



Generative AI In Finance And Banking

Real World Case Studies



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Case Study 1: Fraud Detection in Credit Card Transactions

Problem:

The bank faced increasing credit card fraud, with new types of fraud emerging that traditional models could not detect. Historical data was limited, making it hard to train accurate detection models.

Generative AI Approach

The AI first learned patterns from existing transactions, understanding what normal and fraudulent behavior looked like. It then generated realistic synthetic fraud transactions to supplement the limited real fraud data, covering rare or emerging fraud types.

Step-by-Step Methodology:

- 1** Collect transaction data and engineer features such as amount, merchant type, location, and frequency.
- 2** Train a GAN to generate synthetic fraudulent transactions.
- 3** Train an autoencoder on legitimate transactions to detect anomalies.
- 4** Combine GAN-generated data with historical fraud data to train a hybrid detection model.
- 5** Validate the model using metrics like precision, recall, and SHAP for explainability.
- 6** Deploy for real-time fraud monitoring and iteratively retrain with new patterns.

Results

- Fraud detection improved by 22%
- False positives reduced by 12%
- Faster adaptation to new fraud patterns

Key Takeaways

- GANs effectively address rare-event scarcity
- Hybrid AI models improve detection accuracy
- Explainable AI ensures trust and compliance

Case Study 2: Credit Scoring for Thin-File Borrowers

Problem:

Many new customers had little or no credit history, making traditional credit scoring models unreliable. This limited financial inclusion and loan approvals for underserved segments.

Generative AI Approach

The AI first analyzed patterns in existing borrower data, including demographics, income, and repayment behavior. It then generated synthetic borrower profiles for underrepresented or thin-file customers. By combining real and synthetic profiles, the bank trained a credit scoring model that could predict risk for borrowers with sparse data, enabling more accurate and inclusive lending decisions. Fairness checks and validation ensured the predictions were realistic and unbiased.

Step-by-Step Methodology:

- 1** Collect borrower data including income, repayment history, demographics.
- 2** Encode real borrower profiles using a VAE to capture statistical patterns.
- 3** Generate synthetic profiles using a GAN to augment underrepresented segments.
- 4** Train credit scoring model (PD, LGD, EAD) on combined dataset.
- 5** Validate model predictions for realism and fairness.
- 6** Deploy model for loan approvals and iteratively retrain with new data.

Results

- Accuracy improved by 18% for thin-file borrowers
- Loan approvals for underserved segments increased by 20%
- Regulatory compliance enhanced with interpretable models

Key Takeaways

- Generative AI enables financial inclusion
- Latent space + GAN allows robust scenario modeling
- Validation ensures fair and trustworthy predictions

Case Study 3: Market Scenario Simulation for Portfolio Risk

Problem:

Risk teams could not fully stress-test portfolios because historical data lacked extreme events, leaving portfolios exposed to rare but impactful market fluctuations.

Generative AI Approach

The AI studied historical market patterns, learning asset correlations and temporal trends. It then generated realistic synthetic market sequences, including rare and extreme events such as market crashes or sudden volatility spikes. These synthetic scenarios were used to stress-test portfolio performance, identify vulnerabilities, and improve risk assessment. Statistical validation ensured that generated sequences closely resembled realistic market behavior.

Step-by-Step Methodology:

- 1** Collect historical market data, including asset prices, correlations, and volatility.
- 2** Train TimeGAN to learn temporal and cross-asset dependencies.
- 3** Generate synthetic market sequences representing extreme scenarios.
- 4** Stress-test by calculating VaR and CVaR against synthetic sequences.
- 5** Validate to ensure statistical accuracy against historical distributions.
- 6** Optimize to provide risk insights and adjust portfolio allocations.

Results

- Stress-testing accuracy improved by 25%
- Hidden portfolio vulnerabilities were identified
- Enabled preemptive risk mitigation

Key Takeaways

- Generative AI can simulate rare market events
- Synthetic data improves portfolio resilience
- Validated scenarios increase decision-maker confidence

Case Study 4: Optimizing Algorithmic Trading Strategies

Problem:

A trading firm relied heavily on historical market data to backtest strategies. However, rare events like flash crashes or sudden volatility spikes were missing from historical datasets, causing strategies to fail under unexpected market conditions.

Generative AI Approach

The AI first analyzed historical price movements to understand normal market behavior. It then generated realistic synthetic market scenarios, including extreme volatility and rare price movements that had not occurred frequently in the past. This helped create trading strategies that were more robust and risk-aware.

Step-by-Step Methodology:

- 1 Collect historical price, volume, and volatility data for selected assets.
- 2 Train a GAN to generate synthetic price series representing rare and extreme events.
- 3 Combine real and synthetic market data into a training environment.
- 4 Train reinforcement learning agents to make buy/sell/hold decisions under different scenarios.
- 5 Apply risk constraints such as maximum drawdown and position limits.
- 6 Backtest strategies on unseen synthetic scenarios and refine models iteratively.

Results

- Volatility-adjusted returns improved by **15%**
- Drawdowns during extreme market simulations reduced by 10–12%
- Trading strategies became more adaptive and resilient

Key Takeaways

- Generative AI enables safe testing of rare market events
- GAN + RL creates robust trading strategies
- Synthetic scenarios improve risk-aware decision-making

Case Study 5: Sentiment Analysis for Investment Decisions

Problem:

Investment teams struggled to extract timely insights from unstructured data such as news articles, earnings calls, and analyst reports. Important sentiment signals were often missed or processed too late.

Generative AI Approach

The AI analyzed large volumes of financial text to understand how language reflects market sentiment. It then generated synthetic news and earnings call scenarios, simulating both positive and negative market events. These synthetic texts were analyzed using NLP models to extract sentiment scores, which were combined with historical market data to improve short-term price predictions and investment decisions.

Step-by-Step Methodology:

- 1** Collect financial news, earnings call transcripts, and analyst reports.
- 2** Train NLP models to understand financial language and sentiment patterns.
- 3** Generate synthetic news and event scenarios using generative models.
- 4** Extract sentiment scores from real and synthetic text data.
- 5** Combine sentiment signals with historical price data in forecasting models.
- 6** Monitor prediction accuracy and refine prompts and models over time.

Results

- **Prediction Accuracy:** 12-15% short-term prediction accuracy improved
- **Faster Detection:** 100% faster detection of negative market sentiment
- **Improved Timing:** Improved timing of portfolio rebalancing decisions

Key Takeaways

- Generative AI enhances sentiment-driven investment insights
- Synthetic text allows what-if scenario analysis
- NLP + market data improves decision speed and accuracy

Case Study 6: Anti-Money Laundering (AML) Risk Detection

Problem:

AML teams faced high volumes of alerts, many of which were false positives. Rare and complex money laundering patterns were difficult to detect using traditional rule-based systems.

Generative AI Approach

The AI first learned what normal transaction behavior looked like across customers. It then generated synthetic suspicious transaction patterns to represent rare money laundering activities. These patterns were used to train anomaly detection models that could better identify unusual behavior. By prioritizing high-risk alerts, the AI helped compliance teams focus on truly suspicious cases.

Step-by-Step Methodology:

1 Collect Data

Historical transaction and customer behavior data.

2 Generate Patterns

Create synthetic suspicious transaction patterns.

3 Train Autoencoders

On normal transactions to detect anomalies.

4 Combine Data

Synthetic and real data to improve detection accuracy.

5 Rank Alerts

Based on risk scores for compliance review.

6 Update Models

Continuously based on new laundering patterns.

Results

- Detection of suspicious transactions improved by **25–30%**
- False positives reduced significantly
- Compliance workload reduced by **15%**

Key Takeaways

- Generative AI improves detection of rare AML patterns
- Reduces manual effort and alert fatigue
- Enhances regulatory compliance and operational efficiency

Case Study 7: Personalized Financial Product Recommendations

Problem:

Banks struggled to personalize product offerings due to limited customer interaction data, resulting in low engagement and conversion rates.

Generative AI Approach

Exact AI Actions The AI analyzed customer behavior, transaction history, and demographics to understand preferences. It then generated synthetic customer behavior scenarios, helping the recommendation engine learn how different customer types might respond to financial products.

Step-by-Step Methodology:

1 Collect data

Customer transaction, demographic, and interaction data.

2 Generate Patterns

Train generative models to simulate customer behavior patterns.

3 Combine Data

Real and synthetic behavior data to train recommendation models.

4 Match Products

Match customers with suitable financial products (loans, cards, investments).

5 Monitor Metrics

Monitor customer engagement and conversion metrics.

6 Refine Models

Based on real customer responses.

Results

- Customer Engagement **increased by 20%**
- Product Conversion Rates **improved by 15%**
- Customer Satisfaction **led to higher retention**

Key Takeaways

- **Generative AI enables personalized banking experiences**
- Synthetic behavior data improves recommendation accuracy
- Drives higher engagement and business value

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