

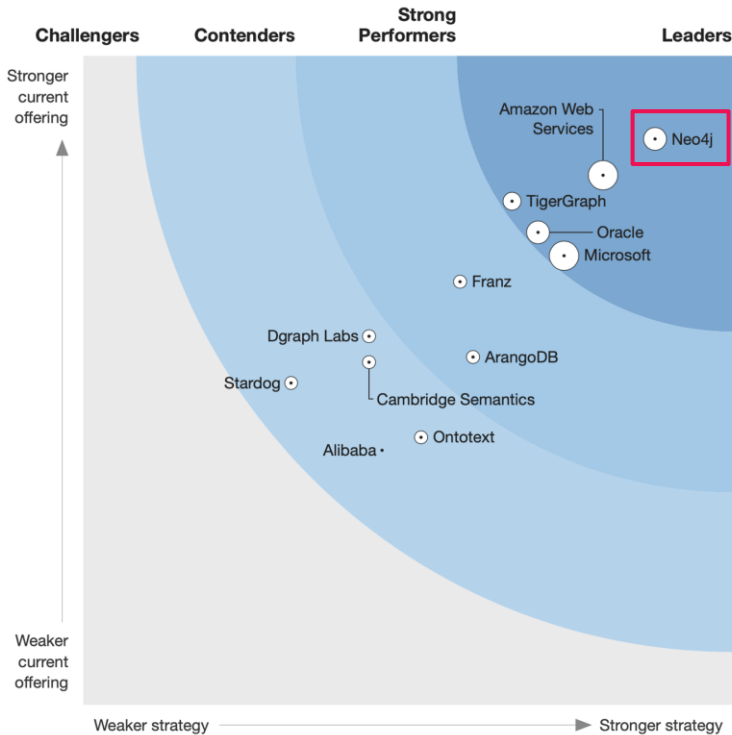
Graph Analytics to Analyze Connected Data

Reza Pahlevi
Country Managing Director
Neo4j Indonesia

Neo4j is the **Undisputed Leader** in Graph Databases

Neo4j Leads the 2020 Forrester Wave™ for Graph Data Platforms

FORRESTER®



DB-ENGINES

#1 Most Popular Graph Database with Developers

□ include secondary database models

36 systems in ranking, January 2022

Rank			DBMS	Database Model	Score		
Jan 2022	Dec 2021	Jan 2021			Jan 2022	Dec 2021	Jan 2021
1.	1.	1.	Neo4j +	Graph	58.03	0.00	+4.25
2.	2.	2.	Microsoft Azure Cosmos DB +	Multi-model	40.04	+0.33	+7.07
3.	3.	↑7.	Virtuoso +	Multi-model	5.37	+0.31	+3.23
4.	4.	4.	ArangoDB +	Multi-model	4.73	-0.02	-0.56
5.	5.	↓3.	OrientDB	Multi-model	4.56	+0.16	-0.77
6.	6.	↑8.	GraphDB +	Multi-model	2.86	-0.02	+0.75
7.	7.	↓6.	Amazon Neptune	Multi-model	2.63	+0.07	+0.32
8.	8.	↓5.	JanusGraph	Graph	2.39	-0.02	-0.19
9.	9.	↑12.	TigerGraph +	Graph	2.02	+0.02	+0.62
10.	10.	↑11.	Stardog +	Multi-model	1.89	-0.04	+0.42



Database

200k+
Developers

72k+
Meetup
Members Globally

50k+
Members with
LinkedIn Skills

Helping Leading Enterprises Solve Their Most Complex Data Needs



Real-Time
Recommendations



Fraud
Detection



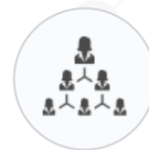
Network &
IT Operations



Master Data
Management



Risk &
Compliance



Identity & Access
Management

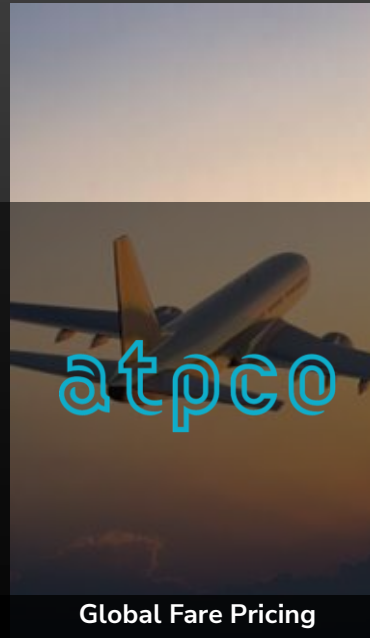
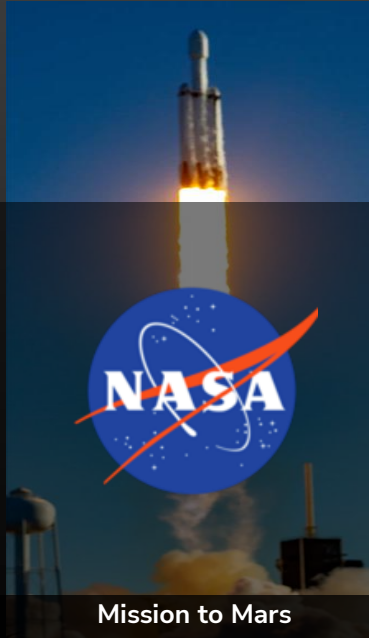


Customer Stories





Customers Solving the Previously Unsolvable



Real-World Workloads at **Mission-Critical Scale**

Lockheed Martin Product 360

Space division integrated disperse process and product data

- Combined data from various silos and created a **360 view of the entire lifecycle of products**
- Significantly **optimized dependencies and supply schedules**



US Army / Calibre Systems Predictive Maintenance

Modernization of procurement, budget and logistics processes for equipment & spare parts

- Shed cost estimation times **by 88%**
- Improved parts delivery **timing and accuracy**
- DBA labor required **dropped by 77%**



Danish Business Authority Fraud Detection

Improving the efficiency in finding fraudulent business relationships

- Built a powerful, explainable AI tool to contextualize business life cycles and provide machine-generated insights
- **Reduced VAT deficit by 1B Krone in the first year**



Bridging Between the Past and the Future

“Using Neo4j, someone from our Orion project found information from the Apollo project that prevented an issue, **saving well over two years of work and one million dollars** of taxpayer funds.”

David Meza
Chief Knowledge Architect
NASA



Credit: NASA

neo4j



Neo4j Aura for Risk Mitigation



Background

- Cutting-edge oil and gas provider based in Norway
- Leader in the industry for digital transformation initiatives

Business Problem

- Leverage data insights to reduce risk and automate subsea operations

Why Aura

- Deliver a cloud based graph database service with the required support, availability and security



US Army / Calibre Systems

Equipment Logistics



Background

- US IT consulting firm helped US Army streamline equipment deployments and maintenance spending
- Saving lives by improving the operational readiness of Army equipment like tanks, radios, transports, aircraft, weaponry, etc.

Business Problem

- Needed to modernize procurement, budget and logistics processes for equipment & spare parts
- Millions of connections among a tank's bill-of-materials, for example
- Improve "what if" cost calculations when planning missions and troop deployments
- Mainframe systems required over 60 man-hrs to calculate changes... planning took too long

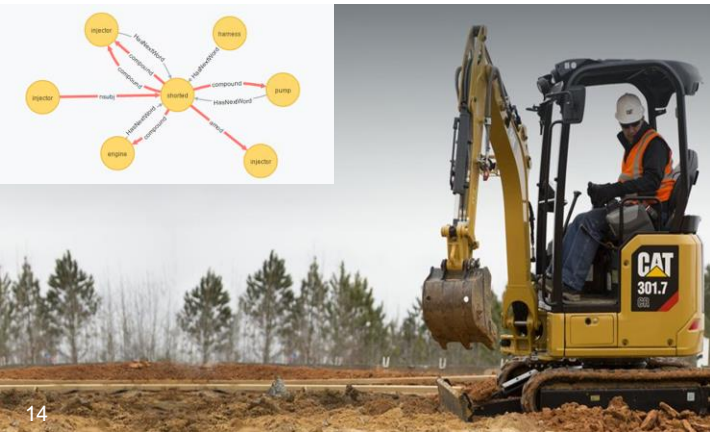
Solution and Benefits

- Shed cost estimation times by 88%
- Improved parts delivery timing and accuracy
- DBA labor required dropped by 77%
- Equipment TCO more predictable
- Safer soldiers



Caterpillar

Heavy Equipment Manufacturing



Background

- Fortune 100 heavy equipment manufacturer
- 27 Million warranty & service documents parsed

Business Problem

- Improve maintenance predictability
- Need a knowledge base for 27 million warranty documents and maintenance orders
- Graphs gather context for AI to identify 'prime examples' of connections among parts, suppliers, customers and their mechanics anticipate when equipment will need servicing and by whom

Solution and Benefits

- Knowledge graph created through Natural Language Processing (NLP) of decades of historical service documents
- Common ontology for complaints, symptoms & parts
- Anticipates when equipment will need servicing
- Improves customer and brand satisfaction
- Maximizes lifespan and value of equipment

Neo4j Graph Data Science

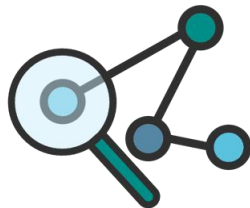


Graphs & Data Science

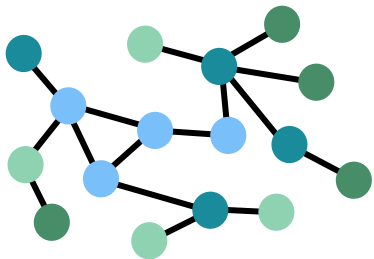
Graph Native Machine Learning



Graph Algorithms



Knowledge Graphs



Find the patterns you're
looking for in connected data

Use unsupervised machine
learning techniques to
identify associations,
anomalies, and trends.

Use embeddings to learn the
features in your graph that
you don't even know are
important yet.

Train in-graph supervise ML
models to predict links,
labels, and missing data.

From Simple Queries to Advanced ML



Queries

Human-crafted query, human-readable result

```
MATCH (p1:Person) -[:ENEMY]->(Person)<-[:ENEMY]-(p2:PERSON)
MERGE (p1) -[:FRIEND]->(p2)
```

Machine Learning Workflows

Train ML models based on results



Algorithms

Predefined formula, human-readable result

$$PR(u) = \sum_{v \in B_u} \frac{PR(v)}{L(v)}$$

PageRank (Emil) = 13.25
 PageRank (Amy) = 4.83
 PageRank (Alicia) = 4.75

$f(x)$



Embeddings

AI-learned formula, machine-readable result

```
Algorithm 1: GraphSAGE embedding generation (i.e., forward propagation) algorithm
Input : Graph G(V, E); input features {x_u, v_u ∈ V}; depth K; weight matrices
W^l, W^l ∈ ℝ^{(1, ..., K)}; non-linearity σ; differentiable aggregator function
AGGREGATE; W ∈ ℝ^{(1, ..., K)}; neighborhood function N^l : v → 2^V
Output: Node representations h_u for all v ∈ V
1 h_u^0 ← x_u, ∀ v_u ∈ V;
2 for l = 1, ..., K do
3   for v ∈ V do
4     h_{(v)}^l ← AGGREGATE({h_{(u)}^{l-1}, v_u ∈ N^l(v)});
5     h_u^l ← σ(W^l · CONCAT(h_{(v)}^{l-1}, h_{(v)}^{l-1}))
6   end
7   h_u^l ← h_{(v)}^l, ∀ v ∈ V
8 end
9 x_u ← h_u^K, ∀ v_u ∈ V
```

Node2Vec (Emil) = [5.4 5.1 2.4 4.5 3.1]
 Node2Vec (Amy) = [2.8 1.8 7.2 0.9 3.0]
 Node2Vec (Alicia) = [1.4 5.2 4.4 3.9 3.2]

Supervised ML in Neo4j

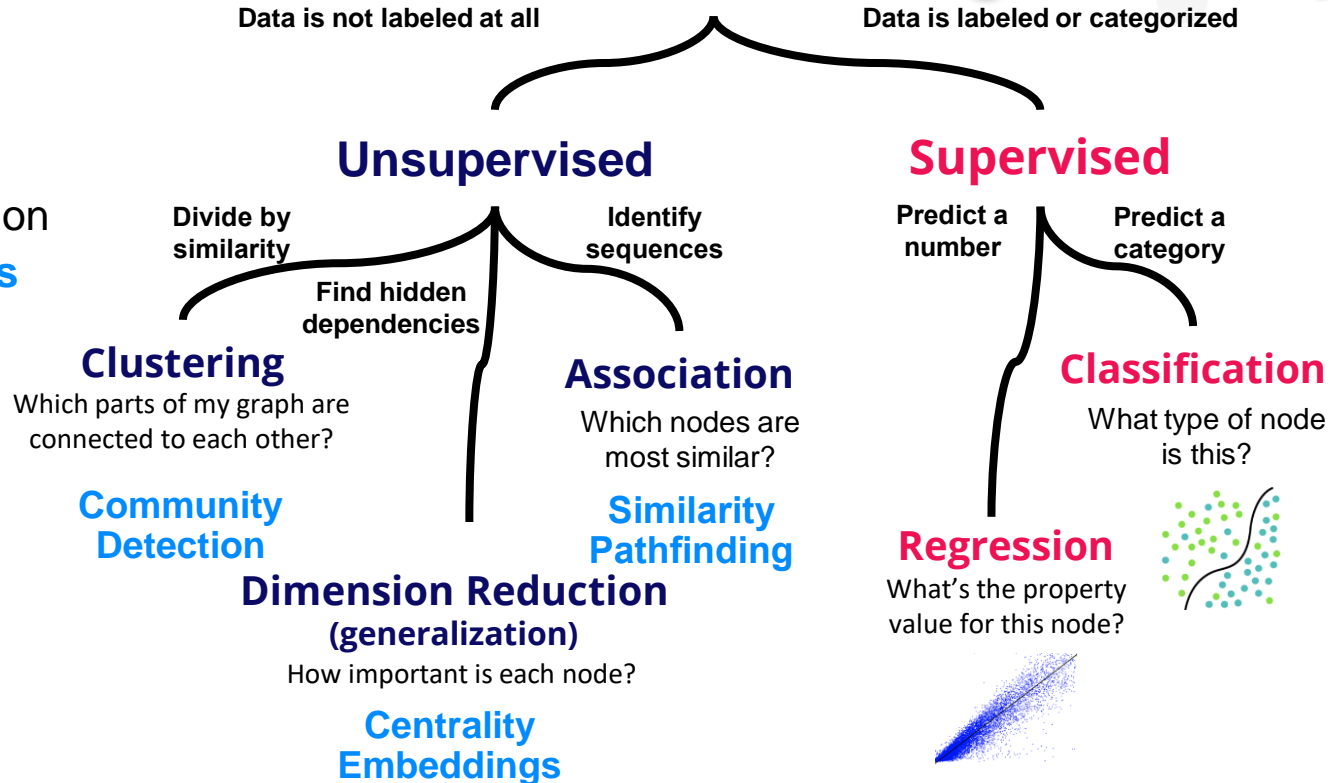
Machine Learning

Unsupervised ML

- Unlabelled data
- Data driven
- Pattern identification
- **Graph algorithms**

Supervised ML

- Labeled data
- Task driven
- Value predicting



Sample of Neo4j Specific Solution

- **Neo4j for Banking**
- **Neo4j for Social Media Analytics**
- **Neo4j for Human Capital Management**

Neo4j for Banking



Banking Recommendation System

Hyper-Personalization

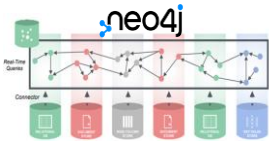
Integrated
Siload System

Customer 360

Customer
Segmentation

Bundle Offering/
Product (Program)
Recommendation

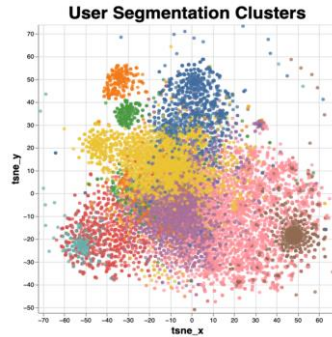
Dashboard



Able to integrated
multiple data
source and type



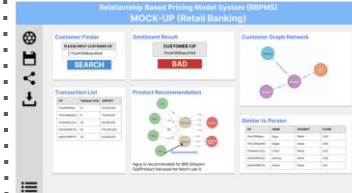
Provide a trusted,
holistic view about
customer and get
hidden insight about
it.



Customer
segmentation is the
important step to
drive RBP Strategy



Define the best
product bundle
offering that fit to
each Customer



Monitor and find
the best strategy to
satisfied customer

Neo4j for Social Media Analytics



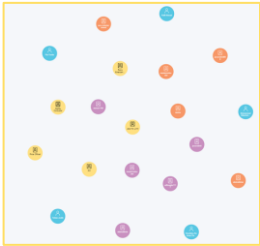
Social Media Hoax Detection

Crawling Data

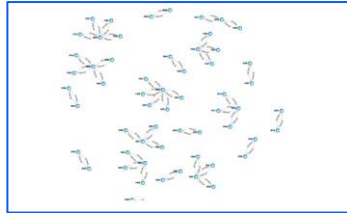
Social Media
360

Social Media Hoax
Identification

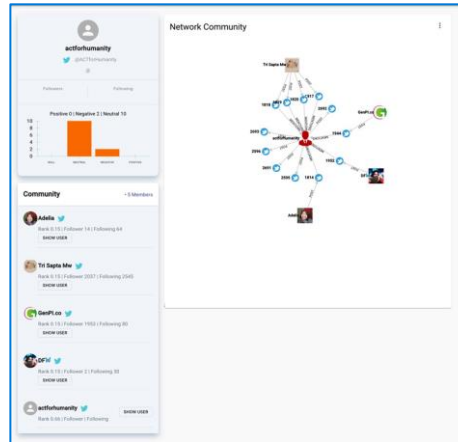
Social Media Sentiment
Analysis



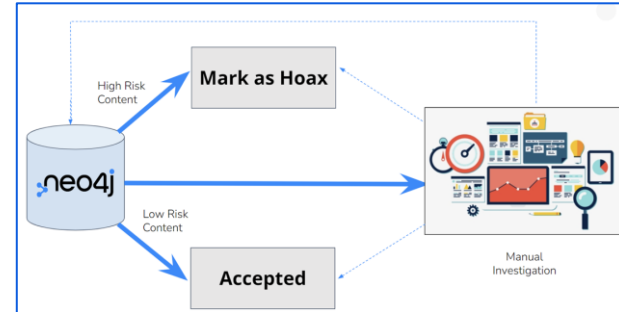
Get information regards to social media user and account



Provides a trusted, single view of social media network



Detect the spread of social media hoax and find out the first author of that hoax



Determines whether the social media text data collection is positive, negative, or neutral.

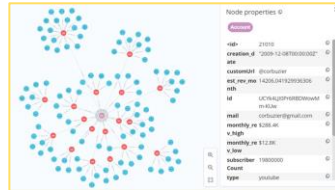
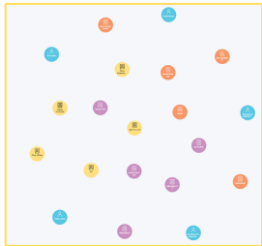
Tax Potency Prediction System

Crawling Data

Social Media
360

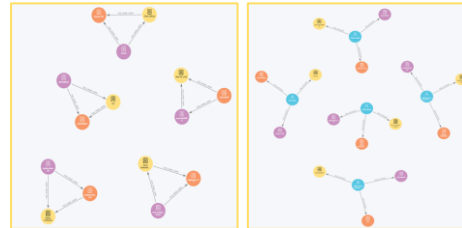
Entity Resolution

Tax Potency Prediction

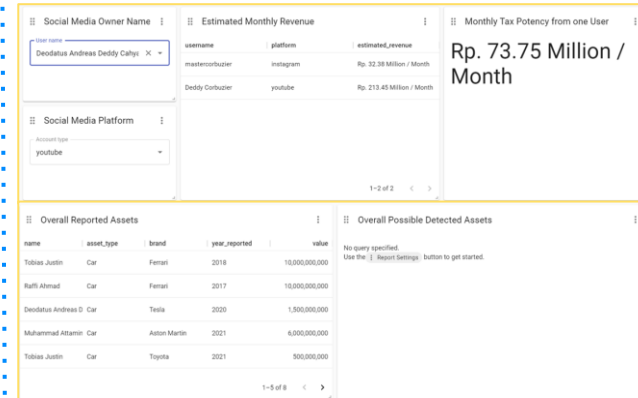


Get information regards to social media user and account

Provides a trusted, single view of social media network



Find the real ownership of each social media account



Predict tax potency from each social media user and account on different platforms

Neo4j for Human Capital Management



Humkan Capital Management

Employee 360

Talent Management

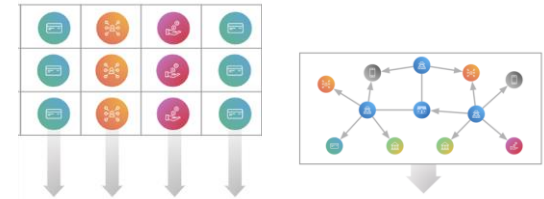
Employee Recommendation
for Job Vacancy



Provides a trusted, single view of an employee, competencies, and its career histories.



Determine organized, strategic process of getting the right talent onboard and helping them grow to their optimal capabilities keeping organizational objectives in mind.



Automatically provide recommendation for job vacancy based on employee scoring and enhance it with Graph ML/AI

Thank you!

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