Device for Analysing Coughing Patterns to Diagnose and Monitor Asthmatic Patients

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Asthma is the most prevalent respiratory condition in the world, affecting over 340 million people, and remains one of the common underlying causes of death. Yet, one in three patients are misdiagnosed by their doctor. Asthmatic cough vibrations detected by stethoscopes are often enigmatic to the human ear, seeding imprecisions. To tackle this issue, a small and affordable wearable device was developed which continuously collects the breathing and coughing vibrations exhibited by the patient. The hardware system was built on a custom PCB that integrates all of the device's electrical components into one system, both minimizing the size and increasing the durability of the device. Additionally, a software program which combines two machine learning algorithms and a mobile application was created to analyze the vibrations. A Time Delay Neural Network (TDNN) was trained to find patterns in the spectrogram of respiratory vibrations which in turn diagnoses an asthmatic patient with 88.6% accuracy. A Convolutional Neural Network (CNN) was developed to find sudden abnormalities in the vibrations displayed and warn the user of a possible asthmatic attack with 98.2% accuracy. Furthermore, a mobile application was established to give patients the ability to see and share their results with their doctor while also being warned of any potential asthmatic attacks. These results support that the whole system could be used to diagnose asthmatic patients with far greater accuracy than what is currently achieved and potentially save the lives of tens of thousands of asthmatic patients every year.

Awards Won:
Third Award of $1,000