Mouthscope: Autonomous Detection of Oral Precancerous Lesions Using Fluorescent-Imaging and Computer-Vision

Mehta, Aditya (School: Dhirubhai Ambani International School)
Kothari, Maanav (School: Dhirubhai Ambani International School)

Oral cancer is highly treatable when diagnosed at an early stage. In rural India, however, 60% of oral cancer cases are diagnosed with advanced stages. Mass screening requires experienced doctors and robust healthcare infrastructure . Our Invention - the Mouthscope -- uses AI to make oral cancer screening more accessible by automating it. We have designed a device that scans the entire oral cavity for potentially cancerous lesions without professional intervention. Mouthscope works on the principle of autofluorescence: it emits low-wavelength light which excites fluorophores in normal mucosa and not cancerous tissues, causing cancerous tissues to have a darker color. The phone camera captures this and sends it to the machine learning model which predicts with 86% accuracy to detect both potentially malignant lesions (erythroplakia and leukoplakia) and cancerous tissue in the form of squamous cell carcinoma. The device contains a long-pass filter, UV LEDs, a microcontroller, a cheek-retractor and a phone holder. Mouthscope uses 2 machine learning models: resnet_v2, a Deep RNN and YOLOv5. The device allows for both real-time self-diagnosis and cloud-based mass screening. To generate a dataset for our machine learning model, we tested it with 24 patients (including 4 cancerous). We found that there was a clear visual distinction between the potentially malignant tissue and normal tissue, with malignant tissue having darker color. Moreover, our AI Models were able to detect this distinction. By using a smartphone and classifying images through machine learning, Mouthscope eliminates the need for extensive infrastructure for mass screening of oral cancer, making it more attainable.

Awards Won:

Second Award of $2,000