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Paper Title: The Influence of Integrating Sex as a Feature in Deep Learning-Based Dental Age Estimation using Panoramic Radiographs

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Abstract

Forensic dental age estimation based on dental panoramic radiographs (orthopantomogram, OPG) is commonly used to assess the age of children and young adolescents. Recent advances in deep learning techniques have shown that it is possible to accurately determine the age of individual from these OPG images. Traditionally, sex has been considered a predictive parameter for dental age estimation. Surprisingly, most deep learning studies have not included sex as a feature in their models. This study aims to investigate the impact of including sex as a predictive feature in deep learning models for estimating dental age. Two deep learning-based methods were developed and compared: the first method used only the OPG image as input, while the second method integrated both the OPG image and sex information. Our study used a dataset of 1734 OPG images from the Thai population aged between 8 and 23 years, along with the corresponding chronological age and sex. A pretrained EfficientNet-B0, a convolutional neural network model, was used to estimate dental age. Our results indicate that there was no statistical difference in error between the age groups of 8 to 15 years when comparing the two methods. However, for individuals in the age groups of 15 to 23 years, using both the OPG image and sex information resulted in a statistically lower error compared to the method using only the OPG image. However, the difference in mean absolute error (MAE) was only 11 days, which might be considered clinically insignificant. Our finding suggests that the development of a deep learning-based dental age estimation model could be accomplished with only one OPG image as input without significantly affecting the accuracy.