Master thesis proposal

Title: Motion-related artifacts reduction in MRI based on deep learning

Krzysztof Brzostowski

Wroclaw University of Science and Technology

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Description

Magnetic resonance imaging (MRI) is one of the most frequently used imaging modality to diagnose different parts of the human body such as the brain, heart, or liver. In the MRI examination, the patients receive instructions to reduce the motions of the body parts to be examined. Cooperation between patients during examination has an impact on the quality of the magnetic resonance images and the subsequent diagnosis made by the radiologist. Unfortunately, in some cases reduction of the patient's motions is not possible, which leads to motion-related artifacts in MRI scans [1].

Recently, deep learning techniques have been developed in different medical imaging problems. One of them is the problem of reducing motion-related artifacts in MRI scans. The most popular methods used in these problems are convolution neural networks, generative adversarial networks, modified U-net [2-4].

The objectives of the work

1. Research on capabilities of different DL models such as VGG, Res-Net, Dense-Net etc. to reduce motion-related artifacts in MRI scans.
2. The proposal of novel algorithm to reduce motion-related artifacts in MRI based on deep learning techniques.
3. Performance analysis of the proposed algorithm.

References

[1] Krupa, K., & Bekiesińska-Figatowska, M. (2015). Artifacts in magnetic resonance imaging. *Polish journal of radiology*, *80*, 93.

[2] Al-Masni, M. A., Lee, S., Yi, J., Kim, S., Gho, S. M., Choi, Y. H., & Kim, D. H. (2022). Stacked U-Nets with self-assisted priors toward robust correction of rigid motion artifact in brain MRI. *NeuroImage*, *259*, 119411.

[3] Chang, Y., Li, Z., Saju, G., Mao, H., & Liu, T. (2023). Deep learning-based rigid motion correction for magnetic resonance imaging: a survey. *Meta-Radiology*, 100001.

[4] Usui, K., Muro, I., Shibukawa, S., Goto, M., Ogawa, K., Sakano, Y., ... & Daida, H. (2023). Evaluation of motion artefact reduction depending on the artefacts’ directions in head MRI using conditional generative adversarial networks. *Scientific Reports*, *13*(1), 8526.

Datasets to be used

[1] <https://openneuro.org/datasets/ds004173/versions/1.0.2>

[2] <https://brain-development.org/ixi-dataset/> to be used together with [https://github.com/antecessor/MRI\_Motion\_Classification/tree/master/Utils/MotionUtils](https://github.com/bduffy0/motion-correction).