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Holotomography and artificial intelligence: label-free 3D imaging, classification, and inference of live cells, tissues, and organoids

Abstract:

Holotomography (HT) is a powerful label-free imaging technique that enables high-resolution, three-dimensional quantitative phase imaging (QPI) of live cells and organoids through the use of refractive index (RI) distributions as intrinsic imaging contrast1-3. Similar to X-ray computed tomography, HT acquires multiple two-dimensional holograms of a sample at various illumination angles, from which a 3D RI distribution of the sample is reconstructed by inversely solving the wave equation. By combining label-free and quantitative 3D imaging capabilities of HT with machine learning approaches, there is potential to provide synergistic capabilities in bioimaging and clinical diagnosis. In this presentation, we will discuss the potential benefits and challenges of combining QPI and artificial intelligence (AI) for various aspects of imaging and analysis, including segmentation, classification, and imaging inference3-6. We will also highlight recent advances in this field and provide insights on future research directions. Overall, the combination of QPI and AI holds great promise for advancing biomedical imaging and diagnostics.

Brief Biosketch

YongKeun (Paul) Park is Endowed Chair Professor of Physics at KAIST. He earned a Ph.D. in Medical Science and Medical Engineering from Harvard-MIT Health Science and Technology. Dr. Park's area of research is optics, holography, and biophotonics. Two start-up companies with +80 employees have been created from his research (Tomocube, The.Wave.Talk). To learn more about Prof. Park's research projects, visit his website: http://bmol.kaist.ac.kr