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AI based image enhancement for reduced radiation exposure in CT imaging

Previously, several authors demonstrated that algorithms based on deep neural networks can be used for the enhancement of low-quality medical images [1–4]. The authors proposed certain types of network architectures that can be trained for the reduction of image artifacts and noise in low-dose CT images. For the patient, this means a lower exposure to ionizing radiation, while maintaining the same diagnostic significance of the CT image.

However, algorithms like this carry a certain risk. The enhancement of the image quality with the help of AI based algorithms could suggest a high image quality to the doctor, despite a potential loss of important anatomical detail during the optimization process [5]. To ensure safe diagnostics for the patient, it is essential to explore the limits of such algorithms and to define the necessary requirements.

In this project, the suitability of AI based algorithms (in particular deep neural networks) for image optimization in CT imaging will be investigated. Special attention will be paid on the development of test criteria aimed on assessment of robustness of such algorithms can be used later to increase the confidence in such algorithms and thus accelerate the broad application of AI driven algorithms in hospitals.

The first objective is to identify high-risk algorithms for image enhancement literature and to establish a database of test-cases. As a second objective, the identified algorithms will be implemented and trained on publicly available patient data. The limitations of the algorithms will be examined by application of objective measures for image quality like observer models [6].

Ultimately, the final objective is to derive criteria reflecting the robustness of the implemented algorithms.

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