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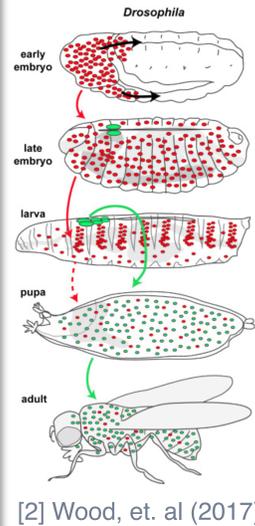
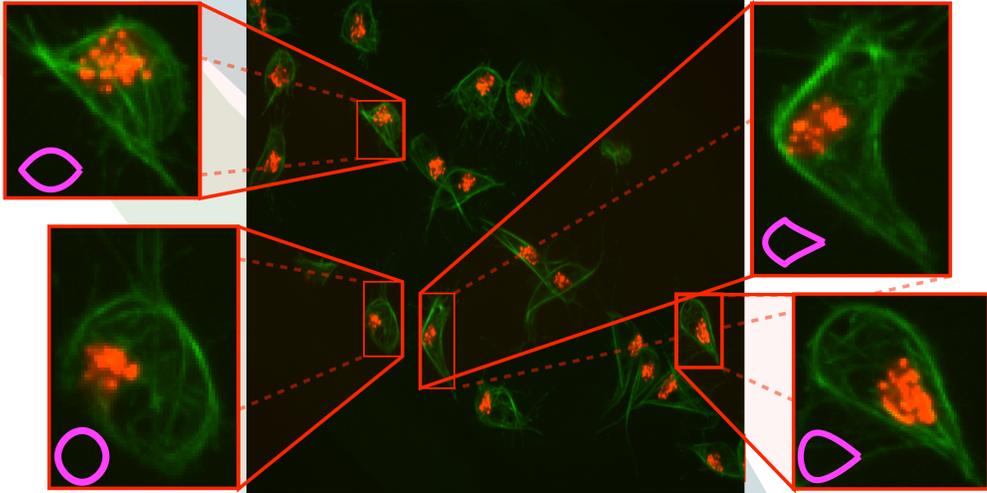
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Shape Analysis and Tracking of Migrating Macrophages

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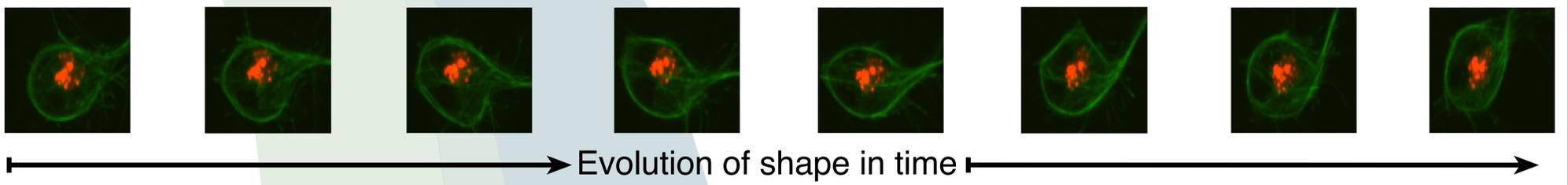
Basic shapes identified in the data



Abstract

This work describes an algorithm to observe cell shape variation associated with migration. The algorithm iteratively segments, tracks and analyses the shape of macrophages in *Drosophila melanogaster* embryos. Analysis of shape, including the number of corners or pointy edges, rely on a novel approach to finding junctions, the anglegram matrix.

The anglegram [1] IS a multiscale angle variation 2D matrix. It is constructed by calculating inner point angles alongside the boundaries of an object.



Data & Methodology

- **Synthetic data** was generated to test the corner detection algorithm and fluorescently labelled images of macrophages were used.

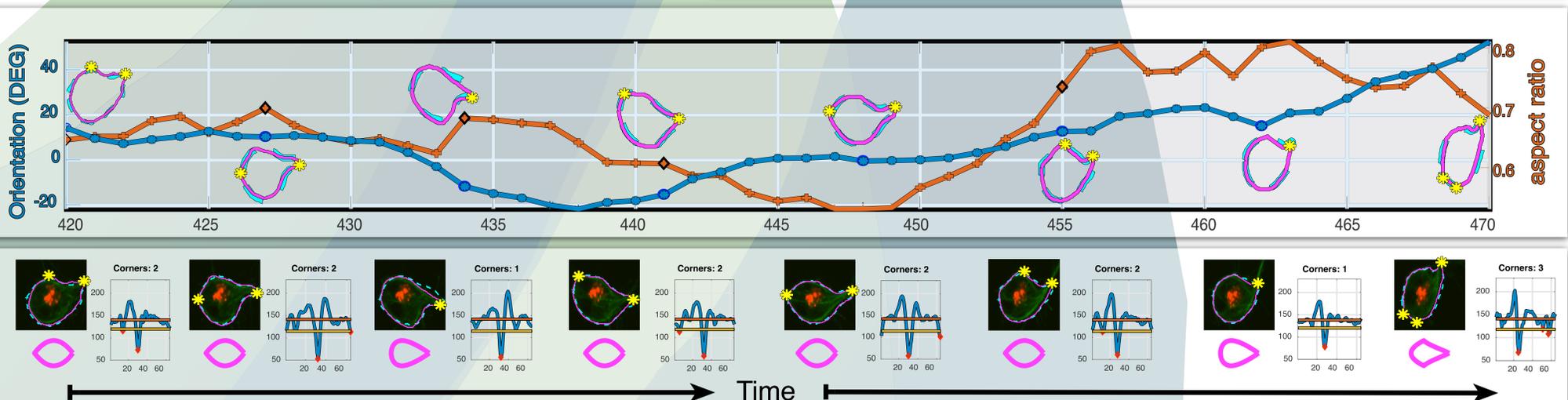
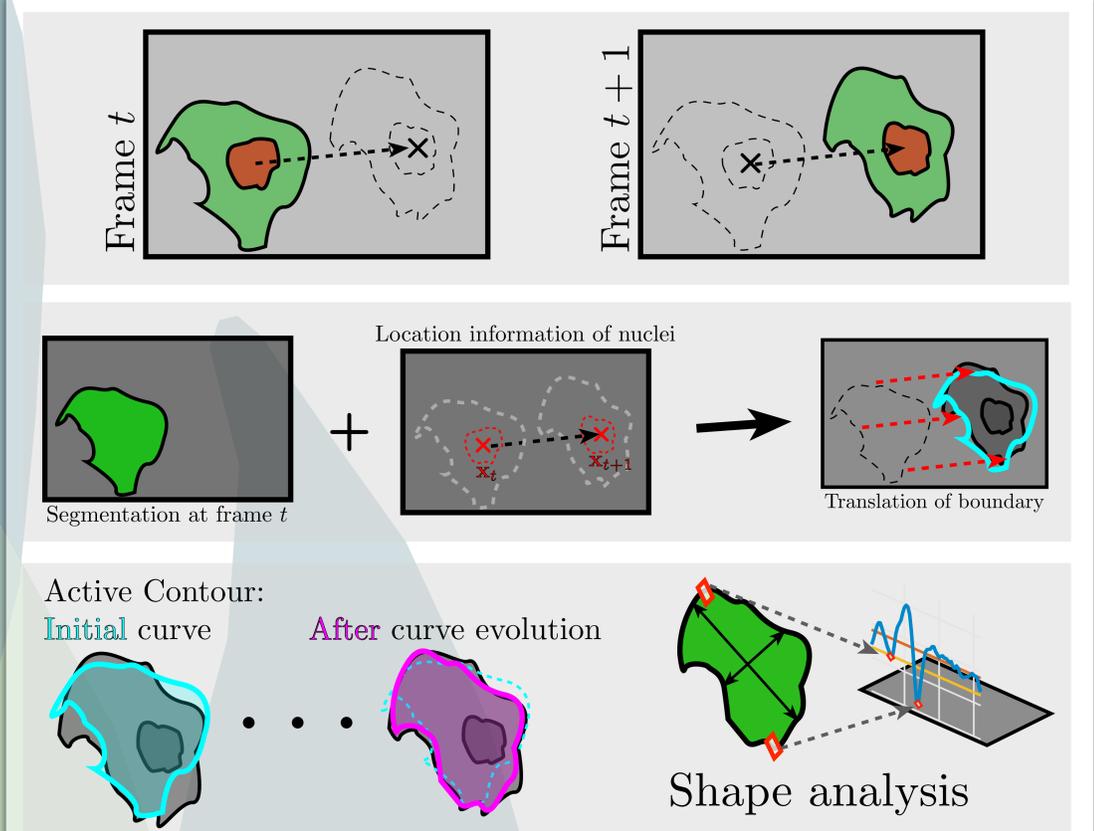
- The **methodology** allows observation of shape variations as the cells migrate. The **main functionality** is a framework in which the algorithm identifies and separates overlapping and non-overlapping cells. Then for the **non-overlapping** cases, it extracts and tracks the shape with and custom implementation of the Active Contours algorithm [5,6].

- Finally, shape measurements are collected from each extracted shape, including calculation of corners with the

Results & Future Work

The **main contribution** was to provide a framework for the **consistent tracking of the shape of a cell** and evolution of the shape's parameters. A new implementation of the **anglegram** matrix allowed for the analysis of a single cell with a straightforward identification of corners in the shapes.

Future developments: extending the shape tracking into overlapping cells to disambiguate them; and use the patterns of the anglegrams corresponding to the basic shapes, to classify cells into basic shapes.



Evolution of Cell Shape Analysis throughout multiple frames. **Top:** Evolution of orientation of segmented cell and aspect ratio of the shape. At eight points in the graphs, the segmented shapes of cells are displayed. **Bottom** Eight instances out of 50 consecutive frames where previous frame segmentation (cyan -) and evolved current frame segmentation (magenta -) are shown. The detected shape is highlighted and the minimum intensity projection of the anglegram is displayed to present the detection of corners.

