highest strain was shown at upper adjacent region to the defect.

These results indicated that unilateral plating using LCP may be able to allow more stable fixation of the proximal extraarticular tibia fracture during the bone healing process as compared to the conventional buttress plates.

압력분포와 편안함의 변화를 통한 기능성 보행화의 평가

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Assessment of functional shoes :

In terms of change in pressure distribution and comfort

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Abstract

Recently functional shoes which apply various design at the sole have been developed. The advantages of functional shoes were reported that to increase body balance ability, muscular strength and induce effective gait. No information, however, is available the effects that the change of the pressure distribution and comfort influence on foot articulation by wearing functional shoes. The purpose of this study is to investigate biomechanical effect that measured changes of plantar pressure and the perception of comfort. Two types of shoes were tested: functional shoes and comfort shoes. After wearing each shoes for 3 month, plantar pressure and comfort levels were measured on 25 subjects(mean age=57.5, S.D=1.0). Eight anatomical defined regions of the foot used plantar pressure pattern analysis. The subjects performed 3 walks of approximately 5 to 6 steps each. Each trial was repeated 3 times. After each trial, they were asked to record the comfort level on a visual analog scale (VAS). Before and after wearing each shoes, functional shoes were recorded lower average peak pressure. At the medial forefoot region, the average peak pressure were concentrated in the functional shoes. These results may indicated concentrated propulsion from the hallux during the gait of the functional shoes in comparison to the comfort shoes. Functional shoes were showed lower average peak pressure at mid foot region. Significantly different average peak pressure were observed at mid foot region after 3 months($p < 0.05$). After 3 months, VAS test value were decreased with no significant difference in comfort shoes($p > 0.05$). But comfort levels of functional shoes were increased with significant difference after 3 months($P < 0.05$). Accustomed gait patterns decreased average peak pressure at forefoot region and increased comfort levels. orthotic footbed suggest that effective distribution of pressure at mid foot region.

3축 가속도계를 이용한 낙상 검출 알고리즘 구현

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Fall Detection Algorithm Using a Portable Triaxial Accelerometer

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Abstract

The purpose of this study was to develop a fall detection system using a portable triaxial accelerometer. The system consisted of a waist-mounted triaxial accelerometer via a real time wireless monitoring and a fall detection algorithm using threshold technique based on actual fall data set. To evaluate proposed algorithm, experiments were performed on ten healthy subjects with several activities such as falls(knee straight, knee flexed), walking, sit to stand, stand to sit, stand to lie, lie to stand, etc. The system was developed using MATLAB & Labview program. The fall detection rate of the system was 99%. System needs to add several algorithms to detect several daily activities.

신발의 종류와 보행 속도에 따른 하지의 협응과 호흡변인에 대한 연구

최진승, 강동원, 탁계래

건국대학교 의학공학부

Study of lower limb segment coordination and respiratory variable according to shoe and walking speed

J. S. Choi, D. W. Kang, G. R. Tack

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Abstract

The purpose of this study was to identify the effects of walking speed and shoe on lower limb segment coordination and respiratory variables. The results revealed that due to the shoe type, there was a difference in lower limb segment and there was a shoe to have kinematic changes due to the walking speed.

고령자와 젊은 성인의 등속성 족관절 모멘트의 남녀차이 비교

김지원, 김나영, 엄광문
건국대학교 의학공학부

Comparison of the Gender Differences in the Isokinetic Ankle Joint Moment in the Elderly and Young Subjects

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Abstract

It is reported that the age-related muscle power decrease is more pronounced in females than males, even when the values are normalized for body mass. However, the dependence of the difference on the movement directions (i.e. concentric and eccentric) is not clear. Therefore, the gender differences in maximum muscle moment at ankle joint under different velocities in both the concentric and eccentric contractions were studied in the elderly subjects (mean age=75.8±1.9years, n=7 males and n=6 females) in comparison with those in young subjects as the control group (mean age=23.0 years, n=7 males and n=5 females). Maximum values of both the dorsiflexion and plantarflexion moment at ankle joint were investigated at pre-specified 5 different angular velocities including concentric, isometric and eccentric directions by using Biodex system. In the elderly, the gender difference in the maximum ankle joint moment normalized for body weight was pronounced in the eccentric contraction than in concentric contraction, and this tendency has statistical significance in the secondary leg. In contrast, there was no statistically significant gender difference in the ankle moment of the control (young) subjects. This suggests that the higher rate of falls in elderly women may be due to the muscle power decrease mainly in the eccentric contraction, which plays role in the initial resistance to the disturbed body balance.

편마비 보행의 개선을 위한 능동형 단하지 보조기의 개발

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Development of an Active Ankle-foot-orthosis to Improve Hemiplegic Gait

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Abstract

In this study, we developed an active ankle-foot orthosis(AAFO) which could control dorsiflexion/ plantarflexion of the ankle joint to prevent foot drop and toe drag during walking. 3D gait analyses were performed on a hemiplegic patient under three different gait conditions: gait without AFO(NAFO), gait with the conventional hinged AFO without controlling ankle joint(HAFO), and gait with the developed AFO(AAFO). Results showed that AAFO could prevent not only foot drop by the proper plantarflexion during loading response but also toe drag by sufficient amount of plantarflexion in pre-swing and reasonable dorsiflexion during swing phase. Even though some modification are necessary in further studies, the present results indicated that the developed AAFO might have more clinical benefits to treat foot drop and toe drag in hemiplegic patients, comparing with conventional AFOs.

근골격계 모델을 이용한 편마비 보행 시 하지 근 길이 변화

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Changes in Muscle Length of Lower Limbs during Hemiplegic Walking Based on the Musculoskeletal Modeling

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Abstract

In this paper, we analyzed changes in the muscle length of lower limbs during hemiplegic walking by the musculoskeletal model. Twenty young healthy volunteers and three hemiplegic patients participated in this study. 3D motion analyses were performed and then the musculoskeletal model was made based on subjects' anthropometric data and 3D motion capture data. The musculoskeletal model included twelve major lower extremity muscles based on the modified Hill type model in each lower limb. Results showed that the sufficient push-off was not found in pre-swing for hemiplegic walking, without showing enough contraction of gastrocnemius and soleus. In addition, excessive ankle dorsiflexion was also found. The contraction of semimembranosus was shown to be tighter than those in the normal subject, and thus knee flexion was larger during loading response. Changes in extensor muscle length were also very similar to the joint motion in the sagittal plane. These results could be very useful to classify and characterize various abnormal gait patterns.

Quantitative Analysis of EMG Activity for Evaluation of Hand Function

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Abstract

The aim of this study was to evaluate the motor recoveries in 4 chronic hemiparetic patients with Fugl-Meyer assessment (FMA) and EMG characteristics before and after the training program with a symmetrical upper-limb motion trainer training. The training was performed at 1 hr/day, 5 days/week during 6 weeks in 4 chronic stroke patients. Electromyographic activities of the affected hand were recorded during isometric wrist flexion/extension movements. In all patients, FMA was significantly improved after the 6-week training. Delay in onset/offset of muscle contraction significantly decreased in the affected wrist during the training. The co-contraction ratio of flexor/extensor muscles decreased significantly after the training. Also, onset/offset delay of muscle contraction and co-contraction ratio correlates significantly with upper limb motor impairment and motor recovery. This EMG-biomechanical technique allows an objective evaluation of changes in muscle activity in post-stroke patients, providing easily measurable, quantitative indices of muscle characteristics. The linear distribution of these measures is particularly indicated for monitoring changes induced by treatment.

Praat script를 이용한 음성치료 프로그램의 개발

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Development of Voice Therapy Program using Praat Script

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Abstract

This study attempted to compare acoustic parameters, physiological observation and perceptual evaluation values obtained from the treatment and control groups in order to find out which of self voice feedback modelling by Praat was better and which methods to train them was more effective. The experimental group carried out a self voice feedback modelling program while the control group did only vocal hygiene. The acoustic measurement and voice manipulation for providing the patients visual, auditory feedback were done by a speech analysis software, Praat. Results of this study are as follows: The treatment group showed much improvement after receiving the voice treatment. In particular, acoustical and physiological indices from the optical endoscopy, pitch variation, amplitude variation, maximum phonation time, and psychoacoustic evaluation showed statistically significant improvements.

DSP를 이용한 디지털 보청기 모듈 설계에 관한 연구

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인하대학교 전자공학과

A Study on Design of Digital Hearing Aid using DSP

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Abstract

In this paper, we developed a hearing aid module using a general purpose DSP. The developed and imported hearing aid algorithm mainly consists of 2 band amplification, output compression, and feedback cancellation. We consider that our system architecture is a behind the ear type hearing aid. As the result of experiment, it is verified that the developed hearing aid module operate like a hearing aid. However, it is necessary to improve the sound quality and optimize the algorithm.

MR 회전형 브레이크를 이용한 하지 근력 증진용 헬스 자전거 개발

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Development of a Health Bicycle Using MR Rotary Brake to Improve Muscle Strength on the Lower Limb

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Abstract

In this study, a new bicycle system was developed to improve muscular strength using the Magneto-Rheological(MR) rotary brake. The characteristic of muscular strength was compared with various friction loads of MR rotary brake. The friction load was adjusted with the current, applied to the MR rotary brake. EMG signals of RF, BF, TFL, VL, VAS, GAS, TA and SOL muscles were measured with surface electromyography, and then the activation and fatigue of the muscle were computed. The more the friction applied, the more integrated EMG we achieved. The median frequency tends to decrease as the cycling time continue. The results showed that the lower limb characteristic was changed according to the friction.

트레드밀 위에서 하지 보조기를 착용한 보행 운동 시 하지 근력 특성

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Characteristics of the Muscle Activities of the Lower Limb Orthosis during Gait on the Treadmill

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Abstract

We have developed a lower limb orthosis with a pneumatic rubber actuator, which is intended for the assistance and the enhancement of lower limb muscular activities of the elderly. For this purpose, we investigated the characteristics of the muscular activities with and without the orthosis in gait motion on treadmill. To find out the characteristics of the muscle activities, we analyzed the gait motion of the subject and flexing and extending motion of the knees and measured muscular power in the lower limb. The subjects wearing the lower limb orthosis were instructed to perform gait on the treadmill and flexing and extending motion of the knees in sitting position for monitoring of electromyogram and muscular activities. We used the C8051F Target Board (SILICON LABORATORIES, Inc., USA) for the orthosis control. The air pressure of the pneumatic actuator was varied from one kgf/cm² to four kgf/cm² to find the most suitable air pressure. Through this study, we expect to find the effect of the lower limb orthosis in the gait motion and muscular activities along with the most suitable air pressure in the pneumatic actuator of the orthosis for the enhancement of muscular power for the elderly.

공압 고무 액추에이터를 장착한 주관절 보조기 착용에 따른 상지근력 특성

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Abstract

We have developed the upper limb orthosis with a pneumatic rubber actuator, which is intended for the assistance and the enhancement of upper limb muscular activities. In this paper, we investigated the effectiveness of the upper limb orthosis we developed. To find out the effectiveness of the orthosis, we analyzed muscular activity in the upper limbs of the Alternate Dumbbell Curl motion. Subjects in experiment were young and healthy person of 20's. The subjects were instructed to the perform Alternate Dumbbell Curl motion in sitting position for motion analysis and we measured muscular activities of the subjects. The subjects were performed the Alternate Dumbbell Curl motion without and with the upper limb orthosis. We made a comparison the muscular activities of the upper limbs between without and with the upper limb orthosis. We compared the muscular activities according to the various load. The experimental results showed that the muscular activities in with the upper limb orthosis were significantly reduced. As a result of this experiment, we confirmed the effectiveness of the developed upper limb orthosis.

뇌졸중 환자치료용 뇌자극 원격 처치 프로그램 개발에 관한 연구

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Development of remote medical treatment program for Stroke patient care

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Abstract

Stroke patients need regular medical treatment. However, it is so difficult for them to change the position with severe aftereffects at home and to go to see doctors regularly. Stroke patients can be treated with the electric stimulation treatment by doctors using the remote medical treatment at home.

In this study, we developed the remote medical treatment program consisting of a brain electric stimulation with the Zigbee communication and Visual C++ based on Windows.

We already embodied the necessary functions and we can apply the remote medical treatment program with a minor stimulation wave modification to the other electric stimulation treatment.

장애인을 위한 중앙관리 기반의 무선 의사소통보조기기

김창걸, 박종명, 최미나, 송병섭
대구대학교 재활과학대학 재활공학과

AAC Device Using Wireless Communication Based on Central Management for Person with Disabilities

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Abstract

An AAC device which has a function of wireless communication based on central management for the person with disabilities was designed and implemented. The device was designed to use in welfare facilities or hospital which many disabled person with communication disorder live in together. For the user convenience, it was designed that direct or indirect scanning selection of the word-plate can be possible and an automatic recognition function using infrared sensors for changing the word-plates was added. As it provide for every contingencies, the emergency alarm function was also included. The designed device was implemented and several experiments were carried out to confirm the performance of the it.

Development of An Electric Pegboard using RFID with Multiple Reader Antennas

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Abstract

Pegboard test is often used in rehabilitation services to assess manual dexterity. It can also be used as an occupational therapy to improve the integration of sensation, cognition, and motor task.. However, it is necessary to provide more interest to patients and intelligence to its functionality. Especially to automate the scoring, it is necessary to detect not only plugged or unplugged state but also correctly or incorrectly plugged state of peg into hole. This study proposes an electric pegboard with RFID with multiple reader antennas. The multiple antennas are scanned in sequence. Sample prototype was made and showed that this system can automatically score pegboard session to provide each session time and success rate. Integration of ubiquitous technology into rehabilitation device, like the case of the electric pegboard introduced here, will be a promising application.

MR 댐퍼가 적용된 불안정판을 이용한 하지근력훈련 특성 분석

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Abstract

We performed experimental studies on the muscle strength of lower extremities of different movement patterns and maintain on an unstable platform with MR dampers. The electromyography of the muscles in lower extremities was recorded and analyzed into the time and frequency domain. The experimental results showed the muscle activities differ in four dynamic exercises and nine static exercises. Especially, the spectral energy of EMG signals of the movement pattern in anterior-posterior, 45 degrees direction higher than the other patterns. The experimental result suggest the choice of different movement pattern or maintain direction could train eight muscles in different intensity. Futhermore this training can improve the ability of postural control.

자동화 심폐소생기의 개발을 위한 체형분석

정집민, 김효민, 송상하, 윤영로, 황성오

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Abstract

In this paper, we present the regression models of anthropometric variables use stature, weight, chest circumference, chest depth for the automated cardiopulmonary resuscitation(CPR). To develop more accurate regression model for anthropometric variables, used a method to estimate anthropometric variables in a herarchical manner based on the relationships among the variables. The 'flat' regression model's adjusted is 0.5~0.8. The hierarchical regression models were compared with the corresponding flat regression models in terms of accuracy.

플라즈마 표면 개질처리된 나노 파이버 지지체를 기반의 간엽줄기세포 배양을 위한 미세유체 세포 칩의 개발

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RF-Plasma Treated Nanofiber Scaffold-Based on Microfluidic Cell Chip with Rabbit Mesenchymal Stem Cell Culture

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Abstract

In this research, we have fabricated Radio-Frequency (RF) plasma treated nanofiber scaffold-based on microfluidic cell chip. We prepared by electrospinning and modified nanofiber scaffold employing RF-plasma treatment for making the hydrophilic surface. We compared and evaluated the functional of this nanofiber scaffold-based on cell chip by culturing the rabbit mesenchymal stem cells (rMSCs) which have broad applications in the biomedical engineering.

의료용 센서 제작을 위한 초전도 박막의 온도특성 평가

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Analysis of temperature characteristic for Superconducting Thin Films for Medical Sensors

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Abstract

BSCCO thin films fabricated by using the evaporation method at various substrate temperatures, T_{sub} and ozone gas pressures PO_3 . As a result, although the composition of Bi2212 was set up, the phase of Bi2201, Bi2212 and Bi2223 was formed. The formation area of these stable phases is indicated as inclined line in the direction of the right lower end from the Arrhenius plot of the substrate temperature-oxidation gas pressure and are distributed in very small area.

의료용 능동소자 적용을 위한 BSCCO 박막의 상안정 영역에 관한 연구

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A Study on the Phase Stability Region of BSCCO Thin Films for Medical Active Device Applications

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Abstract

BiSrCaCuO superconducting thin films have been fabricated by co-deposition using IBS(Ion Beam Sputtering) method. Despite setting the composition of thin film Bi2212 or Bi2223, in both cases, Bi2201, Bi2212 and Bi2223 phase were appeared. It was confirmed the obtained field of stabilizing phase was represented in the diagonal direction of the right below end in the Arrhenius plot of temperature of the substrate and PO₃, and it was distributed in the rezone.

정상망막과 변성망막의 전기자극 파라미터 비교

예장희, 구용숙

충북대학교 의과대학 생리학교실

Comparison of Voltage Parameters for the Stimulation of Normal and Degenerate Retina

J. H. Ye and Y. S. Goo

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Abstract

Retinal prosthesis is regarded as a promising method for restoring vision for the blind with retinal diseases such as retinitis pigmentosa(RP) and age related macular degeneration(ARMD). Among the several prerequisites for retinal prosthesis to succeed, one of the most pressing is the optimization of electrical stimuli applied through the prosthesis. The electrical characteristics of diseased retina are expected to be different with those of normal retina. Therefore, we investigated different voltage parameters to stimulate normal and degenerate retina. The retinal degeneration model(*rd/rd* mouse) was compared against control mice. Voltage stimulations were delivered via one channel of 60 channels 8×8 Multielectrode array(MEA), and ganglion cell activities were recorded with the remaining 59 channels. The parameters of voltage stimulation were set based on previous experiment with rabbit. Evoked responses were counted during a 10~20 ms time span after the stimulation. The voltage amplitudes were optimized to obtain consistent values for ganglion cell responses; stimulus durations and calculated thresholds were also optimized. When the same stimulus was applied on the *rd/rd* mouse, evoked ganglion cell responses were rarely observed. The distribution patterns of evoked responses appeared only on a site distant from the stimulation electrode on the *rd/rd* retina. Conversely, in normal retina, evenly distributed response patterns were observed. Since the charge intensity tends to decrease with the distance from stimulation electrode, the uneven patterns from the *rd/rd* mouse retina suggest that lower charge is required to evoke a response from *rd/rd* retina.

Further study is necessary to have concrete stimulation parameters for testing *rd/rd* mice retina.

강박장애 환자의 평가를 위한 가상현실 시스템

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Virtual reality assessment system for patient with obsessive compulsive disorder

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Abstract

Performance on a novel, virtual reality assessment of characteristics was developed for patients with obsessive compulsive disorder (OCD). The virtual environment was consisted of 2 spaces(a home and a office) and 3 phases(a learning phase, a distracting phase and a main phase). After a learning phase and distracting phase, participants were checked freely, like "real world", and all of these processes were recorded. Virtual reality can measure mission success percentage, number of over-operation, gazing time during distracting behavior, gazing time during checking behavior, complexity of trajectory and checking time. And we confirm the possibility of virtual reality based on 1 typical OCD patient and 1 normal person.

미세유체 칩을 이용한 칼슘 알지네이트 파이버의 제작을 통한 세포의 캡슐화

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Fabrication of Alginate Fiber for Cell Encapsulation using a Microfluidic Chip

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Abstract

This paper describes a new continuous production technique of calcium alginate fibers with the microfluidic platform similar to spider. We have used the poly(dimethylsiloxane) (PDMS) microfluidic device embedded capillary glass pipette. As a sample flow, we used a 2% (w/w) sodium alginate solution and as a sheath flow, a 784 mM CaCl₂ solution was used. The coaxial flows were generated at the intersection of both flows and the sodium alginate was solidified to calcium by diffusion of the Ca²⁺ ions during traveling the outlet pipette. The diameter of the calcium alginate fibers could be tuned by adjusting the flow rates. In addition, we have measured the elasticity of dried fibers. We evaluated the potential use of alginate fibers as a cell carrier by loading mammalian cells during the 'on the fly' fabrication process. From the LIVE/DEAD assay, cells survived well during the fiber fabrication process.

통증조절을 위한 척수강내 약물주입 이식형 펌프

이철한, 홍소영, 백두진, 송승준, 조영호
국립암센터 연구소 의공학연구과

Intrathecal Implantable Infusion Pump for Pain Control

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Biomedical Engineering Branch, Research Institute, National Cancer Center

Abstract

A dedicated implantable intrathecal pump has been developed to control the drug delivery. We have improved the pump size and performance. Also We have implemented and tested main functions : 1) minimization of power consumption 2) drug infusion 3) Data communication and system monitoring.

We found out the best performance of the system and tested the performance of pump and software. In our preliminary results, several problems could be solved and favorable results were achieved in the drug infusion control with wireless communication using the bluetooth module.

수술 로봇 1축 Translation의 힘 반향제어에 관한 연구

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국립암센터 의학공학연구과

Study of Force Feedback Control for 1-DOF Translation

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Abstract

In this paper, we studied force feedback control methods that are applicable to Laparobot. Master system used NCC Laparobot and Slave system used one degree of freedom(DOF) arm of NCC Laparobot. Force control methods are developed for the using force sensor and soft-tissue and hard-tissue experiment respectively. We used only one axis in this study, but this result can be applicable whole five axes of Laparobot

수술로봇을 위한 무센서 힘반향 제어

박준우¹, 이덕희¹, 송승준¹, 신정욱¹, 김윤호¹, 이정주², 이정찬^{3,2}, 조영호¹, 최재순¹

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Sensorless Force Feedback Control for Surgical Robot

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Abstract

We developed a force feedback controller based on the position error between the master and the slave without using additional torque sensors. We implemented an open-loop impedance control algorithm. The slave torque was estimated utilizing position error and its first and second derivatives. Then the current command for the master was found proportional to the estimated slave torque. The algorithm was evaluated using the 1-DOF force feedback device and it showed good performance in edge detection. For softness discrimination, it showed acceptable preliminary results and the research is ongoing.

이층구조 다엽콜리메이터 개념 설계와 유용성 평가

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Development and verification of dual-layer multileaf collimator

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Abstract

Multileaf collimator(MLC) is a widely used dose delivery device for intensity-modulated radiation therapy(IMRT). The MLC is convenience to use and to adjust the field shape and beam fluence. However, there are some limitations to improve. One of them is longer beam-on time. As beam-on time is longer, patient's integrated dose is unnecessarily increased because of inter- and intra-leaf leakage. In this study, a new concept of MLC(dual-layer MLC) was proposed to solve this limitation in the aspects of total delivery intensity or monitor unit. The dual MLC consists of independently movable two MLC layer; upper and lower. Their thicknesses are 1 half value layer(HVL) for upper MLC and 5 HVL for lower. The initial intensity(I) of photon beam is attenuated half intensity (0.5I) if the beam is passing through the upper MLC only. Therefore the intensities are able to be delivered three steps; 0, 0.5, and 1. The sequencing algorithm was modified to dual-layer MLC in step and shot technique. To evaluate the usefulness of a new concept, the total delivery intensity and number of segments were compared with conventional MLC with by three field sizes (5x5, 10x10, 15x15, and 20x20) and four intensity levels(5, 8, 10, and 16). 10000 intensity maps were randomly created for each field size and intensity level. As a result, the total delivery intensity was reduced by 9% to 22% in all field size and number of segment was reduced by 25% to 45%. The unnecessary patient's dose is reduced effectively with dual-layer MLC because the required total delivery intensity was successfully reduced. The treatment time is also reduced.

전립선암 근접치료시 완벽하게 중복된 방사선원 위치 재구성에 관한 연구

홍주영, 라정은, 서태석
가톨릭대학교 의과대학 의공학교실

Study on Inage Reconstruction for Completely Overlapped Seed Localization of Permanent Prostate Brachytherapy

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Abstract

The purposes of this study were to design and fabricate the phantom for prostate brachytherapy, to validate the developed program by applying 3-film technique for determining the location of perfectly overlap seed, and to compare with conventional 2-film technique. The images were obtained from overlap seeds by randomly placing maximum 63 seeds in the -30° to 30° at 15° intervals. Images obtained by the phantom were applied to the image processing, and then processed into the development program for seed localization. In this study, the case to set is which one seed is overlapped, over two seed is overlapped and none of the 3 views has resolved all seeds. The distance between the centers of each seed to reference seed was calculated in a prescribed region. And this distance determined the location of each seed in a prescribed region. The location of overlap seeds was compared with 2-film technique. With this program, the detection rate was 92.2% (at 15° interval), 94.1% (at 30° interval) and 70.6% (2-film technique). The overlaps were caused by 1 or over 2 seeds were overlapped, developed program can identify the location of each seed perfectly. But the 3rd case could not bring the good result rather than two cases. This program can be used to improve treatment outcome in brachytherapy of prostate cancer by reducing the error in the process of reconstructing the locations of perfectly overlap seeds.

재택건강관리시스템에서의 권역응급센터 시스템 설계

송상하, 양용주, 정집민, 김효민, 이주환, 윤영로
연세대학교 보건과학대학 의공학과

Design of Regional Emergency Medical Center in Home Health Management System.

S. H. Song, Y. J. Yang, J. M. Jung, H. M. Kim, J. H. Lee, Y. R. Yoon

Department of Biomedical Engineering, College of Health Science, Yonsei University

Abstract

In this study, we have designed a regional emergency medical center management system in Home Health Management System.(H2MS). The objective of this study is to propose regional emergency detection management system modeling in home healthcare system which copes with emergency situation as quickly as possible.

맞춤형 체형 진단 및 처방을 위한 웹 기반 유비쿼터스 건강 증진 시스템

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Ubiquitous Health Promotion System for Personalized, Online Fitness, Diet Reporting and Counseling

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Abstract

Ubiquitous healthcare solutions are gaining momentum in addressing wide range of issues faced today regarding health promotion and education. In this work, we present a web-based health promotion system responsible for supporting and addressing different aspects of requirements for efficient and effective conversation between a complex chain of healthcare bodies and their concerning patients. Explicitly the system is intended to cater for; the management support concerning involvement of multiple agents, the information requirements in different representations according to the user role, the different functions or services required by each agent. These agents include health organizations, systems and individual users. This work aims to contribute to the collection of efforts for e-Health promotion.

EMR 연동 모니터의 화면 장애

- 증례 보고 -

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Display Failure of EMR Connected Monitors

- A case report -

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²Department of Ophthalmology, College of Medicine, Gunguk University †

Abstract

In this case presentation, we report a monitor display failure. There were simultaneous black-out of around 30 patients' monitors. Possible cause of this failure is communication loss of HL-7 data transport. We propose some monitor criteria which include protection of monitor display even though there is HL-7 communication failure.

실시간 몸동작 인식 시스템의 설계 및 구현

김영운, 강선경, 소인미, 정성태
원광대학교 공과대학 컴퓨터공학과

Design and Implementation of a Real Time Body Action Recognition System

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Dept of Computer Engineering, College of Engineering, Wonkwang University

Abstract

This paper proposes a system that recognizes the body action in real time by statistical learning method. It extracts human's motion from camera image by using background subtraction method. It recognizes the human action by using HMM(Hidden Markov Model) algorithm. Experimental results achieved the recognition rate of 96.29% for the trained body actions.

모바일 협업을 위한 분산객체그룹 컴팩트 프레임워크

김동석, 정창원, 주수종
원광대학교 전기전자및정보통신공학부

Distributed Object Group Compact Framework for Mobile Collaboration

D. S. Kim, C. W. Jeong, S. C. Joo
School of Electrical, Electronic and Information Engineering, Wonkwang University

Abstract

In this paper, we describes a mobile collaboration framework based on distributed object group framework, called DOGCF (distributed object group compact framework). We focuses on the use of this framework to support mobile collaboration in ubiquitous computing. DOGCF provides a mobile collaboration environment where network connectivity, computing devices, and user's activity. It provides support for developing mobile application. We also explained the design requirement and supporting services. Finally, we describes the interaction of components and application example.

반신욕이 인체 생리특성에 미치는 영향

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Effects of Half Bath on the Physiological Characteristics

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Abstract

Bathing provides therapeutic effects as well as sanitary effects. Therapeutic effects of heat and hydrostatic pressure varies depending on the immersion part of the body and the water temperature. In order to study the effects of half and full immersion bath on physiological changes, body temperature, blood pressure, and heart rate variability were measured before, during and after bath. Experiments were performed on partial immersion bath and full immersion bath. The water temperature was kept $39 \pm 0.5^\circ\text{C}$. The body temperature and the heart rate variability of the subject were measured every 5 minutes before, during, and after the bath. We were able to observe that blood pressure, intraocular pressure and skin temperature increased as the time went on during half bath. In the contrary, blood and intraocular pressure decreased during full bath.

헬스 자전거 시스템을 이용한 근육과 호흡의 분석

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Analysis of Muscle and Respiration Using Health Bicycle System

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Abstract

We estimated activities of the muscles in the lower limbs and respiration using health bicycle system. Four normal healthy adults volunteered for the experiments. The analysis software developed using Labview 7.1. The results showed that muscle activity of left was higher than right and O₂ concentration was increased.

Mechanical Properties of Alignment Nyong 6 Nanofibers

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Abstract

The alignment of nanofibers is capable of obtaining the modified collector and controlling the linear velocity of metallic collector. As the results, the nylon 6 nanofibers obtained random arising from the bending instability below 5 m/s of the linear velocity of collector, Above 5 m/s, nanofibers exhibited the highly alignment toward the machine direction due to the drawing effects of charged jets. This result indicated that the orientation of the molecular chains due to alignment was increased, led to be the improved mechanical properties of nylon 6 nanofibers.

전기방사된 산화 티타늄 나노섬유를 이용한 하이드로시아파타이트 결정의 합성

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Synthesis of hydroxyapatite crystals using titanium oxide electrospun nanofibers

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Abstract

Metal - ceramic nanocomposites have a special interest for biomedical applications such as in dental and bone implants. One interesting possibility to control the size of these materials is their fabrication on electrospun nanofibers. In this communication, we reported the use of bio-activated titanium oxide(TiO₂) electrospun nanofibers as a template for the synthesis of hydroxyapatite (HAp)[Ca₁₀(PO₄)₆(OH)₂] crystals. TiO₂ nanofibers were fabricated using a viscous solution of titanium isopropoxide(TiP)/poly(vinyl acetate) (PVAc) via electrospinning and then chemically treated with NaOH followed by diluted HCl to explore the possibility of enhancing the bioactivity. Thus obtained nanofibers were employed for the simulated body fluid(SBF) mediated biomimetic synthesis of HAp crystals. The composites were characterized by different physico-chemical(FT-IR, XPS, XRD, SEM, and EDX) techniques. Results showed that the activated TiO₂ nanofibers served as an effective template for the assembly of plate like hydroxyapatite crystals.

Multi-walled carbon nanotubes/TiO₂ composite nanofiber by electrospinning

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³Department of Textile Engineering, Chonbuk National University, Jeonju, 561-756, Republic of Korea

Abstract

TiO₂/ carbon nanotubes(CNTs) composite nanofibers were prepared by sol-gel processing and electrospinning technique. Phase pure titania/CNT composite nanofiber of 100-150 nm diameters were obtained by high temperature calcinations of the inorganic organic composite fibers. The inclusion of nanotubes with TiO₂ was confirmed by FT-IR and Raman spectra and corresponding morphology and crystallinity were observed by SEM, TEM, and XRD analysis.

Modified Chitosan Stabilized Magnetic Nanoparticles : Implication for Cellular Labeling and Magnetic Resonance Imaging

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Abstract

The objective of this study was to investigate the use modified chitosan stabilized iron oxide nanoparticles (MC-IOPs) delivery to cells in vitro. This project involved the synthesis and biological evaluation of MC-IOPs. IOPs containing chitosan were prepared using conventional methods, and the extent of cell uptake was evaluated using mouse macrophages Raw cell line. MC-IOPs were found to rapidly associate with the RAW cells, and saturation was typically reached within the 24 h of incubation at 37 °C. Nearly 8.53 ± 0.31 pg iron/cell were bound or internalized at saturation. We conclude from these results that MC-IOPs can effectively deliver IOPs into macrophages RAW cell line in vitro, but additional barriers exist in vivo that prevent or decrease effective tumor uptake and retention remains to be elucidate.

Encapsulation of Fe₃O₄ in Gelatin Nanoparticles : Effect of Different Parameters on Size and Stability of the Colloidal Dispersion

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Abstract

In present study, encapsulation of magnetite(Fe₃O₄) in gelatin nanoparticles was done by in situ precipitation of Fe₃O₄ particles in presence of gelatin, followed by desolvation and cross-linking of the composite nanoparticles. Aim of the study was to investigate the effect of various parameters viz. desolvating agent, cross-linking agent, and percentage of Fe₃O₄ on the hydrodynamic size of the composite nanoparticles and stability of the colloidal dispersion. Extensive characterization by Dynamic Light Scattering (DLS), Thermogravimetric Analysis(TGA), X-ray diffraction(XRD), Infrared Spectroscopy(FT-IR), Transmission Electron Microscopy (TEM), and Atomic Force Microscopy(AFM), shows complete encapsulation of Fe₃O₄ of size below 8 nm into gelatin nanoparticles of varying size. Size as well as stability of the colloidal dispersion of the composite nanoparticles was found to be dependent on the investigated parameters. Furthermore, the nanoparticle dispersion was found to be stable in pH ranges from 2 to 12. Thus, obtained composite nanoparticles could hold promise as carrier system in biomedical application.

Synthesis, Characterization, and Self-Assembled Aqueous Dispersion of PCL-Dextran Nanoparticles

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Abstract

In the present study amphiphilic graft copolymer composed of poly(ϵ -caprolactone) and dextran was synthesized by ring opening polymerization of ϵ -caprolactone initiated through hydroxyl group of dextran in presence of stannous 2-ethylhexanoate[Sn(Oct)₂] as a catalyst. Polymeric nanoparticles were prepared in aqueous medium by co-solvent evaporation techniques at room temperature (25°C). Hydrodynamic diameter and particle size were measured by dynamic light scattering spectroscopy(DLS) and atomic force microscopy(AFM), respectively. Core shell geometry of polymeric nanoparticles was characterized by spectrophotometer using pyrene as a probe. Critical micelle concentration of polymer decreased from 6.9×10^{-4} to 8.9×10^{-4} g/L.

포스터 Ⅲ

Small Low Power ECG Telemetry System

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Abstract

Recently, the biotelemetry is become more and more popular and people are trying to find the various methods to send the signal from one place to another remotely with minimum power consumption and as small size as possible. By taking these things in the mind, the system which is discussed in this paper is a step forward in the field of biotelemetry. This paper focus on the development of real ECG biotelemetry having three volt power supply and the dimensions are 2.5 cm by 3 cm, and the average power consumption of the system is 9 mW which is much lesser then the other ECG telemetry system . In this circuit ECG amplifier and transmitter are embedded on the single side PCB.

실험자에 따른 자침에 대한 뇌기능 자기공명영상을 이용한 뇌활성화 변화의 재현성 연구

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Reproducibility of fMRI study on the Brain Activity Induced by Manual Acupuncture at BL62

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Abstract

A large number of randomized controlled trials provides growing evidence of the clinical efficacy of acupuncture for treating a variety of medical conditions. Thus, the development of imaging techniques, such as positron emission tomography(PET) and functional magnetic resonance imaging(fMRI), have opened a 'window' into the brain that allows us to gain an appreciation of the anatomy and physiological function involved during acupuncture in humans and animals non-invasively. Especially fMRI has shown pattern of regional brain activation, it was suggested that fMRI acts as to investigate therapeutic effects of acupuncture.

This research has shown that in observations on the brain activity using fMRI, the reproducibility on the result of inter-physicians was improved by controlling the variance of two physicians conducting the acupuncture.

Changes of Heart Rate Variability during the Day Measured by Mobile ECG Sensors

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Abstract

Heart rate variability (HRV) analysis is often used to depict the activity of autonomous nervous system (ANS) that may be related to mental stress. For mobile health applications, ECG recordings may be made frequently during short periods since the conventional five min long ECG measurement might be inadequately long. Before the establishment of frequency and the duration of reliable mobile ECG analysis, the change of HRV measures during the day needs to be thoroughly investigated. In this study, we first measured ECG signals using a patch type sensor for 22 to 24 hours from six subjects during three different time periods of the day: morning, afternoon, and evening. HRV measures were compared among the stages using the Kruskal-Wallis test. Heart rate, CV, LF/HF and normalized LF showed a pattern of increment whereas RR intervals, RMSSD, PNN50, and normalized HF showed a pattern of decrement during the afternoon and evening periods. In addition, random two minute ECG recordings during the day were performed by a subject using a portable sensor. Heart rate, RR intervals, and HF changed significantly during the day. These findings suggested that the time of the measurement should be considered for more reliable HRV analysis.

연하장애의 진단 시스템 개발

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A Development of Diagnosis System for Swallowing Disorder

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Abstract

In this paper, we present the diagnosis system for swallowing disorder. There are some types of diagnosis device for swallowing disorder, for example, the video fluoroscopy, the nuclear medicine inspection, the endoscopy, EMG and motion analysis. But these systems need heavy devices or have dangerous nuclear exposure, so are uncomfortable for handicapped person.

Our system has advantages of simplicity, accuracy and quantitative analysis. In addition to the diagnosis aspect, this system can be used to biofeedback treatment.

컴퓨터 기반 비만관리를 위한 체중계의 설계와 제작

허 창, 장대근, 서상진, 곽현민, 박승훈
경희대학교 전자정보대학 동서의료공학과

Design and Implementation of a Body Weight Scale for Computer-based Obesity Control

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Dept. of Biomedical Eng. College of Electronics and Information Kyung Hee University

Abstract

In this work, we developed a system that can measure obese patients weight precisely and save body information for making database by using Load Cell sensors. This system measure their weight and gives the feedback about how much to lose weight and what is their goal weight by PC program. So they can lose weight effectively by using this system every day. The software of this system is object-oriented, window based PC application written in C++ language.

가상현실을 이용한 사회적 상황에서의 알코올 갈망감 유발 및 측정 시스템 개발

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Development of Alcohol craving induction and measurement system at social situations using virtual reality

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Abstract

Alcoholism is a disease that affects some part of brain that control emotion, decisions, and behavior. consequently, Alcoholic must train repeatedly Cue-Exposure Treatment(CET) that exposes the patient to patient related high-risk situations during treatment in order to raise ability to recognize high-risk situations by oneself. CET needs that express situations to keep an induced craving. Alcohol craving could be triggered when exposure to objects, environment, or high-risk situations which connected with alcohol. But, social pressure situations to have influence about alcohol craving induction are difficult to induce craving in CET. Virtual reality (VR) is a technique which can provide immersive three-dimensional environment and dynamic social interaction as real world. In this study, we developed alcohol craving induction system using virtual reality to provide social situations in which an avatar asks to drink together. Nine males and one female (age from 21 to 27 years) who do not have any history of alcohol related disease were recruited for this experiment. In the results, in situations without social pressure, more alcohol craving was induced in situation with alcohol than that of a situations without alcohol. That means our alcohol craving induction system shows same result as conventional study shows. In situations with social pressure, induced alcohol craving were not difference between in situations with alcohol and in situations without alcohol. In situations with alcohol and without alcohol, there were significant difference between situations with avatar (social pressure) and without an avatar (situations with alcohol p=0.01, situations without alcohol p=0.001). In cognitive behavior therapy, social pressure situations are needed to alcohol craving, because people get more alcohol craving in social pressure situations which is stressful and negative. It could help to more effective drinking refusal training. Particularly, alcohol craving induction system developed in this study using VR is able to use in alcohol refusal training for alcoholism therapy.

모의 맥파 시뮬레이터 개발 및 그 유효성에 관한 연구

한승신, 박미경, 김은근, 허영
한국전기연구원

A Study of Artificial Pulse Wave Simulator.

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Korea Electrotechnology Research Institute.

Abstract

In this paper, we developed artificial pulse wave simulator and with the simulator, we could imitated human's pulse wave on the radial artery. We verified the pulse wave obtained by artificial pulse simulator by measuring AIx with the SphygmoCor. The AIx of the pulse wave from the simulator was almost same to that of human. We can expect that this study can be used to find out the factors which change the pulse wave.

Synchrotron x선을 이용한 피부암의 영상법 연구

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Ex vivo imaging of skin cancer using synchrotron x-ray microscopy

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Abstract

Introduction Till now, every clinical investigation for research and operation is executed by biopsy after confirming with histopathological image invasively. It is very importance to develop noninvasive method for improving early diagnosis and screening of suspected skin lesions. Synchrotron x-ray microscopy (SAXM) can investigate the microstructures of soft tissue without any staining or contrast-enhancing cell preparation.

Aims To investigate the possibility what synchrotron x-ray (SXR) can be used to explore the microscopic details of skin cancer, such as BCC.

Methods Paraffin fixed tissues from patients with skin cancer, such as BCC (Basal Cell Carcinoma) were cut in 30 μ m thickness for the synchrotron x-ray radiographic imaging. Experiments were performed at the ICPCIR (International Consortium of Phase Contrast Imaging and Radiology) (7B2) beamline of the Pohang Acceleration laboratory in Korea. The SAXM images were achieved using coherent hard x-ray from a synchrotron source with no monochromatization.

Results We got the find and novel images with clear edge enhancement by SAXM. The images taken with this technique showed clear anatomic details of organelles in normal skin, such as epidermis, dermis and skin appendages. Most of cancerous lesions were clearly differentiated from adjacent normal tissues and the images closely corresponded to those obtained with low magnification optical microscopy.

Conclusion In this preliminary study, we successfully demonstrated that synchrotron SAXM could be used for radiological imaging of skin cancer, such as BCC, with great anatomic details.

골프 퍼팅 스트로크시의 초보자와 숙련자간의 악력 분석

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Analysis of Grip Force During Putting Stroke between Elite and Novice Golfer

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Abstract

In this paper, The putting stroke grip force between elite and novice golfer were analyzed. Wireless grip force and acceleration measurement system was developed to set the grip force data and the data post processing was done using MATLAB. Novice showed much greater grip force and variations than elite golfers during the whole putting phases, and grasped the grip only a part of his hand.

발-발 경로로 체임피던스를 측정하는데 있어서 방광안의 소변의 영향

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The Influence of Urine in Bladder for Body Impedance with the foot-foot current path

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Abstract

In this paper, we present the influence of urine in bladder when the body impedance is measured with the foot-foot current path. The errors to affect the measured body impedance are such as conductive length, electrode position, body posture, skin temperature, level of body water compartment, ratio of extra cellular water to total body water, body density, weight, and so on. And, in addition, we propose that the urine in bladder can affect the measured body impedance

the amount of urine in bladder may affect the measured impedance. So we show the influence of urine in bladder when the impedance is measured with the foot-foot current path. In the end, the influence of urine in the bladder must be considered when the body impedance is measured with the foot-foot current path.

피부 각질층의 임피던스 추정값 보정을 위한 연구

최한윤, 심명현, 정인철, 김기원, 윤형로

연세대학교 보건과학대학 의공학과

Research for the compensation on impedance of the stratum corneum.

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Abstract

This study was attempted to suggest a new method to estimate fine impedance of the horny layer of the skin. The phenomenon that the form of isoelectric line for the skin surface is changed with variation of the measuring condition was observed through simulation in a model with different electric properties of the lucid layer. For simulation, Ansys 10.0; Multiphysics was used to analyze electric condition of the subject. The model of the experimental subject was formed while physical properties of the horny layer were fixed but those of the lucid layer were changed. The experiment was conducted by applying constant current to each subject in the 5Hz ~ 5kHz frequency band. As frequency of the applied current was changed, there was significant change in the isoelectric line.

PPG 신호의 형태학적 분석에 의한 연속적인 혈압 추정에 관한 연구: 임상실험

이동희, 정인철, 전석환, 박신우, 윤형로

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A Study of Continuous Blood Pressure Evaluation by Morphological Analysis of Photoplethysmographic Signal : Clinical Experiments

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Department of Biomedical Engineering, Yonsei University

Abstract

The purpose of this study is evaluating blood pressure(BP) from morphological analysis of photoplethysmographic(PPG) signal. Various investigations for estimating BP using PPG is in progress. The alteration of BP cause change of cardiac output(CO) and total peripheral resistance(TPR), and it also changes peripheral vascular system(PVS). Considering the PPG variation of PVS consider in physiological system, the alteration of BP can be evaluated in the arterial tube. CO can be analogized with the PPG DC value and heart rate. TPR can be inferred from slope and area of the PPG. Therefore we have estimated arterial blood pressure with this manner. We performed physiological examination and verified the theory through seven clinical experiments. The clinical test proved that the estimated BP for subjects is related with BP measured with reference device. The result of this experiments shows that PPG signal can be used to evaluate continuous BP.

크롬친화세포의 외포작용을 광학적, 전기적으로 동시에 계측하기 위한 ITO 기반의 미세 전기화학 검출기(ECD)의 제작

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Fabrication of an ITO-based μ -ECD for Simultaneous Optical and Electrical Monitoring Exocytosis in Chromaffin Cells

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Abstract

In this study, we fabricated an ITO-based electrochemical detector (ECD) for simultaneous optical and electrical measurements of exocytosis in chromaffin cells. In a viewpoint of electrical performance, the ITO-based ECD presented satisfactory results with effective current signals and a relatively low noise level. Especially, its transparency provided a significant potential to overcome the limitations in optical imaging with conventional Pt or Au electrodes. From our results, the exocytosis of target cells can be fully monitored by optical and electrical methods using the ITO-based ECD. Moreover, it is expected that the proposed ECD can be applicable to measure various kinds of other cell activities.

The Effects of Somatosensory Input for the Postural Control in Human Standing

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Abstract

The purpose of this study was to analysis the effects of somatosensory input for the postural control in human standing. To study the effects, the sway of the center of pressure was observed on the stable and unstable platform by 10 healthy subjects with two ankle supports attached co-stimulated mechanical vibrations to flexor ankle muscles(Tibialis Anterior, Triceps Surae) and two plantar zone. These results observed vibration stimuli affects postural stability and the effects of vibration increases gradually on the unstable platform. These findings are important for understanding the organizational principles which characterize the state of the system of equilibrium maintenance and the use of somatosensory information.

모션 아티팩트 저감을 위한 손톱위에서의 광전용적맥파 검출 센서

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Nail Style Photoplethysmogram Measurement System for Motion artifact reduction.

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Abstract

Pulse wave is basic and important living body signal for vital sign of measurement target or patient's disease diagnosis. Reflection style of existent pulse wave measurement system is system that receipt light element, emitting light element hangs on palm part of finger or receipt light element, emitting light element hangs on finger lower and upper parts of permeation style.

Such existent pulse wave measurement system is sensitive to motion artifact.

In this study it is going to reduce motion artifact irritableness that existent pulse wave measurement sensor has comparative rigidity degree sensor that receipt light element, emitting light element is situated on nail latitude reveal and do basic research that do example addition.

This is considered to become reduction of motion artifact of other pulse wave sensor.

다채널 다주파수 임피던스 영상 시스템의 보정 방법

구환, 김상민, 이경현, 우응제

경희대학교 동서의료공학과

Calibration Methods for Multi-channel Multi-frequency EIT System

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Abstract

Multi-channel multi-frequency electrical impedance tomography (EIT) system requires a careful calibration to minimize systematic errors. We describe novel calibration methods for the recently developed KHU Mark1 EIT system. Current source calibration includes maximization of output resistance and minimization of output capacitance using multiple generalized impedance converters. Phase and gain calibrations are used for voltmeters. Phase calibrations nulls out the total system phase shift in measured voltage data. Gain calibrations are performed in two steps of intra and inter-channel calibrations. Using the calibration methods described in this paper, we could obtain $1M\Omega$ minimal output impedance of the current source in the frequency range of 10Hz to 500kHz. The reciprocity error was reduced from 5 to 0.05% after voltmeter calibrations. We demonstrate the effects of the calibrations using reconstructed time and also frequency-difference images of a homogeneous conductivity phantom. We found that these three calibrations are essential to minimize artifacts in reconstructed images.

다주파수 EIT 시스템을 이용한 시간차 및 주파수차 영상의 획득과 분석

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Time- and frequency-difference imaging using KHU Mark 1 EIT system

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Abstract

We describe results of frequency-difference imaging experiments using a 16-channel KHU Mark1 EIT system operating in the frequency range of 10Hz to 500kHz. As imaging objects, we used saline tanks including various object with different conductivity σ and permittivity ϵ values. Reconstructed frequency-difference real- and imaginary-part images showed frequency-dependent conductivity and permittivity changes of objects. Nothing that both σ and ϵ affect real and imaginary parts of measured boundary voltages, we suggest new methods of interpreting reconstructed images of σ and ϵ .

실제 자동차 운전 중 무구속 심전도 측정 시스템 및 실험

이햇빛¹, 최종민¹, 김정수¹, 김윤성¹, 백현재¹, 류명석², 손량희², 박광석³
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Nonintrusive ECG Measurement system and experiments for real driving

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Abstract

Recently, the nonconscious physiological signal measurement methods are one of the growing issues in ubiquitous healthcare. Among these methods, we focused on the development of nonintrusive electrocardiogram(ECG) measurement system during driving in the real road and test the performance of the system. Driver's condition monitoring is important in both daily healthcare and prevention of car accidents. However, existing recording methods are so complex and they can disturb driving. Our system consists of dry electrodes attached to the steering wheel and wireless communication module using Bluetooth device. To validate our system, we compared the recorded signal with reference signal. Despite existing motion artifacts, we obtained high correlated parameters of heart rate variability in time and frequency domain. The results implies the potential of developed system to be a good health monitoring system in a vehicle.

주파수차 도전을 영상법을 위한 물질의 도전을 스펙트럼 측정

이경헌, 김영태, 우응제
경희대학교 전자정보대학 동서의료공학과

Conductivity spectra of different materials for frequency-difference imaging

Kyung Heon Lee, Young Tae Kim, and Eung Je Woo
Department of Biomedical Engineering, Kyung Hee University

Abstract

Impedance imaging such as electrical impedance tomography (EIT) and magnetic resonance electrical impedance tomography (MREIT) requires imaging objects with known conductivity distribution for its validation and performance evaluation. Especially for multi-frequency EIT imaging experiments, we need to measure conductivity spectra of imaging objects. We describe a method to obtain conductivity spectra using a bio-impedance spectroscopy (BIS) system. We report measured conductivity spectra of different materials including saline, agar gel, polyacrylamide gel, TX151 gel, animal hide gelatin(AHG), banana and cucumber. Summarizing recipes to construct imaging objects using those materials and also providing their conductivity spectra, we propose best phantoms for frequency-difference imaging experiments in EIT.

3T MREIT system을 이용한 실험견의 대뇌 도전을 영상

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Conductivity Imaging of a Canine Brain Using a 3T MREIT System

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Abstract

Magnetic resonance electrical impedance tomography (MREIT) has the potential to provide conductivity images with high spatial resolution and accuracy. As a step toward clinical imaging experiments of MREIT, we performed MREIT imaging experiments of normal canine brains and could reconstruct the first high resolution conductivity images. Injecting 5mA imaging current through the heads of anesthetized dogs, we collected induced magnetic flux density data inside the brains and applied the harmonic Bz algorithm to reconstruct conductivity images. After imaging experiments, we sacrificed dogs and repeated conductivity imaging experiments using 40mA imaging currents. Reconstructed multi-slice conductivity images of canine brains are compared with those of postmortem canine brains.

구강 내의 pH 측정을 위한 Wireless Intra-Oral pH Telemeter의 구현

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Implementation of Wireless Intra-Oral pH Telemeter to Measure Intra-Oral Acid

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Abstract

An oral cavity is one of the most dangerous parts in human body. Since it is located in the place that easily can be attacked by both physical and chemical factors, as compared with other parts of human body, most people have suffered from dental caries. There are several reasons why people easily get them. Of the reasons, pH has the most serious effect on the dental caries as a chemical cause. For that reason, people have studied methods for measuring pH in the human cavity.

In this study, a method has been implemented as a intra-oral wireless pH telemeter. This method is different from other wired methods. It can efficiently last for long time to measure pH in the human cavity with button rechargeable manganese

-lithium battery and microprocessor(ATmega 168V), and is wireless that optical communication with LED is used to transfer data about pH from pH telemeter to PC through serial communication (RS-232C).

4채널 침습적 혈압 모니터링 시스템 구현

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Implementation of 4-channel invasive blood pressure monitoring system

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Abstract

It is very important that monitoring cardiovascular system in human body. Artery blood pressure being maintained by heart beat is a basic clinical sign evaluating functions of cardiovascular system. The artery blood pressure participates in all tissue's perfusion and influences cerebral blood flow and cardiovascular system to make important, especially. In this study, we implemented 4-channel invasive blood pressure monitoring system that monitoring pressure of blood pump using pressure sensor on the way cardiac surgery, unlike existing methods.

유비쿼터스 헬스케어 위한 무선 PPG 시스템 개발

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충북대학교 의과대학 의공학교실

Wireless PPG System for u-Healthcare

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Abstract

In this paper, we propose a PPG monitoring system using PDA and RF communication technology. PPG(photoplethysmography) is a noninvasive technique for detecting pulsations in blood vessels by monitoring the light absorbed in a tissue illuminated by a monochromatic source. Zigbee Wireless PAN was used as wireless communication technology and its most significant advantage of low-power mode was implemented to this design concept. The developed system is composed of a transmitter and a receiver. The transmitter has microcontroller, three-axial acceleration sensor, PPG circuit, DC-DC Converter and Zigbee communication controller. The Receiver has microcontroller, DC-DC Converter, serial communication and Zigbee communication controller. It forwards the received data to PDA, where the data can be stored and displayed. Using this device, a new method of monitoring PPG is proposed. A PDA-based wireless PPG system enables patients to be monitored during their daily living, without any constraints.

근적외선을 이용한 비침습 방식의 피하지방 두께 및 체지방 측정 시스템 개발

배영석, 김영빈, 김정희, 김진석, 이태동, 김수진¹
Planet82(주) 센서사업부 바이오팀, ¹청담서울여성외과

Development of medical system to measure the thickness of subcutaneous fat layer and body fat by non-invasive method using Near-infrared.

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Bio Team, Sensor Div. Planet82 co. Ltd. ¹Clinic 9

Abstract

In present-day society, Subcutaneous fat is being drawn lots of attentions to people who give importance to their appearance including beauty related fields. This study presents the medical system development to measure the thickness of subcutaneous fat layer and also its performance is verified with the clinical trials using this system.

텔레메트리 생체신호 계측 시스템 개발

김현준, 장준근, 주상규, 임수현, 변미경, 한상휘, 박영배¹, 허 응
 명지대학교 전자공학과
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A Development of Telemetry System To Monitor Biomedical Signals.

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Abstract

In this paper, we implemented a ZigBee-based multi-channel telemetry system capable of measuring EEG, RSP and PPG signals. The software algorithm was developed in order to detect Mac-Yul from RSP, PPG signals. The analysis of acquired EEG signal was analyzed by power spectrum density for biological stable state.

As the result of experiment with 10 subjects, we could have the following conclusions : (1) the devised system could acquire the 3-channel bioelectric signals in a wireless environment with reliability. (2) we could determine the state of the human body in view of oriental medical using the EEG PSD and Mac-Yul.

Event-Recorder 기능이 있는 무선 3채널 심전도 시스템

홍주현, 차은종, 이태수
 충북대학교 의과대학 의공학교실

Wireless 3 Channel ECG System with Event-Recorder Function

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Abstract

In this paper, we proposes a ECG monitoring system using PDA and RF communication technology. Patients with heart diseases have an increased risk of sudden cardiac death. Many of those patients are normally living at home without any kind of arrhythmia monitoring system or cardiac alarm solutions. So, we developed a wireless 3 channel ECG System with Event-Recorder function. This device is composed of a transmitter and a receiver. The transmitter has microcontroller, three-axial acceleration sensor, 3 channel ECG circuit, DC-DC Converter, SD Card and Zigbee communication controller. It stores continuous ECG data in SD Card and transmits pre and post-event 20 second wireless data to receiver when events occur. The receiver transmits event data to remote server through PDA phone. The remote server shows the alarm message. Using this device, a new method of monitoring ECG and transmission data to remote server is proposed. Also, this method will reduce medical costs in the aged society.

수면 중 load-cell을 이용한 heart rate variability 분석 시스템

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Heart Rate Variability Analysis System Using Load-cell during Sleep

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Abstract

It is widely known that human's autonomic nervous system (ANS) varied according to the sleep stage transition and the change of ANS can be reflected to the cardiovascular system. It implies that heart rate variability (HRV) can be one of the parameters that can estimate the sleep stage or sleep quality.

In this research, we introduce a new system that can monitor the heart rates with the physical pulsation of the heart. The load-cells are installed below the bed and pressure changes due to the heart beats are sensed. It can monitor the cardiovascular function during sleep unconsciously.

The results indicate the LF/HF ratio, frequency domain parameter of the HRV, acquired from the developed system. Electrocardiogram obtained by Ag-AgCl electrodes was used as a reference signal to validate the heart beats from the system.

다주파수 전달 어드미턴스 스캐너를 이용한 물체의 검출

김희진, 권지현, 우응제
경희대학교 전자정보대학 동서의료공학과

Anomaly Detection using Multi-frequency Trans Admittance Scanner

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Abstract

We developed a 320-channel multi-frequency trans-admittance scanner for breast cancer detection. Applying a constant voltage with multiple sinusoidal frequencies between a reference electrode and a scan probe placed on the breast, we measure exit currents through array of electrodes inside the scan probe. The distribution of measured currents is termed the trans-admittance map and it represents the local distribution of conductivity and permittivity underneath a scan probe. We can assume a three-dimensional homogeneous domain including an internal lesion with a complex conductivity different from that of the background. Mathematically analyzing the multi frequency trans-admittance map obtained on the surface of the domain, an anomaly detection algorithm was proposed. In this paper, we present experimental results using a saline phantom with an anomaly made from TX-151.

PPG 신호를 이용한 심박 및 호흡 추정

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Estimation of heart and respiratory rate from PPG signal

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Abstract

Heart and respiratory signal can be estimated from photoplethysmography(PPG) by using digital filter. The coefficient of digital filter is varied with people. In order to make an algorithm which determine filtering coefficient automatically, we investigated filtering coefficient suitable for each subject as a preceding study. The photoplethysmographic signals at the fingertip were recorded simultaneously with corresponding ECG and respiratory signal from normal healthy human subjects in the sitting and supine position. After filtering photoplethysmographic signal, we compared filtered PPG signal with ECG and respiratory signal. Results indicate that, with individual calibration, respiratory and heart rate can be estimated with a maximum error of 6 breath/min and 2 beats/min respectively.

완전 이식형 인공중이를 위한 2 채널 음성신호처리 모듈의 FPGA 구현

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Implementation of FPGA Module Based on 2 Channels voice Signal Processing for Fully-Implantable Middle Ear Hearing Devices

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Abstract

Recently, fully implantable middle ear hearing devices (F-IMEHDs) have been developed for hearing impaired person. A sound digital signal processing module for F-IMEHDs must be operated with low power consumption and their size should minimize for implantation.

In this paper, a sound signal processing module is designed to be linked to the ASIC process for realization of low power consumption and minimal size by field programmable gate array (FPGA). Which gives complete flexibility. The device consists of low pass filter, high pass filter, wide dynamic range compression (WDRC) circuit, and equalizer (EQ) filter. The designed digital voice signal processing filters can be operated faster and accurately by adopting the modified radix-4 booth's algorithm than ones with normal multiplier. A WDRC circuit is designed for the nonlinear amplification. EQ filter is used to compensate the various frequency characteristic in the F-IMEHD. The symmetrical architecture of FIR filter reduced FPAG capacitance and power consumption. The designed each module is verified by Quartus-II.

The results shown that the proposed system became flexible structure. In particularly, it was proper to F-IMEHDs because it can be applied to fitting parameters of individual hearing impaired person with designed UART.

LabVIEW를 이용한 완전 이식형 인공중이용 피팅 프로그램의 설계 및 구현

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Design and Implementation of Fitting Program using LabVIEW for Fully Implantable Middle Ear Hearing Devices

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Abstract

Hearing impaired persons have different hearing loss over the audio frequency band. In order to compensate the various hearing loss, parameters of hearing devices should be optimally fitted considering audiogram of the patient. Unlike conventional hearing aid, fully implantable middle ear hearing devices (F-IMEHDs) consists of an implanted microphone, a signal processing unit, and a vibrating transducer. Therefore, the frequency responses of implanted microphone and vibrating transducer should be considered in the fitting program.

In this paper, the fitting program is implemented for F-IMEHDs by a computer program, LabVIEW. FIG6 and Input/Output function are used and the frequency responses of microphone and vibrating transducer are also considered. Through the proposed fitting program, it is expected that hearing loss of patients who use the F-IMEHDs can be compensated properly.

2차원 심실조직에서 fibrosis에 따른 회귀성파동 변화와 수치적해석

최승윤, 권순성, 심은보

강원대학교 공과대학 기계메카트로닉스공학부

Abstract

Ventricular electric wave propagation in 2D tissue model is simulate to assess the effect of fibrosis on reentry wave dynamics. In this 2D cardiac tissue, we generated a reentrant wave using S1-S2 protocol. To test the reentrant wave under pathological state, we simulated a hypertropic model with non-excitabile fibroblasts in stochastic manner. Compared with normal tissue, the hypertropic tissue result showed another center of reentrant wave, indicating that the wave pattern can be more easily changed from regular with a concentric focus to irregular multi-focused reentrant waves in case of patients with hypertrophy.

암의 비대칭적 성장 및 혈관생성에 대한 수치적 연구

김유석, 심은보
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Computational analysis of growth and angiogenesis in asymmetry cancer

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Abstract

Employing a novel two-dimensional computational model we have simulated the feedback between angiogenesis and tumor growth dynamics. Analyzing vessel formation and elongation towards the concentration gradient of the tumor-derived angiogenic basic fibroblast growth factor, bFGF, we assumed that prior to the blood vessels reaching the tumor surface, the resulting pattern of tumor growth is symmetric, circular with a common center point. However, after the vessels reach the tumor surface, we assumed that the growth rate of that particular cancer region is accelerated compared to the tumor surface section that lacks neo-vascularization. Therefore, the resulting asymmetric tumor growth pattern is biased towards the site of the nourishing vessels. The simulation results show over time an increase in vessel density, a decrease in vessel branching length, and an increase in fractality of the vascular branching architecture. Interestingly, over time the fractal dimension displayed a sigmoidal pattern with a reduced rate increase at earlier and later tumor growth stages due to distinct characteristics in vessel length and density.

RSA분석과 자율신경기능 평가를 위한 호흡주기 설정에 관한 연구

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한림대학교 의공학연구소, ¹한림대학교 제어응용연구소

Research for the Respiration rate adjust for RSA analysis and evaluation of the ANS function.

S. M. Rhee, S. J. Rhee, J. S. Rhee¹, J. G. Kim¹, J. M. Ahn
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Abstract

Heart rate variability(HRV) is the clinical consequence of various influences of the autonomic nervous system(ANS) on heart beat. HRV can estimate the potential physiologic rhythm from the interval between consecutive beats(RR interval or HRV data), but cardiovascular system governed by ANS is in relation to respiration and autonomic regulation. It is known as RSA representing respiration-related HR rhythmic oscillation. Because the mechanism linking the variability of HR to respiration is complex, it has so far been unknown well. In this paper, we tried to evaluate 5-min RR interval segments under control of respiration in order to find out a proper respiration rate that can estimate the ANS function. 10 healthy volunteers were included to evaluate 5-min HRV data under 4 different respiration-controlled environments; 0.03Hz, 0.1Hz, 0.2Hz, and 0.4Hz respiration. HRV data were analyzed both in the frequency and the time domain, with cross-correlation coefficient(cross-coeff.) for HRV and respiration signal. The results showed maximum cross-coeff. of 0.84 at 0.1 Hz and minimum that of 0.16 at 0.4Hz respiration. Cross-coeff was decreased at a faster rate from 0.1Hz respiration. All mean SDNN, RMSSD, and pNN50 of time domain measures were 108.7ms, 71.85ms, and 28.47%, respectively, and LF, HF, and TP of frequency domain measures were 12,722ms², 658.8ms², and 7,836.64ms² at 0.1Hz respiration, respectively. In conclusion, 0.1Hz respiration was observed to be very meaningful from time domain and frequency domain analysis in relation to respiration and autonomic regulation of the heart.

바이오피드백과 경쟁심리를 이용한 동기부여방식의 체중관리시스템

장대근, 이고은, 서상진, 박승훈
경희대학교 전자정보대학 동서의료공학과

Weight Management System based on Motivation driven by Competition and Biofeedback

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Dept. of Biomedical Eng. College of Electronics and Information, Kyung Hee University

Abstract

In this paper, we present a software system to manage weight effectively using motivation through competition and biofeedback. The system provides the individual's current trend of body weight change and predicts the future state without any intervention given. Visualizing the enhancement or deterioration of body weight state explicitly and looking ahead into the future act as a biofeedback to motivate the users to change their life style or to make more efforts for maintaining adequate body weight. The management by objectives concept is employed to help the users show persistent interests in body weight controlling activities by setting and monitoring individual's target body weight and grading the achievement. The group contest game provides the social environment that induces competitive spirit and comradeship for the participants to adhere to body weight control.

The software system is an object-oriented, Window-based PC application program written in C++ language. The efficacy validation is now under study and its web-based version is also being developed.

3축 가속도 센서를 이용한 인체활동 모니터링 시스템 구현

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Implementation of Human body activity Monitoring System Using the Triaxial Accelerometer

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Abstract

Human body activity and hurt from a fall monitoring needs to old people who get hurt from a fall frequently. In order to develop this monitoring system. Instrumentation system that used tiny electric power 3 axis acceleration sensor embodied and measure acceleration signal by PC through wireless communication and embodied amenable monitoring system. To use special quality of acceleration signal output, if SMA's signal of human body actual signal is more than 0.1g, it draws that human body is being active, if SMA's signal value is more than 0.6g to use SVM that is detection parameter to check hurt from a fall and if SVM's value is displayed about 3g consecutively, we will know that the person got hurt from a fall.

치과 임플란트의 조기 골유착을 촉진하기 위한 이상성 미세 전류 자극 장치의 개발

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Development of a Biphasic Electrical Current Stimulator for Enhancing Early Bone formation in Dental Implant

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Abstract

In dental implant, early bone formation of surrounding implant surface has long been key technology to increase success rate. In this study, in order to enhance bone formation, we stimulated biphasic electrical current with $20\mu\text{A}/\text{cm}^2$ through temporary healing abutment to a surrounding bone tissues. Developed small sized biphasic electrical current stimulator was integrated in temporary healing abutment with power source and the device was applied for 7 days in early stage of osseointegration in animal experiments.

수압측정 방식의 요류검사 진단매개변수의 정확도 분석

최성수, 이인광, 김경아, 이태수, 차은종

충북대학교 의과대학 의공학교실, 충북 BIT 연구중심대학사업단

Validation of diagnostic parameters evaluated by urinary flowmetry technique with hydraulic pressure measurement

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Chungbuk National University, Cheongju, Korea.

Abstract

Uroflowmetry is of great convenience to diagnose benign prostate hypertrophy common in aged men. The urinary flow rate is obtained by weight measurement using load cell, however, sensitive to impact noise. An alternative technique was recently proposed to measure hydraulic pressure instead of weight and demonstrated to introduce significantly reduced noise. The present study compared the diagnostic parameters between the weight and pressure measuring techniques in 10 normal men. The weight and pressure signals were simultaneously acquired during urination, converted into urine volumes, then differentiated to obtain flow rate signals, which showed very similar waveforms. Diagnostic parameters evaluated by pressure measuring technique were well correlated with the standard weight measuring technique (correlation coefficient > 0.99). Therefore, the new uroflowmetry based on hydraulic pressure measurement can provide accurate diagnostic parameters, which would be clinically valid.

EGSnrc와 GEANT4 시뮬레이션 코드의 Bremsstrahlung process 연구

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Abstract

대표적인 몬테카를로 코드인 EGSnrc와 GEANT4를 이용하여 electron transport에서 주요한 역할을 담당하는 bremsstrahlung process를 비교, 분석하였다. 두 가지 코드를 이용하여 물에 대한 산란단면적(cross section)과 평균자유거리(mean free path) 및 물리량들을 계산하였으며 이때 발생하는 코드 간 차이를 분석하였다. 대부분의 물리량 계산에서 발생된 코드 간 차이는 낮은 에너지에서 매우 두드러졌으며 에너지가 높아질수록 그 차이는 줄어들었다. 각 코드에서 사용한 물리량의 구현 방법과 parameterization을 분석하여 코드 간 차이의 발생 원인을 확인하였으며 실제 물리 이론과의 비교를 통해 두 코드에서 구현된 bremsstrahlung process를 검증하였다. 향후 여러 가지 다른 process의 분석과 검증을 통해 보다 정확도가 높은 시뮬레이션 방법론을 제시하고자 한다.

A Study of Target Source Detection using an Improved Sensing Model in Wireless Sensor Networks

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Abstract

We applied the inverse problem approach to locate the known source in a uniformly distributed sensor network from a simultaneous RSSI measurement between sensors and sources. We also proposed a new sensing model to calculate RSSI between sensors and a specific source and carefully considered the orientation vector of the source. We detected the original source by means of a linear inverse problem using the calculated RSSI at the target source from the improved sensing model. Finally, we simulated the proposed sensing model to verify its ability to detect the original source. Changes in the initial source and calculated results remained quite in place. Moreover, the norm of the detected source was significantly larger than the norm of any other sources.

Gaze 분석을 통한 인공망막에서의 인지기반영상처리의 유효성에 대한 기초연구

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Preliminary Study of Context Based Image Processing for Artificial Retina using Gaze Analysis

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Abstract

One of primary problems in simulating artificial prosthesis is low resolution image. In this paper, the gaze prediction model using saliency map and skin detection algorithm is proposed for an effective image preprocessing in artificial prosthesis. We showed that the result of the gaze prediction is similar to region of actual visual attention through experiments. The experiments demonstrate that the proposed model using saliency map and skin detection is useful to find visual attention by comparing with real eye gaze.

灸法の 표준화를 위한 온도 측정 研究

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The Study on temperature measurement for the standardization of moxibustion

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Abstract

The moxibustion is the method in using the heat stimulation made of attached and burned a moxa or other herbal materials on a healing point or acupuncture point and the chemical stimulation of a resin made from burning them.

The warmed needle technique is the method in combining the effects of acupuncture needle with the effects of moxibustion.

We need to standardize the characteristics of moxa combustion in order to get more systematic and objective result in operation mechanism and effects and then get more clinical abilities in these fields.

In this study, using of labview system on the moxibustion and the warmed needle technique, we studied about measurement and comparison with partial temperature changes according to the position of ignition, the kind of needle and the density of moxa cone and the moxa cone's core peak temperature.

퍼지 PI+D 제어를 이용한 이벤트 제어 기반 원격 수술 로봇의 위치 추종제어기 설계

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Design of Fuzzy PI+D Controller Using Position Tracking Control For Event Control Based Telesurgery Robot

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Abstract

In this paper, we described a coordinative motion control based on the master/slave method using real-time event based control to build fuzzy PI+D control. The purposed fuzzy PI+D structure maintains the same performance as the general-purpose linear PID controller, and enhances the position tracking performance over wide range of input. Numerical simulations and experimental results show the effectiveness of the fuzzy PI+D controller in comparison with the conventional linear PID control.

Charge-coupled Device(CCD)를 이용한 고에너지 X-선 계측용 1차원 광섬유 센서의 성능평가

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Performance Evaluation of One-dimensional Fiber-optic Radiation Sensor for Measuring High Energy Photon Beam Using a Charge-coupled Device

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Abstract

In this study, an one-dimensional fiber-optic radiation sensor with an organic scintillator tip is fabricated to measure high energy X-ray beam of CLINAC. As a scintillating light measuring device, CCD (Charge-coupled Device) is used. The images of proximal ends of one-dimensional fiber-optic sensor array are taken by CCD and are analyzed by a simple imaging software. Also, the PPD (Percentage Depth Dose) of high energy photon beam and the spatial resolution of fiber-optic sensor are measured using a CCD.

강내 방사선 근접치료에서 x선 모의치료촬영기를 이용한 콘빔 재구성

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Cone-beam Reconstruction(CBR) using an X-ray Simulator in Intracavitary brachytherapy

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Abstract

There are few limitations in conventional fan-beam CT for localizing the dummy sources due to the slice image which has a certain distance between images. Recently, the use of cone-beam reconstruction in brachytherapy has been investigated to obtain its advantages such as improved data acquisition efficiency and increased spatial resolution. In this study, we perform a verification of cone-beam CT images by comparing a conventional CT image to verify a possibility of cone-beam reconstruction in intracavitary brachytherapy. In cone-beam approach, we could easily and exactly identify the individual dummy seeds. For a large number of seeds and catheters, and complicated catheter geometries such as prostate and breast cases, the 3D cone-beam method could offer more reliable localization results.

온열치료용 비접촉식 광섬유 온도센서와 열원과의 관계 분석

유욱재, 조동현, 장경원, 신상훈, 이봉수, 정순철, 탁계래

건국대학교 의료생명대학 의학공학부 의공학 실용기술 연구소

Abstract

본 연구는 온열치료 시, 암세포의 온도 및 가열온도의 정확한 측정을 목적으로 하는 기초연구로서 인체 내부온도 및 온열치료에서 사용하는 세포 치사 온도를 포함하는 30~60 °C 의 열원에서 방출되는 적외선을 적외선 광섬유를 통해 전송시켜 열원의 온도 변화에 따른 써모파일 센서의 출력전압을 측정하였고, 열원과 적외선 광섬유 끝단사이의 거리 및 각도 변화에 따른 써모파일 센서의 출력전압 변화를 측정하였다.

체내 수분 계측용 광섬유 습도 센서의 제작

한미라, 조동현, 장경원, 유욱재, 이봉수, 탁계래
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Fabrication of Fiber-optic Humidity Sensor for Medical Usages

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Abstract

In this study, we have fabricated a fiber-optic humidity sensor for medical usages. The mixture of Cobalt chloride and methanol is used as a fiber-optic sensor tip material to determine the degree of moisture using their color change characteristics. Two kinds of optical fibers such as transmitting and receiving are also used to measure the color changes according to moisture contents. The spectra of transmitting and reflected light are measured using a fiber-optic spectrometer to investigate humidities.

치료용 고에너지 광자선 계측을 위한 2차원 광섬유 방사선 센서의 제작

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Fabrication of Two-dimensional Fiber-optic Radiation Sensor for High Energy Photon Beam Therapy Dosimetry

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Abstract

In this study, two-dimensional fiber-optic radiation sensor has been developed using water-equivalent organic scintillators for photon beam therapy dosimetry. And two-dimensional photon beam distribution and percent depth dose (PDD) are measured according to the energy and field size of photon beam. This sensor has many advantages such as high resolution, real-time measurement and ease calibration over conventional radiation measurement devices.

MR 영상을 이용한 20대, 40대 정상 한국인의 대뇌 부피 측정

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Measurement of Cerebral Volume of 20s and 40s Korean People

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Abstract

본 연구에서는 자기공명영상을 이용하여 20대와 40대 정상 한국인의 대뇌 부피를 측정하였다. 20대 120명(남자 59명, 여자 61명)과 40대 92명(남자 37명, 여자 55명) 총 212명을 대상으로 MR 뇌 영상을 획득하였고, 대뇌 부피를 측정하였다. 20대와 40대 한국인의 대뇌 부피의 평균은 $1240.86 \pm 135.17[\text{cm}^3]$ 이었다. 여자에 비해 남자가, 40대에 비해 20대의 대뇌의 크기가 더 컸다.
