APPLICATION AND COMPARISON OF THREE DIFFERENT MACHINE LEARNING MODELS IN PREDICTING THE TEMPERATURE

Accurate temperature prediction is essential for various sectors, including agriculture, energy management, and urban planning. Traditional weather forecasting methods often rely on complex systems, but researchers are increasingly turning to machine learning (ML) techniques to enhance predictions. In this study, we investigate the application and comparison of three distinct ML models for temperature prediction in Istanbul, a city with diverse climatic conditions and experiencing rising temperatures each year.

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OBJECTIVE

- Our primary goal is to predict Istanbul's temperature using historical data.
- We consider three ML models: Linear Regression, Decision Tree Regressor and Random Forest Regressor
- These models are trained and evaluated to assess their efficiency in temperature prediction.

STUDY AREA

Istanbul is a unique city that straddles two continents: Europe and Asia. The city's proximity to the Marmara Sea and the Black Sea significantly influences its weather patterns, resulting in variations in temperature, humidity, and wind.

Figure 3. The geographical location of the study area

DATASET AND FEATURES

Our study is based on the data avaiable on World Weather Online. The data provides detailed hourly measurements of minimum-maximum temperature, pressure, wind speed, cloud cover, precipitation, and heat index data for the period 2009-2019.

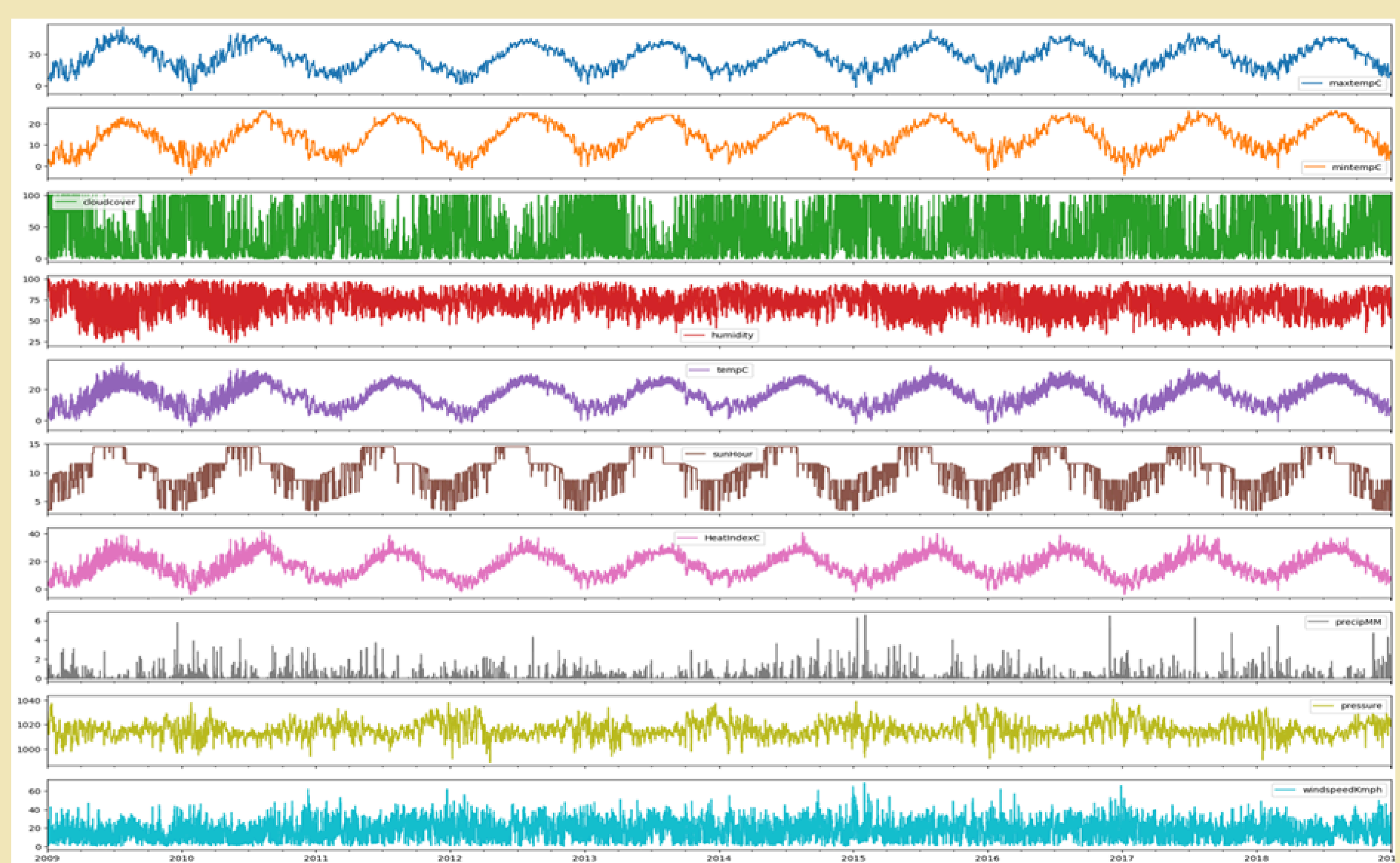


Figure 1. Plot of the selected features change over ten year period

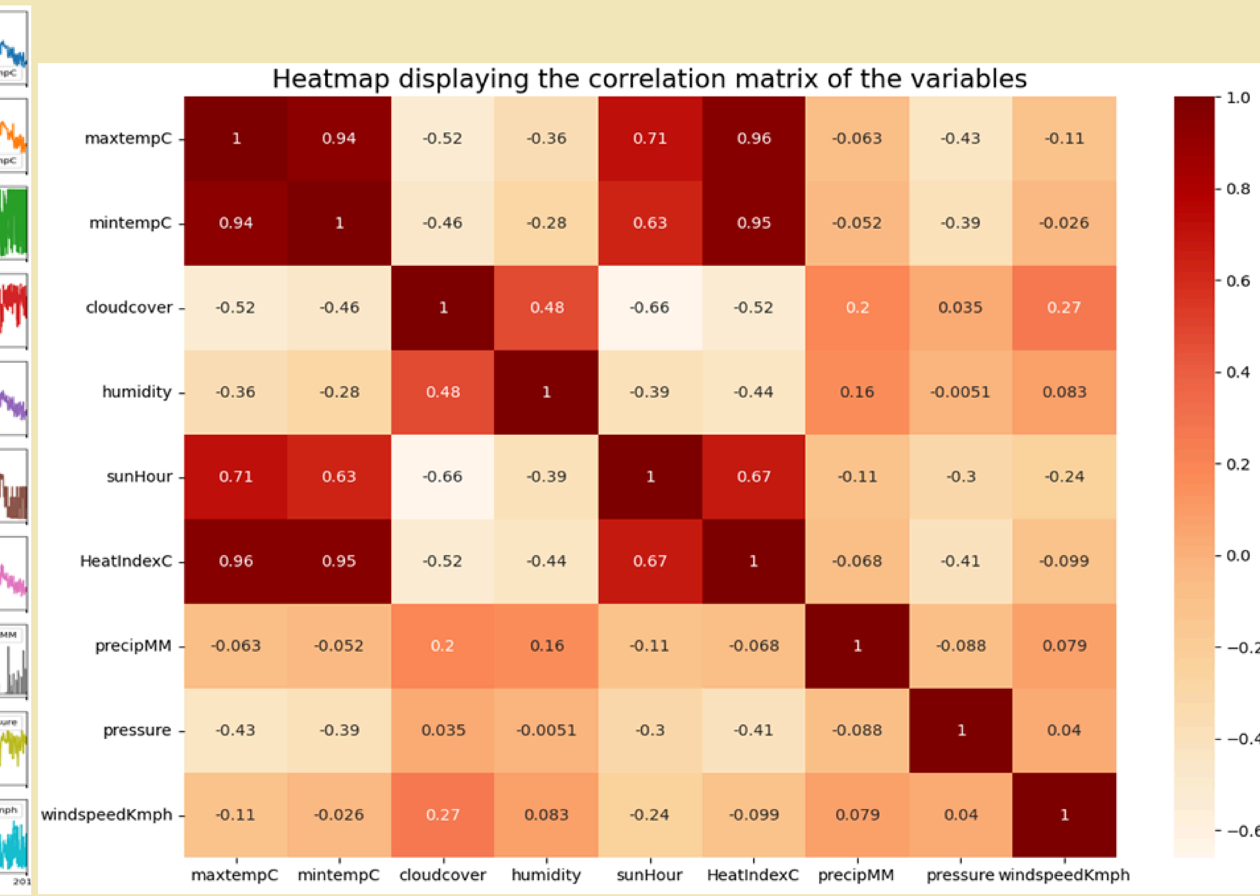
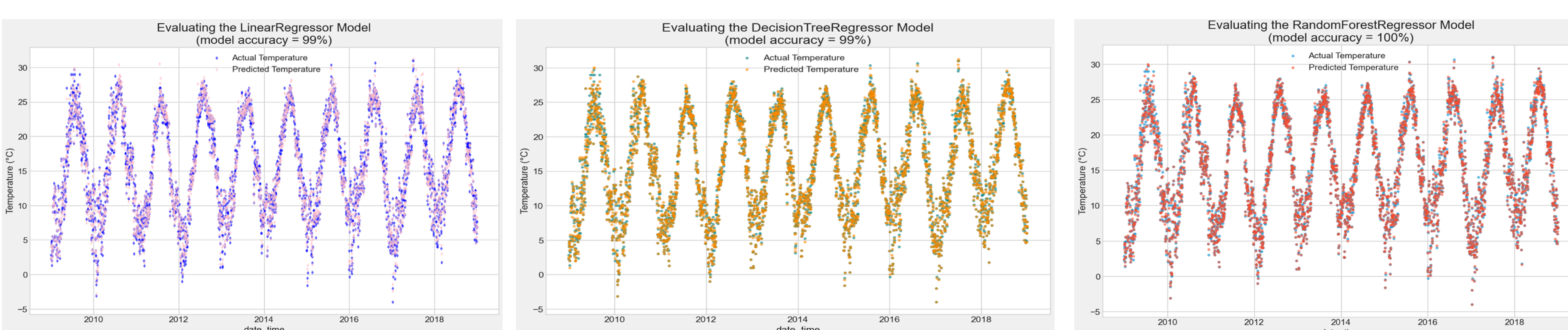


Figure 2. Data correlation on heatmap

PERFORMANCE EVALUATION

- To evaluate the models, we compare the predicted temperature with actual recorded temperature data.
- Correlation coefficient (R2), Mean Absolute Error (MAE) and Mean Squared Error (MSE) metrics are used to assess model performance.
- Random Forest outperformed other models, achieving an impressive accuracy rate of >0.99, MAE of 0.26, and MSE of 0.16.



(a) (b) (c)

Figure 4. Predicted vs. Actual temperature values from the models (a) Linear Regression Model, (b) Decision Tree Regressor Model and (c) Random Forest Regressor Model

CONCLUSION

- As climate patterns evolve, ML-based approaches offer a promising avenue for accurate and efficient temperature predictions.
- By understanding the strengths and limitations of each ML model, we can enhance temperature predictions and adapt to changing climate patterns.
- Our findings contribute to improved weather forecasting in Istanbul, aiding in better planning and resource allocation.