

Credit Card Fraud Detection

Credit card fraud is a critical issue escalating with increased card usage. Global losses are projected to exceed \$400 billion. Machine learning offers a modern defense strategy.

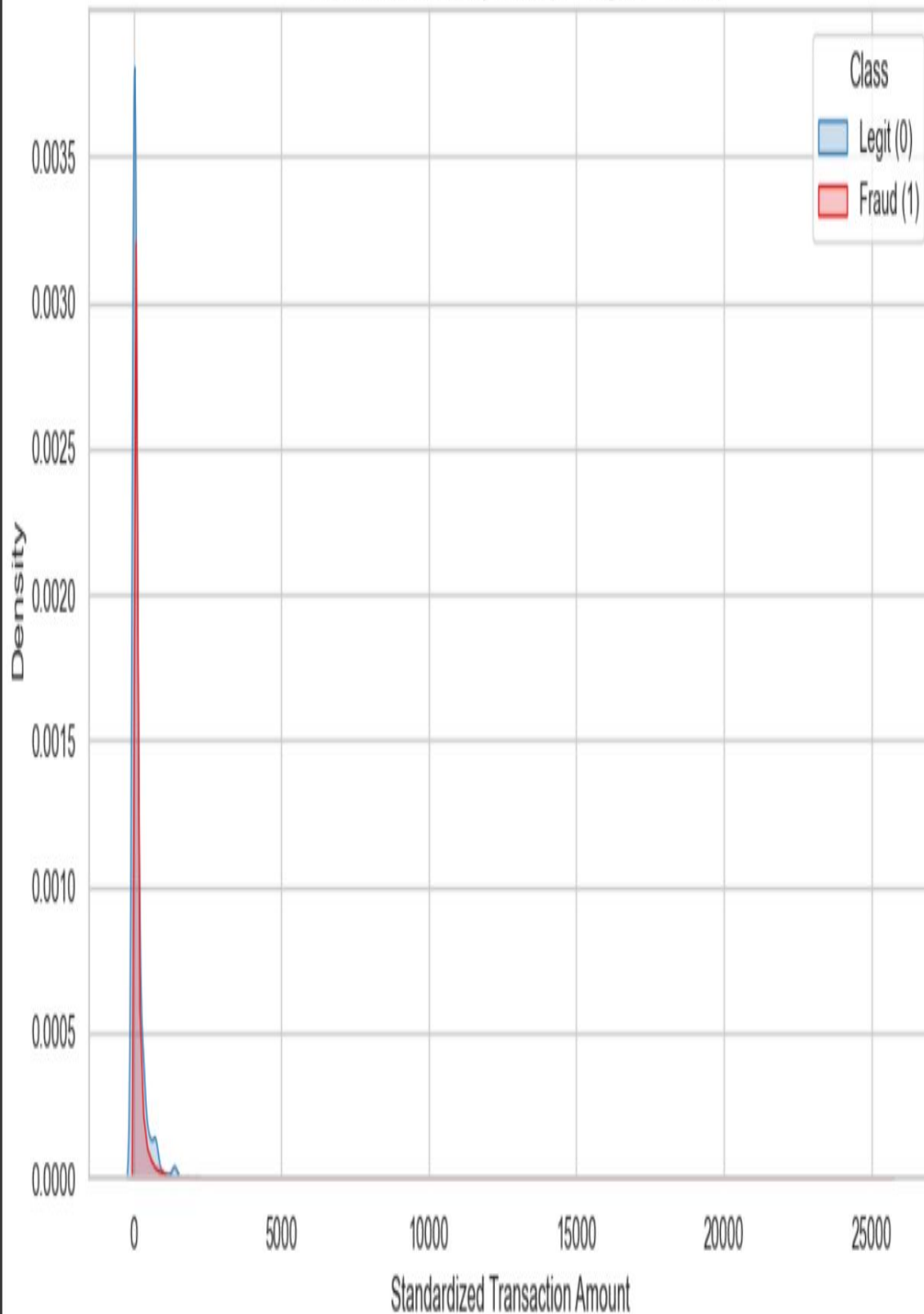


Machine Learning Approach

Steps involved:

1. **Data Acquisition & Exploration**
 2. **Data Preprocessing**
 3. **Handling Class Imbalance**
 4. **Dataset Splitting**
 5. **Model Selection & Training**
 6. **Model Evaluation**
 7. **Results Summary**
 8. **Conclusion**
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Transaction Amount by Class (0 = Legit, 1 = Fraud)



Data Preprocessing

Load Dataset

Loaded `creditcard.csv`

Exploration:

`.head()`, `.info()`,
`.describe()`

Problem Identified:

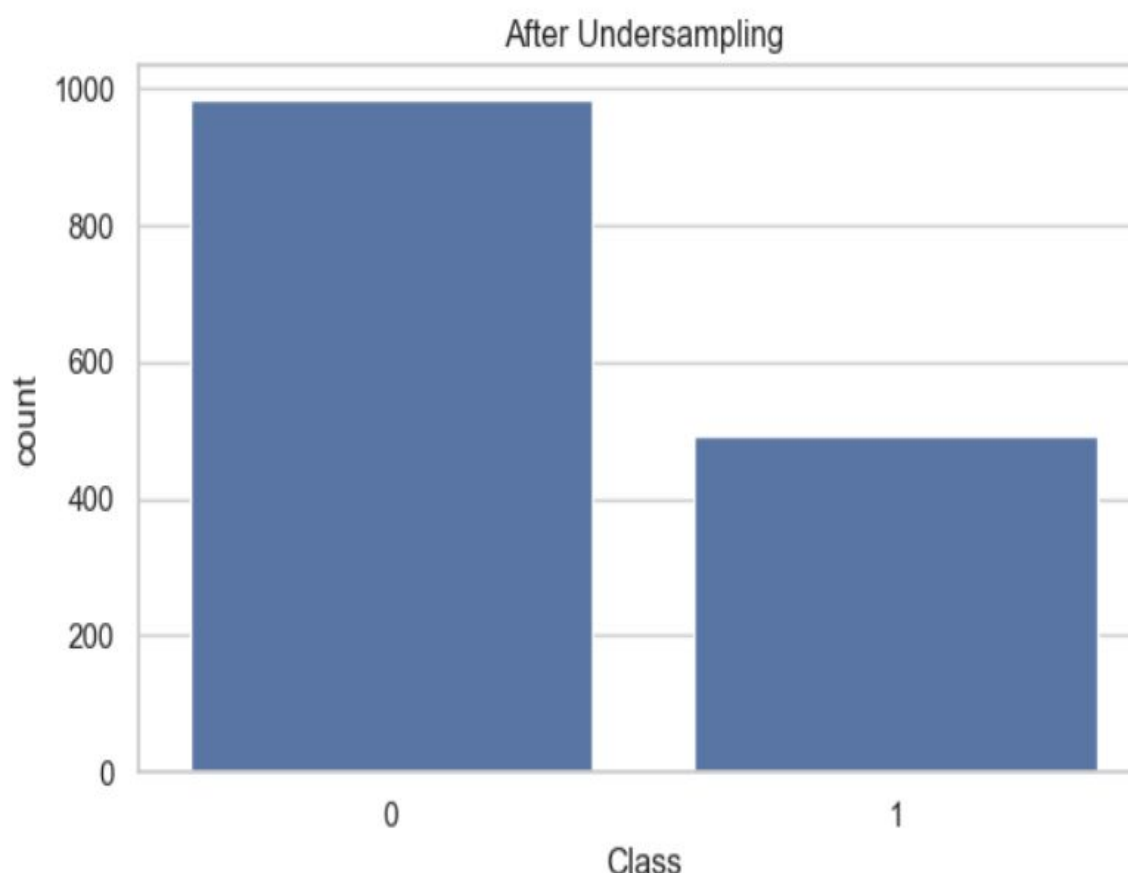
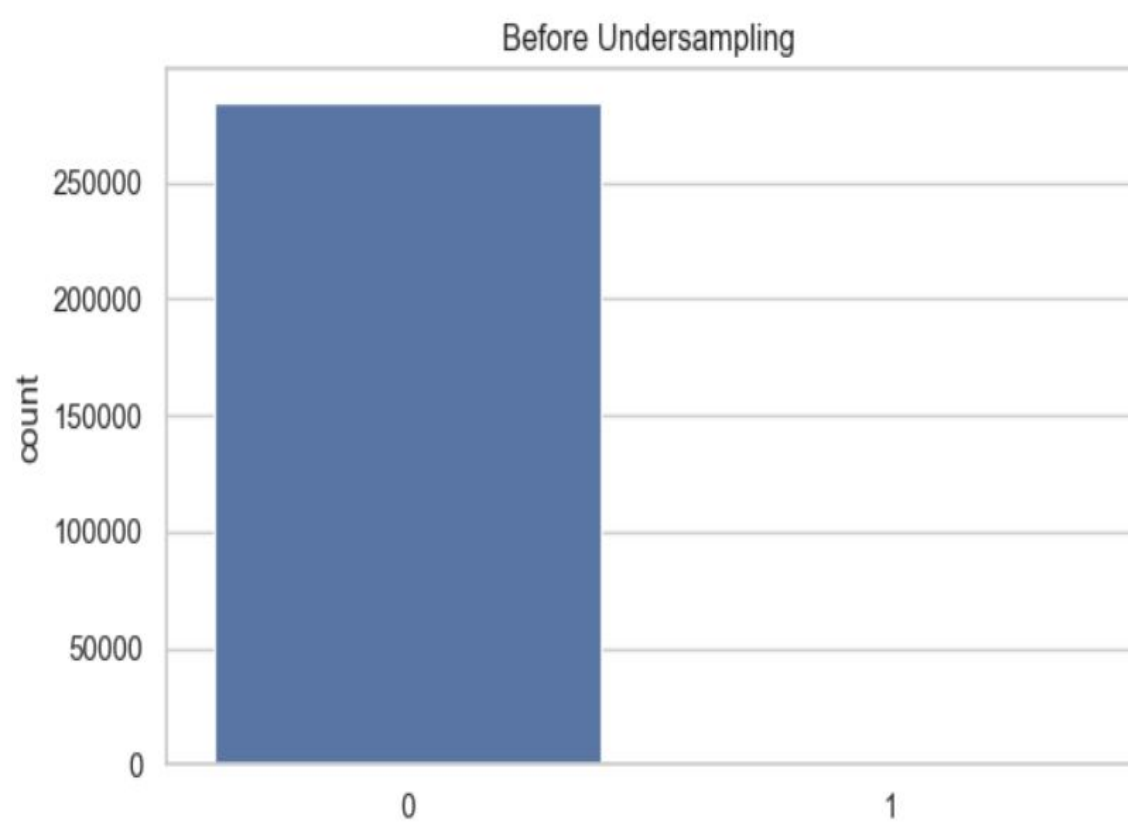
Highly imbalanced dataset (Fraud cases are rare)

Visualizations:

- KDE Plot for transaction amount
- PCA for dimensionality reduction and fraud separation

Cleaning:

- Dropped missing `Class` values
- Dropped `Time` column
- Standardized `Amount` feature



Handling Imbalance

Extreme Class Imbalance:

- Very few fraudulent transactions

Solution:

- Used **RandomUnderSampler** to balance dataset (50:50 ratio)



Visual Proof:

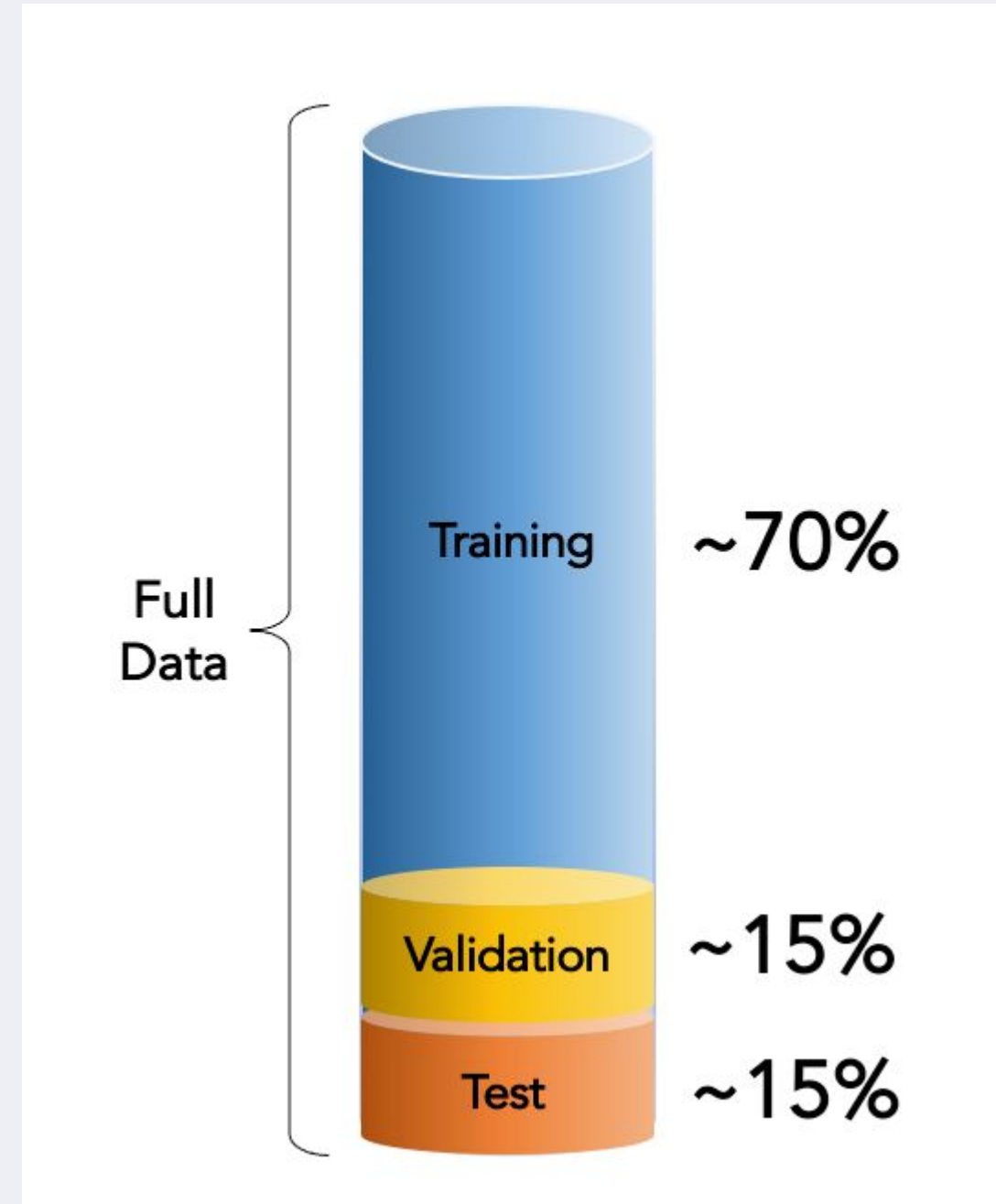
- Bar plots before and after resampling

Train-Test Split

- 80% Training, 20% Testing
- **Stratified Split** (maintains class ratio)

Model Selection

1.  Random Forest Classifier
2.  XGBoost Classifier

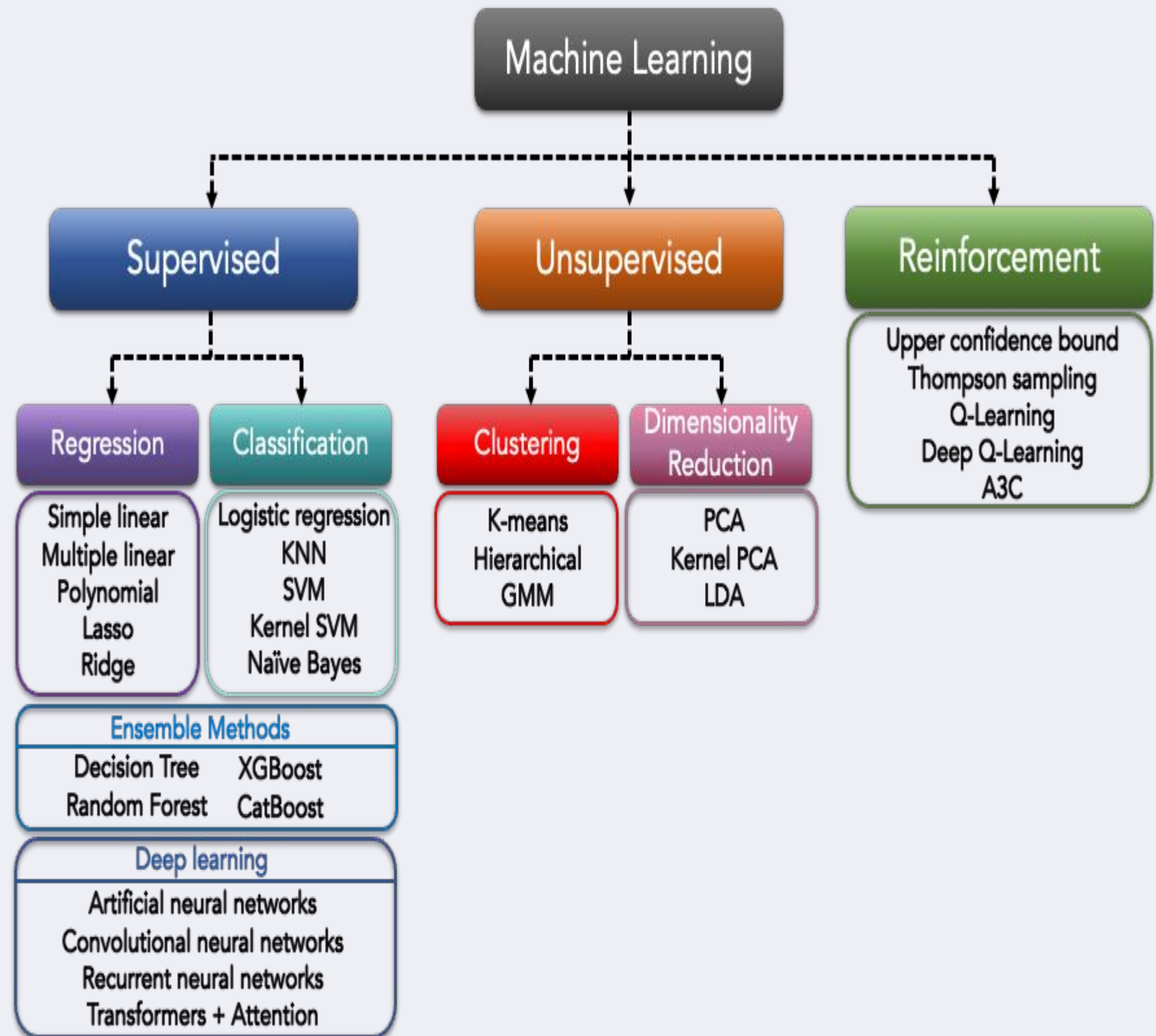


1. 🌲 Random Forest Classifier

- `n_estimators=200`
- `random_state=42`

2. ⚡ XGBoost Classifier

- `n_estimators=300`
- `max_depth=6`
- `learning_rate=0.05`
- `eval_metric='logloss'`
- `use_label_encoder=False`





Evaluation Metrics Used

- **Accuracy:** Correct predictions over total predictions
- **Precision:** Correctly predicted frauds among predicted frauds
- **Recall:** Correctly predicted frauds among actual frauds
- **F1 Score:** Harmonic mean of Precision and Recall
- **Confusion Matrix**
- **ROC Curve & AUC Score**



Random Forest Results

0.9594	ACCURACY
0.9887	PRECISION
0.8888	RECALL
0.9361	F1 SCORE



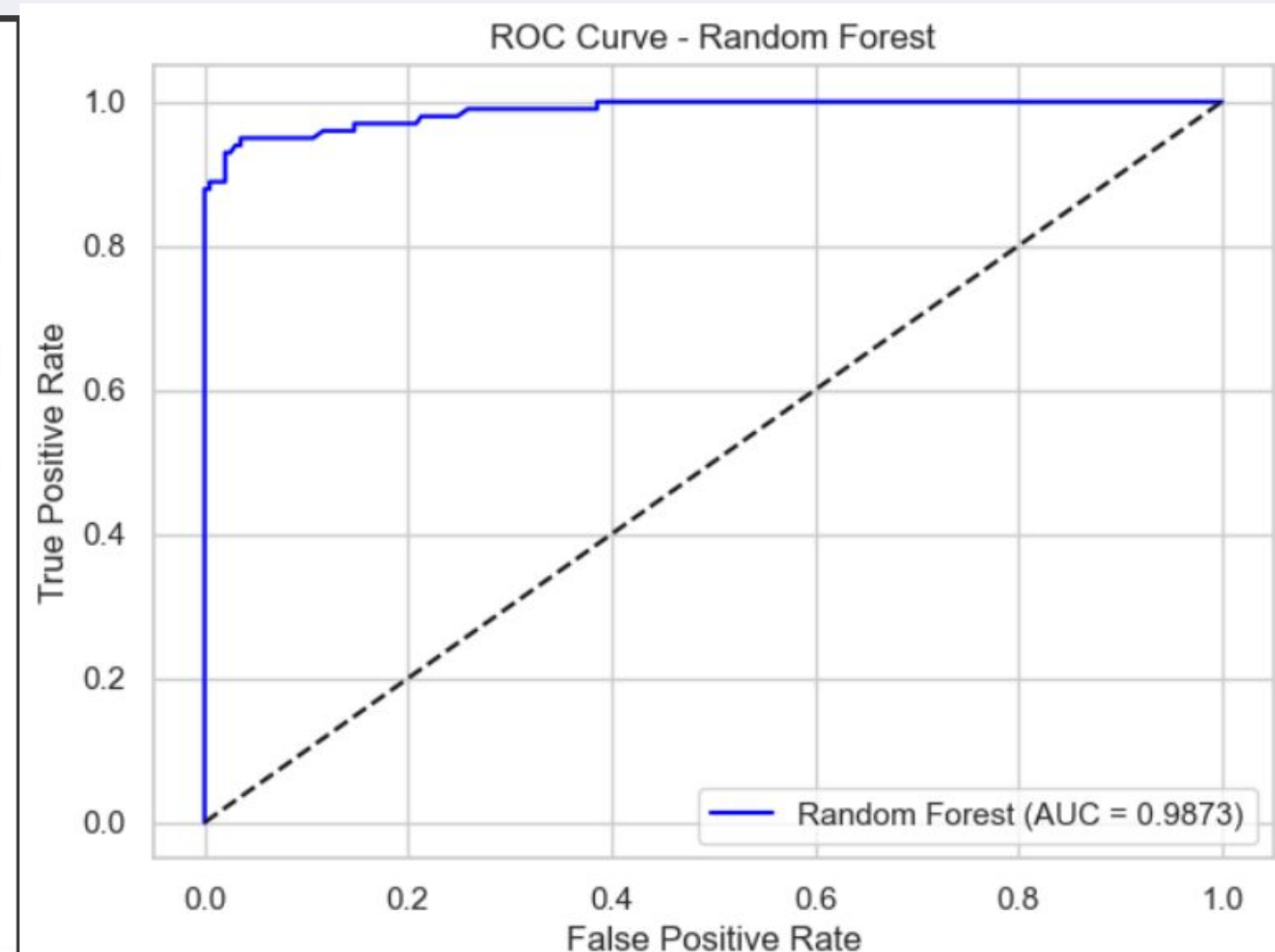
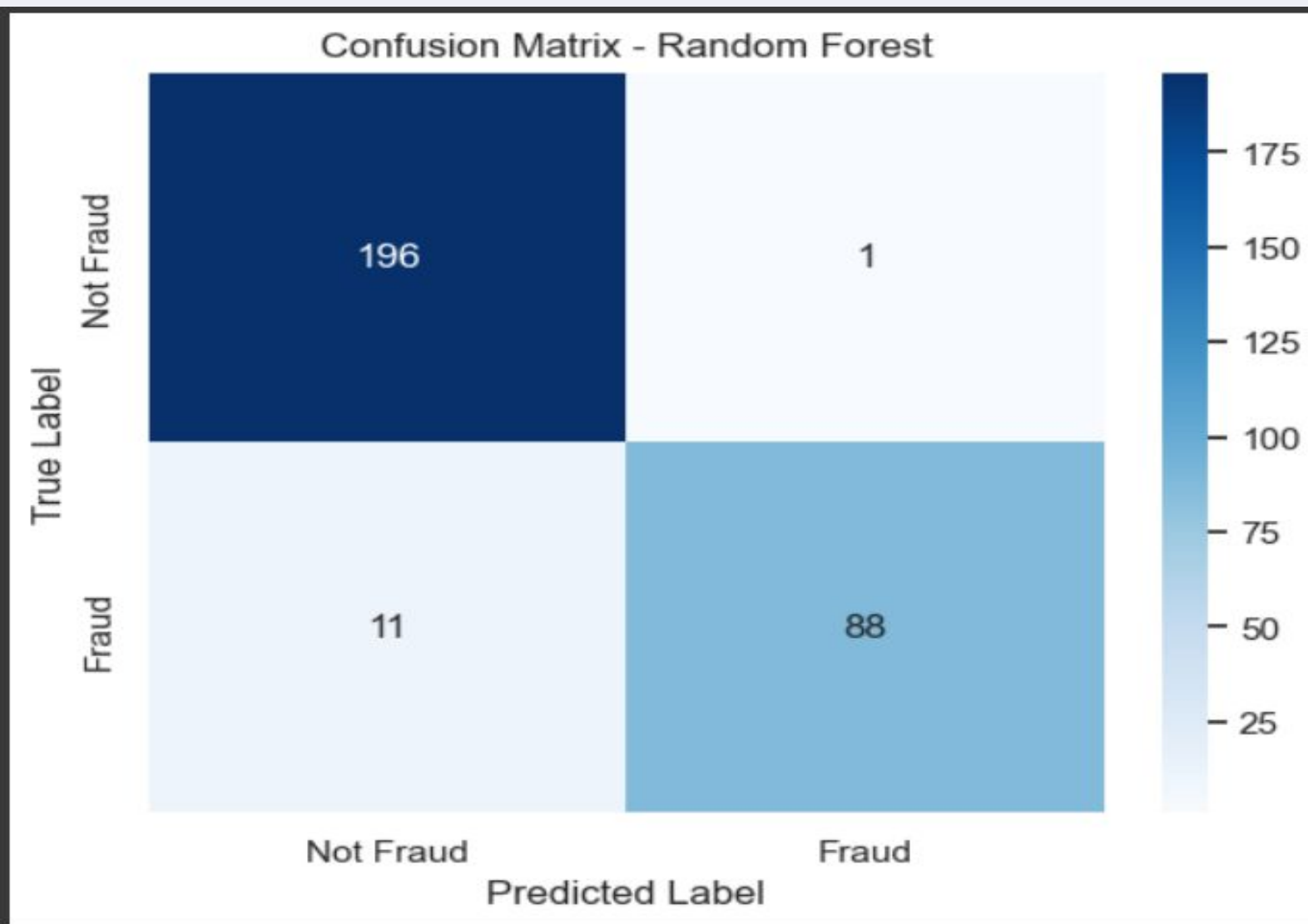
XGBoost Results

0.9594	ACCURACY
0.9887	PRECISION
0.8990	RECALL
0.9368	F1 SCORE



Conclusion

- **Random Forest:**
 - Excellent precision.
 - Slightly lower recall.
 - Good overall performance.



XGBoost:

- Higher recall and slightly better F1 score.
- Best choice for fraud detection where **catching frauds** is critical.

