

EE/CprE/SE 491 WEEKLY REPORT

Start Date – End Date: 11/1/2024 - 11/7/2024

Group number: sdmay25-18

Project title: Weather Triggered Wireless Telemetry System

Client &/Advisor: Daji Qiao and Sarath Babu

Team Members/Role:

1. **Alex Chambers:** Individual Component Designer
2. **Alexander Christie:** Client Interaction
3. **Adam Fields:** Data Formatting
4. **Nisha Raj:** Team Lead
5. **Aidan Gull:** Component Integration
6. **Colin Kempf:** Documentation

Weekly Summary

Now that our group has begun to visualize data, our client has instructed us to begin using that data for different types of analysis. This week, we focused on gathering ground truths to compare our data to. We wanted to find ground truths in the form of the actual weather data for the times we were predicting in order to analyze how accurate our measurements from the API data is. The ground truths we looked for were historical weather data from the API themselves, as well as historical weather data from the ARA framework. These ground truths enable us to create data visualizations both to show how accurate an API is to data that the same API forecasted, measuring its own accuracy, and to show how accurate an API is to data that ARA received. We also began looking into what data exists for ARAs wireless strength overtime, as this is data we are hoping to use to create further analysis. Specifically visualizations like a correlation matrix, which would enable us to determine which features gathered from ARA weather data impacts wireless strength the most.

Past week accomplishments

- **Researching Ground Truths**
 - ARA Ground Truth
 - Spoke with our advisor about how ARA was collecting their historical forecast data
 - Began to collect ARA weather data ourselves so that we could develop our own ground truth for the data we collect
 - API Ground Truths
 - Looked for historical weather data collected by Weather API and Tomorrow API
 - Unlike Meteo they don't appear to have any free collections for historical weather data that we could use for ground truths
 - Began to research other possible options if we cannot find desired data

- **Correlation Matrix**
 - Began to brainstorm different correlation matrix options. These would allow us to better understand which weather features we should focus the most of predicting
 - Investigated how the ARA Framework collects their wireless signal data. We could use this to see when it drops based on weather events
- **Expanded Feature Collection**
 - Expanded our prototype to gather more features from the APIs for our forecasted weather data
 - Gathered the data and created new visualizations like we had done for other features previously
 - Analyzed our findings from these features, looking at the accuracy of the forecasted data.

Pending issues

- Only major pending issue is not being able to find our desired ground truths for some of the APIs and the historical data from them are not accessible to us.

Individual contributions

<u>NAME</u>	<u>Individual Contributions</u>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Nisha Raj	<ul style="list-style-type: none"> -Worked on finalizing the design of our project and considering any concerns and technology considerations -Updated advisor of our progress on the project while he was away on travel -Migrated program code from personal git repository to the Iowa State ECE repository -Became more familiar with running the program on the server 	8	53
Alexander Christie	<ul style="list-style-type: none"> -Updated advisor on meetings missed while traveling -Shared knowledge of server functionality -Brainstormed plans for further development of prototype 	6	52
Aidan Gull	<ul style="list-style-type: none"> - Analyzed graphs created to visualize data - Helped develop a method for getting the ground truths for some of our external APIs - Reflected on progress made by the group and created possible next steps. 	6	52
Colin Kempf	<ul style="list-style-type: none"> - Investigated options for ground truths to use for our data analysis on the forecasted data from APIs. - Researched methods for creating correlation matrices and what data we would need. 	6	52

	- Analyzed gathered forecast data from APIs for accuracy and why it might change over time.		
Alex Chambers	- Worked on documentation pertaining to particular Project Design Decisions - Expanded Data Gathering script to collect a wider variety of data points	6	54
Adam Fields	- Helped finalize the design of the project. - Helped brainstorm solutions to some potential bugs.	6	51

Plans for the upcoming week

- **Continue Ground Truth Analysis**
 - Find and use ground truths to analyze the accuracy of our gathered data's predictions
 - Speak with our client at the next meeting about missing ground truths and their preference about how we utilize that data
 - Use the ARA Framework data to create a desired ground truth to use when predicting for the final prototype
- **Develop Correlation Matrix**
 - Speak with our client about gathering ARA wireless signal data
 - Determine what features we want to find correlation between, either the weather features or the wireless signal features
 - Gather data and create correlation matrices, highlighting which features we should give the most attention to given higher correlation
 - Continue to expand our feature collection for forecasted data from APIs so we are able to focus on them if the matrices highlight them as high correlation

Summary of weekly advisor meeting

Our meeting this week took place on 11/1. We met with our client and advisor and shared our data visualizations from the previous week. These charts incorporated previous feedback from our client, and expanded into 3D visualizations of our prediction data, showing the feature we were looking at (temperature, humidity, etc), the amount of hours out the prediction was from the real time, and the predicted time. This allowed us to show our client an APIs prediction accuracy for numerous predicted points in time at once, and how each of those predictions changed as they got closer to the actual time. The graphs we made used historical weather data from the Meteo API as their ground truths. This made the Meteo API overall more accurate. Our client gave us feedback on this, explaining that we would want to repeat this process with multiple ground truths to analyze the accuracy of the APIs better. This is what we have focused on this week, and our progress on this we will present at the next meeting.