

Virtual Staining of Label-free Tissue Using Deep Learning

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In this presentation, I will provide an overview of our recent work on using deep neural networks in advancing computational microscopy and sensing systems, also covering their biomedical applications. Specifically, I will discuss emerging opportunities to revolutionize tissue staining methods by digitally generating histological stains using trained deep neural networks[1-11], 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,[1,11] including immunohistochemical stains,[7] from label-free microscopic images of unstained samples by using, e.g., autofluorescence microscopy,[1] quantitative phase imaging (QPI)[2] and reflectance confocal microscopy[10]. 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 [5,6,11].

References

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