Rapid full-color Fourier ptychographic microscopy provides new solution for digital pathology

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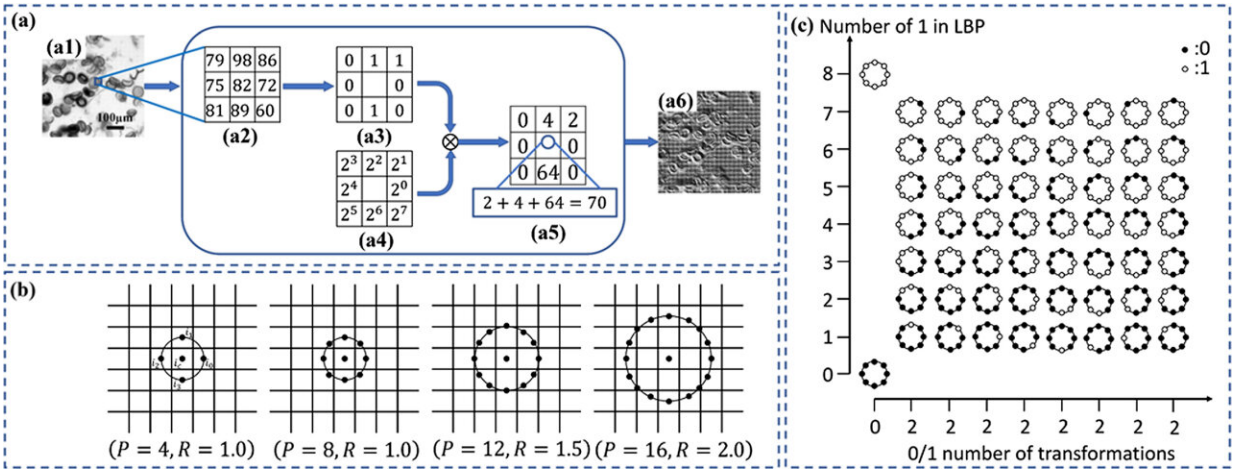

Diagram of LBP principles. (a) Encoding process of original LBP: (a1) grayscale image; (a2) gray value of a 3×33×3 neighborhood in the grayscale image; (a3) binary thresholding result of the neighboring pixels; (a4) corresponding weight of each pixel position; (a5) LBP value of the central pixel; (a6) LBP feature mapping image of the grayscale image. (b) Circular neighborhood corresponding to different values of ?P and ?R. (c) ULBP patterns including two 0/1 transitions and two special cases in LBP. Credit: *Photonics Research* (2022). DOI: 10.1364/PRJ.473038

Fourier ptychographic microscopy (FPM) is a promising computational imaging technique to realize high-throughput pathological imaging in

medical diagnosis. However, existing FPM colorization approaches suffer from a trade-off between color precision and efficiency.

Therefore, a research team led by Assoc. Prof. Pan An, Prof. Yao Baoli and Ma Caiwen from Xi'an Institute of Optics and Precision Mechanics (XIOPM) of the Chinese Academy of Sciences (CAS) reported a colorization method based on color-transfer filtering FPM (CFFPM). The study was published in *Photonics Research.*

In a previous work, the researchers reduced the runtime of full-color FPM by three-fold with negligible sacrifice on color precision through color-transfer FPM (termed CFPM). On this basis, they attempted to improve the ability to recover color information of samples stained by multiple dyes and reduce dependence on graphics processing unit (GPU) acceleration in this study.

The method integrates block processing and trilateral spatial filtering concepts into the transfer learning model of full-color FPM. In addition, an iterative procedure between two color spaces is adopted to refine the colorization results.

To make a comparison of color transfer performance and operating efficiency, the researchers tested several methods on a series of random selected samples.

CFFPM provides more precise color transfer than CFPM, with a decrease of 3.5% in the average error. Without GPU acceleration, its runtime is several minutes, which is heavily reduced from several hours of CFPM. Also, CFFPM effectively eliminates the coherent artifacts introduced by dust particles.

Experts in this field believe that the method in this study provides a turnkey solution for digital pathology via computational optical imaging

due to its high-throughput advantage and low-cost hardware requirements.

More information: Jiurun Chen et al, Rapid full-color Fourier ptychographic microscopy via spatially filtered color transfer, *Photonics Research* (2022). DOI: 10.1364/PRJ.473038

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