TOWARDS HIGH THROUGHPUT DIAGNOSTIC IMAGING USING FOURIER PTYCHOGRAPHIC MICROSCOPY

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Fourier Ptychographic Microscopy (FPM) [1] is a widefield imaging technique in which a high resolution complex image is reconstructed by combining information from low resolution brightfield and darkfield images captured under different illumination angles (Fig. 1). Typically this is achieved by modifying a conventional optical microscope to incorporate a 2D matrix of LEDs. By relaxing the traditional tradeoffs between spatial resolution, field of view and depth of field, FPM allows capture of high resolution images over a large field of view using a low magnification, low numerical aperture objective lens, offering significant benefits in terms of image capture speed and hardware cost. The method is particularly promising for applications in digital pathology which require high resolution imaging of large numbers of spatially extended samples

We have developed whole slide imaging and FPM systems for image-based medical diagnostic screening and discuss the relative merits of these two approaches by a quantitative comparison of image quality and information capture rate (space-bandwidth-frequency product). We investigate the suitability of FPM datasets for automated detection of malarial parasites in Giemsa stained blood films [2] using convolutional neural networks and consider how methods such as domain adaptation and transfer learning can be applied to improve the robustness of automated diagnosis of malaria from FPM images. We discuss the broader application of FPM in digital pathology.

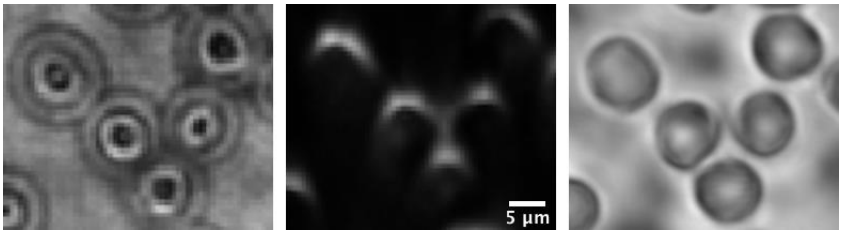

Figure 1: (from left) raw bright field, raw dark field and reconstructed FPM images showing red blood cells in a Giemsa stained blood film.

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