# Can Neuro-Symbolic AI Solve AI's Weaknesses?

Dr. Jans Aasman was interviewed about Neuro-symbolic AI by TDWI.


Dr. Jans Aasman, CEO, Franz Inc.

Neuro-symbolic AI integrates several technologies to let enterprises efficiently solve complex problems and queries demanding reasoning skills despite having limited data. Dr. Jans Aasman, CEO of Franz, Inc., explains the benefits, downsides, and use cases of neuro-symbolic AI as well as how to know it's time to consider the technology for your enterprise.

**Upside: What is Neuro-symbolic AI?**

**Dr. Jans Aasman:** Neuro-symbolic AI is an advanced approach that integrates machine learning, neural network decision-making, symbolic logic and reasoning, and the capabilities of large language models. This combination enables the ability to efficiently solve complex problems and queries demanding reasoning skills while facilitating effective learning with limited data.

By combining these approaches, the AI facilitates secondary reasoning, allowing for more nuanced inferences. This secondary reasoning not only leads to superior decision-making but also generates decisions that are understandable and explainable to humans, marking a substantial advancement in the field of artificial intelligence.

**In what ways does neuro-symbolic AI extend or build upon existing AI methodologies?**

Neuro-symbolic AI is designed to capitalize on the strengths of each approach to overcome their respective weaknesses, leading to AI systems that can both reason with human-like logic and adapt to new situations through learning. The tangible objective is to enhance trust in AI systems by improving reasoning, classification, prediction, and contextual understanding.

**What benefits does neuro-symbolic AI offer?**

The features of Neuro-symbolic AI address the limitations of purely neural network-based or purely symbolic AI systems. Here are the main ones that come to mind:

- Enhanced reasoning and generalization. Neuro-symbolic AI can reason over knowledge represented symbolically, allowing it to generalize from fewer examples than neural networks, which often require large data sets to learn.
- Improved interpretability. Symbolic components allow the AI to explain its decisions and reasoning processes in a human-understandable way, addressing the "black box" issue commonly associated with deep learning models.
- Flexibility in data requirements. This approach can work with both big and small data. Symbolic AI can handle tasks with limited data through predefined rules and logic; neural networks can process and learn from large data sets.
- Error handling. Symbolic systems can be more resistant to errors because they follow explicit rules. Combining this with neural networks can create systems that are both adaptable and precise.
- Learning efficiency. Neuro-symbolic systems can potentially learn more efficiently, combining the rapid pattern recognition of neural networks with the structured knowledge representation of symbolic AI.
- Domain knowledge integration. The ability to integrate expert domain knowledge in a structured form, such as

ontologies and knowledge graphs, allows these systems to make informed decisions in specific areas.

- Combination of learning and reasoning. These systems can both learn from data (just like neural networks) and reason about data (like symbolic systems do), making them versatile for a wide range of applications.

Read the full article at TDWI's Upside.

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# 100 Companies That Matter in KM — Franz Inc.

Franz Inc. is proud to announce it has been named to KMWorld's "100 Companies That Matter in Knowledge Management".

According to KMWorld, Emerging technologies such as GenAI, coupled with enhancements to the time-tested technologies of machine learning, semantic search, natural language processing, cloud computing, knowledge graphs, and chatbots, have resulted in enormous strides in knowledge management and knowledge sharing. Companies on the list are wonderful examples of how these technologies help organizations unlock the power of knowledge in innovative and creative ways.

Read our View from the Top.

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# Exploring AllegroGraph v8 — Unleashing the Power of Neuro-Symbolic AI (Recorded Webinar)

This webinar was held February 7, 2024. This presentation explores the groundbreaking features of AllegroGraph 8.0, the latest revolution in Enterprise **Knowledge Graphs** and **Neuro-Symbolic AI**. This session was tailored for professionals keen to leverage the forefront of advanced AI technologies in their organizations.

Key Webinar Highlights:

**Introduction to AllegroGraph 8.0**: Discover the potential of this advanced multi-modal Graph, Vector, and Document database. We'll demonstrate how it's transforming the landscape of data management and AI application development.

**Revolutionizing AI with AllegroGraph:** Delve into the integration of LLMs, Classical Machine Learning, Symbolic AI, Rules, and Logic within AllegroGraph. Discover how this synergy anchors AI outputs in verifiable facts, significantly enhancing the accuracy and reliability of AI-generated content. This is a vital step forward in ensuring trust and interpretability in AI systems.

Hundreds of AI and Knowledge Graph enthusiats joined us to gain invaluable insights and be part of the conversation shaping the future of AI in enterprise environments.

Link to the Presentation Slides.

# What is Neuro-Symbolic AI?

Neuro-Symbolic AI is a burgeoning field that marries two distinct realms of artificial intelligence: neural networks, which form the core of deep learning, and symbolic AI, which encompasses logic-based and knowledge-based systems. This synergy is designed to capitalize on the strengths of each approach to overcome their respective weaknesses, leading to AI systems that can both reason with human-like logic and adapt to new situations through learning.

Neuro-Symbolic AI aims to create models that can understand and manipulate symbols, which represent entities, relationships, and abstractions, much like the human mind. These models are adept at tasks that require deep understanding and reasoning, such as natural language processing, complex decision-making, and problemsolving.
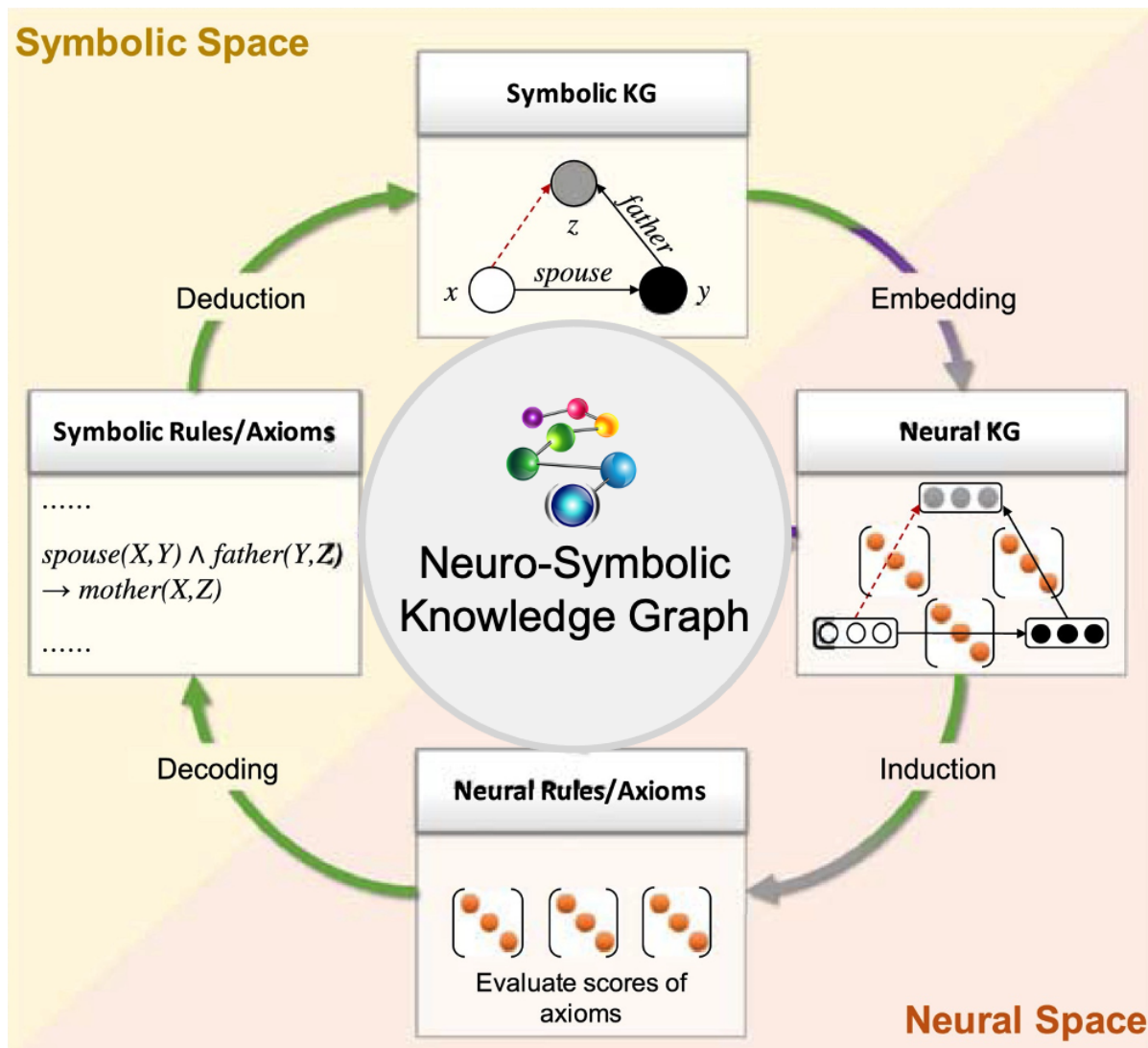
The neural component of Neuro-Symbolic AI focuses on perception and intuition, using data-driven approaches to learn from vast amounts of unstructured data. Neural networks are exceptional at tasks like image and speech recognition, where they can identify patterns and nuances that are not explicitly coded. On the other hand, the symbolic component is concerned with structured knowledge, logic, and rules. It leverages databases of knowledge (Knowledge Graphs) and rule-based systems to perform reasoning and generate explanations for its decisions.

The interplay between these two components is where Neuro-Symbolic AI shines. It can, for example, use neural networks to interpret a complex image and then apply symbolic reasoning to answer questions about the image's content or to infer the relationships between objects within it.

Integrating Knowledge Graphs into Neuro-Symbolic AI is one of its most significant applications. Knowledge Graphs represent relationships in data, making them an ideal structure for symbolic reasoning. They can store facts about the world, which AI systems can then reason about. This is where platforms like AllegroGraph come into play.

AllegroGraph is a horizontally distributed Knowledge Graph Platform that supports multi-modal Graph (RDF), Vector, and Document (JSON, JSON-LD) storage. It is equipped with capabilities such as SPARQL, Geospatial, Temporal, Social Networking, Text Analytics, and Large Language Model (LLM) functionalities. These features enable scalable Knowledge Graphs, which are essential for building Neuro-Symbolic AI applications that require complex data analysis and integration.

In the context of Neuro-Symbolic AI, AllegroGraph's W3C standards based graph capabilities allow it to define relationships between entities in a way that can be logically reasoned about. The geospatial and temporal features enable the AI to understand and reason about the physical world and the passage of time, which are critical for real-world applications. The inclusion of LLMs allows for the processing and understanding of natural language, turning unstructured text into structured knowledge that can be added to the graph and reasoned about.

The combination of AllegroGraph's capabilities with Neuro-Symbolic AI has the potential to transform numerous industries. In healthcare, it can integrate and interpret vast datasets, from patient records to medical research, to support diagnosis and treatment decisions. In finance, it can analyze transactions within the context of evolving regulations to detect fraud and ensure compliance.

Neuro-Symbolic AI represents a significant step forward in the quest to build AI systems that can think and learn like

humans. By integrating neural learning's adaptability with symbolic AI's structured reasoning, we are moving towards AI that can understand the world and explain its understanding in a way that humans can comprehend and trust. Platforms like AllegroGraph play a pivotal role in this evolution, providing the tools needed to build the complex knowledge graphs at the heart of Neuro-Symbolic AI systems. As the field continues to grow, we can expect to see increasingly sophisticated AI applications that leverage the power of both neural networks and symbolic reasoning to tackle the world's most complex problems.

Neuro-Symbolic AI was included in Gartner's 2023 AI Hype Cycle.
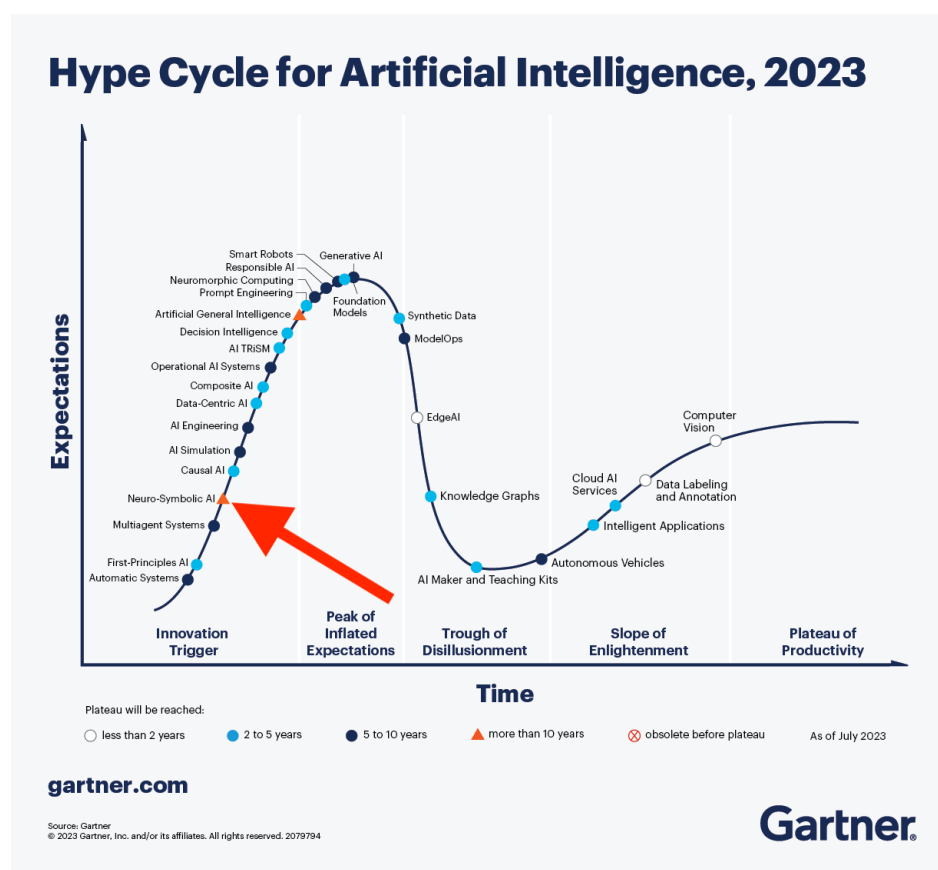


Learn more about Neuro-symbolic AI and AllegroGraph.

# Allegro CL v11 — Now Available! — The Neuro-Symbolic AI Programming Platform

We are excited to announce the release of Allegro CL v11, a significant update to Franz Inc.'s renowned Common Lisp development environment. This latest version is specifically designed to cater to the growing demands of AI technologies and complex problem-solving applications.

Key Features of Allegro CL v11:

**Integration with Large Language Models (LLMs):** This new feature enables developers to harness the power of advanced language models, opening new frontiers in AI development.

**Enhanced Knowledge Graph Capabilities:** Through AllegroGraph, Allegro CL v11 offers superior Knowledge Graph and VectorStore functionalities, crucial for managing complex data relationships in AI applications.

**Support for AWS Graviton Processor:** This enhancement ensures Allegro CL v11 runs efficiently on the latest cloud infrastructure, offering increased performance and scalability.

**New Lock-Free Hash-Table Implementation:** This improvement

boosts the performance of data structures, ensuring faster and more efficient data processing.

**Native Support for Apple Silicon:** Allegro CL v11 is now fully compatible with the latest Apple hardware, providing a seamless experience for users on all platforms.



Allegro CL has always been at the forefront of AI development, and version 11 continues this legacy. Its focus on Neuro-Symbolic AI and the introduction of these new features make it an indispensable tool for AI professionals.

We invite you to explore these new capabilities and see how they can enhance your AI projects. Download our free version today.

Learn more in the Release Notes.

**"Franz has further advanced its industrial-strength Common Lisp platform with the release of Allegro CL 11. Impressive ARM support on both Mac and Linux means switching architectures is painless. Internally, hashtables and sorting are measurably improved. ACL 11 is a great platform for development professionals," said Jason Cornez, CTO of RavenPack.**

# The New Stack Features AllegroGraph v8

Franz has updated its flagship AllegroGraph triplestore graph database to include vector generation and vector storage capabilities. The amalgamation allows organizations to avail themselves of all forms of AI: statistical machine learning, non-statistical reasoning and large language models (LLMs) trained on the entirety of the internet.

With all of these approaches available within a knowledge graph framework, organizations can readily implement retrieval augmented generation (RAG) to heighten the accuracy of the results of language models. More importantly, they can employ these three branches of AI to counterbalance one another so that the strength of one method nullifies the drawbacks of another.
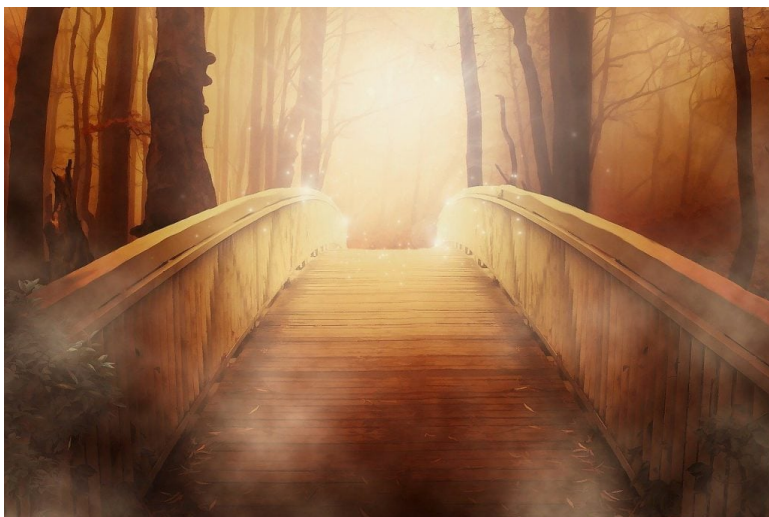


The result is a natural language querying system in which the grand vision of AI, statistical and non-statistical, is finally realized.

According to Franz CEO Jans Aasman, "The point of a neuro-symbolic system is you can do amazing things when you combine these systems, and get better results than you could with any of these systems alone."

Thus, organizations can combine the explainability of logic and rules techniques with the vast information LLMs have learned, while adding the probabilistic pattern recognition of advanced machine learning to ensure accurate AI across any domain — or use case.

Read the full article — https://thenewstack.io/allegrograph-8-0-incorporates-neuro-symbolic-ai-a-pathway-to-agi/

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# Knowledge Graph Technology Showcase Honest Review: AllegroGraph

Ashleigh Faith invited Jans Aasman to discuss the recent release of AllegroGraph v8. Ashleigh has built a technology showcase focusing on knowledge graph, taxonomy, machine learning, and other data science topics, and making them fun and relatable.

Ashleigh notes, "**AllegroGraph is a python-users dream for working with graph data for analytics and ML, and ontologists will have a blast exploring their hard work through the Gruff analytics and query layer that sits on top of the multimodal database (OWL, document and vector store, LLMs, and KGs) under the hood.**"

Get started with AllegroGraph's Free Cloud version.

# New – AllegroGraph v8 – Neuro-Symbolic AI Platform

Today we announced AllegroGraph 8.0, a groundbreaking Neuro-Symbolic AI Platform that incorporates Large Language Model (LLM) components directly into SPARQL along with vector generation and vector storage for a comprehensive AI Knowledge Graph solution. AllegroGraph 8.0 redefines how Knowledge Graphs are created and expands the boundaries of what AI can achieve within the most secure triplestore database on the market.

> "While general-purpose LLMs excel at straightforward tasks that do not necessitate background or changing knowledge, addressing more complex, knowledge-intensive queries demands the capabilities provided with a Knowledge Graph to avoid generating 'hallucinations,'" said Dr. Jans Aasman, CEO of Franz Inc. "We designed AllegroGraph 8.0 with Retrieval Augmented Generation (RAG) capabilities to provide users with seamless Generative AI capabilities within a Knowledge Graph platform, while dynamically fact-checking LLM outputs to ensure that they are grounded in fact-based knowledge."

Leading analyst firms recognize the compelling synergy between Knowledge Graphs and LLMs. "Data and analytics leaders must leverage the power of large language models (LLMs) with the robustness of knowledge graphs for fault-tolerant AI applications," advises Gartner in a June 9, 2023 report titled: *AI Design Patterns for Knowledge Graphs and Generative AI*.

"Knowledge graphs provide the perfect complement to LLM-based

solutions where high thresholds of accuracy and correctness need to be attained," said Radu Miclaus, Senior Director, Gartner. (*Source: Gartner Report, AI Design Patterns for Knowledge Graphs and Generative AI, June 9, 2023*)

As the first Neuro-Symbolic AI Platform, AllegroGraph 8.0 combines Machine Learning (statistical AI) with knowledge and reasoning (symbolic AI) capabilities. This powerful combination enables AllegroGraph to solve complex problems that require reasoning and learn efficiently with less data, thereby expanding applicability across a broad array of tasks. The blending of machine learning and reasoning in AllegroGraph 8.0 also produces decisions that are understandable to humans and explainable, an important step in the progression of AI.

The advancements in AllegroGraph 8.0 encompass the following transformative capabilities and enhancements.

**Retrieval Augmented Generation (RAG) for LLMs —** AllegroGraph 8.0 guides Generative AI content through RAG, feeding LLMs with the 'source of truth.' This innovative approach helps avoid 'hallucinations' by grounding the output in fact-based knowledge. As a result, organizations can confidently apply these insights to critical decision-making processes, secure in the knowledge that the information is both reliable and trustworthy.

**Natural Language Queries and Reasoning —** The new LLMagic functions within AllegroGraph 8.0 serve as the bridge between human language and machine understanding, offering a dynamic natural language interface for both querying and reasoning processes. Users can now engage with AllegroGraph 8.0 in a manner that closely mirrors human conversation, making AI capabilities accessible to a broader set of users and increasing productivity for current users.

**Enterprise Document Deep-insight** — New VectorStore capabilities within AllegroGraph 8.0 offer a seamless bridge

between enterprise documents and Knowledge Graphs. This unique feature empowers users to access a wealth of knowledge hidden within documents, allowing users to query content that was previously considered 'dark data.' Users gain a comprehensive view of enterprise data, contributing to the business's deeper insights from its proprietary data. One unique feature of AllegroGraph's vector store implementation is that it lives under the same security framework that we apply to the graphs. AllegroGraph's 'triple-attributes' mechanism puts security 'in' the data elements itself. AllegroGraph offers the ability to annotate individual triples or text fragments and thus provides the most granular access method of any Graph-Vector platform.

**AI Symbolic Rule Generation** – AllegroGraph offers built-in rule-based system capabilities tailored for symbolic reasoning. This unique feature distills complex data into actionable, interpretable rules. AI symbolic rule generation enables predictions or classifications based on data and provides transparent explanations for their decisions by expressing them in symbolic rules, enhancing trust and interpretability in AI systems.

**Streamlined Ontology and Taxonomy Creation** – LLMagic can streamline the complex and often labor-intensive task of crafting ontologies and taxonomies for any topic. By analyzing diverse data, and identifying patterns, relationships, and semantic connections that underpin the subject matter, LLMagic can quickly generate structured hierarchies and classifications that form the foundation of ontologies and taxonomies. Users can more quickly create ontologies and taxonomies with a reduced need for manual intervention, accelerating the knowledge organization process and enhancing the quality and comprehensiveness of the created structures.

**Knowledge Graph-as-a-Service** – A new hosted, free version grants users access to the power of AllegroGraph 8.0 with LLMagic via a convenient web login –

https://allegrograph.cloud

**New Web Interface** — AllegroGraph 8.0 includes a striking redesign of its web interface — AGWebView. This fresh look and feel provides users an enhanced and intuitive way to interact with the platform, while co-existing in parallel with the Classic View.

**Enhanced Scalability and Performance** — AllegroGraph 8.0 includes enhanced FedShard™ capabilities making the management of sharding more straightforward and user-friendly while reducing query response time and improving overall system performance.

**Advanced Knowledge Graph Visualization** — A new version of Franz's industry-leading graph visualization software, Gruff v9, is integrated into AllegroGraph 8.0. Gruff v9 is the only graph visualization tool that illustrates RDF-Star (RDF*) annotations, enabling users to add descriptions to edges in a graph — such as scores, weights, temporal aspects and provenance.

**AllegroGraph 8.0 Availability**

AllegroGraph 8.0 is immediately available directly from Franz Inc. For more information, visit AllegroGraph.com for cloud and download options.

**AI and Knowledge Graph Leadership**

Franz secured numerous prestigious awards in 2023, solidifying the company's position as a leader in the field of intelligent knowledge management and data. Bloor Research positioned AllegroGraph as a Champion in their 2023 GraphDB Market Report. AllegroGraph won the sought-after 2023 KM World Readers' Choice Award for Best Knowledge Graphs, and Database Trends and Applications placed Franz on its prestigious list of 100 Companies That Matter Most in Data.

**Upcoming Conference Presentations**

The Knowledge Graph Keynote will be delivered by Jans Aasman, CEO, Franz Inc. at the Data (+AI) Day on January 27, 2024. Presentation Title – **"Beyond Human Oversight: The Rise of Self-Building Knowledge Graphs in AI"** – https://datadaytexas.com/2024/sessions#aasman

Dr. Aasman will be presenting "□□**Using Knowledge Graphs and LLMs for Deep Entity Exploration**" on March 27, 2024 at Enterprise Data World 2024 – https://edw2024.dataversity.net/index.cfm

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# AllegroGraph – Trend-Setting Product for 2024

Franz Inc., is proud to announce it has been named a 2024 Trend Setting Product by Database Trends and Applications.

According to Database Trends and Applications, Data continues to grow and is poised to double in 2024. According to Forrester, unstructured data—such as social posts and customer feedback—represent less than a third of managed data today.

With AI itching to unlock a wealth of text insights, these untapped reserves hold huge potential. Language models can surface game-changing trends from unstructured sources, and companies investing now in unstructured pipelines will gain a competitive edge.

This past year focused heavily on the explosive popularity of AI and generative AI (GenAI) along with its evolving applications, including ChatGPT and large language models (LLMs). As the move toward a future state of AI progresses, executive teams will usher in C-level positions focused on overseeing how data is managed in relation to the organization's AI strategies, according to this same Forrester report.

To help make the process of identifying useful products and services easier, each year, DBTA presents a list of Trend-Setting Products. These products, platforms, and services range from long-established offerings that are evolving to meet the needs of their loyal constituents to breakthrough technologies that may only be in the early stages of adoption. However, the common element for all is that they represent a commitment to innovation and seek to provide organizations with tools to address changing market requirements.

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# Data + AI Day 2024

Join us at Data +AI Day in Austin, Texas

**Knowledge Graph Keynote**
**Beyond Human Oversight: The Rise of Self-Building Knowledge Graphs in AI**

The rapid success in extracting 'de-hallucinated' graphs from Large Language Models (LLMs) marks a big step forward in AI. Knowledge Graphs, now the industry standard for knowledge-intensive applications in enterprises, are at the forefront of this progress. The future of these Knowledge Graphs lies in their evolution into self-replicating systems, significantly reducing the need for programming and human oversight. This

shift towards automated and self-sufficient Knowledge Graphs will ensure a reliable and constantly updated "Source of Truth" in various applications.

In this presentation, Jans Aasman will discuss the four essential capabilities a Knowledge Graph must possess to achieve autonomous knowledge generation and curation:
A set of primitives in the query processor allowing for the direct extraction of knowledge and graphs from an LLM without requiring programming skills.

An embedded vector store in the Knowledge Graph. This feature enables natural language queries to interact with your private structured and unstructured data, leading to efficient Retrieval Augmented Information.
A methodology adapted from symbolic AI that allows users to use natural language to generate queries in structured query languages like SQL, SPARQL, or Prolog, even when the underlying schemas are highly complex.
Rule-based logic for a true NeuroSymbolic computing platform. The rule-based system can directly invoke LLM functions, rather than being purely symbolic. The goal is for LLM functions to have the capability to write and execute their own rules, significantly enhancing the system's intelligence and functionality.

Jans will provide a demo of enterprise case studies that illustrate the essential role these capabilities play in the development of self-sustaining knowledge systems.