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Shalin Mehta leads an Advanced Microscopy Platform at the Chan Zuckerberg Biohub, where his team develop optical and computational technologies to measure physical properties of biological systems with increasing precision, resolution, and throughput. Mehta received his Ph.D. at the National University of Singapore. His thesis research led to better mathematical models and novel approaches for label-free imaging cellular morphology. As a postdoctoral fellow and staff scientist at the Marine Biological Laboratory in Woods Hole, Mehta developed novel imaging and computational methods for detecting molecular order across a range of scales in living systems. He built an instantaneous fluorescence polarisation microscope that revealed the dynamic order of cytoskeletal assemblies in live cells.

ABSTRACT

Computational Microscopy of Structural Order without Label

Living systems are characterised by emergent behaviour of ordered components that constantly consume energy. Systematic analysis of cell and tissue architecture requires high throughput methods for visualising the structural order at finer scales of organelles and cells, respectively. It is currently challenging to visualise >6 components in live cells using fluorescence microscopy, which requires optimisation of multiple labels and resolving the spectra of these labels within visible-near IR spectrum. We report a new approach to side-step this bottleneck. By synergistic combination of label-free microscopy (with phase and polarisation of light) and deep learning algorithms, we analyse ordered architecture of cells and tissues with unprecedented throughput and accuracy.