

**ORIGINAL ARTICLE**

**Automated periodontitis diagnosis and staging using an end-to-end deep learning model on panoramic dental radiographs**

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## Supplementary Information (SI)

**Table SI 1.** Mean average precision (mAP) at different Intersection over Union (IoU) thresholds of the segmentation model across tooth types

| <b>IoU</b>                | <b>Incisor</b> | <b>Canine</b> | <b>Premolar</b> | <b>Molar</b> | <b>Total</b> |
|---------------------------|----------------|---------------|-----------------|--------------|--------------|
| 0.50                      | 0.99333        | 0.99291       | 0.99320         | 0.99475      | 0.99355      |
| 0.55                      | 0.99333        | 0.99291       | 0.99320         | 0.99475      | 0.99355      |
| 0.60                      | 0.99333        | 0.98755       | 0.99320         | 0.99475      | 0.99221      |
| 0.65                      | 0.98690        | 0.98755       | 0.99320         | 0.99475      | 0.99060      |
| 0.70                      | 0.97693        | 0.97404       | 0.99320         | 0.99452      | 0.98467      |
| 0.75                      | 0.90827        | 0.93284       | 0.95065         | 0.96391      | 0.93892      |
| 0.80                      | 0.69265        | 0.58728       | 0.70491         | 0.85970      | 0.71114      |
| 0.85                      | 0.17504        | 0.17976       | 0.24146         | 0.56800      | 0.29107      |
| 0.90                      | 0.00886        | 0.00784       | 0.00906         | 0.07505      | 0.02521      |
| 0.95                      | 0.00000        | 0.00000       | 0.00000         | 0.00000      | 0.00000      |
| <b>0.50 – 0.95 (mean)</b> | 0.67286        | 0.66427       | 0.68721         | 0.74402      | 0.69209      |

*IoU Intersection over Union*

## Supplementary Information (SI)

**Table SI 2.** Mean average precision (mAP) at different Intersection over Union (IoU) thresholds of the keypoint detection models across tooth types

| <b>IoU (OKS)</b>          | <b>Incisor</b> | <b>Canine</b> | <b>Premolar</b> | <b>Molar</b> |
|---------------------------|----------------|---------------|-----------------|--------------|
| 0.50                      | 0.96369        | 0.95844       | 0.97639         | 0.95513      |
| 0.55                      | 0.94126        | 0.94298       | 0.94602         | 0.95513      |
| 0.60                      | 0.92696        | 0.93831       | 0.93839         | 0.95513      |
| 0.65                      | 0.92211        | 0.93131       | 0.93268         | 0.95215      |
| 0.70                      | 0.92002        | 0.92919       | 0.92875         | 0.95215      |
| 0.75                      | 0.90650        | 0.92919       | 0.92875         | 0.95052      |
| 0.80                      | 0.89202        | 0.92919       | 0.92574         | 0.94778      |
| 0.85                      | 0.87224        | 0.91363       | 0.91572         | 0.93792      |
| 0.90                      | 0.82715        | 0.91185       | 0.90303         | 0.91289      |
| 0.95                      | 0.72818        | 0.85136       | 0.82573         | 0.81472      |
| <b>0.50 – 0.95 (mean)</b> | 0.89001        | 0.92355       | 0.92212         | 0.93335      |

*OKS* Object Keypoint Similarity

## Supplementary Information (SI)

**Table SI 3.** Performance of keypoint detection models for each periodontitis stage

| Model    | Metric    | Stage I | Stage II | Stage III | Macro   | Micro   | Weighted |
|----------|-----------|---------|----------|-----------|---------|---------|----------|
| Incisor  | Precision | 0.76786 | 0.77812  | 0.80247   | 0.78281 | 0.78112 | 0.78235  |
|          | Recall    | 0.60563 | 0.90141  | 0.58559   | 0.69754 | 0.78112 | 0.78112  |
|          | F1-score  | 0.67717 | 0.83524  | 0.67708   | 0.72983 | 0.78112 | 0.77348  |
| Canine   | Precision | 0.70940 | 0.80672  | 0.50000   | 0.67204 | 0.75630 | 0.75288  |
|          | Recall    | 0.85567 | 0.73846  | 0.09091   | 0.56168 | 0.75630 | 0.75630  |
|          | F1-score  | 0.77570 | 0.77108  | 0.15385   | 0.56688 | 0.75630 | 0.74444  |
| Premolar | Precision | 0.70395 | 0.71636  | 0.73684   | 0.71905 | 0.71300 | 0.71311  |
|          | Recall    | 0.63690 | 0.79757  | 0.45161   | 0.62870 | 0.71300 | 0.71300  |
|          | F1-score  | 0.66875 | 0.75479  | 0.56000   | 0.66118 | 0.71300 | 0.70884  |
| Molar    | Precision | 0.67470 | 0.78175  | 0.79221   | 0.74955 | 0.76214 | 0.76252  |
|          | Recall    | 0.67470 | 0.83122  | 0.66304   | 0.72299 | 0.76214 | 0.76214  |
|          | F1-score  | 0.67470 | 0.80573  | 0.72189   | 0.73411 | 0.76214 | 0.76061  |

## Supplementary Information (SI)

**Table SI 4.** Pearson correlation coefficients (PCCs) for model vs. dentist measurements of radiographic bone loss

| Tooth Type | Dentist 1 | Dentist 2 | Dentist 3 |
|------------|-----------|-----------|-----------|
| Incisor    | 0.878     | 0.857     | 0.898     |
| Canine     | 0.710     | 0.684     | 0.759     |
| Premolar   | 0.853     | 0.801     | 0.865     |
| Molar      | 0.836     | 0.816     | 0.872     |

*95% confidence intervals,  $p < 0.001$*

## Supplementary Information (SI)

**Table SI 5.** Intraclass correlation coefficients (ICCs) for model vs. dentist measurements of radiographic bone loss

| Tooth Type | Dentist 1 | Dentist 2 | Dentist 3 |
|------------|-----------|-----------|-----------|
| Incisor    | 0.871     | 0.849     | 0.894     |
| Canine     | 0.695     | 0.668     | 0.751     |
| Premolar   | 0.843     | 0.788     | 0.858     |
| Molar      | 0.836     | 0.816     | 0.870     |

*95% confidence intervals,  $p < 0.001$*