Unsupervised Ontology- and Taxonomy Construction through Hyperbolic Relational Domains and Ranges

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Introduction

- With the rise of Open Information Extraction and techniques becoming significantly better at extracting KGs from text, the problem of *learning* an ontology from your data arises.

Issues:
- There is no clear way of learning hierarchies in Euclidean space
- Building an ontology using Machine Learning is not a very researched problem

Main insight: In entity- and relationally rich Knowledge Graphs, entity types are inherently linked to which D&Rs they participate in. Domains and ranges are powerful for modelling entity types.

Solution: Learn an ontology jointly with a taxonomy in hyperbolic space!

Result: We can learn both the taxonomy and the ontology simultaneously and build the underlying descriptive ontology & taxonomy for the KG we have!

ML procedure
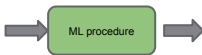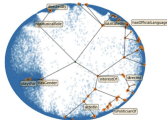
Assumptions

- A Knowledge Graph without any entity types
- A clear implicit relation between relationship types and entity types
- Little prior knowledge of the Knowledge Base

1) Create graph of domains and ranges

We generate a bi-partite graph of entities and domains and ranges

2) Model bi-partite D&R graph in hyperbolic space

Find the spanning tree in Hyperbolic space of head- and tail sets

3) Discretize into taxonomy

Manually edit and inspect

Cluster and manually label nodes

4) Final ontology (on YAGO-310)

Image source: https://yashuseth.files.wordpress.com/2019/10/knowledge-graph.jpg