

Weather Prediction Model

Using Machine Learning to Analyze
Weather Data

Introduction

- This project uses machine learning techniques to predict key weather variables such as temperature and precipitation.
- It demonstrates how data science can help analyze and predict environmental trends, aiding decision-making in areas like climate research and disaster planning.

What Was Done

- 1. Data Preparation:
 - - Cleaned and preprocessed weather data.
 - - Engineered features like rolling averages and lag variables.
- 2. Model Training:
 - - Implemented Ridge Regression and Random Forest models.
 - - Tuned hyperparameters using RandomizedSearchCV.
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- 3. Evaluation:
- - Analyzed model performance using Mean Absolute Error (MAE).
- - Visualized predictions and residuals.

What Was Used

- - Python libraries:
- - Pandas and NumPy for data handling.
- - Scikit-learn for machine learning models.
- - Matplotlib for visualization.

- - Techniques:
- - Feature engineering (rolling averages, lag variables).
- - Ridge Regression and Random Forest.
- - Hyperparameter tuning with RandomizedSearchCV.

Results

- - Ridge Regression:
- - MAE: ~4.51 degrees.
- - Random Forest:
- - MAE: ~4.47 degrees.
- - Insights:
 - - Random Forest performed slightly better.
 - - Predictions were evaluated for accuracy and reliability.

Why It Is Important

- - Weather predictions are critical for environmental research and decision-making.
- - Applications include:
- - Monitoring climate trends.
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- - Disaster preparedness (e.g., floods, droughts).
- - Resource management (e.g., water and agriculture).
- - The model demonstrates how data science can drive actionable insights in environmental science.

Future Applications

- - Extend to predict other variables like wind speed and direction.
- - Combine with geographic data for spatial analysis.
- - Use in long-term climate change studies.
- - Assist policymakers in environmental planning and risk management.

Conclusion

- - The project highlights the potential of machine learning in environmental science.
- - Accurate weather predictions can support critical decisions in research and resource management.
- - Future work could include more variables and integration with geographic systems for deeper analysis.