Deployment of a Scalable Single Shot Detector (SSD) Mobile Architecture for the Localization and Classification of Pneumonia Chest Radiographs

Summary

Summary

Pneumonia emerges as the leading cause of death in children under five years of age worldwide, accounting for more than 1.6 million deaths each year in this age demographic. A combined 18% of these deaths occur in children, and 99% of these complications circulate in low-middle income countries with underserved on-point clinical interventions. Consistent and scalable diagnostic protocols that eliminate problematic human false negatives/positives are essential in preventative clinical and pulmonary treatment measures. The upsurge of Convolution Neural Network (CNN)-driven object detection tasks in the previous ~2-3 years has provided a new field of manipulation for radiographic image feature map detection. This project investigates the potential of a low-latency mobile scaled Single Shot Multibox Detector (SSD) architecture in the localization and classification of Pneumonia-related radiographs. A dataset of ~5000 annotated and de-identified bacterial and viral Pneumonia chest X-Rays were derived from the NIH Clinical Center to deploy a compressed frozen inference model on both a standard Android device and cloud-based web application. Data analysis employed varying confidence thresholds on Receiver Operating Characteristic Curves (ROC), regularized and converged localization-classification loss, and broad total loss values to frame parameters of sensitivity, specificity, and performance on diverse preidentified NIH validation datasets. Following a mini sample size validation of 200 randomized lung radiographs, SSD Mobilenet V1 attained an Area Under the Curve (AUC) of 0.93 with high threshold sensitivity of 94% and a specificity rating of 82% on a standard real-time Android video capture. The SSD model proves applicable in realtime diagnostics.