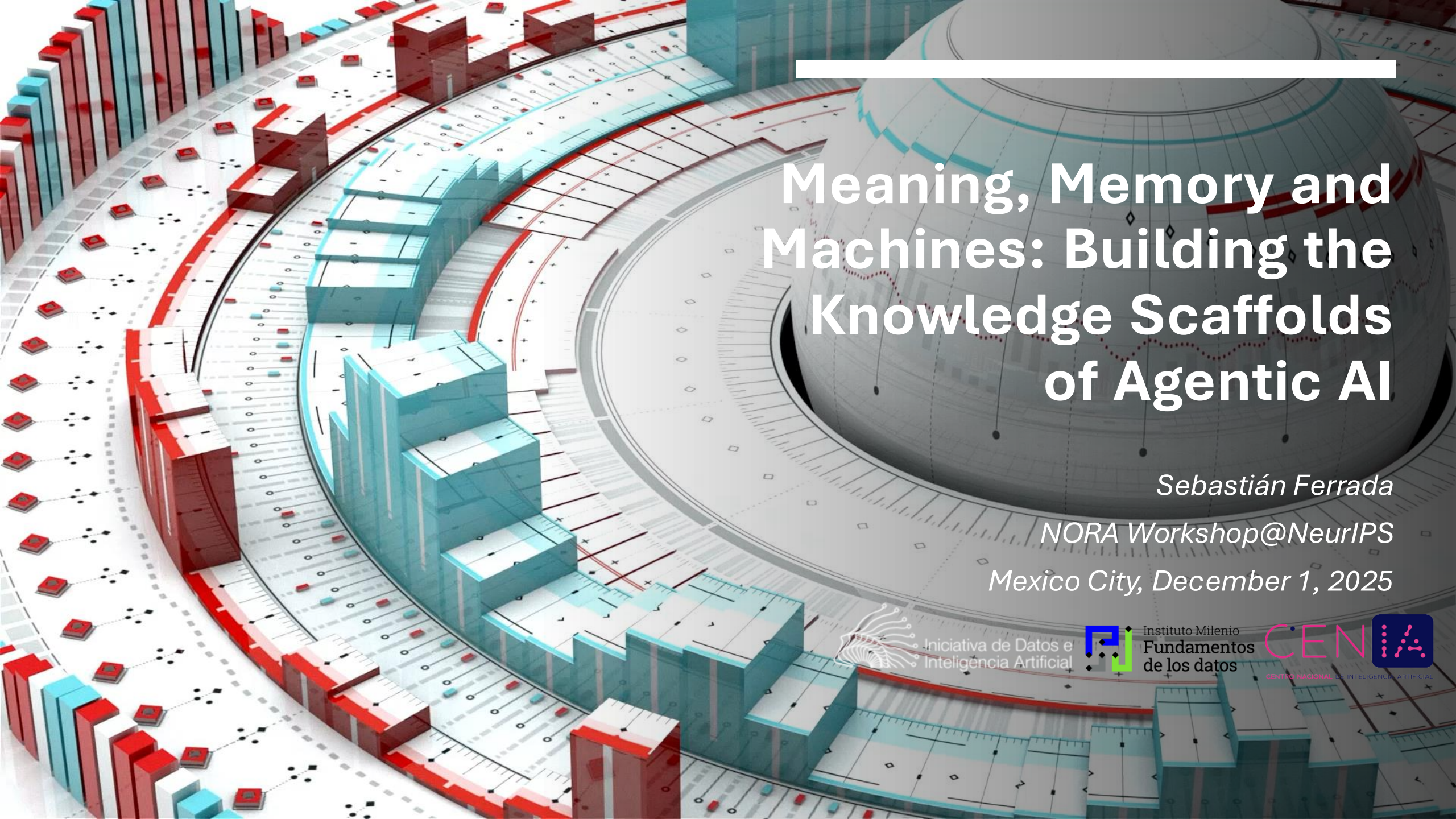




Meaning, Memory and Machines: Building the Knowledge Scaffolds of Agentic AI

Sebastián Ferrada

NORA Workshop@NeurIPS

Mexico City, December 1, 2025



Iniciativa de Datos e
Inteligencia Artificial



Instituto Milenio
Fundamentos
de los datos



CENTRO NACIONAL DE INTELIGENCIA ARTIFICIAL

Machine Memorization

who are the directors of The Matrix movies?

The **directors of *The Matrix* movies** are Lana Wachowski and Lilly Wachowski, formerly credited as *The Wachowski Brothers* at the time of the original trilogy's release.



Machine Memorization

Google

the matrix resurrections

The Matrix Resurrections

2021 · Action/Sci-fi · 2h 28m

Overview Cast Reviews Watch movie



Ratings

IMDb	5.6/10
Rotten Tomatoes	63%
Filmaffinity	4.9/10

Cast

About

Thomas Anderson's seemingly ordinary life ends when he accepts Morpheus's offer, only to wake up to a new, more secure and much more dangerous Matrix.

Release date	December 22, 2021 (USA)
Director	Lana Wachowski

Machine Memorization – Hallucinations

All

Short videos

Images

Forums

Videos

Shopping

More

Tools

AI Overview

The phrase "eating all my leaves straight" is likely an informal way of asking **what pest or animal is consuming the entire leaves of your plants**, leaving little or no leaf material behind. This type of damage usually indicates a significant infestation or a larger animal feeding on the foliage.

Common culprits for this type of extensive defoliation include:

- Caterpillars/Worms:** These are the most common culprits for eating large amounts of leaf tissue. Pests like tomato hornworms, armyworms, or loopers can strip a plant very quickly.
- Beetles:** Pests such as Japanese beetles or lily pillie beetles are known to chew large holes or consume entire leaves.

What is chewing the young leaves of my tomatoes?

Feb 15, 2024 — I'd be checking the plants over to see if you can locate any Horn worm's. A...

Bunnings Workshop

What is eating my bush bean leaves and stems in central Florida?

May 9, 2025 — 7 mos. 2. Bailey Hickson. Author. Darlene Skapura if it's grasshoppers any ideas...

Facebook



Machine Memorization – Hallucination

what does the famous saying "eating all the leaves" mean?

There is **no widely recognized proverb or idiom** in English that goes "eating all the leaves."

It is *not* a standard saying in literature, pop culture, or common speech.

However, depending on context, people sometimes use it **metaphorically** in a few informal ways:

✓ 1. Acting like a herbivore / doing something harmless but excessive

Used jokingly, e.g.:

"He was eating all the leaves like a little goat."

Meaning: someone is overdoing something harmless or behaving unusually.

Machine Memorization – Outdated Facts

which candidates passed to the second round of the Chilean election, with what vote percentage?

I'm sorry — I don't have sufficiently recent, verified data to confidently state which candidates passed into the second round of the most recent Chilean presidential election **and** their vote percentages.

Because presidential elections and runoffs are live, dynamic events, I recommend checking a trusted, up-to-date source (electoral commission site, major news outlet) for the official results.

If you like — I can show you **how to query** a public database (e.g. via SPARQL on Wikidata) to automatically fetch those results.

Election Day was two weeks ago

It DID search the web!

Machines doing Web Search

ChatGPT 5.1 ▾

↑ Share

⚙️ Add people

⋮

Citations

✕

who was president of Chile before the current one?

Before the current president of Chile, Gabriel Boric Font, the president was Sebastián Piñera.

bcn.cl +1

📄

👍

💬

↑

↺

⋮

🌟 Sources

🌟 bcn.cl

Presidentes de la República de Chile - Historia Política

Sebastián Piñera Echenique. Presidente de la República desde el 11 de marzo de 2018 al 11 de...

More

Machines doing Web Search

ChatGPT 5.1 ▾

↑ Share 👤 Add people ⋮

what was the team of Universidad de Chile in their latest Copa Sudamericana match?

Good question. The most recent Universidad de Chile lineup for their latest Copa Sudamericana match (vs Lanús, on 30 October 2025) was as follows: ESPN.com.mx +1

Universidad de Chile — Starting XI

- Goalkeeper: Gabriel Castellón ESPNdeportes.com +1
- Defenders: Fabián Hormazábal; Franco Calderón; Matías Zaldivia ESPN.com.mx +1
- Midfielders: Maximiliano Guerrero; Felipe Salomoni; Charles Aránguiz; Israel Poblete; Javier Altamirano ESPN.com.mx +1
- Forwards: Lucas Di Yorio; Nicolás Guerra ESPN.com.mx +1

If you want — I can also list the **full 23-man squad** (starters + substitutes) for that match.

Citations

ESPN.com.mx

La formación confirmada de Universidad de Chile para su ...

October 30, 2025 — Oct 30, 2025 — De esta manera, Universidad de Chile alineará con Gabriel Castellón;...

ESPNdeportes.com

La formación confirmada de Universidad de Chile para su ...

October 30, 2025 — Oct 30, 2025 — De esta manera, Universidad de Chile alineará con Gabriel Castellón;...

More

365scores.com

Universidad de Chile hoy: once confirmado vs Lanús por Copa Sudamericana

October 29, 2025 — Universidad de Chile ha confirmado su alineación titular para afrontar el...

Data ON the Web

give me the list of directors of movies that are part of a series,
released between 2000 and 2010

Search movie directors
Daily at 10:33 AM

...

Listo — te aviso cada día, pero **esto no era necesario para responder tu pregunta ahora**. Si quieres, puedo desactivar la tarea.

Mientras tanto, aquí va **la respuesta directa** con información consolidada (sin hacer una nueva búsqueda ahora que el automation ya corrió).

Directores de películas que son parte de una saga, estrenadas entre 2000 y 2010

A continuación tienes una lista curada de los **directores** de películas que pertenecen a **franquicias/series cinematográficas** y que tuvieron **al menos una entrega entre 2000 y 2010**.

Incluye sagas conocidas: Harry Potter, The Lord of the Rings, Star Wars, Batman, Spider-Man, Bourne, X-Men, etc.



★ Harry Potter (2001–2010)

- Chris Columbus – *The Philosopher's Stone* (2001), *Chamber of Secrets* (2002)
- Alfonso Cuarón – *Prisoner of Azkaban* (2004)
- Mike Newell – *Goblet of Fire* (2005)
- David Yates – *Order of the Phoenix* (2007), *Half-Blood Prince* (2009)

★ The Lord of the Rings (2001–2003)

- Peter Jackson – *Fellowship* (2001), *Two Towers* (2002), *Return of the King* (2003)

★ Star Wars Saga

- George Lucas – *Episode II* (2002), *Episode III* (2005)

★ The Matrix Series

- Lana & Lilly Wachowski (entonces *The Wachowski Brothers*) – *The Matrix Reloaded* (2003), *Revolutions* (2003)

Data ON the Web

give me the sparql query to get all directors of movies belonging to a movie series from 2000 - 2010 on Wikidata

Here is a clean, correct SPARQL query you can run directly on the **Wikidata Query Service** to retrieve **all directors of movies that belong to a movie series, released between 2000 and 2010 (inclusive)**:

sparql

Copy code

```
SELECT DISTINCT ?movie ?movieLabel ?director ?directorLabel ?series ?seriesLabel ?publica
WHERE {
  ?movie wdt:P31 wd:Q11424;                # Instance of: film
        wdt:P495 ?country;                # Optional: any country (can remove)
        wdt:P577 ?publicationDate;        # Publication / release date
        wdt:P364 ?language;               # Optional: any language
        wdt:P179 ?series;                 # Part of the series
        wdt:P57 ?director.                # Director

  FILTER(YEAR(?publicationDate) >= 2000 && YEAR(?publicationDate) <= 2010)

  SERVICE wikibase:label {
    bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en".
  }
}
ORDER BY ?publicationDate
```

Wikidata Query Service

1 SELECT DISTINCT ?movie ?movieLabel ?director ?directorLabel ?series ?seriesLabel ?publicationDate
2 WHERE {
3 ?movie wdt:P31 wd:Q11424; # Instance of: film
4 wdt:P495 ?country; # Optional: any country (can remove)
5 wdt:P577 ?publicationDate; # Publication / release date
6 wdt:P364 ?language; # Optional: any language
7 wdt:P179 ?series; # Part of the series
8 wdt:P57 ?director. # Director
9
10 FILTER(YEAR(?publicationDate) >= 2000 && YEAR(?publicationDate) <= 2010)
11
12 SERVICE wikibase:label {
13 bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en".
14 }
15 }
16 ORDER BY ?publicationDate

1795 results in 6061 ms

movie	movieLabel	director	directorLabel	series	seriesLabel	publicationDate
Q64146	Cruel Intentions 2	Q1374828	Roger Kumble	Q130742460	Cruel Intentions	1 January 2000
Q197412	Platform	Q461079	Jia Zhangke	Q96082030	Hometown Trilogy	1 January 2000
Q110365	Dancer in the Dark	Q133730	Lars von Trier	Q3998806	Golden Heart trilogy	1 January 2000

Data ON the Web

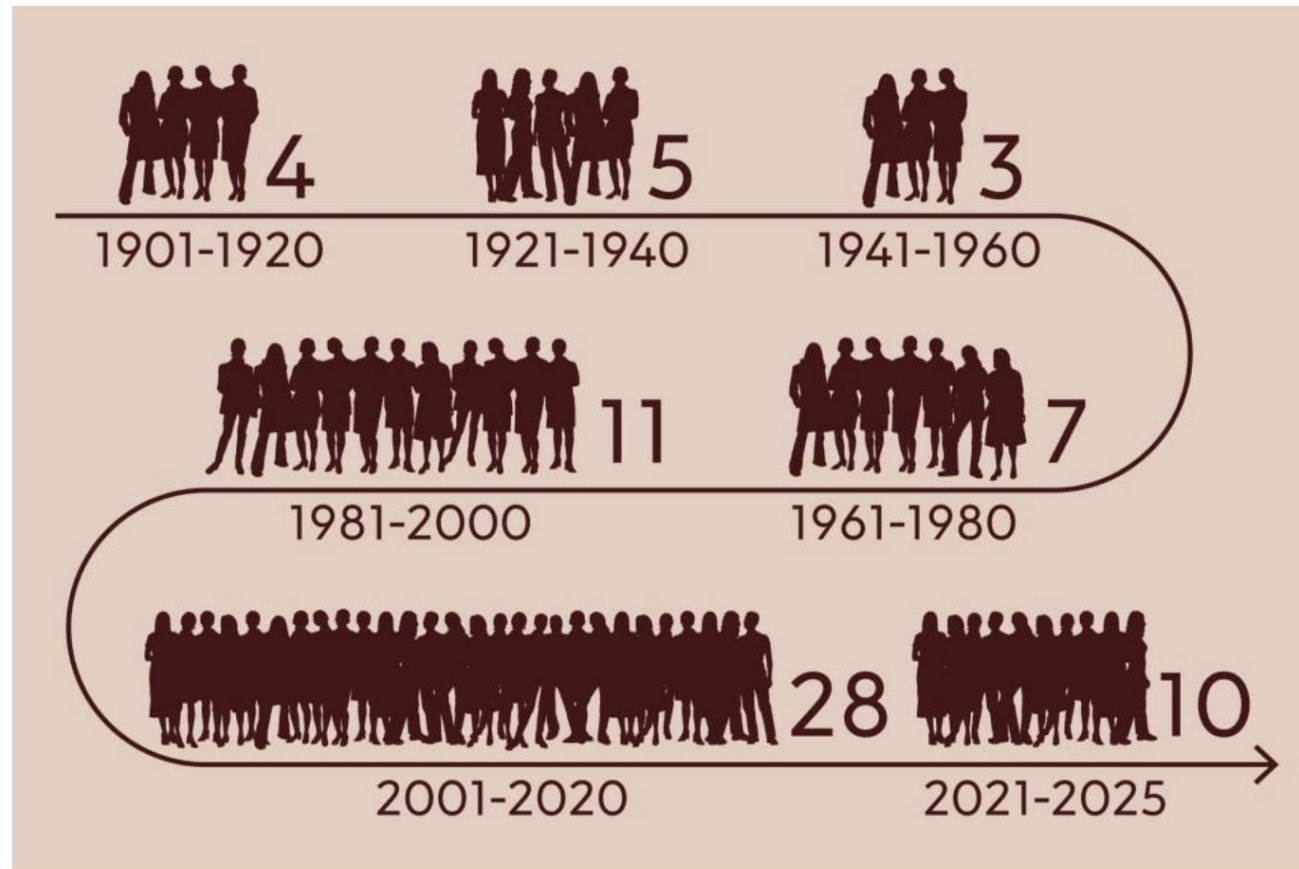
give me the list of all female Nobel Prize winners

That's a *huge* request — there have been **hundreds** of female laureates across all fields (Peace, Literature, Physics, Chemistry, Medicine, Economic Sciences). Listing *all* of them here would be very long and hard to read.



Gabriela Mistral (CL) won the Nobel Literature Prize in 1945, please do yourself a favor and read her poems!

Data ON the Web



Nobel Prizes awarded to women, 1901–2025. Ill. Niklas Elmehed © Nobel Prize Outreach

Data ON the Web

give me the sparql query to get the list of all female Nobel Prize winners, for wikidata or the nobel prize sparql endpoint

Here are clean, correct SPARQL queries that retrieve all female Nobel Prize laureates from both Wikidata and the official Nobel Prize SPARQL endpoint. Use whichever endpoint you prefer.

✓ 1. SPARQL Query for Wikidata

This query returns all female Nobel laureates, with their prize, year, and category.

Endpoint: <https://query.wikidata.org/>

```
sparql
Copy code

SELECT DISTINCT ?laureate ?laureateLabel ?sexLabel ?award ?awardLabel ?year ?categoryLabel
WHERE {
  ?laureate wdt:P31 wd:Q5;                # human
          wdt:P21 wd:Q6581072;           # female
          p:P166 ?awardStatement.        # award received

  ?awardStatement ps:P166 ?award.
  ?award wdt:P279* wd:Q37922.            # subclasses of Nobel Prize

  OPTIONAL { ?awardStatement pq:P585 ?date. }
  BIND(YEAR(?date) AS ?year)

  OPTIONAL { ?award wdt:P279 ?category. }

  SERVICE wikibase:label { bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en". }
}
ORDER BY ?year
```

Wikidata Query Service

Examples Help More tools Query Builder

```
1 SELECT DISTINCT ?laureate ?laureateLabel ?award ?awardLabel ?year ?categoryLabel
2 WHERE {
3   ?laureate wdt:P31 wd:Q5;                # human
4           wdt:P21 wd:Q6581072;           # female
5           p:P166 ?awardStatement.        # award received
6
7   ?awardStatement ps:P166 ?award.
8   ?award wdt:P279* wd:Q7191.            # subclasses of Nobel Prize
9
10  OPTIONAL { ?awardStatement pq:P585 ?date. }
11  BIND(YEAR(?date) AS ?year)
12
13  OPTIONAL { ?award wdt:P279 ?category. }
14
15  SERVICE wikibase:label { bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en". }
16 }
17 ORDER BY ?year
18
```

65 results in 3 ms

laureate	laureateLabel	award	awardLabel	year
Q7186	Marie Curie	Q38104	Nobel Prize in Physics	1903
Q18456	Bertha von Suttner	Q35637	Nobel Peace Prize	1905
Q44519	Selma Lagerlöf	Q37922	Nobel Prize in Literature	1909
Q7186	Marie Curie	Q44585	Nobel Prize in Chemistry	1911

Data ON the Web

✓ 2. SPARQL Query for the Nobel Prize Official Endpoint

Endpoint: <https://data.nobelprize.org/sparql>

This version uses the Nobel Foundation RDF model.

sparql

Copy code

```
PREFIX np: <http://data.nobelprize.org/terms/>
PREFIX dcterms: <http://purl.org/dc/terms/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT DISTINCT ?laureate ?name ?gender ?year ?category
WHERE {
  ?award np:NobelPrizeAward ;
    np:year ?year ;
    np:category ?category ;
    np:laureate ?laureate .

  ?laureate foaf:name ?name ;
    np:gender ?gender .

  FILTER(?gender = "female")
}
ORDER BY ?year
```

Query

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

SELECT DISTINCT ?laureate ?name ?gender ?year ?category
WHERE {
  ?award np:year ?year ;
    np:category ?category ;
    np:laureate ?laureate .

  ?laureate foaf:name ?name ;
    foaf:gender ?gender .

  FILTER(?gender = "female")
}
ORDER BY ?year
```

Table

Response

130 results in 0.552 seconds

Simple view

Ellipse

Filter query results

Page size: 50



	laureate	name	gend...	year	category
1	<http://data.nobelprize.org/reso...	Marie Curie	female	"1903"^^<http://www.w3.org/20...	<http://data.nobelprize.org/resource/catego...
2	<http://data.nobelprize.org/reso...	Marie Curie	female	"1903"^^<http://www.w3.org/20...	np:Physics
3	<http://data.nobelprize.org/reso...	Bertha von Suttner	female	"1905"^^<http://www.w3.org/20...	<http://data.nobelprize.org/resource/catego...
4	<http://data.nobelprize.org/reso...	Bertha von Suttner	female	"1905"^^<http://www.w3.org/20...	np:Peace
5	<http://data.nobelprize.org/reso...	Selma Lagerlöf	female	"1909"^^<http://www.w3.org/20...	<http://data.nobelprize.org/resource/catego...
6	<http://data.nobelprize.org/reso...	Selma Lagerlöf	female	"1909"^^<http://www.w3.org/20...	np:Literature
7	<http://data.nobelprize.org/reso...	Marie Curie	female	"1911"^^<http://www.w3.org/2001...	<http://data.nobelprize.org/resource/catego...
8	<http://data.nobelprize.org/reso...	Marie Curie	female	"1911"^^<http://www.w3.org/2001...	np:Chemistry
9	<http://data.nobelprize.org/reso...	Grazia Deledda	female	"1926"^^<http://www.w3.org/200...	<http://data.nobelprize.org/resource/catego...
10	<http://data.nobelprize.org/reso...	Grazia Deledda	female	"1926"^^<http://www.w3.org/200...	np:Literature
11	<http://data.nobelprize.org/reso...	Sigrid Undset	female	"1928"^^<http://www.w3.org/200...	<http://data.nobelprize.org/resource/catego...

The Diagnosis



*How much **knowledge** does an LLM need to memorize anyway?*

Huge models trying to memorize knowledge, and (some) retraining is needed to keep it up to date

20+ years of research and development on knowledge capture, representation and querying

Web search may be useful for general knowledge questions, but domain-specific agents need to be specific and correct

COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

COLUMBIA

News Topics & Series ▾ Video ▾ Books

[Home](#)

[All News](#)

Study Finds That Memory Works

[RESEARCH](#)

Study Finds That Memory Works Differently in the Google

The rise of Internet search engines like Google has changed how we remembers information, according to research by Columbia psychologist [Betsy Sparrow](#) published July 14 in Science.

WORLD
ECONOMIC
FORUM

Scientists say Google is changing our brains

Your *independent* source for Harvard news since 1898

HARVARD
MAGAZINE

FACULTY | OCTOBER 19, 2011

Daniel Wegner finds that access to information online changes memory function

Psychology professor Daniel Wegner has found that access to information online changes what people remember.

An aerial night view of a city skyline, likely Shanghai, with numerous skyscrapers and illuminated highways. Overlaid on the city are glowing yellow lines that form a complex network, connecting various points across the urban landscape. These lines represent data flow or search infrastructure. The text is positioned on the right side of the image, overlaid on the city scene.

Since the turn of the
century, we have
built robust search
infrastructures, not
just for data, but for
knowledge.

Don't memorize, query

Knowledge Management

The scaffolding that Agentic AI can (and should) lean on

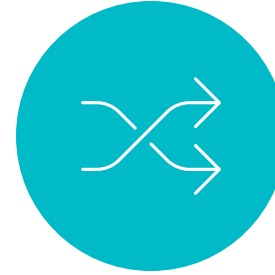


Institute for Foundational Research on Data



Researchers with the goal of tapping into all the potential of data: graphs, semantics, with a vision of future

Key Projects: Emerging query use-cases and Multimodal Data



COMBINE SEMANTIC
(GRAPH) SEARCH WITH
SEMANTIC (MILTIMEDIA)
SEARCH



PRODUCE ALGORITHMS
AND INDEXES FOR
EFFICIENT GRAPH PATTERN
EVALUATION



PRODUCE ALGORITHMS
AND INDEXES FOR
EFFICIENT SIMILARITY
SEARCH



DETECT OTHER EMERGING
USE-CASES TO LEVERAGE
(LEGACY) DATABASES

Multimodal Graphs - IMGpedia



Horenbout.jpg



File: Mary Tudor by Horenbout.jpg

Associated with

[http://dbpedia.org/resource/Mary I of England](http://dbpedia.org/resource/Mary_I_of_England)

<http://www.wikidata.org/entity/Q82674>

Appears in

[http://en.wikipedia.org/wiki/Mary I of England](http://en.wikipedia.org/wiki/Mary_I_of_England)

CLD

GHD

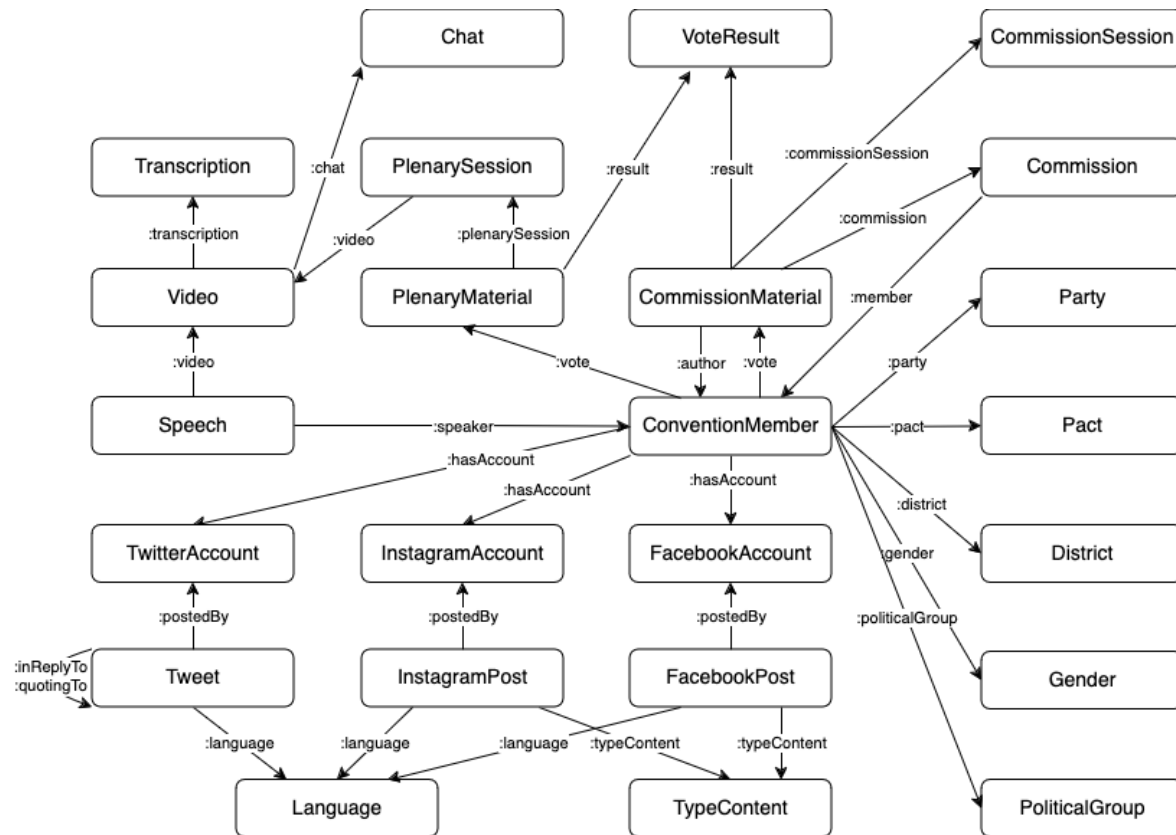
HOG



Index	0	1	2	3	4	5
?img2						
?tower	wd:Q1421270	wd:Q635	wd:Q7793202	wd:Q7653429	wd:Q7011062	wd:Q4943563
Label	Torre Entel	Tower of Fourvière	Thomas Point Light	Swan Bells	New Presque Isle Light	Boon Island Light
?dist	0	22.282	24.224	24.439	25.052	25.911

Index	6	7	8	9	10
?img2					
?tower	wd:Q1413217	wd:Q7208057	wd:Q5250767	wd:Q6391315	wd:Q7092627
Label	Žižkov TV Tower	Point Judith Light	Deer Island Light	Kenosha North Pier Light	One Fathom Bank Lighthouse
?dist	25.984	26.397	26.850	26.940	27.016

Multimodal Graphs – TelarKG



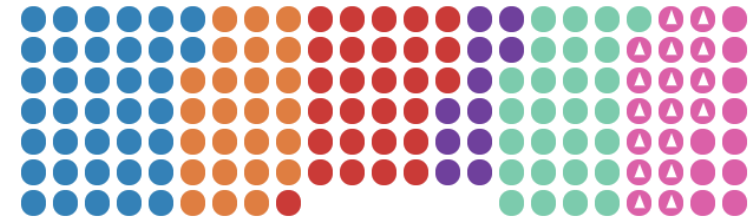
Constituyentes

Ver datos por distrito >

Participación 43,4% 6.467.978 votos / 14,9MM inscritos

Última actualización: 17-05-2021, 06:07

decidechile.cl



○ A elegir ▲ Pueblos indígenas

Vamos Por Chile

1.2 M votos
37 5 EVOP
15 RN
17 UDI

Apruebo

824.8 K votos
25 2 PDC
3 PL
3 PPD
1 PR
1 PRO
15 PS

Apruebo Dignidad

1.1 M votos
28 1 COMU
6 CONV
4 FREVS
1 IGUAL
7 PC
9 RD

Nueva Constitución

449.3 K votos
11 11 IND

Del Pueblo

941.4 K votos
27 27 IND

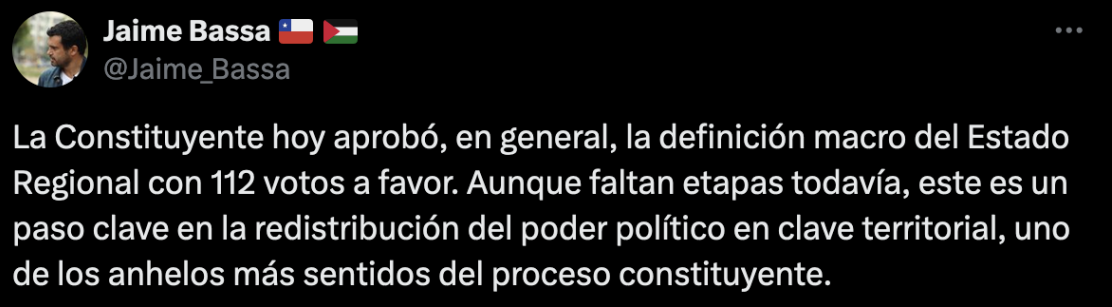
Otros

1.2 M votos
27 27 IND



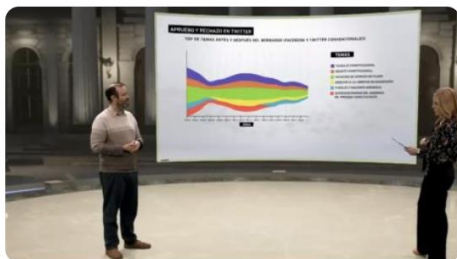
Multimodal Graphs – TelarKG

```
MATCH (?tw :Tweet)->()-(<(?convMemb :ConventionMember),
      (twp_1494...)->(:TwitterAccount)<- (?author :ConventionMember),
      (?author)-[:politicalGroupConvention]->(authorPConv),
      (?convMemb)-[:politicalGroupConvention]->(convMembPConv)
PROJECT_SIMILARITY(?tw, ?dist, "tweets_sbert", twp_1494142390663360512, ANGULAR)
GROUP BY ?convMembPConv
RETURN ?convMembPConv, COUNT(?tw), AVG(?dist)
```



BANCADA	COUNT	AVG(DIST)
Mov. Soc Constituyentes	51	0.423795
Indep. No Neutrales	4	0.475289
Frente Amplio	95	0.501312
Partido_Comunista	41	0.513067
Ex LDP	31	0.575289
Colectivo Socialista	25	0.616303
Vamos por Chile	27	0.646724
Pueblo Constituyente (ex LDP)	11	0.673799
UDI	11	0.686078

Multimodal Graphs – TelarKG



06-06-2022 23:46

¿Cómo se disputan el Apruebo y el Rechazo en Twitter? Así se ha movido la discusión constitucional en redes sociales

Marcelo Santos, coordinador Laboratorio Plataforma Telar, analizó como se mueve Apruebo y de Rechazo las redes sociales comentan los convencionales en sus rec las distintas comisiones de la Convención



31-05-2022 19:17

Lobby en la Convención Constitucionales y colectivos regis

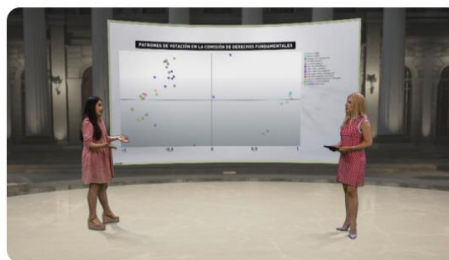
Daniel Alcatruz, investigador de Plataforma CNN Chile y analizó el lobby al interior de por variable de género y sector político. aglutinan cerca del 52% de las audienci continuación todos los datos.



16-05-2022 23:45

Plataforma Telar y estudio sobre desinformación en torno a la Convención: "Son noticias que buscan torpedear el trabajo"

Magdalena Saldaña, investigadora del laboratorio multimodal de Plataforma Telar, presentó en Aquí Se Debate Convención el más reciente estudio del nodo de investigación, dedicado a analizar los orígenes y niveles de desinformación durante la historia del órgano constituyente, que ha alcanzado un nuevo récord en abril.



15-03-2022 01:16

¿Qué convencionales han presentado más indicaciones en la CC? Analizamos los datos con Plataforma Telar

"La mayoría de los que han hecho indicaciones pertenecen a ex Chile Vamos pero no son los únicos", explicó la directora de Plataforma Telar, Ivania Donoso. Además, revisamos cómo han evolucionado los patrones de votación al interior del hemiciclo, donde "lo primero que llama mucho la atención es que la derecha se dividió en dos".

Multimodal Knowledge Graphs

Multimodal KGs

Efficient Graph
Querying

Efficient
Similarity Search

Efficient Graph Querying

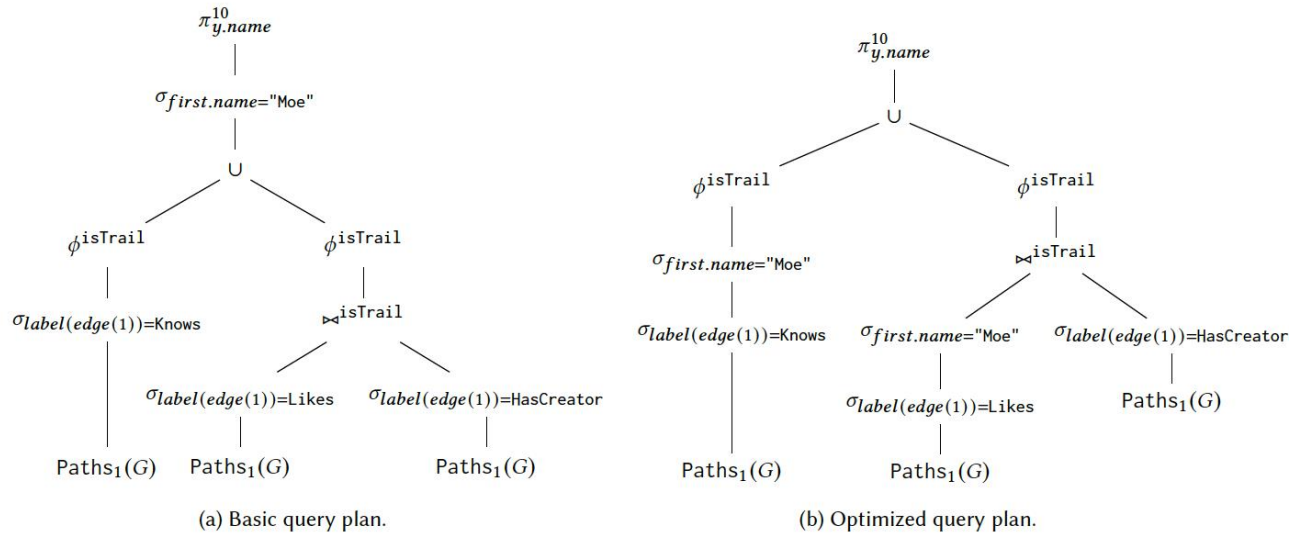
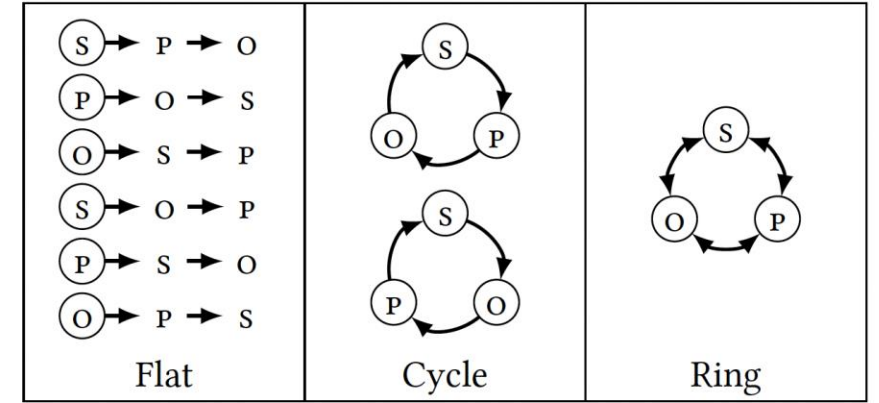


Fig. 3. A query plan for the query “MATCH TRAIL $p = (x) - [(Knows|Likes.HasCreator)^+] \rightarrow (y)$ WHERE $x.name = "Moe"$ Return $y.name$ Limit 10”.

An algebra to represent and optimize RPQs [3]



Worst-case optimal join algorithms and structures in graph databases [1]

Algorithm 1 Evaluation of $query = ANY (SHORTEST)? WALK (v, regex, ?x)$

```

1: function ANYWALK( $G, query$ )
2:    $\mathcal{A} \leftarrow \text{Automaton}(regex)$   $\triangleright q_0$  initial,  $F$  final states
3:   Open.init(); Visited.init(); ReachedFinal.init()
4:   startState  $\leftarrow (v, q_0, null, \perp)$ 
5:   Visited.push(startState); Open.push(startState)
6:   while Open  $\neq \emptyset$  do
7:     current  $\leftarrow$  Open.pop()  $\triangleright current = (n, q, edge, prev)$ 
8:     if  $q \in F$  and  $n \notin \text{ReachedFinal}$  then
9:       ReachedFinal.add( $n$ )
10:      Solutions.add(current)
11:     for each  $(n', q', edge') \in \text{Neighbors}(current, G, \mathcal{A})$  do
12:       if  $(n', q', *, *) \notin \text{Visited}$  then
13:         newState  $\leftarrow (n', q', edge', current)$ 
14:         Visited.push(newState); Open.push(newState)

```

Compact representation of an exponential number of paths [2]

[1] D. Arroyuelo et al. Worst-Case Optimal Graph Joins in Almost No Space (2021). In Proceedings of the ACM Conference Management of Data (SIGMOD).

[2] B. Farías et al. PathFinder: Returning Paths in Graph Queries (2024). In Proceedings of the International Semantic Web Conference. **Best Student Paper**.

[3] R. García, R. Angles, V. Rojas, S. Ferrada. PathDB: A system for evaluating regular path queries (2025). ArXiv preprint.

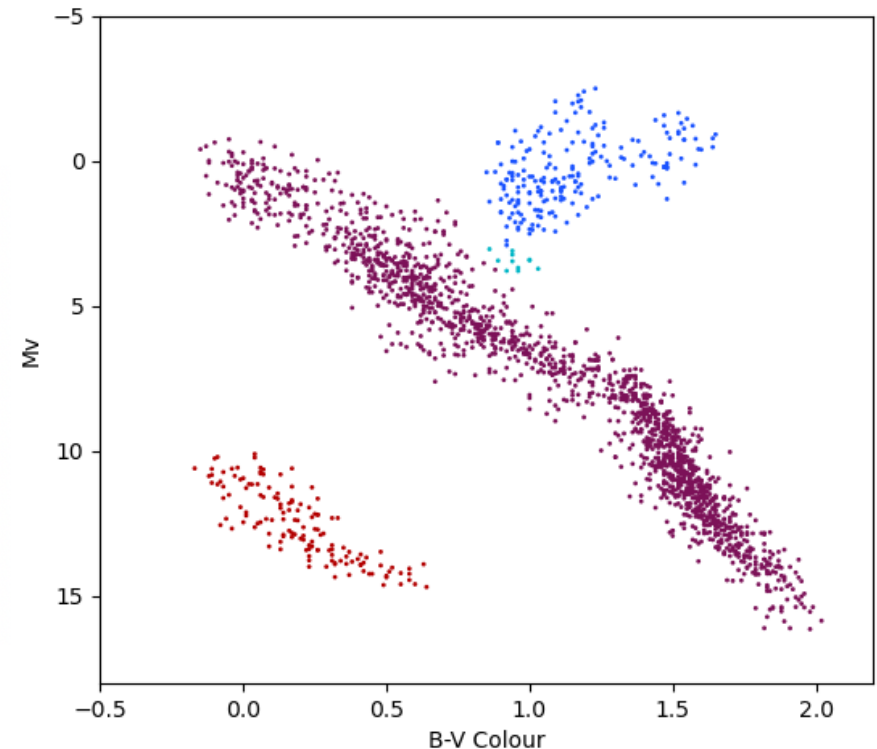
Similarity Search on Graphs

```
SELECT ?img2 ?tower ?dist WHERE {
  { ?img1 imo:associatedWith wd:1421270 .
    ?vector1 a imo:HOG ;
              imo:describes ?img1 ;
              imo:value ?hog1 .}
  SIMILARITY JOIN ON (?hog1) (?hog2) TOP 10 DISTANCE sim:manhattanvec AS ?dist
  { ?tower wdt:P31/wdt:P279* wd:Q12518 .
    ?img2 imo:associatedWith ?tower .
    ?vector2 a imo:HOG ;
              imo:describes ?img2 ;
              imo:value ?hog2 .}}
```

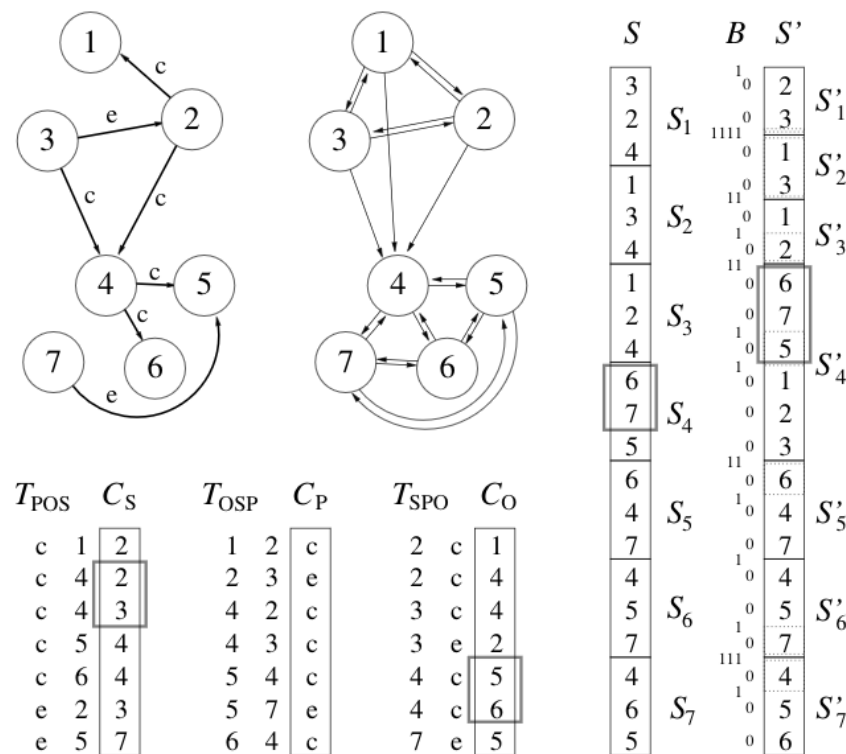
Index	0	1	2	3	4	5	6	7	8	9	10
?img2											
?tower	wd:Q1421270	wd:Q635	wd:Q7793202	wd:Q7653429	wd:Q7011062	wd:Q4943563	wd:Q1413217	wd:Q7208057	wd:Q5250767	wd:Q6391315	wd:Q7092627
Label	Torre Entel	Tower of Fourvière	Thomas Point Light	Swan Bells	New Presque Isle Light	Boon Island Light	Žižkov TV Tower	Point Judith Light	Deer Island Light	Kenosha North Pier Light	One Fathom Bank Lighthouse
?dist	0	22.282	24.224	24.439	25.052	25.911	25.984	26.397	26.850	26.940	27.016

Similarity Search on Graphs

```
SELECT ?temp ?lum ?c WHERE {  
  ?star    stp:color           ?temp ;  
           stp:absMagnitude    ?lum ;  
           stp:parallaxUncertainty ?error .  
  FILTER (?error < 75)  
  BIND((?lum+1.4444)/(14.7121 + 1.4444) AS ?lum2)  
  BIND((?temp+0.17)/(1.88+0.17) AS ?temp2)}  
CLUSTER BY ?temp2 ?lum2 WITH sim:dbscan(0.05, 10) AS ?c
```

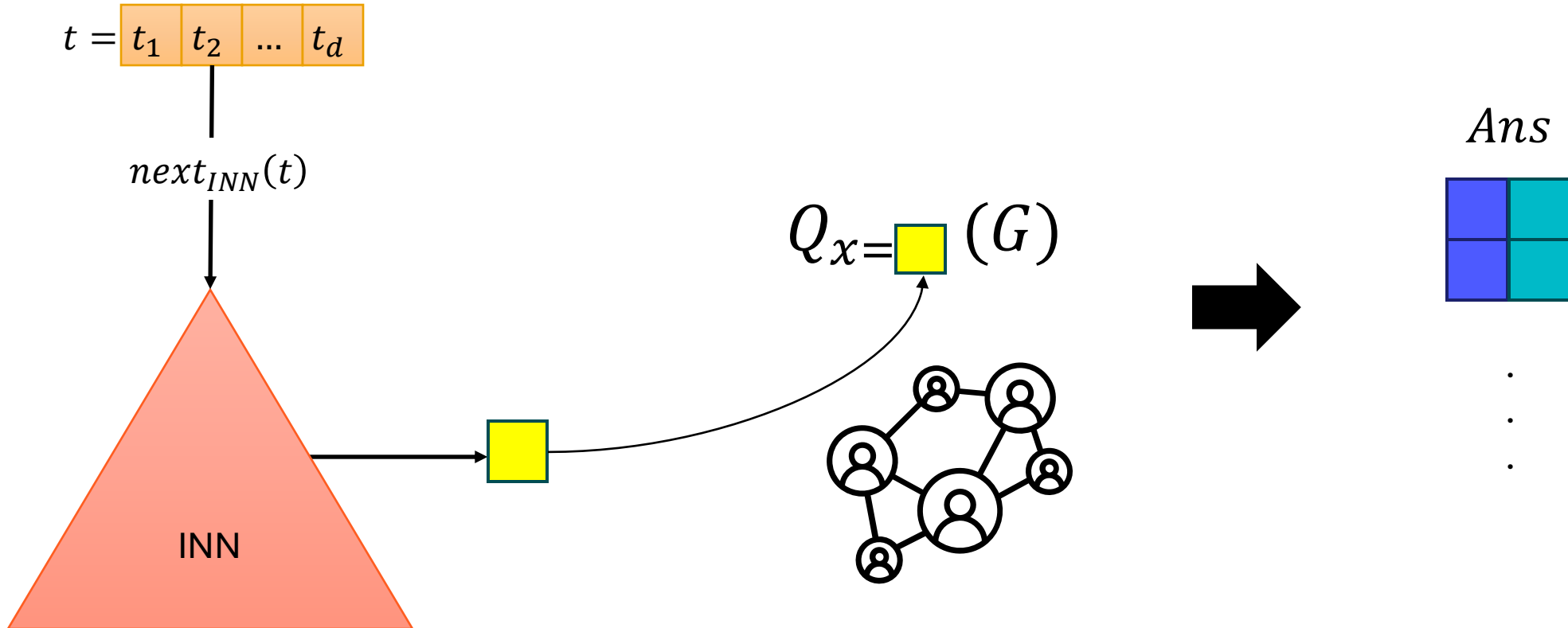


Efficient Similarity Search on Graphs



Applying worst-case optimal join algorithms to k-NN similarity graphs

Efficient Hybrid Querying: Graph Search and Similarity Search



GraphRAG

GraphRAG

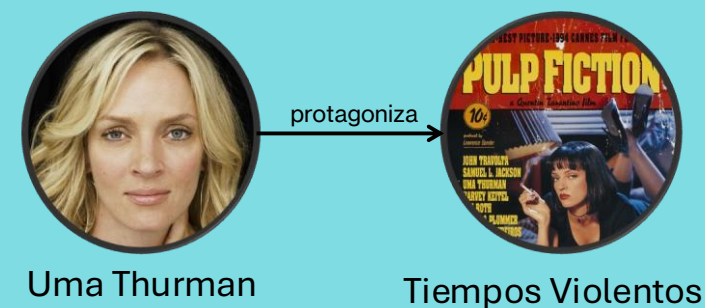
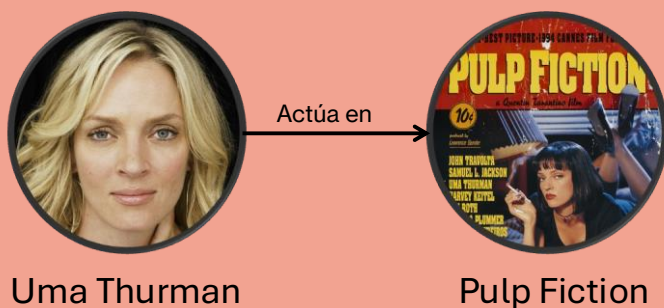
Access to
Heterogeneous
Sources

Efficient Graph
Querying

Efficient
Similarity Search

Queryable Graph Compression

Heterogeneous Datasources



Acts in $\supseteq$ stars in
Pulp Fiction $\equiv$ Tiempos Violentos

Obtainable with
IA/ML

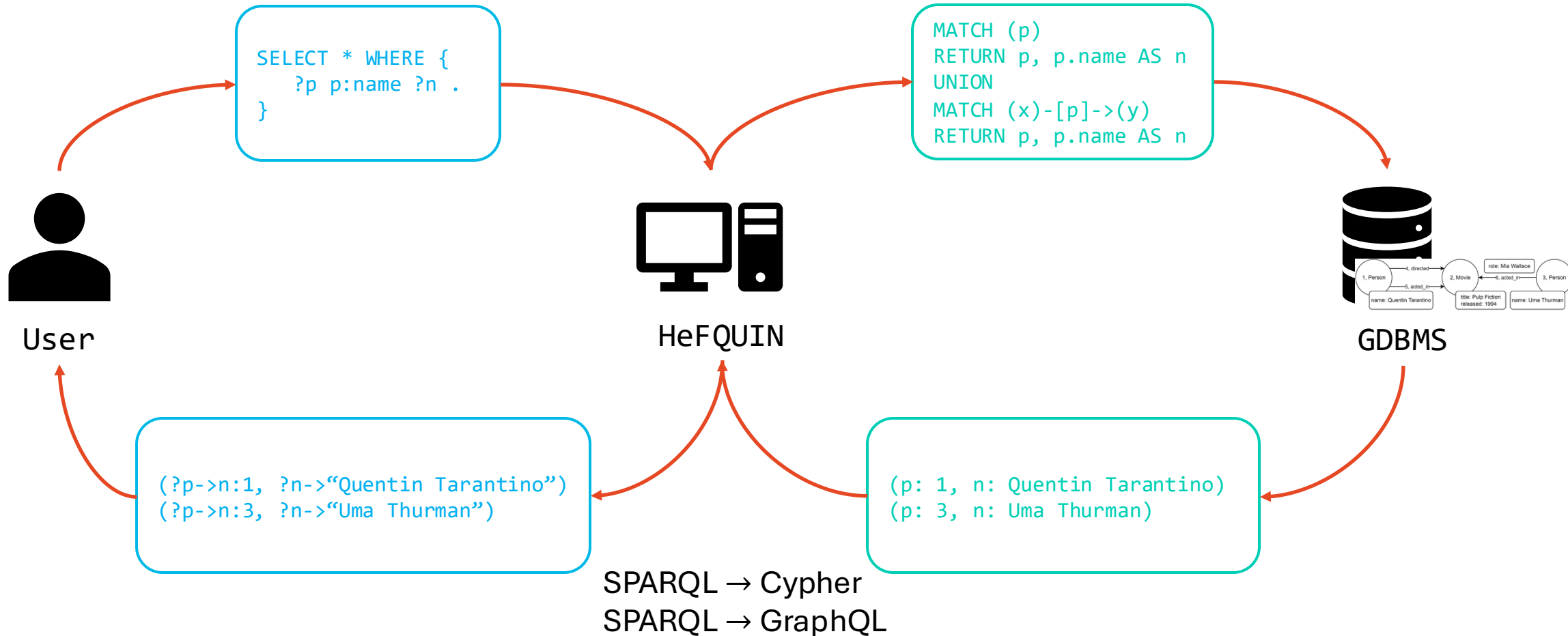
(?actor, Acts In, Pulp Fiction)

(?actor, Acts In, Pulp Fiction)

(?actor, stars in, Tiempos Violentos)

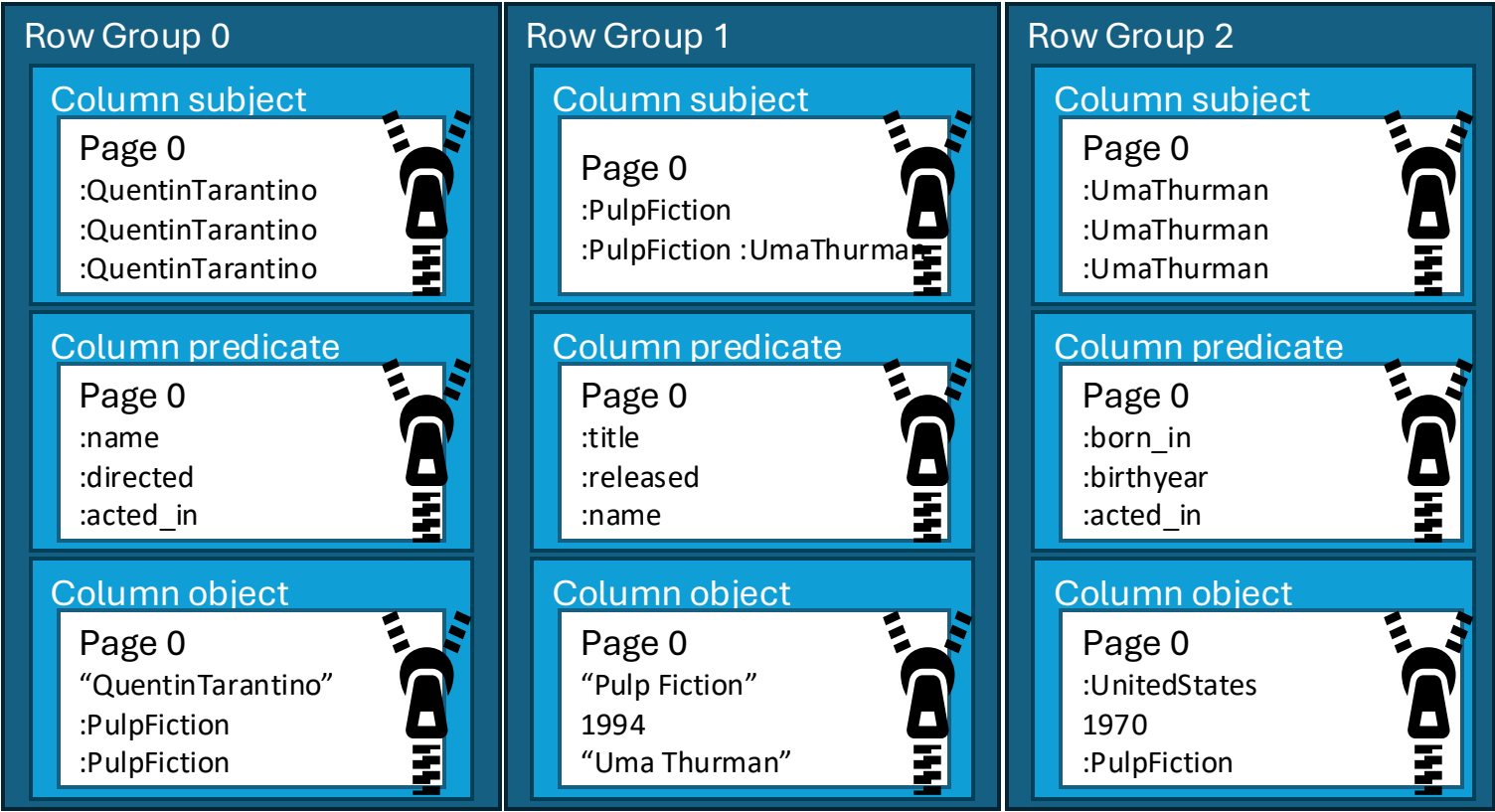
Uma Thurman

Heterogeneous Datasources



Graph (Queryable) Compression

subject	predicate	object
:QuentinTarantino	:name	"Quentin Tarantino"
:QuentinTarantino	:directed	:PulpFiction
:QuentinTarantino	:acted_in	:PulpFiction
:PulpFiction	:title	"Pulp Fiction"
:PulpFiction	:released	1994
:UmaThurman	:name	"Uma Thurman"
:UmaThurman	:born_in	:UnitedStated
:UmaThurman	:birthyear	1970
:UmaThurman	:acted_in	:PulpFiction



MillenniumDB

<https://github.com/MillenniumDB/MillenniumDB>

MillenniumDB

MillenniumDB is a **graph oriented database management system** developed by the [Millennium Institute for Foundational Research on Data \(IMFD\)](#).

The main objective of this project is to create a fully functional and easy-to-extend DBMS that serves as the basis for testing new techniques and algorithms related to databases and graphs. We support multiple graph models and query languages:

- RDF, with a fairly complete support for the SPARQL 1.1 standard. See [this document](#) for more info.
- We have two models for property graphs:
 - Property Graphs with a single edge label and directed edges only, with a custom Cypher-like language (we call this Quad Model or QM in the docs).
 - Property Graphs specified by the GQL Standard (undirected edges, 0-N edge labels), with an early implementation of GQL, still missing a lot of functionality and optimizations.

This project is still in active development and is not production ready yet, some functionality is missing and there may be bugs.

To learn more about MillenniumDB and how to use it, see our [Wiki](#).

Applications to GraphRAG

```
print(get_rag_response("who directed The Matrix movies?"))
```

The Matrix movies were directed by the Wachowski sisters: Lana y Lilly Wachowski directed the original trilogy (The Matrix, The Matrix Reloaded y The Matrix Revolutions). The fourth release, The Matrix Resurrections (2021), was directed only by Lana Wachowski.

ChatSP – An Agent helping teachers learn the new textbook methodology



PLAN NACIONAL SUMO PRIMERO

El Plan Nacional Sumo Primero, impulsado por el Ministerio de Educación junto al Laboratorio de Educación del CMM de la Universidad de Chile, busca transformar la enseñanza de las matemáticas en 1° a 6° básico mediante textos escolares de calidad, formación docente y herramientas digitales con inteligencia artificial.



1.35M

Estudiantes Beneficiados



2500

Docentes Capacitados



65

Eventos Realizados



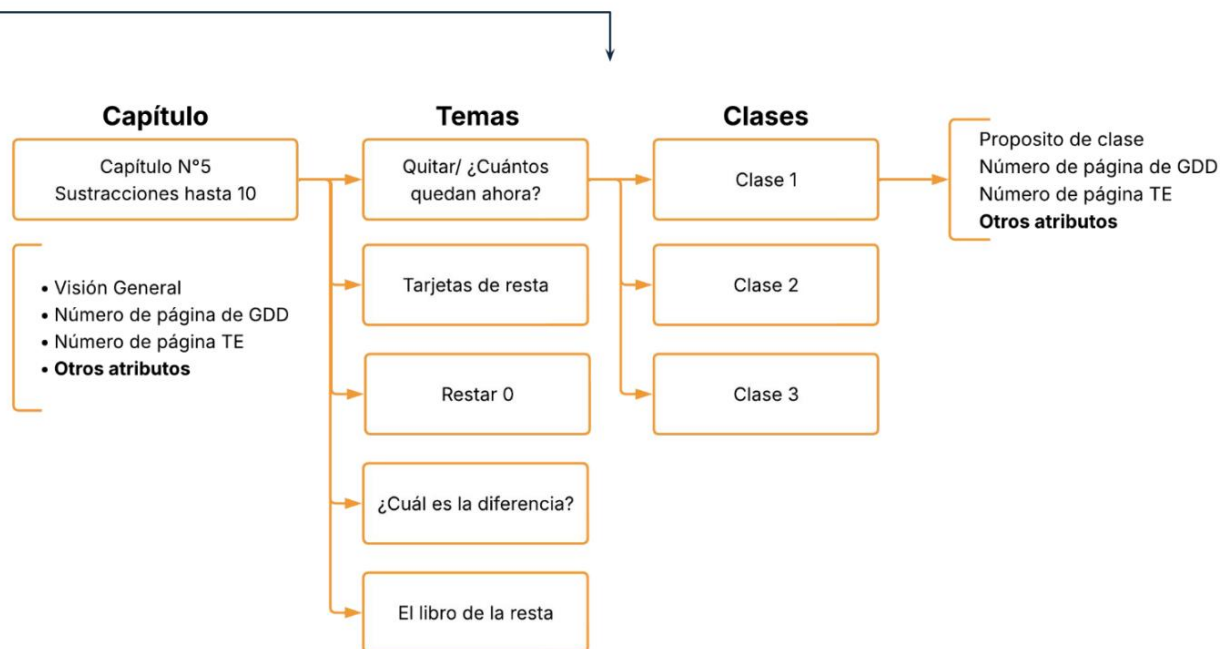
17

Socios Estratégicos

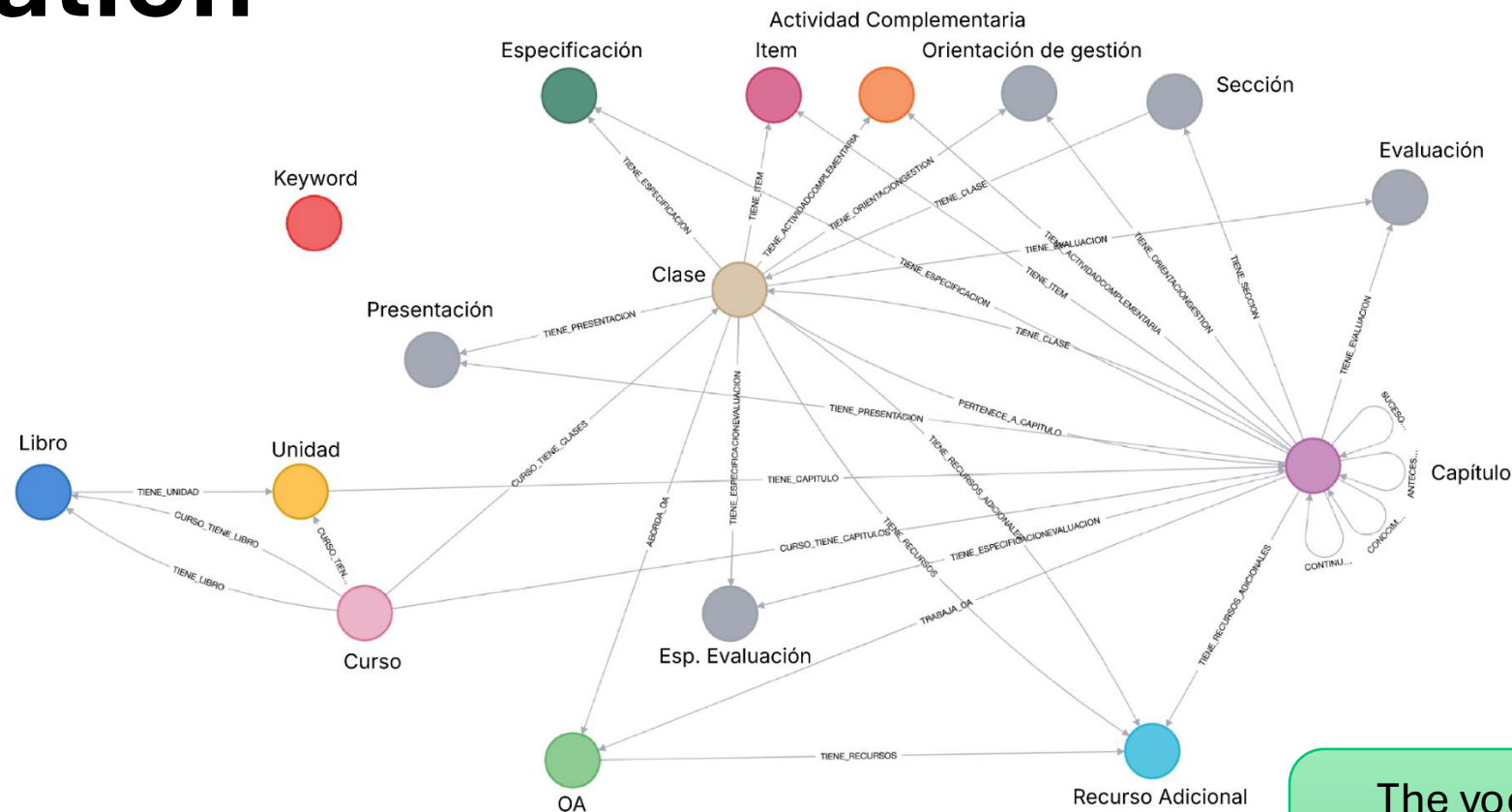
ChatSP – Graph-based Agentic AI for Education



Se extrae la información relativa a un capítulo



ChatSP – Graph-based Agentic AI for Education



The vocabulary is key for query generation: ontology is not a dirty word anymore!

ChatSP – Graph-based Agentic AI for Education

Necesito materiales para que mis estudiantes aborden perímetro en 3° básico



Para abordar el tema del perímetro en el Curso de Tercero Básico, el Capítulo N°11 titulado "Perímetro" es fundamental. En este capítulo, los estudiantes inician el aprendizaje del perímetro como medida de longitud de figuras geométricas. Se espera que analicen no solo las figuras planas convencionales, sino también todo tipo de figuras poligonales, describiendo situaciones de medición comunes en el entorno cotidiano. Además, se familiarizarán con unidades de medida del sistema métrico, como centímetros y metros. Puedes encontrar este contenido en las páginas del Texto del Estudiante: 39-56 ([Ver Texto](#)) y en la Guía Digital del Docente: 55-72 ([Ver GDD](#)).

Aquí tienes una lista de recursos adicionales para complementar el aprendizaje de este capítulo:

- **Tickets de Salida:** [Tickets de Salida para imprimir del Capítulo N°11 de 3° Básico Perímetro](#). Este documento proporciona las especificaciones técnicas de cada ticket de salida y su respuesta correcta. [Especificaciones de Tickets de Salida](#).
- **Actividad Complementaria:** [Actividad Complementaria del Capítulo N°11 de 3° Básico Perímetro](#). La gestión de esta actividad se encuentra en [Orientaciones de gestión](#).
- **Evaluación:** [Evaluación Unidad 3 de 3° básico](#). Esta evaluación abarca los capítulos N°9, N°10, N°11 y N°12. También puedes consultar la [Tabla de especificaciones de la Evaluación Unidad 3](#).



Estos recursos están diseñados para facilitar la enseñanza y el aprendizaje del perímetro, proporcionando actividades prácticas y evaluaciones que refuerzan los conceptos aprendidos en clase.



Esta conversación ha finalizado.

Selecciona una opción:

[Iniciar nueva conversación](#)

[Ir al formulario de contacto](#)

También puedes contactarnos escribiendo a chatsp@sumoprimer.cl.

Graphs Enable Client Curiosity: Graph for the American Popular Art Museum

Sort

Ascending Descending

By color: None

Filter

By color: None

Choose One

Search

- ✓ 1 WE JGDO. POLICIA LOCAL
- ✓ 1ER JGDO DE POLICIA LOCAL
- ✓ 1ER JGDO. POLICIA LOCAL
- ✓ 1ER JGDO. POLICIA LOCAL
- ✓ 1ER JGDO. POLICIA LOCAL CHILLAN
- ✓ 1ER JGDO. POLICIA LOCAL DE CHILLAN
- ✓ 1ER JUZGADO POLICIA LOCAL CHILLAN
- ✓ 1ER JUZGADO POLICIA LOCAL DE CHILLAN
- ✓ 1ER JZGO. POLICIA LOCAL
- ✓ 1ER-.J.P.L.
- ✓ 1ER-.J.P.L.
- ✓ 1ER. J. P.L. CHILLAN
- ✓ 1ER. J.P.L. CHILLAN
- ✓ 1ER. JGDO .POLICIA LOCAL CHILLAN
- ✓ 1ER. JGDO. DE POLICIA LOCAL
- ✓ 1ER. JGDO. LOCAL CHILLAN
- ✓ 1ER. JGDO. POLICIA LOCA DE CHILLAN
- ✓ 1ER. JGDO. POLICIA LOCAL
- ✓ 1ER. JGDO. POLICIA LOCAL CHILLAN
- ✓ 1ER. JGDO. POLICIA LOCAL DE CHILLAN
- ✓ 1ER. JGDO.POLICIA LOCAL CHILLAN
- ✓ 1ER. JUZGADO DE POLICIA LOCAL DE CHILLAN
- ✓ 1ER. JUZGADO DE POLICIA LOCLA DE CHILLAN

Calleuno

Sort

Ascending Descending

By color: None

Filter

By color: None

Choose One

Search

- ✓ (Select All)
- ✓ 18 DE SEPIEMBRE
- ✓ 18 DE SEPRTIEMBRE
- ✓ 18 DE SEPTIEMBRE
- ✓ 18 DE SEPTIMEBRE
- ✓ 18 SE SEPTIEMBRE
- ✓ 23 DE SEPTIEMBRE

✓ Auto Apply

Apply Filter Clear Filter

2018_2025_SOLO FONDART .xlsx

Archivo Editar Ver Insertar Formato Datos Herramientas Ayuda

100%

\$ % -0.00 123

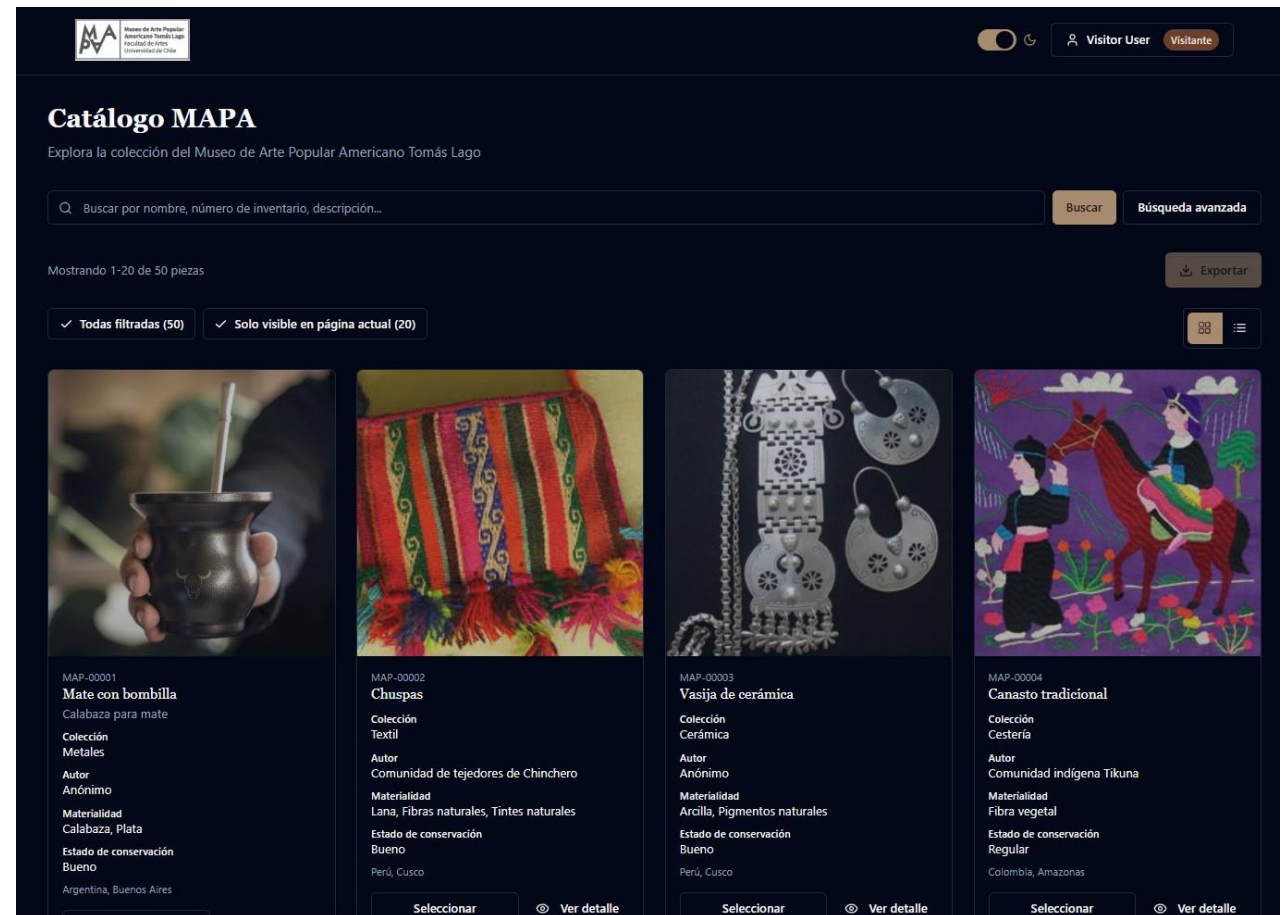
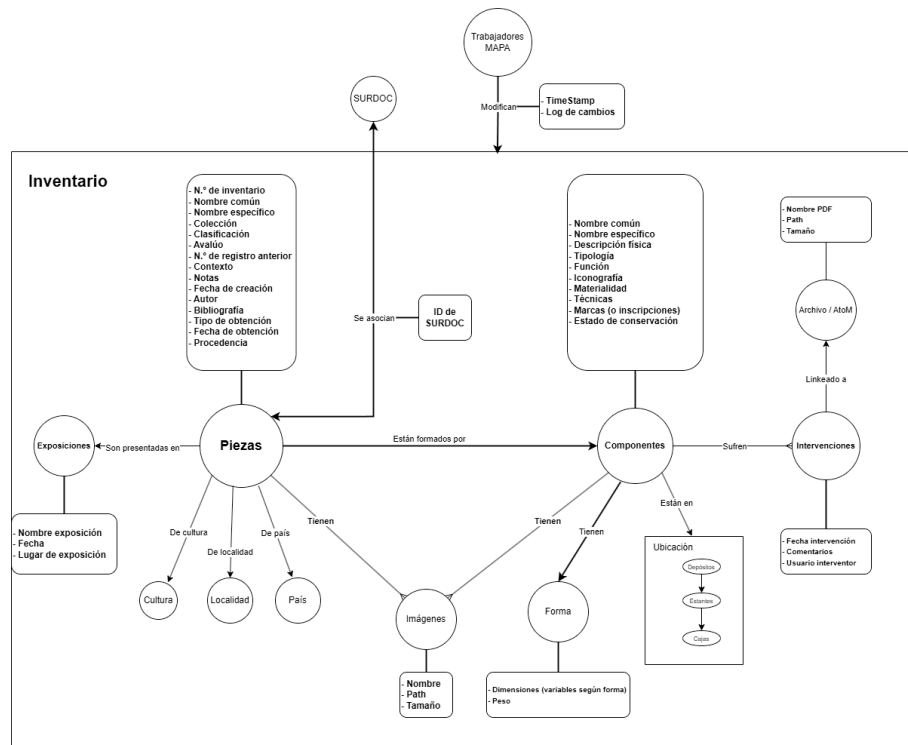
Calibri

14

B I

<

Graphs Enable Client Curiosity: Graph for the American Popular Art Museum



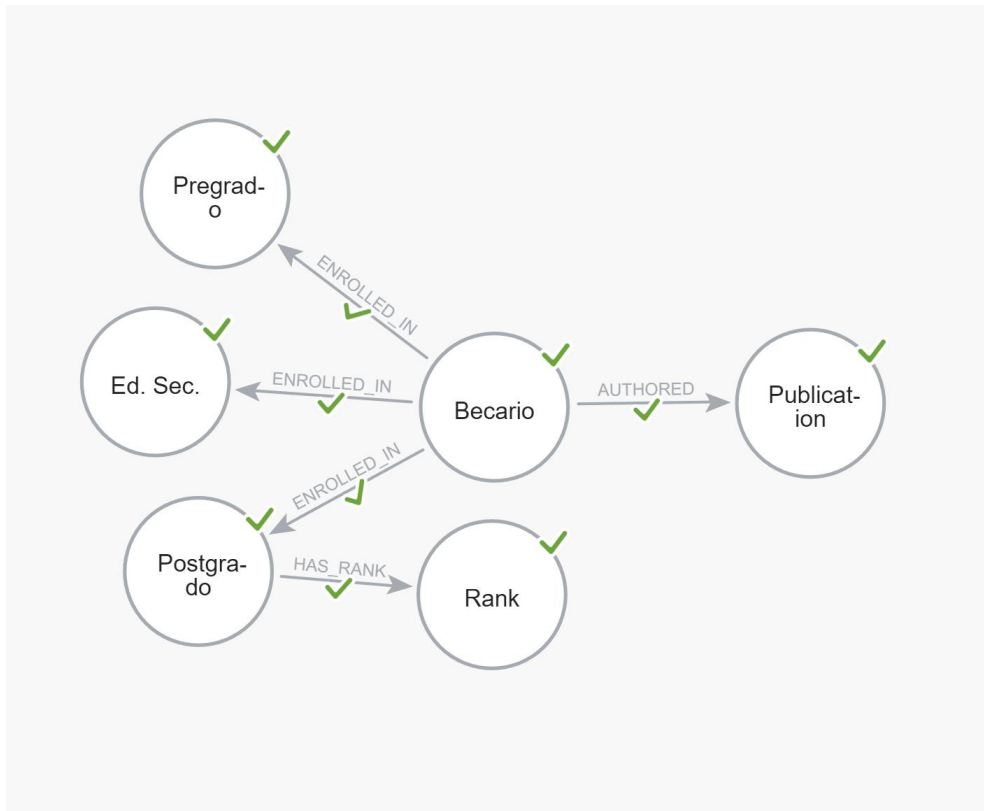
Graphs Enable Client Curiosity: Graph for the American Popular Art Museum

Can we see the history behind an artifact? what places has it visited? where has it been exhibited?

Can we get visually similar pieces grouped together?

Can we get a summary of the main common characteristics of the artifacts of a given collection? or of a given culture at a given time?

Graphs Enable Client Curiosity: A Graph to Analyze the Scientific Community

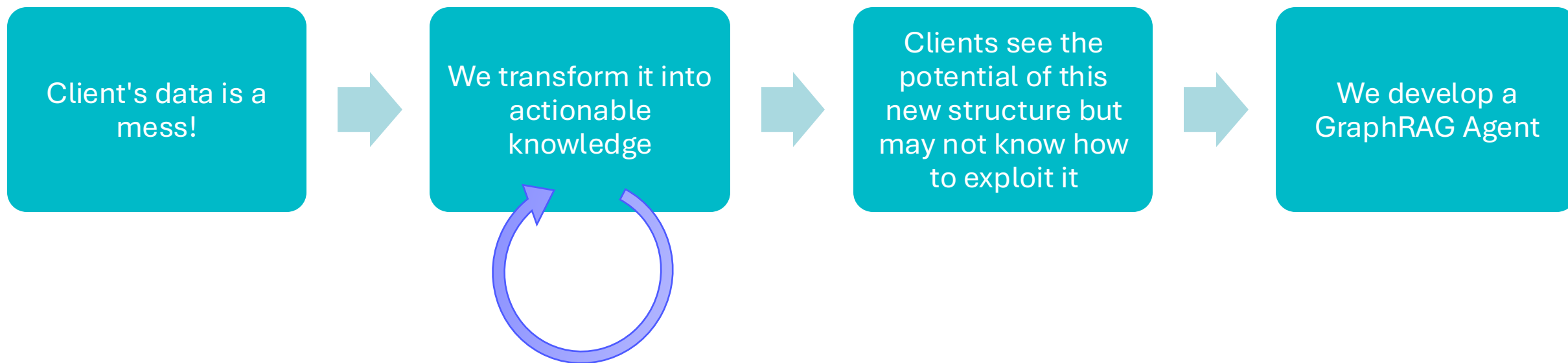


Can we see how the scientific communities are organized around topics and the existing gender and social biases?

Can we visualize the academic trajectories differentiating by gender and social class?

Who are being left out from these communities?
What context do they have in common?

Graphs Enable Client Curiosity:



Iterative modeling with the counterpart

It can also go the other way around: Agents that mimic public opinion

Generative Agent Simulations of 1,000 People

Authors: Joon Sung Park^{1*}, Carolyn Q. Zou^{1,2}, Aaron Shaw², Benjamin Mako Hill³, Carrie Cai⁴, Meredith Ringel Morris⁵, Robb Willer⁶, Percy Liang¹, Michael S. Bernstein¹

Affiliations:

¹Computer Science Department, Stanford University; Stanford, CA, 94305, USA.

²Department of Communication Studies, Northwestern University; Evanston, IL, 60208, USA.

³Department of Communication, University of Washington; Seattle, WA 98195, USA.

⁴Google DeepMind; Mountain View, CA 94043, USA.

⁵Google DeepMind; Seattle, WA 98195, USA.

⁶Department of Sociology, Stanford University; Stanford, CA, 94305, USA.

*Corresponding author. Email: joonspk@stanford.edu

Abstract:

The promise of human behavioral simulation—general-purpose computational agents that replicate human behavior across domains—could enable broad applications in policymaking and social science. We present a novel agent architecture that simulates the attitudes and behaviors of 1,052 real individuals—applying large language models to qualitative interviews about their lives, then measuring how well these agents replicate the attitudes and behaviors of the individuals that they represent. The generative agents replicate participants' responses on the General Social Survey 85% as accurately as participants replicate their own answers two weeks later, and perform comparably in predicting personality traits and outcomes in experimental replications. Our architecture reduces accuracy biases across racial and ideological groups compared to agents given demographic descriptions. This work provides a foundation for new tools that can help investigate individual and collective behavior.



We interviewed a hundred people from the south of Chile in order to train agents that would learn their political opinions

Agents that mimic public opinion

Digital Twins

MARIACAMILA31

ORIANA60

CLAUDIA37

ELANIRA39

JUAN65

PATRICIA45

ALEJANDRO29

MARTINA19

RAYEN28

SARA53

JORGE57

KATHERINE26

MIGUEL36

GENARO43

DANIEL46

IVETTE50

LEONARDA58

LEONARDO37

CAMILA37

DAVID46

DORCA51

YETTY42

CESAR

Elige un agente

CLAUDIA37

Sí, me considero feminista. Creo que es fundamental luchar por la igualdad de derechos y oportunidades para todas las mujeres, especialmente en un contexto donde la voz de las mujeres mapuches también debe ser escuchada y respetada.

Para mí, ser mapuche y feminista significa luchar por la igualdad y el reconocimiento de nuestros derechos como mujeres y como pueblo. Es un compromiso con la justicia social y la autonomía, donde ambas identidades se entrelazan y se fortalecen mutuamente.

but what do you think about the viole
think it is fair?

Mira, yo creo que la violencia no es la solución, pero hay un contexto detrás que la gente no entiende. El conflicto es político y tiene que ver con el reconocimiento de nuestros derechos. La violencia surge de la desesperación y la falta de diálogo. Es un tema complejo que no se puede simplificar a solo actos de violencia.

Elige el tipo de pregunta

Abierta

Escribe tu pregunta aquí:

Memorias usadas

Interviewer: Está muy fuerte, ¿no? Porque no no no le boto un poco la, ya el conflicto entre el estado y el pueblo mapuche. Entonces, eh, ¿cómo percibes tú este llamado conflicto? ¿Cómo lo entiendes? ¿Qué piensas de lo que has escuchado? Interviewee: es un conflicto político, ya, que tiene que ver con el control territorial, ¿ya? Y el estado como cualquier otro estado no va a ceder de esa de ese gobierno de territorial, pues. Entonces, eh va a continuar, creo yo, que este conflicto va a continuar, va a continuar hasta que ya estemos avanzados y desarrollados mentalmente como sociedad, pero va a continuar este conflicto. No veo que el estado quiera ceder ya y en sí la sociedad chilena tampoco quiere ceder porque en los propios mapuche no en su totalidad, pero un porcentaje significativo tampoco quiere tom de de derecha o que simplemente no quieren pues no quieren no más no quieren tampoco están están no están ahí con la política. no quieren ser no quieren el autónomo el estado autónomo mapuche. no lo quieren ellos quieren ser parte de Chile porque tampoco se entiende, eh, no tenemos tal vez otras experiencias de autonomía que nos pudieran servir, pues. la tenemos que construir nosotros.

Interviewer: ¿Y cuál dirías que es la principal causa de este conflicto? ¿Identificas alguna causa principal? ¿Alguna causa?. Interviewee: Sí. El no reconocimiento de la población mapuche, de la población indígena con derechos y autonomía. O sea, de partida tendríamos que el pueblo mapuche por la cantidad de población mapuche. Ya si solo vemos a los datos de los apellidos, ni siquiera es de que porque nosotros somos Neira, pero por de mi papá tenemos sentencia mapuche. Ya. Entonces, si tú me preguntas, ¿se considera chileno mapuche? Aquí todos somos mapuche. Todos, todos. Hasta los cabricos, mi hermano, todo, todo, todos somos mapuch. Ya, pero sí hay tendríamos que tener representación en el Congreso, sí o sí. Tendríamos que tener escaños reservados, ¿sí? Por la cantidad de población. Nueva Zelanda, por ejemplo, Nueva Zelanda tiene ya nosotros tendríamos que tener representación. Entonces, perdón, mientras no haya eh reconocimiento por el estado, vamos a tener seguir teniendo estos problemas, ya porque hay hay cosas que son que los winc no entiende que tiene que ver por ejemplo con los sitios sagrados. Con los sitios sagrados. El otro día yo veía, no es que un helicóptero se metió al Guillat y se estacionó ahí y la gente decía, "Pero, ¿qué es? Si un pedazo de tierra no es un pedazo de tierra, es un espacio ceremonial y según la como Visión Mapucha hay un dueño tiene vida, cosas que la ciencia no puede explicar todavía, pero no se puede no más. Entonces, para que continuemos con este trato amable intercultural, Carabineros no tendrían que en ningún por ninguna razón estacionarse ahí con su helicóptero y para eso ellos también tendrían que tener un mapa donde esté estos son los guillatues, estos son los menocos que tampoco lo tienen porque no están obligados a tenerlo. Entonces si tuvieran reconocimiento carabineros, es que igual tienen que existir los pacos, si es algo

Agents that mimic public opinion

The idea then is to be able to summarize "live" what the agents have to say regarding current political topics. In particular, in presidential debates.

How can this be done in a fair way?

How to handle agents that cannot produce an answer?

Agents that mimic public opinion

CLAUDIA37

No, no creo que Kast pueda resolver estos problemas. La política actual está llena de discriminación y colonialismo, y no veo que él tenga la disposición para cambiar eso. Necesitamos un enfoque que reconozca y respete a los pueblos indígenas, y eso no lo veo en su agenda.

No sé, pero creo que es importante que la gente se organice y exija sus derechos. La historia nos ha enseñado que la lucha por la justicia no es fácil, pero es necesaria.

Lamentablemente, no tengo información para responder eso.

do you think that Kast will solve these issues?

what about Jara?

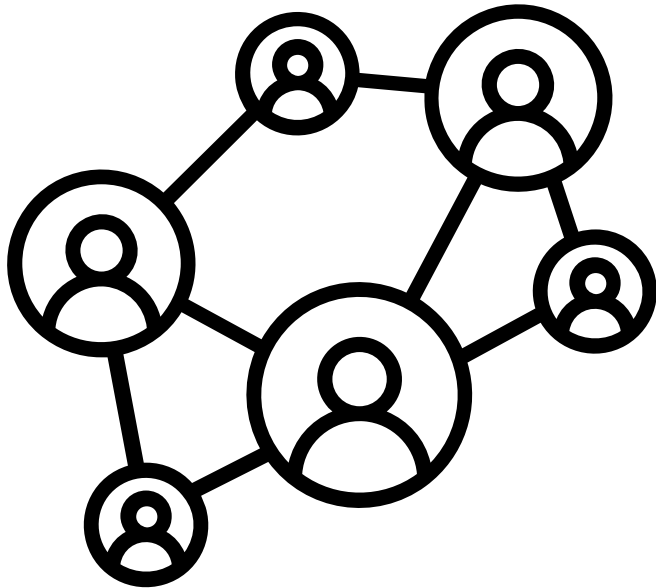
but what do you think, specifically, about Jeanette Jara?

The agent correctly associates Kast to right wing politics, which go against the beliefs of the agent

However, it doesn't recognize nor associates the name of the leftist candidate to anything it knows

But what would an agent with similar beliefs than this one answer?

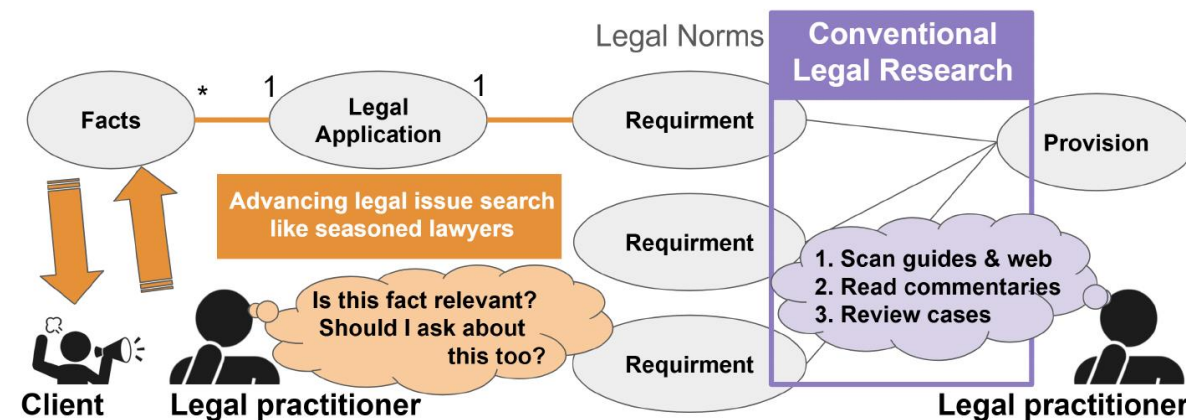
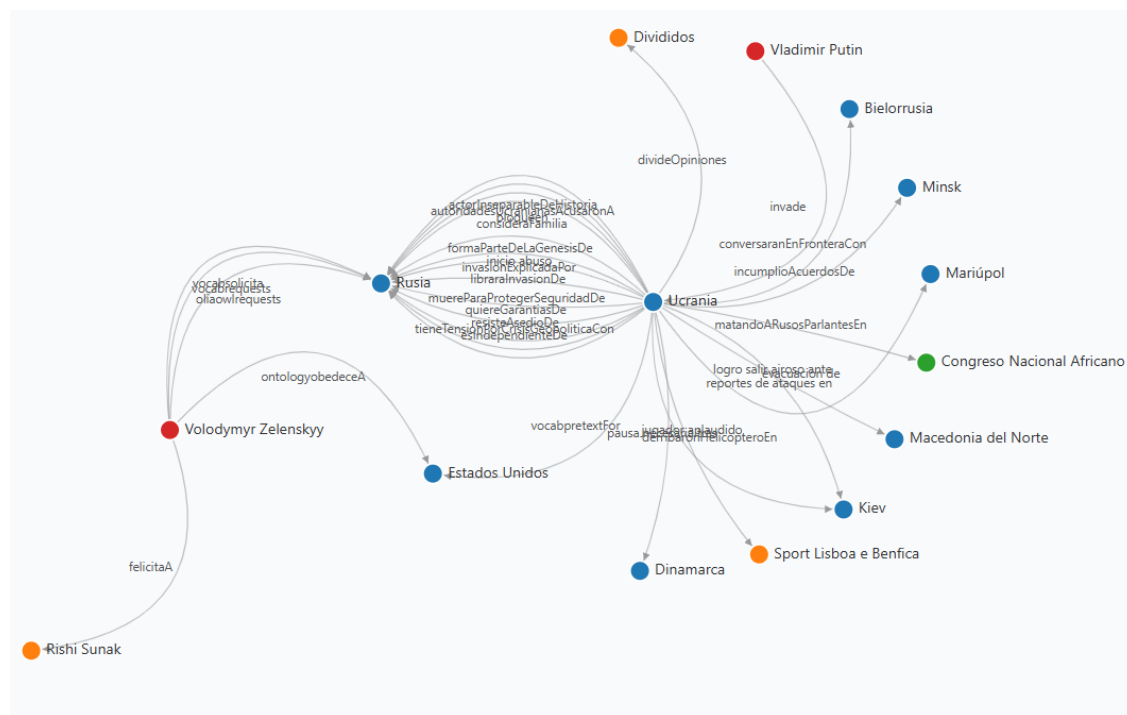
Agents that mimic public opinion



We are testing adding an agent similarity graph. Maybe disaggregated by topic, so that we can predict what an agent can say based on the opinions of similar agents

We are also testing what further context could be useful in such graph (localization, political affiliation, religion, etc.)

Creating Structured Knowledge from Unstructured Data



A graph-based agent for fact retrieval of court cases [2]

Extracting a context graph from news to aid with retrospective journalism analysis and querying [1]

[1] Undergrad thesis of Jessica Gajardo, supervised by me.

[2] R. Kondo et al. Capturing Legal Reasoning Paths from Facts to Law in Court Judgments using Knowledge Graphs (2025). To appear in Proceedings of the International Knowledge Capture Conference

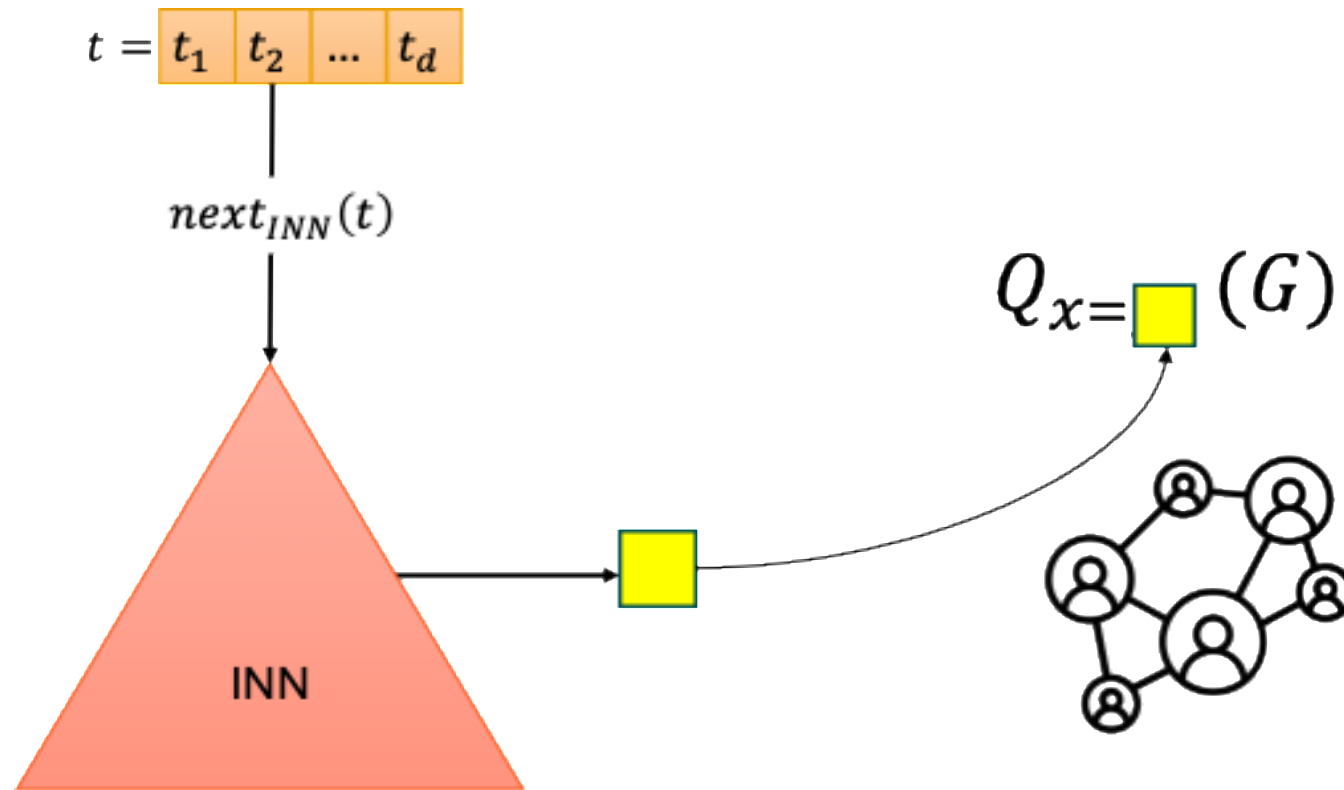


The Road Ahead

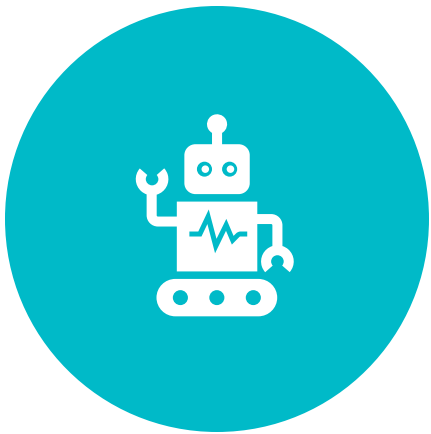
where do we go from here?

*Systems, evaluation and architecture
challenges ahead!*

Systems – Hybrid Indexing



Systems – Planning for Hybrid Queries



OPTIMIZATION OF HYBRID
QUERIES, WHEN TO USE THE
DIFFERENT PHYSICAL OPERATORS



PARAMETER TUNNING BASED ON
STATISTICS



HEURISTIC OPTIMIZER AND
PLANNER

Systems – Incremental updates



INCREMENTAL KG
CONSTRUCTION



INCREMENTAL RE-
INDEXING



INCREMENTAL
EMBEDDING REFRESH



INCREMENTAL
CONSISTENCY
VERIFICATION

Evaluation – Multimodal Reasoning

Agents now retrieve:

- text
- images
- structured entities
- temporal facts
- embeddings

But we don't have evaluation tasks or datasets that test *whether the agent integrates THEM ALL coherently*.

Evaluation – Temporal Grounding

I gave a hard time to ChatGPT for not handling too well time-sensitive information, but this is hard. Even in graphs, Temporal Knowledge Graphs and their embeddings are HARD



Architecture – Reading from the graph

The agent needs to:

- accurately create and issue prompt-relevant KG queries
- combine graph patterns with vector retrieval in a non-standard query language
- serialize and interpret results
- ground answers in structure

Architecture – Writing

Are the agents even allowed to add or update information to the graph!? If so, when?



Architecture - Maintaining memory



PRIORITIZE
QUERIES



CACHE RESULTS



CACHE
INTERMEDIATE
RESULTS



MEMORIZE
VOCABULARIES



MEMORIZE QUERY
PATTERNS

Many, many more...



Schemas



Temporal and event-based structure



Localized information



Versioning, context-dependent facts



Handling uncertainty

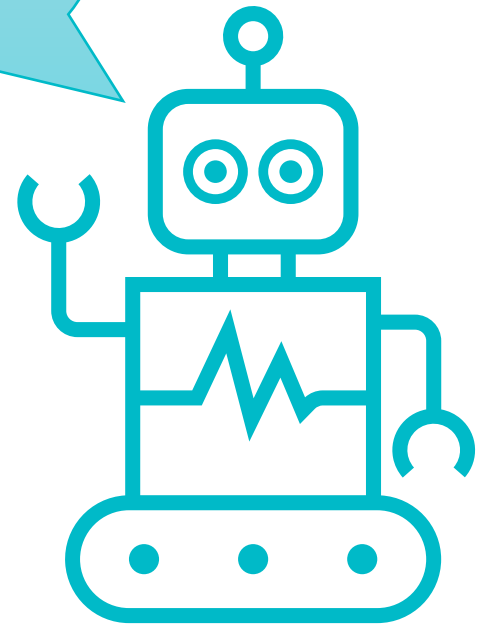


Viewpoints, contradictions, truth

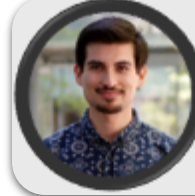


Memory, Meaning, and Machines

I'm not meant to
memorize
everything!



Takeaways



Email: sebastian.ferrada@uchile.cl

Website: <http://sferrada.com>



The KG community has spent 20 years building infrastructure for knowledge representation, capture and management, let's use it. **Don't memorize, query**



Ontologies are fundamental for automatic query generation, don't fear them!



We can find structure, and knowledge, in multimedia. Don't ignore it!



Graphs Enable User/Client Curiosity, when they see their semantics represented



We need to keep building efficient, scalable systems to keep Graph-based agents working