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

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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.

Awards Won:

U.S. Agency for International Development: USAID Science for Development Second Place Award of $3,000.