

Natural Language Processing

Introduction to natural language processing

Marco Kuhlmann

Department of Computer and Information Science



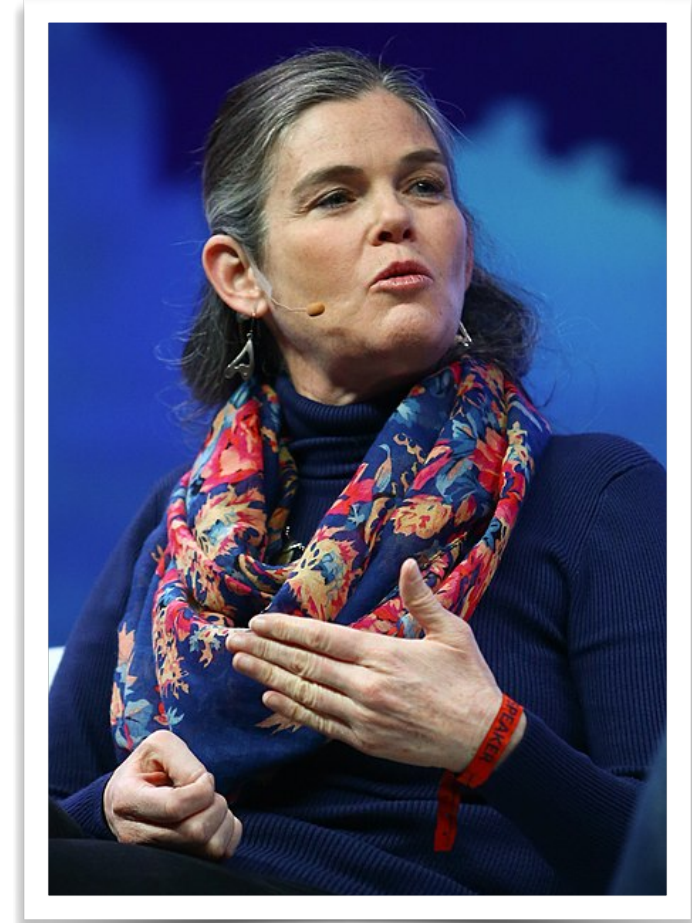
This work is licensed under a
[Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

What is natural language processing?

- **Natural language processing (NLP)** enables computers to work with human language.
- Some well-known example applications are web search, machine translation, and chatbots.
- These diverse applications are based on a common set of ideas from algorithms, machine learning, and other disciplines.

Question answering

Which Stanford University alumna co-founded the educational technology company Coursera?

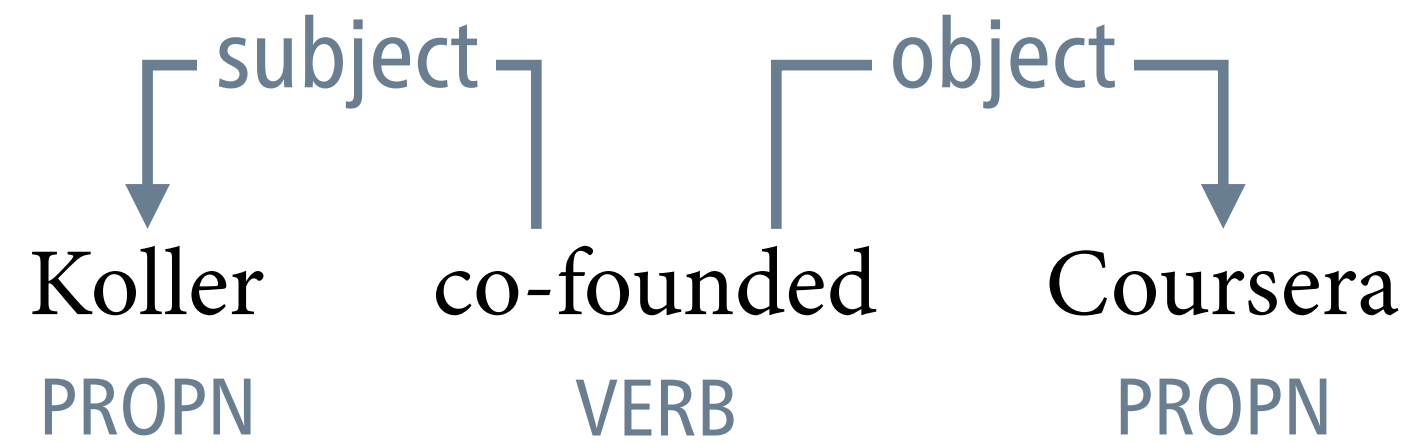


Collision Conf, CC BY 2.0, via Wikimedia Commons

[SPARQL query against DBPedia](#)

```
SELECT DISTINCT ?x WHERE {  
  ?x dbp:education dbr:Stanford_University.  
  dbr:Coursera dbp:founder ?x.  
}
```

Linguistic representations



dbr:Coursera dbr:founder dbr:Daphne_Koller

End-to-end neural networks



You

Which Stanford University alumna co-founded the educational technology company Coursera?



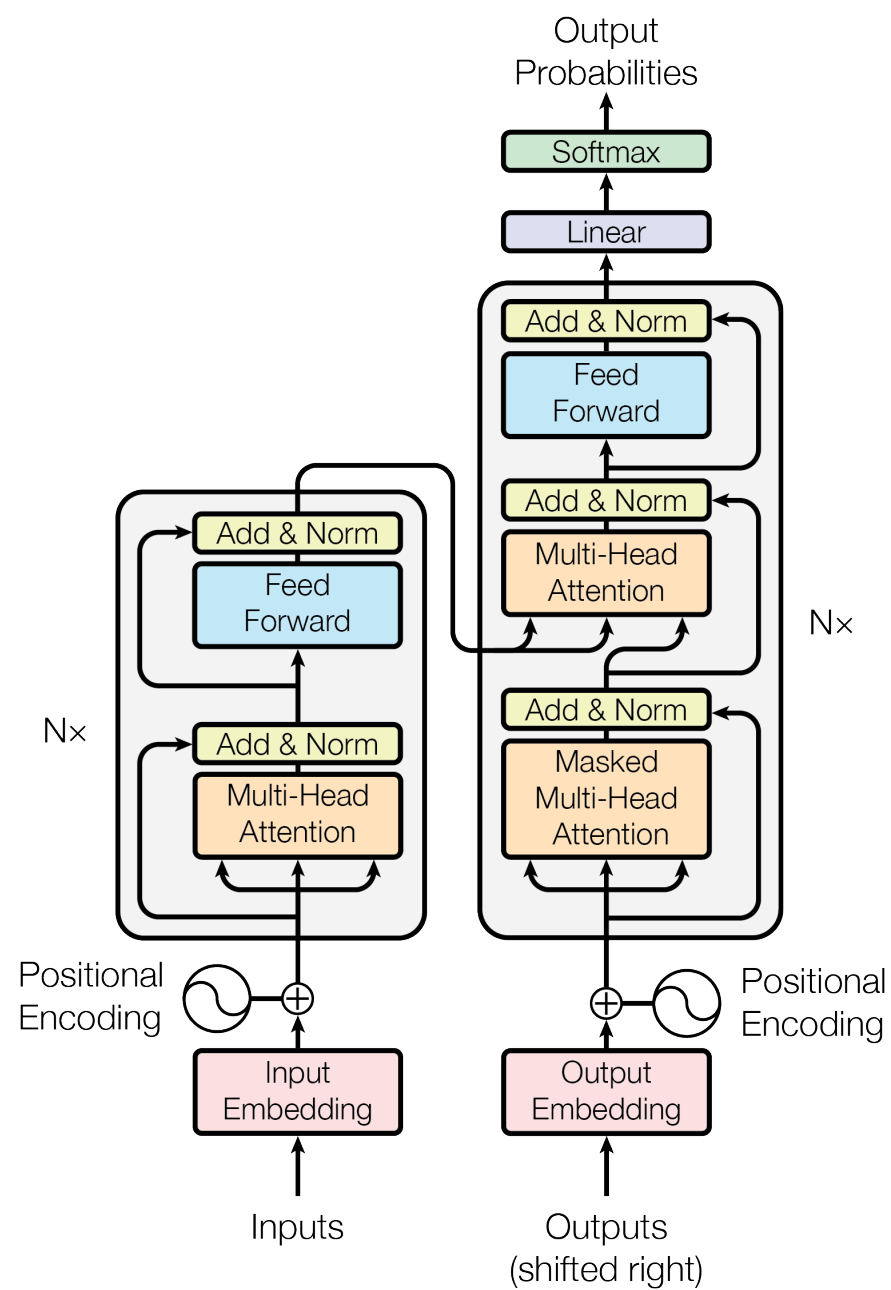
ChatGPT

The Stanford University alumna who co-founded the educational technology company Coursera is Daphne Koller. She co-founded Coursera in 2012 alongside Andrew Ng, another Stanford professor, with the goal of providing universal access to world-class education.

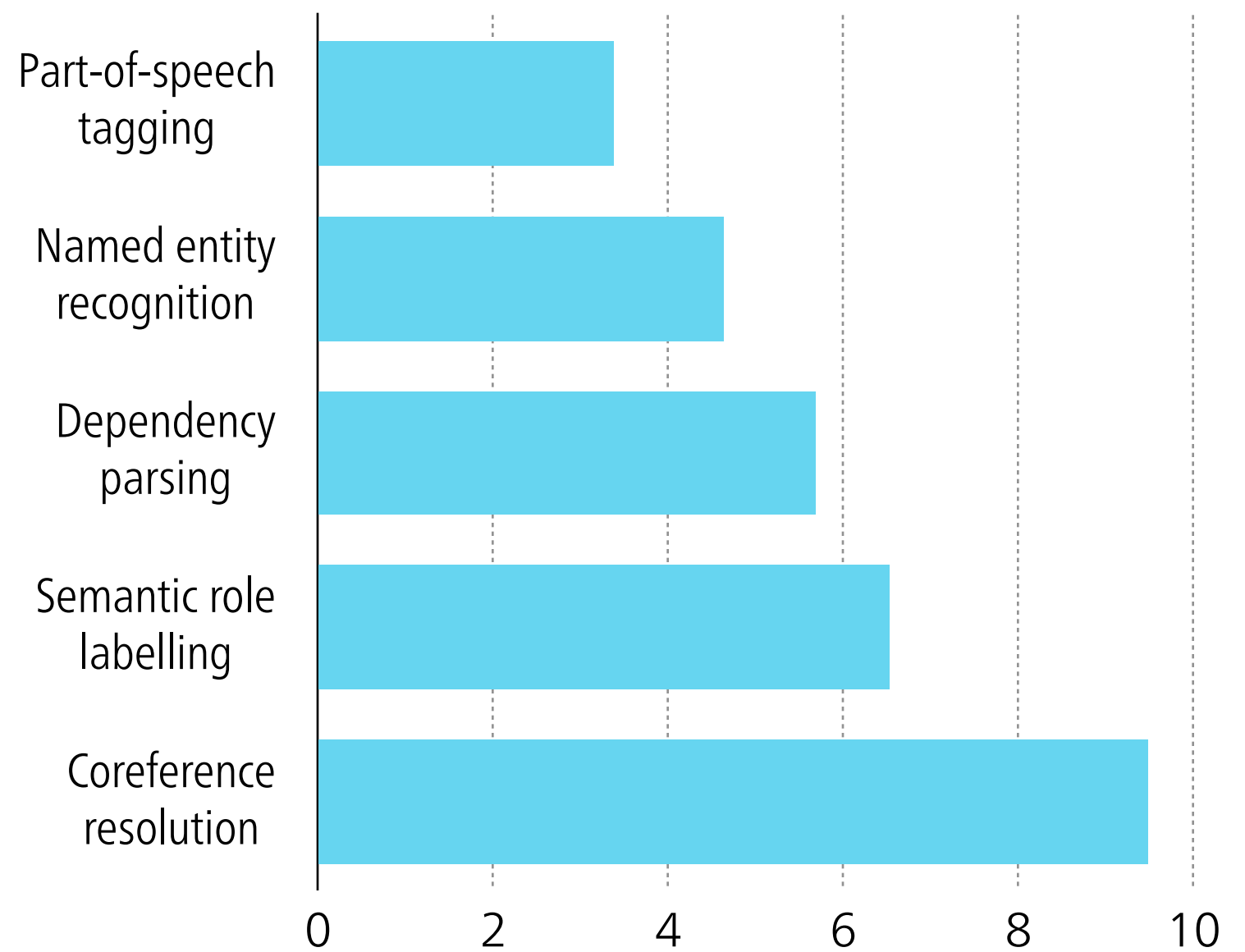


ChatGPT 4, 2023-12-31

"Natural language processing from scratch"



[Vaswani et al. \(2017\)](#)



[Tenney et al. \(2019\)](#)



You

Convert the following question into a SPARQL query against DBpedia: "Which Stanford University alumna co-founded the educational technology company Coursera?"



ChatGPT

To convert your question into a SPARQL query for querying DBpedia, we need to construct a query that looks for a person who is an alumna of Stanford University and a co-founder of the educational technology company Coursera. Here's how the query would look:

sparql

Copy code

```
PREFIX dbo: <http://dbpedia.org/ontology/>
PREFIX dbr: <http://dbpedia.org/resource/>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ?person WHERE {
    ?person dbo:almaMater dbr:Stanford_University .
    ?person dbo:occupation dbr:Entrepreneur .
    ?person dbo:knownFor dbr:Coursera .
    ?person a dbo:Person .
    ?person dbo:gender dbr:Female .
} LIMIT 10
```

[ChatGPT 4, 2024-01-06](#)

Two paradigms

Eisenstein (2019), § 1.2.1

- **Linguistic knowledge**

Build pipelines of modular components that produce general-purpose representations grounded in linguistic knowledge.

morphemes, parts-of-speech, dependency trees, meaning representations

- **Deep learning**

Train end-to-end neural networks that directly transmute raw text into whatever form the desired application requires.

text, code, images

Generate a complete list of Swedish kings born in the 19th century.



Here is a list of Swedish kings who were born in the 19th century, along with their birth dates:

1. **Oscar II**

- **Born:** January 21, 1829
- **Reign:** 1872–1907

2. **Gustaf V**

- **Born:** June 16, 1858
- **Reign:** 1907–1950

These are the two kings of Sweden who were born in the 19th century. If you'd like more context or additional details about their reigns, feel free to ask!

	Charles XV <i>Karl XV</i>		8 July 1859 – 18 September 1872 (13 years, 2 months and 10 days)	Son of Oscar I	Louise of the Netherlands (2 children)	3 May 1826 – 18 September 1872 (aged 46) First monarch of the House of Bernadotte to be born in Sweden. ^[82]	
	Oscar II		18 September 1872 – 8 December 1907 (35 years, 2 months and 20 days)	Son of Oscar I	Sophia of Nassau (4 children)	21 January 1829 – 8 December 1907 (aged 78) Last Swedish king to also be king of Norway (until 1905). ^[83]	
	Gustaf V		8 December 1907 – 29 October 1950 (42 years, 10 months and 21 days)	Son of Oscar II	Victoria of Baden (3 children)	16 June 1858 – 29 October 1950 (aged 92) The marriage to Victoria of Baden, a great-granddaughter of Gustaf IV Adolf , genealogically united the House of Bernadotte with the former royal line. ^{[80][83][84]}	
	Gustaf VI Adolf		29 October 1950 – 15 September 1973 (22 years, 10 months and 17 days)	Son of Gustaf V ^[t]	Margaret of Connaught (5 children) Louise Mountbatten (1 stillborn child)	11 November 1882 – 15 September 1973 (aged 90) ^[83]	



You

Please generate a sentence that starts and ends with the same word.



ChatGPT

"Tomorrow brings another tomorrow full of hope and new beginnings."



ChatGPT 4, 2023-12-31



You

Please generate a sentence that starts and ends with the same word.



ChatGPT

"Tomorrow brings new challenges, yet ends as it begins: tomorrow."



ChatGPT 4, 2024-01-06