



PhD position available in
Medical Physics in Radiation Therapy

**Topic: Machine learning for target volume
definition in radiotherapy**

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Over the past 10-20 years, research in medical physics has provided tremendous improvements to the technology used to deliver radiotherapy for treating cancer. This includes the development of intensity-modulated radiotherapy with x-rays (IMRT) and protons (IMPT), which allows us to deliver radiation precisely to tumors and spare adjacent healthy tissues from radiation. With these technological improvements in precision, the biggest source of uncertainty today is often the definition of the target volume, i.e. the region to be irradiated.

Target volume delineation is a complex problem which involves medical imaging techniques such as computed tomography (CT), magnetic resonance imaging (MRI) and positron-emission tomography (PET). These imaging techniques reveal the macroscopic tumor mass. However, tumor cells also invade neighboring tissues or spread through the lymphatic system. This microscopic progression of the tumor cannot be detected with current imaging techniques, which represents a big challenge for radiotherapy target delineation.

Currently, the target volume is delineated manually by an experienced radiation oncologist, which is a time-consuming process. In this project we develop machine learning methods for target delineation, which partially automate target delineation and provide approaches to improve on current practice. This is achieved by combining different techniques including image segmentation algorithms, mathematical models of the microscopic spread of tumor cells, and statistical techniques to analyze data from previously treated patients.

We are looking for a PhD candidate with a strong background in physics, computer science, applied mathematics, engineering, or a related field. Applicants should have a genuine interest in applying computational techniques to solve applied problems in medicine. Experience and interest in scientific programming is mandatory; prior knowledge in machine learning, medical image processing, statistics, medical imaging, or radiotherapy is beneficial.

The PhD candidate will be enrolled at the science faculty at the University of Zürich UZH and will work in the radiation oncology department at the University Hospital USZ. Zürich offers an attractive environment for medical physics research, including the Institute for Biomedical Engineering, the medical computer vision lab, and other diverse research groups at ETH, UZH and USZ. The position is part of the clinical research priority program "Artificial intelligence in oncological imaging" and close interaction with related research groups will be available.

Please contact Prof. Jan Unkelbach to apply or to obtain further information.