



Neuro-Symbolic Governance

The New Paradigm for Managing and Controlling AI Evolution in Enterprise

Fusion AI Lab, 21 October 2025



The State of AI today



A staggering **95 % of corporate generative AI pilot projects fail** to generate measurable business value, with only 5 % achieving rapid revenue growth.”

Companies **outsourcing AI through specialized vendors** see significantly better results - up to twice the success rate - compared to those attempting to build AI systems in-house.

The GenAI Divide: State of AI in Business 2025

August, 2025 | MIT

https://nanda.media.mit.edu/ai_report_2025.pdf

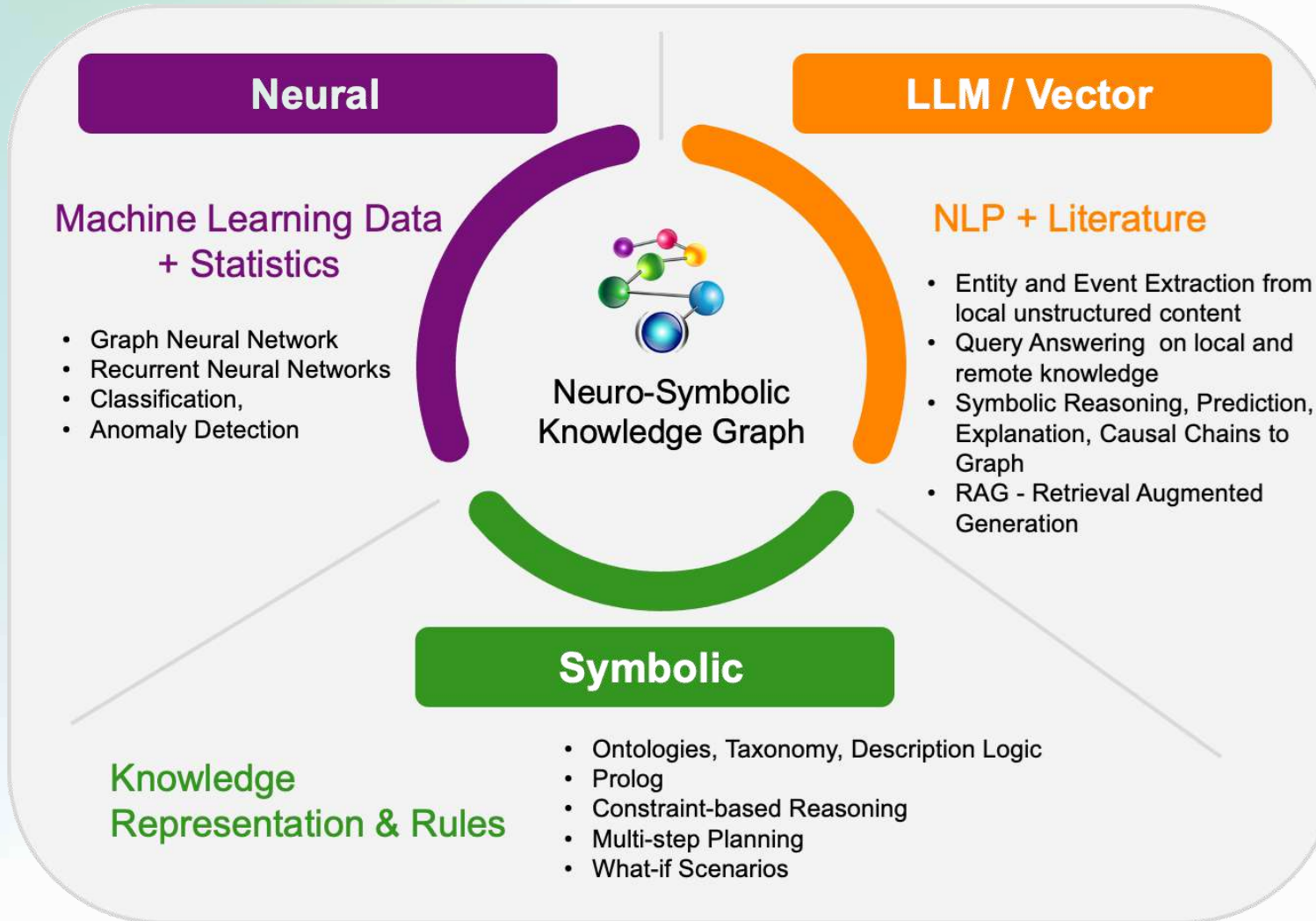
The pace of innovation

Governance has never been so important

Technology	Birth Year (Commercial)	Years to Reach 50% Adoption	Average Update Cycle (Years)	Innovation Speed Index (0–100)	Qualitative Notes
Personal Computer	1981	16	4	30	Continuous but cyclical innovation; major leaps every decade
Internet	1995	10	8	25	Huge initial disruption but base infrastructure remains stable
Mobile Telephony	1990	12	3	45	Frequent standard updates (2G→5G) drive steady innovation
Smartphone	2007	6	1.5	60	Rapid yearly iterations and global adoption
Cloud Computing	2006	8	2	55	Fast evolution from IaaS to PaaS/SaaS layers
Social Media	2004	5	1	70	Continuous feature updates and new platforms every few years
Internet of Things (IoT)	2010	12	3	40	Slow adoption but steady hardware and protocol evolution
Blockchain / Crypto	2009	9	1	65	Fast-paced innovation but still unstable ecosystems
Traditional AI (ML)	2012	10	2	50	Gradual progress leading to the Generative AI era
Generative AI (LLM)	2022	2	0.5	95	Unprecedented speed of innovation (GPT → Claude → Gemini → Sora)

The Neuro-Symbolic Approach

Bringing Logic and Learning Together



Neural AI – *the learning brain.*

It learns from massive amounts of data — spotting patterns, classifying information, and predicting outcomes. It's powerful and adaptive, but it doesn't really understand what the data means — it just learns correlations.

Symbolic AI – *the reasoning brain.*

It works with concepts, relationships, and rules — the way humans' reason. It can explain its decisions, plan steps, and run “what-if” scenarios, but it lacks the creativity and adaptability of neural models.

LLM / Vector AI – *the language brain.*

Large Language Models can read and generate text, connecting human language to knowledge. They're extraordinary at retrieving and summarizing information but have limited control over logic and consistency.

AI Governance Across Six Dimensions

From Power to Control

Projects

AI projects evolve faster than any past technology. Project governance ensures **coherence and continuity** across all initiatives, allowing organizations to innovate quickly **without losing control or consistency**.

Explainability

Most RAG systems can only show *where* information comes from, not *why* it was chosen. Embeddings and chunks tell you which text was used, not the logic behind the answer. **Explainability governance** ensures that AI systems are transparent and auditable, revealing the reasoning that connects data to outcomes.

Processes

AI is not just about understanding documents but understanding **where each piece of information fits in the business flow**. Process governance ensures AI connects data to context, keeping automation aligned with how the organization works.

Cost

Generative AI introduces a new variable cost model which is difficult to estimate and can grow rapidly over time. Semantic AI, by contrast, has a higher initial setup cost but almost no running cost. **Cost governance** means deciding when to use one or the other to achieve efficiency.

Results

Generative AI is powerful but inherently uncertain — it will produce errors, and we can't always know when. This makes **result governance** essential to ensure reliability, consistency, and accountability.

Knowledge

Enterprise knowledge is complex, fragmented, and often domain-specific. LLMs alone struggle to understand it, especially when documents differ in structure and language. **Knowledge governance** means structuring this information into a predictable and reusable with domain-specific semantic model.



Project

A governance framework to manage the evolution of multiple AI initiatives.



Why it matters

AI projects evolve faster than any previous technology. Without a governance framework, each initiative becomes a disconnected experiment.

Project governance ensures coherence, continuity, and strategic control across multiple AI initiatives – allowing the organization to **evolve without chaos**.



Customer value

- **Sustainable innovation:** every new use case reuses validated components, avoiding duplication.
- **Agility with control:** models and architectures evolve rapidly without breaking integrations.
- **Strategic visibility:** leaders can monitor all AI initiatives and investments from a single governance layer.



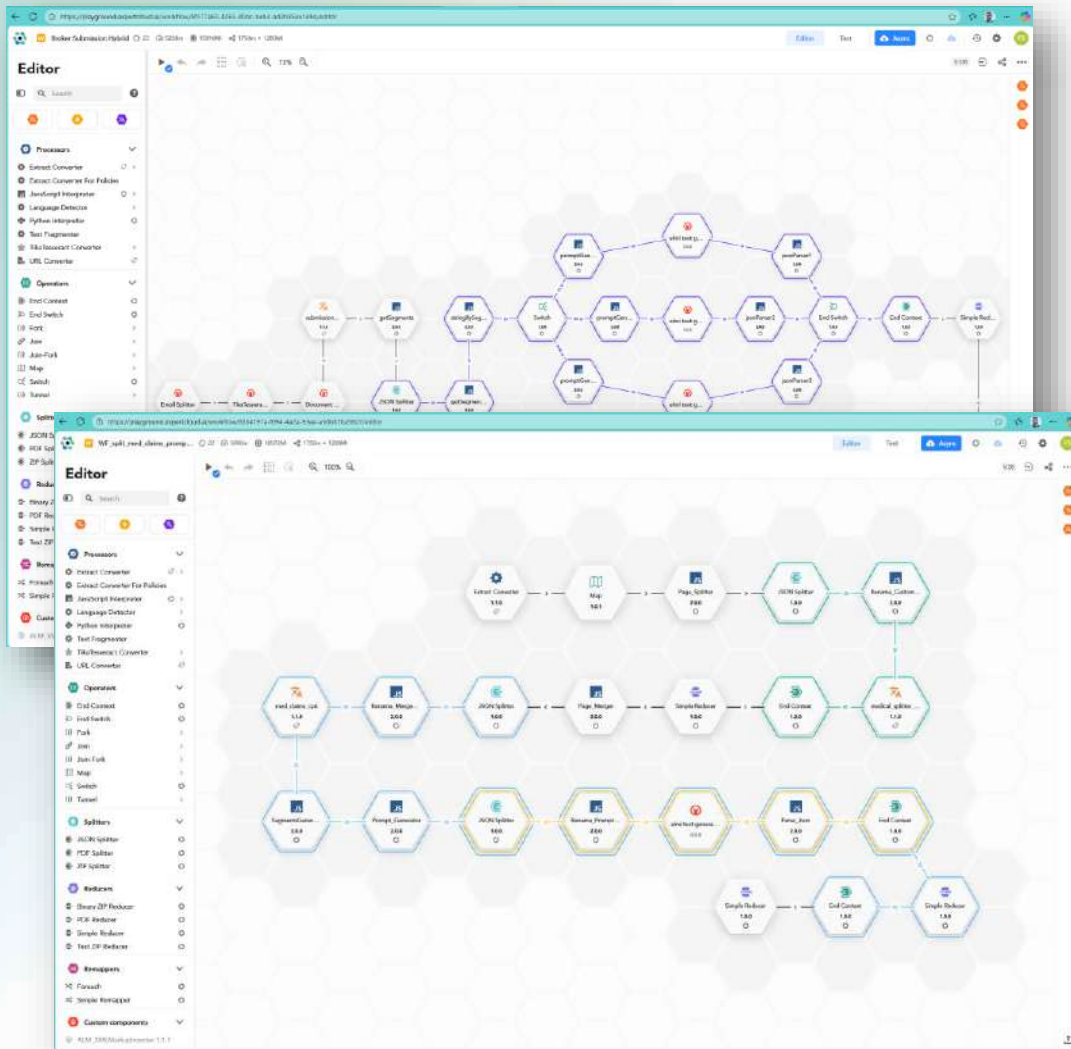
Neuro-Symbolic advantage

The neuro-symbolic approach merges the **adaptability of neural models** with the **logical precision of symbolic reasoning**.

This hybrid architecture allows enterprises to replace or improve models without losing meaning, structure, or traceability.

It transforms fragmented projects into a coherent, evolvable AI ecosystem that remains under full organizational control.

Project : One tools, multiple use cases



The screenshot shows the 'Editor' interface with a complex workflow diagram and a 'Component keys' table. The workflow diagram is similar to the one in the previous screenshot, but with different node labels and connections. The 'Component keys' table is displayed on the right side of the interface.

Category	Label	Category ID	Score	Freq.	Hits
co-line (incluso il furto)	02.09.02	1800	30.45	7	
OPERATIONS (escluso il furto)	02.09.04	1380	23.35	11	
Altre - Gestione Oper.	01.04.03.01	510	9.53	4	
Conti correnti	01.01.02.02	500	8.46	3	
Sito Internet (gestione)	01.04.02.02	400	6.76	2	

The 'Content viewer' on the right shows a document titled 'BIBBEGGIN LASTMAIL' with a body of text in Italian, including a date '26 luglio 2024' and a reference to a 'discriminazione'.

Processes

From understanding documents to understanding business context..

Why it matters

Most AI initiatives focus on reading and interpreting documents – extracting or classifying content. But in real life, **documents and data arrive at different times** and belong to specific steps of a workflow.

Process governance ensures AI understands *where* each piece of information fits, *how* it connects to other elements, and *when* it should be used.

It transforms AI from a passive “reader” into an active component of the business process.

Customer value

- **Operational consistency:** every AI system aligns with real workflows and business rules.
- **Process visibility:** organizations can monitor how data flows through different steps and decisions.
- **Automation reliability:** AI decisions are coherent with process timing and context, not just data content.
- **Faster scaling:** once the process logic is modeled, new use cases can be deployed with minimal redesign.

Neuro-Symbolic advantage

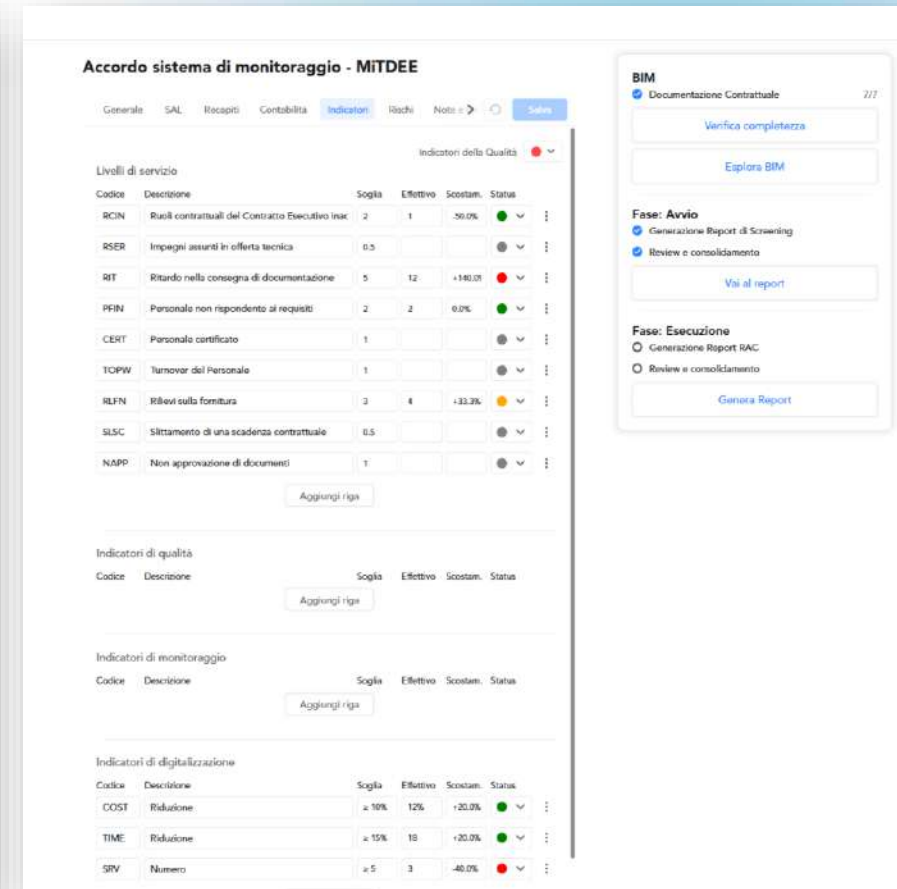
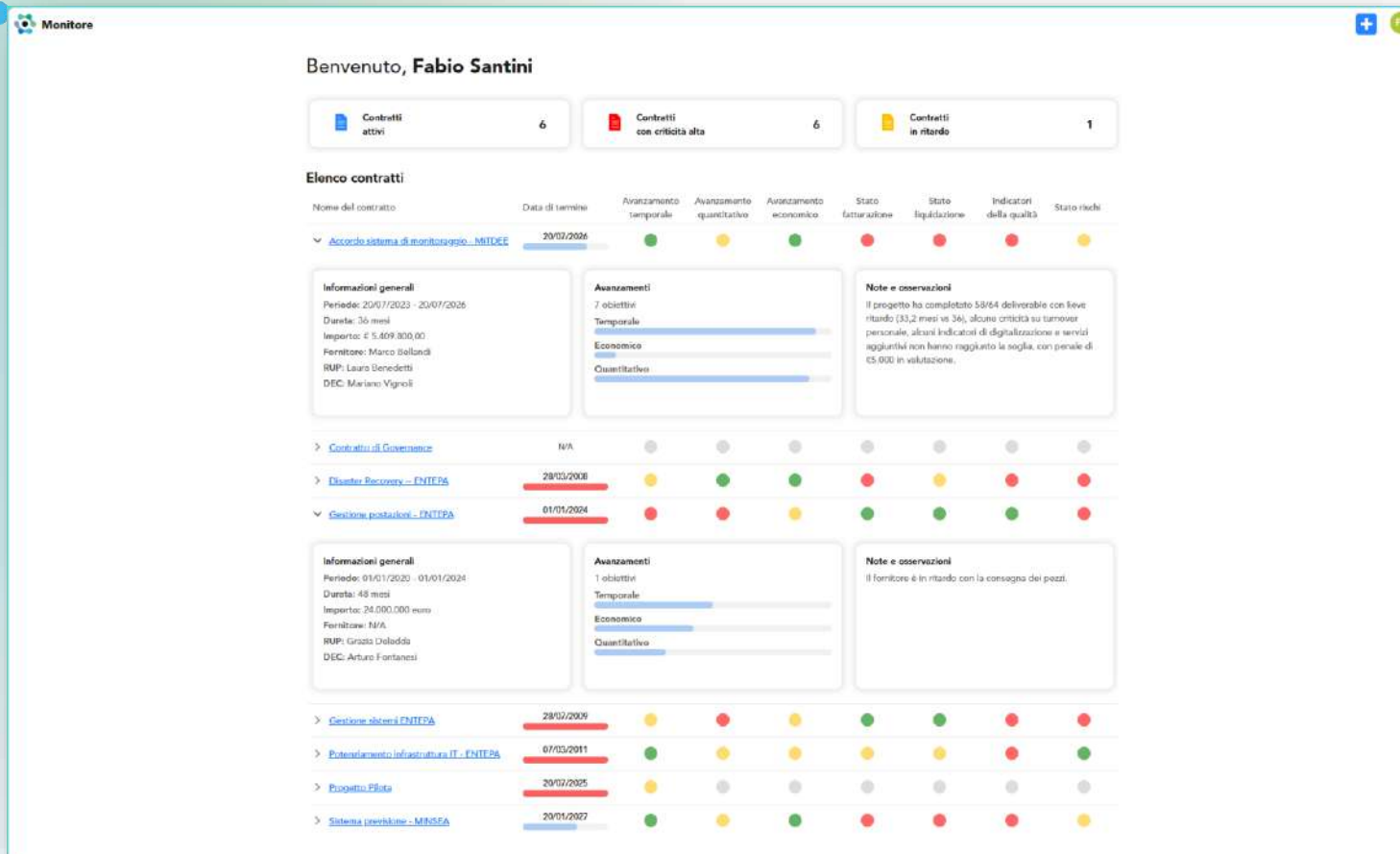
Generative AI can understand language, but it doesn't know the *logic* of the business process.

By combining **Generative AI** with **Symbolic reasoning**, we can connect data to process semantics – identifying dependencies, priorities, and roles.

The **neural side** interprets the unstructured content; **the symbolic side** manages how this information fits in the workflow.

This ensures decisions are **context-aware, traceable, and explainable** – a foundation for reliable enterprise automation.

Processes : multiple documents, one process





Results

From generating answers to guaranteeing reliability.



Why it matters

Generative AI is powerful but inherently unpredictable. It doesn't reason – it estimates probabilities.

This means errors are not occasional; they are **inevitable**.

And the biggest risk is **unpredictability**: the system can perform flawlessly for days, then suddenly produce a wrong or biased result.

Result governance ensures that every AI output is verified, measured, and understood before it impacts a business decision.



Customer value

- **Trust and reliability:** outcomes can be validated and traced to their sources.
- **Risk reduction:** minimize hallucinations and unpredictable behaviors.
- **Performance transparency:** leaders can measure model accuracy and evolution over time.
- **Compliance readiness:** results can be audited and justified to regulators or stakeholders.



Neuro-Symbolic advantage

The **neural side** provides adaptability and scale – it can analyze vast amounts of data and generate meaningful responses.

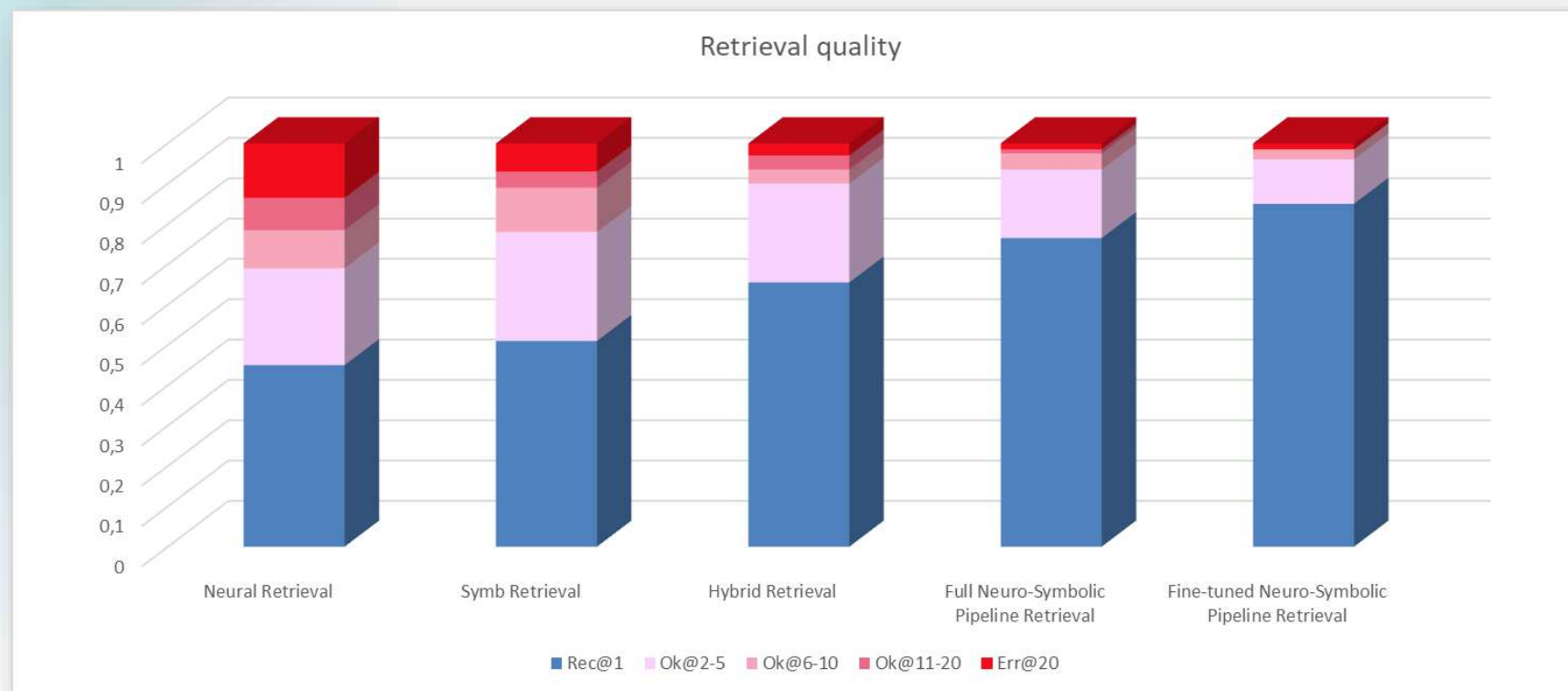
The **symbolic side** adds reasoning and control – validating the logic behind every output.

Together, they create **explainable and trustworthy AI systems** that deliver consistent results.

This hybrid governance transforms AI from a *probabilistic generator* into a *predictable decision engine*.

Results : Confronting AI approaches

MODEL	MRR	Rec@1	Rec@5	Rec@10	Rec@20	Err@1	Ok@2-5	Ok@6-10	Ok@11-20	Err@20
Neural Retrieval	0,57	45,0%	69,0%	78,5%	86,5%	55,0%	24,0%	9,5%	8,0%	13,5%
Symb Retrieval	0,62	51,0%	78,0%	89,0%	93,0%	49,0%	27,0%	11,0%	4,0%	7,0%
Hybrid Retrieval	0,76	65,5%	90,0%	93,5%	97,0%	34,5%	24,5%	3,5%	3,5%	3,0%
Full Neuro-Symbolic Pipeline Retrieval	0,84	76,5%	93,5%	97,5%	98,5%	23,5%	17,0%	4,0%	1,0%	1,5%
Fine-tuned Neuro-Symbolic Pipeline Retrieval	0,90	85,0%	96,0%	98,5%	98,5%	15,0%	11,0%	2,5%	0,0%	1,5%



- **Recall** : If the system retrieves 10 documents and 9 of them contain the right information, recall is 90%. It measures coverage – how much of the relevant knowledge the system was able to find.
- **Top-k Accuracy (Ok@)**: If the right document appears first, we say Ok@1. If it's second or third, Ok@2-5, and so on. It measures how quickly the user would see the right answer.



Explainability

From knowing the source to understanding the reasoning.



Why it matters

Most enterprise AI systems today, especially those using **RAG (Retrieval Augmented Generation)**, can tell you *where* an answer came from – which document or text chunk – but not *why* that answer was chosen.

This lack of reasoning transparency makes it difficult to trust or validate results, especially in regulated or high-impact environments.

Explainability governance ensures every AI decision can be traced, interpreted, and justified.



Customer value

- **Transparency:** users and auditors understand the path from question to answer.
- **Trust and accountability:** decisions are explainable and defensible.
- **Faster validation:** teams can quickly identify why results differ or fail.
- **Regulatory readiness:** explainable logic supports compliance and ethical standards.



Neuro-Symbolic advantage

Generative AI alone operates as a “black box,” where correlations drive outputs, but reasoning remains hidden.

By combining **Generative AI** with **Semantic AI**, the neuro-symbolic approach builds a **hybrid reasoning layer**.

This hybrid creates a system that can not only answer but also **explain its reasoning** – showing *why* certain information was chosen and *how* it connects to the context.

The result: AI that is not just powerful, but **transparent, predictable, and trustworthy**.

Explainability : why and where

Back

reclamo e contestazi... (234.0 KB)

Categories JSON Winner Search

Label	Category ID	Score	Freq.	Hits
on-line (incluso il furto...	02.09.02.	1800	30.45	7
HIERARCHY				
Motivi > Frodi e smarrimenti > on-line (incluso il furto d'identità)				
POSITIONS				
Start: 1217 End: 1227 Start: 1553 End: 1561 Start: 1712 End: 1722 Start: 1723 End: 1736 Start: 1834 End: 1841				
Start: 1962 End: 1970 Start: 2058 End: 2067				
operazioni eseguite s...	02.08.04.	1380	23.35	11
HIERARCHY				
Motivi > Esecuzione operazioni > operazioni eseguite senza previa autorizzazione				
POSITIONS				
Start: 310 End: 318 Start: 325 End: 338 Start: 1712 End: 1722 Start: 1723 End: 1736 Start: 1941 End: 1944				
Start: 1945 End: 1955 Start: 1962 End: 1970 Start: 2787 End: 2797 Start: 2797 End: 2810 Start: 3693 End: 3703				
Start: 3704 End: 3717				
Altro - Gestione Oper...	01.04.03.01.	510	8.63	4
HIERARCHY				
Prodotti > Organizzazione altro e Sito Internet > Altro > Altro - Gestione Operatività MTA				
POSITIONS				
Start: 1945 End: 1955 Start: 1962 End: 1970 Start: 1976 End: 1983 Start: 2672 End: 2680				
Conti correnti	01.01.02.02.	500	8.46	3
HIERARCHY				
Prodotti > c > c depositi e dossier titoli > Conti correnti > Conti correnti				
POSITIONS				
Start: 1712 End: 1722 Start: 1723 End: 1736 Start: 1826 End: 1833				
Sito internet (gestione...	01.04.02.02.	400	6.76	2
HIERARCHY				
Prodotti > Organizzazione altro e Sito Internet > Sito internet (gestione del sito) > Sito internet (gestione del sito) e remote banking - ORD				
POSITIONS				
Start: 1826 End: 1833 Start: 1834 End: 1841				

Status: 200

Editor Test Async

Content viewer

Search

##BEGIN LASTMAIL

Buonasera,

riscontro la Vostra comunicazione odierna, relativa al prelievo da me disconosciuto di Euro 502,40 effettuato da terzi a mia insaputa il 26 luglio 2024, per contestarla integralmente.

La Vostra conclusione è frutto di una valutazione superficiale ed errata dei fatti.

Preciso innanzitutto che ho SEMPRE curato la scrupolosa custodia di carta e PIN.

Quanto alla prima è stata SEMPRE a mie mani e da me custodita, tanto da averla regolarmente riconsegnata presso la mia filiale di riferimento.

Quanto al PIN non l'ho MAI comunicato o reso accessibile ad alcun terzo ed ho SEMPRE eseguito TUTTE le operazioni di pagamento e prelievo avendo l'accortezza di coprire la tastiera con l'altra mano durante la digitazione.

L'operazione di prelievo dell'importo di Euro 502,40, da me disconosciuta, è stata attuata senza il mio consenso né il mio intervento e senza che mi possa essere imputata alcuna mancanza nell'uso di carta e PIN.

E' evidente che si è trattato di un'operazione non autorizzata poiché è avvenuta alle 21,13 del 26 luglio 2024 in Gran Bretagna.

Un minuto dopo (21,14) io mi trovavo a Veremate con Minoprio (CO) ad effettuare il pieno di gasolio della mia vettura (Euro 52,67), come contabilizzato sul mio estratto conto.

Quindi, è impossibile sostenere che sia stato io ad effettuare il prelievo.

Aggiungo che il Vostro sistema di sicurezza tramite invio di messaggio sul mio cellulare non ha funzionato poiché nulla ho ricevuto in relazione all'operazione disconosciuta (né subito né successivamente) che ho, infatti, scoperto solo l'indomani, accedendo al mio conto on line tramite applicazione.

Per quanto precede, Vi invito a riconsiderare subito la Vostra posizione e a non effettuare alcun prelievo dell'importo a me correttamente riaccreditato.

IBAN: IT12A1234512345123456789999

carta pagamento nr. 5167952537773194

Attendo urgente riscontro.

Cordiali saluti

Cristian Pozzecco

INTERNAL & TRUSTED 3rd PARTIES

##END LASTMAIL

##END BODY#

###BEGIN ATTACHMENT-0# Esito_010252024000354205.pdf

Milano, 6 agosto 2024

OGGETTO: Pratica di disconoscimento n. 010252024000354999 Gentile Cliente POZZECCO

CRISTIAN, ci riferiamo alla pratica nr 010252024000354999 relativa al disconoscimento delle operazioni

eseguite tramite l'utilizzo dei seguenti rapporti: carta pagamento nr. 516795*****3194, IBAN:

Explainability : why and where

expert.ai Content QC - IB / Investigator-Brochure_SNEAI001_Demo_v... Study number: SNEAI001 Edition: No. 2.0

Study References

Back to reports

All highlights

Filter

CODE EXTRACTIONS

SNEAI-2025-001 2

SIMILARITIES

SNEAI001 was administered once intravenously to Sprague Dawley rats, four per group (2M, 2F) at 0.5, 1, 5, or 10 mg/kg with the purpose of assessing pharmacokinetic parameters (SNEAI-2025-001). Plasma...

Following single IV administration of ^{14}C -SNEAI001 at 1 mg/kg (110 $\mu\text{Ci/kg}$) to Sprague Dawley rats (2M, 2F), the excretion of radioactivity in urine and feces through seven days post dose was measured...

Investigator's Brochure Version 2.0 SNEAI001

4.2.2. Absorption and Pharmacokinetics

4.2.2.1. Single dose pharmacokinetic studies with SNEAI001

4.2.2.1.1. Rat

SNEAI001 was administered once intravenously to Sprague Dawley rats, four per group (2M, 2F) at 0.5, 1, 5, or 10 mg/kg with the purpose of assessing pharmacokinetic parameters (SNEAI-2025-001). Plasma samples were collected at 0.5 minutes, 30 minutes, 1 hour, 8 hours, 1, 3, 5, 15 and 20 days post dose. Plasma concentrations of SNEAI001 (ADC), SNEAIgG (anti-TROP antibody) and SNEAIload (payload) were determined.

Maximum plasma concentration (C_{max}) and area under-the-curve (AUC) increased proportionally with dose in all cases. At a SNEAI001 (ADC) dose of 8 mg/kg, C_{max} was 150 $\mu\text{g/mL}$ with a T_{max} of 30 minutes, while the AUC_{0-24} was 150 $\mu\text{g}\cdot\text{d/mL}$. Total body clearance and steady-state volume of distribution were 20 mL/kg and 150.6 mL/kg respectively, with a terminal half-life of 2.5 h.

4.2.2.1.2. Monkey

SNEAI001 was administered once intravenously to cynomolgus monkeys, four per group (2M, 2F) at 0.2, 0.5, 2, or 5 mg/kg with the purpose of assessing pharmacokinetic parameters (SNEAI-2025-002). Plasma samples were collected at 0.5 minutes, 30 minutes, 1 hour, 8 hours, 1, 3, 5, 15 and 20 days post dose. Plasma concentrations of SNEAI001 (ADC), SNEAIgG (anti-TROP antibody) and SNEAIload (payload) were determined.

Maximum plasma concentration (C_{max}) and area under-the-curve (AUC) increased proportionally with dose in all cases. At a SNEAI001 (ADC) dose of 2 mg/kg, C_{max} was 130 $\mu\text{g/mL}$ with a T_{max} of 39 minutes, while AUC_{0-24} was 130 $\mu\text{g}\cdot\text{d/mL}$. Total body clearance and steady-state volume of distribution were 17.1 mL/d/kg and 40.2 dL/kg, respectively, with a terminal half-life ($t_{1/2}$) of 1.96 d.

4.2.2.2. Repeat dose pharmacokinetic studies with SNEAI001

Not applicable.

SNEAI-2025-001.pdf

Single dose pharmacokinetic study of SNEAI001 in rats

Introduction

A GLP study was conducted to determine the single dose pharmacokinetics of SNEAI001 in the rat after intravenous administration.

Pharmacokinetics I

Sprague Dawley rats, 4 per group (2M, 2F), were administered a single intravenous dose of SNEAI001 at concentrations of 0.5, 1, 5, or 10 mg/kg. Plasma samples were obtained at 0.5 minutes, 30 minutes, 1 hour, 8 hours, 1, 3, 5, 15 and 20 days following dosage. The plasma concentrations of SNEAI001 (ADC), SNEAIgG (anti-TROP antibody) and SNEAIload (payload) were measured.

Parameters C_{max} and AUC increased dose-proportionally in all cases. At a dose of 8 mg/kg of SNEAI001, C_{max} was low at 150 $\mu\text{g/mL}$ with maximal concentration occurring at 30 minutes post dose, while AUC_{0-24} was 150 $\mu\text{g}\cdot\text{d/mL}$.

SNEAI001 displayed total body plasma clearance and steady state volume of distribution of 20 mL/kg and 150.6 mL/kg, respectively, having a terminal half-life ($t_{1/2}$) of 2.5 h.

Pharmacokinetics II

In order to evaluate excretion, four Sprague Dawley rats (2M, 2F) were administered intravenously ^{14}C -SNEAI001 at 1 mg/kg (110 $\mu\text{Ci/kg}$). Radioactivity excretion in urine and feces was measured for four days post dose by liquid scintillation counting (LSC).

It was determined that 96.9% of the administered ^{14}C -SNEAI001 radioactivity had been excreted from the body by two days (69.7% in feces and 27.2% in urine).

It is concluded that intravenously administered ^{14}C -SNEAI001 is predominantly excreted through the fecal route in Sprague Dawley rats.

Similar Blocks

SNEAI-2025-001.pdf

Pharmacokinetics I

Sprague Dawley rats, 4 per group (2M, 2F), were administered a single intravenous dose of SNEAI001 at concentrations of 0.5, 1, 5, or 10 mg/kg. Plasma samples were obtained at 0.5, 1, 5, or 10 minutes, 30 minutes...

Pharmacokinetics II

In order to evaluate excretion, four Sprague Dawley rats (2M, 2F) were administered intravenously ^{14}C -SNEAI001 at 1 mg/kg (110 $\mu\text{Ci/kg}$). Radioactivity excretion in urine and feces was measured for four days post dose by liquid scintillation counting (LSC).

Introduction

A GLP study was conducted to determine the single dose pharmacokinetics of SNEAI001 in the rat after intravenous administration.

Single dose pharmacokinetic studies with SNEAI001

Single dose pharmacokinetic study of SNEAI001 in rats

Report title: Pharmacokinetic study of SNEAI001 in rats

Report title: Pharmacokinetic study of SNEAI001 in rats

INTERNAL & TRUSTED 3RD PARTIES



Cost

Balancing innovation power with economic sustainability.

Why it matters

Generative AI introduces a **new and variable cost model** – every interaction has a price, usually calculated per token.

This makes expenses hard to predict, costs depend on the model used, the number of users, and even prompt length.

On the other hand, **Semantic AI** has a higher setup cost but minimal ongoing expenses.

Cost governance is the discipline of managing these trade-offs to ensure AI remains sustainable.

Customer value

- **Predictable budgets:** clear visibility on the cost per model, task, and usage pattern.
- **Efficiency:** use the right AI for the right purpose, minimizing waste.
- **Sustainability:** balance between innovation speed and long-term affordability.
- **Strategic control:** the ability to switch models or mix approaches without financial surprises.

Neuro-Symbolic advantage

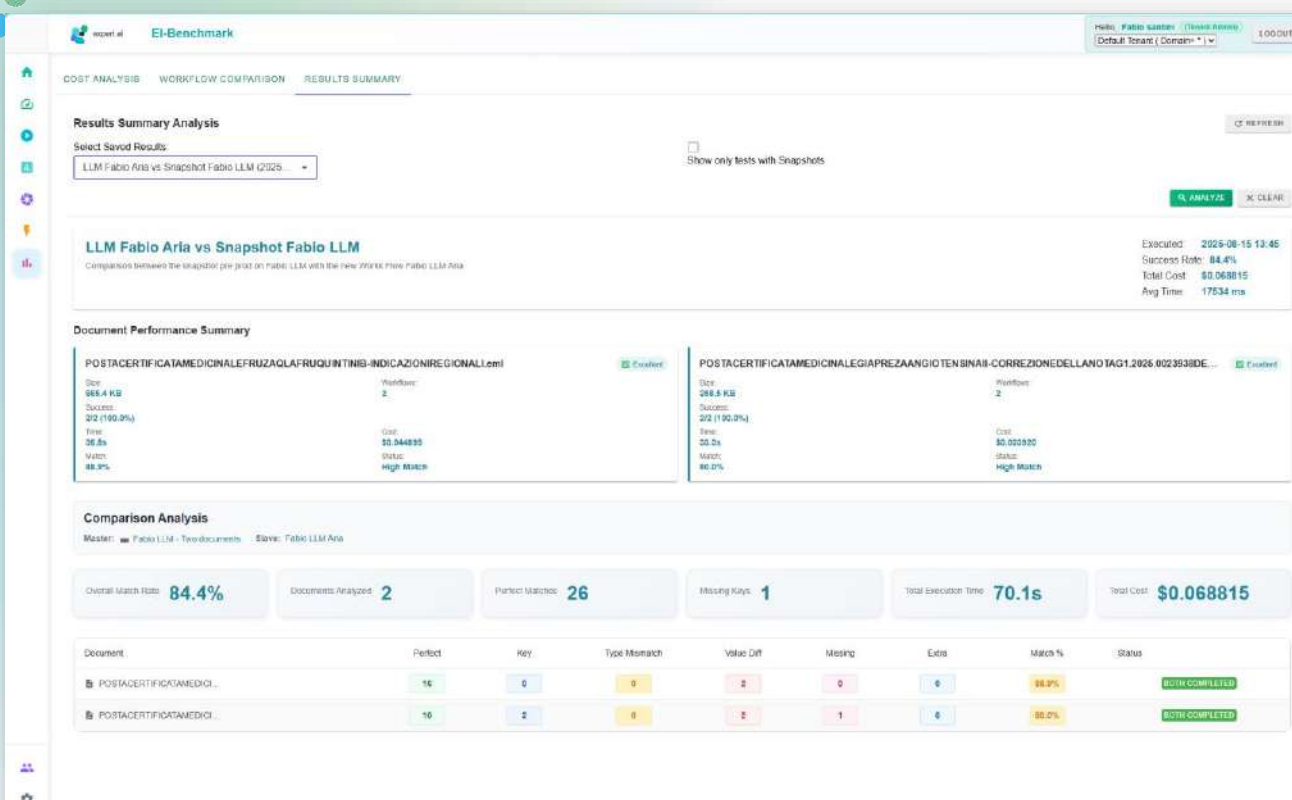
The **neuro-symbolic approach** combines the **flexibility of Generative AI** with the **efficiency of Semantic AI**.

It allows organizations to dynamically choose:

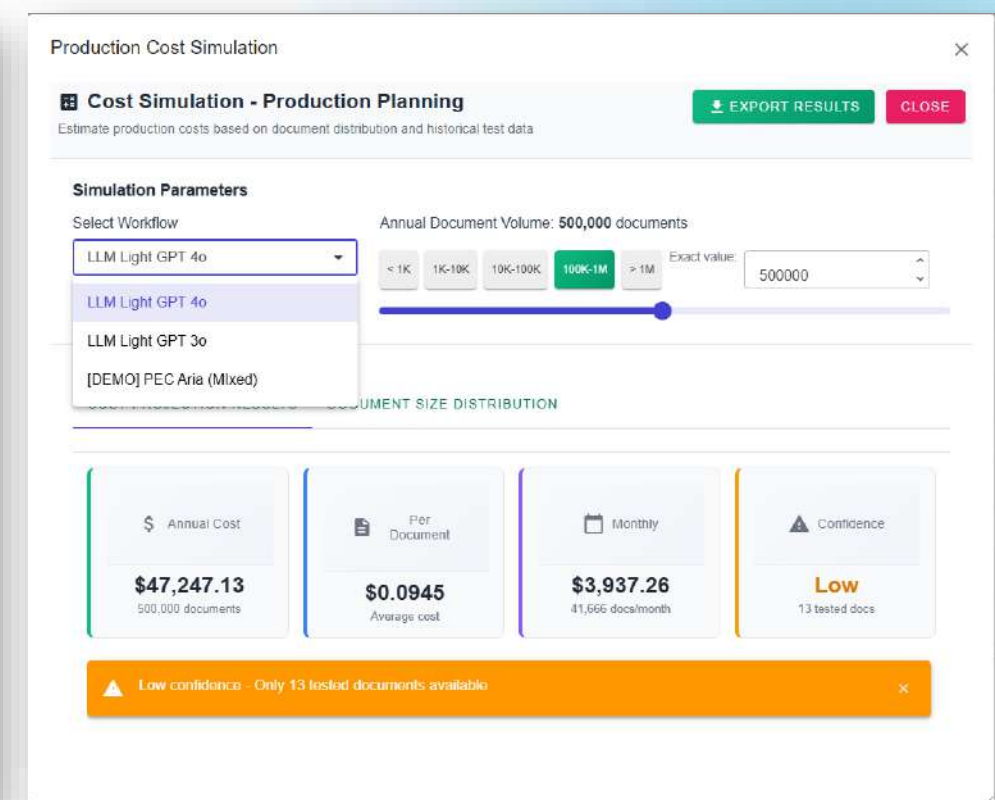
- when to leverage **Generative AI** for creativity and exploration,
- and when to rely on **Semantic AI** for stability and low cost.

This hybrid strategy keeps AI economics **under governance**, ensuring enterprises can innovate fast **without losing financial control**.

Cost : reduce cost doing benchmarks



- **Compare** different workflows to understand which one perform at best
- Release updated version of workflow without **breaking the entire process**



- **Confront** different workflow to estimate the production cost
- Compare **workflow costs** with same results



Knowledge

Turning scattered information into structured intelligence.



Why it matters

Enterprise knowledge is vast, unstructured, and often fragmented across documents, systems, and departments.

LLMs alone struggle to interpret such data especially when formats, vocabularies, and domain languages differ. Even fine-tuned models can't fully capture the **specific logic and terminology**.

Knowledge governance ensures that organizational know-how is structured, connected, and continuously updated, enabling AI to understand—**not just read**—the enterprise context.



Customer value

- **Consistency:** unify scattered content into a single, reliable knowledge layer.
- **Quality:** reduce ambiguity and misinterpretation of domain-specific terms.
- **Scalability:** once the domain is modeled, it can support multiple AI use cases.
- **Strategic asset:** transforms internal knowledge into a reusable, intelligent resource.



Neuro-Symbolic advantage

By combining **Generative AI** with **Semantic AI**, organizations can transform raw information into **governed knowledge**.

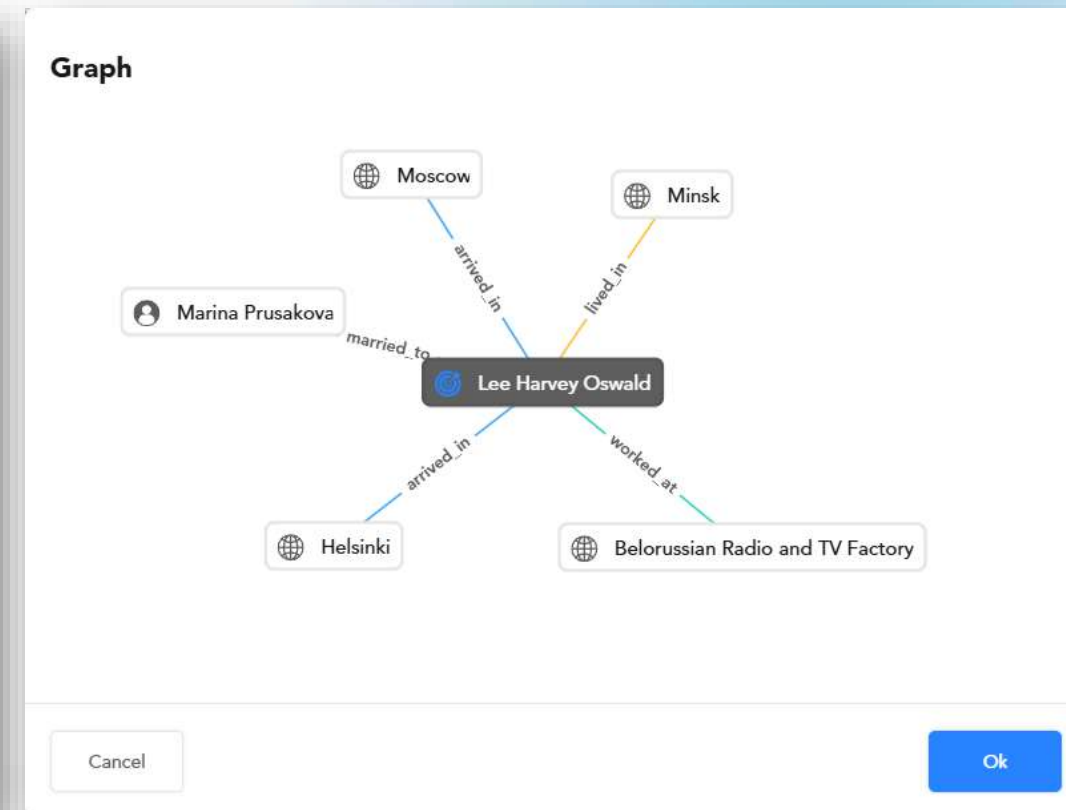
The **neural side** interprets and summarizes complex, unstructured content.

The **symbolic side** models the logic, entities, and relationships of the domain.

Together, they create **domain-specific knowledge graphs** that guide retrieval, disambiguate meanings, and contextualize answers.

Knowledge : add your specific domain data

The screenshot shows a web application interface with a sidebar on the left containing a 'Summary' and 'Key Facts' section. The main content area displays a document titled 'What happened while LHO stayed in USSR between 1959 and 1962'. The document is a typed letter from Mr. Richard Helas, Deputy Director for Plans, Central Intelligence Agency, Washington, D.C. 20505, dated May 25, 1964. The letter discusses Lee Harvey Oswald's activities in the USSR, including his arrival in Helsinki, his time in Moscow, and his time in Minsk. It mentions that Oswald was a radio and TV factory worker in Minsk, married Marina Prusakova, and that they had a child. The letter also mentions Oswald's request for U.S. citizenship and his return to the U.S. in June 1962.



- Make a conversation with **complex documents** with different formats and size
- Every insight produced by the AI is fully traceable – users can click on any sentence of the answer and instantly **see the exact document passage that supports it**.

- **Understand** which part of the **specific domain knowledge graph** has been used to retrieve the right documents to generate a better answer.

Thank you



www.expert.ai



[linkedin.com/company/expert-ai](https://www.linkedin.com/company/expert-ai)



marketing@expert.ai

