The Role of Processing Cough Audio to Detect Covid-19

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Abstract

This project aims to examine the role of signal processing in aiding audio classification, specifically detecting Covid-19 in cough audio files. During the pandemic, it took some time before the first accessible covid tests were released, posing a global health issue. If we were to collect data early on and use machine learning in the future, we would potentially be able to deploy these accessible tests at a much faster rate, and at significantly less cost.

This project compares the accuracies of different classification techniques, namely KNN, SVM, and ML, combined with different forms of signal processing on the COUGHVID dataset [1]. The types of processing used are: no processing, DFT, and MFCC. As shown in this project, adding even one layer of signal processing can boost classification accuracy.

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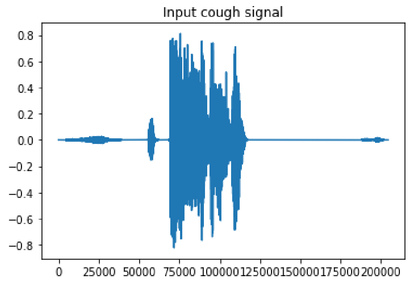
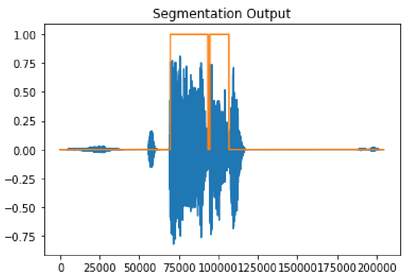
Dataset

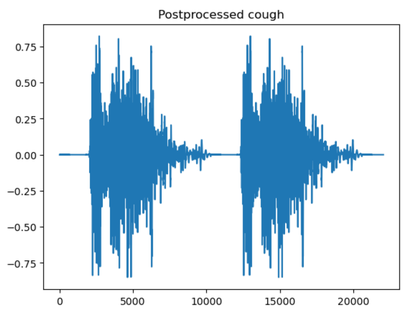
- COUGHVID dataset
- Healthy, (symptomatic,) covid
- Varying lengths, background noise, etc.



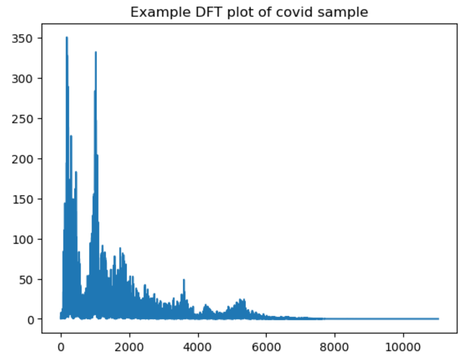
Data Preprocessing

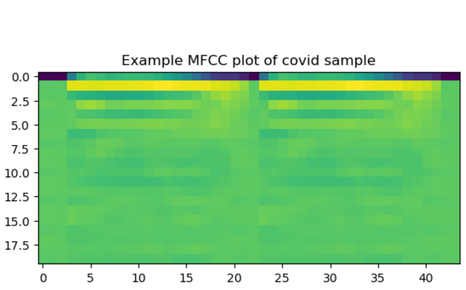
- Sample rate, segmentation , resizing, normalization





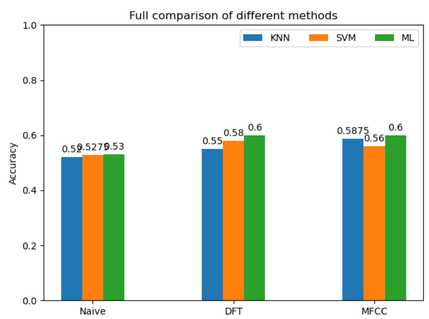
Data Preprocessing (Cont.)





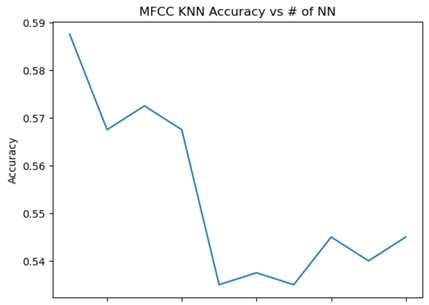
Discussion

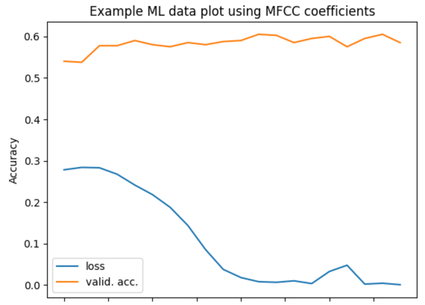
- In general, KNN worst, ML best
- For KNN, 1 neighbor performed best
- For SVM, depended on method

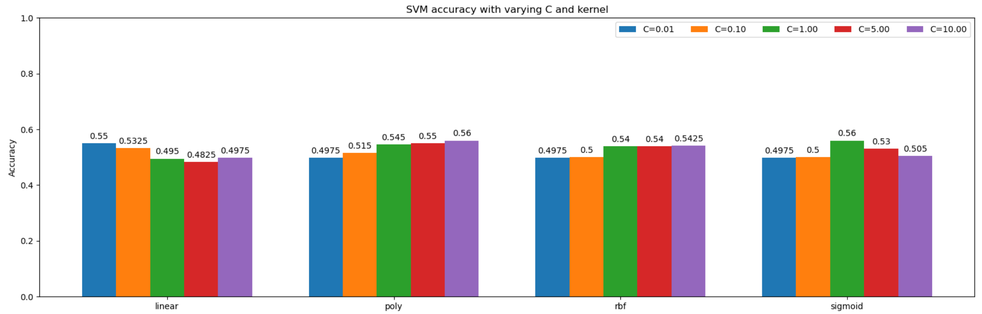


Results and Plots

- NN structure: Input -> Linear -> ReLU -> Linear -> ReLU -> Softmax -> Output
- 20 epochs, batch size 4, MSE loss, Adam Optimizer (learning rate varied)







Future Work

<u>Accuracy</u>

- Use rest of dataset
- Combining types of processing
- Fine-tuning of classifiers and hyperparameters
- Different techniques (wavelets, etc.)

<u>Other Applications</u>

- Flu detection

References

[1] Orlandic, L., Teijeiro, T. & Atienza, D. The COUGHVID crowdsourcing dataset, a corpus for the study of large-scale cough analysis algorithms. *Sci Data* **8,** 156 (2021). https://doi.org/10.1038/s41597-021-00937-4