CS-577 Project Proposal: Covid-19 Detection from speech signals

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1 Motivation & Problem Description

Since the outbreak of the SARS-CoV-2 virus, registered Covid-19 cases have exceeded 648M, while the induced deaths have surpassed 6.65M [3]. The Covid-19 pandemic has heavily influenced the world in many ways. Even though the disease has been largely contained, there is still a need for reliably testing and identifying new cases. Features extracted from speech signals (such as natural speech, cough, breathing patterns, etc.) can be utilized by a machine learning architecture for automatically detecting Covid-19. Such a method would be invaluable as a screening tool or a preliminary test since it would be scalable, inexpensive, fast, and accessible to the general public (the final model could be deployed as a web page or an app, like [2]). I will study and try to extend the relevant literature (e.g. [5], [4]).

2 Data

I will work with data containing speech signals from healthy subjects, subjects with respiratory ailments, and Covid-19 patients. I will first focus on the Coswara database [6], containing respiratory sounds (cough, breath, and voice), with samples collected via worldwide crowd-sourcing using a website, but I may also use other datasets. For feature extraction, I plan to use the popular openSMILE feature extraction toolkit [1]

3 Methods

Our analysis will include choosing the feature set to extract (feature sets), a feature selection algorithm (to be determined) and performing analysis and visualization of the data. I will also use some form of cross-validation to tune the hyperparameters of candidate classification models (e.g. Random Forest, SVM, and Gradient Boosting) and select the best configuration. Furthermore, I may apply Bootstrap Bias Correction on the best-performing configuration, in order to correct the optimistically biased cross-validated performance.

References

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[3] *Our World in Data*. `https://ourworldindata.org/explorers/coronavirus-data-explorer`. (10/12/2022).

[4] Björn W Schuller et al. "Covid-19 and computer audition: An overview on what speech & sound analysis could contribute in the sars-cov-2 corona crisis". In: *Frontiers in digital health* (2021), p. 14.

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[6] Neeraj Sharma et al. "Coswara–a database of breathing, cough, and voice sounds for COVID-19 diagnosis". In: *arXiv preprint arXiv:2005.10548* (2020).

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