ST 4: AI in Medicine

Time: Wednesday 9:30–10:30 Location: PC 203

ST 4.1 Wed 9:30 PC 203

Enhancing Brain Tumor Characterization through Machine Learning on Raw MRI K-Space Data — •Marco Schlimbach[1], Jens Kleesiek[2], Kevin Kröninger[1], Moritz Rempe[2], and Jens Weingarten[1] — [1]TU Dortmund University — [2]Institute for AI in Medicine (IKIM)

Differentiating brain tumor types is a diagnostic challenge, influencing subsequent therapeutic decisions. Clinics employ various methods to examine tumors, including biopsies and Magnetic Resonance Imaging (MRI). One goal of research is the improvement of MRI-based tumor characterization to avoid invasive biopsies. Numerous Machine Learning (ML) approaches have been developed to enhance tumor classification in MRI scans. However, most of these methods use the final images created by MRI scanners through a complex reconstruction pipeline, involving filtering operations. This process, aimed at producing human-interpretable images, loses phase information of the complex-valued raw MRI data, which potentially has diagnostic value.

In an ongoing data acquisition process from our medical partners, raw data, known as k-space data, is extracted from clinical MRI scans to create a new unique dataset. The k-space is hypothesized to reveal new features for the characterization of tumors. This work introduces the innovative approach of applying ML techniques directly to this MRI k-space data. It aims to utilize the complete information of the raw MRI data by using different complex-valued neural network architectures. A generative neural network approach is introduced with the objective to produce synthetic k-space data.

ST 4.2 Wed 9:45 PC 203

Fast Dose Prediction in Microbeam Radiation Therapy (MRT) Across Varied Field Angles. — •Tobias Cremer[1], Cornelius Grunwald[1], Kevin Alexander Kröninger[1], Jens Weingarten[1], Marco Schlimbach[1], and Florian Mentzel[2] — [1]TU Dortmund, Germany — [2]formally TU Dortmund, Germany

Microbeam radiation therapy stands as a promising preclinical approach to treating tumors, offering enhanced post-treatment outcomes. It uses a multi-slit collimator to create dosis peaks with high doserates and valleys in between with lower doserates. This spacial segmentation of the beam and high doserates over small amounts of time (FLASH-Therapy) leads to a higher survivability rate of the healthy tissue. For clinical implementation

This project builds upon prior research which demonstrated the suitability of Machine Learning for dose prediction. This work involves training a neural network capable of predicting doses for diverse field angles. Initially, training data are simulated for basic volumes as a proof of concept. Using this training data, a 3D U-Net will be trained to predict the corresponding dose deposition. Subsequently, the developed prediction model for basic volumes will be adapted to function with CT data imported into the Geant4 Simulations.

The presentation will showcase recent outcomes from the mentioned project, featuring initial results from the basic simulation and insights into the corresponding neural network utilized for dose prediction.

ST 4.3 Wed 10:00 PC 203

Entwicklung und Überprüfung eines Ensemble Learning basierten Entscheidungsunterstützungssystems. — •Jonathan Berthold, Carlos Brandl, Anna Nitschke, Jannis Demel und Matthias Weidemüller — Physikalisches Institut, Universität Heidelberg, Heidelberg, Deutschland

Die Durchführung vermeidbarer invasiver Eingriffe, wie beispielsweise einer Biopsie, stellt eine unnötige Belastung sowohl für Kliniken als auch für Patienten dar. Eine auf Machine Learning basierende Entscheidungsunterstützung bietet einen vielversprechenden Ansatz zur präziseren Diagnosestellung und zur Reduzierung unnötiger Eingriffe. Für die spezifische Entscheidung zur Durchführung einer Biopsie bei einem Verdacht auf ein malignes Prostatakarzinom haben wir ein Entscheidungsunterstützungssystem entwickelt. Es basiert auf Ensemble-Learning und bietet Ärzten Interpretationsmöglichkeiten für die Vorhersagen. In diesem Vortrag wird eine Untersuchung vorgestellt, die den Einfluss des Systems auf ärztliche Entscheidungen überprüft. Diese Untersuchung wurde unter Mitwirkung von zwei Urologen des Universitätsklinikums Heidelberg durchgeführt.

ST 4.4 Wed 10:15 PC 203

Prediction of Chronic Disease for improved screening on large scale population Data — •Carlos Brandl, Anna Nitschke, Jonathan Berthold, Jannis Demel, Carola Behr, and Matthias Weidemüller — Physikalisches Institut, Universität Heidelberg, Deutschland

Chronic Diseases threaten a lot of individuals worldwide and are a major cause of mortality. Early detection by Screening is effective in reducing severity and improving the quality of life. However, early screening is often not accepted or even available to the individual, the latter being a big problem in developing countries. To overcome this, we are developing a prediction system using Machine Learning and Network-based approaches on different granularities of large-scale population data in India. The first results have been obtained based on a large publicly available dataset ranging from socio-economical data to behavioural to biological factors. Ultimately our goal is to allow public health professionals to identify population groups at risk and improve their access to screening capacities.