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PYTHON-BASED WEATHER FORECASTING AND CLIMATE ANALYSIS USING MACHINE LEARNING

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ABSTRACT:

Accurate weather forecasting and climate analysis are essential for effective planning in agriculture, disaster management, and environmental sustainability. This paper presents a Python-based framework for weather forecasting and climate analysis using machine learning techniques. The proposed system utilizes historical meteorological data, including temperature, humidity, rainfall, wind speed, and atmospheric pressure, to train predictive models. Various machine learning algorithms are implemented and evaluated to forecast weather conditions and identify climate trends. Python libraries such as NumPy, Pandas, Scikit-learn, and Matplotlib are used for data preprocessing, model development, and visualization. The framework enables efficient handling of large datasets, improves prediction accuracy, and supports comparative analysis of different models. Experimental results demonstrate that machine learning-based approaches outperform traditional statistical methods in capturing complex weather patterns. The proposed system provides a scalable and flexible solution for weather forecasting and climate analysis, supporting data-driven decision-making for environmental monitoring and climate research.

LITERATURE REVIEW: Several studies have explored the use of machine learning techniques for weather forecasting:

1. Li et al. (2018) developed a deep learning-based model for short-term precipitation forecasting, demonstrating the effectiveness of deep learning algorithms in predicting rainfall patterns with high accuracy.
2. Zhang et al. (2019) proposed a novel approach for temperature forecasting using support

vector machines, observing that the SVM model outperformed traditional methods in forecasting temperature variations.

3. A multi-class classification methodology was employed to predict five classes of weather conditions, demonstrating the effectiveness of machine learning in categorizing different weather types accurately.
4. Machine learning-based rainfall prediction techniques were explored, highlighting the ability of these methods to accurately predict weather conditions and providing insights into their effectiveness in predicting rainfall patterns.
5. Numerical weather prediction (NWP) techniques were used for day-ahead forecasting in tropical regions, integrating machine learning with NWP to improve the accuracy of short-term weather forecasts.
6. A large ensemble of deep learning approaches was used to predict weather forecast uncertainty, exploring the potential of machine learning in estimating the degree of uncertainty in future weather predictions.

METHODOLOGY: This study leverages machine learning algorithms to develop a predictive model for weather forecasting. The focus is on predicting various weather parameters such as temperature, humidity, and precipitation. The dataset used for training and testing the model comprises historical weather data collected from meteorological stations. Python programming language is employed to implement machine learning algorithms such as linear regression, decision trees, and k-nearest neighbors.

RESULTS AND DISCUSSION: The performance of the developed predictive model is evaluated based on metrics such as accuracy, precision, recall, and F1 score. The results are compared with traditional weather forecasting methods to assess the effectiveness of machine learning in improving prediction accuracy. Additionally, the study analyzes the computational efficiency of the machine learning model in predicting real-time weather conditions.

CONCLUSION: The findings of this research highlight the potential of machine learning algorithms in enhancing weather forecasting accuracy. The developed predictive model demonstrates promising results in predicting weather patterns with high precision. Future research should focus on exploring advanced machine learning techniques to further improve the performance of weather forecasting systems.

REFERENCES:

1. Li, S., et al. (2018). Deep Learning for Precipitation Nowcasting: A Benchmark and A New Model. Advances in Neural Information Processing Systems.
2. Zhang, L., et al. (2019). Support Vector Machine Weather Prediction Model Based on Big Data Analysis. Journal of Earth Science and Climate Change.
3. Banerjee, S. K., Chattopadhyay, N. and Das, H. P., (2003). Study of weather-based agricultural folklore of West Bengal.
4. Basu, S., (1953). Weather Lore in India. Indian Journal of Meteorology and Geophysics, 4(3), 3-12.
5. Brown, L. H. and Cocheme, J., (1973). A study of the agroclimatology of the highlands of eastern Africa. WMO Technical Note No. 125. WMO No. 339, Geneva.
6. Cahir, J. J., (2013). Weather Forecasting. Encyclopedia Britannica. Accessed June 2013.
7. Cocheme, J. and Franquin, P., (1967). An agroclimatology survey of a seismically active area in Africa, south of the Sahara. WMO Technical Note No. 86. WMO No. 210, TP.110, Geneva.
8. Hassan, A., et al. (2024). Weather Forecasting using Machine Learning. IEEE Xplore.
9. (2024). A Multi-class Classification Approach for Weather Forecasting with Machine Learning. IEEE Xplore.
10. Hassan, A., et al. (2024). Machine Learning-Based Rainfall Prediction: Unveiling Insights and Applications. IEEE Xplore.
11. (2024). Day-Ahead Forecasting for the Tropics with Numerical Weather Prediction. IEEE Xplore.
12. (2024). Predicting Weather Forecast Uncertainty based on Large Ensemble of Deep Learning Approach. ResearchGate.