VSB TECHNICAL UNIVERSITY OF OSTRAVA | FACULTY OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE | DEPARTMENT OF COMPUTER SCIENCE

Deep Learning

Word meaning representation

Jan Platoš, Radek Svoboda

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Department of Computer Science
Faculty of Electrical Engineering and Computer Science
VŠB - Technical University of Ostrava

Word meaning representation

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- The **meaning** means:
  - the idea that is represented by a word, phrase, etc.
  - the idea that a person wants to express by using words, signs, etc.
  - the idea that is expressed in a work of writing, art, etc.
- A WordNet is a great resource of meaning:
  - A complex network of words made by human.
  - A list of synonyms, hypernyms (generalization), antonyms, etc.
  - A word category with dictionary-like description of a meaning.
  - A new meaning are missing in a database.
  - Some meaning and synonyms are valid only in some contexts.

Representation of the meaning of a word

- The standard representation is called **one-hot** vector.

$$\begin{aligned} motel &= [00000000100] \\ hotel &= [00000100000] \end{aligned}$$

- Vector dimension = number of word in a corpus
- Vectors are orthogonal $motel \cdot hotel = 0$
- Similarity cannot be defined on one-hot vector representation.
- WordNet may be used to extract synonyms for each word that will be used as similarity function, but ist too complicated approach.

Representation of the meaning of a word

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Example:

...reasonable and to prevent the network trips from swamping out the execution...
...distance between nodes; network traffic or bandwidth constraints; ...
...beyond your control (i.e. network outage, hardware failure) or the latency ...
...experience was a temporarily-high network load which caused a timeout...
...is removed (i.e. temporary network disconnection resolved) then ...
...see their involvement with the network and its digital properties expand ...
...but cant get mobile network connection to work. Basically ...

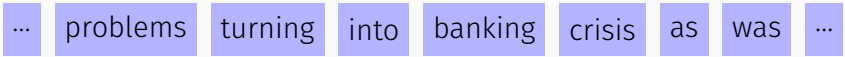
Representation of the meaning of a word - Word2Vec

Word2vec is a framework for learning word vectors.

- We have a large corpus of text.
- Every word in a fixed vocabulary is represented by a vector.
- Go through each position *t* in the text, which has a center word *c* and context words *o*.
- Use the similarity of the word vectors for *c* and *o* to calculate the probability of *o* given *c*.
- Keep adjusting the word vectors to maximize the probability.

Representation of the meaning of a word - Word2Vec

Word2vec principle.



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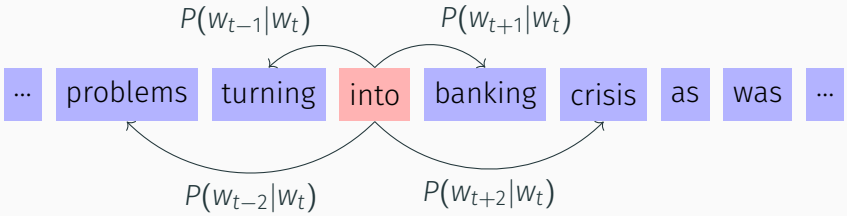

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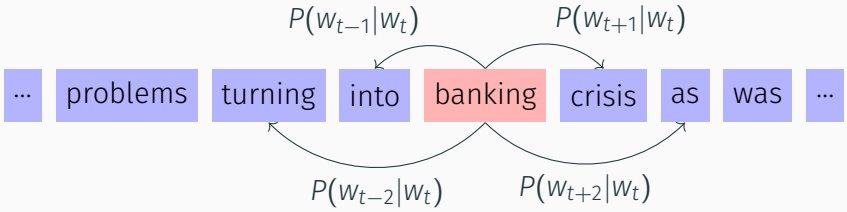

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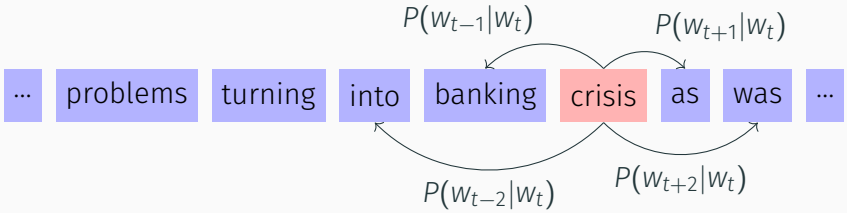
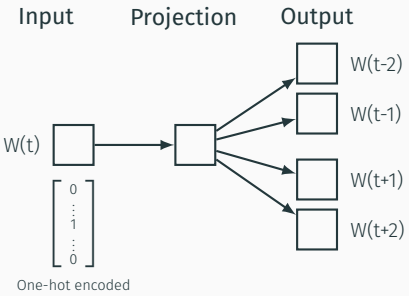
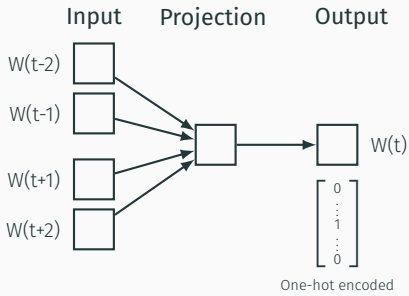


Representation of the meaning of a word - Word2Vec Variants

Skip-Gram (SG) where the contexts predicts words given the center word independently on position.



Continuous Bag of Words (CBOW) where the center word is predicted from context words.



Representation of the meaning of a word - GloVe

GloVe: Global Vectors for Word Representation

- Combines both Skip-gram and C-Bow methods
- Fast training, scalable to huge corpora but works even on small ones.

Representation of the meaning of a word - Glove: Examples

Most similar words in a corpora Glove6B[1] using Euclidean distance

man		woman		queen		university		learning	
2.60	woman	2.43	girl	3.01	princess	3.23	college	2.65	teaching
2.81	another	2.60	man	3.16	lady	3.29	harvard	2.93	practical
2.81	boy	2.79	mother	3.30	elizabeth	3.42	graduate	2.93	experience
2.97	one	2.88	boy	3.39	prince	3.51	institute	3.10	knowledge
3.02	old	3.08	her	3.44	coronation	3.54	yale	3.10	lessons
3.04	turned	3.14	she	3.48	king	3.58	professor	3.14	skills
3.07	whose	3.17	herself	3.57	consort	3.72	faculty	3.15	instruction
3.15	himself	3.38	victim	3.62	victoria	3.74	school	3.16	classes
3.15	who	3.38	child	3.67	crown	3.83	graduated	3.17	learn
3.24	friend	3.45	husband	3.69	bride	3.86	academy	3.18	studying
3.24	him	3.47	old	3.73	majesty	3.90	princeton	3.19	teach

[1] https://nlp.stanford.edu/projects/glove/

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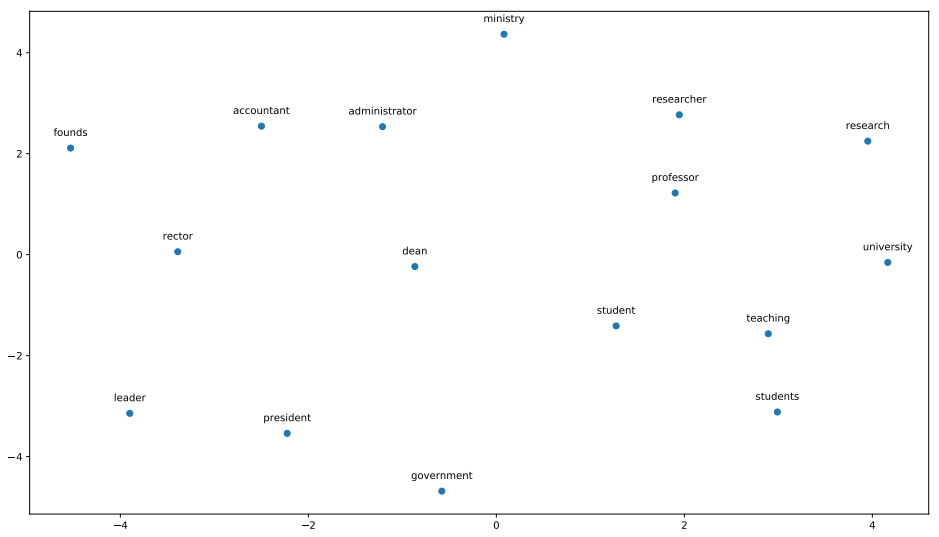

Representation of the meaning of a word

Word2Vec as well as GloVe generates context-independent representation.

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Context dependent embedding may be generated using ELMo and other approaches.

Questions?