University of Cyprus
Department of Biological Sciences

POSTGRADUATE SEMINAR ANNOUNCEMENT

Seminar Series 2022-2023

Assoc. Prof. Stathis Hadjidemetriou

Applied Information Technologies (AIT) program,
Cyprus International Institute of Management

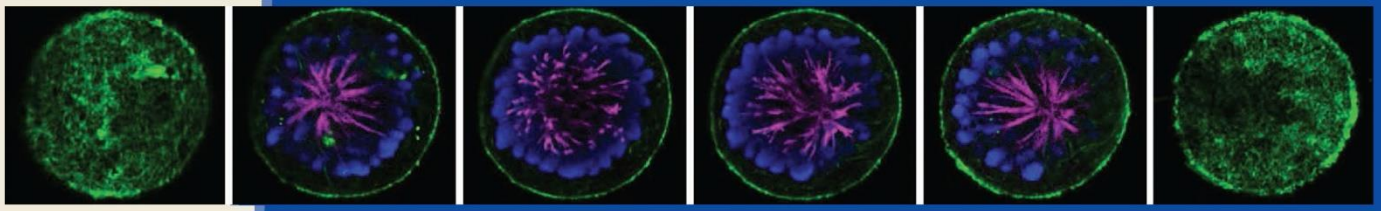
"Spatiotemporal Detection and Characterization of Cell Divisions in Time-Lapse Phase Contrast Microscopy"

Wednesday,
16 November 2022
at 5:00 pm

in Building CTF 01, Room 108

The seminar is open to the public.

A variety of biological and pharmaceutical studies, such as for anti-cancer drugs, require the quantification of cell divisions over long periods of time. The monitoring of the cells uses time-lapse video microscopy that gives a long sequence of frames. The phase contrast imaging is commonly used since it is minimally invasive. The manual identification and characterization of cell divisions is tedious, subjective, and restrictive. This study introduces an automated method for these measurements. It starts with preprocessing for restoration and reconstruction of the phase contrast time-lapse sequences. The data are first restored from intensity non-uniformities. Subsequently, the halo of the dividing cells in the phase contrast images is used for a Circle Hough Transform (CHT) enhanced with the ability to "vote" exclusively towards the center of curvature. This reconstructs the entire cells. The CHT image sequence is then registered for misplacements between successive frames. The sequence is subsequently processed to detect cell centroids in individual frames and to use them as starting points to form spatiotemporal trajectories of cells along the positive as well as along the negative time directions, that is, anti-causally. The trajectory formation emphasizes the extraction of the smoothly diverging trajectories of the daughter cells. The connectivities of the various trajectories provide as topological by-products the events of cell divisions together with the corresponding entries into mitoses as well as exits from cytokineses. The anisotropies of parent and daughter cells are measured throughout the division. The validation uses several experimental video sequences from three different cell lines with many cells undergoing mitoses and divisions. The quantitative results demonstrate the high performance and efficiency of the method.



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