



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT



UKP Lab  
Darmstadt, Germany

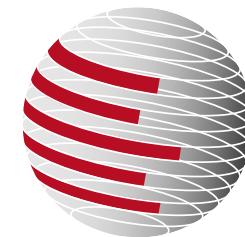
# Building a Knowledge Base Question Answering Pipeline



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<https://daniilsorokin.github.io>



**UKP**

**London Data Science Journal Club**

January 28, 2019

# Me

Bachelor in Applied  
Linguistics  
at St. Petersburg State  
University, Russia  
2011

Master in Computational  
Linguistics  
at University of Tübingen,  
Germany, 2014

PhD in NLP  
at the **UKP Lab**,  
Darmstadt University of  
Technology, Germany,  
since 2015,  
<http://ukp.tu-darmstadt.de>

Research intern at  
**Factmata**, London  
November 2018 -  
January 2019,  
<https://factmata.com>

# Knowledge Base Question Answering

*What is Princess Leia's home planet?*

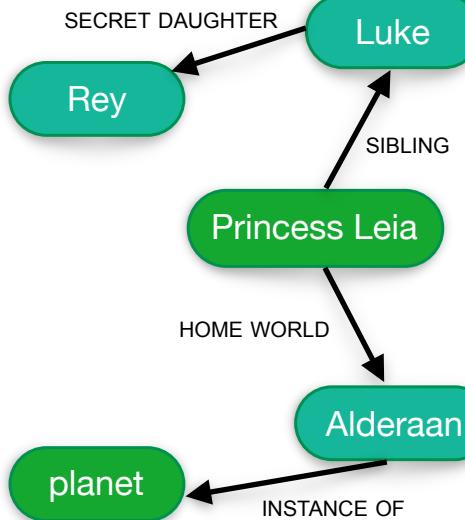
Entity Linking

Princess Leia      planet

Semantic interpretation

?

Knowledge Base



Answer

Alderaan

# Knowledge Base

## Knowledge Base

Princess Leia

English Not logged in Talk Contributions Create account Log in

Item Discussion Read View history Search Wikidata

### Princess Leia (Q51797)

character in Star Wars

Leia Organa | Princess Leia Organa of Alderaan | General Organa | Princess Leah

[edit](#)

[In more languages](#) [Configure](#)

Language	Label	Description	Also known as
English	Princess Leia	character in Star Wars	Leia Organa Princess Leia Organa of Alderaan General Organa Princess Leah
French	Leia Organa	personnage de Star Wars	Princesse Leia
German	Leia Organa	Figur in Star Wars	Prinzessin Leia Prinzessin Leia Organa
Scots	Princess Leia	No description defined	

All entered languages

### Statements

home world	Alderaan	<a href="#">edit</a>
	▼ 0 references	<a href="#">+ add reference</a>
	Naboo	<a href="#">edit</a>
	from fictional universe	Star Wars expanded to other media
	▼ 0 references	<a href="#">+ add reference</a>
		<a href="#">+ add value</a>

# Knowledge Base Question Answering

*What is Princess Leia's home planet?*

Entity Linking

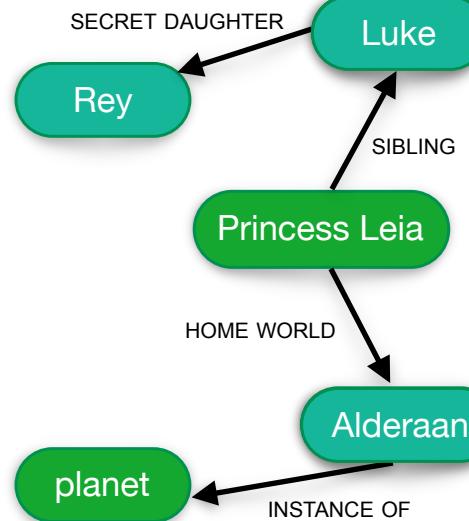
Princess Leia      planet

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Knowledge Base



Answer

Alderaan

# Knowledge Base Question Answering

What is Princess Leia's home planet?

Entity Linking

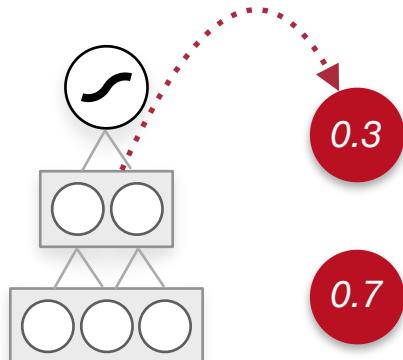
Princess Leia

planet

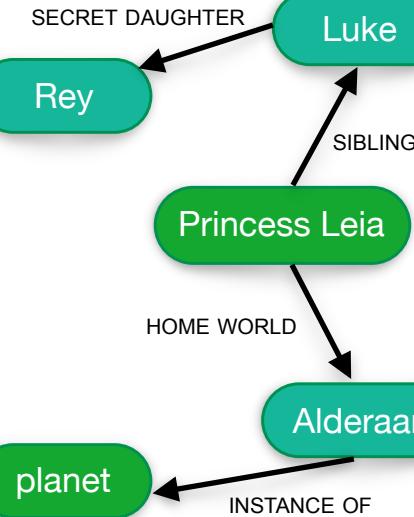
Semantic interpretation

Luke

Alderaan



Knowledge Base



Answer

Alderaan

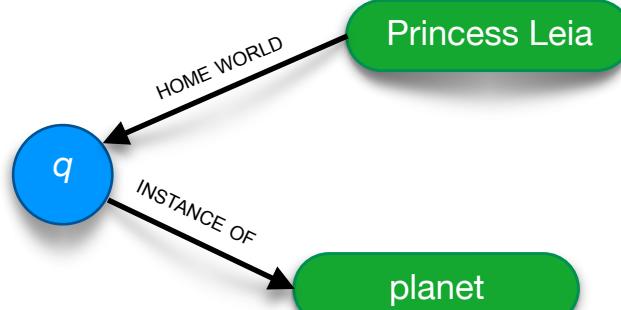
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What is Princess Leia's home planet?

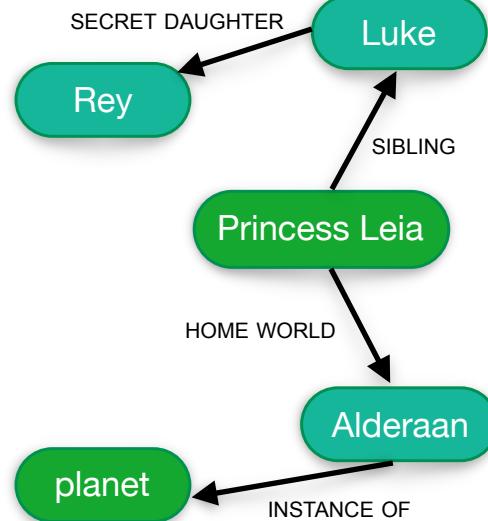
Entity Linking

Princess Leia      planet

Semantic interpretation  
Structured representation



Knowledge Base



Answer

Alderaan

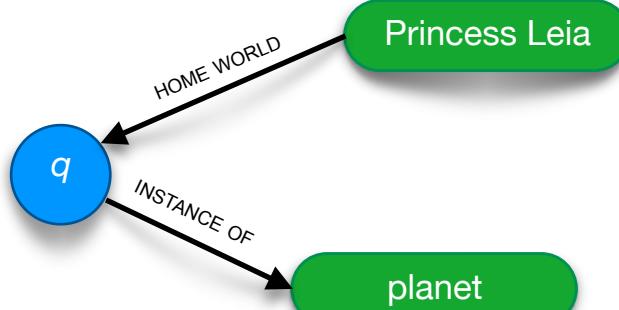
# Knowledge Base Question Answering

What is Princess Leia's home planet?

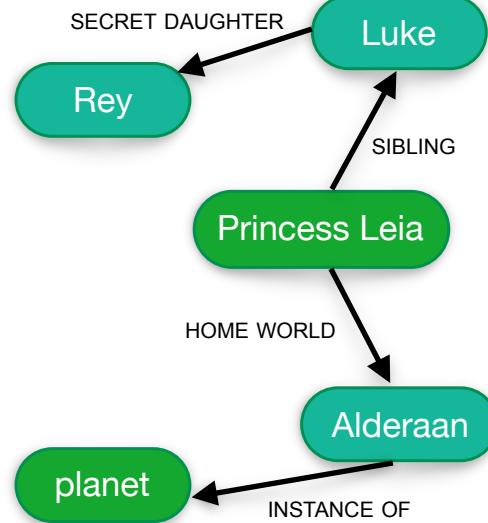
Entity Linking

Princess Leia      planet

Semantic interpretation  
Structured representation



Knowledge Base



Answer

Alderaan

# Knowledge Base Question Answering

What is Princess Leia's home planet?

Entity Linking

Princess Leia

planet

Semantic interpretation

$q$

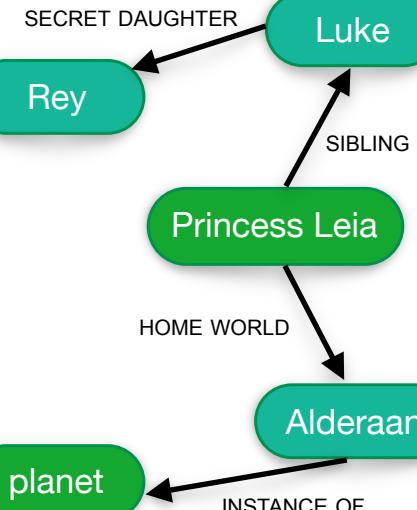
Princess Leia

planet

HOME WORLD

INSTANCE OF

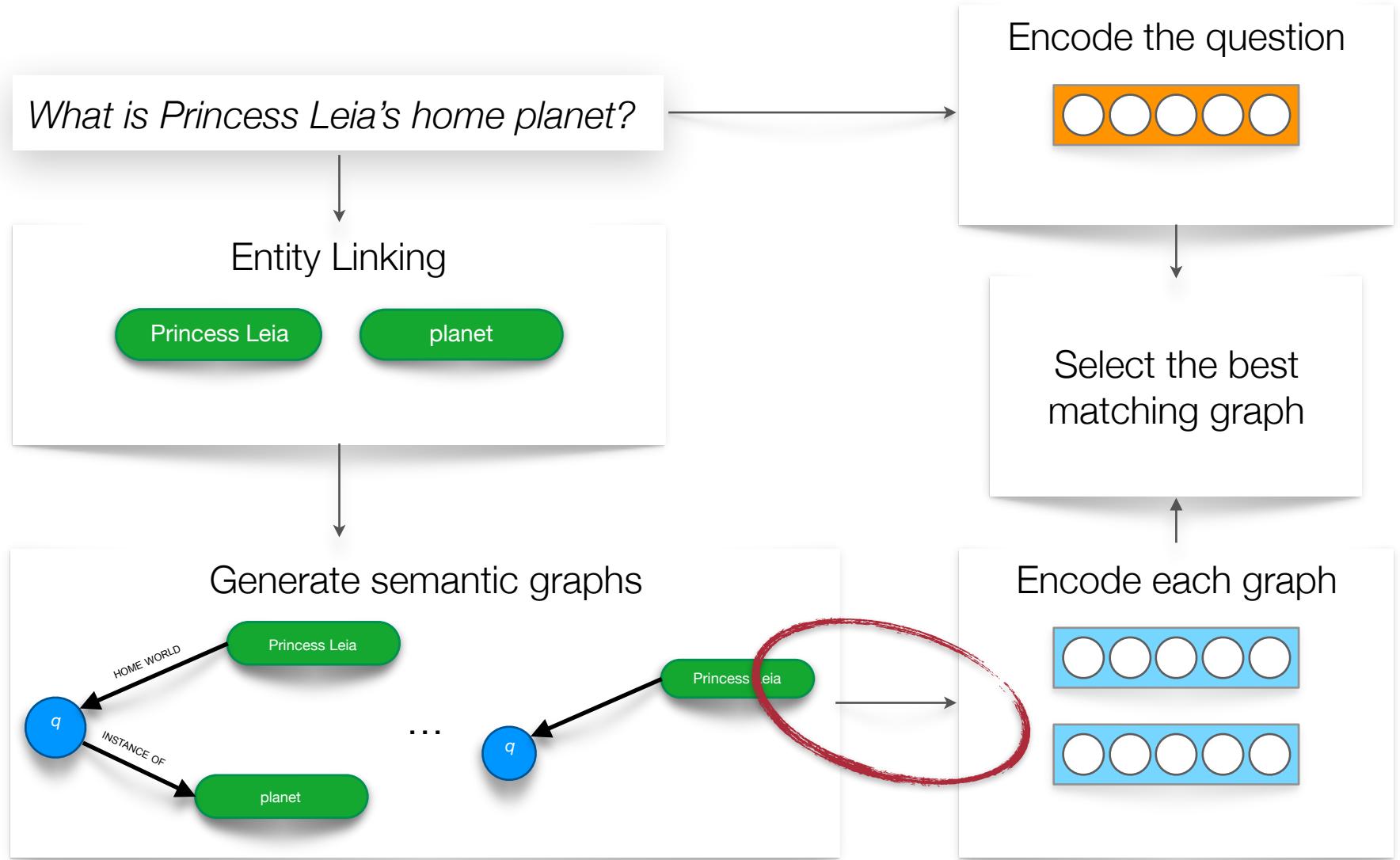
Knowledge Base



Answer

Alderaan

# Representation Learning



# Modeling the knowledge base graph and other graphs

## 1. Graph Convolutional Networks

- Kipf and Welling (2017) – document classification
- Marcheggiani and Titov (2017) – encode syntax dependencies for SRL
- Schlichtkrull et al. (2018) – KB embeddings

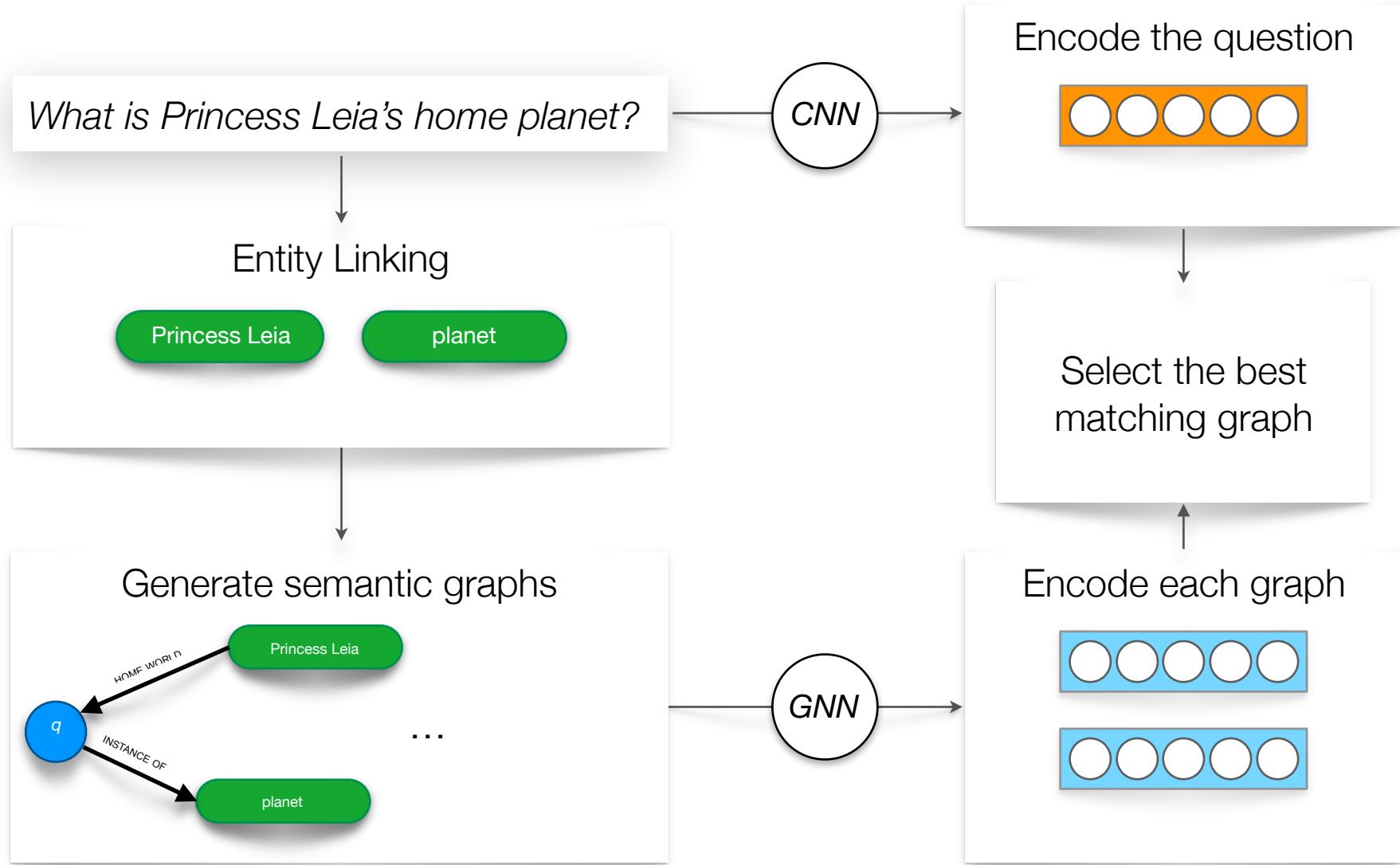
## 2. Gated Graph Neural Networks

- Scarselli et al. (2009) – Graph Neural Networks
- Li et al. (2016) – Gated variant
- Chen et al. (2018) – Structured Dialogue Policy
- Sun et al. (2018) – QA with Fusion of Knowledge Bases and Text

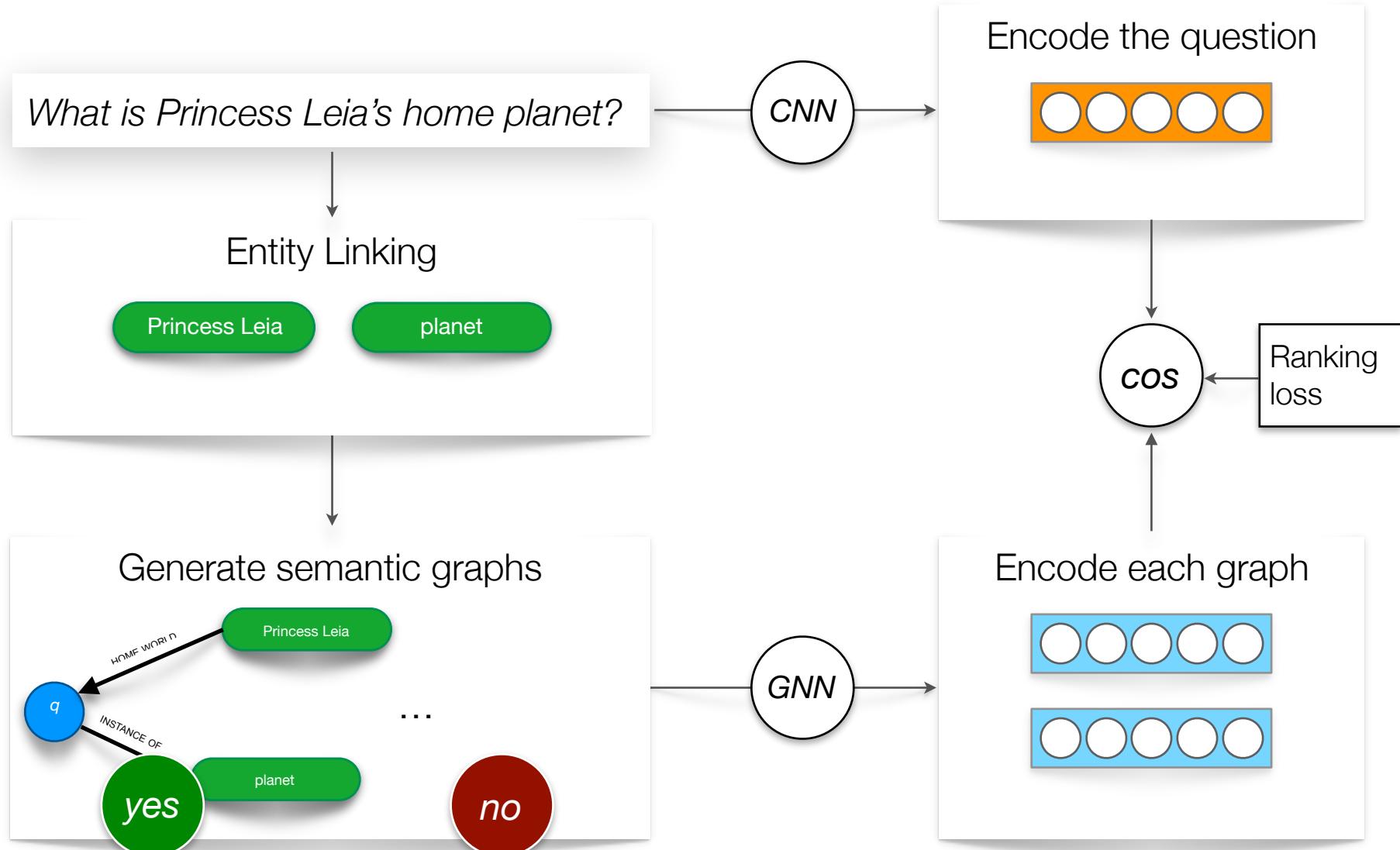
## 3. Battaglia et al. (2018) – Relational inductive biases, deep learning, and graph networks

The Graph Neural Network models all aspects of the semantic graph representation

# Question Answering Pipeline – Representation Learning



# Question Answering Pipeline – Representation Learning



Demo and code <https://github.com/UKPLab/coling2018-graph-neural-networks-question-answering>

## Knowledge base question answering

Your question

Who played Luke Skywalker in Star Wars?

Answer

# Follow up?

- <https://daniilsorokin.github.io> ← slides
- [sorokin@ukp.informatik.tu-darmstadt.de](mailto:sorokin@ukp.informatik.tu-darmstadt.de)
- [@daniilmagpie](https://twitter.com/daniilmagpie)
- COLING'18 Paper: <http://aclweb.org/anthology/C18-1280>

