

Motion Artifact Removal in MRI Using U-NET Neural Network

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Magnetic Resonance Imaging (MRI) is one of the most useful tools available today for medical diagnosis. One major drawback of MRI is that due to their relatively long scan acquisition time they are very sensitive to in-scanner patient movements. These movements could result in motion artifacts in the final scan. These artifacts primarily manifest in two forms: blurring or smearing, resulting in an unfocused appearance on the scan, and ghosting, which introduces extraneous elements and compromises important structural components within the scan. Both these artifacts could lead to a significant degradation in the quality of the MRI. This could affect the overall accuracy of the clinical diagnosis as well as making automated diagnosis challenging. In this paper, we propose a U-NET type neural network architecture that requires less computational resources to train and is able to remove motion artifacts from head MRI to improve the accuracy of the images. The model was trained to minimize the Mean Squared Error. One of the main bottlenecks faced in this research is the scarcity of task-specific datasets. Hence, to ensure robust training, accurately simulated motion artifacts were introduced into the non-corrupted MR-ART dataset to generate training pairs. Subsequently, the model's efficacy was tested using clinically captured MRIs with motions. Motion corrected MRIs were rated by medical professionals for the quality of the output. The assessment conducted by professionals demonstrated that the model is effective in accurately removing motion artifacts.

Keywords: MRI, Motion Artifact Removal, U-NET, Motion Artifact Simulation, Clinical Validation