

**Title:** Malignant and Non-Malignant Oral Lesions Classification and Diagnosis with Deep Neural Networks

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Oral cancer remains a serious global health challenge, especially in underserved communities with limited access to dental care. Early detection can significantly improve survival rates, but traditional screening often requires specialist examination.

This proof-of-concept study developed and tested a smartphone-compatible AI tool using deep neural networks (EfficientNetV2 and MobileNetV3) to classify oral lesions as non-neoplastic, benign, or premalignant/malignant using 342 pre-collected oral lesion images. The goal was to create an affordable, user-friendly screening tool for high-risk, remote communities.

**Key findings:**

- The models achieved 75–76% overall accuracy.
- They effectively identified premalignant/malignant lesions (80–82% accuracy).
- Accuracy for non-neoplastic lesions was lower (64%), highlighting the need for further refinement.
- The area under the ROC curve (AUC) was 0.88 for both models, indicating strong classification capability.

The study demonstrates AI's potential to support early detection of oral cancer, especially in areas where access to specialists is limited, by enabling remote, smartphone-based screening. While promising, further model improvements are necessary to increase accuracy in classifying non-malignant lesions and to integrate this tool effectively into community health frameworks.

This work reflects a commitment to equity in healthcare, aiming to empower frontline health workers and communities with accessible AI tools for early oral cancer detection, contributing to reducing disparities in health outcomes.

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