Enhancing Knowledge Graph Embeddings with Ontological Information

Elvira Amador-Domínguez, Ontology Engineering Group
Universidad Politécnica de Madrid, Spain

eamador@fi.upm.es
@elviamador

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Outline

1. Brief introduction to Knowledge Graph Embeddings
2. Usages of Knowledge Graph Embeddings
3. The fresh entity introduction problem
4. Developed solution
5. Conclusions
6. Future work

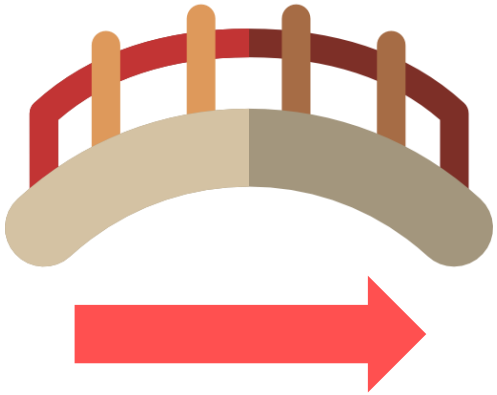
What are Knowledge Graph Embeddings?

Symbollic representations

- *Ontologies*
- *Knowledge graphs*
- *Texts*

…

Embedding models!

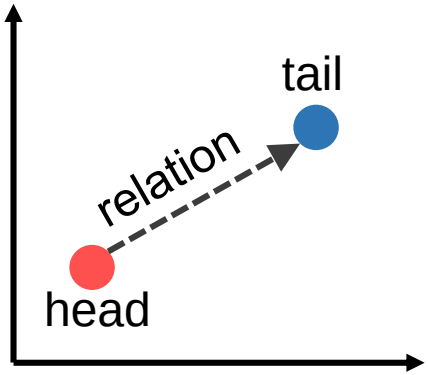


Subsymbollic representations

- *Probabilistic representations*
- *Matrices*
- *Vectors*

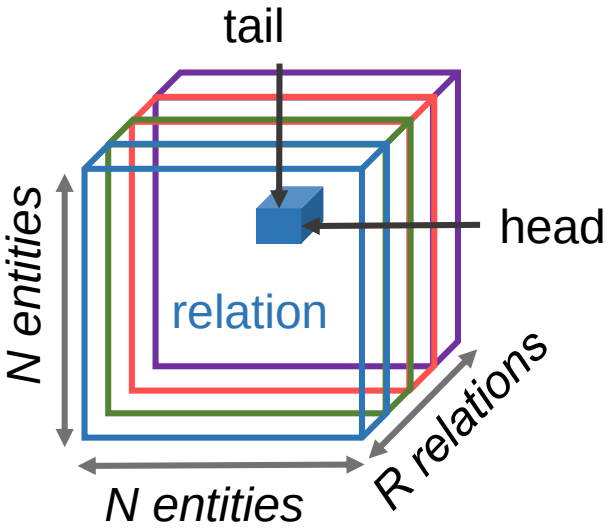
…

- Translation-based



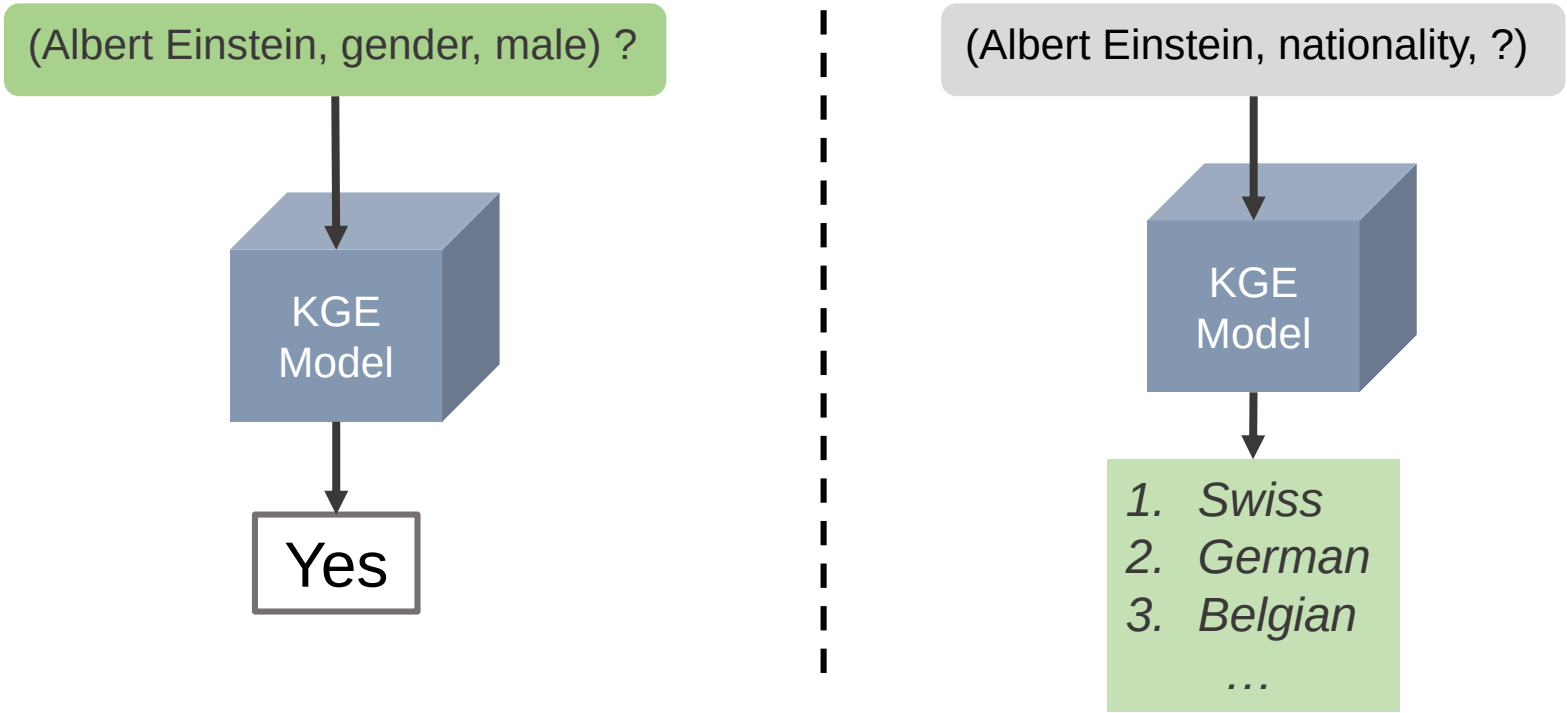
$$f(h,t) = \|h + r - t\|_{1/2}$$

- Semantic matching



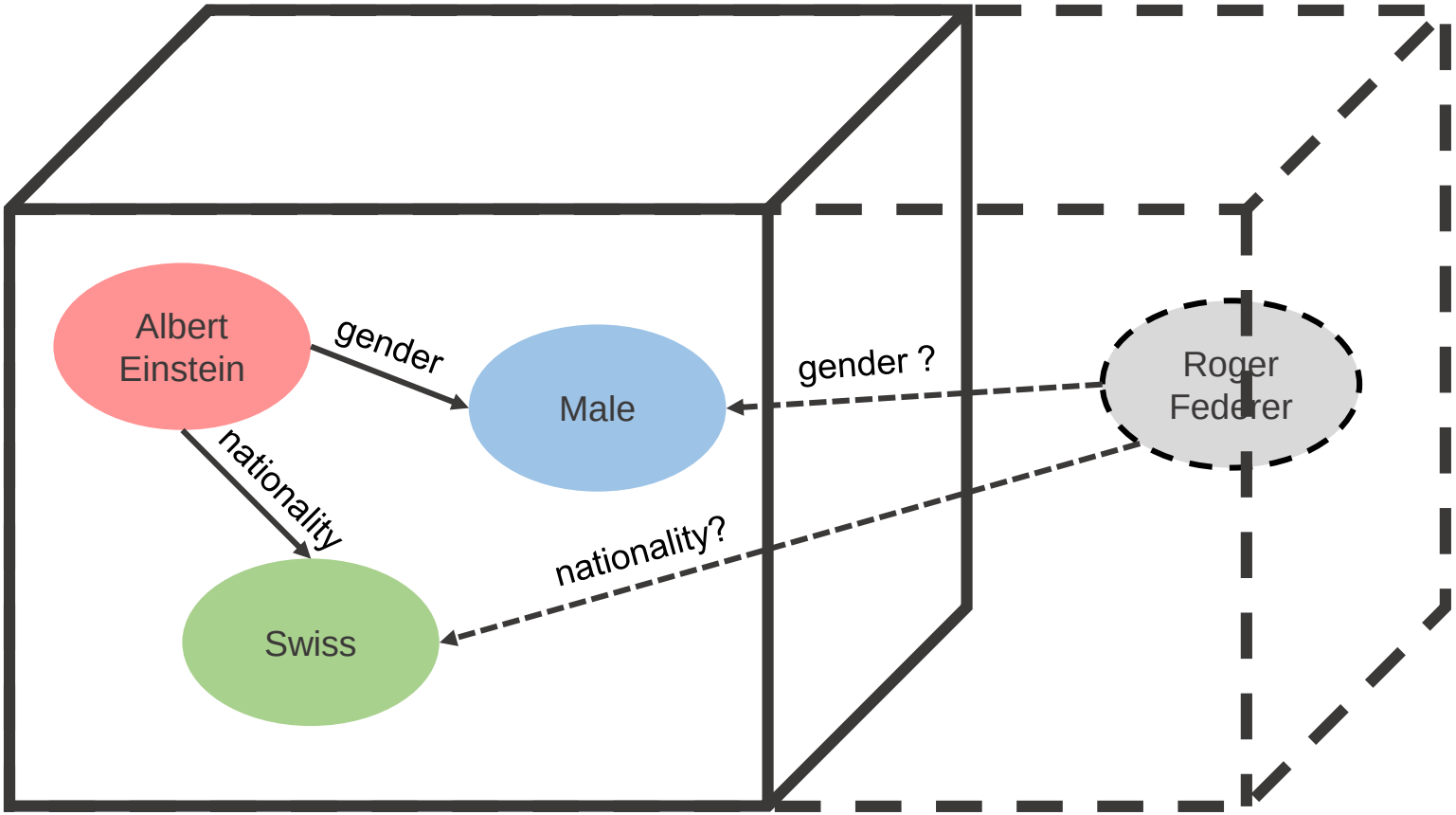
$$f(h,t) = h^T M_R t$$

- Triple classification:
  - *Is this fact feasible or not?*
- Triple prediction:
  - *What is the relation that best joins these two entities?*
  - *What is the missing part of this fact?*

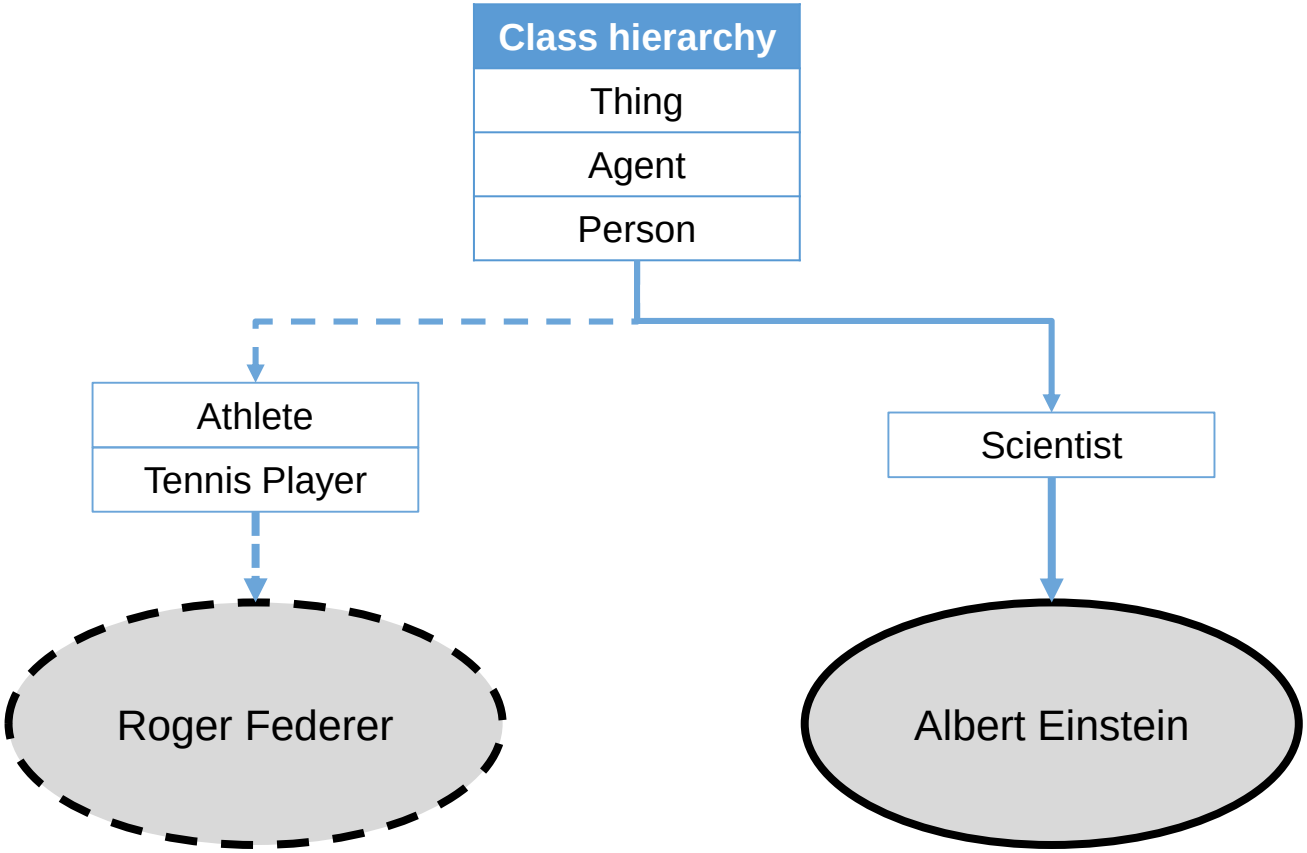


The fresh entity introduction problem

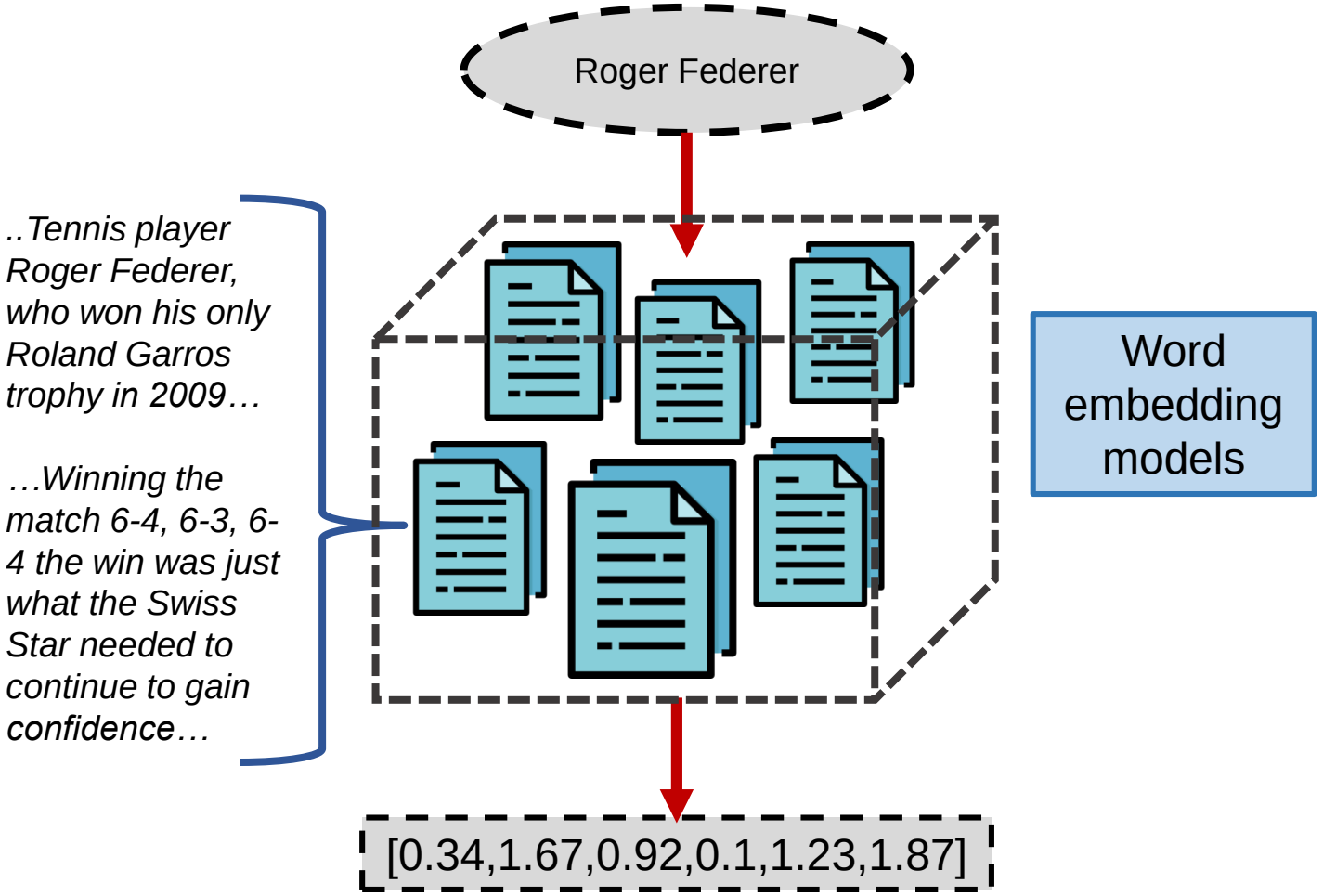
There is no valid representation!



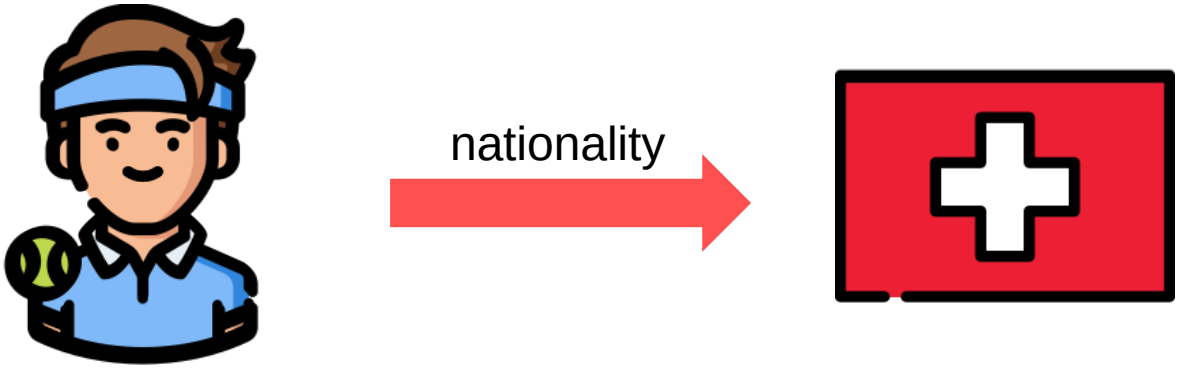
1st Question: *Is there any information that is shared between existing and new entities?*

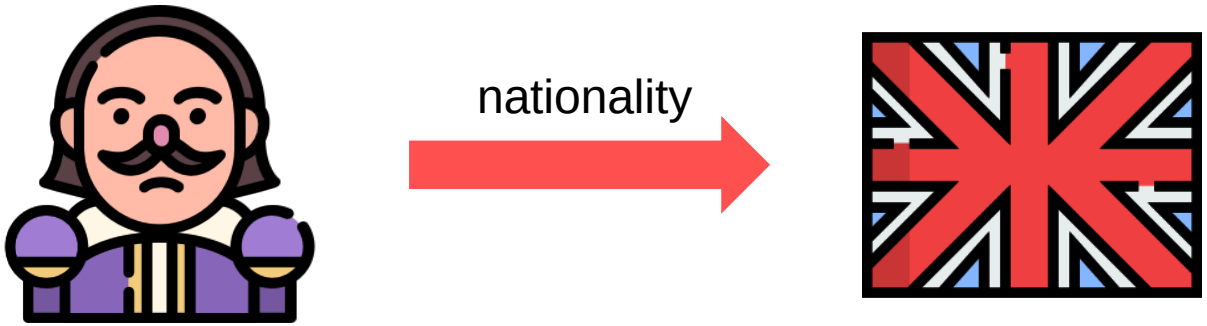


2nd Question: *Is there any embedding model capable of providing a representation for an unseen entity?*



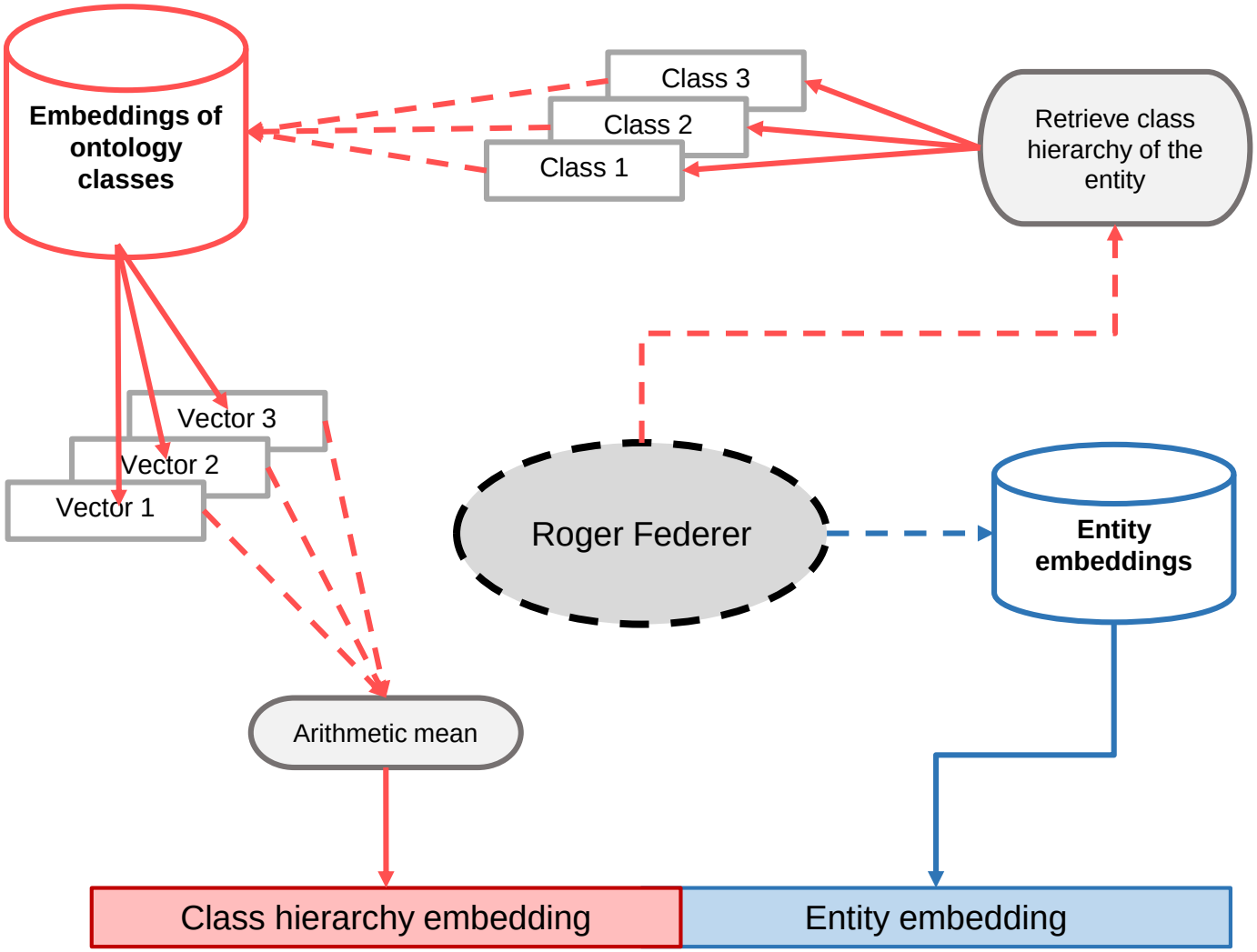
3rd Question: *Are there general restrictions about relations?*



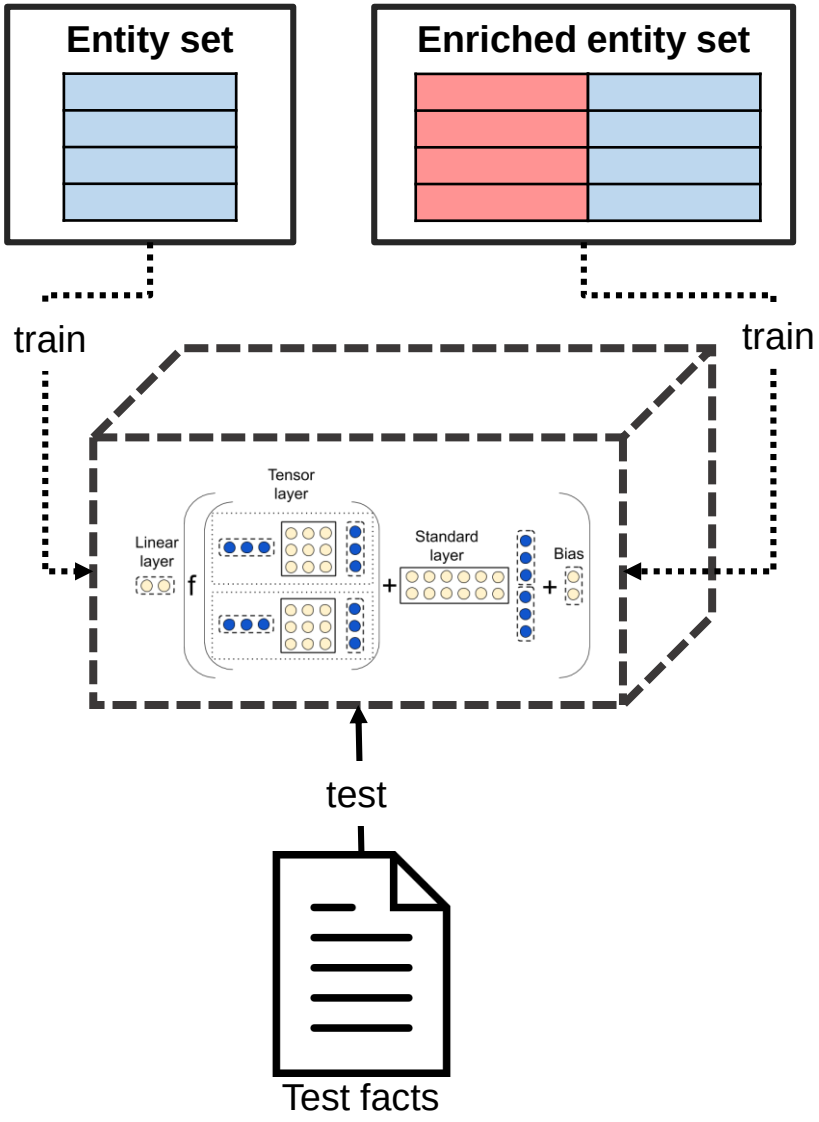


Proposed solution

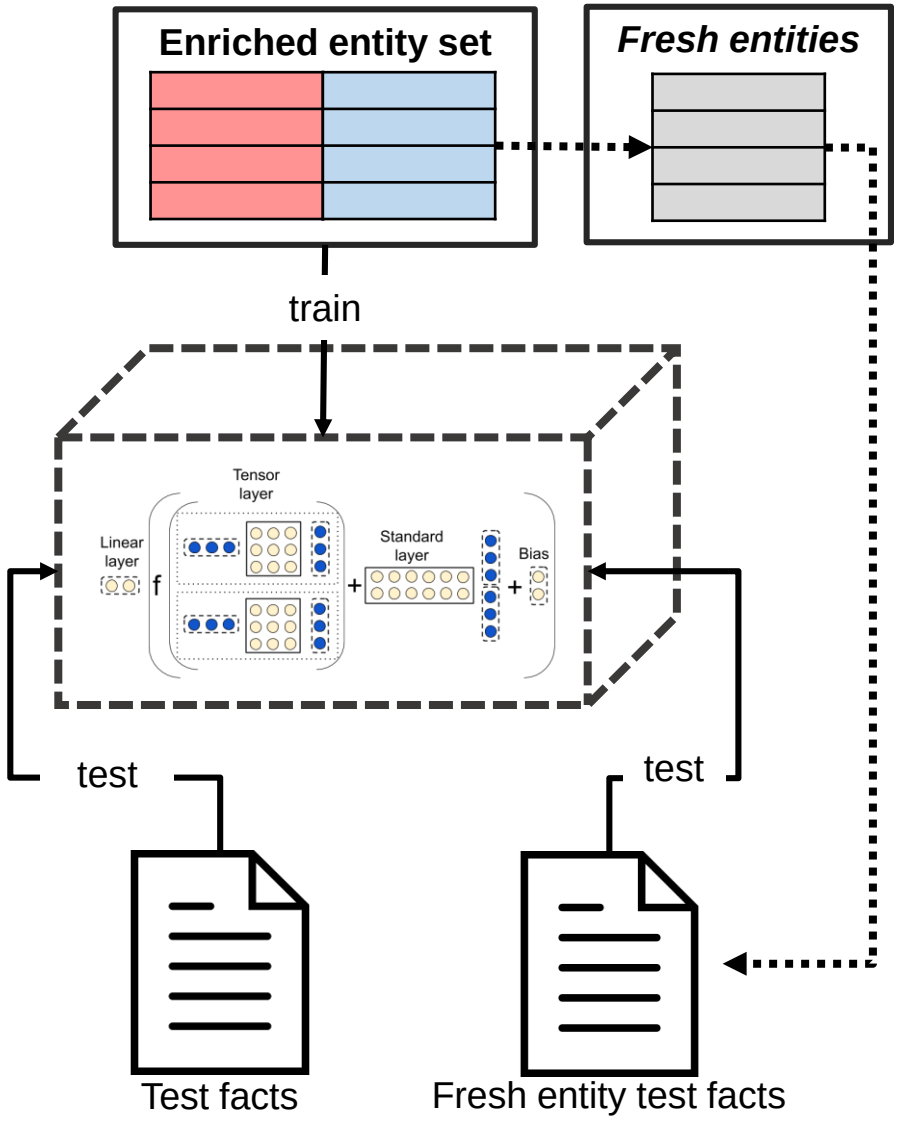
A pretrained Word2Vec model was employed to generate the embeddings of the ontological information.



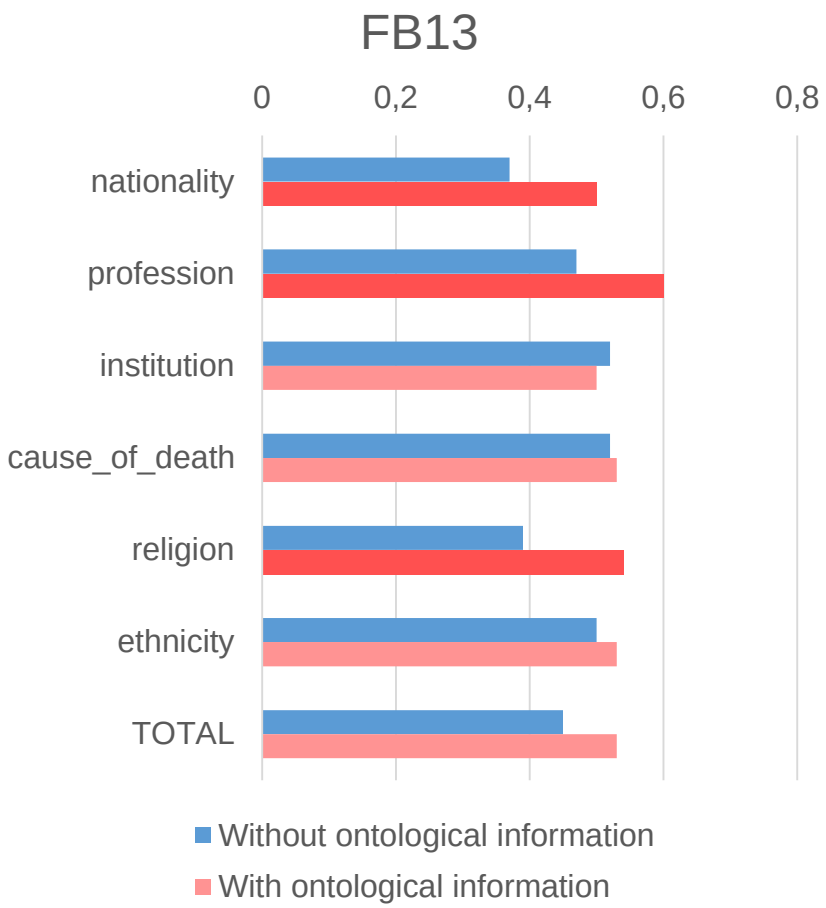
Phase 1: Evaluation over known facts with and without ontological information

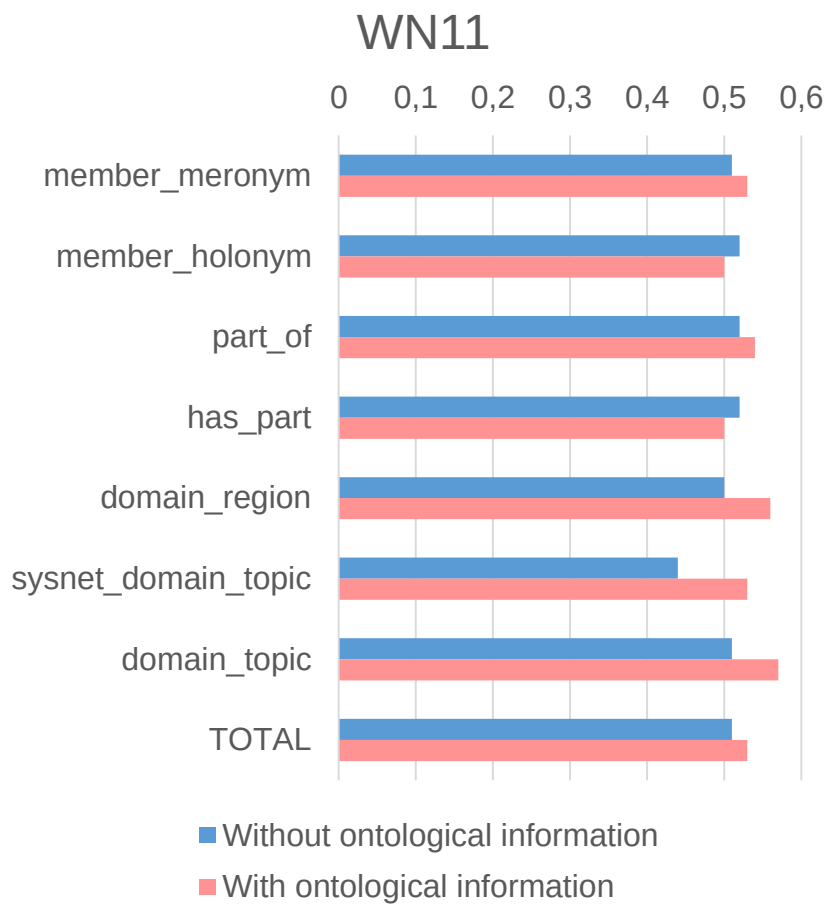


Phase 2: Evaluation over known facts and fresh entity facts



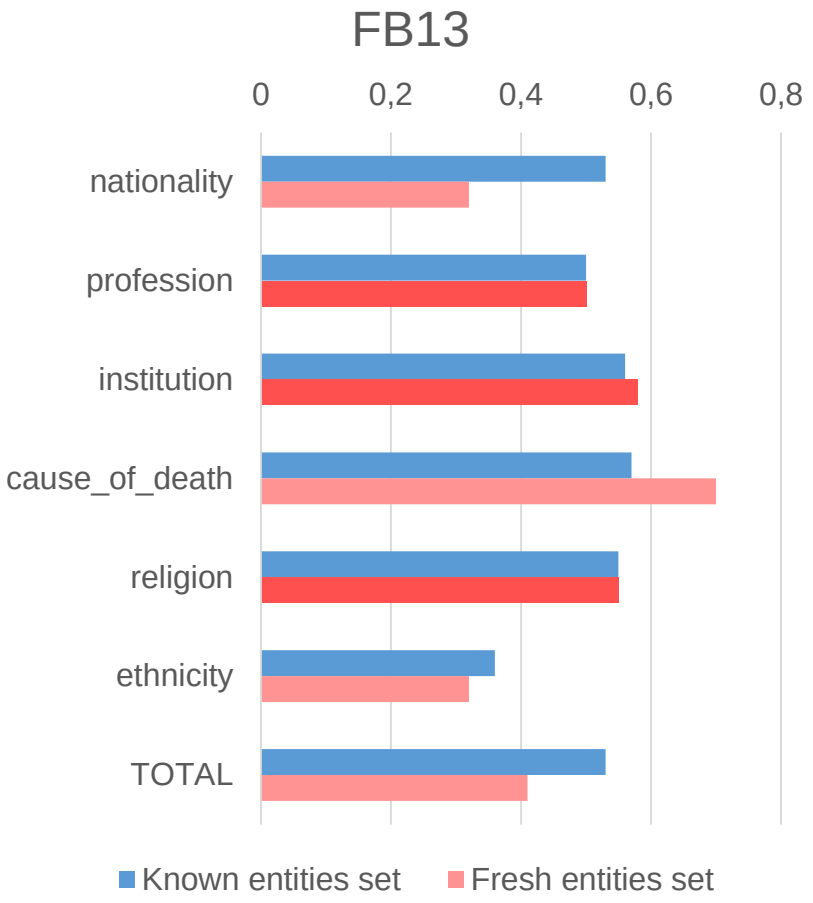
Firstly, the performance was evaluated over the datasets FB13 and WN11. Entities with no ontological information available were removed, with induced the removal of some of the relations

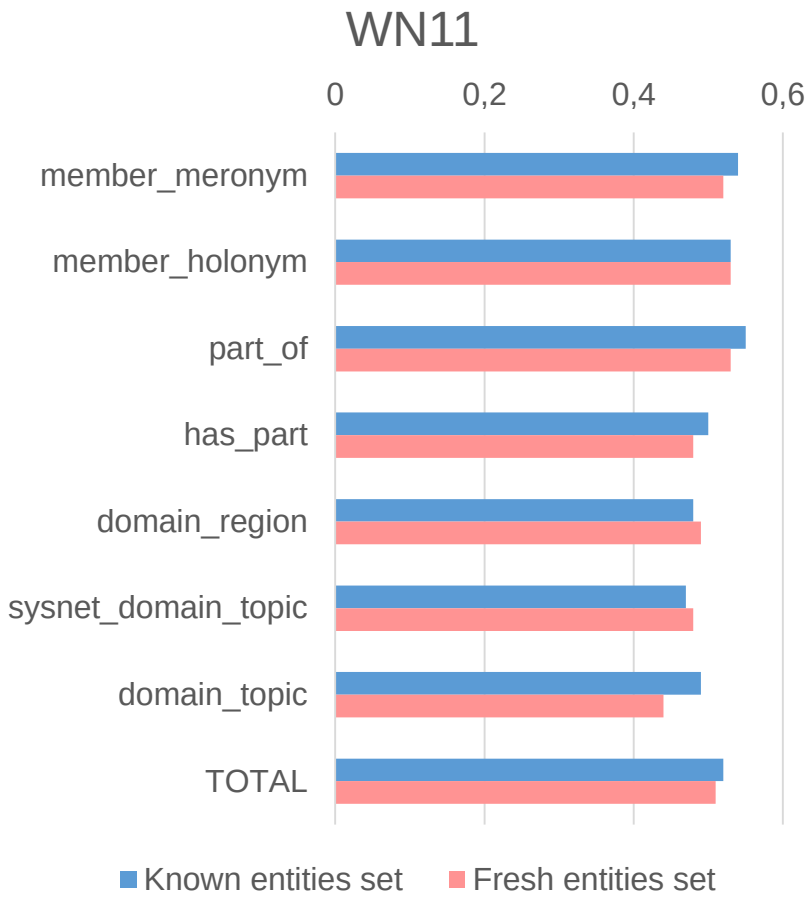




Proposed solution

To evaluate the approach over fresh entities, we randomly extract 1.500 entities from the total entity pool. All facts containing one of those entities are extracted from the training, validation and test files and included into the fresh entity test set. ***Class hierarchy is employed, as well as word embeddings to initialize fresh entities.***





Conclusions

- The presented approach tackles an unexplored problem in the literature: *fresh entity introduction*
- The inclusion of ontological information slightly improves the performance of the studied model in terms of triple classification accuracy
- Word embeddings are a potential way of initialization for KGE models

Future work

- Evaluating the approach on different state-of-the-art semantic matching models
- Employ different word embedding models for initialization (i.e. FastText, ElmO, BERT…)
- Study the impact of word embedding initialization in terms of performance

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