BABEȘ BOLYAI UNIVERSITY, CLUJ NAPOCA, ROMÂNIA
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Medical Imaging for Dentistry Using Segmentation and Detection Deep Learning techniques

Student
Jurjiu-Țandrău Darius-Ștefan

Supervisour Professor
Laura Dioșan

2023-2024

The problem being tackled here is reliable and fast segmentation of dental images. Progress in this area can lead to an increased quality of life for countless people by providing automated screenings, as well as assistance to practitioners. Such automation could be useful for reducing net costs per diagnostic: having a panoramic X-ray is all that is needed for such a screening, with no input from the doctor required. The techniques presented in this work can provide a foundation for such endeavors.

The approach is based on deep learning, which has shown significant improvements compared to other methods in the past years. Particularly, this project aims to tweak some existing approaches for the given problems : (Kamnitsas, et al., 2017), (Qin, et al., 2020), (Weber, et al., 2021). It also aims to provide novel approaches towards overcoming challenges, especially in the tooth measurement department, such as merging of separate teeth.

Contributions

The research presented in this project advances the theory, design, and implementation of several particular models. The main contribution of this report is to present an intelligent algorithm for solving the problem of dental imaging. The investigated approaches range from U-NET and classical YOLO to Meta's new Segment Anything Model and oriented bounding box predictions. The second contribution of this report consists of building an intelligent system where medical practitioners as well as patients can have seamless access to these imaging techniques. The system is also meant to encourage the usage of the developed models by integrating them in an intuitive and simple interface meant to digitalize the treatment process.

The present work is structured into five chapters as follows:

The first chapter is introductory, presenting general information and motivation.

The second chapter formulates the scientific problem.

The third chapter presents the current state of the art and work related to this topic.

The fourth chapter presents the particular approaches being investigated in this work.

The fifth chapter presents the application that integrates the developed intelligent algorithms.