

FRAUD DETECTION SYSTEM USING BAYESIAN NETWORK

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What is Fraud??

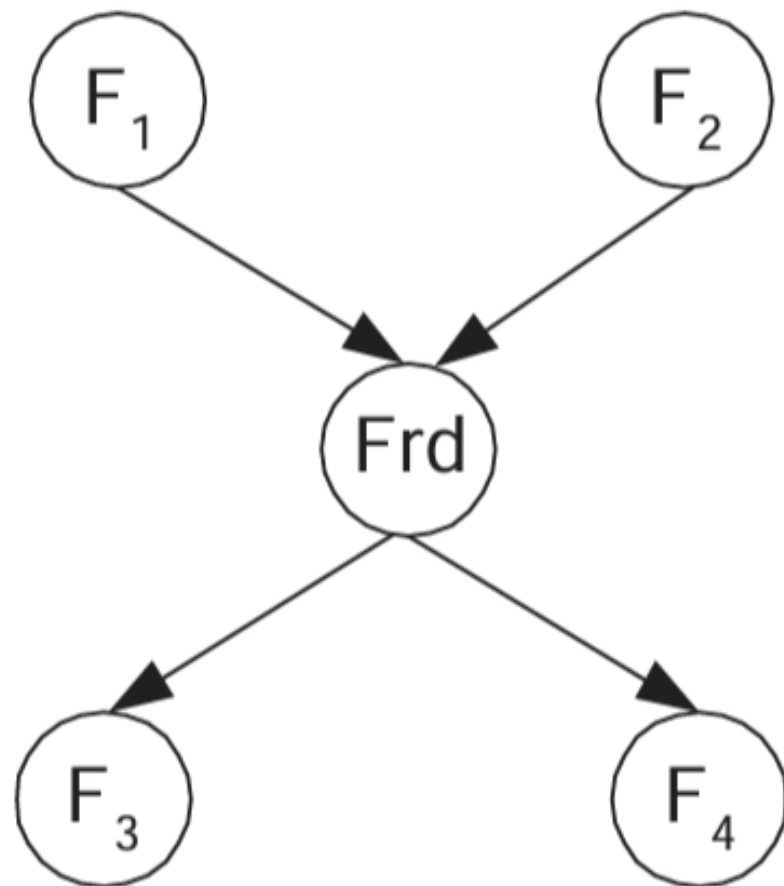


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An Intentional deception or misrepresentation of the truth to gain an unfair advantage or cause harm, often financially

Examples of fraud: insurance fraud, credit card fraud, identity theft, money laundering, tax evasion, product warranty, healthcare fraud

What is Bayesian Network?



A graphical model that represents a set of variables and their conditional dependencies through a directed acyclic graph

Each node in the graph corresponds to a random variable

The edges between nodes indicate direct probabilistic dependencies

$$P(X_1, X_2, \dots, X_n) = \prod_{i=1}^n P(X_i | \text{Parents}(X_i))$$

Why Bayesian Networks in Fraud Detection?

Aspect	Bayesian Belief Networks	Artificial Neural Networks
Detection Accuracy	68-74% True Positive Rate	47-70% True Positive Rate
Training Time	~20 minutes	Several hours
Evaluation Speed	Slower	Faster
Interpretability	High (white box)	Low (black box)
Knowledge Integration	Can incorporate expert knowledge	Requires large labeled datasets

Methodology

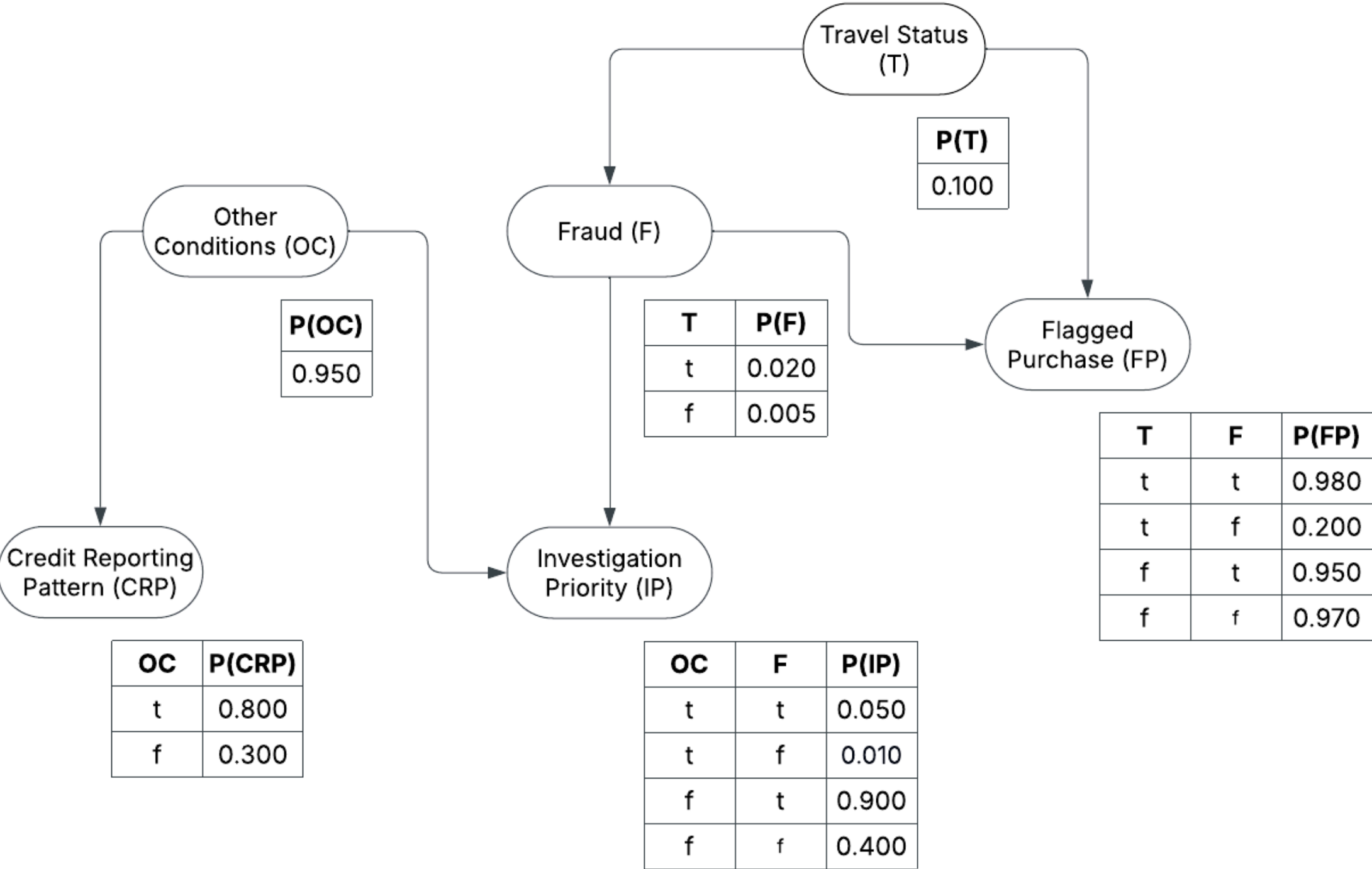
SIX KEY VARIABLES:

- 1.Travel Activity (Trav)
- 2.Fraud Status (Fraud)
- 3.Other Conditions (OC)
- 4.Credit Reporting Pattern (CRP)
- 5.Flagged Purchase (FP)
- 6.Investigation Priority (IP)

INFERENCE PROCESS:

- 1.Evidence Application
- 2.Variable Elimination
- 3.Final Computation

Network Structure



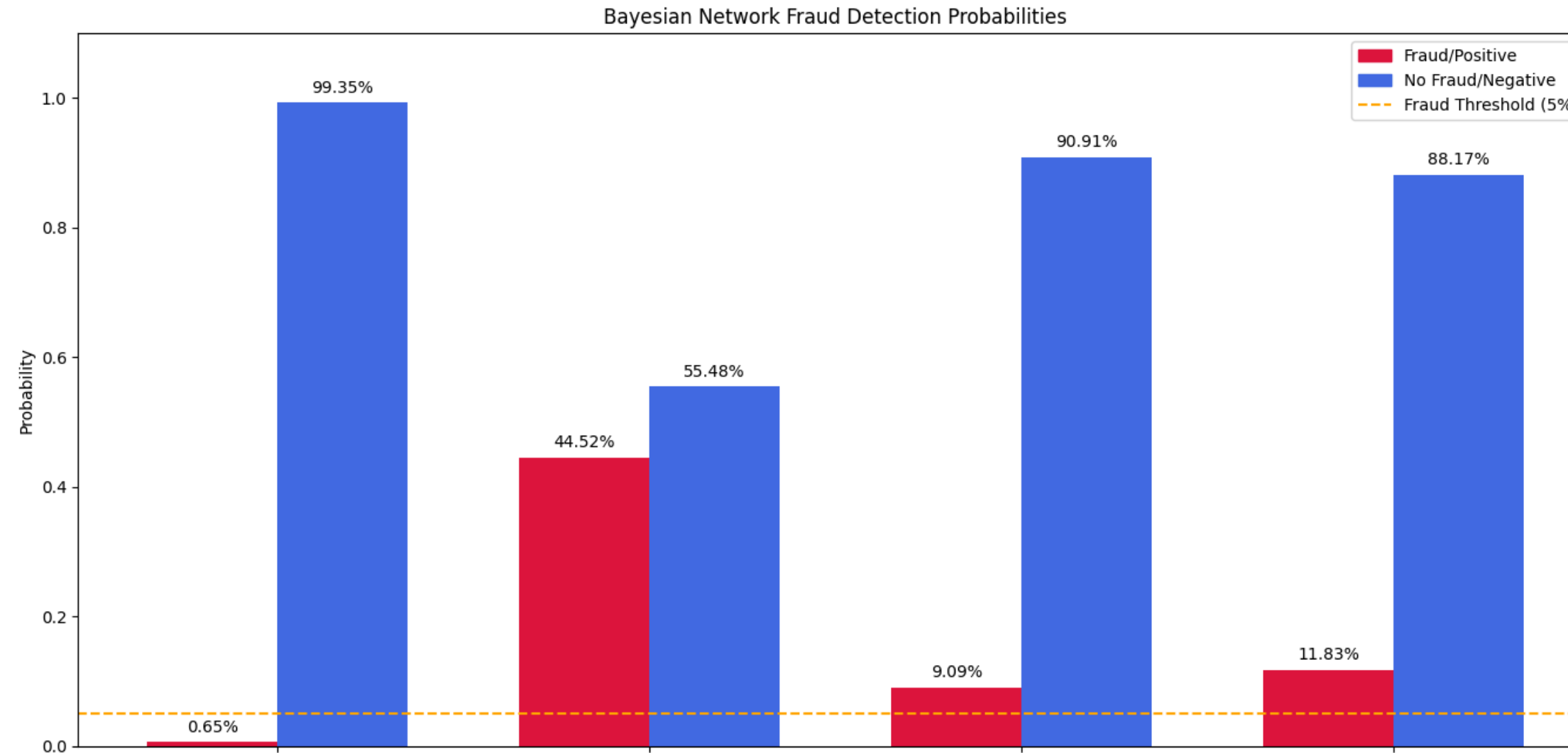
Conditional Dependencies:

Higher fraud risk during travel (2%) vs. non-travel (0.5%)

Strong correlation between fraud and flagged purchases

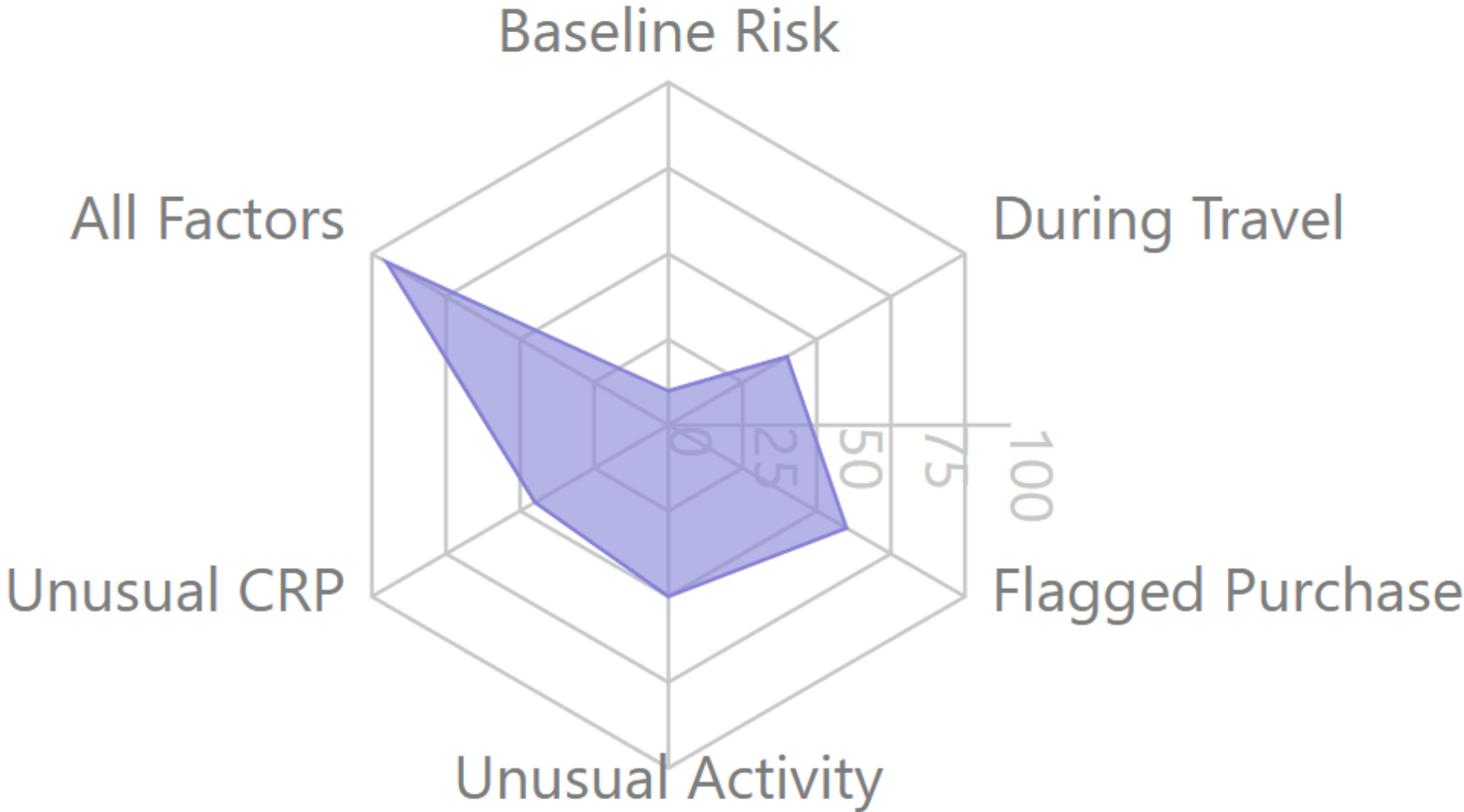
Investigation priorities vary based on evidence patterns

Experimental Results



Scenario	Fraud Probability	Classification
Base Fraud Rate $P(\text{Fraud})$	0.65%	SAFE
$P(\text{IP} \text{FP}=+, \text{Trav}=-, \text{CRP}=+)$	44.52%	Requires Investigation
$P(\text{Fraud} \text{FP}=+, \text{Trav}=+)$	9.09%	ALERT: Fraud Detected
$P(\text{Fraud} \text{FP}=+, \text{OC}=+)$	11.83%	ALERT: Fraud Detected

Risk Analysis Visualization



Conditional Dependencies:

Baseline Risk (0.65%)

During Travel

Flagged Purchase

Unusual Activity

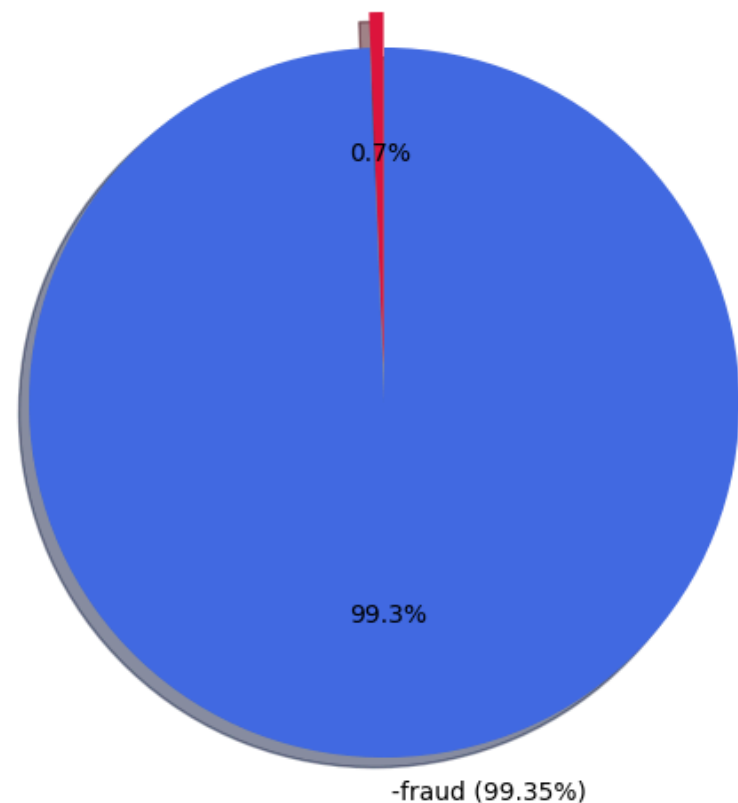
Unusual Credit Reporting Pattern

All Factors Combined (11.83%)

Implementation Strategy

01. Low Risk (<5%):

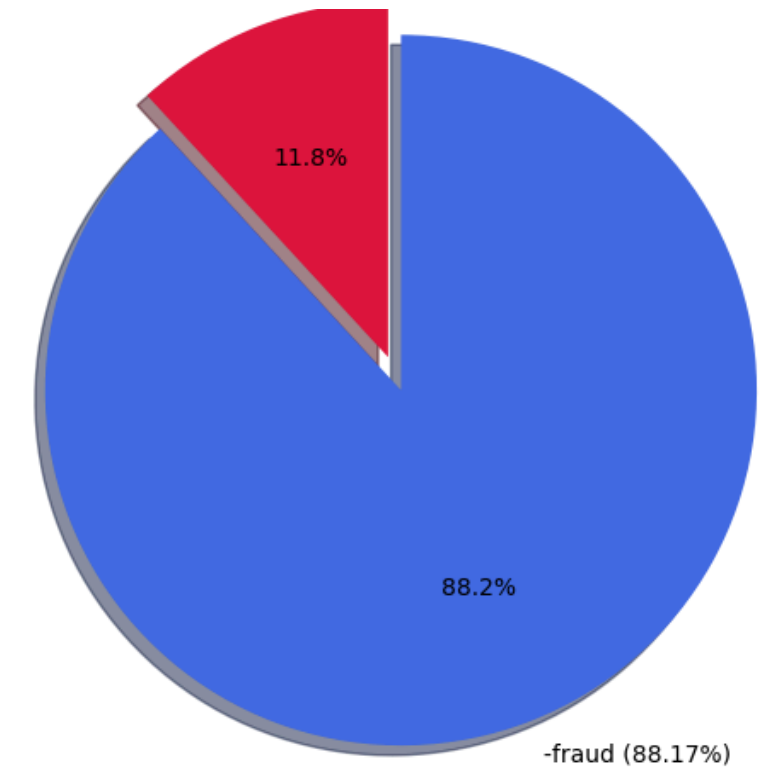
- Automatic approval
- Example: Baseline transactions



SAFE: No Fraud Detected

02. Medium Risk (5–25%):

- Enhanced verification
- Example: Travel with flagged purchase



ALERT: Fraud Detected

03. High Risk (>25%):

- Manual review required
- Example: Investigation priority cases

Limitations & Future Work

CURRENT LIMITATIONS:

1. Limited variable set
2. Static probability tables
3. Computational complexity for larger networks

FUTURE OPPORTUNITIES:

1. Expand variable set
(transaction amount, merchant category)
2. Implement dynamic probability updates
3. Explore hybrid approaches with deep learning
4. Optimize for real-time implementation

Conclusion



Bayesian Networks provide a **probabilistic framework** for fraud detection

The approach offers **interpretability** and **adaptability**

Our model demonstrates **effective risk discrimination**

Probabilistic models represent a promising direction for **future fraud detection systems**

THANK YOU

QUESTIONS??

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