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Aydogan Ozcan
„AI in Biomedical Imaging: Transforming Microscopy and Diagnostics“

Abstract

I will provide an overview of our recent work on using deep neural networks to advance computational microscopy and sensing systems, including their biomedical applications. Specifically, I will discuss emerging opportunities to revolutionize tissue staining methods by digitally generating histological stains using trained deep neural networks, providing rapid, cost-effective, accurate and environmentally friendly alternatives to standard chemical tissue staining methods. These deep learning-based virtual staining techniques can successfully generate different types of histological stains, including immunohistochemical stains, from label-free microscopic images of unstained samples by using, e.g., autofluorescence microscopy, quantitative phase imaging and reflectance confocal microscopy. Our team also demonstrated similar approaches for transforming images of an already stained tissue sample into another type of stain, performing virtual stain-to-stain transformations. Finally, I will discuss our work on paper-based sensors enabled by AI for multiplexed, cost-effective sensing of a panel of biomarkers within ~20 min using a mobile phone-based device.

SHORT CV

Dr. Aydogan Ozcan is the Chancellor’s Professor and the Volgenau Chair for Engineering Innovation at UCLA. He is also the Associate Director of the California NanoSystems Institute. Dr. Ozcan is elected a Member of the U.S. National Academy of Engineering (NAE) and the European Academy of Sciences and Arts, as well as a Fellow of the U.S. National Academy of Inventors (NAI), and holds >90 issued/granted patents in microscopy, holography, computational imaging, sensing, mobile diagnostics, nonlinear optics and fiber-optics, and is also the author of one book and the co-author of >1350 publications in leading scientific journals and conferences. Dr. Ozcan received major awards, including the Presidential Early Career Award for Scientists and Engineers (PECASE), International Commission for Optics ICO Prize, Dennis Gabor Award (SPIE), Joseph Fraunhofer Award & Robert M. Burley Prize (Optica), Rahmi Koç Science Medal, Keith Terasaki Innovation Award, SPIE Biophotonics Technology Innovator Award, SPIE Early Career Achievement Award, Army Young

Investigator Award, NSF CAREER Award, NIH Director's New Innovator Award, Navy Young Investigator Award, IEEE Photonics Society Young Investigator Award and Distinguished Lecturer Award, National Geographic Emerging Explorer Award, National Academy of Engineering The Grainger Foundation Frontiers of Engineering Award and MIT's TR35 Award for his seminal contributions to computational imaging, sensing and diagnostics. Dr. Ozcan is elected Fellow of Optica, AAAS, SPIE, IEEE, AIMBE, RSC, APS and the Guggenheim Foundation, and is a Lifetime Fellow Member of Optica, NAI, AAAS, SPIE and APS. Dr. Ozcan is also listed as a Highly Cited Researcher by Web of Science, Clarivate.