

14. September 2021

Master Thesis

CeCILE – automated detection and tracking of mammalian cells in microscopy videos based on artificial intelligence

In order to infer the behavior of tissue after irradiation, it is necessary to understand what happens to each individual cell. A method to observe cells after irradiation is via phase-contrast microscopy. Here, cells can be followed for up to one week under physiological conditions and every reaction of the cells can be monitored. As the recording of such cell videos produces a lot of data an automated software tool is required for analysis in order to detect and track every cell throughout the video and evaluate their behavior. CeCILE (Cell Classification and In-vitro Lifecycle Evaluation) is such a software which is based on an artificial intelligence and is developed in our group. (<https://www.frontiersin.org/articles/10.3389/fonc.2021.688333/full>). Within this Thesis you will be directly involved in the development and optimization of the software, including the improvement and extension of the dataset, and the testing and finetuning of different smart detection and tracking methods. Furthermore, as a practical part of this thesis you will learn how to cultivate and image mammalian cell lines and also to perform a proof of principle irradiation experiment. Experience in the field of artificial intelligence/deep learning or in computer vision are helpful but not required and can be learnt during this thesis.

This thesis gives knowledge in artificial intelligence, computer vision, radiobiology, microscopy and radiation physics.

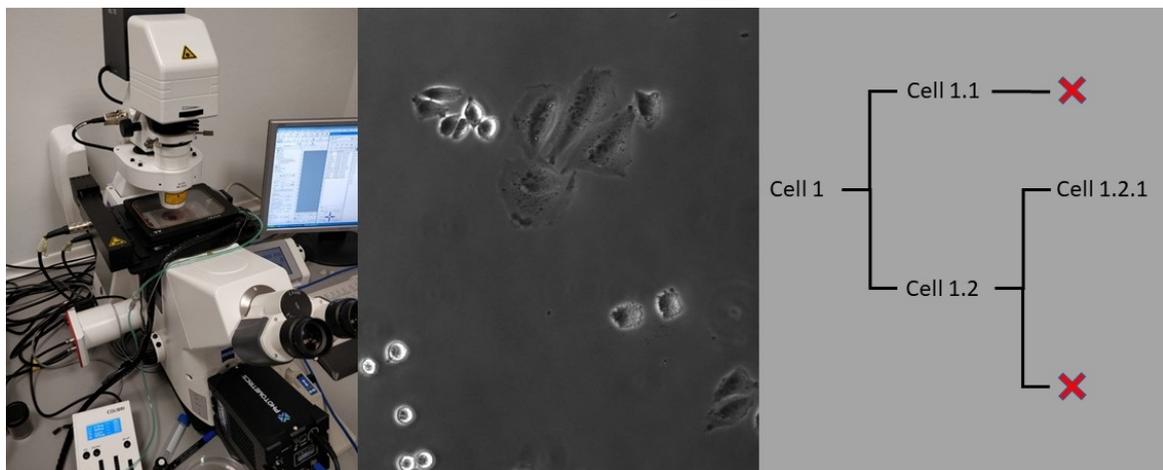


Figure 1: On the left the microscope is shown with a live-cell-imaging set-up installed. In the middle a phase-contrast image of CHO-cells is depicted and on the right an example lineage for cells. Our aim is to create from phase-contrast videos such lineages for every cell and analyze them with CeCILE.

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