A SMARTPHONE AUTOFLUORESCENCE IMAGING PLATFORM AND CLASSIFICATION ALGORITHM FOR THE EARLY DETECTION AND REFERRAL OF ORAL LESIONS IN PRIMARY CARE SETTINGS

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The global burden of oral cancer is high, with over 350,000 cases diagnosed every year [1]. Early detection is crucial, particularly in primary care and dental settings, where patients are likely to first present with early-stage disease. Yet, the five-year survival rate continues to be disproportionately low even though the oral cavity is easily accessible to examination. This is, in part, because visual precursors of oral cancer can be difficult to assess by front line clinicians, such as dentists, mid-level providers, or community health workers. Even in settings with access to specialized equipment, such as commercially available autofluorescence tools like VELscope (LED Apteryx/VELscope, Atlanta GA, USA), examinations are still subject to interpreter variability. In particular, distinguishing between subtle benign and pre-malignant mucosal changes versus malignant mucosal changes can be difficult for non-experts. This may be due to numerous reasons, including a lack of training and that lesions present with non-specific clinical features, which can lead to both overtreatment and undertreatment of patients. Identifying benign and suspicious lesions early must be balanced with appropriate referrals to specialists, especially since it requires patient time, travel, and expenses. Thus, there is a need for a simple and automated tool to aid clinicians in robustly assessing patients for oral cancer and its precursors in a primary care setting. We have developed a mobile Detection of Oral Cancer (mDOC) smartphone platform that integrates image capture with machine learning methods to provide clinicians with a data-driven approach to triage patients in a primary care setting. mDOC captures white light and autofluorescence images of the oral cavity using a custom developed Android application. Data was collected from patients at the UT School of Dentistry and MD Anderson Cancer Center clinics. Expert clinicians provided referral decisions for each anatomic site as the gold standard. The dataset includes over 240 anatomic sites and over 255 white light and autofluorescence image pairs. We leverage machine learning algorithms to determine if the patient needs further evaluation by a specialist (Figure 1). Data was split at a site level into training and validations sets using a 60-40 split. A pretrained mobilenetv3_small model was used to evaluate different image inputs. Preliminary results showed that the model can achieve an AUC > .83 on the validation dataset for the various image inputs tested. The combined white light and autofluorescence image input outperformed using the white light image input alone. Future work involves continued optimization of the algorithm and validation in a test population. mDOC has great potential to bridge the gap in expertise in primary care settings and enable early detection of oral lesions, ultimately improving patient outcomes.

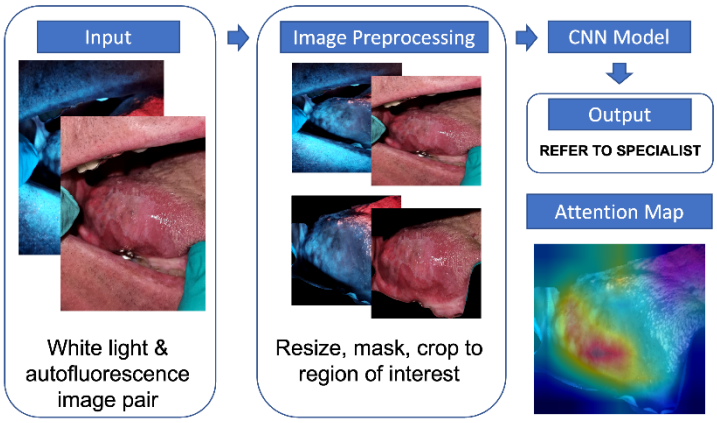

Figure 1 – mDOC algorithm workflow

[1] Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018; 68: 394–424.