

From static Embeddings to Transformers

Natural Language Processing

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Course Overview

1. Introduction
2. Language modeling
3. Static embedding (word2vec)
4. Contextualized Word Embeddings
5. Attention and Transformers
6. Transfer Learning, Pre-training and Fine-tuning
7. Benchmarking
8. Interpretability
9. Formalia

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Meaning representation

- Human has an intrinsic ability to understand words
- Computers often use one-hot representations
- Or limited knowledge bases
- How similar is “pasta” to “pizza”
- Distributional Hypothesis (Harris, 1954; Firth, 1957)
- Know the word by the company it keeps

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Meaning representation

- What about a dictionary
 - WordNet
 - Brown clusters
 - Lesk algorithm (tf-idf)

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Understanding distributional semantics

- Marco saw a **furry little wampimuk** **hiding in the tree**

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Lexical Semantics

- Introducing some basic principles of word meaning
- How should we represent the meaning of a word?
- Lexical semantics
 - The linguistic study of word meaning
- The relationship between word senses
 - Synonym
 - couch/sofa car/automobile
- Propositional meaning
- Two words are synonymous if they are substitutable for one another in any sentence without changing the truth conditions of the sentence.

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Lexical Semantics

- Word Similarity
- Words don't have many synonyms
- Most words do have lots of similar words
- Word similarity is very useful in larger semantic tasks
- Computing how similar the meaning of two phrases or sentences are.
- Getting word similarity is to ask humans to judge
- **SimLex-999** (<https://fh295.github.io/simlex.html>)

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Lexical Semantics

Word Similarity

Pair	Simlex-999 rating	WordSim-353 rating
<i>coast - shore</i>	9.00	9.10
<i>clothes - closet</i>	1.96	8.00

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Lexical Semantics

- Word Relatedness
- The meaning of two words can be related in ways other than similarity.
- **Word Association** in psychology
- Example :
 - coffee and cup are clearly related
- Words are related if they belong to the same **semantic field**
- A semantic field: is a set of words which
 - cover a particular semantic domain
 - bear structured relations with each other.

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Lexical Semantics

- Semantic Frames and Roles
- The notion of a **semantic frame** is closely related to **semantic fields**
- A semantic frame denote
 - perspectives
 - participants in a particular type of event
- Example:
 - A commercial transaction

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Lexical Semantics

- Connotation
- Words have affective meanings or connotations
- The word connotation has different meanings in different fields
- the aspects of a word's meaning that are related to a writer or reader's
 - Emotions
 - Sentiment
 - Opinions
 - Evaluations