Model Card for Credit Card Fraud Detection Using XGBoost

# Model Overview

Model Type: XGBoost (Extreme Gradient Boosting) classifier.  
Primary Purpose: Detect fraudulent credit card transactions in an imbalanced dataset.  
Version: Final tuned version using RandomizedSearchCV for hyperparameter optimization.

# Model Details

Architecture: XGBoost ensemble model, optimized for class imbalance.  
Key Features:  
- Learning rate: 0.2  
- n\_estimators: 300  
- max\_depth: 5  
- scale\_pos\_weight: 1 (to handle class imbalance)  
- subsample: 1.0  
- colsample\_bytree: 1.0

# Performance Metrics

Precision (Fraudulent): 0.77  
Recall (Fraudulent): 0.81  
F1-score (Fraudulent): 0.79  
ROC AUC Score: 0.99  
Accuracy: 1.00 on a test set containing 56,962 transactions.  
Confusion Matrix:  
- True Negatives: 56,840  
- False Positives: 24  
- False Negatives: 19  
- True Positives: 79

# Considerations

Intended Use: The model is intended for real-time fraud detection systems in credit card transactions, where class imbalance is a key challenge.  
Ethical Concerns: Since the dataset is anonymized, no direct ethical concerns arise, but careful attention must be given to the fairness and transparency of model decisions in deployment.  
Limitations: The model is optimized for the specific dataset, so it may require retraining or further tuning to generalize to different datasets or environments.

# Evaluation and Maintenance

Ongoing Evaluation: The model's performance should be regularly evaluated in a live environment to ensure that it continues to perform as expected with new data.  
Updates: Future updates to the model could include fine-tuning on new datasets or improving interpretability with SHAP values or LIME explanations.