Natural Language Processing

Unit 1: Introduction and Concepts

August 2019

Who am I?

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Master in Computer Science (UADY)
Research Engineer at SoldAI
Experience as Webmaster, Chief technology officer and Research engineer at SoldAI
Interest in conversational systems, Automatic reasoning and Biologically inspired algorithms

Course Syllabus

- Unit 1: Classical approaches: 11/10/2019
  - Introduction and concepts
  - Preprocessing
  - Lexical analysis
  - Sintactic analysis
  - Semantic analysis

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About the course

- Homework
  - Individual
  - Teams (2 persons)

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- Evaluation
  - Participation
  - Assignments (40 %)
  - Exam and projects (60 %)

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  - Projects: Python code (.py)

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  - Reports/Essays/Presentations: PDF
  - Programming assignments: Jupyter Notebok (.ipynb)
  - Projects: Python code (.py)
- Naming Individual:
  NLP_{*homework_no*}_{*last_name*}_{*first_name*}.{*file_extension*}
  Team:
  NLP_{*homework_no*}_{*team*}_{*last_names*}.{*file_extension*}
  examples: NLP_01_Campos_Mario.pdf,
  NLP_03_TeamA_Campos_Soberanis_Perez.pdf

What NLP is all about?

Natural Language Processing

"Natural Language Processing (NLP) is the interdisciplinary field of study between artificial intelligence, linguistics and computer science whose goal is to make computers perform useful tasks that involve human language"

What is NLP used for?

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- Make useful processing of text and speech (ortographic correction)

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- Tool to obtain knowledge of a bunch of unestructured data.

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  - Writing and grammatical errors

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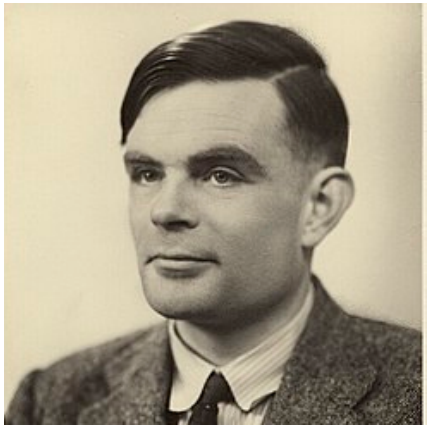
The perfect understanding of the human language is an AI-complete problem.

Turing Test



"A computer can be considered intelligent if it's able to hold a conversation with a human beign without realizing to be talking with a machine"

— Alan Turing

Ambiguity

- I saw the mountains flying to New York
- After the death, the miners refuse to work
- In Mexico a woman gives birth every 15 minutes
- The officer shot the man with the knife

Lost in translation

"The spirit is willing, but the flesh is weak"
Translates to:

Lost in translation

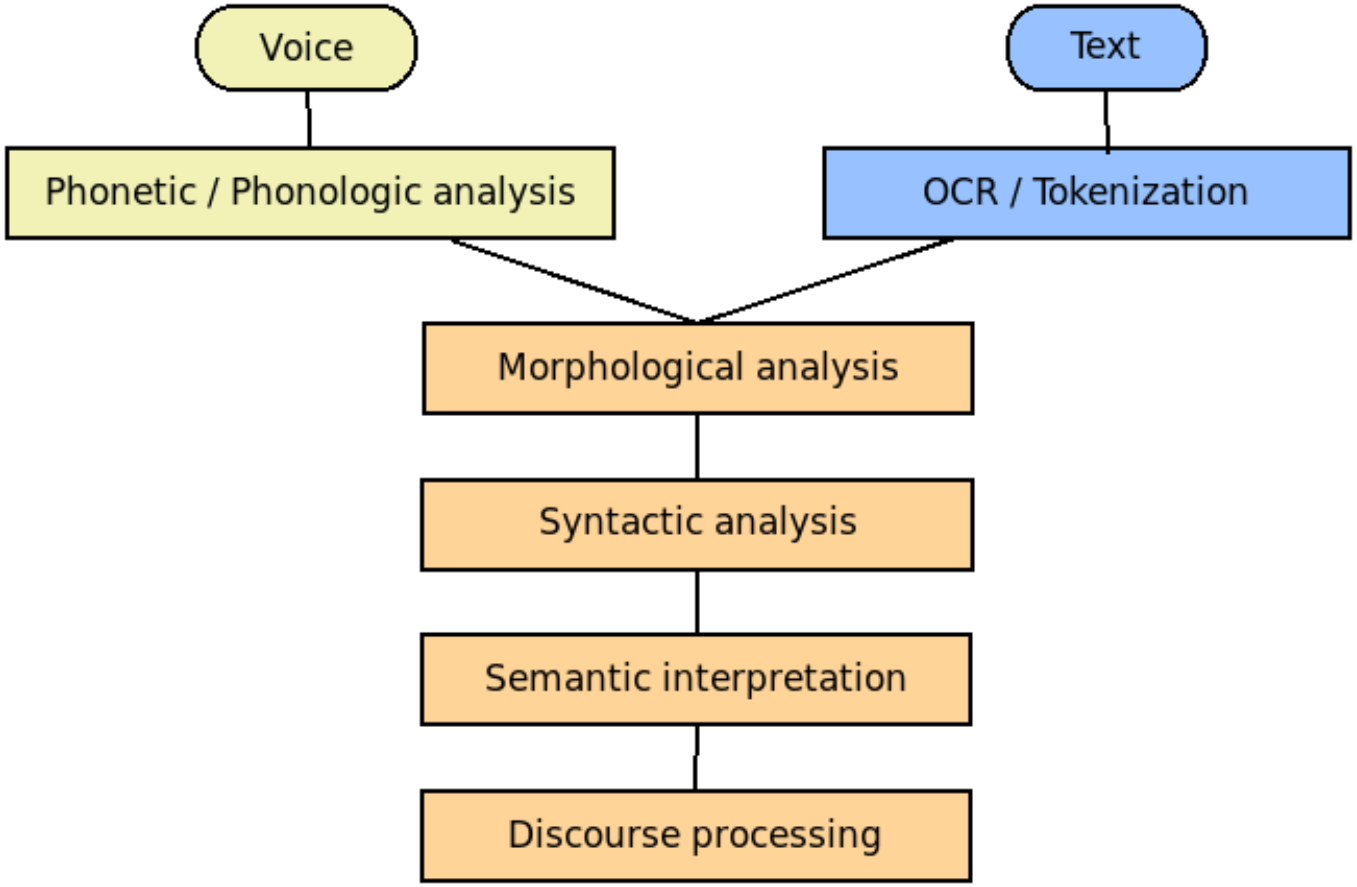
"The spirit is willing, but the flesh is weak"
Translates to:

"The vodka is agreeable, but the meat is rotten"

Combinatorial space for words

- A highschool student knows around 60,000 words
- Almost each sentence produced by a person is a combination generated for the first time in it's life.

NLP Levels


Voice
Text
Phonetic / Phonologic analysis
OCR / Tokenization
Morphological analysis
Syntactic analysis
Semantic interpretation
Discourse processing

Pre-processing

- Cleaning
  - Deletion of empty meaning words (stopwords)
  - Capitalization
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  - Stemming
  - Lematizing
- Others
  - Tokenizing / Segmentation
  - Counting and grouping

Main approaches

- Rule based methods
  - Regular expressions
  - Free context Grammars
  - First order logic

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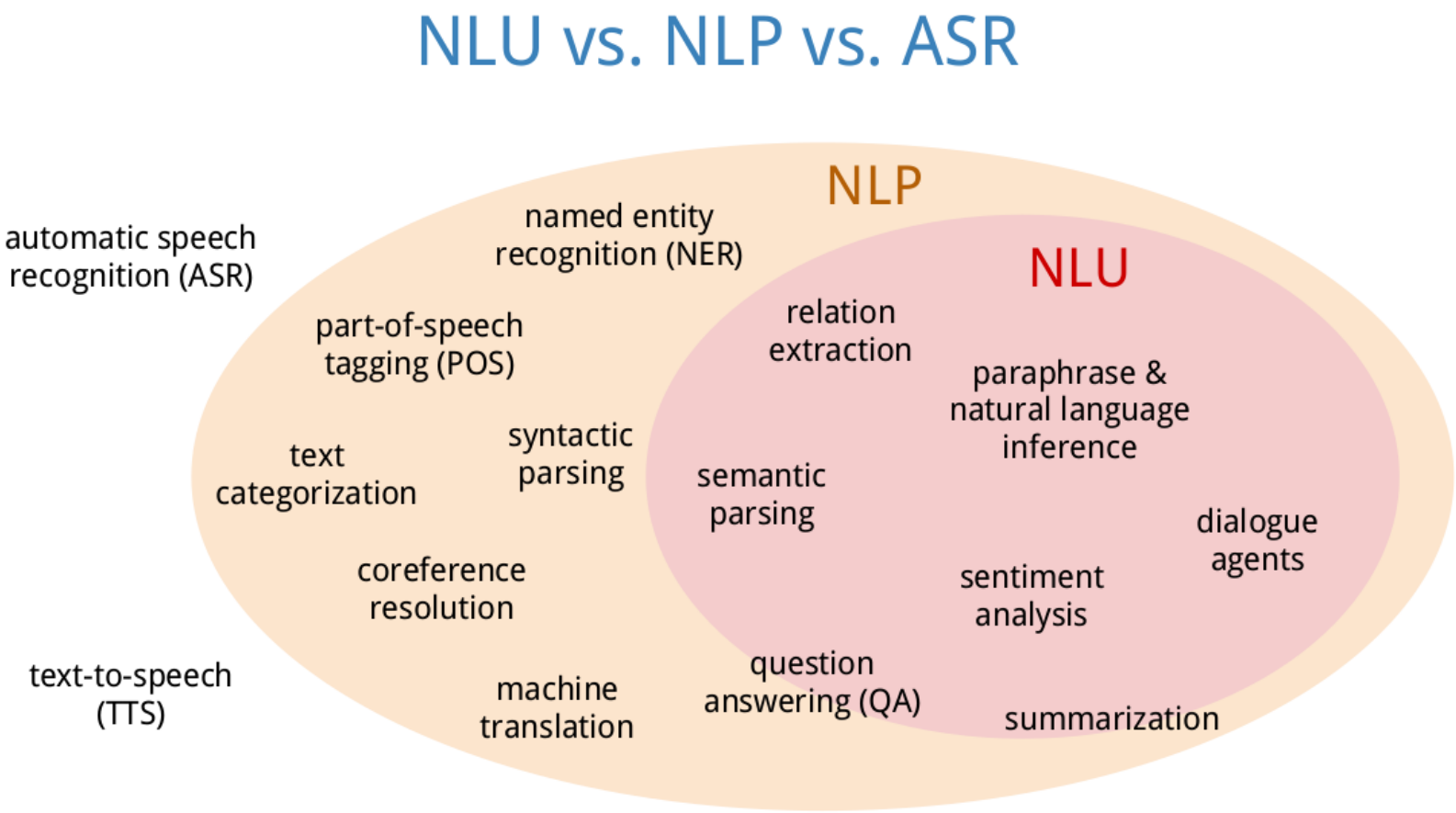
  - Maximum likelihood
  - Linear classification
  - Markov hidden chains
- Deep learning
  - Representation Learning
  - Embeddings
  - Convolutional, Recursive, Long Short Term Memory and Recurrent Neural Networks

Task terminology



Some interesting applications

- Sentiment Analysis
- Ortographic correction
- Search engines
- Information extraction
- Document classification
- Automatic translation
- Dialog systems and digital assistans
- Automatic quesiton answering
- Natural language database interfaces
- Automatic summary

Resources

- Libraries
  - NLTK (Natural Language Toolkit)
  - Stanford CoreNLP
  - Apache OpenNLP
  - Spacy
- Corpus and databases
  - WordNet
  - Penn TreeBank

Assignments

Assignment 1: Write a repport about one of the following NLP tasks:

- Automatic speech recognition
- Dialogue agents
- Sentiment analysis
- Question answering

The report will include:

- Applications
- Appraoches to solve the task
- Commercial products using it
- References

Let's code

Execute in your machine

git clone https://github.com/MaxSob/nlp-introduction

References

[1] Jurafsky, D., Martin, J.: Speech and Language Processing 2nd. ed. (2009).

[2] Mikolov, T., Corrado, G., Chen, K. y Dean, J.: Efficient Estimation of Word Representations in Vector Space. In: CoRR, (2013). https://dblp.org/rec/bib/journals/corr/abs-1301-3781

[3] Pinker, S.: The Stuff of Thought - Language as a window into human nature. https://www.youtube.com/watch?v=5S1d3cNge24