

AI BUILDERS SUMMIT

WORKSHOP

AI Agents



Amy Hodler

Founder | Consultant |
Graph Evangelist
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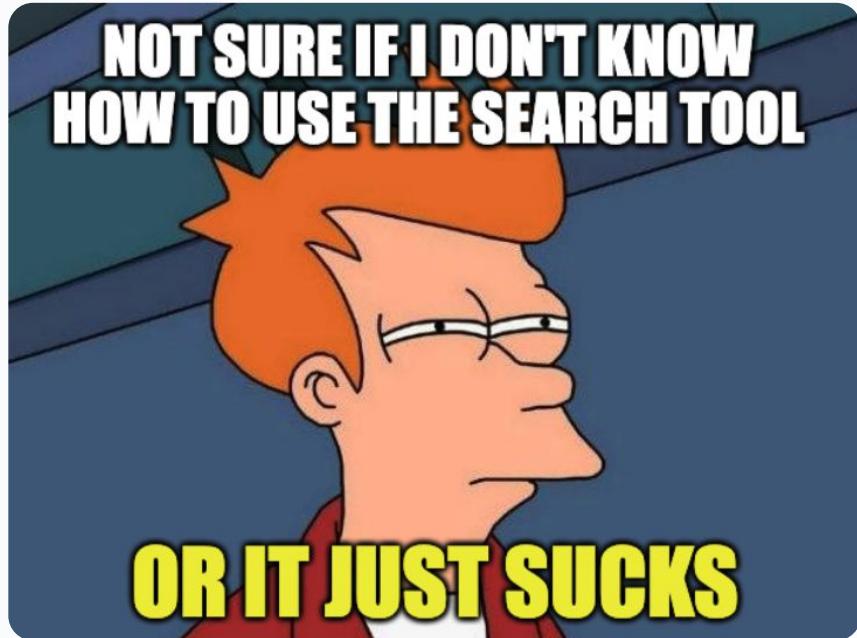
David Hughes

Principal Data & AI Solution
Architect
Enterprise Knowledge

Advancing GraphRAG: Multimodal Integration with Associative Intelligence

VIRTUAL JAN 15 - FEB 6

Knowledge Retrieval



**Slow
Inaccurate
Incomplete
Unexplainable**

And getting worse

LLMs & GraphRAG

We're Supposed to Give Us the Answers!



Today's GraphRAG is good at adding guardrails but **is tossing out:**

Latent image data

Interwoven data types
 $(1+1=3)$

Associative detail

LLMs & GraphRAG

We're Supposed to Give Us the Answers!



Google search gave us a bunch of **sink** photos



5315 Zelzah Ave APT 4, Encino,
CA 91316 | Zillow



Heavy Flow - Album by Tween Queens | Spotify

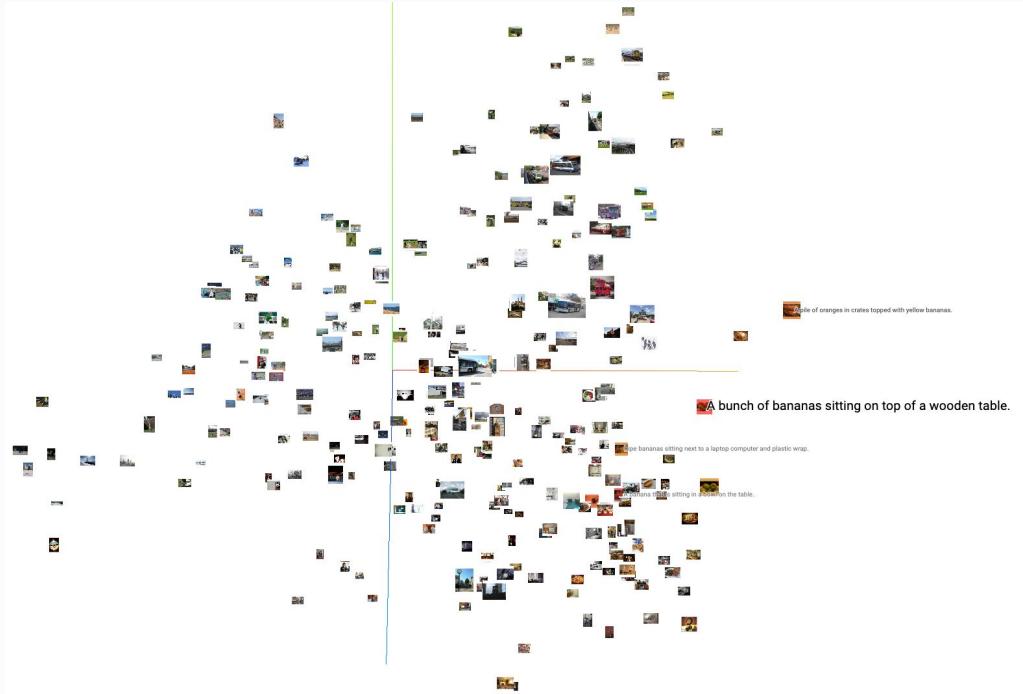


Booking.com

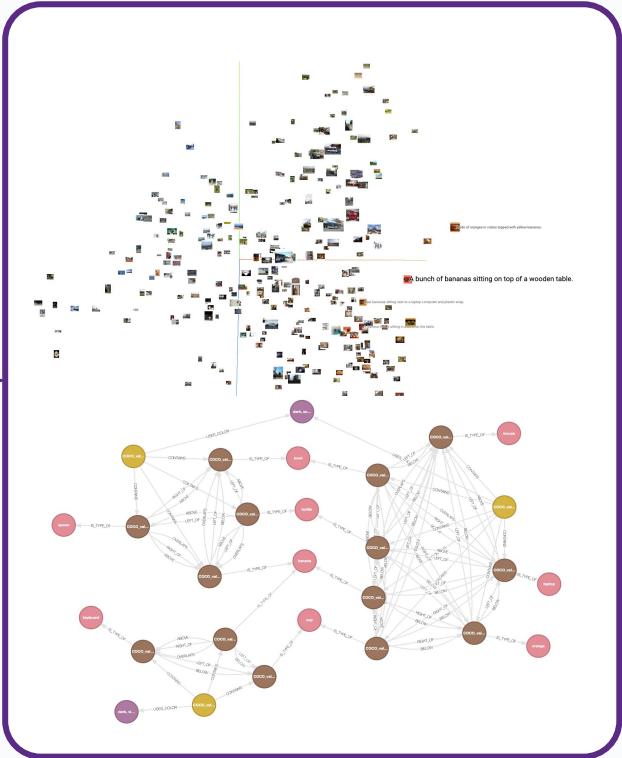
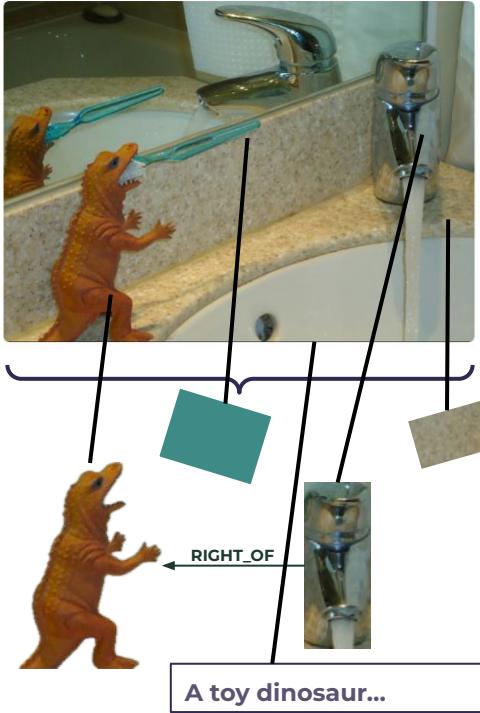
Claude thought it was a **joke about T-Rex** having short arms

Both missed the toothbrush

The Role of Images in RAG



Multimodal Search: Semantics + Reasoning!?



Search Images

Find images with basins

Search

Image with sink

These images contain sinks located in bathrooms

Image with sink

Multimodal GraphRAG provides Associative Intelligence



mmGraphRAG breaks down components that can be explored (texture, spatial placement, etc) individually or together

Blending of semantic context and data (text, visual, etc) enables reasoning across multiple levels of abstraction and associations

Next Several Mins...

Advancing GraphRAG



David Hughes

Principal Solution Architect
Advanced Data Services and Enterprise AI

ENTERPRISE KNOWLEDGE



Amy Hodler

Graph Advisor
Founder, Executive Director

GraphGeeks



Demonstrate how
mmGraphRAG works.
(Sensory GraphRAG?)



Highlight the integration of
vision models,
hypervectors, and **graph**
databases.



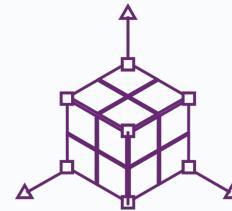
Introduce **BAML for AI
Development**



Walk through **Notebook
for Associative Search**

mmGraphRAG

mmGraphRAG in a Nutshell



Decomposition

Break down images into subcomponents

Generate captions

Graph

Components and subs are loaded into a graph

Preserve context

Embedding Space

Space with anchors created for global search in the graph

Basis of semantic search

Multimodal Context

Provide blended results to LLMs for full context of text and images

High Fidelity Reasoning *Within Components*

Are there ships with similar marketings or surface wear nearby?

What are the kinds of ships in the image and are they moving together or apart?



Contextual Understanding

Precision Object Recognition

Nuanced Similarity

Graph Reasoning

Explainability

Notable Uses

Geospatial Analysis

Search satellite or aerial images for specific features
“buildings with red roofs near water”

Surveillance & Security

Identify similar objects or scenarios based on context, spatial relationships, and object features

Medical Diagnostics

Search images for specific markers or abnormalities based on features, spatial relationships, & annotations

IP Search

Compare new designs against existing patents by identifying visual & textual similarities while preserving privacy

Recommendations

Enhance product search results by integrating embeddings & relational data

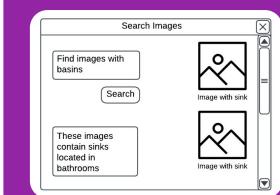
“Cheap shovels with a yellow handle”

Archival Data Management

Find & catalog images from historical archives based on complex visual features and captions

Architectural Layers

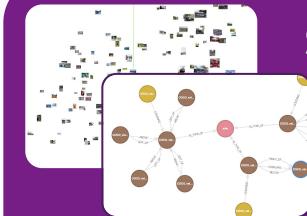
Presentation Apps



Query and Explain

- Vector similarity searches on images
- Graph queries retrieve contextual details on similar images
- LLMs generate explanations linking results to user queries

Semantics



Semantic and Graph Construction

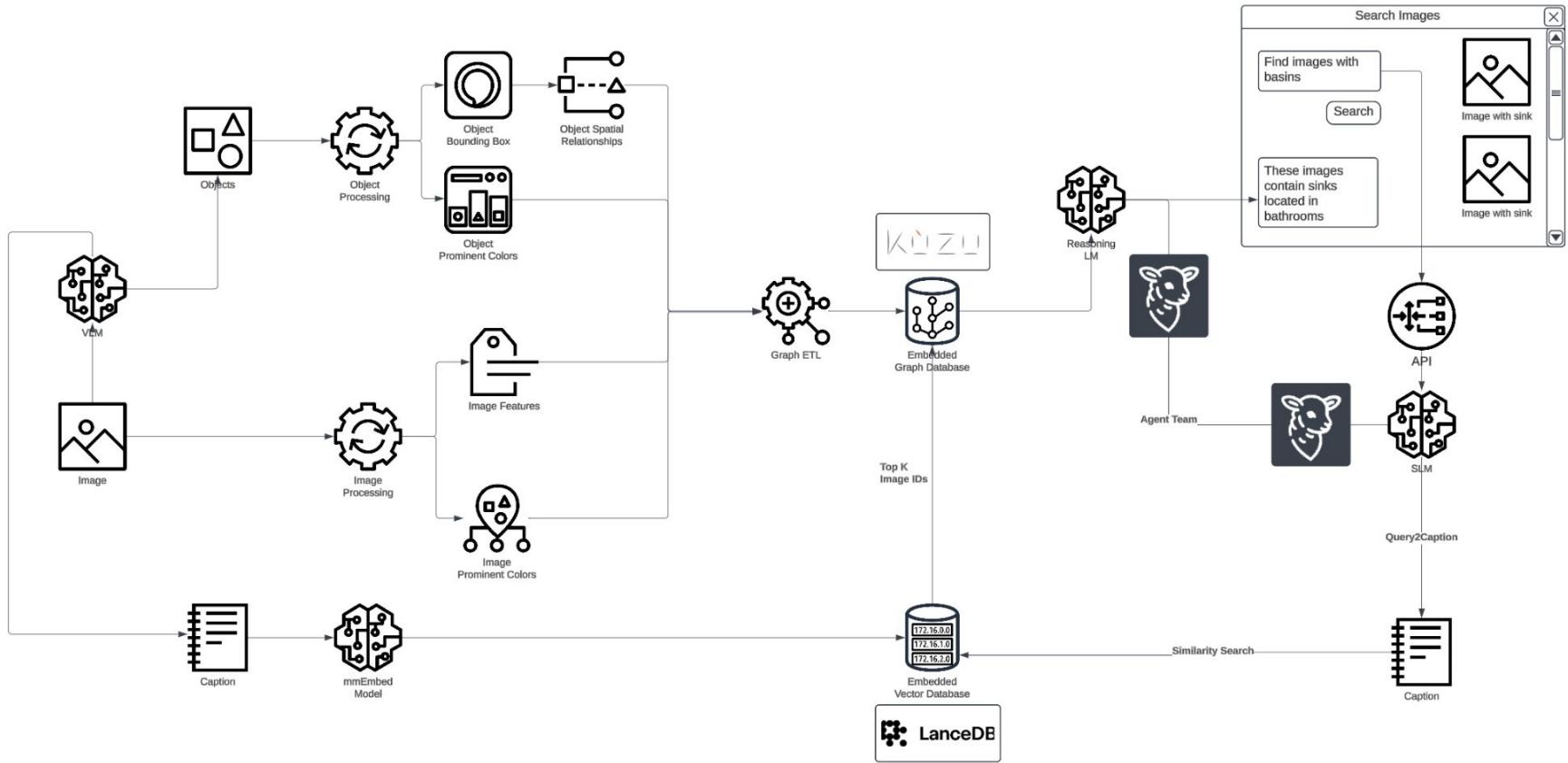
- Load hypervectors & relationships into vector & graph DB
- Connect nodes representing image features, metadata, & text-based context

Data Sources



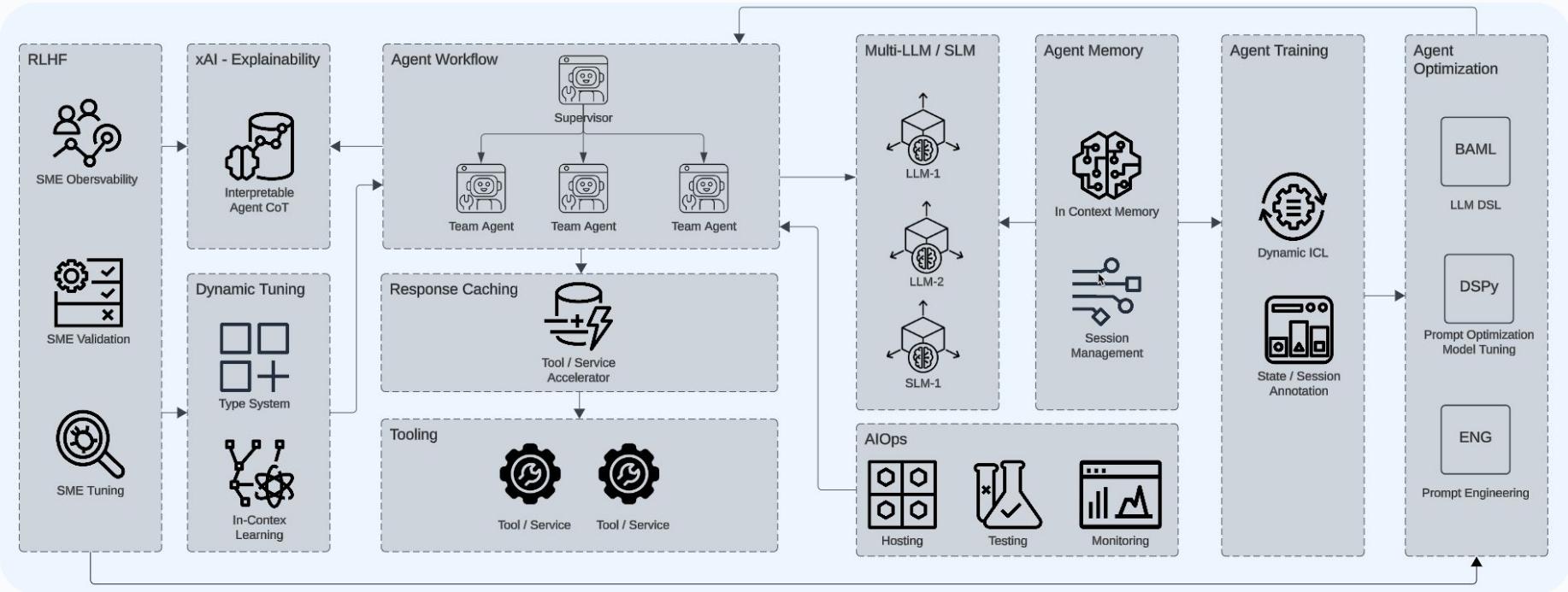
Data Extraction and Embedding

- Visual features extracted using pretrained models
- Features converted into hypervectors for high-dimensional encoding



Detailed Architecture

(:Agents)-[:ORCHESTRATED_IN]->(:Lamb)



The Semantic & Graph Layer

Semantic Layer | Associative, Local

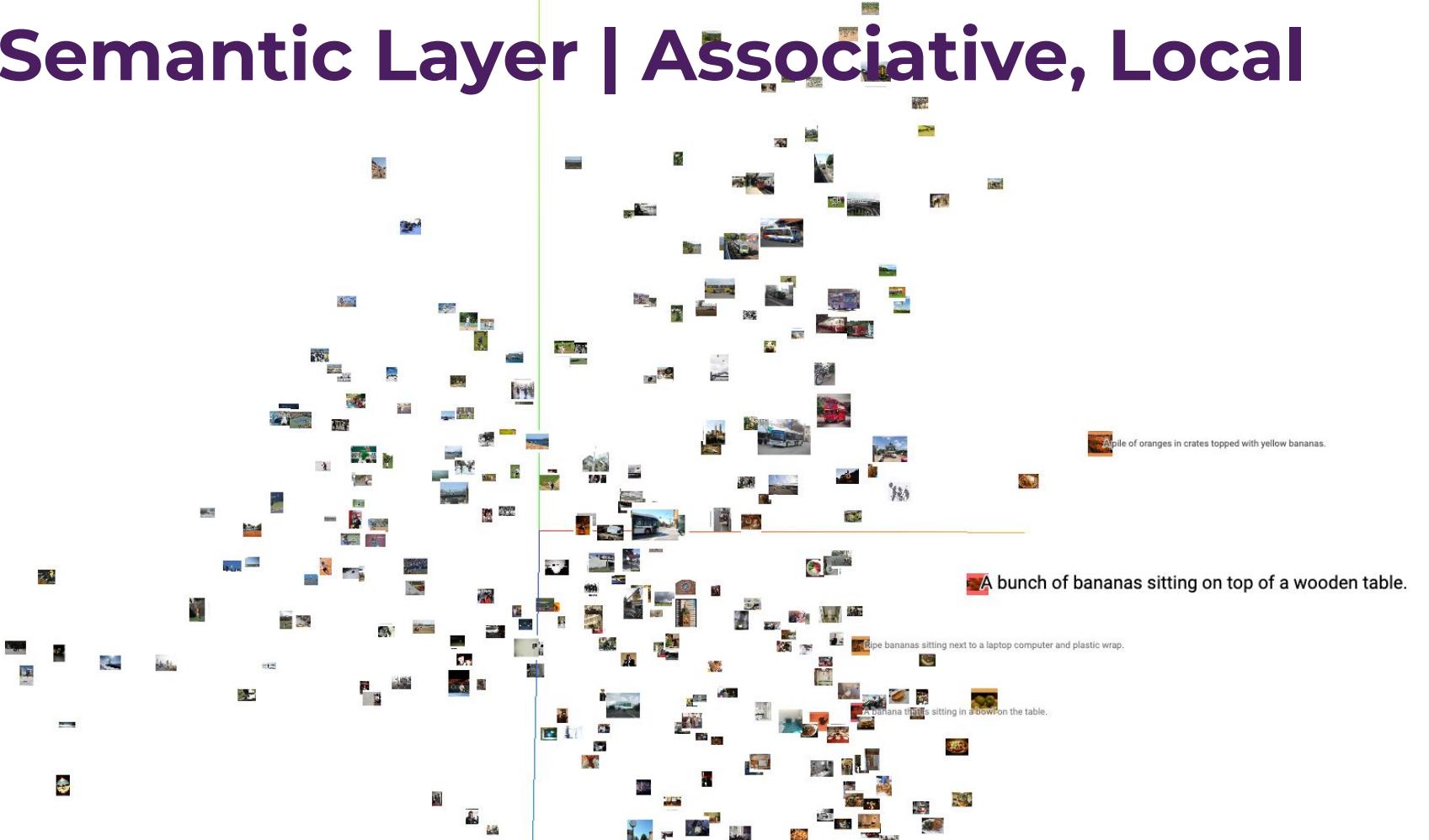


Image Graph | Discrete, Global

Each node can have multiple spatial relationships

Properties can
be qualitative or
dominance
scores

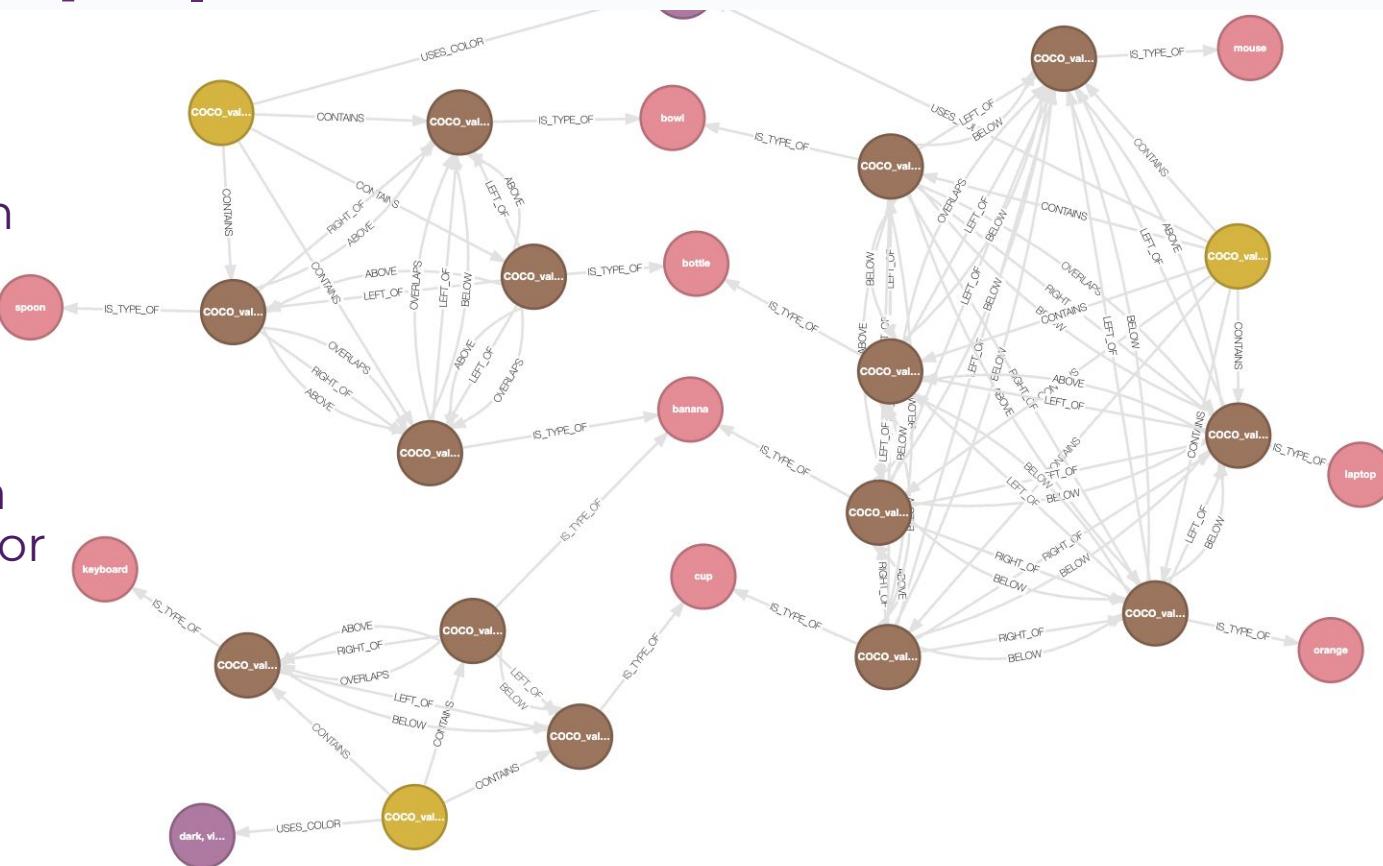
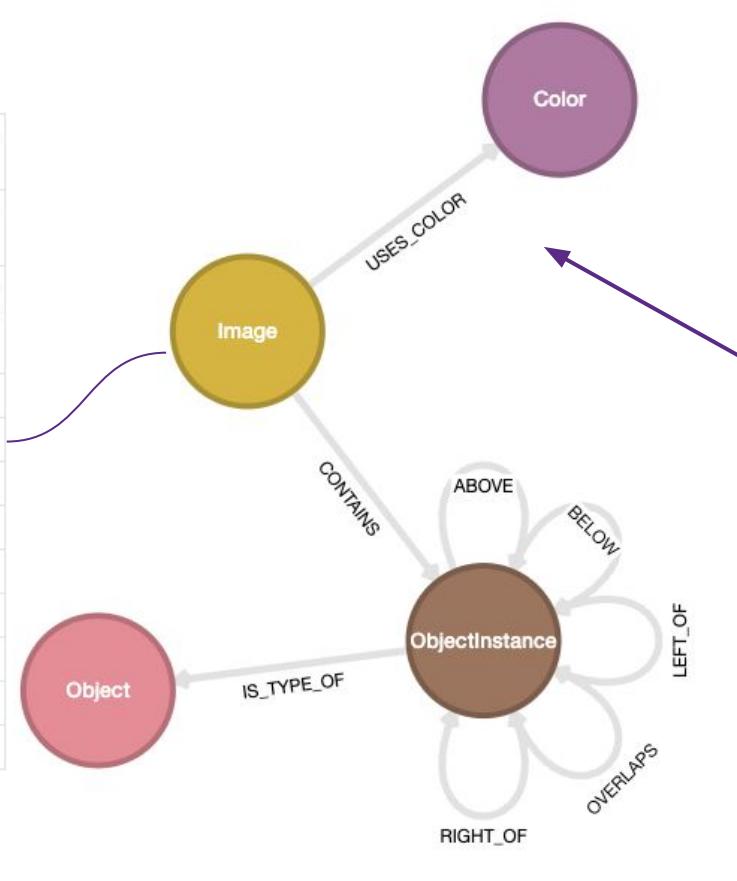


Image Graph

id <small>PK</small>	COCO_val2014_000000000208.jpg
name	COCO_val2014_000000000208.jpg
caption	A toy dinosaur standing on a sink next to a running faucet.
complexity_value	12759
complexity_description	highly complex
texture_value	42.90502166748047
texture_description	smooth
sharpness_value	1603.90087890625
sharpness_description	sharp
lightness_value	124.84366607666016
lightness_description	balanced
pattern	geometric patterns



E.g.
color present,
major color,
minor color,
dominant color
score

Follow Along

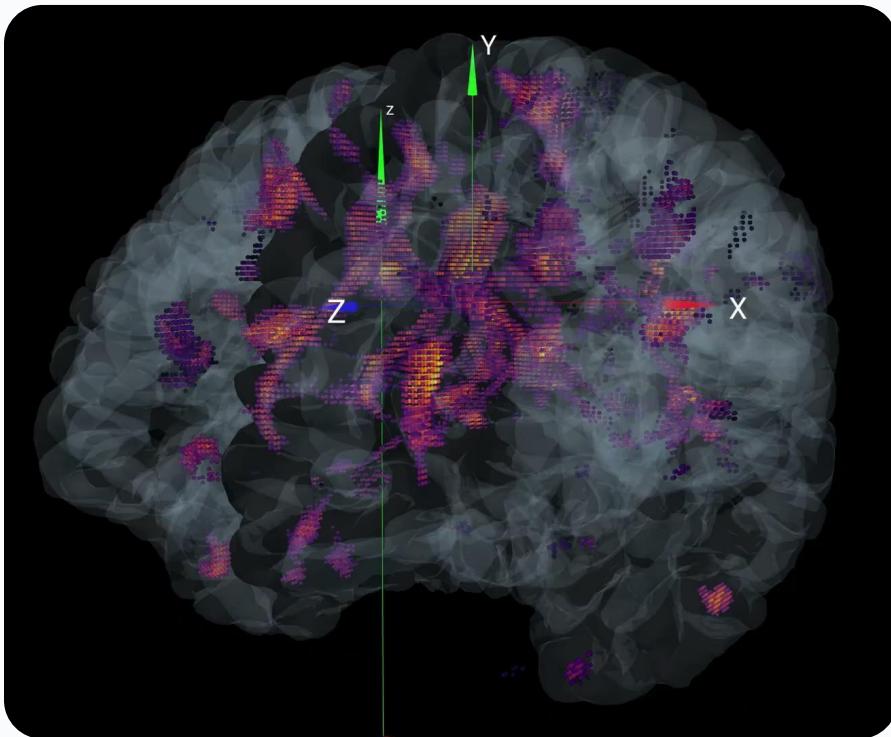
Notebook for Associative Search

bit.ly/3WMdVx1

Future Directions

BrainGraph

Using Latent Data and Graph Analytics



Medical images consist of 3D pixels called voxels.
Voxels are nodes in a graph with neighbors.



Communities of voxels can represent anatomical structures, or abnormalities like tumors. **Evolution in the graph** can represent disease progression or treatment response.

Please Reach Out



Q&A



David Hughes

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