Multi-class Brain Tumor Segmentation via 3D and 2D neural networks**Sergey Pnev, Bair Tuchinov**

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Brain tumor segmentation is an important and time-consuming part of diagnosis. Multi-class segmentation of different tumor types is a challenging task because of differences in shape, size, location, and distinctions in scanner parameters. It is known that even an experienced radiologist can make a mistake in 10-15% of cases.

Many 2D and 3D convolutional neural network architectures have been proposed to solve this problem, and they have achieved significant success. The 2D approach is known to be faster and there are many more datasets with 2D data. In contrast, 3D models. Using computationally-costly 3D operations allows the model to account for context along the z-axis and learn 3-dimensional features. This simultaneously improves the quality of segmentation, increases the learning time, and decreases the speed of operation. In this paper, we decided to compare 2D and 3D approaches on 2 datasets with MRI images: from the BraTS2020 competition and our private Siberian Brain Tumor Image Segmentation dataset.

In each dataset, the image is represented as 4 sequences T1, T1C, T2, T2-FLAIR, and a specialist-labeled mask. The data differ in dimensionality, class set, and tumor type. Comparisons were made based on the Dice Index. We performed an analysis of which cases and why they caused difficulties for the models. Final improvements on the test part of both datasets are in the range of 3–5% on the five-fold trained model according to the Dice metric. The results suggest interesting conclusions and will allow us to get a little closer to making a diagnosis with AI.

Keywords: Medical imaging, Deep learning, Segmentation, Brain, MRI.

Biography:

Graduated from the Faculty of Mechanics and Mathematics, NSU, majoring in Applied Mathematics and Computer Science in 2020. Did bachelor thesis on Unet modifications for solving the problem of acute stroke segmentation. He is currently enrolled in the master's program Big Data Analytics and AI at NSU MMF. Also working on solving brain tumor segmentation problems in the Laboratory of Streaming Data Analysis and Machine Learning at NSU.