Fraud Detection
with Graph Approaches

Robert Han

Ryan McGibony

Headquarters
300 W. Main Street, Suite 301
Charlottesville, VA 22903
434.973.7673 | fax 434.973.7673

www.elderresearch.com
Copyright © 2017 Elder Research, Inc.

Office Locations
Arlington, VA
Linthicum, MD
Raleigh, NC

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Webinar Agenda

- Graph terminology primer
- Why graphs for fraud detection?
- Real graph use cases
- Do I have graph data?
- Tools
- Key points for implementation
- Q&A

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

About Elder Research

Elder Research delivers business value through customizable advanced analytics solutions that solve your most challenging problems.

20+ years experience

150+ customers

Data science experts

Trusted partner

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Advanced Analytics is Our Strength

Data Science and Predictive Analytics

Discovering patterns in past data that can be used to predict the outcome of future events including statistical modeling, classification & analysis, clustering, optimization & simulation, and customer segmentation

Text Mining

Understanding information stored in text documents and databases including document classification, natural language processing, information extraction and search

Data Infrastructure

Cleaning, preparing, and integrating disparate data sources and building ETL and data pipelines optimized for advanced analytics
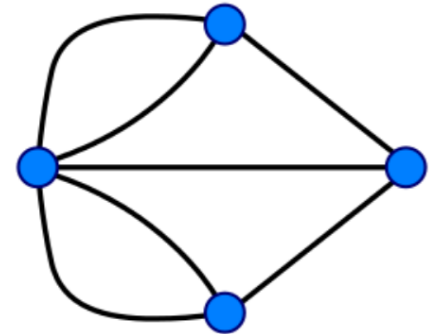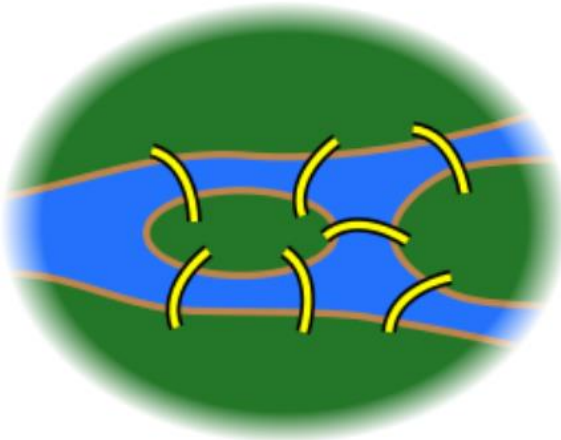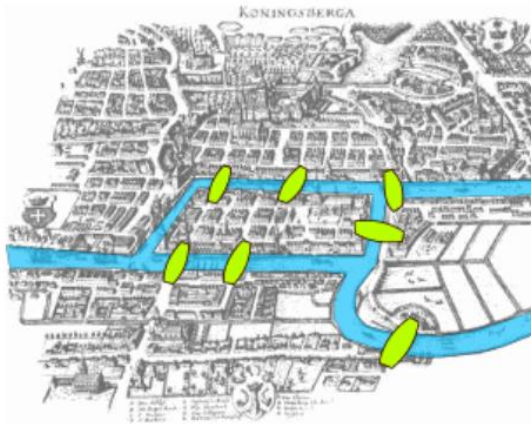
Data Visualization

Making advanced algorithms easily accessible through 2-D & 3-D, statistical and spatial visualization

ELDER RESEARCH
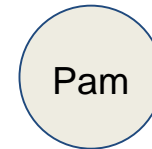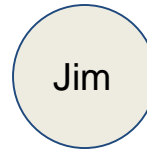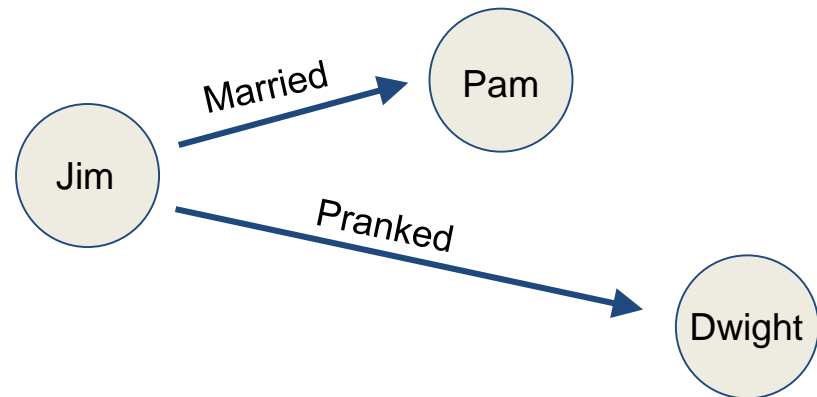DATA SCIENCE & PREDICTIVE ANALYTICS

Graph Basics

What is a Graph?

The "Property Graph Model"

- Nodes

ELDER RESEARCH
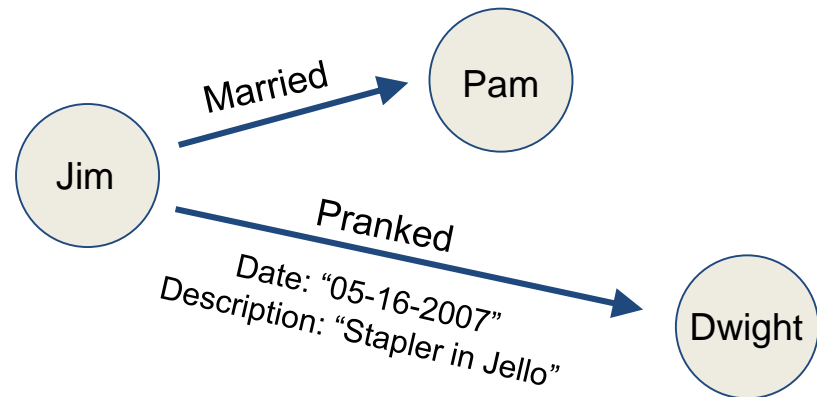DATA SCIENCE & PREDICTIVE ANALYTICS

The "Property Graph Model"

- Nodes
- Relationships

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

The "Property Graph Model"

- Nodes
- Relationships
- **Properties**

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Graphs for Fraud Detection

ELDER RESEARCH
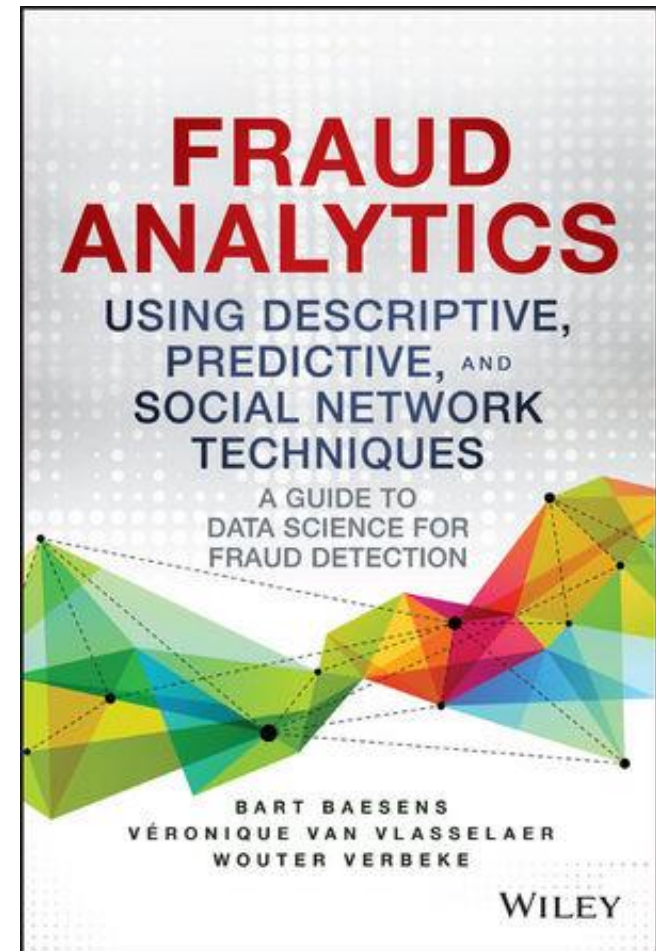DATA SCIENCE & PREDICTIVE ANALYTICS

Smart Defense

"Defenders think in lists.
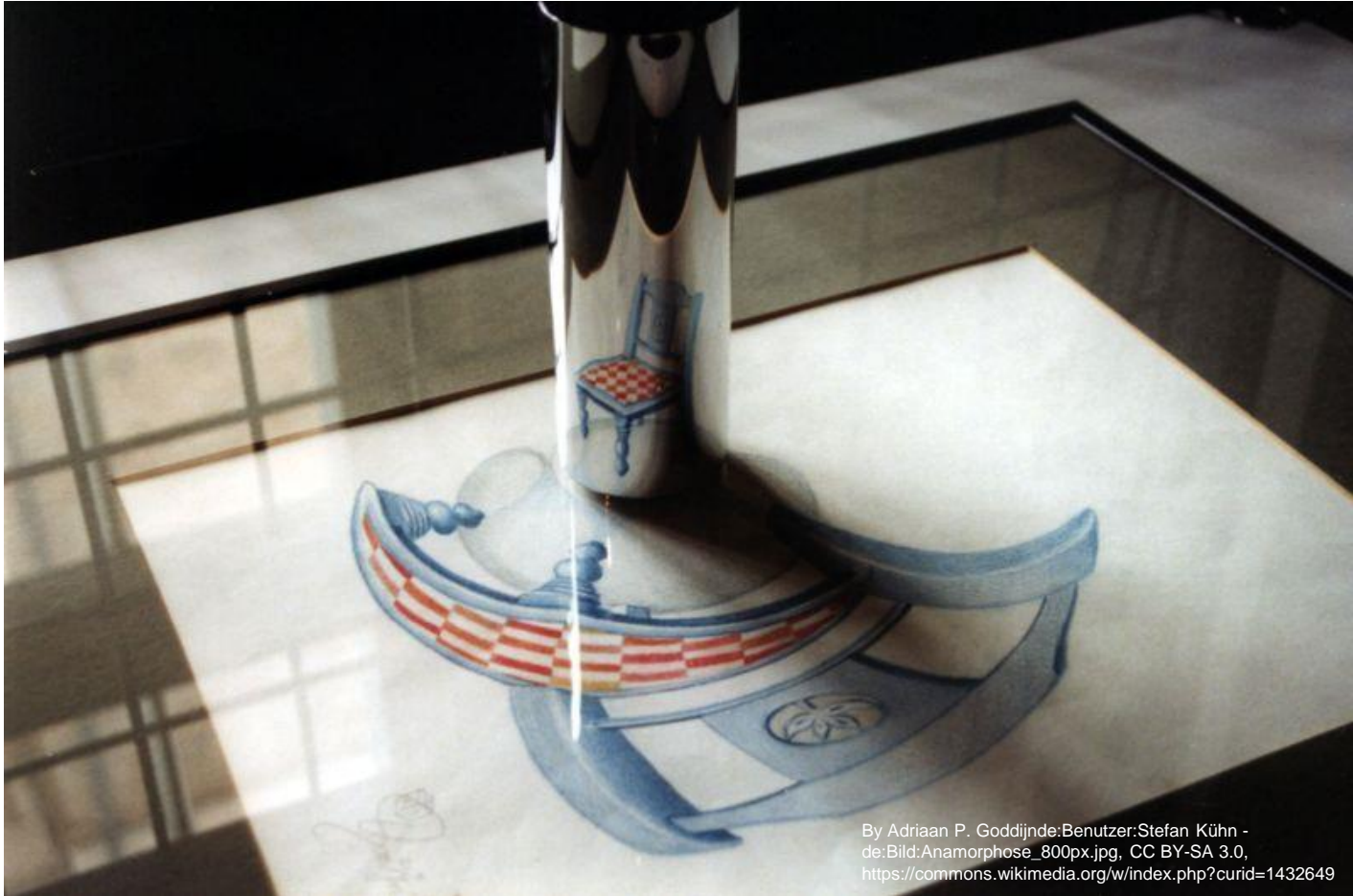Attackers think in graphs.
As long as this is true, attackers win."

John Lambert,
Microsoft Threat Intelligence Center

The Nature of Fraud

"Fraud is…
well-considered,
imperceptibly concealed,
time-evolving, and often
carefully organized crime
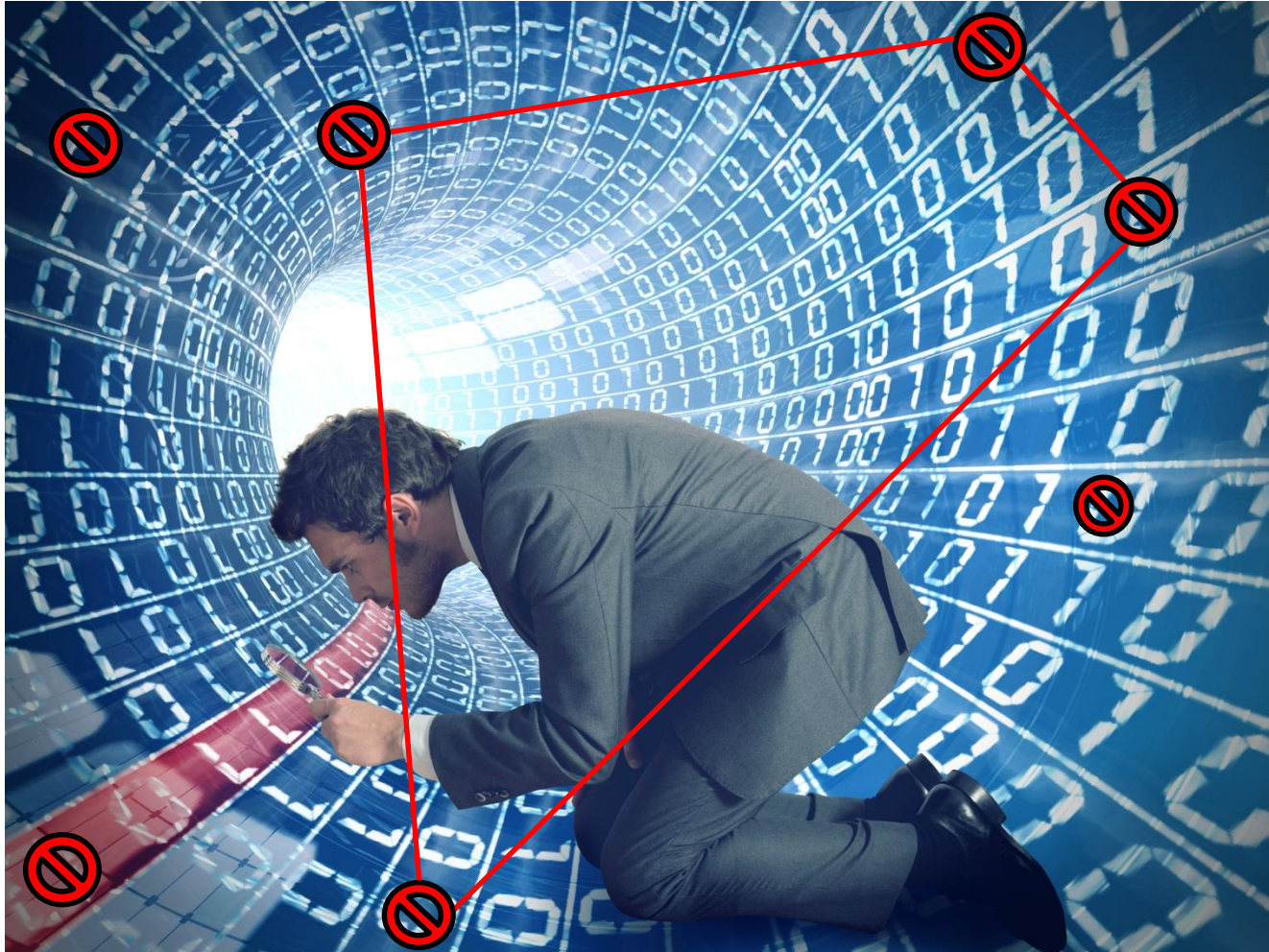which appears in many
types of forms"

Why Graphs?

By Adriaan P. Goddijnde:Benutzer:Stefan Kühn - de:Bild:Anamorphose_800px.jpg, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1432649

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Why Graphs?
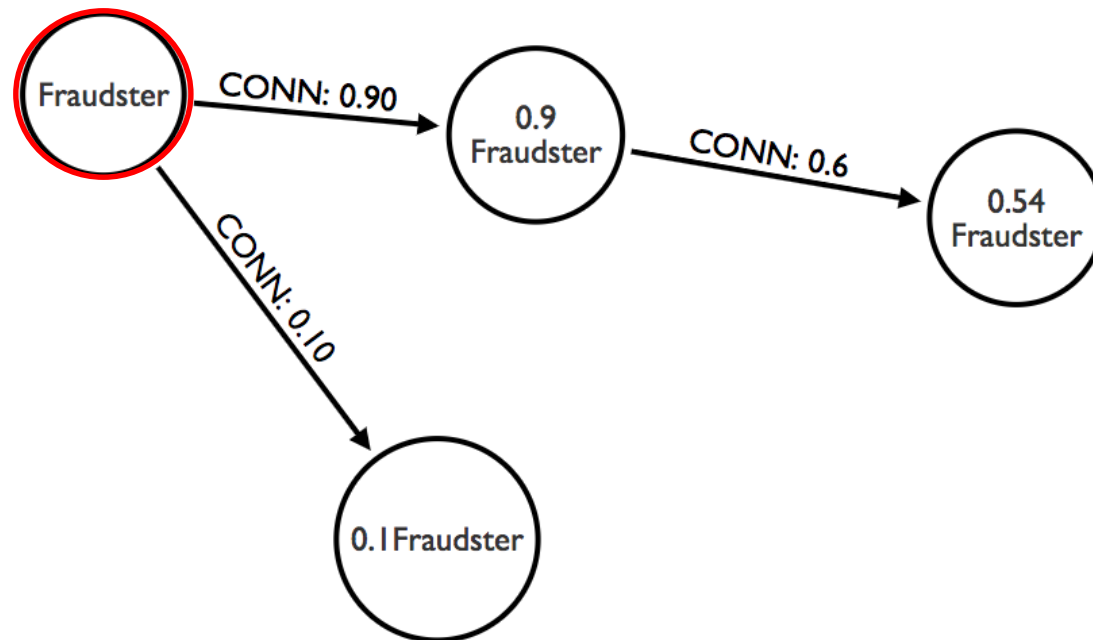
Why Graphs?

Why Graphs?

Graph Use Cases

Graphs Reveal What is Connected

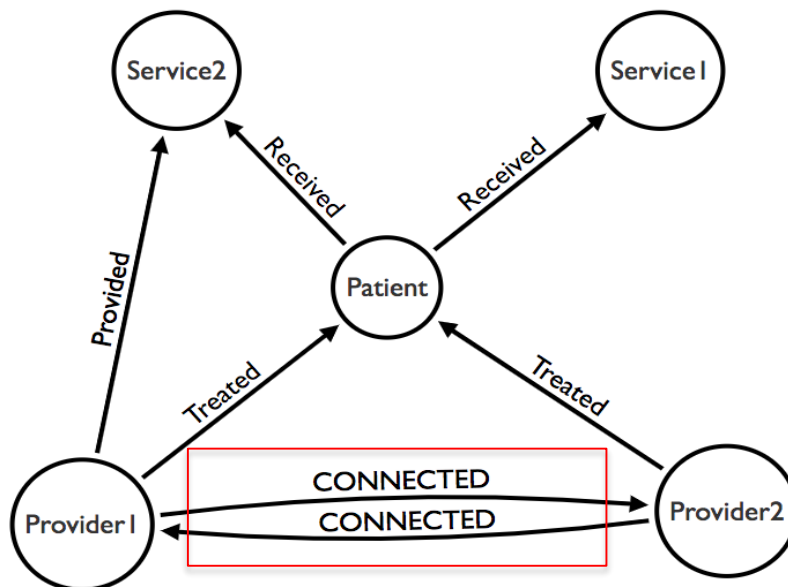| Question	Graph concept
If we know a few bad actors, who else should we monitor?	Risk propagation

Graphs Reveal What is Connected

Question	Graph concept
If we know a few bad actors, who else should we monitor?	Risk propagation

Graphs Reveal What is Connected

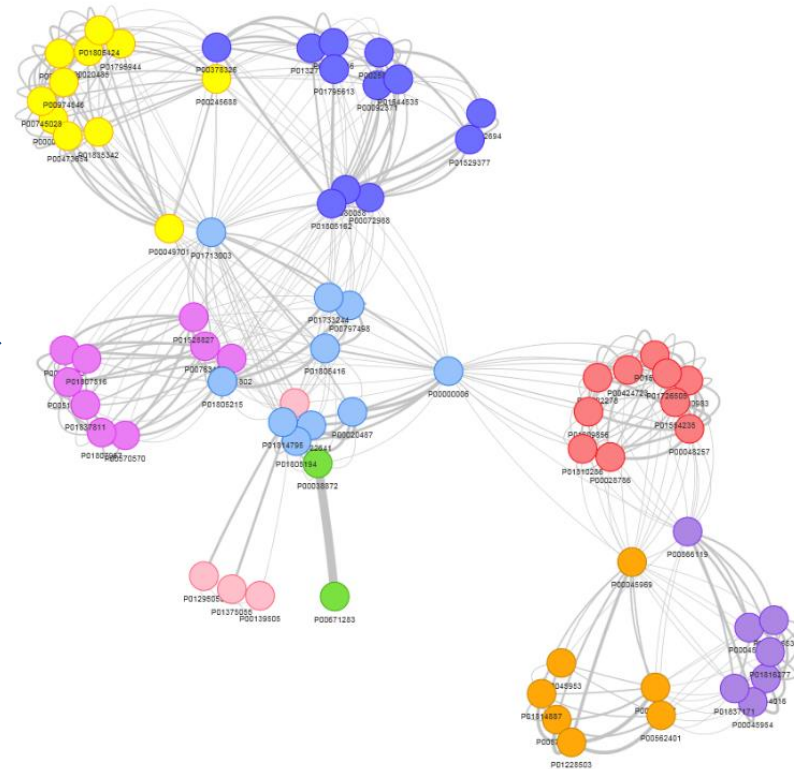| Question	Graph concept
Which groups of people are working together?	Community detection

Graphs Reveal What is Connected
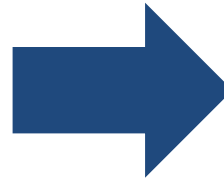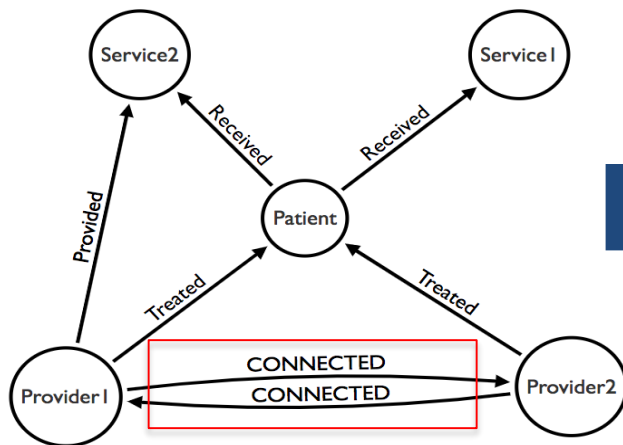
Question	Graph concept
Which groups of people are working together?	Community detection

Graphs Reveal What is Connected

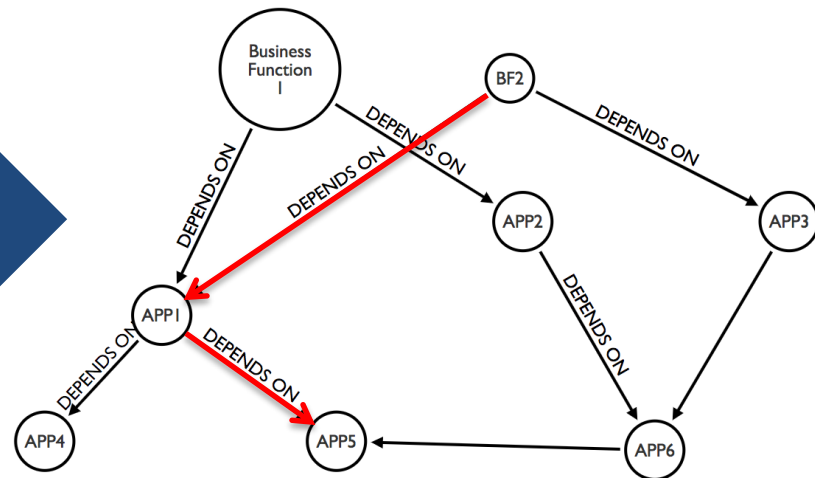| Question	Graph concept
Which groups of people are working together?	Community detection

Graphs Reveal What is Connected

Question	Graph concept
Who are the most critical/influential entities?	Centrality and path analysis

ELDER RESEARCH
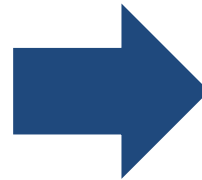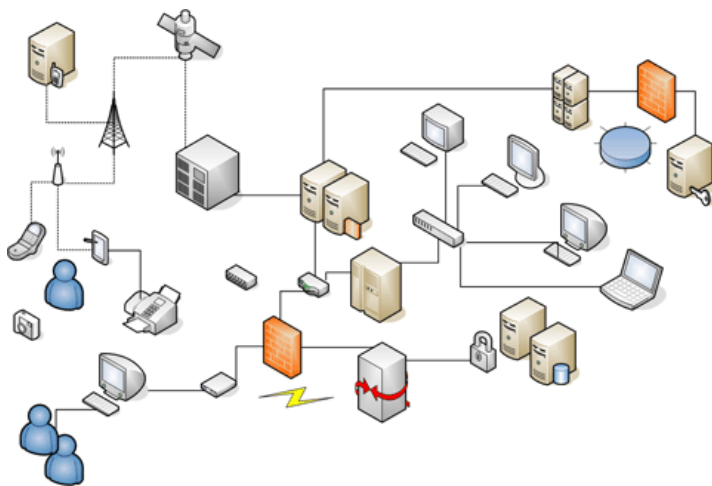DATA SCIENCE & PREDICTIVE ANALYTICS

Graphs Reveal What is Connected

Question	Graph concept
Who are the most critical/influential entities?	Centrality and path analysis

Graphs Reveal What is Connected

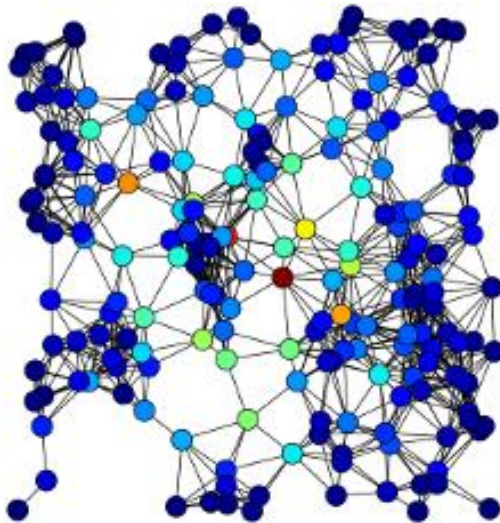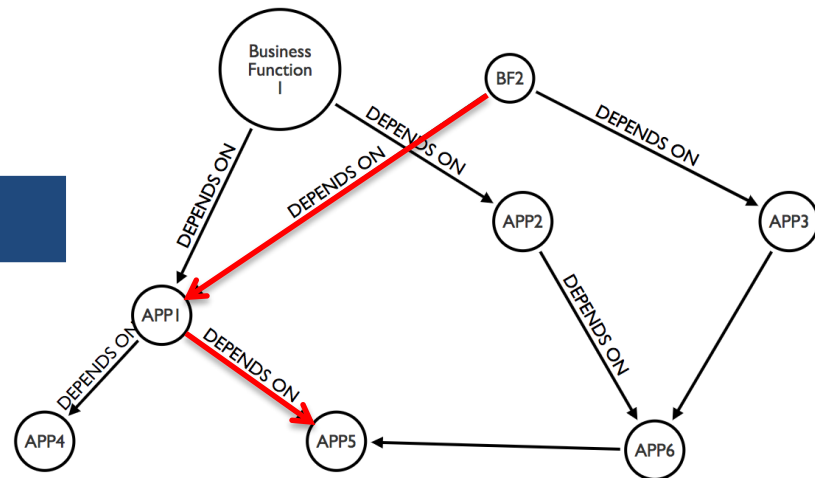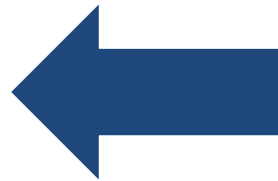| Question	Graph concept
Who are the most critical/influential entities?	Centrality and path analysis

By Tapiocozzo - Own work, CC BY-SA 4.0

Do I Have Graph Data?

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Same Data, Different Form

From Relational DB…   **…to Graph**

Customers		Returns		Employees	
CustomerID 🔑		ReturnID 🔑		EmployeeID 🔑	
CompanyName		CustomerID		FirstName	
ContactName		EmployeeID		LastName	
Address		ReturnDate		Address	
Phone		Amount		Phone	

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS
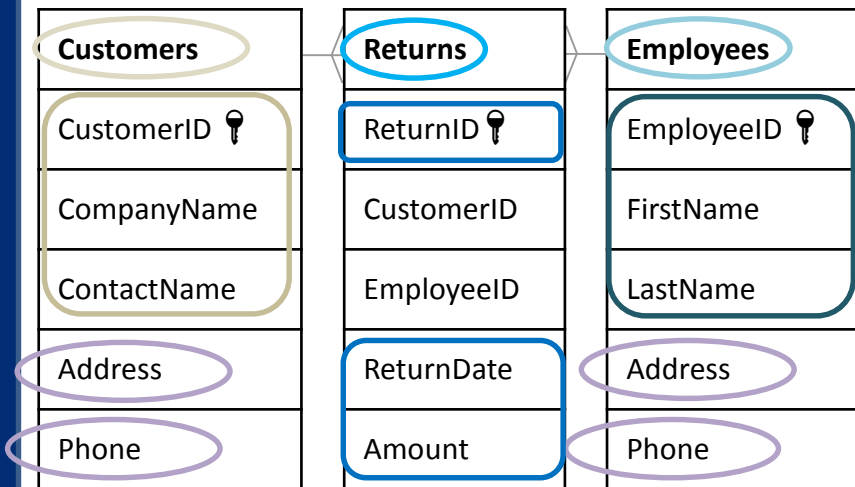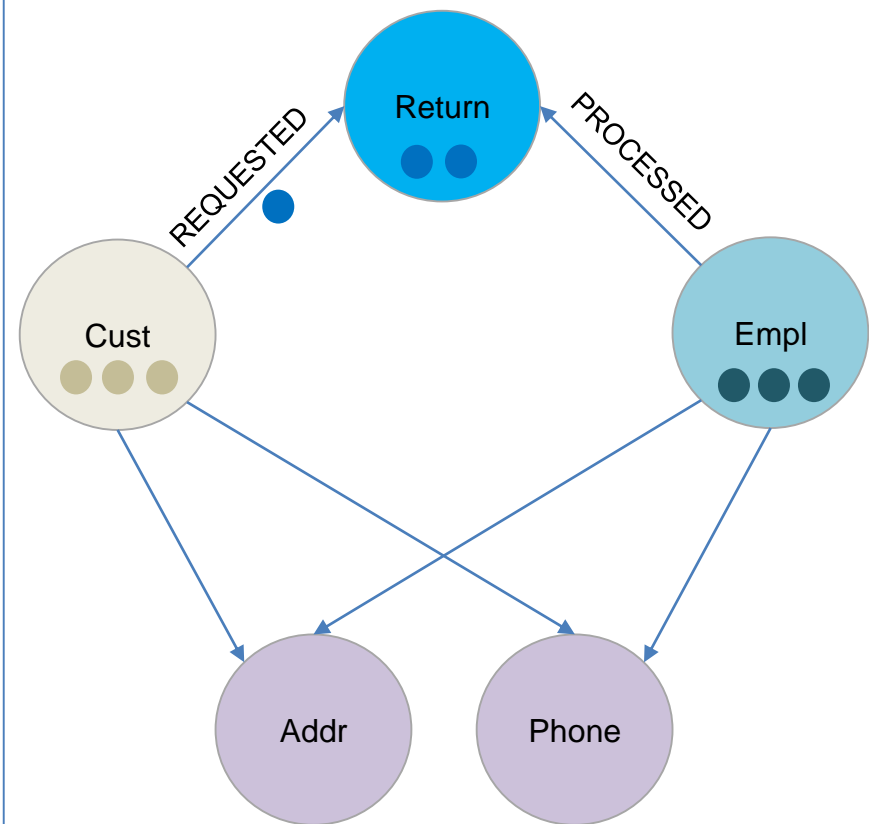
Graph Data Structure

Customer ID	Company Name	Contact Name
C1	Acme Corp.	R. Runner
C2	Dunder Mifflin	P. Beesly

Return ID	Amount
R1	$100
R2	$200
R3	$50

Start Node	End Node	Return Date
C1	R1	02-21-2018
C2	R2	03-05-2018
C2	R3	03-08-2018

28
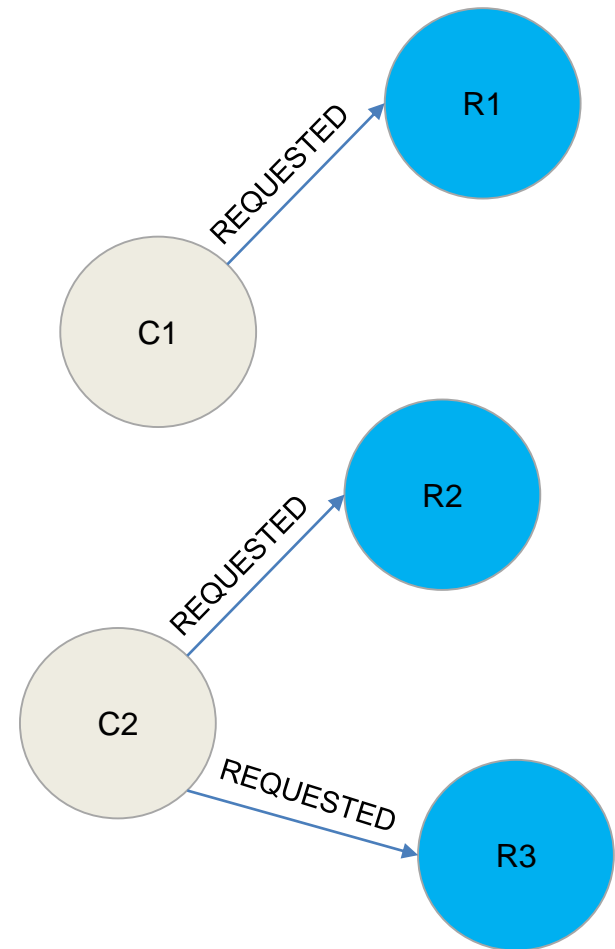
Finding Fraud with Pattern Matching
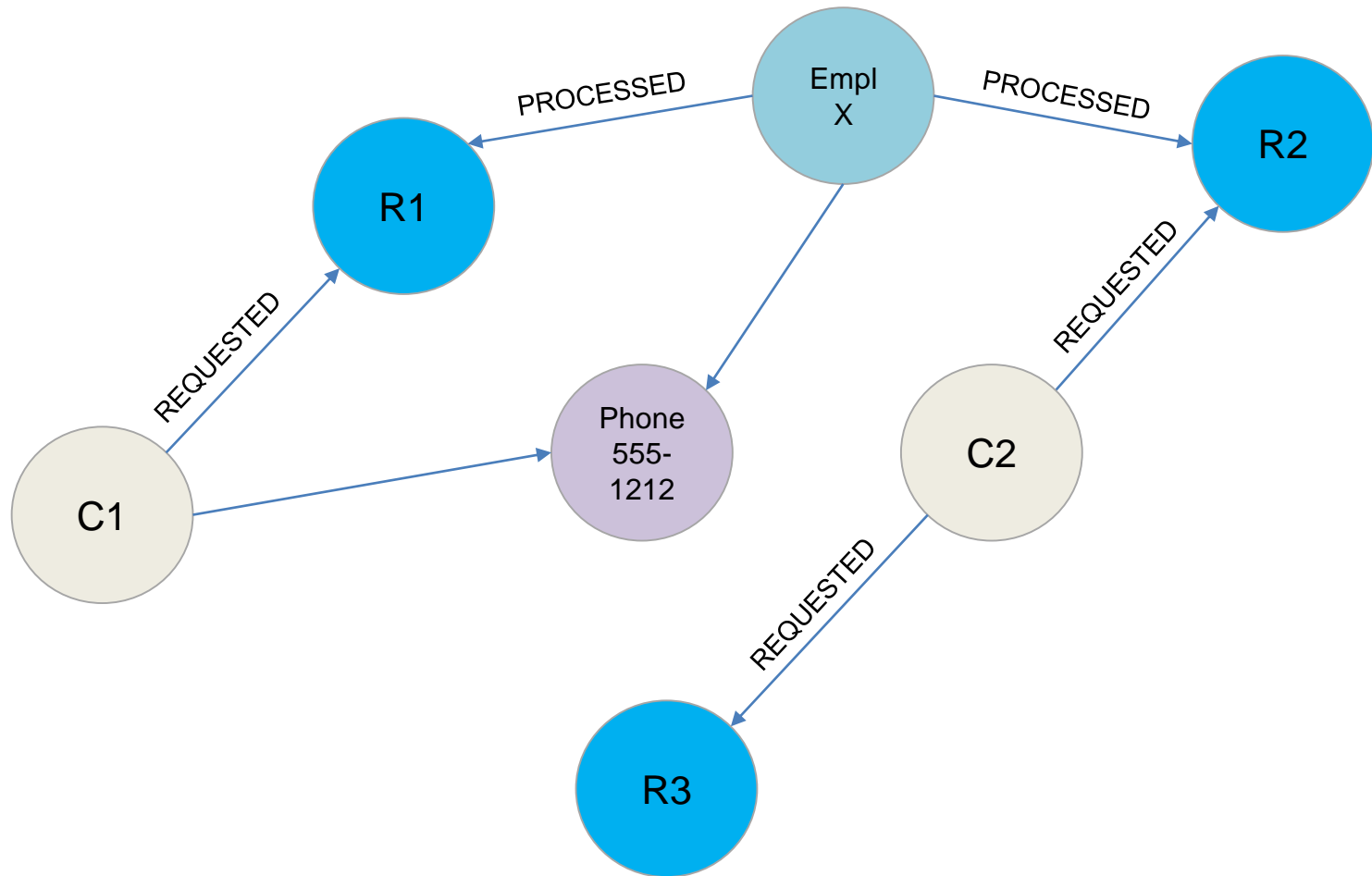
Graph Databases & Tools

Databases

Analytics Tools

Graph Databases & Tools

Visualization

Storage/
Querying

Analytics/
Algorithms

Key Points for Implementation

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS
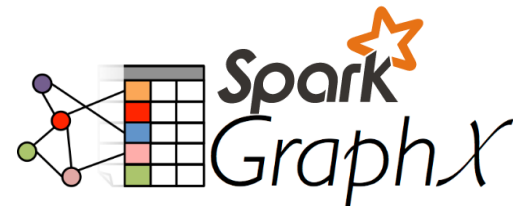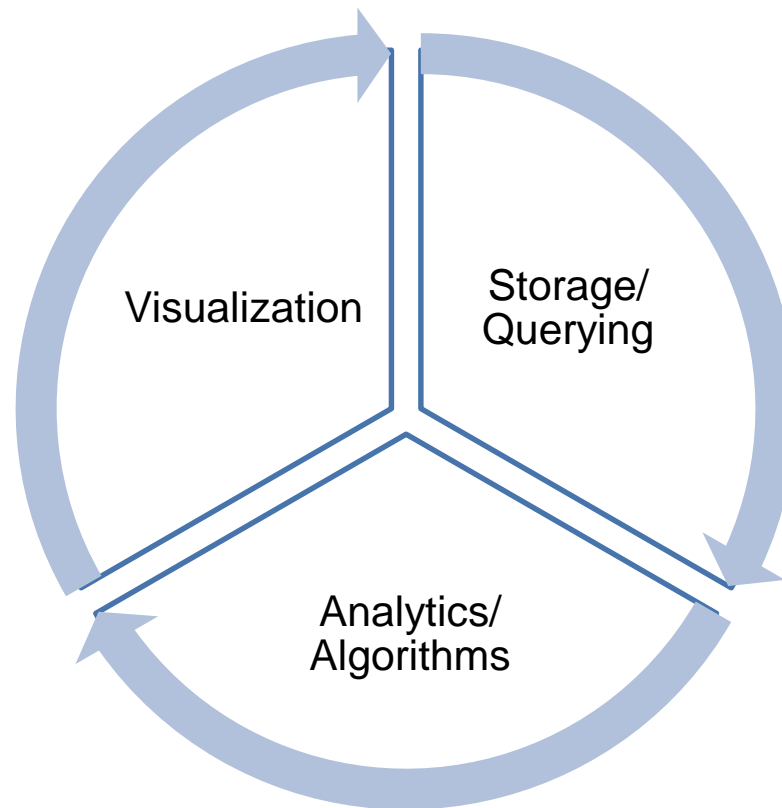
Relationship Weights

Why are weights important?

- Critical for analytics, such as community detection
- Useful for queries

How to quantify?

- Length of time as classmates
- Number of classes in common
- Combination of different factors
- Etc.

Entity Resolution

John Doe

John Q. Doe

Lines of Defense

Semi/Supervised Anomaly Detection

Supervised Modeling
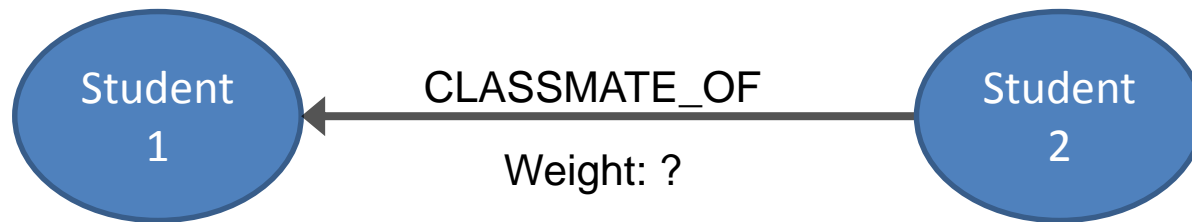
Offline Techniques

Time Series Statistics

Node Metrics

Community Metrics

Anomaly Detection

Pattern 5

Pattern 6

Pattern 8

Update DB: Richer Data Coming In

Pattern 1

Pattern 2

Pattern 3

Pattern 4

Near/Real Time

Fraudsters

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS
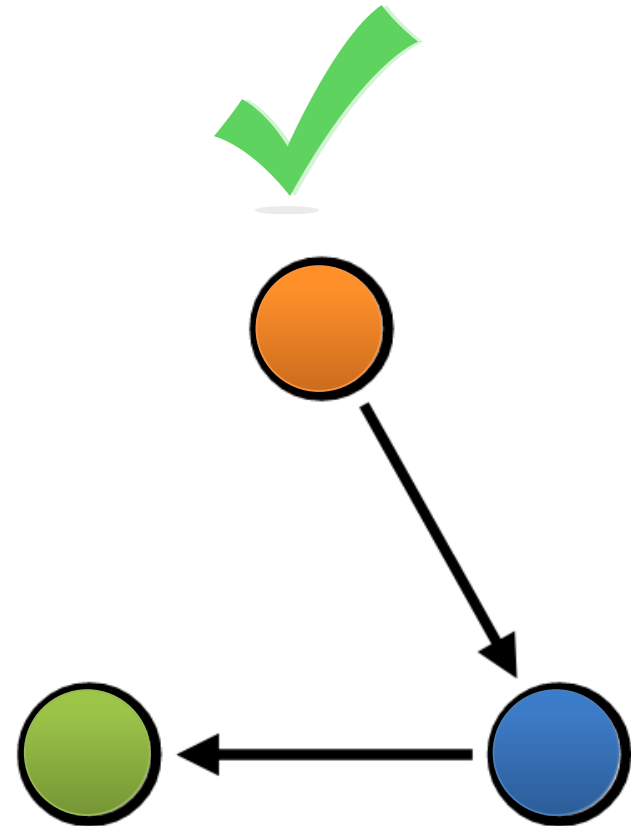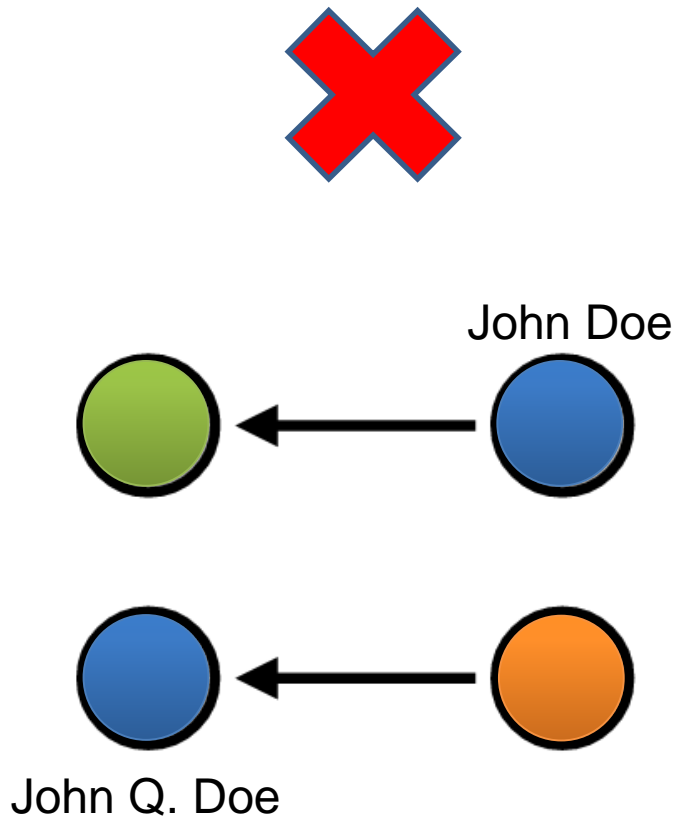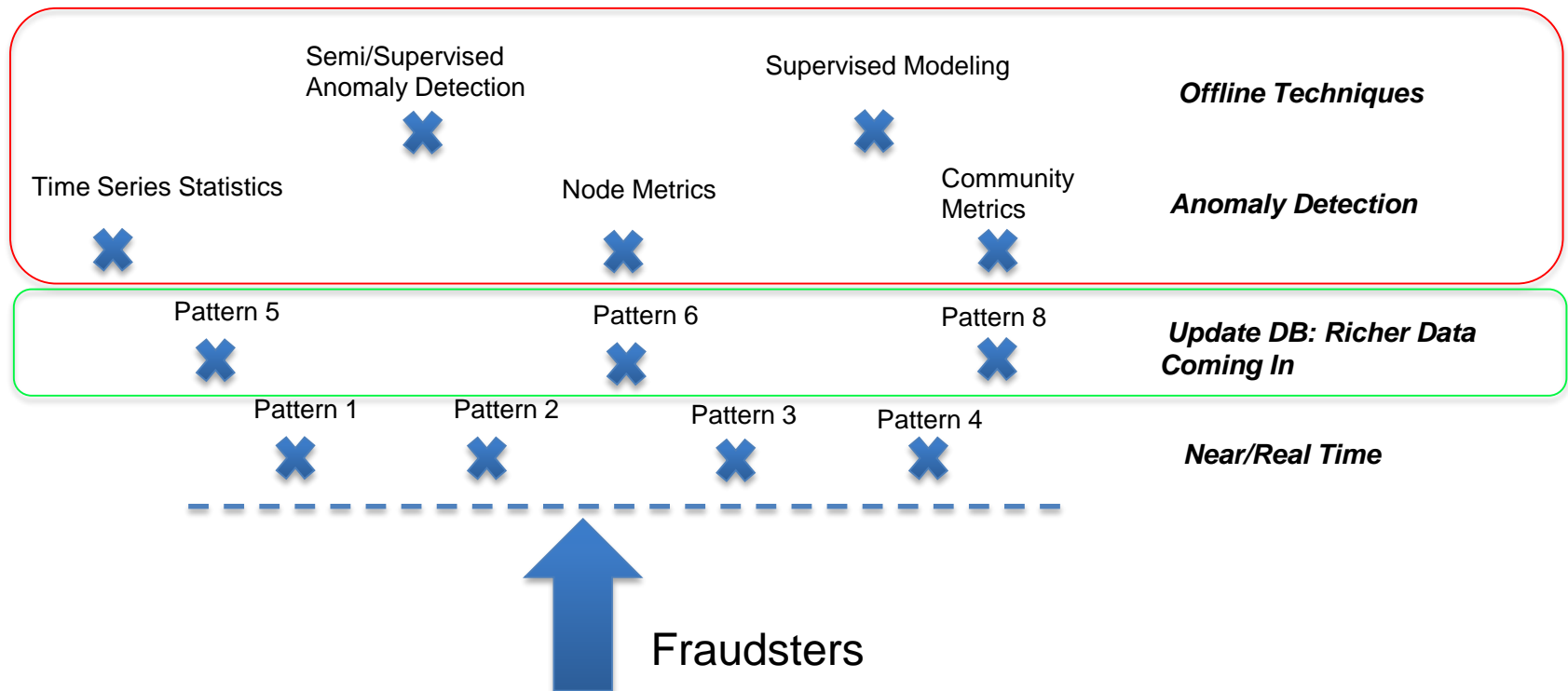
Key Points

- Start small and experiment
- Use analytics tools in combo with DB
- Clean up the entities
- Define relationship weights
- Context is everything

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Q & A

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Upcoming Webinar

Using Advanced Analytics to Detect Fraud in Pharmacy Claims

Thursday, April 19th 2018 - 2:00-3:00 PM (EDT)

This webinar will highlight the key types of pharmacy fraud and review advanced analytics techniques to uncover fraud refined over more than 20 years of experience developing and deploying successful fraud solutions.

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS

Robert Han
Elder Research
Director and Program Manager
han@elderresearch.com

Ryan McGibony
Elder Research
Senior Data Scientist
ryan.mcgibony@elderresearch.com

Blog: www.elderresearch.com/company/blog
Webinars: www.elderresearch.com/company/resource-center/webinars

ELDER RESEARCH
DATA SCIENCE & PREDICTIVE ANALYTICS