Low-Level Design Document
Money Laundering Prevention System

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1. Problem Statement

This document outlines the design of a machine learning model aimed at detecting potential money laundering activities by analyzing transactional behavior. The model scrutinizes users' fund transfer activities to predict their likelihood of engaging in money laundering.

2. System Architecture

The architecture comprises several core modules: Data Ingestion, Validation, Transformation, Model Training, Evaluation, Deployment, along with User Interface design, Monitoring, and Maintenance functionalities. Each module is designed to ensure seamless data flow and processing efficiency.

3. Data Ingestion Module

Data is sourced from the Ineuron Portal and loaded into a database. A dedicated function imports the data into a DataFrame for preprocessing, including splitting into training and test datasets.

4. Data Validation Module

This module ensures data integrity and quality, handles anomalies and missing values, and validates data consistency against predefined standards.

5. Data Transformation Module

Key operations include feature engineering, normalization, and encoding, aiming to prepare the dataset for effective model training. Techniques like SMOTE are employed to address imbalances.

6. Model Training Module

Applies various machine learning algorithms (e.g., Random Forest, Gradient Boosting, SVM) optimized through hyperparameter tuning to train the model effectively.

7. Model Evaluation Module

The model's performance is evaluated using metrics such as accuracy score, f1 score, precision score, and confusion matrix, ensuring its reliability and efficacy.

8. Model Deployment Module

Deploys the trained model into a production environment with an API endpoint for real-time predictions, facilitating seamless integration into existing systems.

9. User Interface

Provides a platform for users to input data and receive predictions, enhancing user engagement and model accessibility.

10. Model Monitoring and Maintenance

Continuous monitoring and periodic retraining are conducted to maintain model performance and adapt to new data patterns or changes.

11. Documentation and Collaboration

Project resources, including code and documentation, are made available on GitHub, encouraging community collaboration and project enhancement.

12. Conclusion

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This document sets the foundation for developing a comprehensive system designed to predict and prevent money laundering activities, ensuring a structured and methodical approach to its implementation and maintenance.