

Intro to NLP

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МИПТ

12 февраля 2020 г.

Today

Intro

About this course

Recent trends in NLP

Example task: text classification

Practice: tools for processing Russian

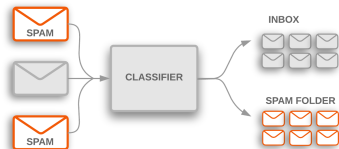
Natural language processing ...

- ▶ along with computer vision a crucial part of modern artificial intelligence
- ▶ deals with all human (and machine) interactions in language
- ▶ requires understanding of linear algebra, statistics, mathematics in general, linguistics and coding skills

Example tasks

Text classification

- ▶ Sentiment analysis
- ▶ Intent detection
- ▶ Spam filtering
- ▶ Topic classification



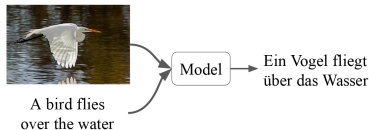
Sequence labelling

- ▶ Named entity recognition
- ▶ Coreference resolution

contentShip to site index?PoliticsSubscribedLog InSubscribeLog InToday's [Paper](#)AdvertisementsSupported [066](#) by? B.I. Agent [Peter Strick](#) [PERSON](#).
[Who Criticized Trump](#) [PERSON](#) in Texas, in [Fandango](#) [Peter Strick](#), a top [F.B.I. SFE](#) counterintelligence agent who was taken off the special counter
investigation after his disparaging texts about President [Trump](#) [PERSON](#) were uncovered, was fired. [Credit J. Kirkpatrick](#) [PERSON](#) for [The New York](#)
[Times](#) [Adam Goldman](#) [CNN](#) and [Michael S. Schmidt](#) [NY](#) [PERSON](#) 13 [CARDINAL](#) 2018WASHINGTON [CARDINAL](#) — [Peter Strick](#)
[PERSON](#) the [F.B.I. SFE](#) senior counterintelligence agent who disparaged President [Trump](#) [PERSON](#) in inflammatory text messages and helped
coerce the [Henry Clinton](#) [PERSON](#) email and [Roxane SFE](#) investigations, has been fired for violating bureau policies, Mr. [Strick](#) [PERSON](#) 's lawyer
said [Monday](#) [DATE](#) Mr. Trump and his allies seized on the texts — exchanged during the [2015](#) [DATE](#) campaign with a former [F.B.I. SFE](#) lawyer,
[Lisa Page](#) — [F.B.I. SFE](#) encoding the [Roxane SFE](#) investigation as an illegitimate "witch hunt." Mr. [Strick](#) [PERSON](#) who rose over [20](#) [years](#)
[DATE](#) at the [F.B.I. SFE](#) to become one of its most experienced counterintelligence agents, was a key figure in the early months [DATE](#) of the
inquiry. Along with writing the texts, Mr. [Strick](#) [PERSON](#) was accused of sending a highly sensitive search warrant to his personal email account. The
[F.B.I. SFE](#) had been under immense political pressure by Mr. [Trump](#) [PERSON](#) to dismiss Mr. [Strick](#) [PERSON](#) who was removed last summer
[DATE](#) from the staff of the special counsel, [Robert S. Mueller Jr.](#) [PERSON](#) The president has repeatedly denounced Mr. [Strick](#) [PERSON](#) in posts on

Sequence transformation (seq2seq)

- ▶ Machine translation
- ▶ Question answering



Phenomena to handle

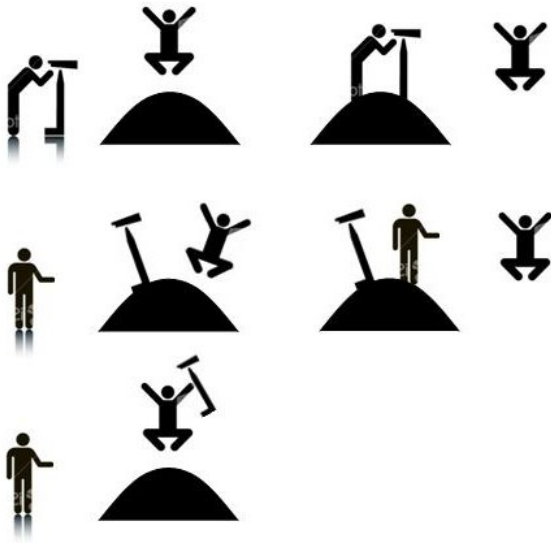
1. Tokenization and sentence boundary detection
2. Morphology
3. Syntax
4. Semantics
5. Discourse
6. Pragmatics
7. Multilinguality

Ambiguity

1. Polysemy and word-sense disambiguation: орган, bank
2. Homonymy: the ship or to ship, стекло
3. Syntactic ambiguity: John saw the man on the mountain with a telescope.

Syntactic ambiguity

John saw the man on the mountain with a telescope



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- ▶ Lectures: Sergey Aksenov, Anton Emelyanov
- ▶ **Chat:** t.me/mipt_nlp_2020
- ▶ **Final mark:**

$$M = \text{round}(0.2\text{quiz} + 0.8\text{HW})$$

$$M_{\text{final}} = \text{round}(0.4\text{exam} + 0.8M)$$

Our plan

1. Word embeddings
2. Text classification
3. Sequence modelling
4. Walk down Sesame Street
5. Syntax
6. Machine translation
7. Natural language generation

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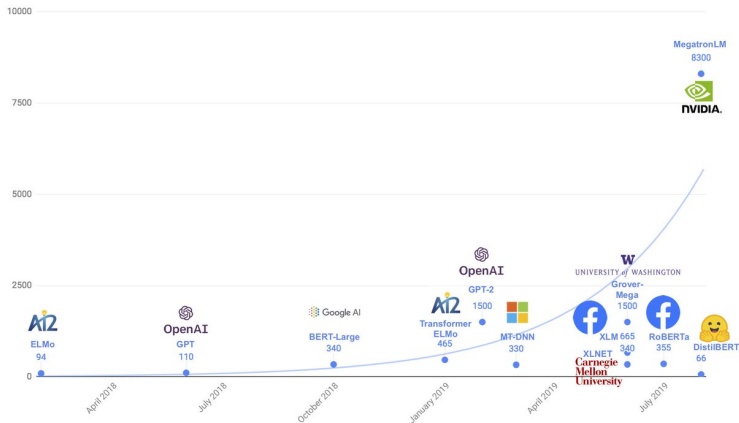
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NLP's ImageNet moment has arrived



... but is rather questionable

Recent trends in NLP

1. The ethics of AI

- ▶ Fairness
- ▶ Societal applications

2. Transfer learning

- ▶ Cross-lingual methods
- ▶ Cross-domain methods

3. Question answering

4. Multimodal NLP

5. Clinical NLP

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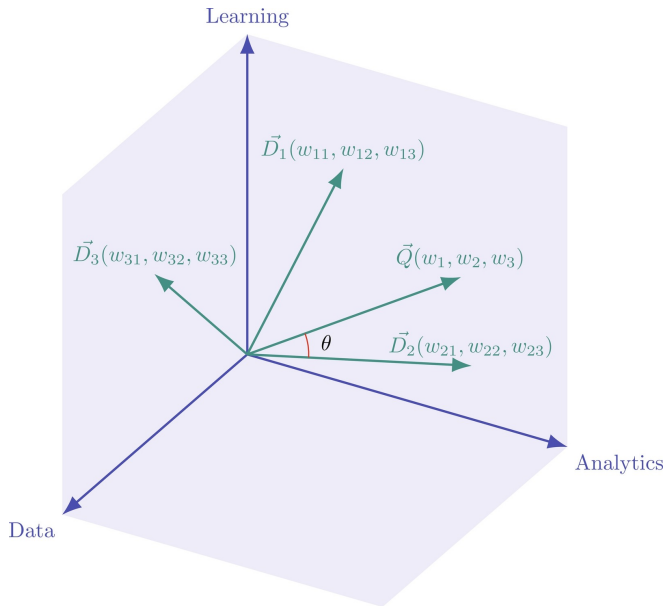
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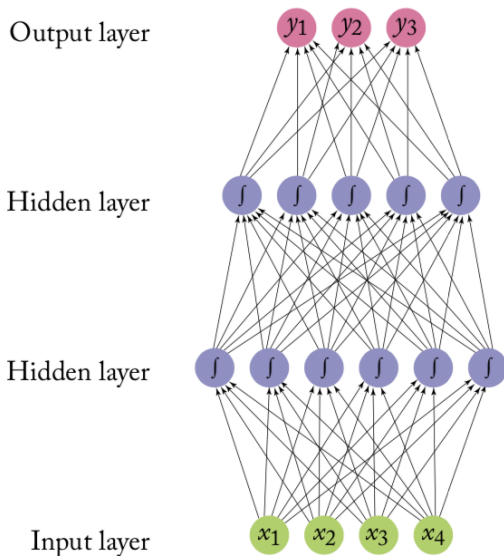
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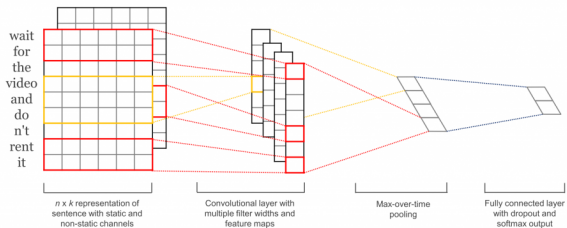
Vector space model [1]



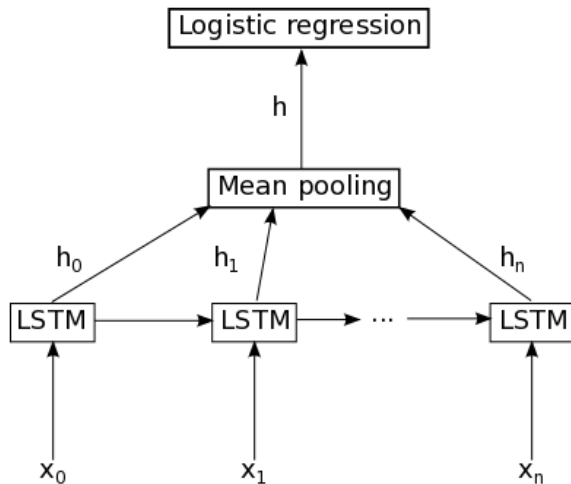
Feed forward network



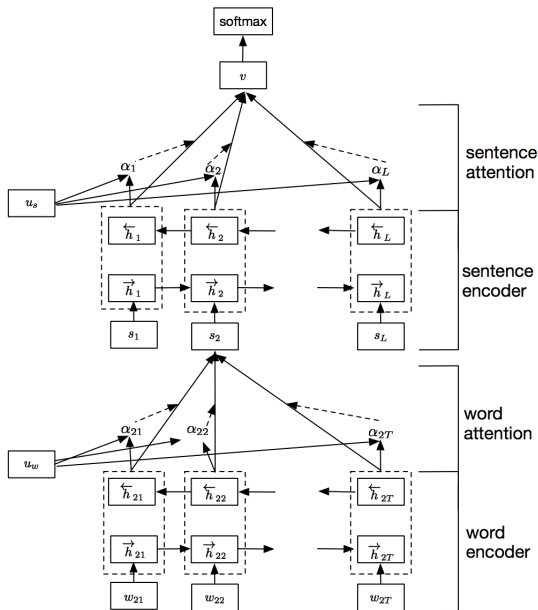
Convolutional network [2]



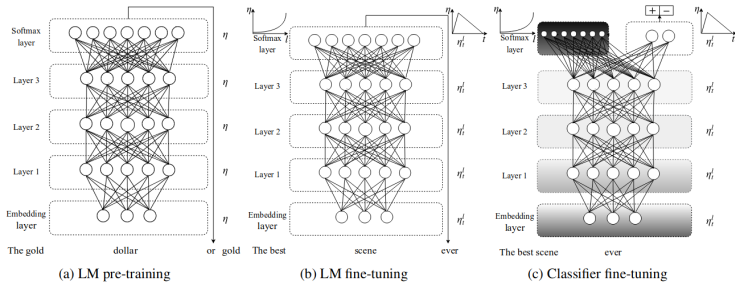
LSTM



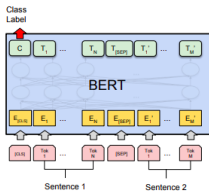
Hierarchical attention network [3]



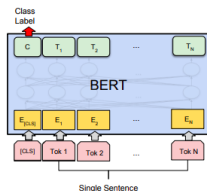
ULMFiT [4]



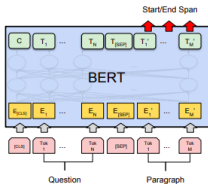
BERT [5]



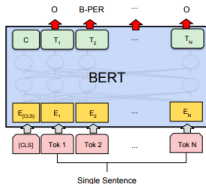
(a) Sentence Pair Classification Tasks:
MNLI, QQP, QNLI, STS-B, MRPC,
RTE, SWAG



(b) Single Sentence Classification Tasks:
SST-2, CoLA



(c) Question Answering Tasks:
SQuAD v1.1



(d) Single Sentence Tagging Tasks:
CoNLL-2003 NER

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Reading

1. Text classification algorithms: a survey [arXiv]
2. Speech and Language Processing. Daniel Jurafsky, James H. Martin, Ch. 2 [url]
3. Natural Language Processing. Jacob Eisenstein, Ch. 2-4, [[GitHub]

Reference

-  G. Salton, A. Wong и C.-S. Yang, “A vector space model for automatic indexing”, *Communications of the ACM*, т. 18, № 11, с. 613—620, 1975.
-  Y. Kim, “Convolutional neural networks for sentence classification”, *arXiv preprint arXiv:1408.5882*, 2014.
-  Z. Yang, D. Yang, C. Dyer, X. He, A. Smola и E. Hovy, “Hierarchical attention networks for document classification”, в *Proceedings of the 2016 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*, 2016, с. 1480—1489.
-  J. Howard и S. Ruder, “Universal language model fine-tuning for text classification”, *arXiv preprint arXiv:1801.06146*, 2018.
-  J. Devlin, M.-W. Chang, K. Lee и K. Toutanova, “Bert: Pre-training of deep bidirectional transformers for language understanding”, *arXiv preprint arXiv:1810.04805*, 2018.