ClimateWins

Machine Learning for Weather Assessment Solutions

Julia Reeves 04.04.2024

Project Overview

What problem are we solving?

Project Objective

Predict the consequences of European and worldwide climate change by tapping into machine learning.

Background

Global climate change's impact on daily weather norms.

Example: Valentia mean and median temperatures, 1961 vs. 2009

Increase in extreme weather events over the past 10 - 20 years.

Potential research directions

More rainfall: If the range of a weather station's average temperatures increases over the past 10 years, then its average rainfall increases.

Daily mean temperatures as indicators: If a weather station's average temperatures increased by at least 2° Fahrenheit over the last 20 years, then it will have a higher percentage of extreme weather events.

Pleasant weather: If we examine a weather station's average temperatures over time, we can accurately forecast whether conditions are pleasant or unpleasant.

What data are we utilizing?

European Climate Assessment & Data Set + Corresponding Pleasant Weather Data

- 18 different weather stations across Europe ranging from the late 1800s to 2022.
- Temperature, wind speed, snow, global radiation, and more.

Potential Biases

- Infrastructure for data collection and interpretation of results

Accuracy

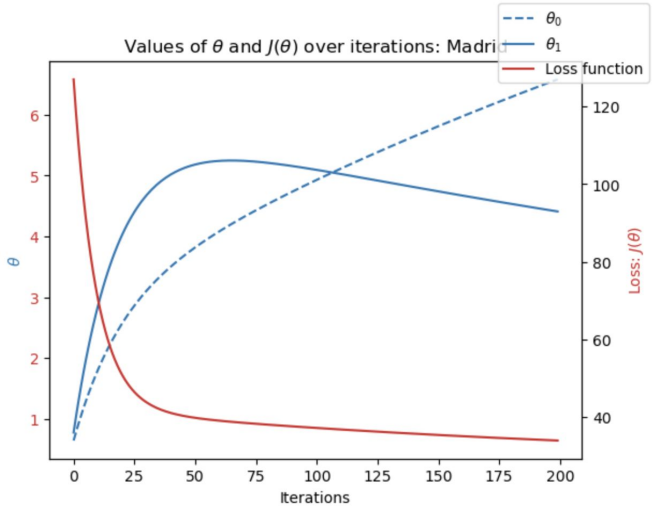
- EU-based source backed by European Commission and EUMETNET
- Technology of the times

Diving In:
Supervised Machine Learning

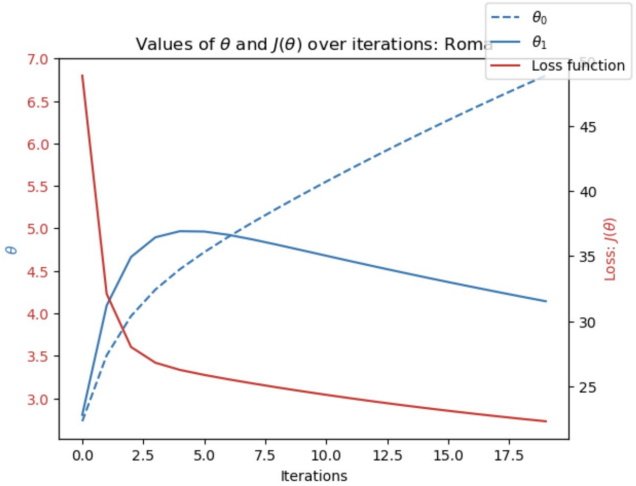
Optimization

Gradient Descent Algorithm: Calculate the loss

Example: **Madrid, 2019**



Roma, 1961



Supervised Machine Learning

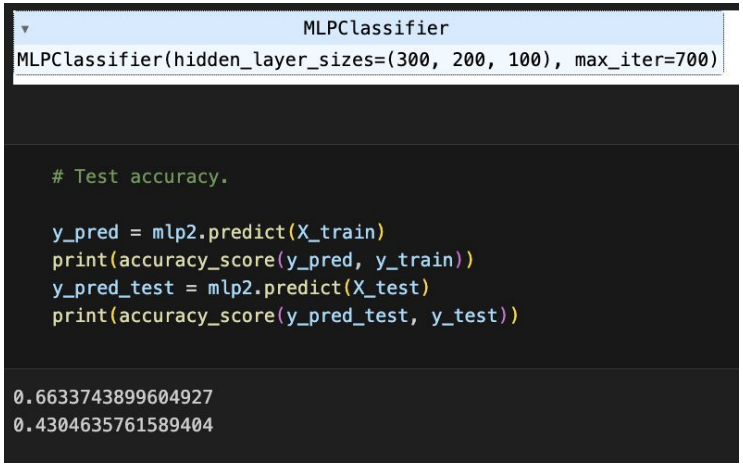
K-Nearest Neighbors (KNN): 44% accuracy on testing data with 3 neighbors.

Decision Tree: 40% accuracy on testing data.

Artificial Neural Network (ANN): 45% success rate with simplest layers (5,5).

44% when the number of nodes was increased (10,5).

43% when the number of layers, nodes, and iterations were increased.



Suggested Model: ANN

Potential for increased accuracy for determining pleasant vs. unpleasant weather

Summary

Hypothesis: If we examine a weather station's average temperatures over time, we can accurately forecast whether conditions are pleasant or unpleasant.

Methods: KNN, Decision Tree, ANN

Conclusions so far: Forecast accuracy is generally low at <50%.

Next steps: Continue developing a more complex ANN model by adding penalty or dropout.

Future analyses: Rainfall and daily mean temperatures as indicators.

Thanks!

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GitHub Repository:
https://github.com/jsreev/ClimateWins