Demand Forecasting and Comparative Performance analysis Performed with Hybrid CNN-LSTM Deep Learning Model for Business

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ABSTRACT - ***The purpose of this project is to perform forecasting and comparative analysis using historical data. Demand forecasting plays a major role in business decisions making, especially in inventory management and supply chain optimization. Forecasting helps organizations predict future trends and make better decisions. In this project, different models from Machine Learning and Deep Learning are used to predict future values. The perfomance of these models is compared based on accuracy and error metrics. This results help to identify the most efficient model for forecasting .This project proposes a hybrid deep learning model combining convolution neural networks(CNN) and long short term memory(LSTM) to improve forecasting accuracy.***

2. Introduction

Forecasting is an important techniques used in business analytics to predict future outcomes based on historical data. Organizations use forecasting to plan production, manage inventory, and improve decision-making. With the advance of Artificial Intelligence, forecasting models have become more accurate and efficient by using advance machine learning tools like convolution neural networks(CNN) and long short term memory(LSTM). Different algorithms can be applied to analyse patterns and trends .This project focuses on analysing historical datasets and applying different forecasting algorithms to predict future values and compare them with historical values .

3. Literature Survey

Previous studies show that forecasting techniques play a major role in business decision-making. Traditional statistical methods such as ARIMA have been widely used for time-series forecasting. machine learning and deep learning like RANDOM FOREST ,SVR . Hybrid models like convolution neural networks(CNN) Long Short-Term Memory (LSTM) networks have shown improved performance, especially with large datasets. Hybrid models like CNN-LSTM provides better accuracy by combining feature extraction and sequence learning.

4. Proposed Methodology

The proposed system uses historical data to forecast future values and perform comparative analysis between different datasets. The methodology includes steps like , data collection, data pre- processing, future extraction using CNN (convolution neural network), time series prediction using LSTM (long short term memory)

Model training and testing, performance comparison.

5. Architecture Diagram (Text Representation)

-> Data Collection

-> Data Pre-processing

-> Feature Selection

-> Forecasting Models (ARIMA / ML / LSTM)

-> Prediction

-> Comparative Analysis

-> Results

6. Various Phases / Methodologies

1.Data Collection – Gather historical data.

2. Data Pre-processing – Remove missing values and normalize data.

3.Feature Engineering – Select relevant features.

4. Model Training – Apply forecasting algorithms.

5. Model Evaluation – Evaluate performance using metrics.

6. Comparative Analysis – Compare results of different models.

7. Input

The input to the system is historical data such as sales data, stock market data, or demand forecasting data. Here the data are collected from the clients from their database and moves for further process . the collected data will be loaded into dataset for forecasting and predicting the demand

8. Pseudo Code and Implementation

Pseudo Code:

-> Start

-> Load dataset

-> Pre-process the data Split dataset into training and testing

-> Apply forecasting model

-> Generate prediction

-> Calculate accuracy metrics and Compare model

-> performances Display results

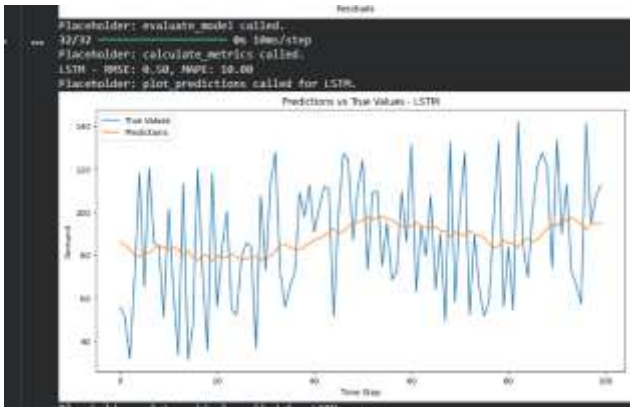
-> End

-> Implementation can be done using Python library such as NumPy, Pandas, Scikit-learn, and data visualization with matplotlib, deep learning frame works with tensor flow.

Pseudo Code:

```
# Import libraries

import pandas as pd

from sklearn.model_selection import train_test_split

from sklearn.linear_model import LinearRegression

from sklearn.metrics import mean_absolute_error


# Load dataset

data = pd.read_csv("sales_data.csv")


# Select input and output

X = data[['Month']]

y = data['Sales']


# Split dataset

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)


# Train forecasting model

model = LinearRegression()

model.fit(X_train, y_train)


# Generate predictions

predictions = model.predict(X_test)
```

```
# Evaluate model
error = mean_absolute_error(y_test, predictions)

# Display results
print("Predicted Values:", predictions)
print("Mean Absolute Error:", error)
```

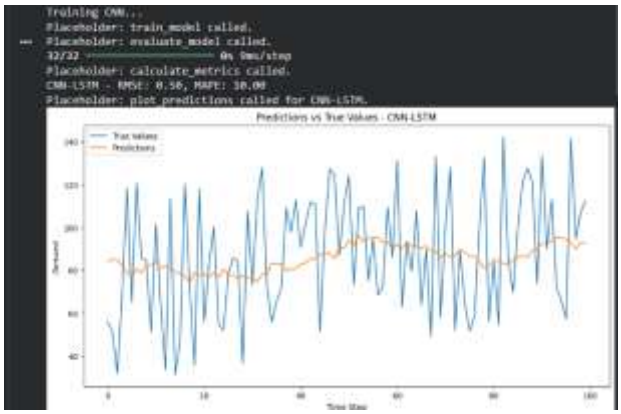


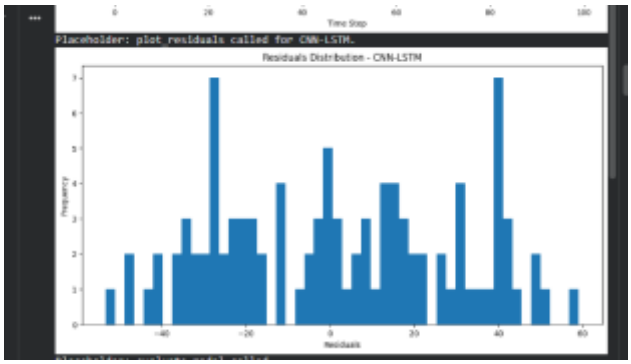
9. Output

The system outputs predicted future values and a comparison between different forecasting models. The results will be displayed with graph charts and bar chart.

10. Result and Discussion

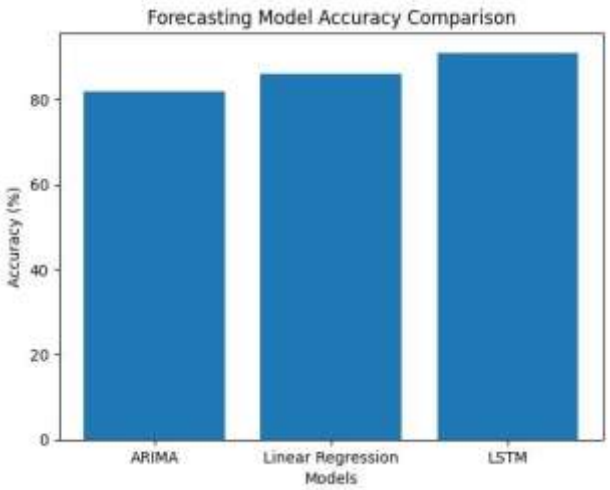
Models are evaluated using metrics like MAE and RMSE. The model with the lowest error value is considered as the best value.

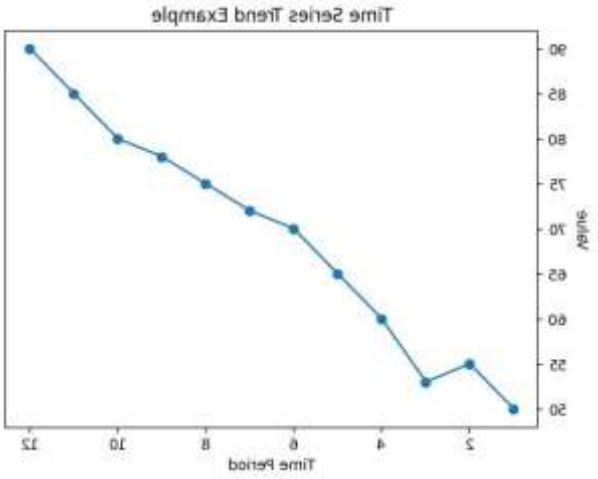


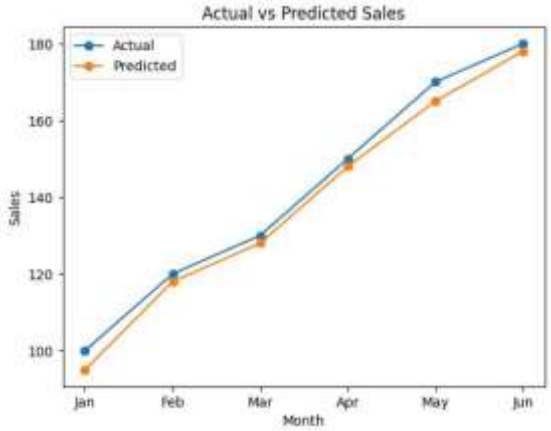


11. Charts / Graphs

Line graphs for actual vs predicted values, bar charts for model comparison, and time-series trend graphs.







12.Conclusion

This project demonstrates how forecasting techniques can help businesses organisations to predict trends and improve decision-making through comparative analysis of different models. Every business companies or organisations needs to know there growth and developments in basis like daily, monthly, yearly. some companies follows there sales records and follows there productions and the sales should not be stopped due to shortage of products. This methods helps to predict the product sales and forecast them to make the production accordingly.