Label-free tumor cell detection in microfluidic flow

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Circulating tumor cells (CTCs) are released in the blood by primary tumors during dissemination. Depending on the type of cancer, this step can happen early in cancer development, which makes the CTCs a good marker for early cancer diagnostic [1,2]. Most of the current CTCs detection methods require expensive and time-consuming procedures, including enrichment steps and immunoassays or genomic analysis [1-3] and are not applicable in a routine screening.
We propose a microfluidic approach to classify blood cells taking advantage of their distinctive shape in flow. To extract the characteristic signature for each cell type, we use high-speed microscopy (40,000Hz) on blood cells that are pumped through microfluidic channels. Besides, the future device will be designed with a tilted microfluidic channel to capture the 3D shape of cells while they are passing the focal plane.
Preliminary results are based on red blood cells (RBCs) passing through rectangular microfluidic channels. The processing applies a numerical slit mask. This approach enables us to differentiate the two most abundant shapes of RBCs in flow, parachute and slipper, comparing the signatures to empirically established references. The next step is to distinguish white blood cells from cancer cells by their deformation in a microfluidic constriction.

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