**JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, NOIDA**



**OPEN SOURCE SOFTWARE LAB**

**Time Series Forecasting Report: MONTHLY SALES OF FRENCH CHAMPAGNE - Perrin Freres**

**SUBMITTED BY:**

KESHAV SINGH SOLANKI - 21103152

KUNAL KISHORE - 21103159

PRIYANSHU CHAUDHARY - 21103157

BATCH- B6

**SUBMITTED TO:**

MS. DEEPTI

**INTRODUCTION**

The primary aim of this project is to construct a robust time series forecasting model for predicting the monthly sales of Perrin Freres champagne, spanning a comprehensive 10-year dataset encompassing 105 monthly observations. The critical objectives encompass gaining insights into the temporal patterns, trends, and potential outliers within the data through thorough exploration. To accomplish this, we employ the AutoRegressive Integrated Moving Average (ARIMA) methodology, a well-established approach for capturing and predicting time-dependent variations. The dataset is strategically divided into training and testing sets to facilitate model development and evaluation, with hyperparameter tuning to optimize its performance. A crucial aspect of the project involves validation on unseen data, ensuring the model's capacity to generalize and produce accurate forecasts. The results, gauged using metrics like Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE), reflect the model's efficacy in predicting champagne sales. In conclusion, the ARIMA model emerges as a valuable tool for forecasting, offering insights that can inform strategic decision-making, inventory management, and overall business planning. Furthermore, this project recommends ongoing model monitoring, periodic retraining, and the exploration of advanced forecasting techniques and machine learning models for continual improvement. This comprehensive endeavor promises to provide strategic advantages in the sales domain, leveraging historical data to optimize business strategies.

**ABSTRACT**

This project focuses on creating a reliable time series forecasting model for monthly sales of Perrin Freres champagne, utilizing a 10-year dataset with 105 monthly observations. The AutoRegressive Integrated Moving Average (ARIMA) methodology is employed, and the project emphasizes data exploration, model validation, and performance evaluation using metrics like MAE and RMSE. The project concludes with the recommendation for ongoing model monitoring and exploration of advanced forecasting techniques for strategic sales optimization.

**TECHNOLOGIES USED**

* Python
* Machine Learning
* Pandas
* Numpy
* Scikit-learn
* Statistical tool
* Matplotlib

**FINDINGS**

The findings of this project are centered on the development and evaluation of the time series forecasting model for Perrin Freres champagne sales. The ARIMA model was applied to a 10-year dataset with 105 monthly observations. Here are the key findings:

1.**Model Performance:** The ARIMA model demonstrated promising results in forecasting monthly sales. The accuracy metrics, including Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE), indicated that the model provided reasonably accurate predictions. These metrics are essential for measuring the forecasted values' proximity to the actual sales figures.

2. **Temporal Patterns:** Through data exploration, the project uncovered crucial temporal patterns in champagne sales data. This insight can help the business understand the seasonality and trends within their sales, enabling more informed decision-making.

3. **Validation and Generalization:** The model's successful validation on additional, previously unseen data is a significant finding. It confirms the model's capacity to generalize and make accurate predictions beyond the training and testing datasets. This provides confidence in its reliability for future forecasting.

4. **Strategic Insights:** The insights gained from this project offer valuable inputs for strategic decision-making. It can assist in optimizing inventory management and inform business planning, allowing the company to align its resources and strategies with expected sales fluctuations.

5. **Recommendations:** The project's recommendations highlight the importance of continued model monitoring and periodic retraining to adapt to evolving sales patterns. Additionally, exploring advanced forecasting techniques and machine learning models can lead to further enhancements in forecasting accuracy and business strategies. In summary, the ARIMA model, developed and validated in this project, holds substantial potential for guiding business strategies, optimizing inventory management, and improving overall sales-related decision-making for Perrin Freres champagne. The project's findings underscore the value of data-driven forecasting in the business domain.

**REFERENCES**

* <https://www.kaggle.com/datasets/galibce003/perrin-freres-monthly-champagne-sales>
* <https://scikit-learn.org/0.21/documentation.html>
* <https://www.datacamp.com/tutorial/decision-tree-classification-python>
* <https://scikit-learn.org/stable/modules/generated/sklearn.neighbors.KNeighborsClassifier.html>