Automatic Cellular Segmentation in Time-lapse Phase Contrast Images

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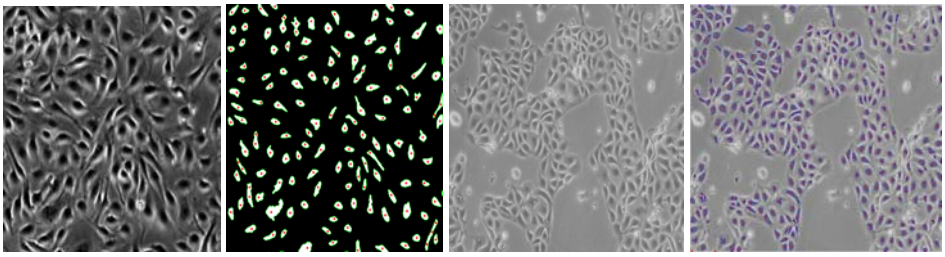
The process of cellular detection and tracking is a key task in the analysis of cellular motility and proliferation. The current clinical procedure involves a time consuming procedure that requires the manual annotation of cells in sequences of time-lapse phase contrast microscopy images. With the development of modern imaging modalities, the amount of data to be interpreted by biologists is constantly increasing, thus the development of automatic techniques that are able to detect cellular structures in large image sequences is more necessary than ever before. Robust cellular detection represents the first step in the development of cellular tracking algorithms and one of the objectives of our work was focused on the development of an automatic technique that is able to segment the cells in various sequences of cellular data. The proposed segmentation framework adaptively determines the criteria to separate the cells and the background and additional morphological operations are applied to detect the initial structures that define the cells in each image of the sequence. The initial segmentation results are refined by applying motion consistency constraints to detect the cells that are missed by the initial segmentation process due to factors such as image noise and low contrast. In our experiments we have applied the proposed segmentation framework to NE4C, MDCK and HUVEC cellular data. A number of experimental results are illustrated in Figure 1.



(a) (b) (c) (d)

Figure 1. Experimental results. (a,c) Input Images. (b,d) Segmentation results.

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