

# **Retail Inventory and Demand Forecasting**

**Laxmi Thakur<sup>1</sup> and Prof. Ujwala Khartad<sup>2</sup>**

Student, Department of Computer Science and Engineering (Data Science)<sup>1</sup>

Supervisor, Department of Computer Science and Engineering (Data Science)<sup>2</sup>

Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur, India.

**Abstract:** *This paper presents the design and implementation of a data analytics system for retail inventory management and demand forecasting using time series analysis in the movie rental economy. The system analyzes historical rental data, customer demand patterns, seasonal trends, and inventory turnover rates to predict future demand and optimize stock levels. The architecture integrates data collection, preprocessing, time series modeling, and visualization layers using tools like Microsoft Excel and Power BI. The proposed framework enables efficient inventory control, reduces stock shortages and overstock situations, and improves decision-making for retail businesses in the movie rental domain.*

**Keywords:** Retail Analytics, Demand Forecasting, Time Series Analysis, Inventory Management, Movie Rental Economy, Power BI, Data Visualization, Business Intelligence

## **I. INTRODUCTION**

The retail industry heavily depends on accurate demand forecasting and efficient inventory management to maintain profitability and customer satisfaction. In the movie rental economy, demand fluctuates based on factors such as genre popularity, seasonal trends, new releases, and customer preferences. With the growth of data analytics, businesses can now leverage historical rental data to forecast future demand using time series models. This helps retailers optimize inventory levels, minimize costs, and improve service efficiency. This project focuses on analyzing movie rental data to identify patterns and predict future rental demand using data visualization and forecasting techniques

## **II. SYSTEM DESIGN**

The system design focuses on building an efficient, modular, and scalable architecture. The overall system is divided into multiple layers, including:

- **Data Collection Layer:** Responsible for gathering movie rental data from retail stores and structured datasets containing multiple movies across various genres and time periods, and storing them in Excel/CSV format. The data includes rental transactions, movie categories, customer demand, and inventory stock levels.
- **Data Cleaning Layer:** Handles missing values, removes duplicate records, and standardizes data formats for consistency.
- **Data Transformation Layer:** Converts raw data into structured formats and creates calculated fields such as total rentals per genre, average demand rate, inventory turnover ratio, and time-based aggregations.
- **Computation Layer:** Processes transformed data to calculate key performance indicators (KPIs) including total rentals, average demand per movie, most rented movies, peak demand periods, stock availability ratio, and demand forecasting metrics using time series analysis.
- **Visualization Layer:** Displays interactive dashboards in Power BI, representing movie rental performance, demand trends over time, inventory distribution, and forecasting insights through line charts, bar charts, doughnut charts, slicers, and KPI cards.

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### III. METHODOLOGY

Microsoft Excel was used as the primary data source and preprocessing environment. After preprocessing in Excel, the dataset was imported into Power BI where an interactive multi-page dashboard was created. Key performance indicators were visualized using line charts (demand trends over time), bar charts (genre vs. rentals), donut charts (inventory distribution and genre share), scatter plots (demand vs. inventory turnover), and card visuals for headline KPIs. Slicers and filters were implemented for Genre, Time Period, Movie Title, Inventory Status, and Rental Frequency, enabling detailed drill-down analysis for end users.



Fig. 1. Power BI Dashboard Displaying AI Tool Performance

### IV. RESULT AND DISCUSSION

The Power BI dashboard provided clear insights into movie rental demand and inventory performance. High-demand movies and genres were identified based on rental frequency and customer demand, while low-performing titles were also highlighted. The dashboard enabled comparison of different movies and genres. It also helped in understanding rental trends and peak demand periods. The visual representation made it easier for users to interpret complex data and analyze inventory utilization and demand patterns effectively.



Fig. 2. System Architecture for AI Tool

### V. CONCLUSION

This paper successfully demonstrates how Microsoft Excel and Power BI can be used to analyze and visualize movie rental data effectively, creating a practical system for retail inventory management and demand forecasting. The proposed



dashboard provides a structured approach to data collection, cleaning, aggregation, and interactive visualization across multiple movies and genres over different time periods.

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