Identifying Circulating Tumor Cells (CTCs) by Image Analysis

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Introduction

The Cancer-ID consortium aims to validate blood-based biomarkers for cancer.

- cells dissociate from primary tumor and invade blood circulation
- rare cell events, challenging to detect
- CTC count has prognostic value for survival outcome
- no overall CTC definition exists yet

Automatic Data Processing

Development of an automated, platform-independent identification algorithm.

- sensitivities in data: noise, contrast, background artifacts...
- reliable and efficient segmentation forms basis for further processing

Active-contour segmentation energy:

\[ J(c_1, c_2, C) = \int_{\Omega_{\text{in}}} |f(x) - c_1|^2 \, dx + \int_{\Omega_{\text{out}}} |f(x) - c_2|^2 \, dx + \alpha \cdot \text{Length}(C) \]

Results

Improved Segmentation:

- increased threshold & decreased \( \alpha \)
- improved robustness (esp. against noise)
- \( \alpha \) determines segmentation scale

Automated Classification:

- kNN, SVM, PCA

Conclusion / Outlook

- Validation
  - Segmentation: manually segmented cells from MCBP members
  - Classification: manually scored images from CANCER-ID partners

- Robustness
  - improve background artifacts robustness

- Automatic Parameter Choice
  - relation to scale space approaches?

- Advanced Classification Methods