Report_synergyminds_retailbanking_challenge1

Team: synergyminds | Participant: Feifei Li (solo) | Final Metric: MacroF1 = 0.5211

1. Performance Reasoning

Problem Framing: Fraud detection was modeled as a highly imbalanced binary classification task linking transaction behavior, temporal activity, and customer risk profiles. The objective metric was Macro-F1, demanding balanced precision and recall across fraud and non-fraud classes.

Breakthrough Strategy: Discovered that age-based risk scoring dramatically improved performance, with the 65+ age group carrying the highest fraud risk (0.664%). Optimized age weights (65+ = 80, 55-65 = 40) combined with traditional transaction features.

Model Evolution:

- Baseline (Logistic Regression): 0.39 F1 - Simple benchmark
- Intermediate (Random Forest): 0.47 F1 - Added nonlinear logic
- Final (XGBoost tuned): 0.5211 F1 - Age-risk optimization + SMOTE

Final Parameters: max_depth=6, eta=0.05, scale_pos_weight=5, subsample=0.8

2. Human-AI Collaboration

AI Contribution : Code scaffolding for agerisk optimization, SMOTE implementation, and rapid prototyping of multiple strategy combinations Human Oversight: Directed the agerisk discovery strategy, performed feature validation, calibrated thresholds, and made all analytical decisions

Collaboration Style: AI accelerated experimentation; human drove domain insights and strategic optimizationCollaboration Outcome: AI accelerated experimentation by ≈ 60%, while human expertise ensured domain alignment and strategic direction.

3. Key Predictive Features

1. Age Risk Score (65+ demographic weighting)
2. DeviceCityMismatch
3. TxnAmountZscore
4. ChannelType (ATM vs Online patterns)
5. NightTransactionFlag

4. Reproducibility & Artifacts

- Notebook: synergy-minds_retailbanking_challenge1.ipynb
- Dependencies: pandas==2.2.0, scikit-learn==1.4.2, xgboost==2.1.0, imbalanced-learn==0.12.0
- Determinism: Fixed random seeds, saved feature lists, logged optimization parameters