center for systems biology dresden

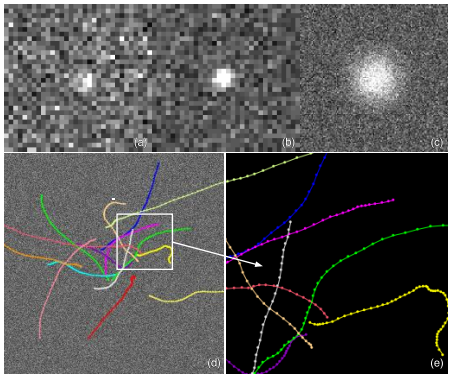
COMPUTER VISION LAB DRESDEN

**MOSAIC Group and Computer Vision Lab Dresden,**
**MPI-CBG and TU Dresden**

# Master Thesis

We are looking for a student who would like do his or her master thesis on the topic:

## Tracking of Biological Objects in Microscopy Using an Adaptive Motion Model



Examples of object appearances (top row) and motion (bottom row). The objects have been tracked from videos using a particle filtering approach with a fixed, pre-defined motion model. The goal there is to replace that with a motion model that can be flexibly learned from a few manually tracked examples. Figure from: Ö. Demirel, I. Smal, W. J. Niessen, E. Meijering, and I. F. Sbalzarini. Piecewise constant sequential importance sampling for fast particle filtering. In *Proc. 10th IET Conf. Data Fusion & Target Tracking*, Liverpool, UK, April 30 2014. IET.

Tracking moving cells or moving objects inside of cells has become vital in the field of experimental cell biology and regenerative medicine, where large amounts microscopy movies are acquired. When tracking an object one usually assumes a statistical motion model describing which movements are more likely than others. This renders the tracking task easier and more robust to solve. Using this prior knowledge can speed up the computation time and allow the system to deal with difficult and noisy images.

In biological applications however, it is often the goal of the experiments to *determine* the statistics of motion in the first place. The motion model of the object thus cannot be predefined. The goal of this thesis should be to build a tracking system that uses a flexible adaptive motion model, which is learned prior to tracking from a few hand-tracked objects or user input.

The main aspects of the thesis should be:

- Study of literature
- Design and implementation of a tracking system using an adaptive motion model
- Allying and evaluating the system on real microscopy movies
- Compare the system to other systems that use no motion model or a fixed one

The student should ideally have a background in computer vision, image processing or machine learning, and possess good programming skills.

**Please contact Alexander Krull (*alexander.krull@tu-dresden.de*)**