



Automated tracking and characterization of cell dynamics for classifier models

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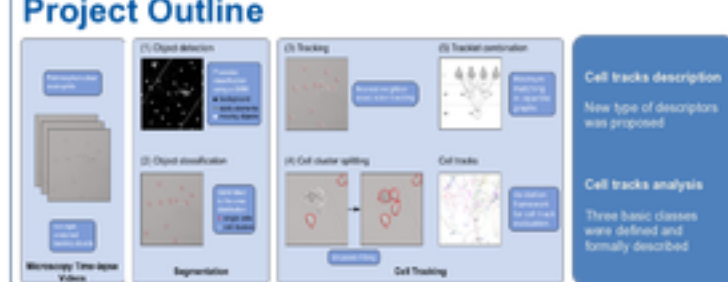
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 Applied Systems Biology, Leibniz Institute for Natural Product Research and Infection Biology – Hans Knöll Institute

Project Aim

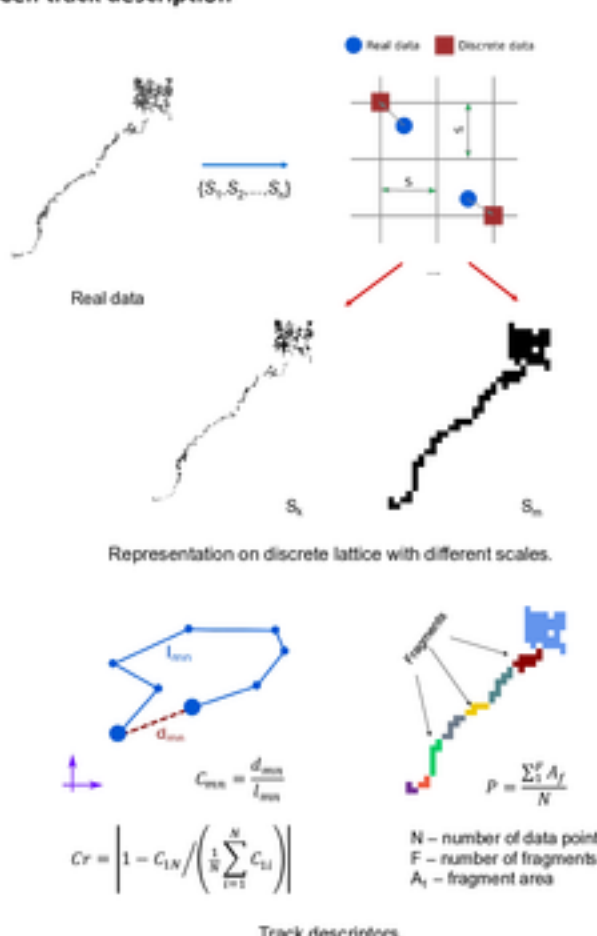
Automated characterization of cell tracks based on interpretable features, in order to construct classifier models based on dynamic cell properties.

Project Outline



State of the art work

Cell track description



Real data: (S_1, S_2, \dots, S_N)

Representation on discrete lattice with different scales:

$$C_{max} = \frac{d_{max}}{L_{max}}$$

$$Cr = \left| 1 - C_{1N} \left(\sum_{i=1}^N C_{1i} \right) \right|$$

Track descriptors:

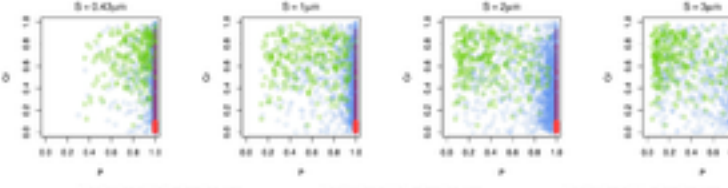
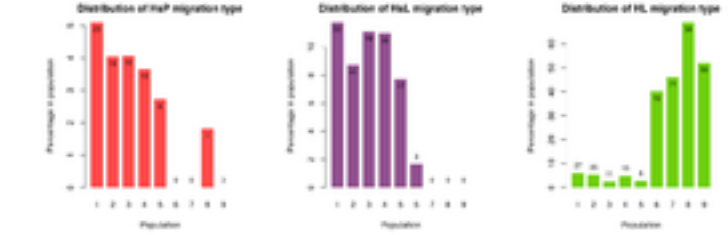
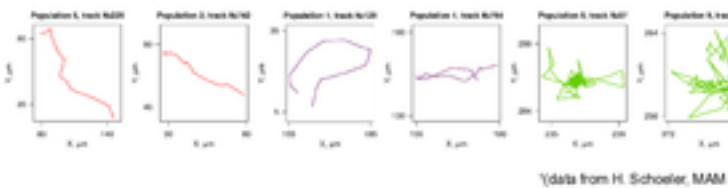
- N – number of data points
- F – number of fragments
- A_i – fragment area

Cell track analysis

Basic types:

- Highly localized migration (HL) – max displacement (D_{max}) within the course of time less than cell diameter d . $D_{max} < d$
- High-speed linear migration (HLi) – track speed of cell not less than one cell diameter per minute. It is possible to fit the track by a line without knots. $P(S) \in [0.43, 1.2, 3] = 1$
- High-speed persistent migration (HSP) – speed of cell not less than one cell diameter per minute, direction of migration fairly the same within the course of time. $P(S) \in [0.43, 1.2, 3] = 1$, $Cr < 0.1$

Experiment: polymorphonuclear leukocytes, 9 populations in different conditions!

*Data from H. Schöler, MAM 190

Network

Create and analyze a classifier model, implement tracklet analysis.

Test on various data sets: different cell types in different conditions and different imaging parameters (WP 1-3, 9). Provide results for WP 1-3.

Combine this method with shape descriptors (WP12). Adapt the method to 3D track data, analyze 3D track data (WP 8).