Neural networks for detection of visual faults in Dental X-ray images

The machine learning and artificial intelligence revolution is moving forward faster than ever. The healthcare is not untouched from it. The latest machine learning advancements have potential to redesign healthcare completely. Being a customer service engineer for healthcare machines previously in India, Harshit, currently a master's student at School of Science, Aalto University, passionately dreams about a world where healthcare is accessible to everyone with the lowest possible time and cost.

CBCT machines (Dental X-rays) have been a widely used tool for several dental applications such as implant planning, endodontics, maxillofacial, surgery and orthodontics. Dental X-ray systems go through thorough quality assurance protocols following their production and assembly. The protocols include tests which address image quality and find certain errors or artefacts that may be present in the images.

Detecting faults from the images needs human effort, experience and time. Recent advancements in deep learning algorithms have proven to be successful in image classification, object detection, machine translation etc. The applications of deep learning can be extended to fault detection in X-ray systems. This thesis work consists of surveying, applying and developing state of art deep learning approaches for detection of visual faults or artifacts from dental X-ray systems.

Harshit did his master’s thesis at Planmeca Oy, Helsinki, Finland. Two types of artifacts were studied in this work: Geometry and Collimation artifacts. The training data was acquired on CBCT systems at Planmeca's R&D facility. Deep convolutional neural networks were applied for detecting the artifacts automatically. The trained model was able to detect the artifacts in milliseconds of time with justified accuracy.

Detecting faults with machine learning can be helpful for assisting the quality checks as well as monitoring of the image quality during the usage at customer sites. It can help in prognosis and preventive maintenance of the system which will enhance the overall customer satisfaction.

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