AstraZeneca

Graph technology: Redefining the boundaries of analytics at AstraZeneca

In its long history of delivering life-changing medicines, AstraZeneca has consistently redefined the boundaries of science.

In the age of digital business and healthcare, extending this track record and further personalizing patient treatments will, in the words of AstraZeneca's Science Committee, depend on making strategic science capabilities — such as data science, AI, and knowledge graphs — a key R&D focus. Success will mean increased productivity of specialist talent across the R&D pipeline, accelerated drug discovery, and increased profitability. Along the way there will also be opportunities to deliver on the company's Ambition Zero Carbon programme.

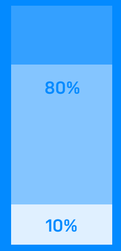
Neo4j's graph technology is already helping AstraZeneca to achieve similar outcomes, from extracting novel insights about relationships between biological and chemical data, to managing compliance and streamlining R&D[1].

But we can achieve something greater, together.

Neo4j: built from the ground up to leverage relationships in data

Neo4j is a native graph database — meaning its native storage layer is a connected graph — designed around a simple yet powerful optimisation. Each data record or node contains direct pointers to all the nodes that it's connected to. All information needed to find relationships between nodes, or the next node in a sequence, is available in the node itself.

The result? Neo4J doesn't need to compute the relationships between your data at query time. That means queries of densely connected data are executed orders of magnitude faster than other databases, which must repeatedly look up each connection.



Gartner predicts that, by 2025, graph technologies will be used in 80% of data and analytics innovations, up from 10% in 2021, facilitating rapid decision making across the organization.

[1]https://www.gartner.com/en/newsroom/press-releases/2021-03-16-gartner-identifies-top-10-data-and-analytics-technologies-trends

The power of graph databases in life sciences

According to Deloitte's 2022 Global Life Sciences Outlook report, "many life sciences companies are showing a 'need for speed' as their focus is on driving research and development productivity... in 2022, pressures are expected to be on optimizing processes to fundamentally change the drug development paradigm."

The same report also notes that:

Advanced data collection and analysis is essential to shortening the R&D cycle and meeting the needs of patients.

Genomic information and improvements in technology – like AI and quantum computing – are evolving the way life science organisations approach drug discovery.

Real-world data and real-world evidence collected today have the potential to deliver insights never before thought possible.

Life science companies – dealing with everything from patients to molecules – are using Neo4j today to respond to these challenges and opportunities, by extracting insights about relationships in its data to accelerate drug discovery. They are also streamlining and automating privacy and regulatory compliance, and making affiliation management between healthcare providers (HCPs), patients and organizations more efficient.

5 Neo4j use cases in AstraZeneca today

There is strong business value in the ability of graphs to enable AstraZeneca to get higher volumes of better-quality drugs to market more quickly, while reducing the costs associated with scientists and researchers doing manual data analysis. But the technology also has multiple use cases that cross the enterprise. From improving and optimizing the supply chain in drug manufacturing, to HR and competitive intelligence.

Here are five use cases for Neo4j's graph technology in AstraZeneca today

Accelerating drug discovery for BioInformatics

Quantitative Biology

Neo4j has helped AstraZeneca's BioInformatics team build intuitive representations of massive amounts of connected data.

This allows the team to interrogate relationships in their data more deeply, to drive better predictions and accelerate exploration. Outcomes include enabling scientists to uncover high-quality novel targets and make data-driven decisions regarding research and testing priorities. It has also enabled the creation of a consolidated overview of disparate datasets, for the drawing of connections between diseases and targets that may not be obvious from any single source.

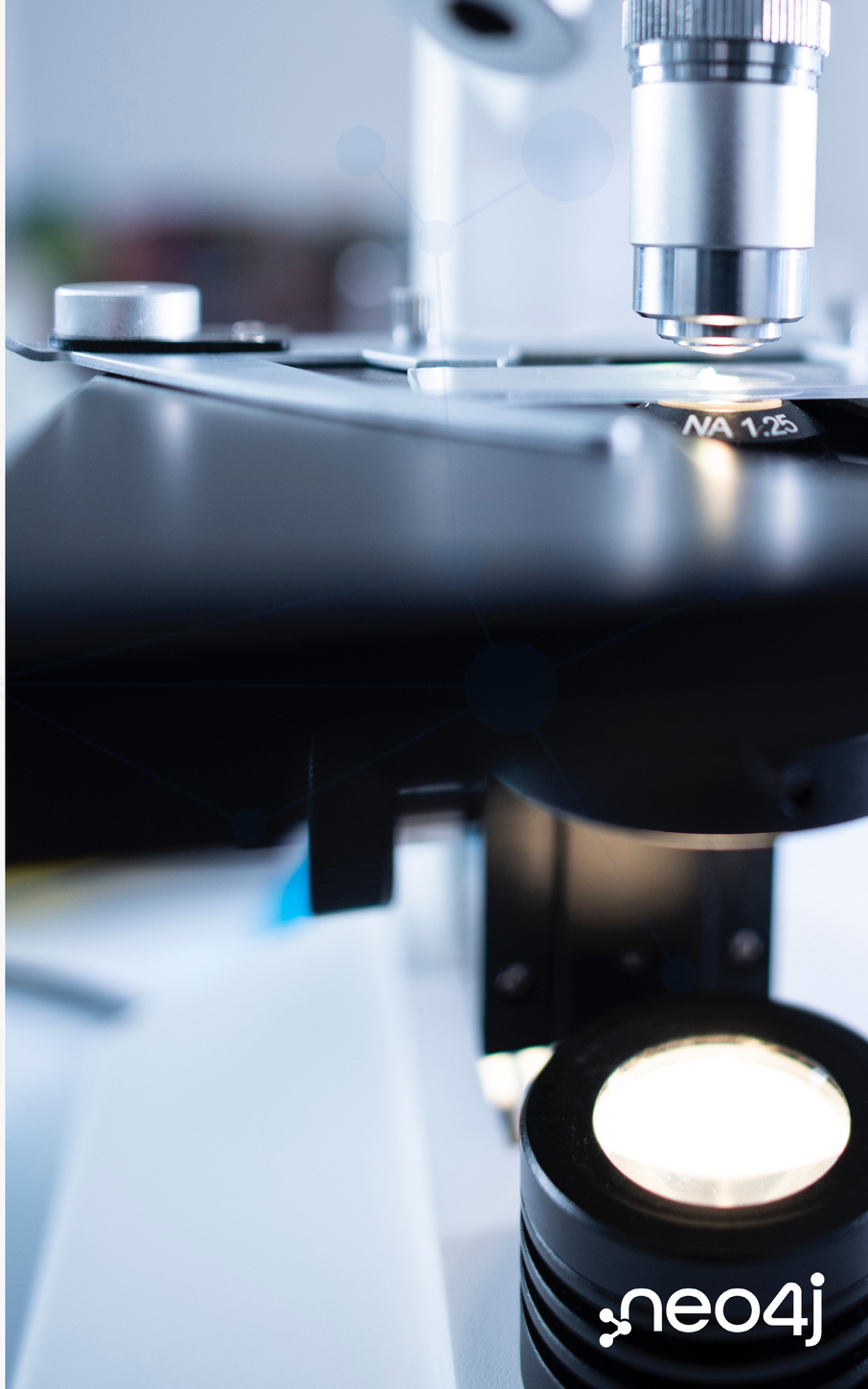
Overall, decision-making accuracy is improved, manual effort has been reduced, costs are down and speed to value is up.

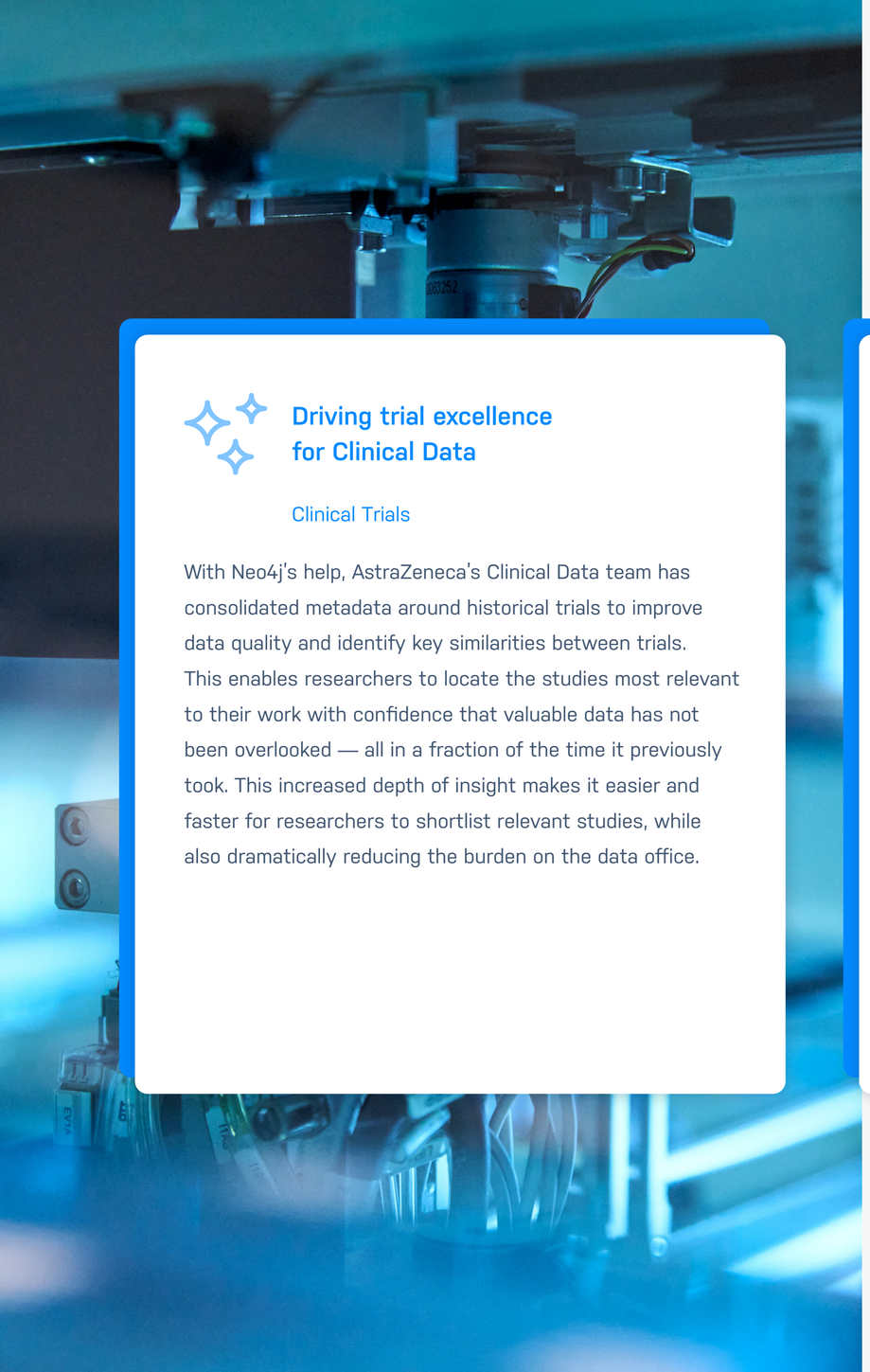
Creating richer patient journey models for Affiliation Management

Commercial IT

The AstraZeneca Affiliation Management team has used Neo4j to model the patient journey as a chronological graph, including medical claims, diagnoses, prescriptions and physician details.

This has identified patterns and archetypes to drive enhanced inputs into existing machine learning operations, revealing journey similarities and influential touch-points. This in turn enabled deeper intelligence through richer context. Finding patients with specific journey types and patterns, and revealing similar cases, helped to identify opportunities to intervene sooner for complex diseases that develop over years, resulting in improved overall patient outcomes.





Driving trial excellence for Clinical Data

Clinical Trials

With Neo4j's help, AstraZeneca's Clinical Data team has consolidated metadata around historical trials to improve data quality and identify key similarities between trials. This enables researchers to locate the studies most relevant to their work with confidence that valuable data has not been overlooked — all in a fraction of the time it previously took. This increased depth of insight makes it easier and faster for researchers to shortlist relevant studies, while also dramatically reducing the burden on the data office.

Graphs for Compound Synthesis & Management

Compound Synthesis & Management

AstraZeneca's Compound Management department is adopting Neo4j to consolidate multiple disparate source systems and create a global, connected view of their inventory data. Local queries which previously had to span multiple data sources in a data pipelining protocol can now be executed in a single, simple Cypher query, reducing time and cost and increasing speed. Analysing inventory within a graph builds agility and resilience, allowing AstraZeneca to reduce risk, for example in the earlier detection of 'sample swaps' via track and trace.

Modeling supply chain relationships to drive digital excellence

Pharma Supply Chain

AstraZeneca's multi-echelon supply chains are complex networks of vendors, partners, manufacturing and storage sites, machinery, logistics, and more. With Neo4j's help, AstraZeneca US has modeled hierarchical structures within the supply chain — such as those between facilities, work centers within those facilities, and machines within work centers — and unified seven SAP deployments. This has enabled AstraZeneca to drive supply chain excellence through digitization, better react to rapidly changing customer preferences, and — ultimately — push down the cost of healthcare.

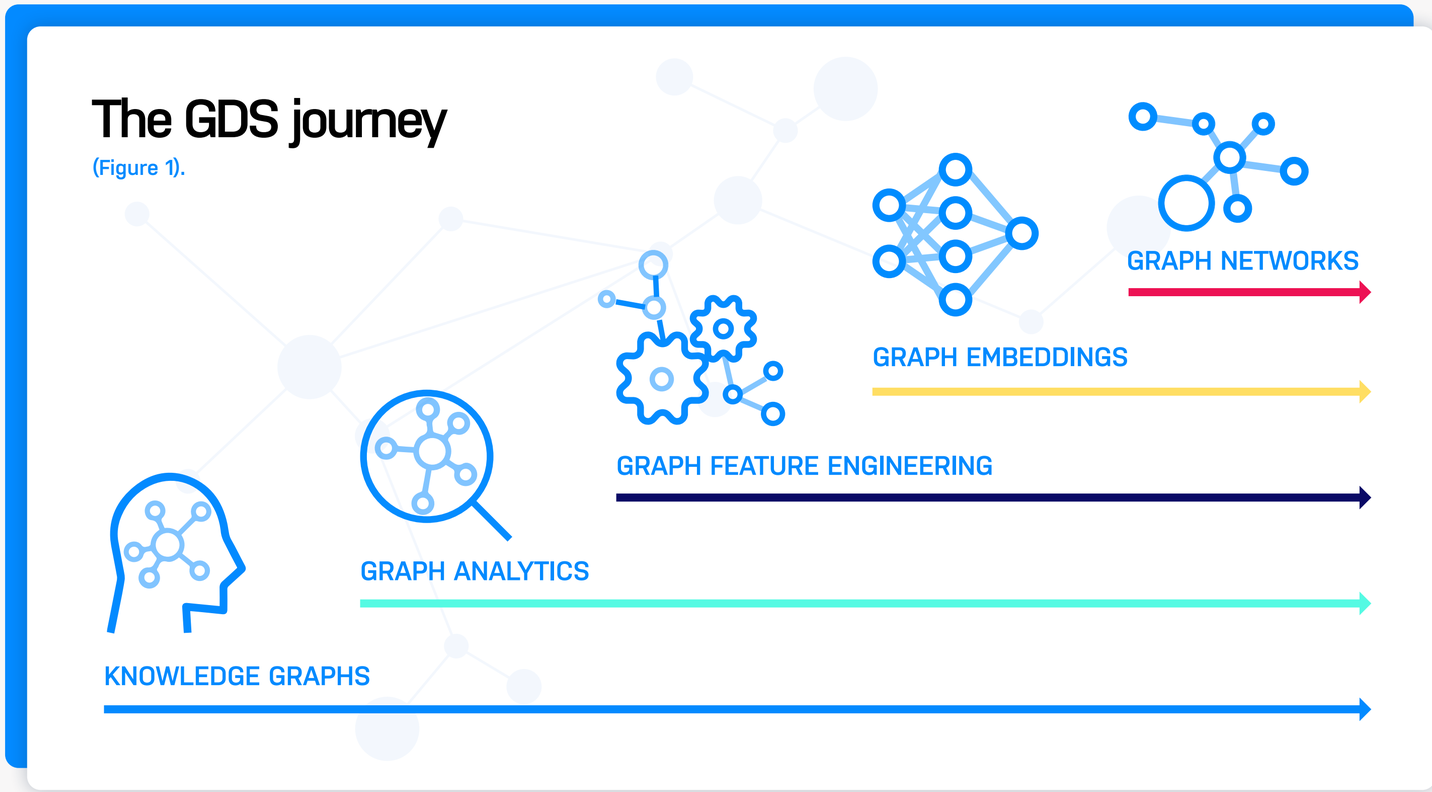
Graph databases: the future of AI at AstraZeneca

Neo4j's graph structure is uniquely suited to evolving machine learning at AstraZeneca. Today's knowledge graph applications, although powerful, are only the first step on the graph data science (GDS) journey towards faster and cheaper drug discovery, and more accurate strategic decision making (see Figure 1).

Graph analytics-enabled algorithms will have particular applications for drug repurposing, such as heuristic link prediction models that consider the proximity of nodes to estimate the likelihood of a new relationship forming, or that undocumented connections exist.

Relationships are extremely predictive of behavior and they inherently exist inside current data. That means graph feature engineering will enable AstraZeneca to improve predictions, and increase machine learning model accuracy, with the data it already has.

Finally, at the bleeding edge of graph technology research, graph neural networks and graph native machine learning promise to free data scientists.



AstraZeneca already has a live Neo4j graph database deployment. Want to learn more about how this graph technology can help you get deeper insights from your existing data, faster and more cost-effectively?

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