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ADAPTIVE FRAUD DETECTION ENGINE

Real-Time ML Decisioning with
Auto Case Resolution

PRESENTED BY
Vachan Sardar

1. WHAT THIS PROJECT IS

Goal:

Build a production-style fraud detection system, not just a model.

Focus:

- Real-time fraud scoring
- Business-driven decisions
- Analyst review workflows
- Operational monitoring

Data:

- Credit Card Fraud Detection Dataset (2023 – Kaggle)
- Synthetic streaming data to simulate live transactions

2. DATA & STREAMING SETUP

Base data

- Anonymised PCA features (V1–V28)
- Transaction amount
- Highly imbalanced fraud labels (realistic)

Why synthetic data

- Original data is static
- Production systems are continuous

Synthetic stream preserves

- Fraud rate
- Feature distributions
- Transaction velocity (Tx/min)

Used by

- Live Feed
- Ops Analytics
- Case Queue

3. MACHINE LEARNING & DECISIONING

Model

- LightGBM (Gradient Boosted Trees)
- Optimised for imbalanced tabular data

Decision strategy

- Cost-sensitive thresholding
- False Negative \gg False Positive
- Cost ratio: FN = 100x FP

Output

- Fraud probability score
- Business decision:
 - APPROVE
 - REVIEW

Impact

- Optimises financial loss, not accuracy
- Aligns model output with real fraud risk trade-offs

4. CORE SYSTEM COMPONENTS

Live Transaction Feed

- Simulated real-time transaction stream
- Instant fraud scoring per transaction
- Threshold-based decisioning
- Visual risk indicators for fast triage

Batch Scoring

- CSV-based ingestion for bulk transactions
- Designed for backfills and daily extracts
- Outputs:
 - Fraud probability
 - Business decision at active threshold

Single Transaction Analysis

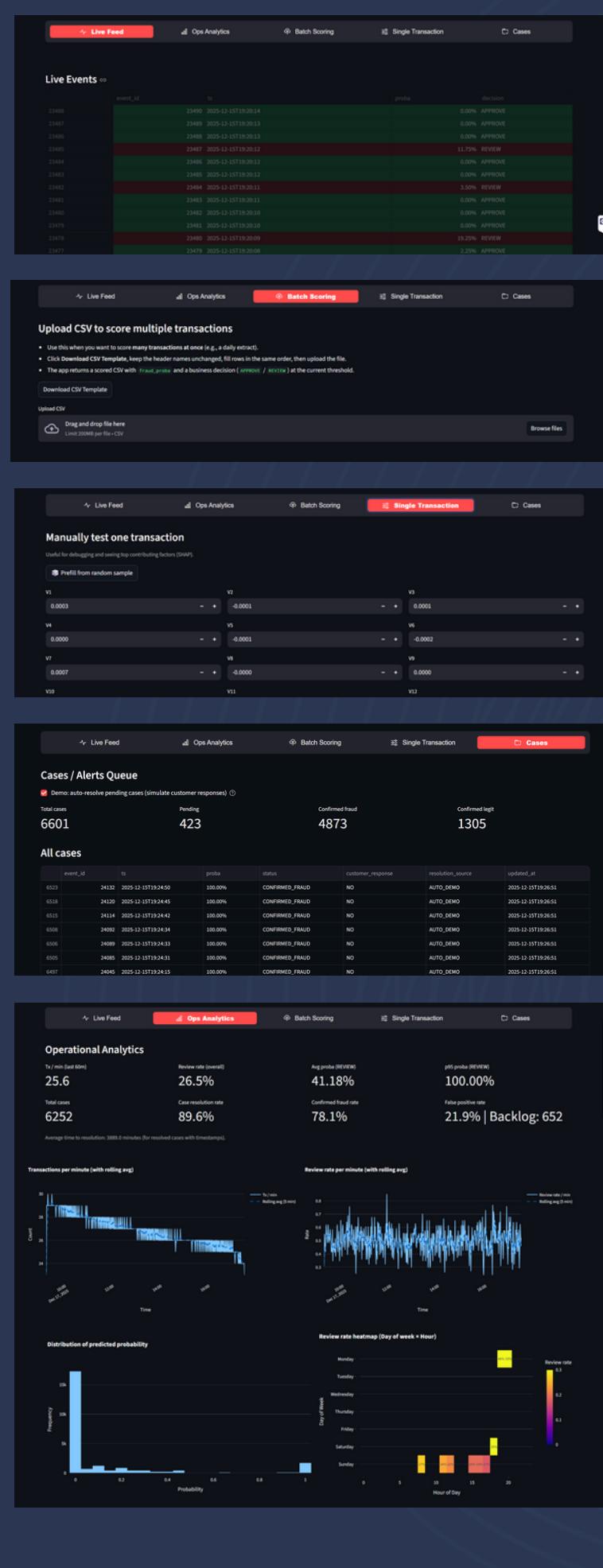
- Manual feature input
- Immediate scoring and decision
- SHAP explainability:
 - Top risk-increasing features
 - Top risk-reducing features
- Used for debugging and analyst trust

Case Management

- REVIEW decisions automatically create cases
- Tracks:
 - Case status
 - Customer response
 - Resolution source
 - Timestamps & SLAs

Auto-resolution (demo)

- Time- and probability-based logic
- Simulates customer confirmation & back-office actions



5. OPERATIONAL ANALYTICS (OPS VIEW)

Monitors system health & workload

- Transactions per minute (rolling avg)
- Review rate
- Case backlog
- False positive rate
- Case resolution rate
- Average time to resolution
- Risk concentration by hour & day