**Sales-Forecasting-for-Retail-Chains**

**Abstract**

This project tackles the critical challenge of accurate sales forecasting, a crucial component for effective inventory management and strategic business planning. The initiative employs an advanced machine learning model to enhance forecasting precision by leveraging a comprehensive dataset that includes historical sales, calendar events, and pricing adjustments. At the heart of this model is the CatBoost regression algorithm, chosen for its exceptional performance with categorical data and large datasets. The model is designed to capture complex temporal patterns and seasonal trends through sophisticated preprocessing techniques, including lag features and rolling windows, which allow it to learn from past sales data and external variables. The effectiveness of the model is measured using the Weighted Root Mean Square Scaled Error (WRMSSE), a metric that evaluates the accuracy of predictions across different hierarchical levels such as product categories, stores, and geographic regions. By integrating these advanced methodologies, the project aims to provide a more accurate and actionable forecast, supporting better inventory management, optimized resource allocation, and strategic decision-making within the retail sector.

**Existing System**

Current sales forecasting systems generally rely on traditional statistical methods or simpler machine learning techniques that may not fully exploit the potential of complex, multidimensional data. Many existing approaches utilize basic regression models or time-series techniques such as Autoregressive Integrated Moving Average (ARIMA) models. While these methods are useful, they often fall short in capturing the nuanced interactions between sales data and external factors such as calendar events, promotional activities, or price changes. Traditional models may also struggle with high-dimensional categorical data, leading to less accurate forecasts. On the other hand, some contemporary systems employ machine learning algorithms like random forests or gradient boosting, which improve upon traditional methods by handling non-linear relationships and interactions between variables. However, these models often lack sophisticated preprocessing and feature engineering, which can limit their ability to capture intricate patterns in the data. Furthermore, existing systems frequently evaluate model performance using basic metrics that may not fully reflect the accuracy needed for effective decision-making across different hierarchical levels. As a result, while these systems provide valuable insights, they may not achieve the level of precision required for optimal inventory management and strategic planning in the fast-paced retail environment.

**Proposed System**

The proposed system is an advanced sales forecasting solution designed to address the limitations of existing methods by integrating state-of-the-art machine learning techniques with comprehensive data preprocessing strategies. The system initiates with the preprocessing phase, where historical sales data is transformed into features that capture essential temporal dynamics. This includes the creation of lagged variables and rolling window statistics to encapsulate past sales patterns and detect emerging trends. Additionally, the system incorporates external factors such as calendar events (e.g., holidays, promotions) and pricing changes, which significantly impact sales but are often overlooked in simpler models. The core of the forecasting engine is the CatBoost regression model, selected for its ability to manage large datasets and complex categorical variables effectively. This model is trained to recognize intricate patterns in the data, enhancing its predictive accuracy. To ensure robust performance evaluation, the model’s predictions are assessed using the WRMSSE metric, which accounts for accuracy at various levels of aggregation, including product categories, individual stores, and regional sales. By incorporating these advanced features and evaluation methods, the proposed system aims to deliver more reliable sales forecasts, enabling businesses to make informed decisions that improve inventory control, reduce operational costs, and optimize overall performance.

**Modules**

**Admin**

* Login
* Verify Shop owners
* View registered shop owners
* View complaints & send reply
* View forecast result
* View feedbacks, ratings

**Shop Owner**

* Registration
* Login
* View profile
* Update password
* Add & manage products
* View order request & verify
* View completed orders
* Add & manage offers and discounts
* Chat with users
* Send complaint & view reply
* Accept payments
* View sales forecast
* View feedbacks, ratings

**Users**

* Registration
* Login
* View profile
* Update password
* View products
* Chat with shop owners
* Send order request
* Send payments
* View order status, previous orders
* Send complaint & view reply
* Send feedback, ratings

***SYSTEM SPECIFICATION***

**Software Requirements**

One of the most difficult tasks is selecting software, once the system requirement is to find out then we have to determine whether a particular software package fits for Those System requirements. This section summarizes the application requirement

Operating System : Windows 8 or above

Front End : Html, CSS, JavaScript, Flutter

Back End : Python-Django

IDE : Android Studio / JetBrains PyCharm

Database : MySQL

Web browser : Chrome, Explorer, Edge…etc

**Hardware Requirements**

The selection of hardware is very important in the existence and proper working of any of the software. When selecting hardware, the size and capacity requirements are also important. The hardware must suit all application developments.

Processor : i3 or above

System Bus : 32 Bit or 64 Bit

RAM : 4GB or Above

Hard Disk : 500 GB or Above

Keyboard : 108 Keys

Mouse : Any Type of Mouse

Monitor : 14” LCD or Above

Mobile : Android Supported Mobile Phone