

Weather Forecasting Using Machine Learning: A Comprehensive Approach

S. Zahir Hussain and Dr. K. Rajakumari

Department of Computer Applications

Bharath Institute of Higher Education & Research, Chennai, Tamil Nadu.

Zahirhus1@gmail.com and Rajakumari.mca@bharathuniv.ac.in

Abstract: *Weather forecasting plays a crucial role in various domains including agriculture, transportation, disaster management, and day-to-day planning. Traditional numerical weather prediction (NWP) models, although effective, require significant computational resources and often face limitations in capturing non-linear patterns in meteorological data. The advent of machine learning (ML) offers a promising alternative by learning complex patterns from historical data, enabling accurate and efficient forecasts. This paper explores the integration of ML techniques in weather forecasting, emphasizing recent advancements in deep learning architectures like LSTM and ConvLSTM. A comparative analysis is performed on multiple ML models using publicly available datasets. Results demonstrate the superior accuracy of deep learning models, particularly those incorporating both spatial and temporal features. The paper also discusses challenges in data preprocessing, model generalization, and interpretability. Future work includes hybrid approaches that combine ML with physics-based models and the deployment of edge computing systems for real-time forecasting..*

Keywords: Weather prediction, machine learning, LSTM, ConvLSTM, time series analysis, deep learning, meteorological forecasting

