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CS6315 AI and ML

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Proposal for Extended-Range Weather Prediction using Forecasting Modeling

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Climate drives various major aspects of human life, from agriculture and cuisine to infrastructure and recreation. However, climate change is increasingly disrupting the natural and man-made facilities for these societal mechanisms. In 2021, the United States alone has experienced a winter storm in February that resulted in a power crisis in the state of Texas, a sustained heat dome in the early summer that broke down the infrastructure of the Pacific Northwest and sparked multiple wildfires, a tropical storm later that summer that hit New York City and brought torrential rainfall that flooded the city’s subway system, and a rare December tornado outbreak in the Ohio Valley that leveled homes as it tore through neighborhoods. Although large scale and biome-oriented effects of climate change have extensively been studied, not much attention has been paid to how non-coastal municipalities, like the San Antonio-New Braunfels metropolitan area (known as “Greater San Antonio”), will be affected. Furthermore, local weather is conventionally forecasted a week or two in advance, with the most extensive forecasts spanning around six months. The farther the date, the less likely the forecast for that data is accurate. Can a weather forecaster be trained to predict the weather for each date in a full calendar year? To find the answer to this question, I will obtain publicly available historical weather data from the National Weather Service (https://www.weather.gov/ewx/) for the Greater San Antonio area for the past five years. In particular, data will be collected from March 1, 2017, to February 28, 2022. A forecasting model-based machine learning algorithm will be trained on the historical data. This algorithm will then perform predictive analysis and determine what the weather will be for each day from March 1, 2022, to February 28, 2023. Multiple visualizations (e.g., line charts) will summarize the predictions. This project will demonstrate an approach framework for generating climate information that will help local communities like San Antonio prepare for weather events and seriously consider the challenges posed by climate change. The predictive analysis process can be built upon to help weather services flag concerning climate patterns and encourage policymakers to reduce climate alteration caused by humans. This project will be written in Python and executed on Jupyter Notebook.

The following is a timeline of my project:

* March 21 – March 27
  + Obtain past five years of weather data for the Greater San Antonio area (data from March 1, 2017 to February 28, 2022)
* March 28 – April 3
  + (If needed) Convert data into a tabular format
* April 4 – April 10
  + Research optimal forecasting model for the data
* April 11 – April 17
  + **Train** forecasting model on data from March 1, 2017 to February 28, 2021
  + **Test** on data from March 1, 2021 to February 28, 2022
* April 18 – April 24
  + Have forecaster predict the weather from March 1, 2022 to February 28, 2023 and make visualizations
* April 25 – May 1
  + Write draft paper for project
  + Prepare PowerPoint for May 2 class presentation of project
* May 2 – May 8
  + Record presentation at May 6 CS Symposium
  + Finish final draft of paper.