

Quantitative Determination of Vertebral Material Parameters in Magnetic Resonance Imaging Using Deep Learning and Tissue-Equivalent Phantom

Kristian Stojšić

Doctoral research focuses on developing a novel framework for quantitative characterization of vertebral tissue from magnetic resonance imaging (MRI) data using deep learning and physically interpretable material parameters. Existing MRI-based approaches, such as the vertebral bone quality (VBQ) score, rely on empirical signal intensity relationships and do not directly estimate physical properties.

The aim of the investigation is to develop a deep learning model capable of estimating relative electron density (RED), effective atomic number (Z_{eff}), and a composite vertebral material descriptor from multiparametric MRI measurements. Neural network training will be performed using an in-house developed tissue-equivalent phantom with known physical properties and DIXON VIBE MRI sequences enabling water-fat signal separation. The expected outcome is a quantitative MRI framework for robust estimation of vertebral material properties with improved physical interpretability and reproducibility.