Particle image velocimetry to study cell migration

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Particle image velocimetry (PIV) is a widely used optical method originally developed to understand fluid dynamics by tracking seeded particles moving through a fluid. In the context of biological disciplines, image-based pseudo-PIV is now a common tool to examine flows in tissues and cells, by exploiting the ability of tracking movement in time-lapse bioimages where features of interest are fluorescently tagged. A feature within a field of view at a specific time frame is searched for in subsequent frames by means of image cross-correlation. This allows for particle tracking and for the definition of a vector velocity field. We applied this technique to study cell migration, with a specific focus on retrograde flows of the actin cytoskeleton and their correlation to cell motion (Yolland et al., 2019). The aim of this software demonstration is to briefly introduce how the algorithm works, show the best strategies for parameter setting and demonstrate how to run it. Some application examples will be presented within the cell migration remit. The software can be found at https://github.com/stemarcotti/PIV; it is written in MATLAB and was tested with version R2018b (Curve Fitting Toolbox required).