# Project Report: Walmart Retail Store Sales Analysis and Forecasting

## 1. Problem Statement

The challenge at hand revolves around delving into the world of a Walmart retail store chain's sales data across multiple outlets. The primary objective is to extract actionable insights from historical data and construct predictive models capable of forecasting sales within a defined time frame.


## 2. Project Objective

This project's overarching goals encompass:

- Analyzing historical sales data to uncover valuable insights.
- Developing advanced time series forecasting models to predict future sales trends.
- Offering strategic recommendations to enhance inventory management and optimize sales strategies.

## 3. Data Description

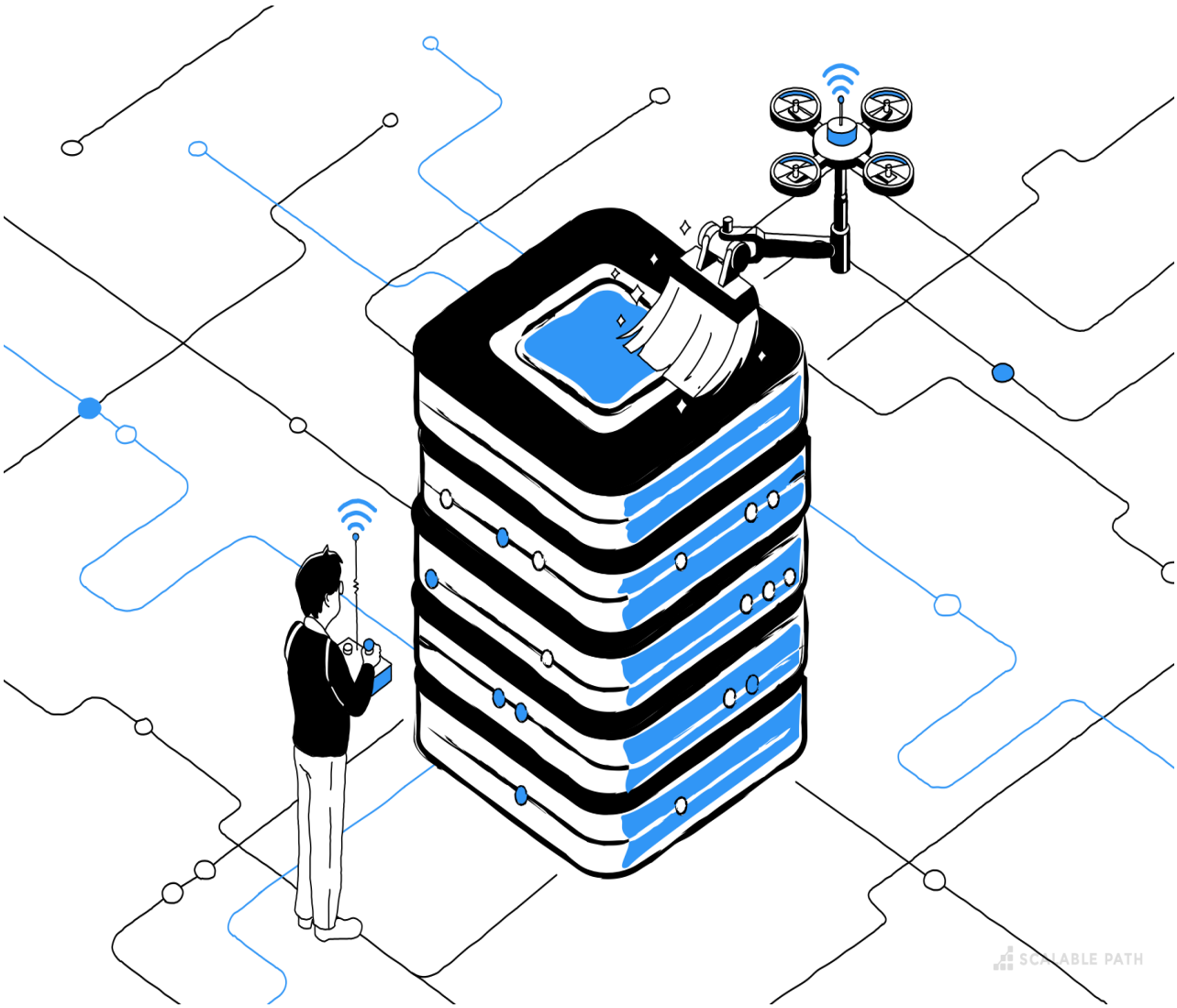
The dataset under examination, aptly named "Walmart.csv," comprises an impressive 6435 rows and 8 columns. Each row captures a comprehensive snapshot of store-specific details, including:

- Store numbers
- Dates of sales
- Weekly sales figures
- Indicators reflecting holidays, temperature variations, fuel prices, Consumer Price Index (CPI), and unemployment rates

## 4. Data Pre-processing Steps and Inspiration

The pre-processing journey encompassed several key steps:

- Transformation of the 'Date' column into datetime format for accurate analysis.
- Extraction of nuanced day, month, and year attributes from the 'Date' column.
- Creation of a 'Week' column utilizing isocalendar functions, aiding in tracking weekly trends.
- Introduction of scaling to weekly sales values for a more manageable analytical process.
- Unveiling relationships between various features and weekly sales through insightful visualizations.



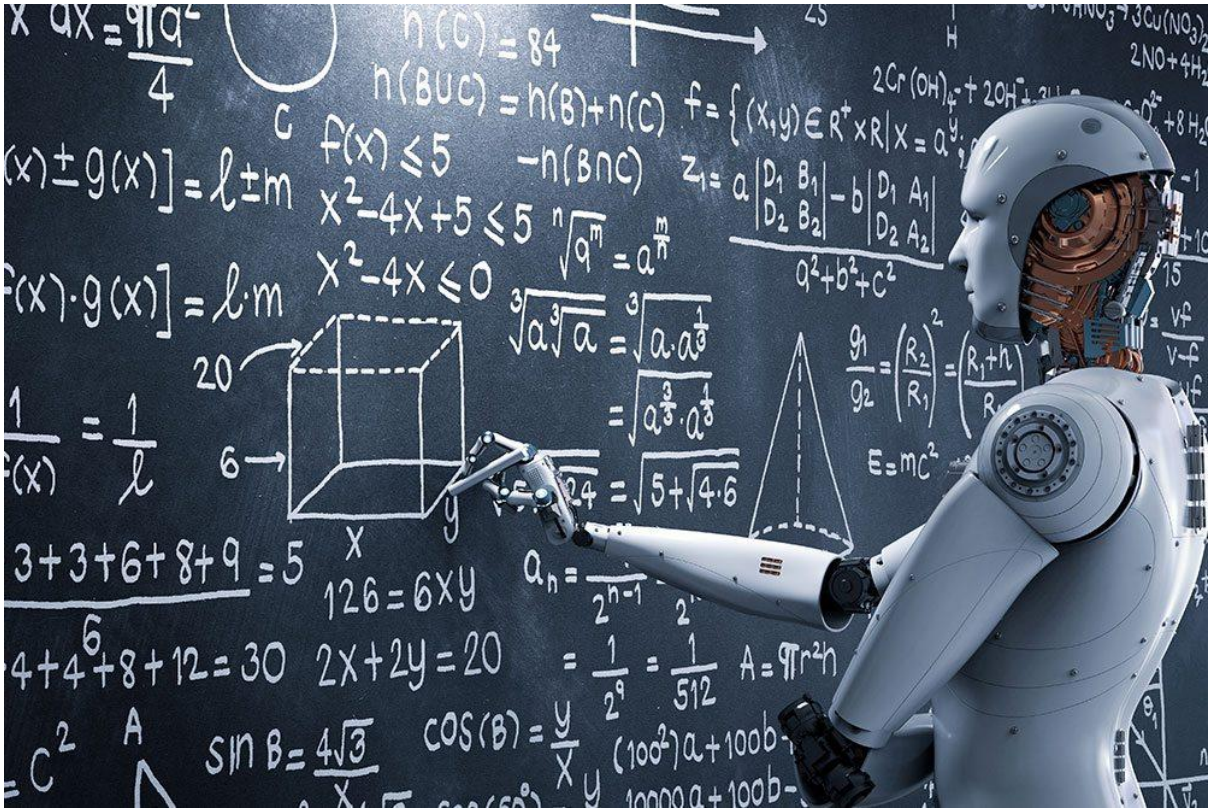
## 5. Choosing the Algorithm for the Project

For the intricate task of time series forecasting, the Seasonal Autoregressive Integrated Moving Average (SARIMA) model emerged as the algorithm of choice. Its unique capability to capture both seasonality and trends held immense promise for this project's objectives.

## 6. Motivation and Reasons for Choosing the Algorithm

The selection of the SARIMA model was driven by its remarkable strengths:

- Proficiency in handling intricate seasonality, evolving trends, and unpredictable irregularities.
- Innate ability to predict future sales based on the rich tapestry of historical patterns.
- Direct alignment with the project's core objective of precise sales forecasting.



## 7. Assumptions

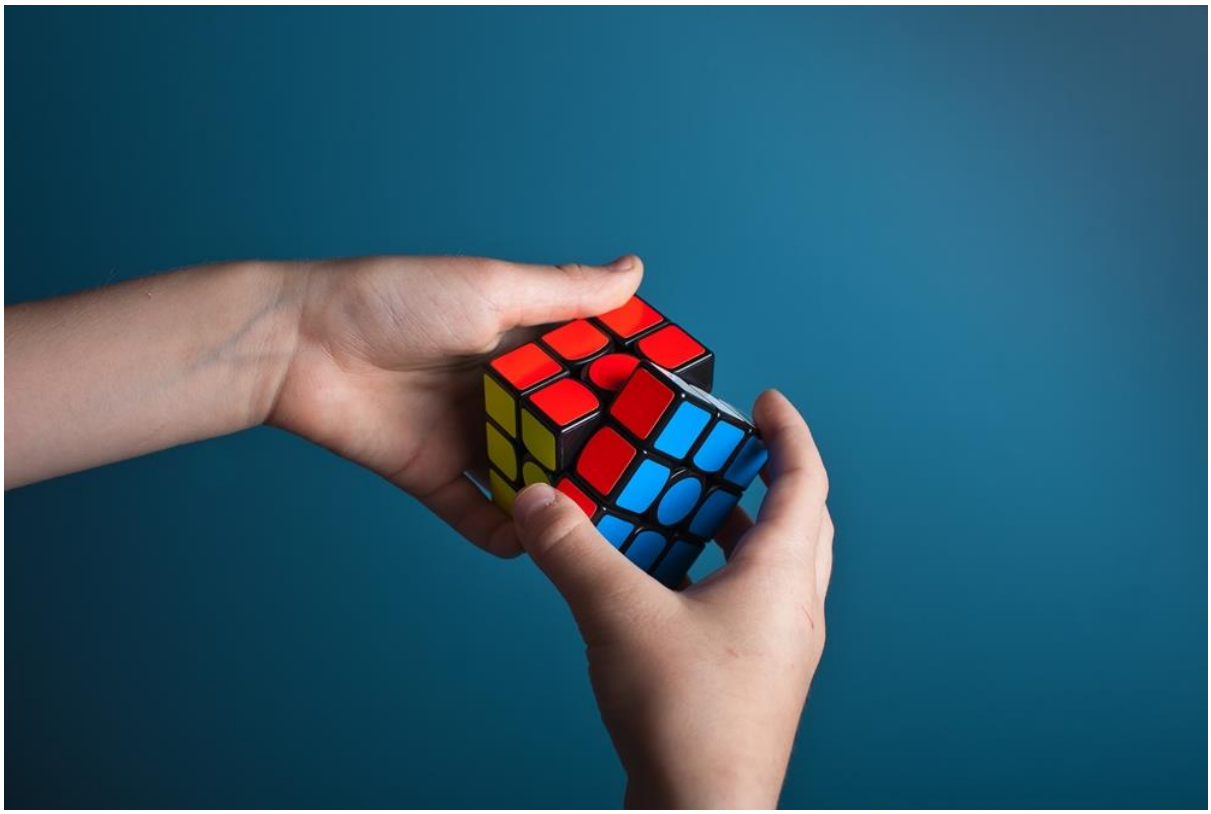
Two key assumptions were central to the implementation of the SARIMA model:

- The SARIMA model operates under the assumption that future sales trends Will closely mirror historical patterns.
- The forecasted outcomes are contingent upon the premise that the influencing factors behind sales will remain relatively stable.

## 8. Model Evaluation and Techniques

The evaluation and validation process featured several crucial elements:

- Comprehensive time series decomposition to unravel the intricate interplay of trends, seasonality, and residual components.
- Rigorous training of the SARIMA model utilizing a rich historical sales dataset.
- Generation of one-step-ahead forecasts and dynamic forecasts to meticulously gauge the model's predictive accuracy.
- Utilization of the Root Mean Squared Error (RMSE) metric as a reliable gauge to quantify forecast precision.



## 9. Inferences from the Analysis

The project's meticulous analysis yielded several noteworthy insights:

- Evident seasonality and discernible trends emerged as dominant characteristics within the sales data.

- Holidays exhibited pronounced spikes in sales, underscoring their impact on consumer behaviour.
- The SARIMA model impressively replicated historical trends, generating forecasts of remarkable reliability.


## 10. Future Possibilities of the Project

The journey is far from over, as this project opens avenues for future enhancements:

- Integrate external variables such as strategic marketing campaigns, promotional activities, and economic indicators to enhance forecast accuracy.
- Venture into advanced machine learning techniques to capture intricate nonlinear patterns and complex relationships.
- Develop an interactive and dynamic dashboard, empowering real-time sales monitoring and strategic decision-making.

## Conclusion

In conclusion, this project stands as a testament to the fusion of advanced time series analysis and forecasting methodologies within the realm of Walmart's retail store sales. The SARIMA model's predictive prowess has yielded invaluable insights, poised to reshape inventory management and elevate sales strategies.

## Acknowledgments

We express sincere gratitude to Walmart for providing access to the dataset that underpins the analyses and insights presented within this project.