AUTOMATIC DETECTION OF CELL NUCLEI IN FLUORESCENCE MICROGRAPHS

Jonas De Vylder, Filip Rooms, Wilfried Philips

Image Processing and Interpretation group (IPI)
Ghent University
St-Pietersnieuwstraat 41, B-9000 Gent, Belgium

E-mail: Jonas.devylder@telin.ugent.be

1. Description of the method

We present a novel approach to automatically detect cells. In a first step, we build an energy map. This energy map has a high value near edges in the image and low values far away from edges. The energy slowly decreases in function from the distance of an edge. By defining the energy this way, less problems occur near blurred edges, since edge evidence from nearby high contrast edges is propagated. In a second step, the valleys of the energy map are detected using a watershed algorithm. These valleys have been proven useful since they correspond to either a single nucleus or to background, such as was proven in [1]. Based on shape, size and intensity, each energy valley is detected as a nucleus or is discarded.

2. Experimental results

For the validation of the proposed method, a synthetic set of micrographs is analyzed [2]. A part of such a micrograph can be seen in Fig.1. In Fig.2 the result of the proposed technique is shown. Our measurements, which are shown in Table1, show good results for our testing data set. The proposed algorithm can detect (touching) cell nuclei with blurred edges, different intensities, non uniform intensities, etc. This is achieved in a memory and speed efficient way, which makes it interesting for 3D and high throughput systems.

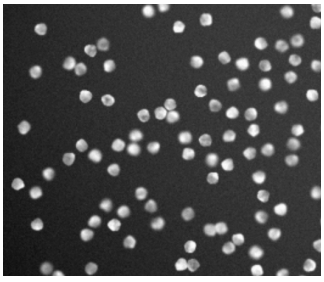

Figure 1: Simulated micrograph

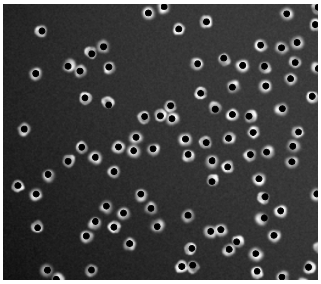

Figure 2: Cell detection of Fig.1

Table1: Measurements

# nuclei/ micrograph	300
Average # detected nuclei	299.9
Maximum error	-3

3. Conclusion

A new energy map, which can be efficiently calculated ,is proposed. By using existing segmentation techniques in combination with this new energy map, cell nuclei can be detected in fluorescence micrographs.

[1] G. Li, T.Liu, J. Nie, L. Guo, J. Chen, J. Zhu, W. Xia, A. Mara, S. Holley and S.T.C. Wong, "Segmentation of touching cell nuclei using gradient flow tracking" in *Journal of Microscopy,* **231,** 47-58 (2008).

[2] P. Ruusuvuori, A. Lehmussola, J. Selinummi, T. Rajala, H. Huttunen, and O. Yli-Harja, " set of synthetic images for validating cell image analysis" in *Proc. of the 16th European Signal Processing Conference (EUSIPCO-2008),* available from the Broad Bioimage Benchmark m Collection (www.broad.mit.edu/bbbc).