

Precise Identification of Oral Cancer Lesions Using Artificial Intelligence

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Abstract. Dentists, especially those who are not oral lesion specialists and live in rural areas, need an artificial intelligence (AI) system for accurately assisting them in screening for oral cancer that may appear in smartphone images. Not many literatures present a viable model that addresses the needs, especially in the context of oral lesion segmentation in smartphone images. This study demonstrates the use of a deep learning-based AI for simultaneously identifying types of oral cancer lesions as well as precisely outlining the boundary of the lesions in the images for the first time. The lesions of interest were oral potentially malignant disorders (OPMDs) and oral squamous cell carcinoma (OSCC) lesions. The model could successfully (1) detect if the images contained the oral lesions, (2) determine types of the lesions, and (3) precisely outline the boundary of the lesions. With future success of our project, patients will be diagnosed and treated early before the pre-cancer lesions can progress into deadly cancerous ones.

Keywords. image segmentation, oral lesions, OPMD, OSCC

1. Introduction

Artificial intelligence (AI) technology has demonstrated exceptional usefulness in the early detection of oral potentially malignant disorders (OPMDs) and oral squamous cell carcinoma (OSCC) lesions in oral images [1]. However, in the context of oral lesion analysis in the smartphone image dataset, most of the literature revolves around classification problems. There are only a few studies that demonstrated the usability of AI in segmentation problems [2]. In this work, we present that a deep learning artificial intelligence can be used to simultaneously perform lesion classification as well as to precisely outline lesions at the pixel level.

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2. Methods

In this study, we demonstrate the use of DeepLab v3+ with ResNet-50 network for segmenting oral lesions in photographic images. This architecture has been shown to outperform other models in many other medical image data types [3]. We had 2591 images which consist of normal, OPMD, and OSCC lesions. The study was ethically approved by the CMU Faculty of Dentistry (No. 65/2566).

3. Results

The model precisely identified types and locations of the oral lesions (if any). Figure 1 shows that the model was suitable for aiding clinicians to determine if the oral tissues were normal or not, and if the lesion was OPMD or OSCC. Moreover, the model could precisely outline the boundary of the lesion. The mean accuracy was 87.57%.

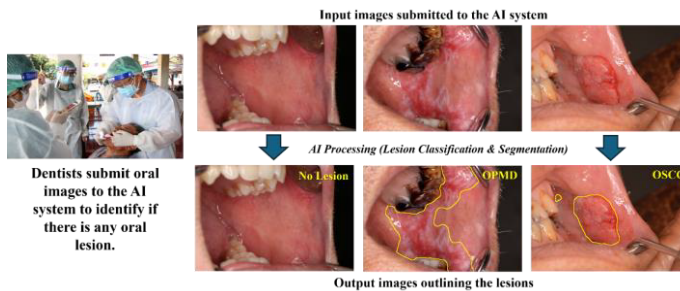


Figure 1. The model was suitable for helping dentists as it can precisely outline oral lesions in our dataset.

4. Conclusion

Currently, there are only a few AI publications that can effectively segment the lesions in smartphone images. This is largely due to the limited number of publicly available oral images [4]. High variations in the image quality and non-standard anatomical views can also affect AI performance. Based on our preliminary results, we believe that the proposed model along with the developing digital platform will be beneficial for dentists, especially those living in rural areas that are far away from the specialists. With future success of our project, patients will be diagnosed and treated early before the pre-cancer lesions can progress into deadly cancerous ones.

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