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Miniaturized holographic imaging system for real-time cellular detection JUN SONG, Massachusetts General Hospital/Harvard University, HYUNGSOON IM, MONTY LIONG, LIOUBOV FEXON, MISHA PIVOVAROV, Massachusetts General Hospital, RALPH WEISSLEDER, Massachusetts General Hospital/Harvard Medical School, HAKHO LEE, Massachusetts General Hospital
— We herein present a miniaturized holographic imaging system for high throughput cellular detection. The system consists of an imager chip with a microfluidic channel built on top. Clinical samples (e.g., blood) are introduced into the fluidic channel, and holographic images of cells are recorded by the imager chip. We then perform computational reconstruction of original cell images, retrieving both the intensity and phase information. For fast image reconstruction, we have implemented parallel computing software and utilized multicore GPU (graphics processing unit) chips. The resulting imaging system enabled high throughput cellular detection; up to 1000 cells/μL could be imaged over a wide detection area (20 mm^2), and cellular images could be reconstructed in real time (20 frames/sec). Furthermore, assays can be performed without extra dilution and washing steps, which significantly simplifies the diagnosis process. This cost-effective, real-time holographic imaging system can be used for target cell detection in point-of-care applications.

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