FRONTIERS OF LABEL FREE AND COMPUTATIONAL MICROSCOPY

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Label free microscopies are bringing new light to the way we image, and understand, complex biological systems. Innovative microscopes exploit the native photophysical processes present when light interacts with matter presenting a plethora of options not only for introducing image contrast, but in providing information unobtainable with traditional approaches [1]. Alongside the development of these new physical instrumentation, computational approaches are finding significant applications in label-free imaging. From predictive labelling [2] to 3D autofocusing [3], research concerning the application of high-powered computation to microscopy is profoundly powerful and pertinent to imaging biological systems.

The frontier of label-free microscopies is therefore in the marriage of instrumental and computational approaches. To this end, we utilise quantitative phase microscopy, and intelligent reconstruction algorithms, to collect the refractive index of biological structures within the cell nucleus. Combining this information with data collected from other techniques, such as Muller Matrix Microscopy [4], we develop an understanding of cellular structure without the reliance on labels or significant sample modification.

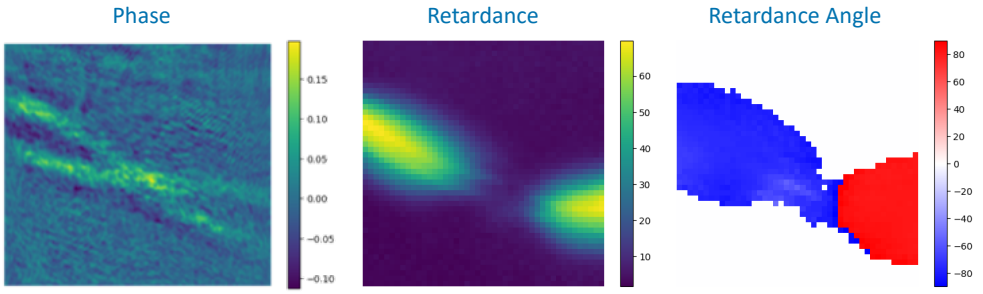

Figure 1: Quantitative phase, retardance and retardance angle of a collagen fibre.

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