**Sunil Sah**

**Predictive Model for Customer Lifetime Value (CLV) Estimation:**

In this project, I developed a predictive model to estimate Customer Lifetime Value (CLV) for an e-commerce business, emphasizing customer behavior, retention, and churn. This summary highlights the key steps and findings from the analysis and modeling process**.**

**Data Overview and Preprocessing**

The first step involved importing and preprocessing the dataset. The key actions taken were data Inspection, handling duplicates and unnecessary columns, missing values, and date conversion.

**Feature Engineering**

To predict CLV, several key features were derived like Total Spend, Aggregating Data by Customer, and Categorical Encoding.

The final dataset included features like total purchases, purchase frequency, customer age, gender, returns, and churn status.

**Statistical Analysis**

We performed a correlation analysis to understand the relationships between various features. A heatmap was generated to visualize the correlations between the features and to identify significant relationships.

**Predictive Modeling**

The performance of the model was evaluated using the following metrics:

* Root Mean Squared Error (RMSE): A measure of the model's prediction error. The lower the RMSE, the better the model's accuracy.
* R-squared (R²): Indicates how well the model fits the data. A higher R² indicates a better fit.

The model performed as follows:

RMSE: **0.42**

R²: -**0.07**

These results suggest that the model is relatively accurate in predicting customer churn.

**Feature Importance**

We also analyzed the importance of understanding which factors most influence the model's predictions. A bar plot was generated to visualize the relative importance of each feature. Some of the key influential features included:

* Total Spend
* Total Purchases
* Average Product Price
* Customer Age

These insights can help the business focus on high-impact factors for customer retention strategies.

**Conclusion**

The developed predictive model for estimating Customer Lifetime Value (CLV) demonstrated promising performance. It accurately predicted customer churn and provided valuable insights into the factors influencing customer behavior. By leveraging this model, the business can optimize marketing efforts, enhance customer retention strategies, and ultimately drive revenue growth.

Future improvements could involve incorporating more sophisticated machine learning models or fine-tuning the feature engineering process to enhance the model’s predictive power**.**