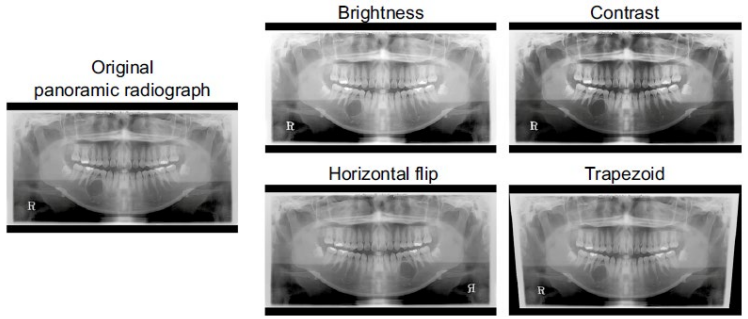
Attention-Guided Jaw Bone Lesion Diagnosis in Panoramic Radiography Using Minimal Labeling Effort

Background and Objective

Medical imaging, particularly panoramic radiography, plays a critical role in the early detection of jaw bone pathologies. This research aims **to provide both clinical convenience and fine-grained classification performance** by guiding model's attention map with a small portion of attention labels and tailored augmentation technique for panoramic radiography data. The proposed method significantly improves the diagnostic performance using only a small amount expert-provided attention labels.

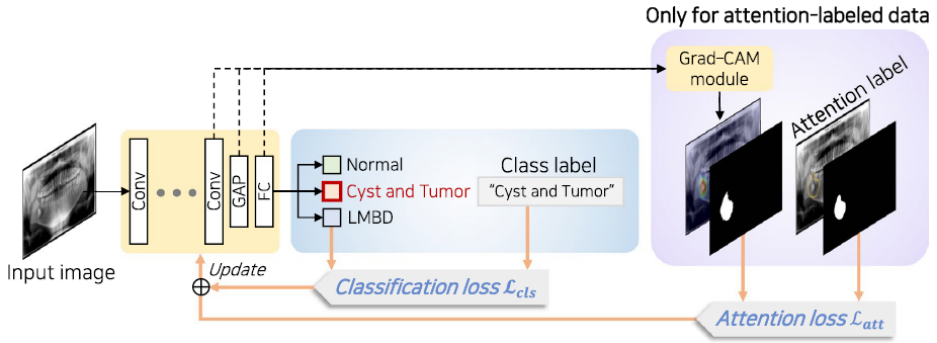
Methods

- Trapezoid augmentation for better generalization across various maxilla-mandible ratios



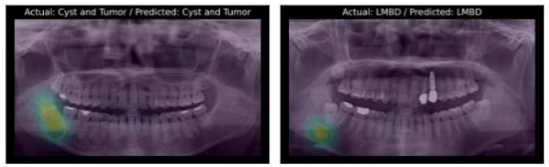
In addition to traditional augmentations centered on brightness adjustments, we employ a horizontal warping strategy to enhance data diversity.

- Attention-guiding loss between attention labels and soft attention masks from activation maps



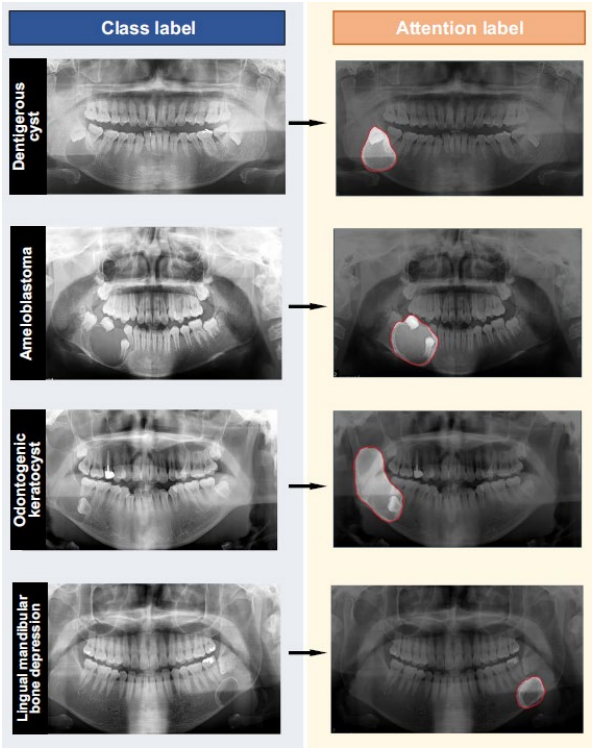
$$\mathcal{L} = \alpha_{cls}\mathcal{L}_{cls} + \alpha_{att}\mathcal{L}_{att},$$

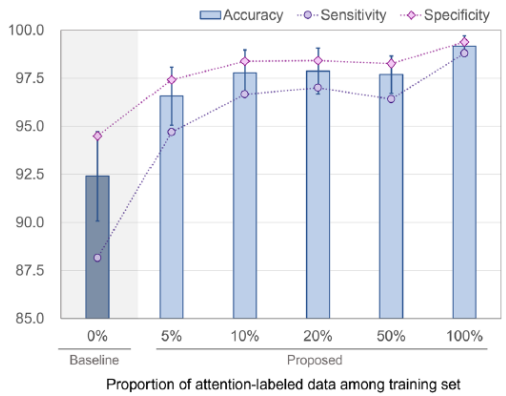
$$\mathcal{L}_{att} = \begin{cases} 1 - \mathrm{IoU}(\tilde{H}, Y), & \text{if } Y \text{ exists} \\ 0, & \text{otherwise} \end{cases}, \quad \tilde{H} = s(\omega(\tilde{H} - \theta J_{m\times n})),$$



Results

1. Improved diagnosis performance (92.41% → 97.50% (+loss) → 99.17% (+aug))
2. Efficient development workflow with minimal data labeling (5-10%)
3. Enhanced clinical interpretation through assistive visualizations





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