

Non-invasive measurement for living cells using digital holography microscopy

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Non-invasive imaging for living cells in the natural environment is essential for inspecting the change of biological processes. Most biological cells are quasi-transparent and differ slightly from the surrounding tissues in absorbance, thus they are called phase objects. The traditional differential interference contrast (DIC) and Zernike phase contrast microscope can't acquire the quantitative phase information. Recently, several quantitative phase imaging techniques such as Fourier phase microscopy (FPM), Hilbert phase microscopy (HPM), and diffraction phase microscopy (DPM) are developed, but they are not often applied in the cell detection for the complex scanning or calibration system. Comparing with the above methods, digital holographic microscopy (DHM) can retrieve quantitative information of object wavefront by the numerical reconstruction from a single digital hologram, and it does not demand to record hologram in the focus image plane of the object, which is suitable for non-invasive real-time detection of the living cells, especially the suspension cells [1-3]. In this contribution, the off-axis lensless Fourier transform (LFT) based digital holography is applied to the living cell imaging without prestaining, and the amplitude and phase of living cells can be reconstructed by Fresnel reconstruction and phase-unwrapping algorithms. In the imaging experiment, the profile of cervical cancer cells HeLa is detected, and the phase distribution is illustrated in Fig. 1. Though the imaging resolution of our LTF based configuration needs to be improved further, the result can demonstrate that digital holography microscopy provides a feasible non-invasive method for living cell imaging to a certain extent.

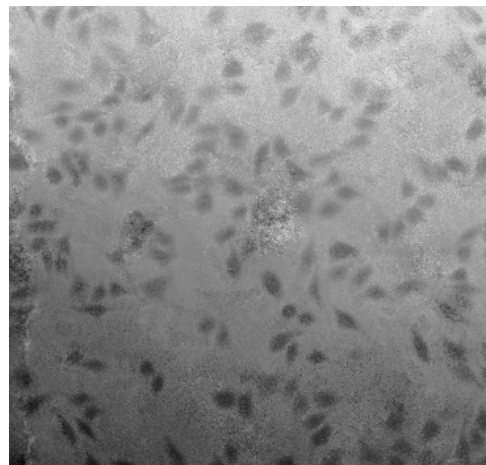


Fig. 1 Phase distribution of living cells HeLa

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