Master thesis project proposal

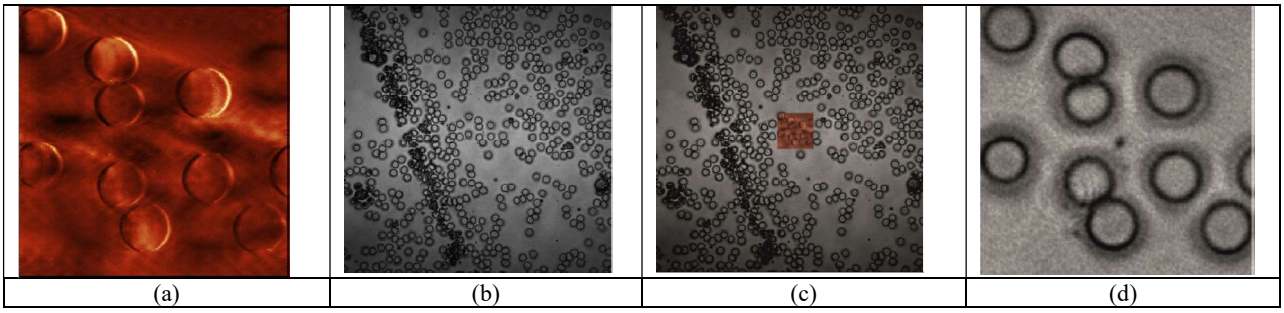
Multi-modal registration of microscopy images

Background

The availability of multimodal imaging system is increasing. Modern microscopy, by utilizing combinations of different imaging techniques, enables capturing of overlapping fields of views of the same specimen in micro- and nano-scale, by that providing very information rich data. This, in turn, leads to an increasing need for the development of image analysis methods which are applicable to such multi-channel data.

For efficient analysis, it is required to align, or *register*, the multimodal images into a common reference frame. Due to the large difference in scale, in combination with very different imaging and noise properties of the various techniques, such alignment becomes a challenging problem. An example of simultaneously collected microscopy images of red blood cells is shown below; there exist no direct mapping of intensities between the different modalities and reliable feature points are often lacking. In many cases manual interaction is required for the registration step, which is costly, tedious and imprecise.

We aim at developing a framework for robust automatic registration of images obtained by such multimodal imaging system.



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

(a) Scattering-type Scanning Near-Field Optical Microscopy (s-SNOM);
(b) Reflectance Confocal Laser Scanning Microscopy (CLSM);
(c) Identified position of the FoV of s-SNOM in the FoV of CLSM;
(d) Cropped CLSM image, registered with the s-SNOM, for further correlative analysis.

Project description

To evaluate performance of different methods for multimodal image registration on the data obtained by a multimodal microscopy imaging system.
To suggest adjustments of the existing methods for their improved performance on the test data (such as in the example above).

The thesis work should include

- A survey of relevant literature and selection of state of the art multimodal registration methods.
- Planning of implementation and evaluation of the selected methods.
- Prototype implementation (e.g. in Matlab) and quantitative evaluation of the method(s) on the provided data.
- Improvement of the performance by adjustments of the method.
- Writing of the thesis report.

Contact

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