

Graph Technology

A BRIDGE BETWEEN STUDENTS AND DATA

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<https://theartsandeducation.com/2021/01/21/art-history-memes/>

Overview

- ▶ How can students engage more with data in a changing landscape?
- ▶ What are graphs?
- ▶ Graphs and the human brain
- ▶ Applying graphs with graph technology
- ▶ Conclusion and questions

The Question



- ▶ How can students participate more in data technology?
- ▶ Data technologies and analytics have accelerated in the last 25 years.
 - ▶ Data technology significantly impacts the development of IA.
- ▶ What skills do we need as educators and students to keep our footing in this rapidly evolving field?

The Answer

Learn graph technology



- ▶ Graphs are a human-native type of data model
 - ▶ Graph technology persists, store, and retrieve data like the human brain does – Through relationships/associations.
 - ▶ This makes visualizing, understanding, and manipulating graphs intuitive.
- ▶ Graphs are involved in multiple aspects of technology
 - ▶ Artificial Intelligence
 - ▶ Network analysis
 - ▶ Fraud detection
 - ▶ Communicating Visually

What would you say the limiting factor is on today's generative AI?
What is holding you back the most?



The primary limiting factors on today's generative AI (like me) can be categorized into a few key areas:

1. Data Quality and Scope

- **Bias and Representation:** AI models are trained on vast amounts of data scraped from the internet. If the training data contains biases, errors, or underrepresentation of certain groups, the model will reflect these biases in its outputs. This limits the quality and fairness of the responses.
- **Outdated Knowledge:** AI models like mine are trained on data that has a cutoff point (in my case, October 2023), so I can't access or incorporate real-time or the most up-to-date information unless I use specific tools for browsing.

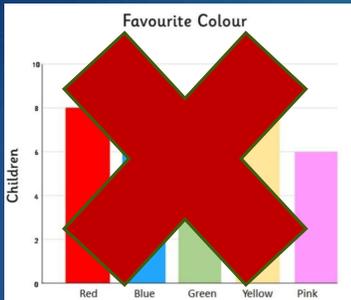
2. Understanding Context and Intent

- **Nuanced Understanding:** While I can handle a wide range of queries, I sometimes struggle with understanding deep, nuanced meaning, such as interpreting sarcasm, context, or highly complex multi-turn conversations.
- **Lack of Real-World Knowledge:** Although I can mimic reasoning based on text data, I don't have actual experience or true understanding of the real world. I process patterns, but I don't "know" things like humans do.

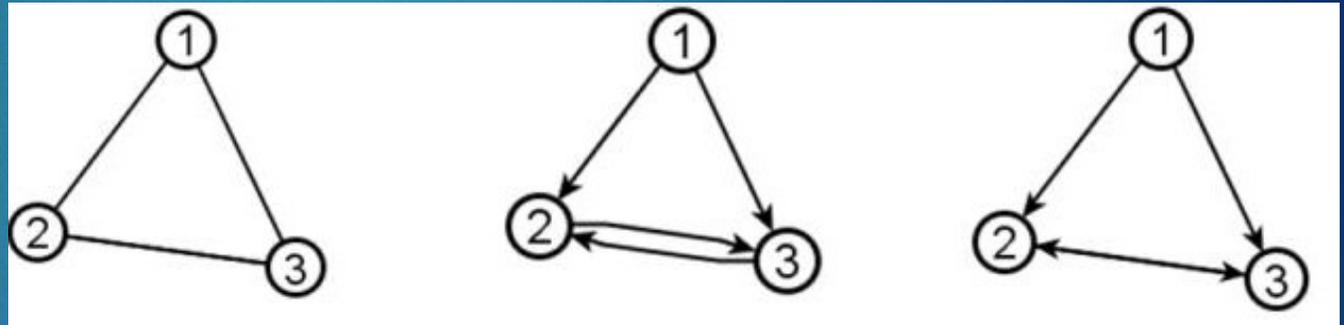


What is a graph?

- ▶ A graph is a mathematical abstraction of entities (nodes) and edges (relationships) between the nodes.



<https://www.twinkl.ch/teaching-wiki/bar-chart>



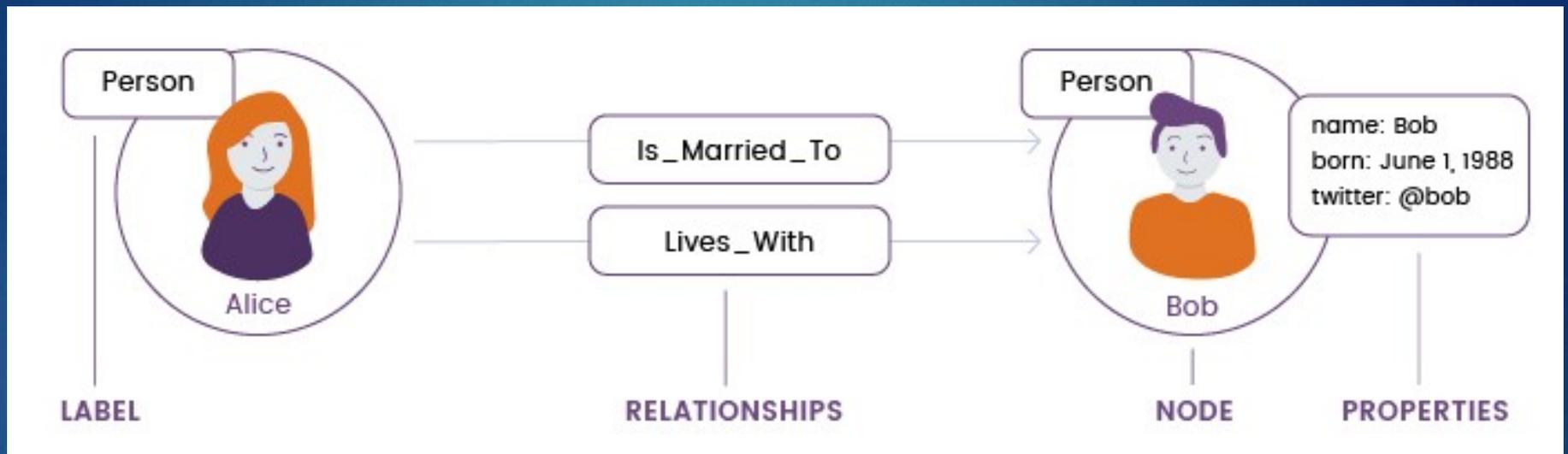
<https://edshare.soton.ac.uk/922/2/index.html>

- ▶ But this representation is abstract. It doesn't tell a story.

Property graphs

- ▶ Abstract mathematical graphs represent structure, but they don't tell a **story**.
- ▶ Property graphs include **data**
- ▶ Property graphs reflect what each node and edge represents so that a **story** emerges.

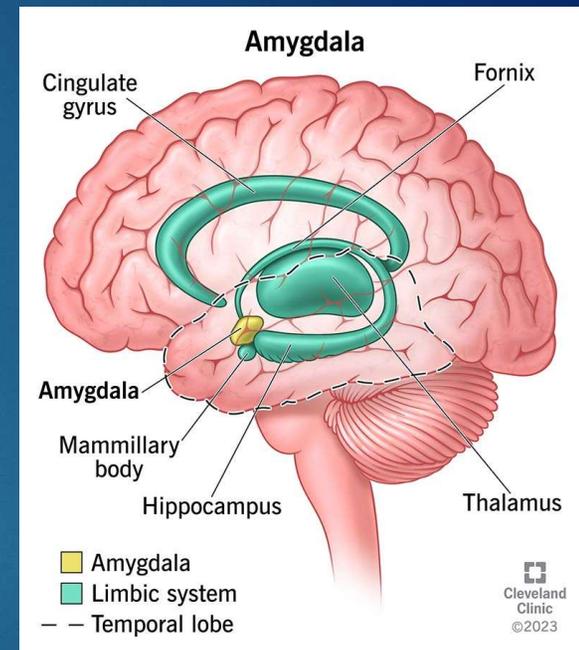
Property graphs include data



<https://rubygarage.org/blog/neo4j-database-guide-with-use-cases>

Memory and The human brain

- ▶ The human brain stores data as a graph
 - ▶ Structurally and logically
- ▶ The factual context of memories is regulated by the hippocampus.
- ▶ The amygdala processes and retrieves emotional memories.



<https://my.clevelandclinic.org/health/body/24894-amygdala>



Experiment!

Your Graduation Day!



Office Stock Photos

- Write a list of the first five words that come to mind.
- People, places, things.

What is graph technology?

- ▶ Graph data v. tabular data
- ▶ Graph technologies mirror how the human brain stores relationships –
Through relationships

Graph technologies store and process data as property graphs

- ▶ **Neo4j**
- ▶ TigerGraph
- ▶ Neptune (AWS)

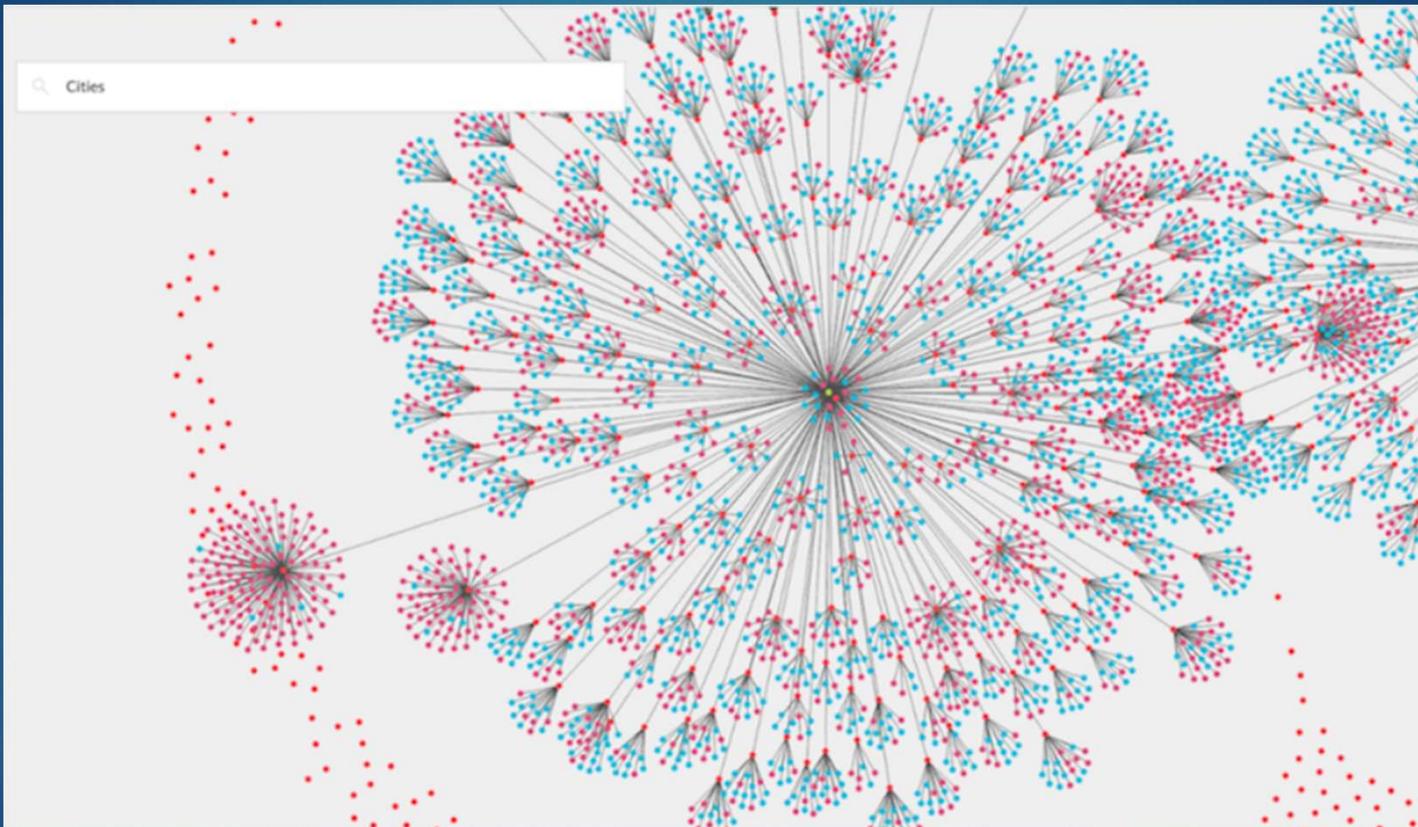


<https://www.prnewswire.com/news-releases/neo4j-announces-collaboration-with-microsoft-to-advance-genai-and-data-solutions-302098979.html>

How do we use graph technology to educate and collaborate?

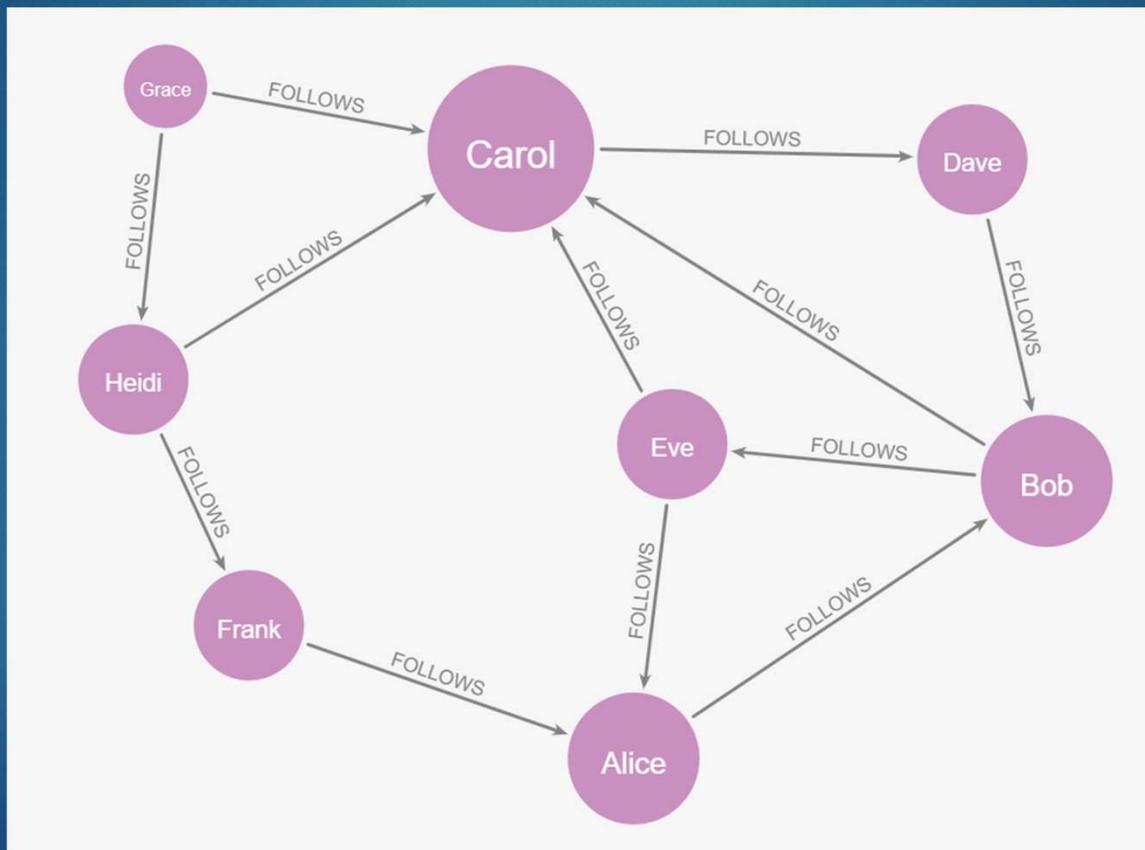
- ▶ Humans can naturally and easily navigate graph data models with modern tools.
- ▶ This allows for easy
 - ▶ Visualization
 - ▶ Discovery of patterns
 - ▶ Data analysis

Graph visualization with Neo4j



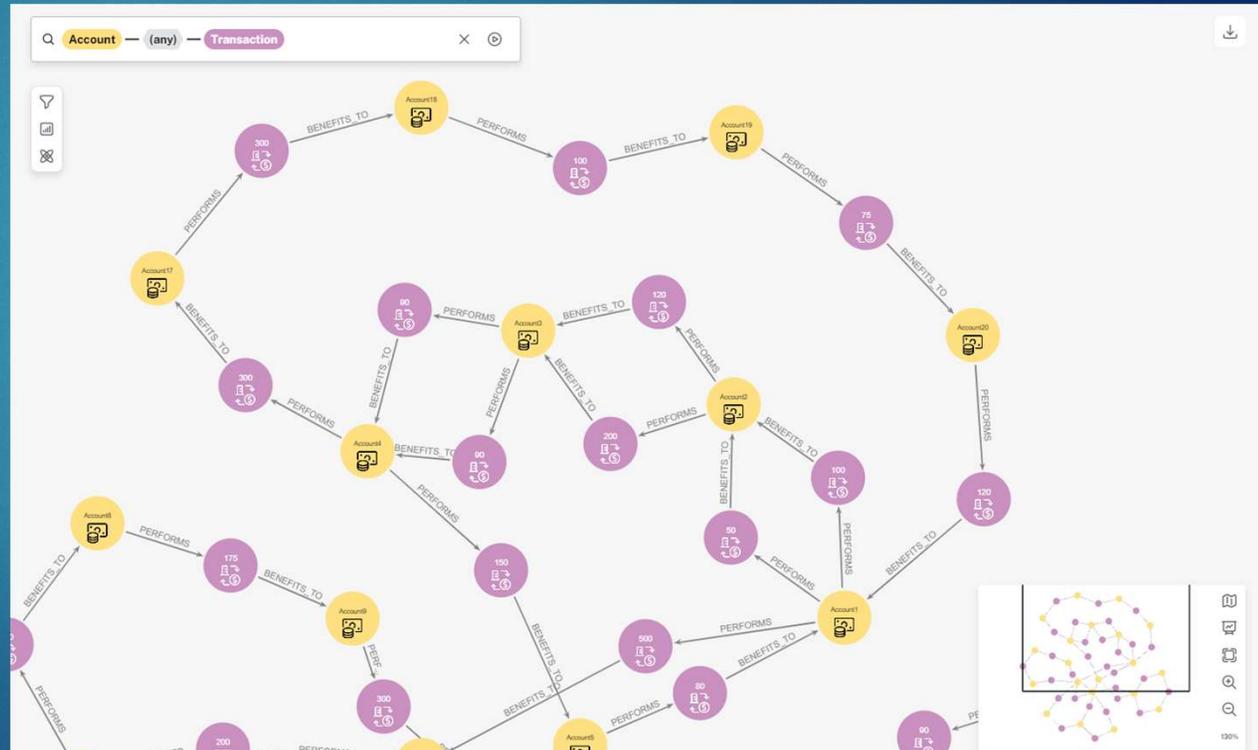
<https://neo4j.com/blog/introducing-neo4j-bloom-graph-data-visualization-for-everyone/>

Use cases – Centrality and key opinion leaders (Marketing)

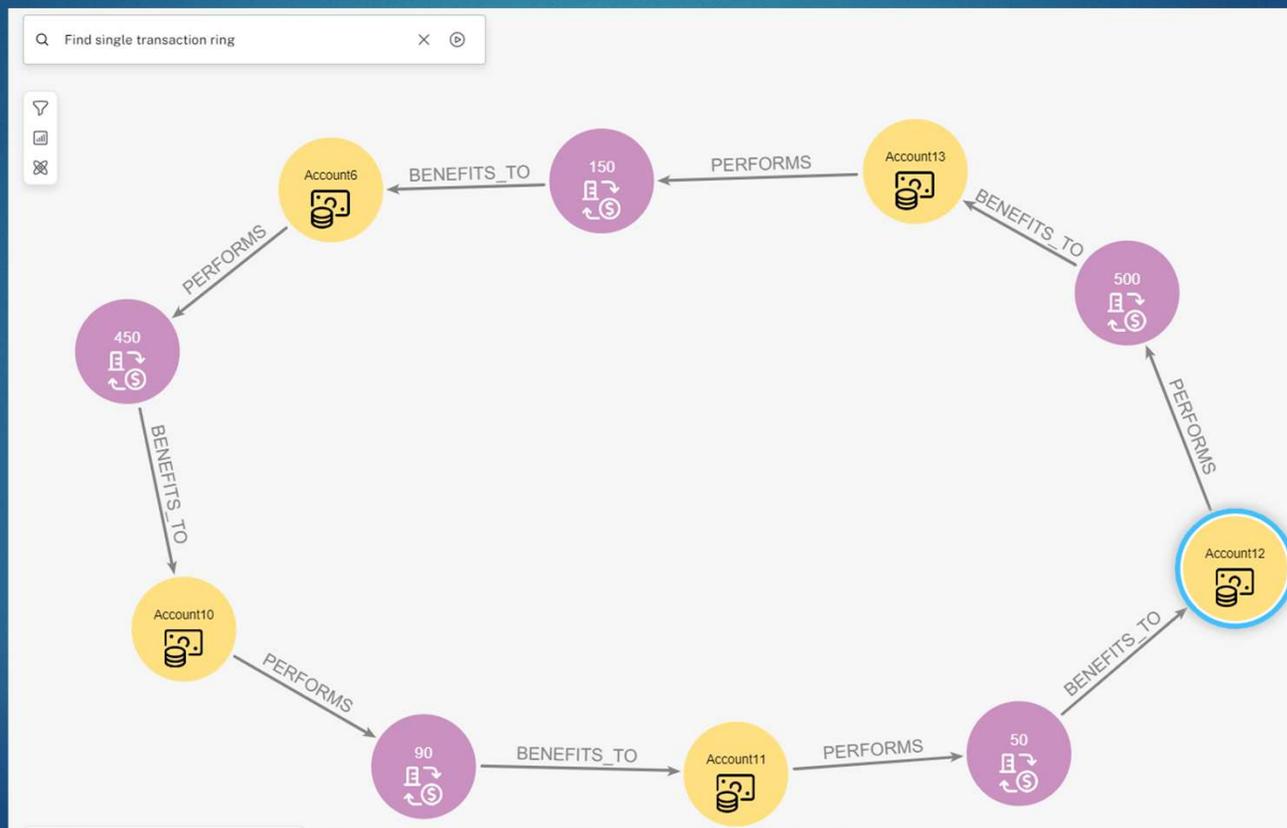


Business scenarios – Detecting transaction fraud

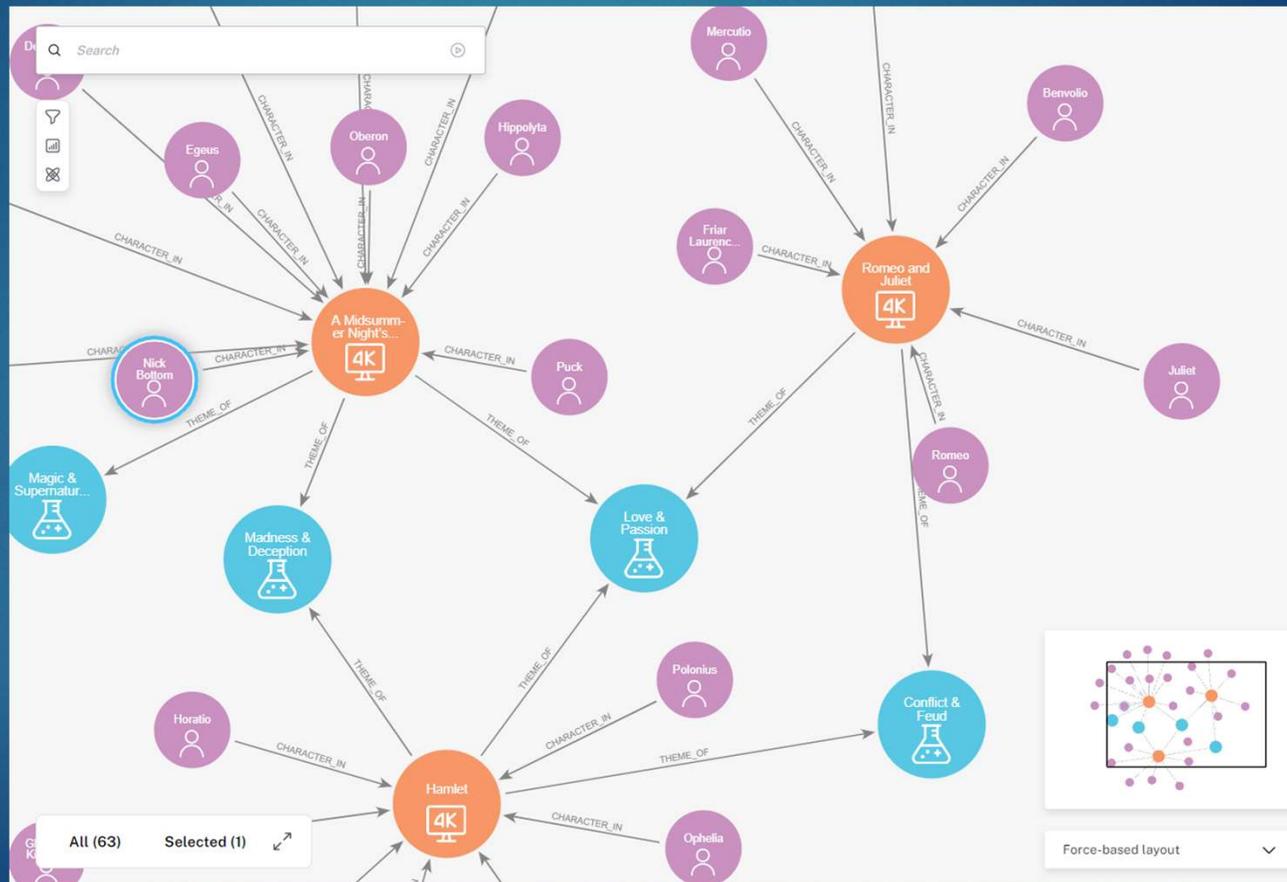
- ▶ Finding fraud is difficult
- ▶ Graph technology can quickly analyze a network of transactions.



Business scenarios – Detecting transaction fraud



Communicating Visually: Shakespeare Themes



Conclusion

- ▶ Now you understand graph data models and how to apply them!
- ▶ You can help your students visualize and understand connected data!
- ▶ Neo4j is free to download and start using right away!

Download Neo4J Desktop at <https://neo4j.com/>

Go online and explore Neo4j Databases:

<https://neo4j.com/docs/getting-started/appendix/example-data/>



Thank you!