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Medical imaging data analysis using 3D deep learning models towards improving the individual treatment plans

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TEAM NET Project "A reconfigurable detector for measuring the spatial distribution of radiation dose for applications in the preparation of individual patient treatment plans"is being supported by Machine Learning (ML) techniques in building a reconfigurable three-dimensional (3D) detector for rapid and precise measurement of the radiation 3D dose distribution and improving individual treatment plans. Individual treatment plans are currently being prepared using tools based on analytical methods, which generates uncertainties. The project idea is to use a high-quality GEANT engine and Monte Carlo techniques for simulations. The key point is to deliver the proper geometry for the three-dimensional detector. In our case, it is in the form of a 3D Computed Tomography (CT) scan of the human body with precise delineation of the area of affection.
Medical image segmentation refers to the process of extracting the desired object from a medical image which can be done manually or automatically. The presentation will describe the current stage and future plans of the process of building the fully-automatic segmentation tool based on the most advanced Machine Learning models that is able to distinguish between the affected area and surrounding healthy organs inside the patient's body on the basis of 3D CT scan images. Working with specific medical data formats for this purpose requires designing a special preprocessing pipeline. Three-dimensionality requires high computational power and GPU's support in the process of ML models training. This is the reason for using dedicated platforms such as MONAI and NVIDIA CLARA, that apart from increasing the training performance with domain-specific GPU optimization also provides state of the art pre-trained ML models and more modern powerful techniques. The output of the automatic segmentation after transforming it into the standard formats is the input of simulation which is the crucial part of the measurement process.

Collaboration

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