Project for Master Thesis

Deep Learning in Radiation Oncology

@ Division of Medical Radiation Physics, Department of Radiation Oncology, Medical University of Vienna

Supervisors: Dr. Gerd Heilemann, Dr. Andreas Renner, Prof. Dr. Dietmar Georg

Motivation:

Radiation therapy is a key treatment modality and strong pillar in cancer management. Due to the high complexity of modern treatments, the extensive monitoring and subsequent follow-up of the patients a massive amount of partly heterogeneous data is generated. A typical case in radiation oncology does not only consists of demographic data, but includes volumetric imaging data of the patient in treatment position combined with the volumetric information of the dose distribution of radiation dose, as well as a large amount of other medical data (e.g. from pathology, diagnostic radiology, medical oncology) at time of diagnosis and during follow-up. The handling of this information is challenging and is often overwhelming for manual inspection by the physician.

Big Data analytics can be a powerful tool in developing predictive models with the aim of guiding treatment decisions for patients undergoing external beam radiotherapy. For this thesis project a database of 500+ prostate cancer patients treated at the Department of Radiation Oncology will be used to assess deep learning methods in order to predict acute and late toxicities following radiotherapy.

The database consists of complete sets of segmented and labeled CT images for each patient, including the delivered radiotherapy dose to the functional organs and tumor as well as years of follow-up. The goal of this thesis will be to identify a feasible deep learning techniques and develop a model that can support decision making during treatment planning. The department has dedicated computers equipped with NVIDIA Titan XP graphics cards as well as access to a GPU cluster for extensive learning.

Work Description:
- Data analysis using deep learning methodologies (2D/3D neural networks)

Qualifications:
- Student of computer science, physics, biomedical engineering or similar technical studies
- Programming experience in MATLAB, Python and/or C++
- Written English skills for documentation and reports

Duration: 9 months, the position is open now (07/2019)

If you are interested in the topic please send an email to gerd.heilemann@meduniwien.ac.at, andreas.renner@meduniwien.ac.at or dietmar.georg@akhwien.at.