Team Group Group - Forecasting Weather with TinyML

Claire Chiang - Model training

Zourong Jiang - Data preprocessing, Initial model architecture building

Allison Lampe - Microcontroller configuration and data collection

Sonia Aung - Testing

Creating final deliverables - Everyone

For our project, we attempted to forecast weather with TinyML using temperature, humidity, and pressure data from an Arduino Nano 33 BLE Sense. Our first attempt at a proof of concept was to get data from meteostat.net and see if we can predict temperature in next hour from the past 24 hours of weather data. This was correct with about 86% accuracy.

Then, we attempted to use the three parameters: temperature, humidity, and pressure to predict the temperature in the next hour. We also attempted to deploy this to the microcontroller. We collected 9 hours of weather data on the microcontroller and a year of historical weather data from meteostat.net. This had some issues though because the historical data only had a point for every hour and the live data had a point every 10 seconds and not enough points to be adequately compared to the historical weather data, without having to interpolate historical data or way overpower live data. Therefore, we built this idea to a functional result (that ultimately had low accuracy), and decided to make a simpler model using just the live microcontroller data as training to actually deploy to our microcontroller.

We used the collected microcontroller data to train a TinyML model using TensorFlow. It used the past 15 data points (collected every 10 seconds) to predict the temperature in the next 30 minutes. We used two metrics for evaluating our data. First, we evaluated if it predicted the temperature to be higher or lower than the actual result and counted how many were correctly predicted. This had an accuracy of 52.8%. Second, we evaluated the average distance between the predicted result and the average result. The average distance was 1.30 C. More work could be done here to fine tune, but we are happy to have achieved a working model and think more data could lead to improvements. It is also possible that temperature, humidity, and pressure are simply not enough data points for even the best AI to predict future temperature.

If we were to continue this work with more time, we would collect a lot more microcontroller data. Because the computer had to be left outside to collect data, it could only be collected in good weather conditions and when someone was available to sit and wait outside for hours. We also would like to collect data from more weather patterns since all of our data was collected in autumn. Also, with more data, we would be able to use microcontroller data in conjunction with historical data which would be interesting to see.