Diagnosing the Stage of COVID-19 using Machine Learning on Breath Sounds

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With rapidly increasing COVID-19 cases, patients with mild and moderate symptoms are being asked to home-isolate themselves to save hospital resources for more severe patients. Such patients have been asked to self-monitor themselves and seek medical attention if their condition worsens. COVID-19 affects the respiratory system and home-isolated patients must monitor their lung condition continuously before it quickly deteriorates. But this is difficult to monitor by oneself, and the patient may not notice his worsening lung condition before it is too late. A machine-learning based approach is proposed to monitor lung condition by analyzing the breath sounds of a patient for respiratory sounds like wheezes, crackles and tachypnea, which in turn can identify the stage of COVID-19. This model can be integrated with a mobile application to record and analyze breath-sounds. This will enable the patient to admit himself sooner if he is progressing to a more severe stage of COVID-19 or any other lung ailment. Data from a respiratory sound database with recordings from 226 patients was split into 6898 respiratory cycles and pre-processed. Two approaches to evaluating the right machine-learning model for this use-case were experimented with: - The recordings of respiratory cycles were converted to spectrograms to train the model with Transfer Learning in Google Cloud AutoML. This achieved an accuracy of 65%. - Log Mel filter-bank features were extracted from the breath sounds and used to train multiple CNN models to hierarchically classify breath sounds. This ensemble-learning with hierarchical-model approach achieved a higher accuracy of 70.03% for the first-level model and 78.12% for the second-level model.

Awards Won:

Third Award of $1,000

Acoustical Society of America: Honorable Mention