HISTOPATHOLOGY

1. **Automated Detection and Classification of Oral Lesions using Deep Learning for Early Detection of Oral Cancer**

In this paper they combined annotations from multiple clinicians using data provided from the first phase of collection. Then they have demonstrated the performances of deep learning-based image classification and deep learning-based object detection frameworks for the use of oral lesion detection and classification for the early detection of oral cancer. The use of deep learning means that complex patterns could be derived for tackling this difficult task. For image classification, ResNet-101 was used to classify the entire image. It is a CNN with a depth of 101 layers. For object detection, the faster R-CNN (with ResNet-101 as the base CNN) was used to locate and classify oral lesions. It focuses on bounding box detection performance. The bounded boxes that were deemed similar according to a criterion based on IOU were combined. Then the bounding boxes were brought together according to a criterion based on simple overlap. If an image contained multiple annotated lesions then that with the highest referral decision severity was used. If no annotated lesions exist, then the image was labelled as ‘no lesion’. The best model was achieved when freezing the layers prior to conv4_1 of ResNet-101 and then fine-tuning the rest of the system with our oral lesion dataset.

LIMITATIONS: Dataset is currently problematic as it’s extremely varied, not just because of the varied disease types, but also the varied presentation of each disease type.

2. **Cascade Correlation Neural Network Model for Classification of Oral Cancer**

In this paper, a Cascade correlation neural network model has been built to overcome the problem of oral cancer classification. Cascade-Correlation begins with a minimal network consisting only of an input and an output layer, then automatically trains and adds new hidden units one by one creating a multi-layer structure. Cascade correlation combines two ideas: first is the cascade architecture and second is the learning algorithm. The architecture is cascading because one hidden unit is added to the network at one point of time and it receives the inputs from all the neurons already in the network. Once the hidden unit is added to the network, it does not change and learning algorithm tries to maximize the magnitude of the correlation between the new neuron's output and the residual error signal of the network.

3. Oral Disease Detection using Neural Network

This paper uses parameters like pH, temperature, CO2 in the diagnosis of oral problems. The captured data is fed to the Convolutional Neural Network. The parameters like pH, temperature, CO2 , and alcohol concentration levels are collected using pH sensor, temperature sensor, CO2 sensor and MQ6 sensor respectively.
The pH value of normal mouth ranges between 6.85 - 6.96. For the diseased subject, the pH value is in the range of 9.11-10.2. The temperature sensor measures the temperature of the mouth. The average normal oral temperature is 31o C and for the person affected by oral disease, the temperature is greater than 31o C. The MQ6 detects the alcohol content of the mouth, it ranges between 360 - 650 ppm. The normal range is 480 - 530 ppm. The abnormal values lie between 360-480 and 530-650. The bacteria in the mouth use the CO2 during the fermentation process and it varies for the healthy and unhealthy person. For the diseased person, it is in the range of 390-470 ppm. The data from the sensors fed to the Arduino UnoR3. The sensor data from the Arduino is sent to the cloud through the WiFi module which forms the dataset. Pre-existing dataset from kaggle is also stored in the cloud to increase dataset variability. Once the dataset is created, it is applied to CNN algorithm for training and testing process. Based on the values in the dataset, CNN classifies it as normal, periodontal and oral cancer.

4. Learn like a Pathologist: Curriculum Learning by Annotator Agreement for Histopathology Image Classification

In this paper, curriculum learning is used to train neural networks for segmentation. Base of the neural network is ResNet-18 with Adam optimizer,50 epochs. The data-set is divided based on the level of difficulty (very easy,easy,hard,very hard). The difficulty criteria is set by annotator agreement.If most annotators are able to classify the image distinctly,then it is classified as very easy, other images are classified as easy,hard and very hard in similar manner. Neural network is trained with this data-set in various stages.This mode of learning has proven to be more efficient than training a neural network with random images.