Holo-tomographic flow cytometry

School of Instrumentation & Optoelectronic Engineering, Beihang University, China
Feng Pan
Email: panfeng@buaa.edu.cn

The integration of holo-tomographic flow cytometry represents an innovative approach that synergistically combines the strengths of both techniques. By exploiting the self-rotation of cells to capture multi-angle projection images, this method enables label-free, quantitative, and isotropic reconstruction of the refractive index (RI) distribution. This offers a transformative perspective for high-throughput, three-dimensional (3D) cell analysis. However, several critical challenges remain. To address these, we developed a rotation angle calculation method based on position tracking and sinusoidal fitting. This method achieves accurate recovery of self-rotation angles in flowing cells. Additionally, we utilized a deep learning-assisted approach to realize high-fidelity 3D RI distribution reconstruction, even with sparse data caused by high-throughput imaging. Furthermore, by leveraging neural networks on the reconstructed 3D cellular architectures, we accomplished high-accuracy cell classification. Overall, our research provides a novel paradigm for advancing the development and application of holo-tomographic flow cytometry.

Short Bio:

Feng Pan received his PhD degree in Physicelectronics and Optoelectronics from Harbin Institute of Technology. He is an associate professor of Beihang University, China. He has long been dedicated to the research of high-throughput, high-resolution flow cytometry imaging and AI-assisted diagnostic technologies, with extensive experience particularly in the early detection of cancer cells. His research covers cutting-edge areas such as digital holographic microscopy, quantitative phase imaging, and multimodal, non-destructive measurement of biological cells.