

Milestone 6

1. Covid19 Audio Cough Classification
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3. Client: Dr. Zahra Nematzadeh, Florida Tech College of Engineering and Science:
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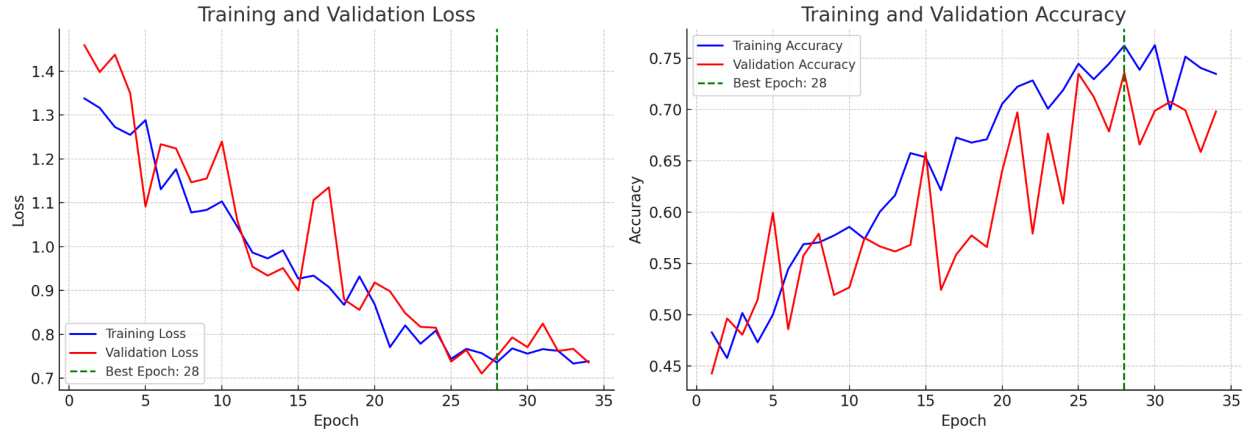
4. Milestone 6 Matrix

| Task | Rodrigo | Emma | Lamine | Audrey | Notes |
|--|---------|------|--------|--------|---|
| 2. ML testing and refinement of framework | 0% | 25% | 60% | 5% | Achieved 69% accuracy and 69% precision with the final Attention Enhanced CNN model |
| 3. Web testing | 40% | 25% | 20% | 15% | Implemented New Features based on User Reviews. Added additional tables and questions to the dashboard. Changed other page designs. |
| 4. Integrating Base ML Model with Web Using a Neural Network Framework | 75% | 0% | 0% | 25% | Implemented Attention Enhanced CNN model, and it is working as intended. |

5. Discussion (at least a few sentences, ie a paragraph) of each accomplished task (and obstacles) for the current Milestone:

- Task 1: The ResNet50 model was receiving similar precision to the CNN, so the team pivoted to focus entirely on the development of the CNN. It was switched from a model with 3 evaluation results to 2 evaluation results: 'healthy' and 'COVID'. The final model architecture for the developed Attention Enhanced CNN can be seen below. It was determined through various tests that 60 epoch training runs were receiving the best results, so the number of epochs was not increased further, as it did not improve the precision and accuracy. The 69% accuracy achieved will also help diminish the number of false positives and negatives received by a user during their use of the webapp. The model and its weights were passed off to then be implemented into the webapp.

- **Block 1:** Conv 3×3 (1→32) → BN → ReLU → MaxPool 2×2 → Channel-Attention 32 → Spatial-Attention
- **Block 2:** Conv 3×3 (32→64) → BN → ReLU → MaxPool 2×2 → Channel-Attention 64 → Spatial-Attention
- **Block 3:** Conv 3×3 (64→128) → BN → ReLU → MaxPool 2×2 → Channel-Attention 128 → Spatial-Attention
- **Head:** AdaptiveAvgPool 1×1 → Flatten → FC 128→64 → ReLU → Dropout 0.5 → FC 64→2 (logits)



| | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| healthy | 0.73 | 0.81 | 0.77 | 368 |
| COVID-19 | 0.64 | 0.53 | 0.58 | 234 |
| accuracy | | | 0.70 | 602 |
| macro avg | 0.68 | 0.67 | 0.67 | 602 |
| weighted avg | 0.69 | 0.70 | 0.69 | 602 |

- **Task 2:** Implemented multiple models as precision of the Attention Enhanced CNN increased. Alongside the model implementation a few features were implemented as well. An initial questionnaire asking about symptoms, a time limit for how long a cough can be recorded for, and a graph to show users their results. Once a final model was implemented, it was sent to users for their review and to see how the user experience could be improved. This led to changes being made to the user dashboard included: additional information provided in graphs, further questions added to the questionnaire users answered when they recorded their coughs, and different page redirects after a user logs into their account or creates a new account to improve the ease of use.
- **Task 3:** Trained and saved the weights of Attention Enhanced CNN for web integration. Saved weights and model architecture to web application. Implemented data pipeline which retrieves an audio sample from the user model for classification, classifies audio,

and displays the classification result and the prediction confidence. As in previous milestones, working to implement a classification pipeline was challenging, and many errors were encountered, but were eventually resolved. We have only had the opportunity to test the web application with non-COVID-19 users, but in these tests, the model was able to correctly classify the users as not having COVID-19.

6. Discussion (at least a few sentences, ie a paragraph) of contribution of each team member to the current Milestone:

Rodrigo Alarcon

Fully implemented detection dashboard on the web application. This included finishing the development of audio classification functionality, adding a symptom questionnaire, and implementing status visualization in the form of a graph. Completed classification functionality by implementing a pipeline in which, upon request, an audio sample is retrieved from the user model, converted to a Mel spectrogram, is classified by the trained Attention Enhanced CNN, and the classification of the audio is displayed to the user along with prediction confidence. Implemented symptom questionnaire, the answers of which are saved to the user model. Implemented functionality that displays a patient's status as a graph to complete the detection dashboard.

Updated contents of web application (home page, research page) to reflect current project status. Updated web application to address user feedback from usability testing.

Emma Conti

Continued working with the ResNet50 model, but could not get results to improve beyond 64%, and switched to assist with the development of the Attention Enhanced CNN. Confirmed the highest precision of 69.8%, essentially 70%.

Assisted in developing which graphs should be put on the design layout of the website, and gave clarification on which symptoms should be on the questionnaire provided to users whenever they record a new cough.

Updated the research pages to include more information about the current model

Made a questionnaire with the metrics provided by Dr. Chan to better determine what was useful and less useful to a user. This was then distributed to get us feedback from various users both on and off campus. Many of these changes for the webapp were then implemented. This includes the switching the page rerouting so once a character has created an account or signed into an account it routes to the dashboard page instead of the home page. As well as implementing a table that better shows the symptoms implemented in tandem with the results from the Attention Enhanced CNN.

Designed the poster with feedback from the Client in order to best show what the project has accomplished and how it can be used and submitted it for the showcase. Made and distributed a document with all remaining deadlines to ensure the team was well informed about all timelines so work could be completed in a timely manner. Designed a pamphlet to be distributed at the Senior Design Showcase, as well as a QR code that will be placed on the

table to ensure all visitors will have quick and easy access to the webapp for their own personal use and testing.

Wrote the user manual explaining the details of the project, its features, and how it works. This will be available both on the website and at the senior design showcase.

Lamine Deen

- Designed, implemented and tested my version of demo website (4 months)
- Experimented, Designed and optimized all ML Models until final one for showcase Attention enhanced CNN (8 months)

Audrey Eley

Created a backlog for remaining requirements including a code, description, difficulty (T-shirt size method), importance (HML method), dependency list, team member assignment and current status. This ensured that each task was assigned to one or more group members and their status was monitored to ensure no remaining requirements would slip through the cracks. Sourced a COVID-19 symptom database to train a COVID-19 prediction model in case we decided to use symptom questionnaire input for predictive purposes. Created, trained and tested a neural network to predict COVID-19 status using symptom input. This network was not ultimately used, because it would be too difficult to determine the accuracy of the ensemble model that would've been made by combining it with the CNN. Worked on training/validating/testing the Attention Enhanced CNN for web integration. Worked with Emma to create the senior design showcase poster. Distributed usability testing questionnaire. Contributed to aesthetic improvements to the web application.

8. Lessons Learned

Task 1: The dataset used had many faults that should have been checked earlier. Unfortunately, our team trusted the integrity of the labeled data and proceeded for months before cleaning the data beyond our preprocessing. If we had listened to the recordings prior, and shortened them to one cough earlier it may have been easier to ensure whether or not our earliest models were predicting accurately. With a highest result of 69% for the Attention Enhanced CNN, we were still able to implement and make a usable webapp.

Task 2: Receiving User feedback became incredibly useful for determining which features users will actually want to see while they were sick. Originally there were far more complicated graphs in mind, but users appreciated seeing their progression over multiple recordings, as well as having the ability to log their symptoms. Taking into account that our primary user base will be sick while using our webapp also helped with certain design choices, making it as streamlined as possible to encourage a simple and quick user experience.

Task 3: Figuring out the best way to accommodate sick users while still developing a usable webapp proved to be more difficult than we intended. There was some debate about trying an ensemble model and included symptoms reported in order to potentially increase precision, but

the issue became that while the model might perform well, it would be hard to determine how precise it was being since the metadata we had would not also provide symptom information. Therefore this was also abandoned in lieu of the Attention Enhanced CNN.

9. See Faculty Advisor Feedback Below

10. Meeting Date: April 22nd, 2025

11. Faculty Advisor feedback on each task for the current Milestone 4

- Task 1:
- Task 2:
- Task 3:
- Task 4:

Faculty Advisor Signature: _____ Date: _____

Evaluation by Faculty Advisor

Faculty Advisor: detach and return this page to Dr. Chan (HC 209) or email the scores to pkc@cs.fit.edu

Score (0-10) for each member: circle a score (or circle two adjacent scores for .25 or write down a real number between 0 and 10)

| | | | | | | | | | | | | | | | | |
|---------|---|---|---|---|---|---|-----|---|-----|---|-----|---|-----|---|-----|----|
| Rodrigo | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Emma | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Lamine | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Audrey | 0 | 1 | 2 | 3 | 4 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |

Faculty Advisor Signature: _____ Date: _____