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Designing Intuitive and Flexible Software for a Novel Image-Based Cell Sorting Method

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Image-based cell sorting is a key technology in molecular and cellular biology, as well as in medicine, enabling the isolation of desired cells based on spatial and temporal information extracted from live microscopy. Beyond the extensive application of sorting methods in the fields of immunology and oncology, growing interest from other disciplines like personalized medicine underscore the need for user-friendly and versatile sorting platforms. Here, we present a novel, automated image-based sorting method that leverages a microscope to selectively target and isolate cells. In this method, cells are resuspended in photoresist, and undesired cells autonomously identified and encased in hardened structures via selective photopolymerization, allowing for subsequent filtration. The experimental set-up is adaptable to microscopes commonly found in life science laboratories, which eliminates the need for expensive sorting equipment or extensive user training.

Our method includes custom-designed software that manages microscope communication and image analysis for high-throughput sorting decisions. The software is currently being developed as a Python package and designed for flexibility, aiming for an easy adaptation for specific research needs and use cases. The software provides an interface to control the microscope through an API and for configuring sorting procedures –such as selecting scan patterns, magnification levels, and cell classifiers. It further includes an adaptation protocol for researchers to develop or integrate their own image analysis pipeline for classification. An important consideration in the software design is the efficient scheduling of hardware configuration changes in coordination with fast and reliable image analysis to ensure a high accuracy of the experimental outcome. To ensure accessibility, we are also developing an intuitive graphical user interface to allow users with no programming experience to effortlessly set up a sorting process and fine tune analysis parameters.

By providing intuitive and flexible software for our platform, we hope to present a versatile, accessible and cost-effective sorting solution for researchers across disciplines.

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