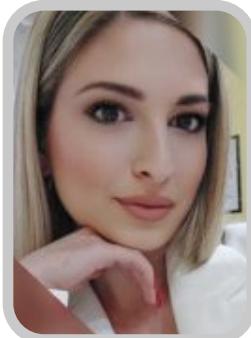**3rd** International Conference on
Neurology & Neurological Disorders

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&
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Optimizing 3D U-Net for Multi-Class brain segmentation in MRI data

Abstract:

Accurate multi-class brain segmentation from MRI data is essential for quantitative analysis in neuroscience, clinical diagnosis, and treatment planning. In this study, we present an optimized 3D U-Net architecture tailored for the segmentation of multiple brain tissue classes, including gray matter, white matter, and cerebrospinal fluid. The proposed model integrates advanced preprocessing techniques, data augmentation strategies, and architectural modifications aimed at enhancing both spatial precision and generalization capability across diverse MRI scans.

We trained and evaluated the model using a publicly available brain MRI dataset with expert annotations. The optimized 3D U-Net achieved high segmentation accuracy, measured by Dice similarity coefficient and Hausdorff distance, outperforming baseline methods and standard 3D U-Net configurations. Key improvements include deeper encoder-decoder paths, enhanced skip connections, and the use of regularization techniques to mitigate overfitting.

This work demonstrates the potential of tailored 3D convolutional neural networks for reliable and efficient multi-class brain segmentation, paving the way for their integration into neuroimaging analysis pipelines and real-world clinical settings. Future research will explore the extension of the model to multi-modal MRI data and additional pathological classes.

Biography

Milena P. Zivkovic, born on September 1, 1995, in Kragujevac, Serbia, is a highly accomplished academic excelling in physics and radiation science. Graduating with an exceptional 9.49 GPA during her undergraduate studies, she was consistently recognized as the top-performing student at the Faculty of Sciences and Mathematics for four consecutive years. Currently pursuing postgraduate studies specializing in physics, Milena maintains an impressive 9.67 average grade. Her dedication to advancing the field is evident through her extensive publication record and active involvement in research projects, including a Ministry of Education-funded project on

"Experimental and Theoretical Research in Radiation Physics and Radioecology." Additionally, Milena serves as an editor for the journal "Imaging and Radiation Research" and contributes as a reviewer for "Radiation Science and Technology." As one of the authors of the monograph "Application of Monte Carlo programs and phantoms in Dosimetry", she showcases her expertise in dosimetry, further solidifying her reputation as a prominent figure in physics and radiation science.

Biography

Dubravka Zivkovic graduated in Psychology from the University of Kragujevac (2023/24) with top honors, specializing in clinical psychology. She is pursuing a Master's in Social Psychology at the University of Niš while interning at an elementary school through the "Talents in the Public Sector" program. She has presented research on AI and mental health at national and international conferences and led workshops promoting communication and emotional awareness. A volunteer with NURDOR and Srce Center, she supports children in crisis and holds UNICEF certification in Mental Health Support. Her interests span clinical, forensic, and social psychology, with extensive experience working with youth.