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Yolov5 Based Detection and Enumeration of Teeth on Bitewing Radiographs

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Objectives To build YOLOv5 based a deep learning model for detection and enumeration of teeth and validation of the diagnostic performance of model
Methods The dataset consisted of 3491 anonymised bitewing radiographs exported in jpeg file format acquired randomly using various intraoral phosphor plates with different sizes and resolutions. Ground truth labeling was performed in CranioCatch annotation software by 2 oral radiologists .Experts were instructed to draw minimum-size boxes around each tooth (including the entire crown and root) and label each box using the FDI two-digit numbering system.All images have been resized to 224x224 pixels. The 3491 anonymized bitewing images were randomized into training, validation, and test sets of 2792, 367, and 332 radiographs respectively. The proposed AI model approach for classifying bitewing radiographs as left or right trained with YOLOv5. Confusion matrix was used to calculate sensitivity, precision, and true positive and false positive/negative values to examine the performance of the algorithm.
Results Sensitivity and Precision were 0.9940 and 1, respectively, for the classifying task. In addition, the predicted F1 score was 0.99970, demonstrating a favorable balance between recall and precision. On the right side, the IDF1 score was 89%, with a confidence of 0.73. The mAP for all classes was high, accurately modeling 90.9% with a 0.5 threshold. On the left side, the IDF1 score was 89% with a confidence level of 0.37. The mAP for all classes was high, accurately modeling 91% detections with 0.5 thresholds.
Conclusions On bitewing radiographs sometimes different areas of the teeth cannot be completely reflected. This situation leads to a reduction in the detection ability of the model. However our study shows that CNN algorithms can be very accurate and effective for detection and teeth enumerations.