A Low-Cost Computer-Aided Lung Auscultation Apparatus and Automated Diagnosis of Respiratory Illnesses

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After losing my grandfather to COPD, I was determined to develop an accessible method for diagnosis of chronic respiratory illnesses. The objective of my project was to design and create a hardware and software solution that involves: (a) development of a low-cost apparatus to obtain respiratory sounds and transmit them to a device (b) subsequent assessment of the patient's respiratory illness, via development of a multi-model machine learning algorithm. The data source used for this project was Kaggle's Respiratory Sound Database, that consisted of 5.5 hours of recordings, with 920 audio samplings of respiratory illnesses, collected by researchers in Portugal and Greece. My first step was data preprocessing using a custom Python script that I wrote in Jupyter Notebook. Create ML was used for training my sound classification models. I then designed my user interface and integrated these machine learning models into an iOS app, using Swift programming in Xcode. Finally, I constructed my hardware prototype and tested my prototype in a triple-phased approach with preliminary review in Create ML, UI and software performance testing in Xcode, and hardware-software integration. The accuracies of my diagnosis, crackling, and wheezing classifiers were well above the anticipated accuracy values set in my goal. This device prototype highlighted the possible implications of ML in assessing respiratory health. This apparatus can be commercialized as an inexpensive, effective method for on-the-spot diagnosis of respiratory illnesses and can have a tremendous impact, especially in remote areas, where access to healthcare is limited. It targets a real-world problem affecting a large population, and may prove useful in assessing lasting lung damage post-pandemic.

Awards Won:
First Award of $5,000