

Study Program                      Biomedical Sciences  
Organizational structure        Full-time

## Assessment of Master's Thesis - 2. Assessor

|                       |   |                            |
|-----------------------|---|----------------------------|
| Title Master's Thesis | Segmentation of Phase Contrast Images in Multi-Epitope Ligand Cartography for Image Quantification at the Single Cell Level |                            |
| Name of student       | Filip Mivalt  | Student number: 3317369308 |
| Assessed by           | Sabine Taschner-Mandl, PhD  | Date: 18.9.2019            |

|   | Brief verbal evaluation  |
|---|--|
| <p><b>Quality of own contribution</b></p> <p><b>Applied methods i.e.</b></p> <ul style="list-style-type: none"> <li>▪ project approach</li> <li>▪ Scientific – systematic methods in analysis and problem solving</li> </ul> <p><b>Type of problem solution</b></p> <ul style="list-style-type: none"> <li>▪ Was the problem really solved?<br/>Independence and creativity of the solution</li> <li>▪ Own contribution must be clearly evident</li> <li>▪ Quality of the solution</li> </ul> | <p>Mr Mivalt has developed and tested an original approach to solve an instance aware segmentation problem in phase contrast microscopy images. His project was embedded in a bigger, international collaborative program that aims at building a multi-OMICS and imaging platform for personalized medicine. One aim therein is the development of a multi-plex fluorescence/phase contrast image analysis approach that allows feature quantification at the single cell level. Based on previous work in the lab on cell nucleus segmentation in immunofluorescence images, Mr Mivalt successfully performed registration and background correction of phase contrast images. He annotated cells in phase contrast images, which were used to create a training dataset, a pre-requisite to systematically test 1) the benefit of data augmentation methods (augmented image dataset and synthetic images) and 2) two different architectures of a deep learning algorithm for instance aware segmentation, Mask-R-CNN. He was able to show that synthetic images can be used, if no annotated dataset is available for training, but real and augmented images are more suitable and result in higher precision of segmentation. Further, the FPN architecture was superior to the C4 Mask-R-CNN architecture. Based on Mr Mivalts results and developments the existing image processing pipeline will be significantly improved, as precise cell segmentation will enable a more precise measurement of cell surface located biomarkers (features) on corresponding immunofluorescence images. Mr Mivalt was co-supervised by a bioimaging specialist (Kromp) and a biology expert (Taschner-Mandl), but developed own ideas and carried out his tasks independently, generating a high-quality solution for the scientific problem.</p> |
| <p><b>Form / Style.</b></p> <ul style="list-style-type: none"> <li>▪ The Master's Thesis has a clear structure and is representative of the template</li> <li>▪ Is citation correct?</li> <li>▪ Images</li> <li>▪ Language; editing required from the supervisor</li> </ul>   | <p>All figures and text presented in the master thesis has been compiled and written by Mr Mivalt. In his thesis, Mr Mivalt states the problem, gives an overview on the technical state-of-the-art, the contribution of the work, explains all methods used in detail and presents the results and their implications comprehensively. The relevant literature in the field has been discussed and cited correctly. The thesis contains illustrations taken from the literature (literature reference in the figure legends) and original own images and diagrams created and compiled in multi-panel figures by Mr Mivalt. The thesis was written in English. Mr Mivalt prepared a draft version, which was commented (structure, scientific content, presentation of the results, discussion, figures, language, etc) by the two supervisors and revised by Mr Mivalt in an adequate and timely manner.</p>   |
| <p><b>Quality of background information</b></p> <ul style="list-style-type: none"> <li>▪ Has the bigger picture been recognised? Have the significance and weight of influential factors/dates/other relevant information been correctly assessed.</li> <li>▪ Intelligent presentation of relevant state of technology and company environment.</li> <li>▪ Uncovering and presenting larger (i.e. socio-economic) contexts and respective discussion</li> </ul>                               | <p>Please see also above. Presentation of the bigger context, state-of-the art and contribution of the work is comprehensive and covers all relevant aspects in a concise manner.</p>  |