W6. Lecture Notes — By Junyi

Summary

Graph inference algorithms fall into two broad categories

- Traditional Graph Algorithms
 - Path finding, centrality, community detection
- Ontology-based algorithms
 - Taxonomic reasoning, Rule-based reasoning
- ▼ knowledge graph retrieval
 - **▼** Query languages
 - **▼** SPARQL
 - **▼** Cypher
- ▼ knowledge graph inference
 - ▼ draw implicit conclusions E.g., conclude new connections
 - **▼** algorithms
 - ▼ graph-based
 - **▼** path finding
 - **▼** shortest path
 - ▼ single source shortest path
 - **▼** minimum spanning tree
 - **▼** centrality detection
 - **▼** function
 - understanding the importance of a node most important nodes, bridges in a network
 - **▼** types

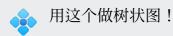
- **▼** degree centrality
- **▼** betweenness centrality
- **▼** closeness centrality
- **▼** page rank
- **▼** community detection
 - **▼** algorithms
 - ▼ standard graph algorithms
 - **▼** connected components
 - ▼ strongly connected components
 - **▼** bottom up algorithms
 - ▼ label propagation
 - · assign each node to be a different community
 - examine all nodes in a fixed order → update the community of a node that is shred by most of its neighbors, break ties in a random order
 - terminate when each node is in a community shared by most of its neighbors
 - **▼** unfolding
 - **▼** phase 1
 - Assign each node into a separate community
 - Examine each node and its neighbors to test if there will be an overall gain in modularity by placing it in the same community as a neighbor

▼ phase 2

- Create a new graph in which each node represents a community from Phase I
- If there are edges between nodes in a community, represent it as a self-loop
- **▼** repeat

- ▼ ontology-based
 - **▼** KG features
 - Associates classes with nodes
 - Defines semantic properties of relationships
 - Two major categories of inference
 - ▼ Class-based Inference or Taxonomic Reasoning
 - **▼** Application conditions
 - ▼ applicable when it is useful to organize knowledge into classes
 - ▼ both property graph and RDF data models support classes
 - **▼** class
 - **▼** hierarchy
 - **▼** disjoint
 - **▼** definition
 - **▼** necessary properties
 - ▼ have instance-of in the body of the rule
 - **▼** sufficient properties
 - ▼ have instance-of in the head of the rule
 - **▼** value restriction
 - **▼** domian
 - **▼** range
 - **▼** cardinality
 - **▼** inheritance
 - ▼ Rule-based inference
 - ▼ Boundary between taxonomic inference and rule-based inference is not sharp
 - It is generally a matter of the implementation approach

- Taxonomic inferences can be usually implemented using rules
- **▼** Approaches
 - ▼ bottom up / chase
 - ▼ top-down



Taxonomic Inference

- Given two classes A and B, whether A is a subclass of B?
- Given a class A and an instance I, whether I is an instance of I?
- Given a ground relation atom determine whether it is true or false?
- Given a relation atom, determine values which values make it true?