MU-CZ

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Platform: Windows (x64)

Prerequisites: None

MU-CZ: SUMMARY

The method follows the tracking by model evolution paradigm. It is based on the minimization the Chan-Vese model in a fast level set-like framework that is integrated with a topological prior allowing simultaneous tracking of multiple cells over time.

MU-CZ: PREPROCESSING

To reduce the amount of noise in the analyzed 2D and 3D time-lapse sequences, every single frame was preprocessed using a Gaussian filter with the standard deviation of one pixel in each direction.

MU-CZ: SEGMENTATION AND TRACKING

The method used for analyzing some of the competition datasets is built on our previously published cell tracking scheme [1, 2]. It follows the tracking by model evolution paradigm, in which the segmentation and tracking steps are solved simultaneously, exploiting final results of individual frames as initial conditions for the analysis of the following frames. The approach is based on the minimization of the Chan-Vese model in a fast level set-like framework that is integrated with a topological prior allowing simultaneous tracking of multiple cells over time. In comparison to the published approach [1, 2], several modifications have been introduced to deal with specific features of the analyzed competition datasets. They are described in more detail in the rest of this section.

Clustered cells in the first frame. One of the main limitations of the original tracking scheme is its inability to correctly track cells being clustered in the first frame, calling for manual interaction with the user. To fully automatize the whole process, a cluster separation routine based on the evolution of topologically inflexible implicit active contours has been employed [3].

Capturing entering cells. The original approach assumes that new cells entering the field of view are border components disjoint with the existing cells. However, due to low temporal resolution and various experimental setups, entering cells do not necessarily touch the image border when they first appear in

the field of view in some of the analyzed competition datasets. Therefore, the condition for selecting entering cell candidates has been slightly modified omitting the necessity of being border components in a binary mask obtained using a weighted 2-means clustering.

Compensation for time-variant fluorescence intensity. In the analyzed simulated datasets, we have often observed a phenomenon of time-variant average fluorescence intensity within individual nuclei. This especially holds shortly before and after division events, when the amounts of fluorescently stained DNA materials dramatically change. To partly compensate for this phenomenon, the background weight in the Chan-Vese model (λ_2) is temporarily multiplied by a user-defined constant (*mult*).

MU-CZ: POST-PROCESSING

Based on the instructions from the challenge organizers, all tracked objects outside a specified field of interest (*borderSize*) are systematically discarded from the tracking results, not to be penalized during the TRA measure evaluation.

REFERENCES

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3. Maška M, Daněk O, Ortiz-de-Solórzano C, Muñoz-Barrutia A, Kozubek M, García IF. A two-phase segmentation of cell nuclei using fast level set-like algorithms. In *Proceedings of the 16th Scandinavian Conference on Image Analysis*, 390-399 (2009).