TECHNISCHE UNIVERSITÄT DARMSTADT

Thesis Topic (B.Sc. / M.Sc.)

Deep Learning for Cell Segmentation in Synthetic Biological Research

One of the primary methods through which information is acquired from biological experiments is by optical microscope imagery [1, 2]. A common bottleneck to scientific analysis is the segmentation of cells or regions of interest. Accurate determination of cell contours is an important step in quantifying morphological features as well as cell fluorescence intensity.

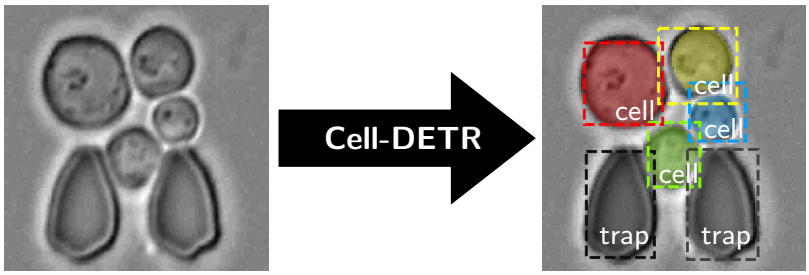

Figure 1: Microscope image of yeast cells immobilised in microscopic trap structures (left); instance segmentation of traps and cells (red).

Recently a range of machine learning techniques have been applied to such data, however, all of these still have some drawbacks. This is in particular the case when cell trap structures are included on the images (Fig. 1). The potential of deep neural networks for this task, has recently been demonstrated [3, 4, 5, 6, 7].

The demonstrated performance in terms of runtimes and accurate segmentation make advanced experimental techniques, such as online monitoring feasible. For example closed-loop optimal experimental control requires online

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- Machine Learning
- Image Processing
- Automation
- Cell Segmentation
- Supervised Learning
- Bio-application

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monitoring and promises to increase the information gain of experiments [8].

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