Automatic Cellular Segmentation in Time-lapse Phase Contrast Images

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Introduction

- Cellular segmentation and tracking is a key issue in the process of understanding the biological processes.
- Due to factors such as low contrast data, non-uniform intensity, agglomeration, non-uniform shape and Brownian motion the cell segmentation is a challenging task.
- Over and under segmentation is tackled by the temporal region matching and contour analysis.

Objectives

- Develop an automatic segmentation technique that can adapt to non-ideal imaging conditions and different types of cellular data.
- Extract quantitative measurements – cell count, cell morphology, etc.

Proposed method

- The initial segmented regions resulting from adaptive thresholding are further analysed to handle the over & under segmentation.
- It integrates contour, intensity and mathematical morphology operators to solve the under segmentation.
- The temporal region matching is incorporated to solve the uncertainties caused by low contrast data and image noise.
- The cell clusters are separated using distance transform analysis.

Conclusions

- A segmentation framework is proposed and evaluated on three different cellular data sets.
- The inclusion of temporal and tracking information is successfully incorporated to address the under and over segmentation.
- The future work will focus on the robust cell identification when the multiple cells are grouped into clusters.

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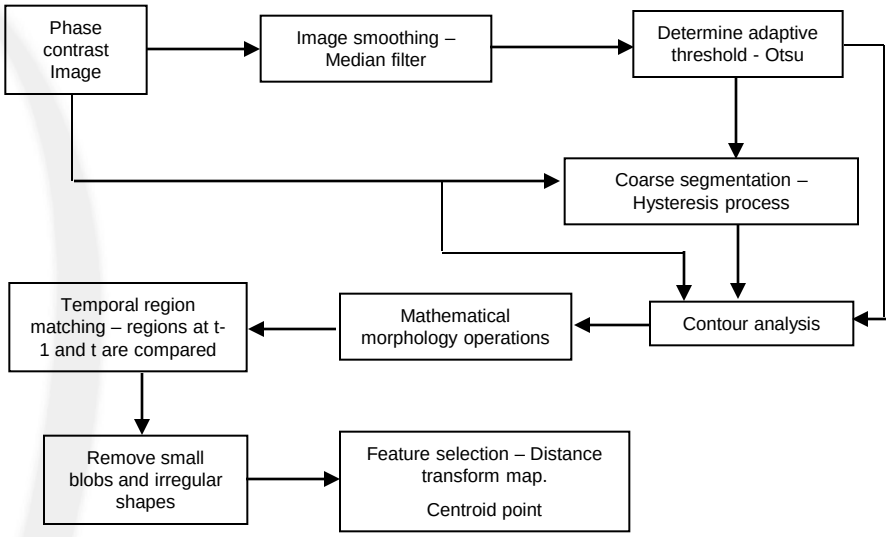
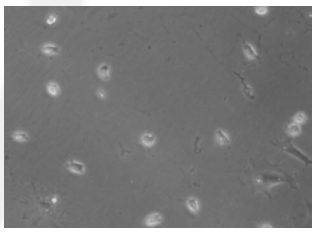
HEA Higher Education Authority An tÚdarás um Ard-Oideachas

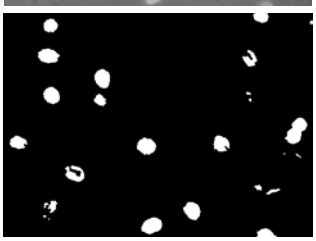
NDP National Development Plan 2007 - 2013

The segmentation framework



Experimental Results





a) Original image b) Initial segmentation c) Segmentation after contour and temporal analysis d) Final segmentation. For clarity the detected contours are overlaid on the original image.

The bottom rows show the original, final segmentation and the contour data overlaid on the original image. The detected centroids are marked in red.