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Weather Forecasting System Using Machine Learning And Kotlin-Based Interface

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Abstract

Weather forecasting is crucial in multiple domains such as agriculture, transportation, and disaster management. This paper presents a weather forecasting system that combines machine learning techniques with a Kotlin-based mobile interface. Historical weather data is processed and used to train an LSTM (Long Short-Term Memory) neural network, which predicts weather parameters like temperature, humidity, and rainfall. The frontend interface, developed in Kotlin for Android, allows users to visualize weather trends and receive predictions in real-time. The system is efficient, user-friendly, and can be extended to support live weather feeds.

Keywords
Weather Prediction, LSTM, Kotlin, Machine Learning, Android App, Temperature Forecasting

1. Introduction

Forecasting weather conditions is vital for daily planning, especially in regions prone to climate variability. Traditional models rely on numerical computations, while modern solutions leverage the power of machine learning to deliver better accuracy. This paper introduces a system where a machine learning model is trained to predict key weather parameters, and Kotlin is used to develop a mobile application for user interaction.

2. Literature Review

Several research works highlight the use of deep learning in weather prediction. LSTM networks are particularly effective due to their capability in handling time-series data. Studies by Reen et al. (2021) demonstrated an LSTM model outperforming classical regression methods. Additionally, Kotlin, being the official language for Android, provides modern features like coroutines and type-safety, which are essential in real-time weather app development.

3. System Architecture

The architecture consists of three core components:

1. **Data Preprocessing Module**: Collects historical weather data, cleans it, and formats it for training.

2. **LSTM Prediction Model**: Trained using TensorFlow/Keras in Python to learn patterns in temperature, humidity, and rainfall.

3. **Kotlin Mobile Interface**: An Android application that connects to the model backend via REST API to fetch and display forecasts.

This architecture ensures modularity and platform independence.

4. Implementation

Model Training: The LSTM model was trained using historical weather data from the OpenWeatherMap dataset. It uses sequences of past 7 days to predict the 8th day's parameters. The model was trained with MSE loss and Adam optimizer.

Kotlin App: Developed in Android Studio using Kotlin, the app features:

- User login & dashboard
- Graphical display of temperature and humidity
- Real-time weather prediction call to a Flask-based backend

The interface uses Retrofit for API communication and MPAndroidChart for plotting weather trends.

5. Results and Evaluation

The trained LSTM model achieved an RMSE of 1.5°C for temperature and 3% for humidity over the test set. The Kotlin-based Android app successfully retrieved forecasts and displayed them dynamically. Users were able to compare predicted vs. actual weather from integrated live feeds, showing a close correlation.

6. Future Scope

The system can be enhanced by:

- Integrating real-time weather sensors
- Adding more weather parameters like wind speed and pressure
- Deploying the LSTM model using TensorFlow Lite for offline mobile inference
- Providing alert notifications for extreme conditions

7. Conclusion

This research presents a practical weather forecasting system integrating machine learning and mobile development. By using LSTM for accurate prediction and Kotlin for robust frontend interaction, the system offers a real-time, efficient, and user-friendly platform. It serves as a foundation for future enhancements in smart environmental monitoring.

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