

## Research objectives

- Answer to a query accessing to external knowledge.
- Personalize the answers based on user preferences or information.
- Continually update the external source of knowledge.
- Ground the answers.

## Continual Learning

- Ability of a model to learn from a sequence of tasks without forgetting the previous knowledge.
- Catastrophic forgetting is the degradation of performance on previously learned concepts when training sequentially on new data.

## Document representation & retrieval

- How to encode documents and the relationships between them?
- How to train a GNN to effectively capture the graph topology?
- How to continually keep the knowledge updated?

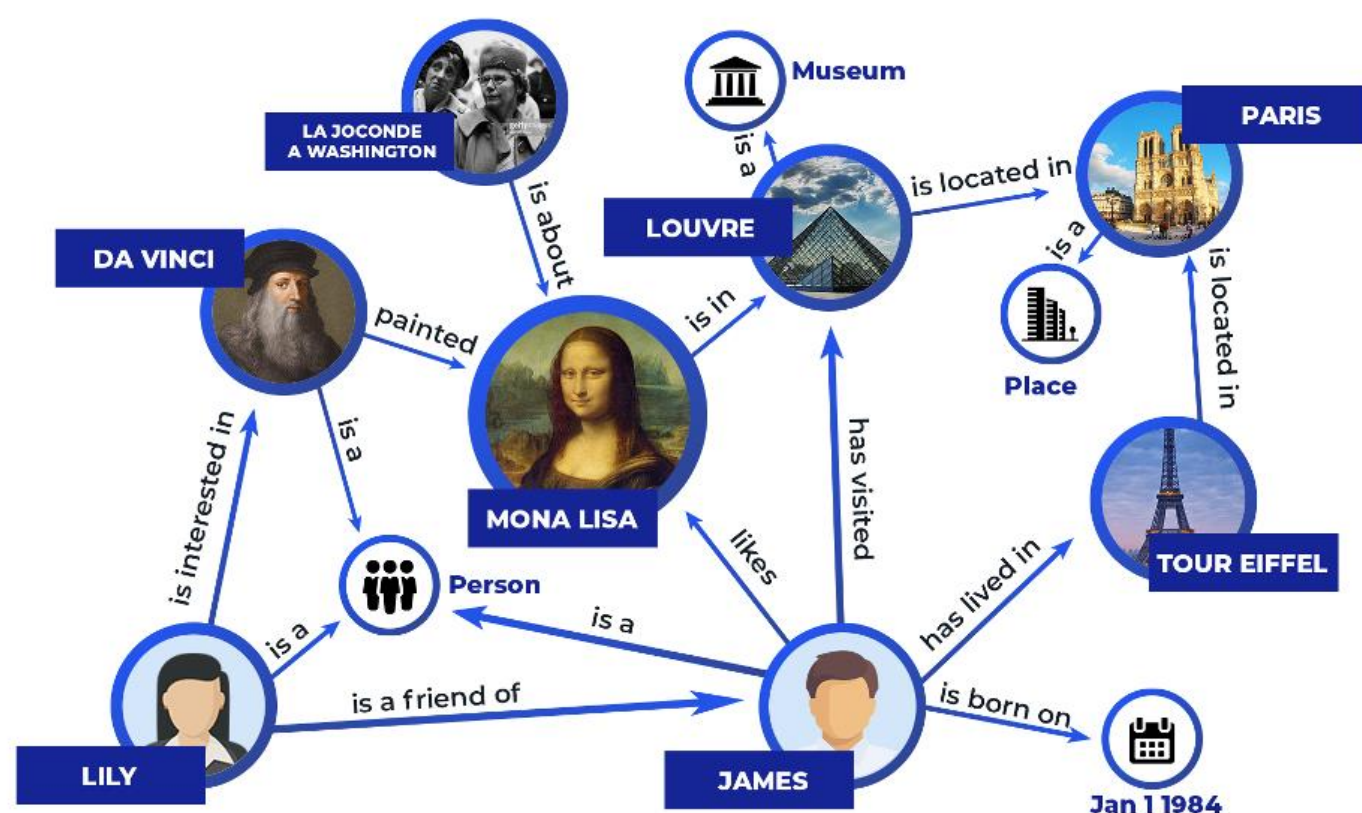
## Answering

Gemini

- A language model provide the answer based on the query and the additional input context.
- How to verify if the answer is correct? LM suffer of hallucinations.
- How to provide the grounding for the information provided?

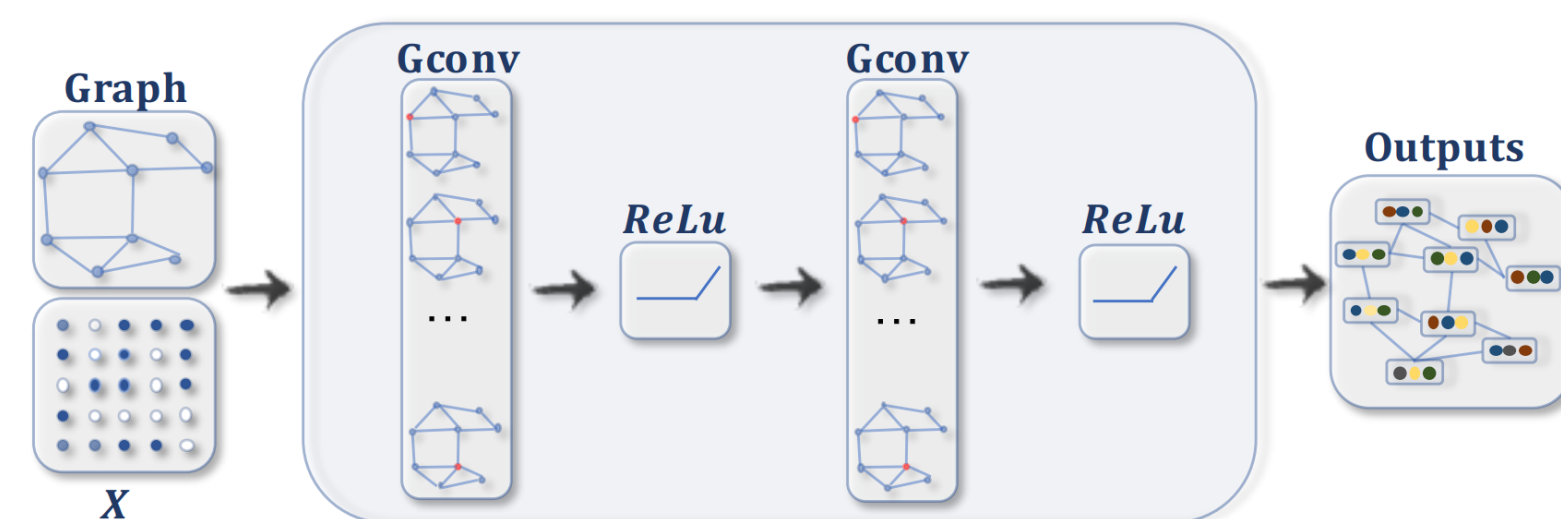
Stanford Alpaca

## Knowledge Graph



- A KG is a structured representation of information.
  - $KG = \langle V, E \rangle$ , where:
    - $V$  is the set of entities.
    - $E \subseteq V \times R \times V$ .
    - $R$  is the set of relations.

## Graph Neural Network



- GNNs are neural networks designed to work on data represented as graphs.
- A graph can be defined as a tuple  $G = \langle V, \mathcal{E}, X, E \rangle$ 
  - $V$ : nodes,
  - $\mathcal{E} \subseteq V \times V$ : edges,
  - $X$ : node features,
  - $E$ : edge features.

## Chain of Thoughts

- Roger has 5 tennis balls. He buys 2 more cans Of tennis balls. Each can have 3 tennis balls. How many tennis balls does he have now?
- Roger has started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls.  $5 + 6 = 11$ .

## Customized answer

- Does my company have to comply with all health and safety provision of law n°...?
- Yes, because you have a construction company with more than 100 employees.

## Answer motivation

- What effect does bone marrow stromal cell-conditioned media have on...
- The effect of bone marrow stromal cell-conditioned media (SCM)...
- We found that T-cells did not exhibit significant alterations in their surface expression...