



Identification of Mesiodens Using Machine Learning Application in Panoramic Images



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INTRODUCTION

Mesiodens refers to a supernumerary tooth located in the anterior maxilla. Impacted mesiodens has various effects on the succeeding teeth or adjacent permanent teeth. However, clinician with little experience or when many images need to be read in a short time, the detection of mesiodens on panoramic radiographs is often missed.

The aim of this study was to evaluate the use of easily accessible machine learning application to identify mesiodens and to compare the ability to identify mesiodens between trained model and human.

MATERIAL AND METHOD

A total of 1604 panoramic images (805 images with mesiodens, 799 images without mesiodens) of patients aged 5 –7 years were used for this study.

The model used for machine learning was Google's teachable machine(<https://teachablemachine.withgoogle.com>).

Data set 1 was used to train and verify the model. Data set 2 which was not used for model training and validation was separated to compare the ability between the learning model and human group (Residents of pediatric dentistry, Students of dental school)..

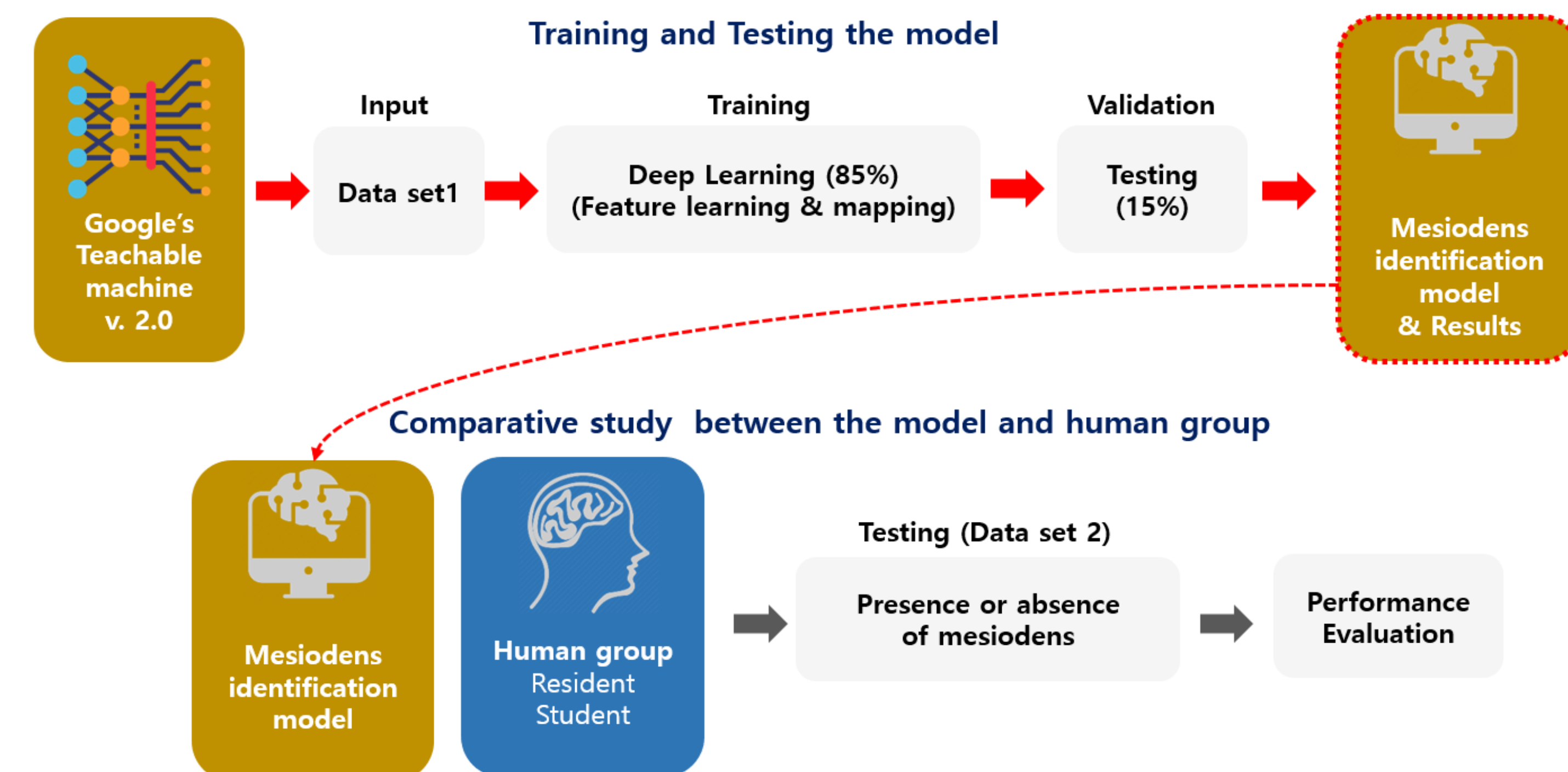


Fig 1. Schematic illustration of the classification of mesiodens.

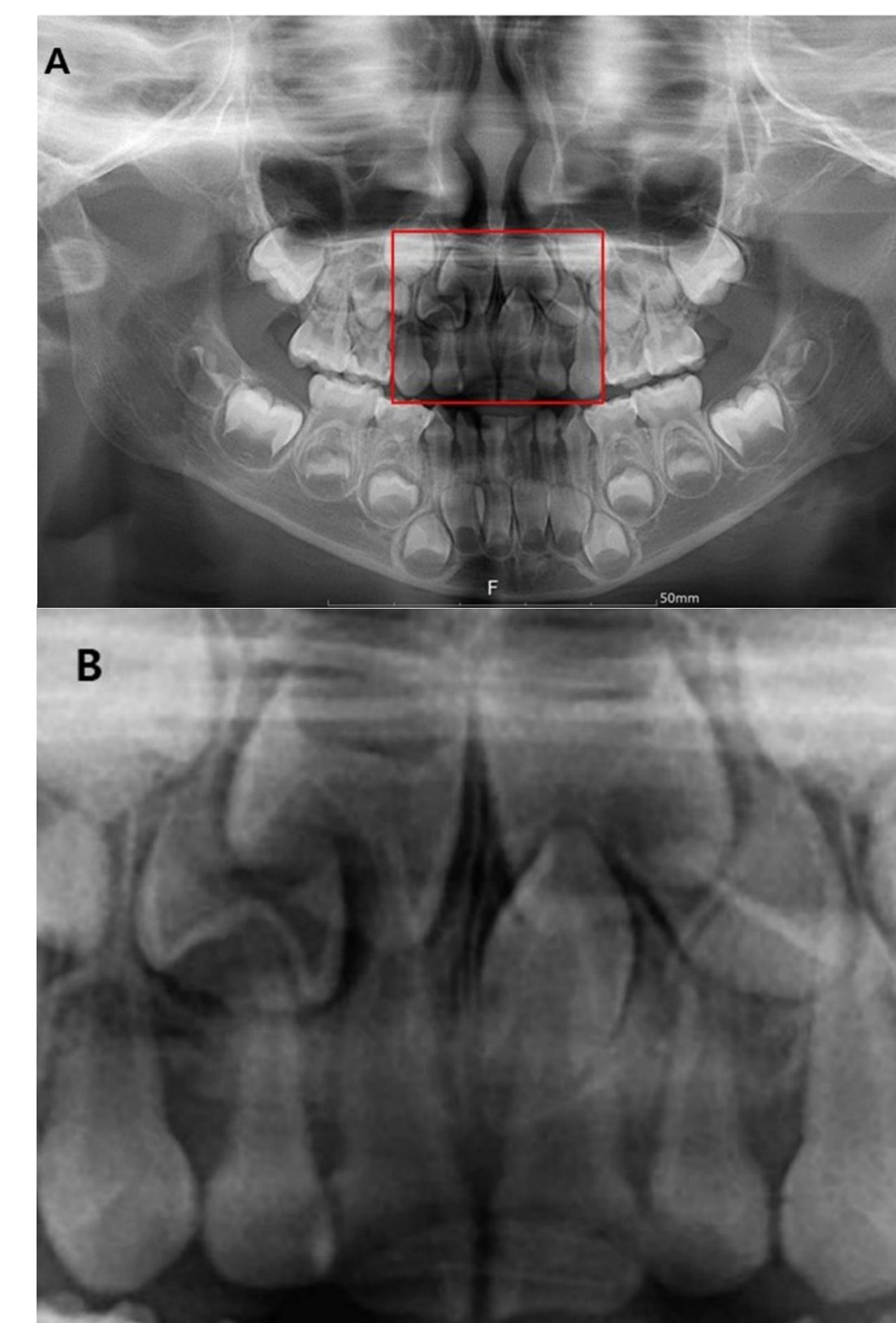


Fig 2.
(A) Panorama image with region of interest.
(B) Cropped image for input data.

RESULTS

1. Classification performance of trained model from data set 1

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Average
Sensitivity	0.84	0.78	0.87	0.86	0.77	0.84	0.82
Specificity	0.76	0.81	0.82	0.86	0.89	0.82	0.82
Accuracy	0.80	0.79	0.84	0.86	0.83	0.83	0.82

Table 1. Performance matrix for the classification of mesiodens from data set 1

2. Comparative classification performance with human group from data set 2

Trained model			Resident group			Student group		
Sensitivity	Specificity	Accuracy	Sensitivity	Specificity	Accuracy	Sensitivity	Specificity	Accuracy
0.87	0.67	0.78	0.85	0.80	0.82	0.65	0.71	0.69

Table 2. Performance matrix for the classification from data set 2 by trained model and human group.

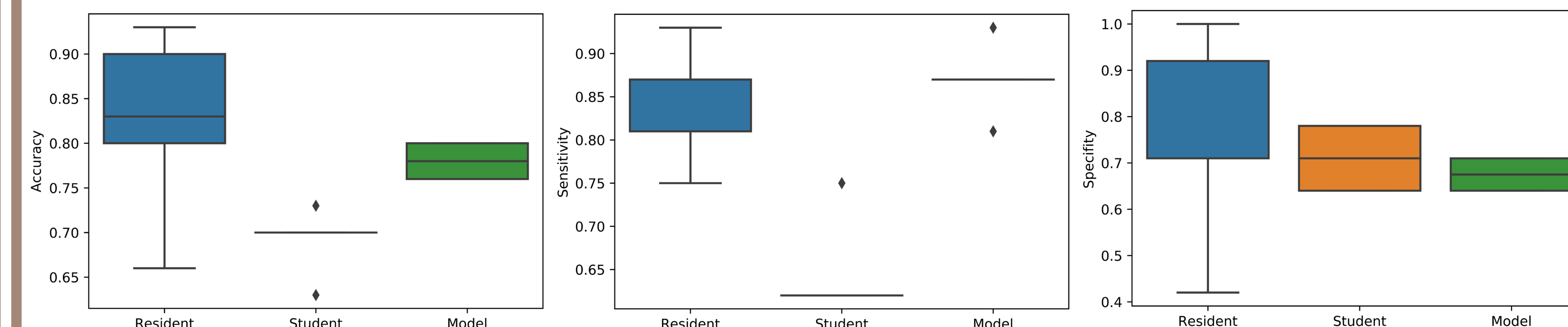


Fig 3. Boxplot among three groups (Resident, Student, Model).

*Kruskal-Wallis test was performed to analyze the statistical significance

CONCLUSIONS

This study developed a model for classifying mesiodens using panoramic radiographs of children in primary and early mixed dentition. The classification accuracy of the model was lower than that of the resident group. However, the classification accuracy (0.78) was higher than that of dental students (0.69), so it could be used to assist the diagnosis of mesiodens for non-expert students or general dentists.