CS520: KNOWLEDGE GRAPHS
Data Models, Knowledge Acquisition, Inference, Applications

Lectures and Invited Guests
Spring 2021, Tu/Thu 4:30-5:50, cs520.Stanford.edu

Learn about the basic concepts,
latest research & applications
Knowledge Graphs Seminar

• What is a Knowledge Graph?
• How to Create a Knowledge Graph?
• How to Reason with and Access Knowledge Graphs?
• Applications
• Implementation Tools
• Future Research
How do Knowledge Graphs Relate to AI?
Outline

• Knowledge Graphs as a Test Bed for AI
• Graph Data Science
• Knowledge Graphs for the ultimate vision of AI
Knowledge Graphs as a Testbed for AI

• Two-way symbiosis
  • Knowledge Graphs enable many AI applications
  • AI algorithms can be used to create Knowledge Graphs
Knowledge Graphs as Enablers of AI

• Knowledge Graphs enable
  • A personal assistant to get more things done
  • A recommendation system to offer better recommendations
  • A search engine to answer questions
AI as an Enabler for Knowledge Graphs

• Machine learning / NLP algorithms play a central role in
  • Schema mapping entity linking
  • Entity and relation extraction
  • Data cleaning and anomaly detection
  • Inference and question answering
Graph Data Science

• Availability of huge amount of data
• Derive knowledge from the structure in data
Graph Data Science
Graph Data Science

Use Machine Learning for Predictions
Graph Data Science

Use Machine Learning for Predictions

Requires Feature Engineering
Graph Data Science

Use Machine Learning for Predictions

Requires Feature Engineering

User Experience for Large Datasets
Knowledge Graphs for AI

• Knowledge Graphs have been used in AI since the beginnings
  • Semantic networks
  • Description Logics
  • Rule Languages
  • Graphical Models
Knowledge Graphs for AI

• But Knowledge Acquisition has been an equally central concern
  • Semantic networks  
  • Description Logics  
  • Rule Languages  
  • Graphical Models  

  Knowledge Engineering
  Inductive Learning
  Machine Learning
Knowledge Graphs for AI

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Knowledge Engineering
Inductive Learning
Machine Learning

Scale
Bottom-up construction
Mixed modes of construction
Knowledge Graphs for AI

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Knowledge Engineering
Inductive Learning
Machine Learning

<table>
<thead>
<tr>
<th>Scale</th>
<th>Small scale intelligence</th>
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<tbody>
<tr>
<td>Bottom-up construction</td>
<td>Top-down design</td>
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<tr>
<td>Mixed modes of construction</td>
<td>Ability to write what you know</td>
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Knowledge Graphs for AI

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  • Graphical Models

Knowledge Engineering
Inductive Learning
Machine Learning

Programs that have a model of the domain, formulate a hypothesis, design an experiment, provide explanations, remain an open challenge for AI
Prof. James A. Hendler
Semantics for scaling the Knowledge Graphs

Dr. Douglas Lenat
Knowledge Graphs++