

Why Network Analysis Matters

Insights from the Royal Bank of Canada Case

SMM638 Network Analytics

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The RBC Challenge

Context: First-Party Fraud Detection

- ▶ RBC: Canada's largest bank with 15+ million clients, 6.5M cards
- ▶ **Problem:** Detecting fraudulent credit applications by own customers
- ▶ **Traditional approach:** Rule-based systems with **85:1 false positive ratio**
- ▶ **Cost:** \$10M upfront + \$1M annual maintenance + 30TB weekly data processing

McKenzie's Mission: Reduce false positives from 85:1 to 10:1

! Important

The Connected Explosion: "Ten fraudsters sharing 10 common data elements can create 100 false identities; if they defraud 4 financial instruments per identity with \$5,000 credit limit, potential loss = **\$2 million**"

Why Networks Detect Fraud Better

! Important

Traditional Fraud Detection Limitations:

Individual attribute checking misses organized fraud patterns:

- ▶ Credit scores, income verification, address validation
- ▶ Each application evaluated in isolation
- ▶ Fraudsters exploit this independence

💡 Tip

Network Analysis Advantage:

Reveals the **connected explosion** - fraudsters' coordination creates detectable signatures:

- ▶ Shared phone numbers across multiple applications
- ▶ Common email domains and IP addresses
- ▶ Linked banking activities and transactions

Fraudsters Face a Paradox

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Fraudsters' greatest strength (coordination) becomes their **Achilles' heel** (detectability through network patterns)

The Analytical Challenge

16 Fraud Detection Rules Applied to 13,731 Customers

Key Performance Metrics:

Rule	Positive Hits	True Positives	Detection Rate	False Positive Rate
R1	3,221	189 (45.5%)	45.5%	17:1
R27	2,057	169 (40.7%)	40.7%	12:1
R18	9,107	84 (20.2%)	20.2%	108:1



Caution

The Core Trade-off:

- ▶ Higher detection rate → More false positives → Higher investigation costs
- ▶ Lower false positive rate → Fewer fraudsters caught →

Business Value: Three Critical Insights

1. Precision Enhancement Through Combined Rules

- ▶ **Logit model** combining 16 rules outperforms any single rule
- ▶ Achieves **2.7:1 false positive ratio** at optimal threshold (0.275)
- ▶ Trade-off: Only 13% detection rate at lowest FP ratio
- ▶ **Sweet spot**: 80% detection (330/415 fraudsters) at 10:1 ratio (threshold = 0.05)

2. Cost-Benefit Analysis

Must balance: - Average cost of undetected fraudster (\$2M potential loss per ring) - Average cost per investigation (\$500-2000 per positive hit) - Data processing costs (ETL: 30TB weekly, 5 days processing time)

3. System Performance Optimization

- ▶ **Real-time vs. batch processing**: 5-day lag creates vulnerability window
- ▶ **Super clusters**: Everyone-connected-to-everyone formations

What Business Analysts Must Understand

The Multi-Dimensional Optimization Problem:

Technical Dimensions:

- ▶ Feature engineering from network patterns
- ▶ Model performance (precision, recall, F1-score)
- ▶ Computational efficiency and scalability

Business Dimensions:

- ▶ Customer experience (minimizing false accusations)
- ▶ Operational efficiency (investigation team capacity)
- ▶ Financial impact (fraud losses vs. prevention costs)

Strategic Dimensions:

- ▶ System evolution as fraudsters adapt
- ▶ Integration with legacy banking systems
- ▶ Regulatory compliance and data privacy



Key Lessons for Analysts

1. Context Matters More Than Algorithms

- ▶ Best model must align with business constraints
- ▶ Pure accuracy is not the goal—balanced performance is

2. Trade-offs Are Inherent

- ▶ Detection rate vs. false positive rate
- ▶ Thoroughness vs. operational efficiency
- ▶ Real-time responsiveness vs. computational cost

3. Network Analysis Reveals Hidden Patterns

- ▶ Individual-level analysis misses organized fraud
- ▶ Connectivity is both the crime's structure and its detection mechanism
- ▶ Network thinking transforms how we identify risk

Note

This case demonstrates why business analysts need both tech-