CANCER RESEARCH UK | CAMBRIDGE INSTITUTE

Course Assignment

Write a report to describe, justify and present the results of your workflows. You should describe any mathematical methods you use. If you use a plugin / inbuilt function you should describe the methods used by that plugin. Please include enough detail to demonstrate a sound understanding. Your workflows should be fully automated.

We recommend using Fiji and/or Matlab to solve these problems. If you write any scripts they should be included and **fully commented**.

Section 1: Volume Measurement

Embryo.ome.tif contains a z-stack of a (partial) mouse embryo (7.5 days old) with a nuclear DAPI stain. The data was acquired using a two photon laser scanning microscope.

Using the DAPI stain calculate the volume of the embryo and estimate the total number of cells.

Hints:

- Do you need to count each cell individually to estimate the total number?

Section 2: Tracking

N2DL-HeLa.ome.tif contains a time-series epi-fluoresce time-lapse movie of Histone 2B (H2B)-GFP expressing HeLa cells. This data series is from a publically available repository [1]. You should segment and track the cells using the histone signal.

Cells are capable of dividing (mitosis) but not merging. Your algorithm should account for this. In such a scheme a single “track” can consist of many cells all formed from a single “parent”.

Your report should include:

- A plot of the number of cells in the field of view over time.
- What is the mean number of cell divisions (per track) across the whole movie? Only tracks originating from cells present at the start of the time-lapse should be considered. If a single cell from a track leaves the field of view then the entire track should be removed from the analysis.
- A conclusion describing the advantages and drawbacks of your protocol. How could you improve / develop this approach further?

Hints:

- The Fiji TrackMate plugin could be very useful [2].

[1] Maška, Martin, et al. "A benchmark for comparison of cell tracking algorithms." Bioinformatics 30.11 (2014): 1609-1617.

[2] http://fiji.sc/TrackMate