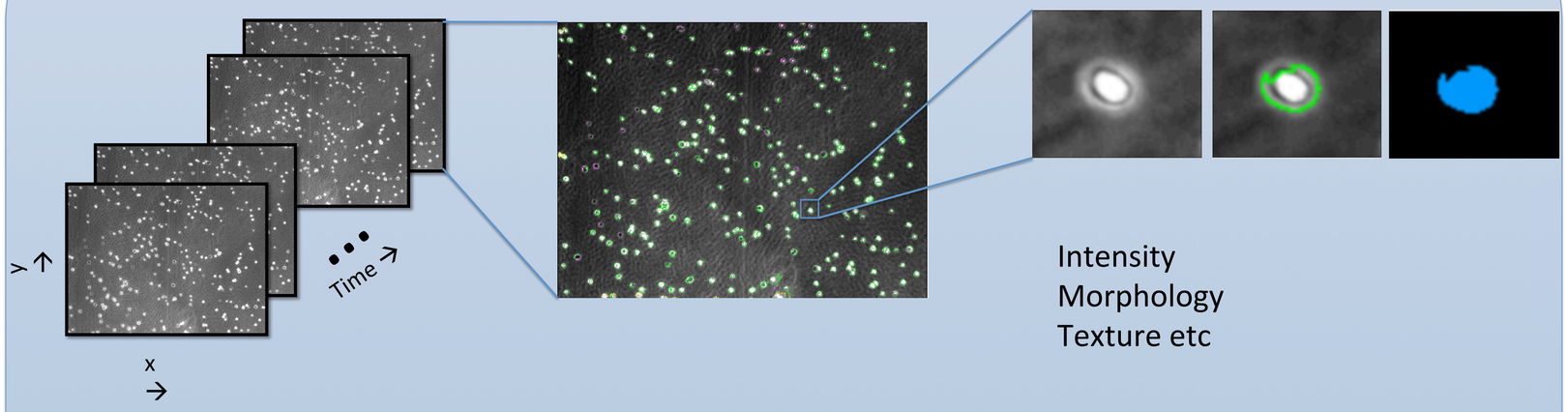
Large- Scale Analysis of Live Cells

Sajith Kecheril Sadanandan[a,b] and Carolina Wahlby[a,b]

[a]Center for Image Analysis, Uppsala University, Sweden and [b]SciLife Lab, Sweden

Large Scale Analysis



Many time frames per experiment | Many cells per image | Many measurements per cell

Aim of the project: Follow live cells over time to

- Find variation in phenotype
- Find change in speed and direction of movement

Introduction

Obtaining quantitative data from live cells is of great importance for understanding the cellular and molecular processes. A recurring task in many experiments is the tracking of large number of cells and the analysis of their spatiotemporal behavior. Live cell experiments using automated imaging systems generate a huge amount of data that is difficult for a human observer to analyze.

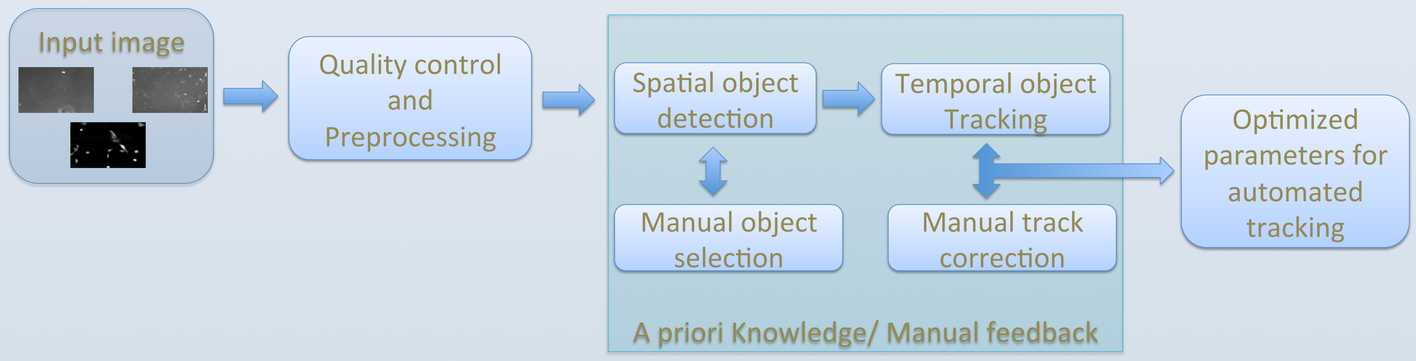
Issues:

- The investigators suffer from lack of user-friendly software and infrastructure in terms of computing and data storage.
- Need to know complex image analysis algorithms for application based parameter tuning which prohibits from routine usage.

Novelty:

- Use the investigator's biological knowledge as feed-back to the system in the form of manual selection/training detection of objects of interest and manual editing of erroneous tracks
- Flexible automated high throughput system
- Reduce the time and algorithmic insight required by the investigator

System architecture



Segmentation of neutrophils: The time lapse microscopy images of neutrophils revealed that they are comparatively fast moving cells. This often causes them to come closer to each other, making it difficult to distinguish between two near by cells. For the tracking to be successful, it is important to identify all the cells present in the image. For this experiment local maxima is found at the scale of the cells and set as marker for segmentation. Thus close by cells were separated.

Initial results

Input image | Initial segmentation | Segmentation of near by cells | Markers detected on cells | Final segmentation result