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Teeth Disease Detection using Deep Learning

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ABSTRACT

Dentists use the panoramic dental X-ray images as a crucial diagnostic tool to identify symptoms early on and create effective treatment strategies. Deep learning techniques have been used in recent years to segment teeth in dental X-rays, helping dentists make clinical choices. The region-of-interest (ROI), which should be the maxillofacial region, must be extracted from the original images because they are filled with a lot of unnecessary information. However, due to the poor image quality, a quick and precise maxillofacial segmentation without hand-crafted features is difficult. In order to address this issue, we generate a sizable maxillofacial dataset and suggest an effective encoder-decoder network model called EED-Net. This dataset includes 2602 panoramic image

Keywords: CNN; Medical Imaging; Image Processing; Machine Learning; Dental Informatics; X-Ray Images; Semantic Segmentation.

I. Introduction

For clinical diagnosis, treatment, and surgery in dentistry, dental radiographs are frequently employedby using these images, dentists can identify cavities, bone loss, and hidden dental structures that are difficult or impossible to see with the naked eye. As a result, dentists are able to identify problems at an early stage and create effective treatment strategies. The upper and lower teeth are partially visible on the bitewing X-rays, which are used to look for changes in bone density brought on by gum disease

While the bitewing and periapical X-rays focus on the details of individual teeth or parts of teeth, thepanoramic X-rays capture the entire mouth area,including all the teeth, gums, jaws, and bone structure to provide more diagnostic evidence. The entire teeth are visible on the periapical X-rays, which are used to assess the surrounding bone structures and root areas in the upper or lower jaw..

II. Related Work

In the field of dental informatics there are several approaches developed for teeth segmentation victimization differing types of radiographic images equivalent to bite wing, periapical and panoramic images. segmentation strategies applied in dental imaging. The author planned a way for teeth instance segmentation in panoramic images employing a mask region-based convolution neural network to accomplish instance segmentation. Once victimization Resnet-101 to extract features, a feature pyramid network (FPN) is made wherever anchors are outlined, and region of interest are extracted. The FPN and therefore the anchors kind the region proposal network (RPN). Once this step, the regions of interest are aligned in order to own a similar size. Furthermore, every feature is assessed as a tooth or background, then it's localized by the bounding box coordinates. Finally, within the last step the tooth is segmented, and a bounding box is drawn around it. The downside of this methodology is that it focuses solely on the detection of teeth feat, aside different varieties of issues equivalent to dentures and regions wherever teeth are missing.

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III. Methodology

Teeth detection Teeth detection method uses the state-of-the-art Faster R-CNN model. 15 Faster R-CNN was evolved from Fast R-CNN architecture, which was, in turn, based on R-CNN method (Region-based CNN). The chal- lenging task of object detection is to define the regions of interest where the objects can be located.

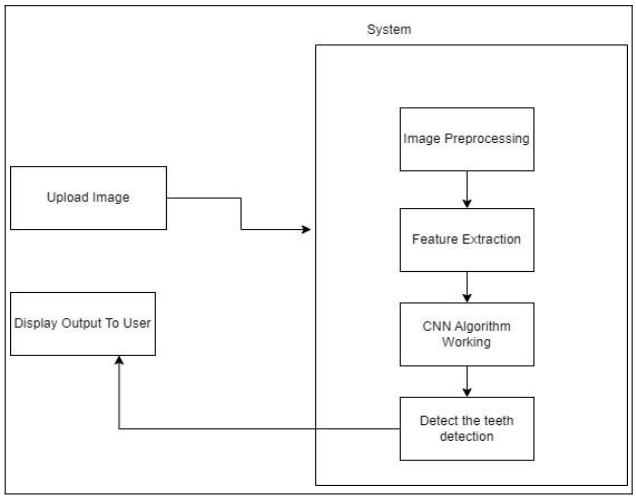

Fig. 1: Proposed Method

Convolutional Neural Network is used for classification of the disease. Convolutional Neural Network is basically made up of neurons with weights and bias, that are inspired by the human brain. Architecture of CNN consists of an input layer, hidden layer and output layer. Convolution layers and batch normalization layers form the hidden layer. The output layer is usually fully connected layer followed by softmax and classification layer.

IV. Literature survey

In paper [1] requirements for neural network architecture is also very important in this research, so we changed the CNN architecture and the parameters of the test set many times to achieve optimal performance. The preliminary results showed the highest detection accuracy rate of the four categories were normal teeth at 87%, implants and fillings at 98% and cavities at 89%. We were able to achieve an average accuracy at 93.04%. Thus we believed that this result could apply in periodontology dentistry field in the near future.

In paper [2], we expound the application of Mask RCNN on automatic tooth detection and segmentation. Mask RCNN is a recently proposed surprising algorithm for object detection and semantic segmentation. This paper aims at detecting and segmenting tooth only. We show that Mask RCNN also has a good segmentation effect in complex and crowded teeth structures. We use the pixel accuracy (PA) to evaluate the result.

In paper [3] work aims at creating an economical, multimodal, personal oral sensing device that automatically senses and categorizes the data which will assist the clinician in early diagnosis and effective treatment. Our proposed smart electronic device automatically captures valuable parameters like pH, temperature, CO2 and other gases to overcome the challenges in the diagnosis of the oral problem. The captured data is fed to Convolutional Neural Network for classification of oral diseases.

V. Future Scope

we aim to improve the running time of the proposed solutionusing hardware acceleration methods. Furthermore, we would like to increase the accuracy of the proposed solution and include more semantic classes. Each tooth or group of teeth, depending on the scenario, are numbered and a report containing the dental problems for each instance is generated aiding the medical staff in the diagnosis process

VI. Conclusion

This work assists in detecting oral diseases. So, it is possible to reduce deaths caused by Oral cancer, by detecting it in early stage. This study described a brand-new method for classifying dental issues and detecting teeth using panoramic dental radiographies. Images from three different

dental clinics were gathered in order to get the desired results, and they were then annotated at the pixel level to highlight 14 various dental issues. Multiple techniques were used to enrich the annotated data, and these images were then used to train a semantic segmentation CNN. After that, a two-step labelling technique was used to recognise each instance of a tooth on the semantic segmentation image after it had been binarized using several thresholds. Following the determination of the bounding boxes for each instance, the portions left behind after the semantic segmentation image was inconsistent are removed using a refinement process. Each instance's bounding boxes are projected onto the semantic segmentation.

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