University of Basel
Department of
Biomedical Engineering

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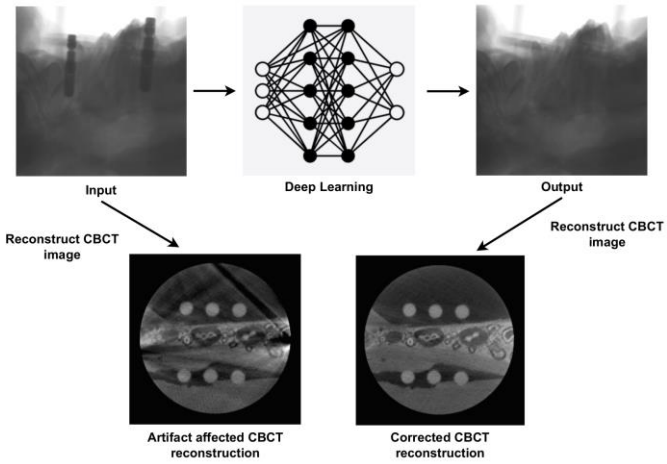
Master of Science – Biomedical Engineering
Thesis Proposal

Development of a Deep Learning Model for Artifact Reduction in CBCT Images



Cone-beam computed tomography (CBCT) is a commonly used and important 3D imaging modality. This imaging method is capable of producing high-quality images and providing minimal radiation exposures. However, CBCT is susceptible to the occurrence of artifacts arising from metallic and ceramic objects such as dental implants and endodontic filling. These imperfections in the reconstructed images deteriorate the image quality and may negatively affect some diagnostic tasks.
There exist already several classical and deep-learning based metal artifact reduction approaches, operating both in the projection and image domain. In this master's thesis, the objective is to mitigate artifacts arising from dental implants through the training of a deep learning model. Specifically, the aim is to perform image-to-image translations from projection images containing implants to projection images without implants, as shown in the Figure. Using the corrected projections, we want to reconstruct the 3D CBCT images, resulting in images with reduced artifacts. In addition, a metal reconstruction approach should be performed to restore metal areas in the image domain. We aim to quantitatively analyze the corrected reconstructed images by comparing with the reconstructed control images without implants.
The University Center of Dental Medicine Basel (UZB) has provided us with a dataset comprising CBCT projections from 5 pig jaws. Each jaw was scanned several times with different implant conditions, ranging from 1 to 3 implants, or no implants. Additionally, there are three different implant materials and two different field of views included in the dataset. The projections were acquired using four different scanner units, resulting in a total of 400 projection series obtained through a 360° rotation around the jaws.

Nature of the Thesis
Programming: 80%, Documentation: 20%

Specific Requirements
Programming skills in Python

Group Leader / Supervisor
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