

AI for Market Trend Analysis Using LSTM Neural Network

Student & Project Details

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Module: E
Project Title: AI for Market Trend Analysis Using LSTM Neural Network

1. Problem Statement

Understanding market trends is a key requirement for effective business decision-making. In retail and similar domains, market behaviour is often reflected through changes in product demand over time. Accurately identifying these trends helps organizations manage inventory, plan supply chains, and respond to customer demand more efficiently.

However, market demand is rarely stable. It changes due to seasonality, customer behaviour, and long-term trends. Traditional rule-based or manual analysis methods are often insufficient to capture these complex patterns, especially when working with large volumes of time-dependent data.

This project aims to address this challenge by using Artificial Intelligence to analyse historical sales data and identify market trends. By leveraging a Long Short-Term Memory (LSTM) neural network, the system learns patterns from past data and predicts future demand, thereby providing insights into upcoming market trends.

2. Objectives of the Project

The main objectives of this project are:

- Analyse historical sales data as a representation of market behaviour
 - Identify trends and patterns in market demand over time.
 - Apply an AI-based approach for forecasting future demand.
 - Present market trend insights through clear visualizations
 - Develop a deployment-ready system for trend analysis.
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3. Dataset Description

The dataset used in this project consists of historical retail sales records obtained from a publicly available source. The data represents real-world market activity captured over time.

Dataset Characteristics:

- Time-series data with daily records
- Multiple stores and product categories
- Sales quantity representing market demand.

Key Attributes:

- Date
- Store Identifier
- Product Category
- Sales Quantity

The dataset serves as a practical representation of market demand and is suitable for trend analysis using time-series modeling techniques.

4. System Overview

The system is designed as an end-to-end AI pipeline for market trend analysis. It begins with raw data input and concludes with an interactive deployment interface.

Overall Workflow:

Market Data
→ Data Preprocessing
→ LSTM Neural Network
→ Market Trend Prediction
→ Visualization and Deployment

Each stage of the system is modular, allowing the workflow to remain clean, understandable, and reproducible.

5. Methodology

A structured methodology was followed to develop the AI-based market trend analysis system.

Initially, the dataset was cleaned and sorted chronologically to preserve the time-series nature of the data. A single store and product category were selected to maintain consistency during modeling. Sales values were normalized using MinMax scaling to improve model training stability.

The processed data was then converted into fixed-length sequences, where sales data from the previous 30 days was used as input to predict future demand. This sequential structure allows the model to learn temporal dependencies.

An LSTM neural network was used as the core model due to its ability to retain long-term information and recognize patterns over time. The model was trained and evaluated before being prepared for deployment.

6. Market Trend Analysis Using AI

Market trends are reflected through variations in demand over time. In this project, the LSTM neural network analyses historical demand data to learn underlying market patterns such as upward trends, downward movements, and seasonal fluctuations.

By learning from past sales behaviour, the AI model captures how market demand evolves over time. The predicted outputs represent future demand levels, which function as indicators of upcoming market trends.

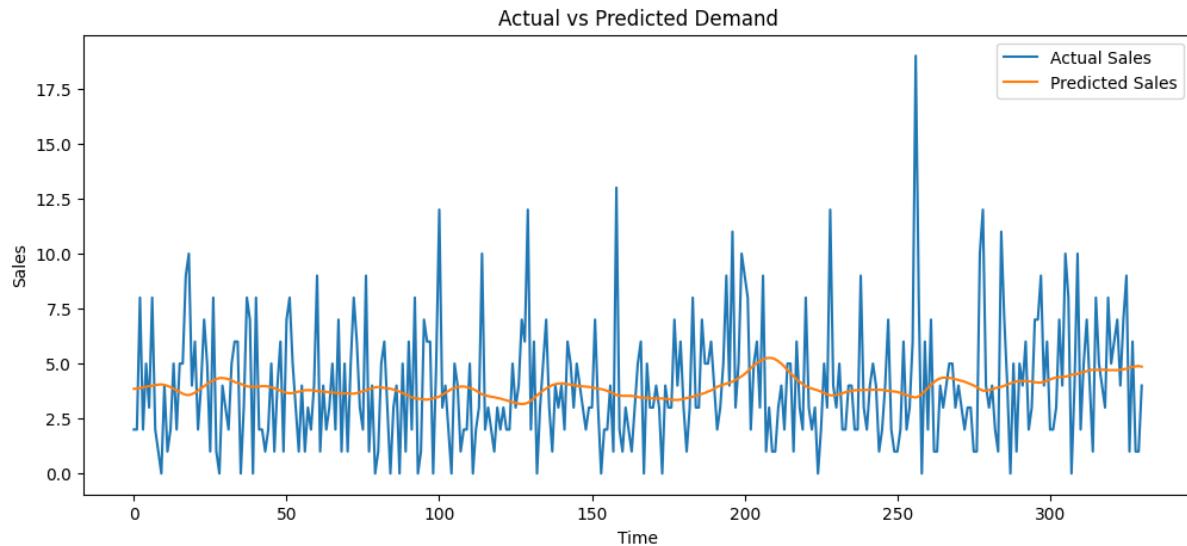
This AI-driven approach enables automated and data-driven trend analysis, reducing dependence on manual interpretation and improving the reliability of market insights.

7. Results and Observations

The trained AI model successfully generated forecasts based on historical market data. The results include visual comparisons between actual demand and AI-predicted demand.

The Actual vs Predicted graph shows that the model effectively follows the general direction of market trends. While small deviations are observed, the overall movement pattern is captured well by the model.

These results indicate that the AI system can analyse market behaviour and produce meaningful trend forecasts, particularly for short- to medium-term predictions.



8. Deployment Details

The trained LSTM model was deployed using a Streamlit-based web application. The deployment allows users to interact with the system by selecting a store, product category, and forecasting duration.

Once user input is provided, the application processes recent sales data, loads the trained model, and displays future market demand predictions along with graphical visualizations.

This deployment demonstrates how an AI model can be transformed into a usable tool for market trend analysis and decision support.

9. Learnings

This project provided valuable technical and practical learnings.

From a technical perspective, experience was gained in handling time-series data, designing LSTM neural networks, and deploying AI models. The project also improved understanding of how AI techniques can be applied to real-world market analysis problems.

From a system design perspective, the importance of modular development and clean project structure was learned. The project also highlighted challenges related to data preparation and model tuning.

10. Limitations & Future Scope

The current system relies solely on historical sales data and does not consider external factors such as promotions, economic conditions, or seasonal events, which can influence real market trends.

Future improvements may include incorporating additional data sources such as weather, festivals, pricing strategies, and customer behaviour. Deploying the system on a cloud platform and enabling real-time data processing could further enhance scalability and usability. Expanding the model to analyse multiple markets simultaneously is another potential enhancement.

11. References & AI Usage Disclosure

References:

- Retail sales time-series dataset sourced from Kaggle.
- Python libraries: Pandas, NumPy, TensorFlow, Keras, Streamlit

Source Code Repository:

GitHub – <https://github.com/sksaxena6688/ai-market-trend-analysis>

AI Usage Disclosure:

AI tools such as ChatGPT were used for conceptual guidance, clarification of AI concepts, and assistance in structuring the documentation. All implementation, experimentation, and final project development were performed by the student.