Banking Predictive Analytics and Recommendation Systems

Project Overview:
This project leverages data analytics and machine learning to address critical challenges in the banking domain. It focuses on three objectives:

1. Predicting loan defaults using customer and loan data.
2. Segmenting customers based on transaction behavior to enhance targeted services.
3. Recommending suitable banking products based on customer interaction data.

Key Business Benefits:

1. **Loan Default Prediction**: Reduces financial risk and enhances the loan approval process by accurately predicting potential defaulters.
2. **Customer Segmentation**: Improves customer satisfaction and marketing efficiency by tailoring strategies to specific groups.
3. **Product Recommendations**: Increases customer loyalty and revenue through personalized product offerings.

Approach:

1. **Loan Default Prediction** (Supervised Learning):
    - Uses historical customer data such as credit scores, income, and repayment history.
    - Machine learning models like Logistic Regression, Random Forest, and Gradient Boosting were developed and evaluated.
    - To balance the data for fairer predictions, techniques like SMOTE (Synthetic Minority Oversampling) were applied.
    - Key metrics used: Accuracy, Precision, Recall, F1-Score, and ROC-AUC Score.
2. **Customer Segmentation** (Unsupervised Learning):
    - Clusters customers based on features like income, age, and transaction patterns.
    - Uses K-Means clustering for grouping customers into meaningful segments.
    - Results were visualized using PCA (Principal Component Analysis) for clarity.
3. **Product Recommendations** (Recommendation Engine):
    - Recommends products by analyzing past interactions, such as purchases or views.
    - Demonstrated through collaborative filtering and dummy customer-product interaction data.

Findings and Results:

- The predictive model identified key factors influencing loan defaults and achieved competitive accuracy and recall rates.
- Customer segmentation revealed distinct behavioral groups, enabling tailored marketing strategies.
- The recommendation system showcased potential for delivering personalized product suggestions.

Deliverables:

- An interactive application using **Streamlit**, allowing users to explore:
    - Loan default analysis and predictions.
    - Customer segments and their characteristics.
    - Example product recommendations.
- Documentation of all processes, including model training, feature engineering, and evaluation.
- Visualizations like heatmaps, boxplots, and cluster diagrams to illustrate findings effectively.

Impact and Recommendations:

1. Implement the loan default prediction model to refine loan approval criteria.
2. Use segmentation insights to design custom campaigns for high-value customers.
3. Expand the recommendation system with real-world interaction data for higher precision.

Future Scope:

- Integrate real-time data for continuous learning and improvement.
- Explore advanced models for better accuracy in recommendations and segmentation.
- Collaborate across departments to align machine learning outcomes with business goals.