Visual Diagnostic of Dental Caries Using Deep Learning Model

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Abstract

In the realm of oral health, the pervasive concern of dental caries demands a precise and timely diagnostic approach for effective intervention. Generally, the effect of untreated dental caries extends beyond localized oral health issues, potentially leading to pain, infection, difficulty in eating, and even systemic health problems. Therefore, early diagnosis of dental caries is essential for preventing its progression and minimizing the need for extensive dental treatments. Recognizing the critical importance of accurate detection and classification, this study introduces an innovative strategy at the intersection of dentistry and artificial intelligence. This work aims to propose a solution to address oral health issues including dental caries by using dental imaging approach. This work proposed computer vision approach to identify three classes of dental health conditions namely without cavitation, micro cavitation and cavitation by leveraging the capabilities of deep learning. Methods: This study utilizes a diverse data set comprising a wide spectrum of dental images, capturing various stages and manifestations of caries. A low-cost visual diagnostic algorithm was developed using YOLO model to identify dental caries. Real-time diagnostic capabilities are crucial, especially in settings where prompt intervention is essential. The YOLO system's ability to process entire images swiftly and provide rapid predictions for each region aligns with the urgency required in dental diagnostics. Results: The experimental results demonstrated that the proposed model outperformed previous approaches, achieving higher average precision. Conclusion: This study suggests that the proposed solution is suitable for deployment on limited resources embedded devices. Clinical significance: The proposed model offers accurate, fast, and lightweight dental caries detection model, enabling use on low-cost devices. Its adaptability to other dental conditions highlights its potential for broader clinical application in resource-limited settings.