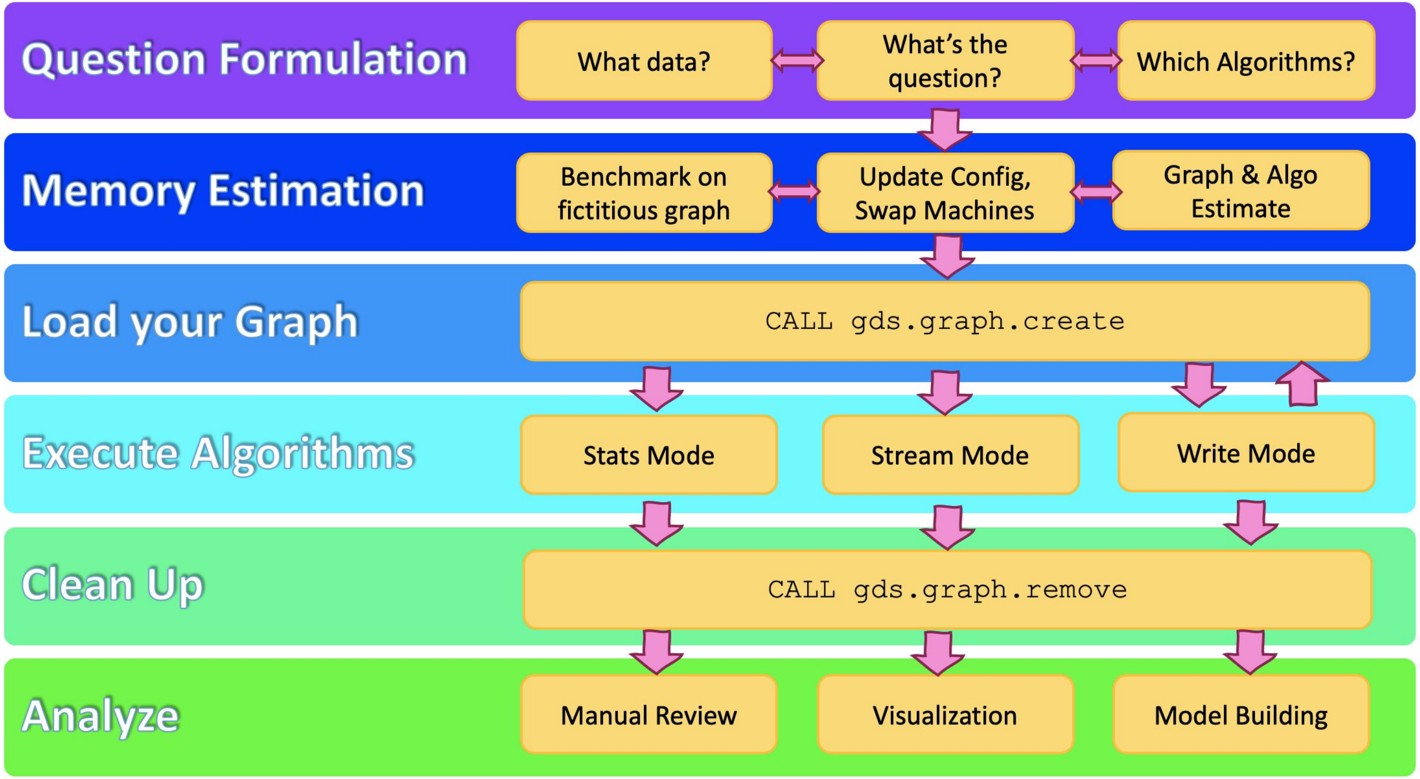
Neo4j GDS Best Practices
Graph Data Science Workflow

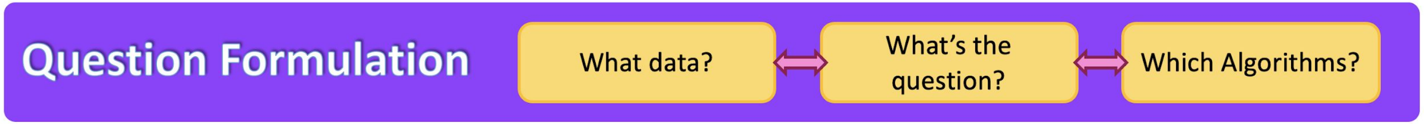
Objective

Know how to put together the right workflow for your project, and how to combine algorithms effectively.

GDS in production



GDS in production



Emphasis on data modeling:

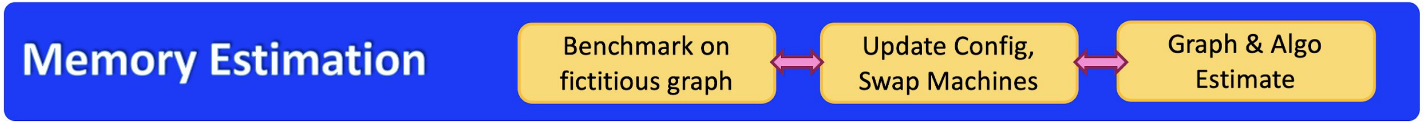
(1) **Define the problem you're trying to answer:**
Making recommendations? Finding anomalies?

(2) **Match the problem to the correct set of algorithms:**
recommendation = similarity, anomalies = centrality

(3) **Modify your data model for the algorithms you want to use**

- mono- or bi-partite
- modify labels, relationships to use native graphs
- consider weights, seeding

GDS in production



Configuration & best practices:

(1) **Do I have enough memory to run this?**

(2) **How long will this take to run?**

(3) **What do I need to change?**

GDS in production

Load your Graph

```
CALL gds.graph.create
```

Loading the analytics graph:

- This is one of the *slowest* steps, unavoidable, and takes up the most memory so we want to minimize the number of graphs we load
- Is it possible for us to load data for all the algorithms into a single graph?

GDS in production

Running your algorithms:

- `.stats` returns summary statistics about the results of the algorithm without writing to the database. *Run this first to check if the calculations make sense!*

- `.stream` returns all the results as a stream - use this if you're extracting them for use elsewhere (eg. Python)

- `.mutate` writes to the in-memory graph. Output from the first algorithm are written before moving onto the next one in the sequence

- `.write` writes to the Neo4j database. This is the slowest, so only run it once you know your algos make sense!

GDS in production

Clean Up

```
CALL gds.graph.remove
```

Don't forget this step:

```
CALL gds.graph.drop('Similarity-Graph');
CALL gds.graph.drop('Monopartite-Graph');
```

Double check that you've got all of them:

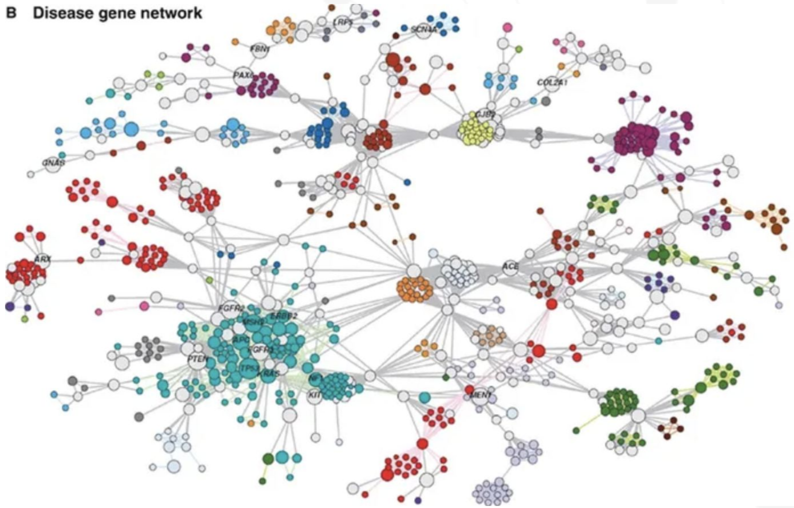
```
CALL gds.graph.list();
```

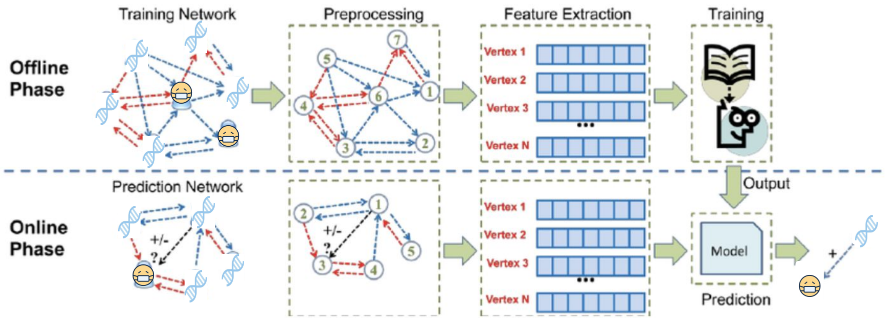
GDS in production

Analyze

Manual Review | Visualization | Model Building

Time to data science:





GDS is general purpose!

Common Algorithms & Combinations

Data Pre-processing:

1. Identifying and removing super nodes: ***degree centrality***
2. Identifying subgraphs: ***weakly connected components***

Common Algorithms & Combinations

Community Detection + ???? = Profit

Community detection algorithms break up your graph into smaller subgraphs based on edges. Use community detection to downscope problems on large graphs and focus on the important parts.

- **Speed up calculations:** Community detection + node similarity
- **Focus on the important stuff:** Community detection + centrality
- **Aggregate your graph:** Treat communities as nodes and run centrality, similarity, etc

What else can we use GDS for?

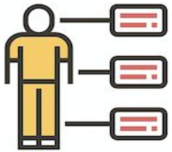
Fraud Detection

Weakly Connected Components - First Party Fraud

Louvain - Fraud Rings

Page Rank, Degree Centrality - Anomalies

Disambiguation



Weakly Connected Components - Common identifiers

Label Propagation - Overlapping relationships

Node Similarity

Recommendations

Louvain - Interacting communities

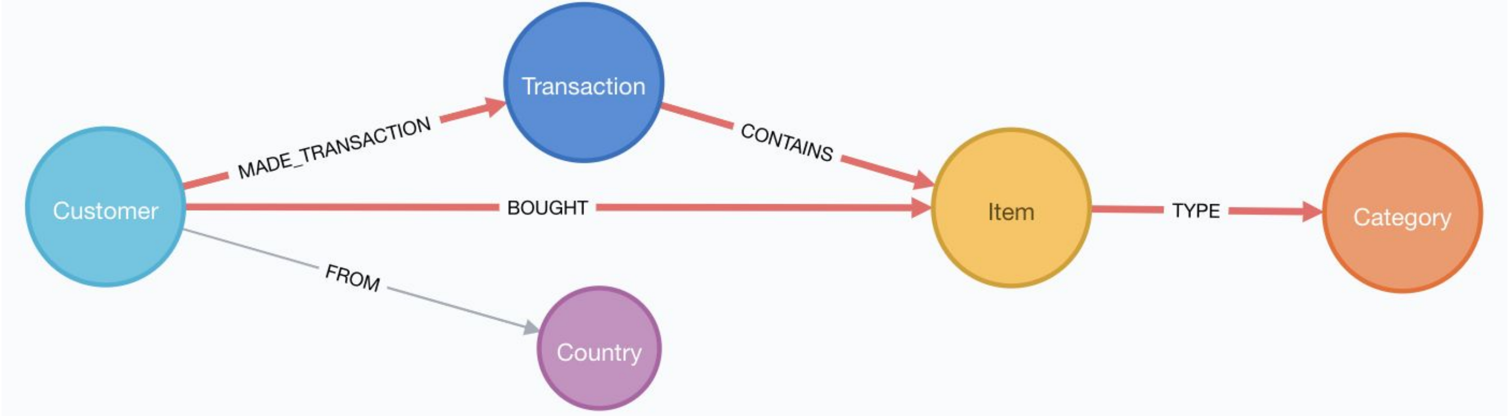
Page Rank, Betweenness, Closeness Centrality- Important users

Node Similarity

And much more!

Examples from … Retail

Transactional graph:

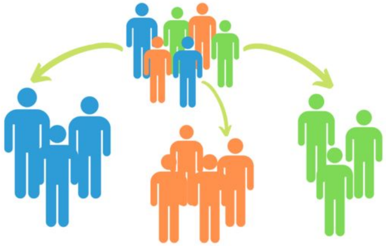


What kind of questions can we answer?

Examples from … Retail

Customer segmentation:

Identify customers who buy similar items (**node similarity**), and use **Louvain** to identify clusters of consumers with similar behaviour



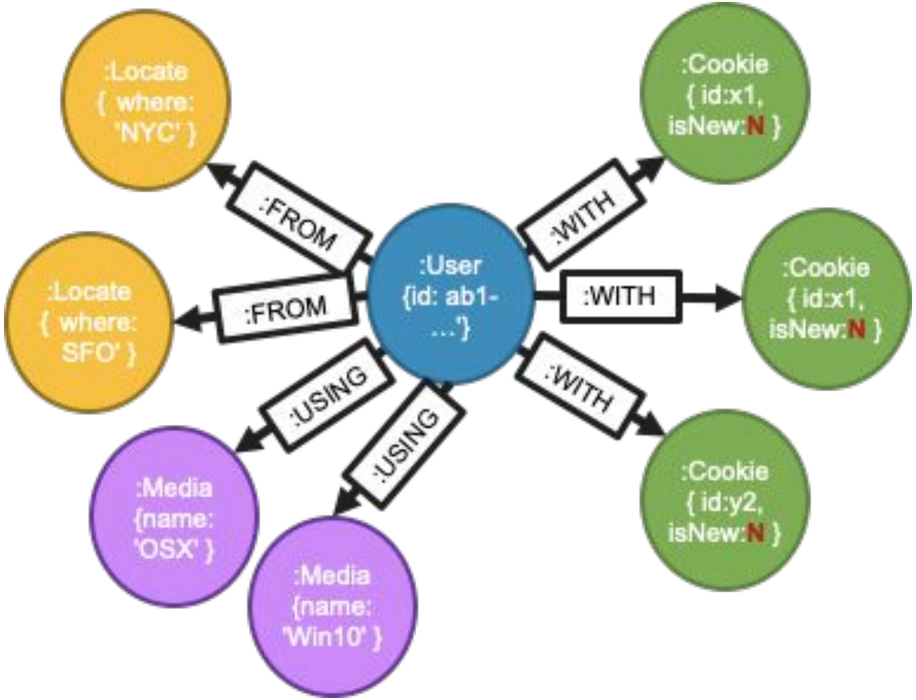
Item recommendations:

Recommend items that are frequently bought by the same customers or in the same transaction with **node similarity**.

Find items that influence copurchases using **Page Rank**, or fast moving items with **closeness Centrality**

Examples from ... Marketing

Web Traffic Graph:



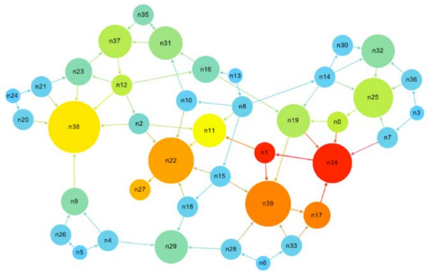
How can we tell whos who?

Examples from … Marketing

Disambiguation:

Identify subgraphs of users with co-occurring identifiers using **Weakly Connected Components**

User Behavior:

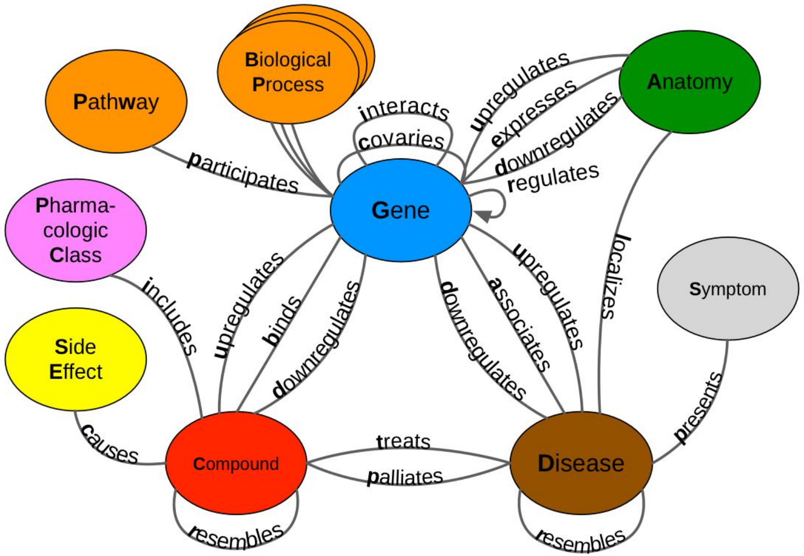


Identify communities of unique users that interact with the same websites using **Label Propagation**

Identify which websites drive traffic using **Page Rank**

Examples from … Life Sciences

Knowledge graph representing genes, chemicals, diseases:



What questions can we answer?

Examples from … Life Sciences

PageRank & **Betweenness** to identify essential regulatory genes or drug targets

Louvain to identify protein regulatory networks

Shortest path to link drug targets to possible outcomes or side effects

Node Similarity to find structurally similar chemicals

Link Prediction to estimate likelihood of interactions

What are your use cases? Let’s brainstorm!

Questions?

neo4j