

Intelligent Image-Activated Cell Sorting

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A fundamental challenge of biology is to understand the vast heterogeneity of cells, particularly how the spatial architectures of cells are linked to their physiological functions. Unfortunately, conventional technologies such as fluorescence-activated cell sorting are limited in uncovering these relations. In this talk, I introduce our machine intelligence technology known as “Intelligent Image-Activated Cell Sorting” [Cell 175, 266 (2018)] that builds on a radically different architecture that realizes real-time image-based intelligent cell sorting at an unprecedented rate. This technology integrates high-throughput cell microscopy, focusing, sorting, and deep learning on a hybrid software-hardware data-management infrastructure, enabling real-time automated operation for data acquisition, data processing, intelligent decision-making, and actuation. I also show the broad utility of the technology to real-time image-activated sorting of microalgal and blood cells based on intracellular protein localization and cell-cell interaction from large heterogeneous populations for studying photosynthesis and atherothrombosis, respectively. The technology is highly versatile and expected to enable machine-based scientific discovery in biological, pharmaceutical, and medical sciences.