Mentornnes Task 2 26/02/2024

**MIP-ML-06 BATCH**

**Evaluation Metrics and Analysis Report**

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**Introduction**

This report evaluates the fraud detection model's performance, employing Gradient Boosting with optimized parameters.

**Model Selection**

Best Parameters: {'learning\_rate': 0.1, 'max\_depth': 5, 'min\_samples\_leaf': 1, 'min\_samples\_split': 2, 'n\_estimators': 100} Cross-Validation Accuracy: 99.88%

**Test Metrics**

Accuracy: The model achieved 100% accuracy on the test set.

Precision: 100% precision for both fraud and non-fraud classes.

Recall: Impressive 100% recall for both fraud and non-fraud instances.

F1-Score: Perfect F1-scores for both classes, demonstrating a harmonious balance between precision and recall.

**Confusion Matrix**

True Positives (Fraud): 823 instances correctly identified.

True Negatives (Not Fraud): 177 instances correctly classified.

False Positives: 0 instances.

False Negatives: 0 instances.

**ROC Curve**

The ROC curve showcases outstanding sensitivity and specificity.

Area Under the Curve (AUC): High, indicating robust model performance.

**Model Robustness**

Optimal parameters and high cross-validation accuracy signify robustness.

Best parameters: {'learning\_rate': 0.1, 'max\_depth': 5, 'min\_samples\_leaf': 1, 'min\_samples\_split': 2, 'n\_estimators': 100}

**Recommendations**

1. Deploy the model in production for real-time fraud detection.
2. Regularly update with fresh data to adapt to evolving patterns.
3. Implement continuous monitoring for long-term efficacy.

**Conclusion**

The model, tuned with optimal parameters, demonstrated exceptional accuracy, precision, recall, and F1-scores on the test set. It is recommended for deployment in real-world scenarios, showcasing robustness and a strong ability to identify both fraud and non-fraud transactions. Ongoing vigilance will be crucial for maintaining effectiveness.