Weather Forecasting Using AI and Deep Learning

Abstract

Accurate weather forecasting is crucial for various industries, including agriculture, aviation, and disaster management. Traditional numerical weather prediction models require extensive computational resources and often lack real-time adaptability. This project proposes an **AI-driven deep learning model** that leverages **Convolutional LSTMs (ConvLSTMs) and Spatiotemporal Transformers** for high-accuracy weather forecasting.

The dataset consists of satellite imagery, meteorological station readings, and real-time sensor data. **Deep neural networks (DNNs) trained on radar images** extract spatial features, while **LSTM networks analyze sequential weather patterns** to predict future conditions. Transfer learning is applied to adapt pre-trained climate models for specific geographic regions.

To improve real-time forecasting, **reinforcement learning-based self-adaptive models** continuously update predictions based on incoming data. AI-driven **predictive analytics** help governments and businesses make informed decisions during extreme weather events. Future advancements include integrating **IoT-based weather sensors** and using **GANs for synthetic weather simulations**, enhancing forecasting reliability.