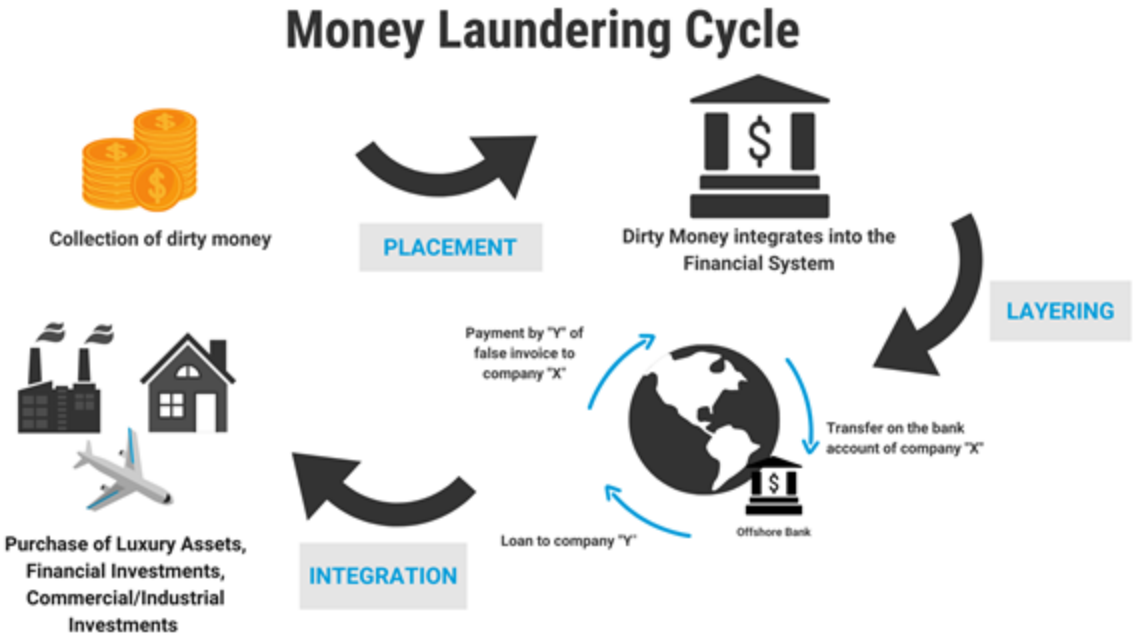
Deep Learning for Anti-Money Laundering: Detecting Suspicious Transactions



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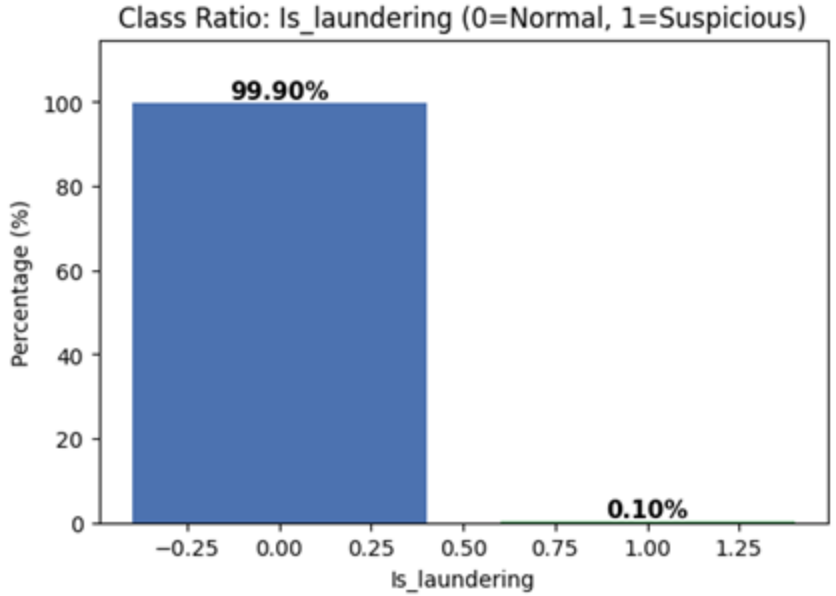
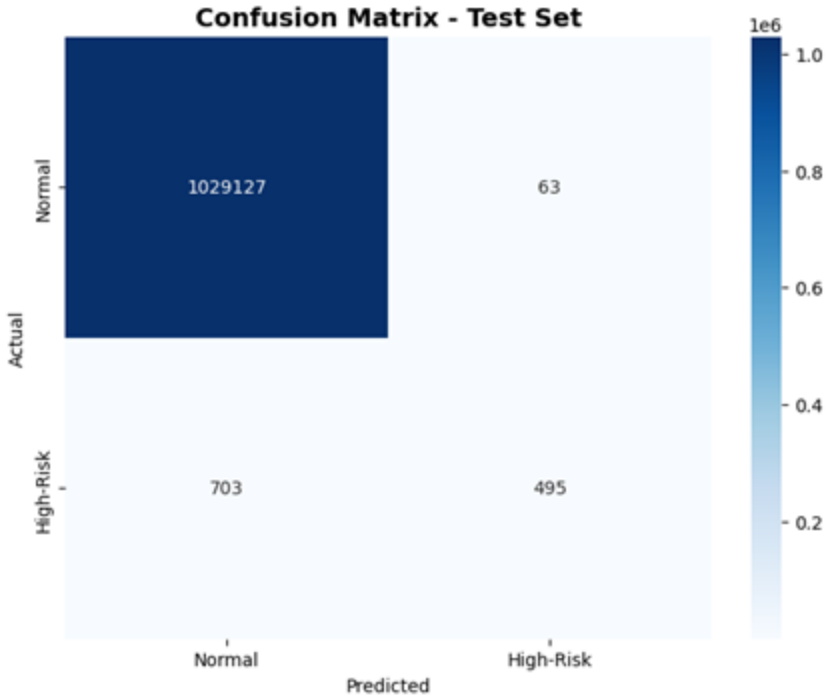
Synthetic Anti-Money Laundering Dataset (SAML-D)

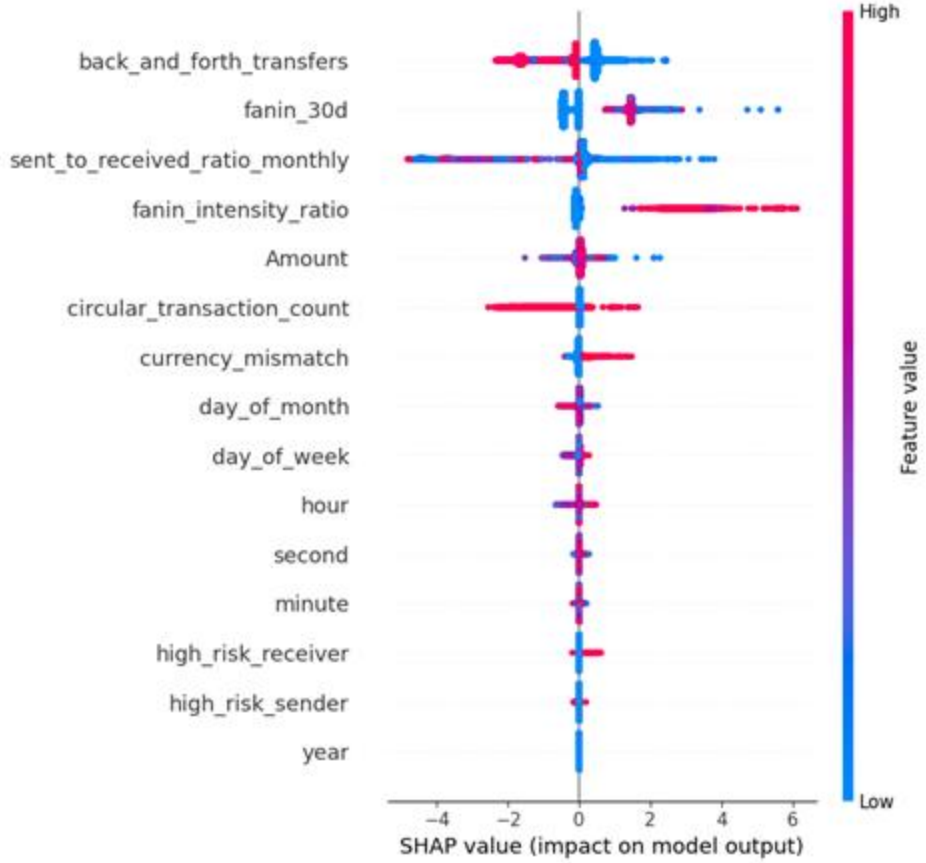
- **Large dataset**: Contains 9,504,852 transactions.
- **Structure**: Includes 11 core features and 28 transaction typologies.
- **Class imbalance**: Highly imbalanced, with just 0.1039% suspicious transactions.
- **Feature extension**: Supports additional graph-based features (e.g., fan-in, fan-out, circular transaction counts) and temporal features (e.g., day of month, day of year).



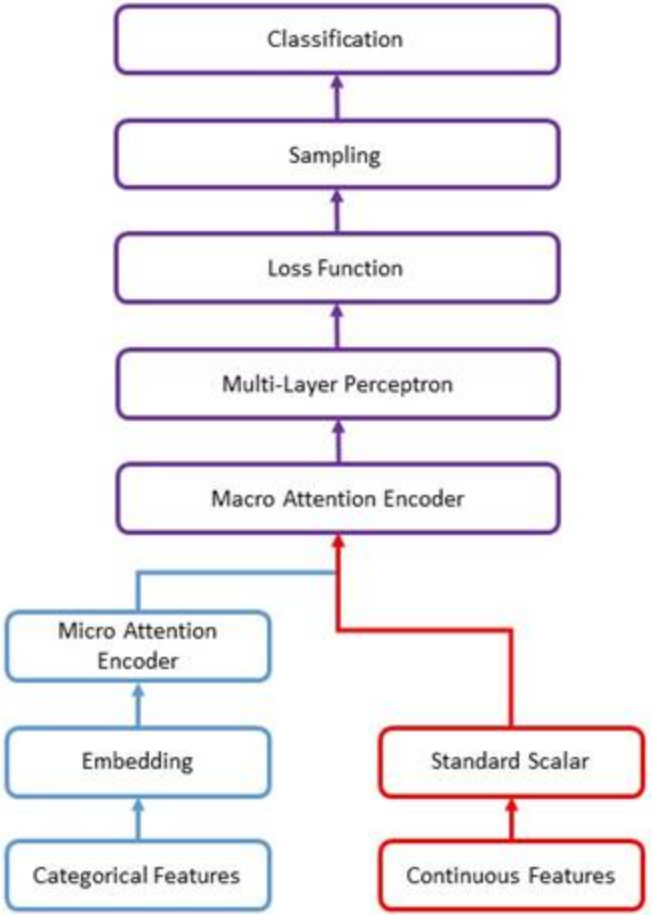
XGBoost Model: High Precision, Low Recall



Precision: 0.887
Recall: 0.413
PR-AUC: 0.559



Transformer: Good Recall & Precision



❖ Model Overview:

- Learns behavioral patterns across transaction attributes, instead of treating features independently.
- **Micro-level attention** captures sender–receiver interactions and transaction context.
- **Macro-level attention** integrates global patterns across all features.
- Categorical features are embedded; continuous features standardized.
- Final classification via MLP with residuals, dropout, and Focal Loss to handle class imbalance

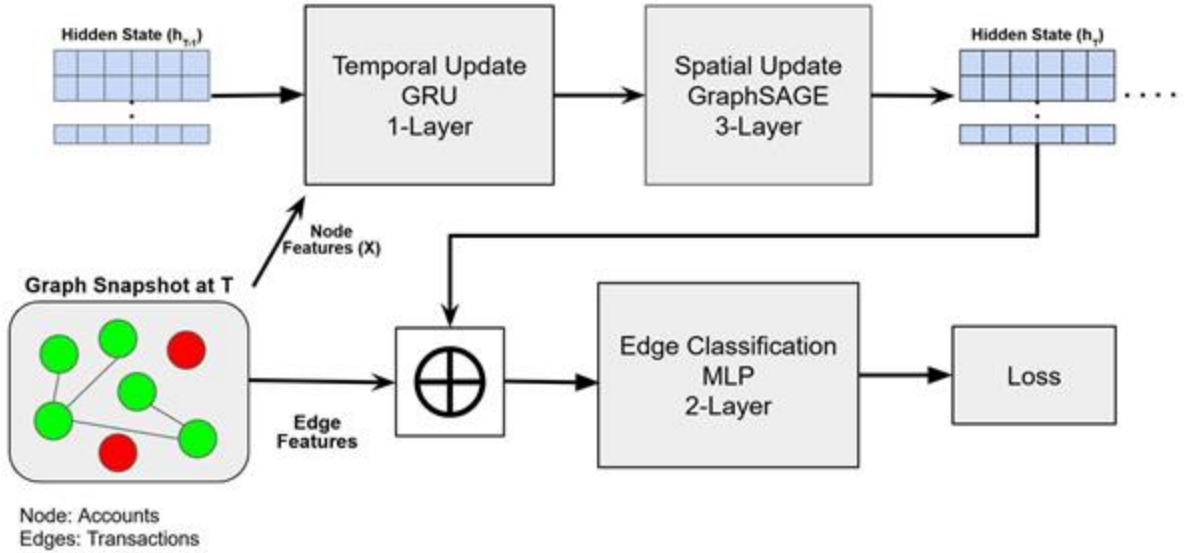
❖ Training Setup:

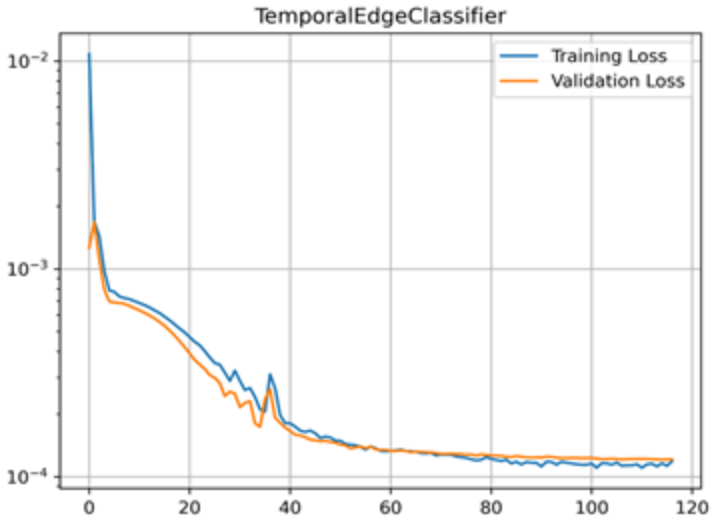
Optimizer: AdamW | Scheduler: ReduceLROnPlateau
Loss: Focal Loss | Regularization: Dropout + LayerNorm

❖ Results:

Recall: 0.5993 Precision: 0.6492 PR-AUC: 0.64

Temporal GNN: High Precision & Recall



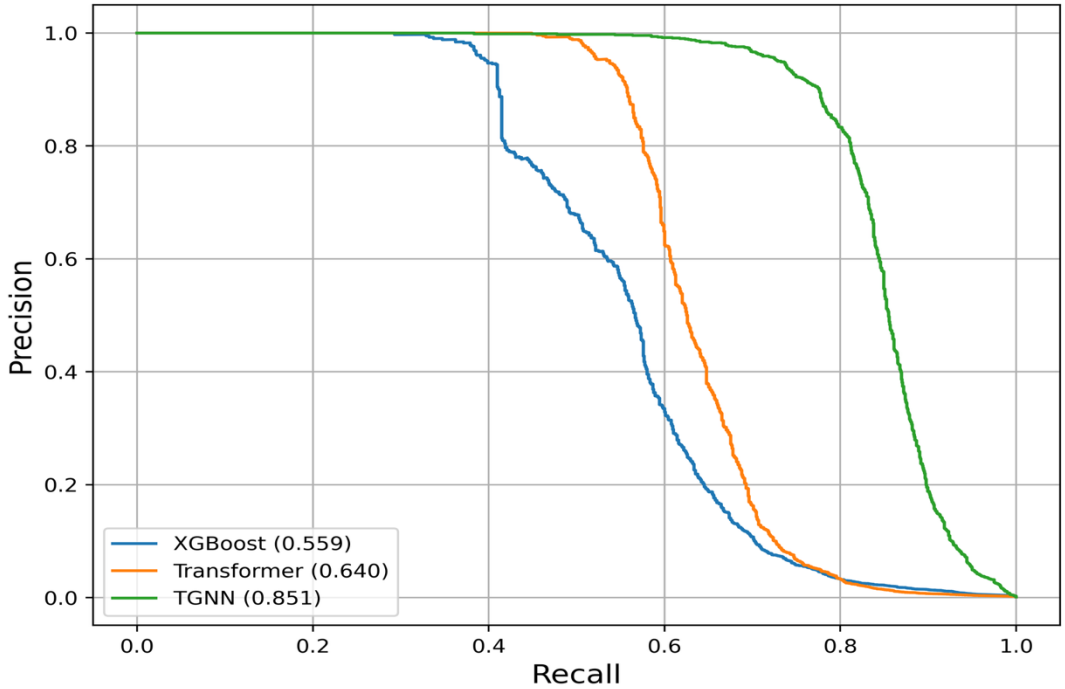


TemporalEdgeClassifier

- Optimized threshold for F2 value
- Dropout rate: 0.3
- Activation Func: ReLU
- Loss function: Focal loss (α=0.25, γ=2)
- Truncated backpropagation through time

Precision: 0.812
Recall: 0.814
PR-AUC: 0.851

TGNN > Transformer > XGBoost



- Our findings lay a strong foundation for scalable, graph-based solutions in real-world AML systems.
- **Next steps:** hybrid models, temporal graphs, and real-time inference to boost performance.

Thank you!

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