*Skrivet av Evan Saboo och Perttu Jääskeläinen*

Computers are great at numbers, greatly exceeding what humans are able to calculate and doing so in milliseconds. Working with structured data is easy and fast for computers to handle, but when it comes to humans, we don’t communicate using this kind of structure. We communicate using words, which is a form of unstructured data, which computers cannot easily handle. Through the help of Natural language processing (NLP), computers can understand and process the natural language that humans use.

At the infancy of NLP around 1950-1980’s, most existing systems used hand-written rules, such as the SHRDLU system[[1]](#footnote-0). However, in more modern systems starting around the late 1980’s with the introduction of machine learning and the increase in computational power, more possible solutions and algorithms for NLP were developed such as part of speech matching introduced the use of hidden markov models (HMM), and decision trees. Most recently in the 2010’s, deep neural networks have become widespread in NLP, enabling even greater results.

Current challenges in natural language processing frequently involve the following:

Speech recognition - translating speech into text form, which is then processed using

NLP. This falls into natural-language understanding, but is also individually marked as a challenging area, since it has to do with understand speech converted to text rather than written text.[[2]](#footnote-1)

Natural-language understanding - processing what is written and understanding the meaning depending on various variables.

Natural language generation - generating responses that is natural to humans. This can be seen as the opposite to natural-language understanding, since it is being translated from machine language to speech or text rather than vice-versa. This can be seen in various text-to-speech systems.[[3]](#footnote-2)

What are hidden markov models (HMM)?[[4]](#footnote-3)

Hidden markov models are used in various fields, such as data compression, molecular biology, pattern recognition and AI. For NLP, markov models are used to recognize patterns in speech, and by doing so, being able to break it down into text.[[5]](#footnote-4)

What is Backus-naur form (BNF)?[[6]](#footnote-5)

BNF is used when it is needed to describe the syntactic structure in a certain context. This can be the case for describing programming languages, formats or protocols.

What is natural language generation (NLG)?[[7]](#footnote-6)

NLG is producing written or spoken language from a dataset. For example, if given a bunch of financial data summarizing a year for a company, NLG could be used to draft a short report of the year, automatically generated instead of being written by a human. By only using the data points provided, NLG would generate text to represent the data.

What is natural-language understanding (NLU)?[[8]](#footnote-7)

Opposite to natural language generation (NLG), where NLG converts data to human (natural) language, NLU converts something received from a human (natural) language to data. This can be seen in systems such as Alexa for speech recognition, where a voice command is analyzed, broken down into text and then decided upon what operation is to be performed.

What are some areas for natural language processing (NLP)?

Speech recognition, translating human (natural) language to text/data and processed by computers, and text to speech, translating human written text into speech in various languages.

Explain parse trees

A parse tree is an ordered, rooted tree that breaks an sentence into its syntactic structure. While constructing a parse tree from a sentence, we can check if the sentence has the correct syntactic structure. We can generate a different sentence from the parse tree by following the syntactic rules. [Lecture 8]

What are stop words?

Stop words are commonly used words which are filtered out before or after processing of natural language data. These word are programmed to be ignored in search engines in order to save space and time.[[9]](#footnote-8)

What is Natural language processing (NLP)?

A subfield of AI, where the goal is to make computers able to interact with human (natural) languages. Areas for NLP are, for example, speech recognition, natural language understanding and natural language generation.

Explain what parsing in natural language processing is[[10]](#footnote-9)

Analyzing a string and determining the structure of the text. This can be, for example, breaking down “Tom ate an apple” into noun (apple), verb (ate), etc..

In what systems can Natural language processing (NLP) be seen today?

Google translate uses NLP to process a sentence in one language, identifying what it means and then re-structuring it in another language, where the sentence structure might not be the same. Alexa or Siri for speech recognition, where someone's voice command is broken down to determine what operation to do.

1. <http://hci.stanford.edu/winograd/shrdlu/> [↑](#footnote-ref-0)
2. <https://searchcrm.techtarget.com/definition/speech-recognition> [↑](#footnote-ref-1)
3. <https://searchenterpriseai.techtarget.com/definition/natural-language-generation-NLG> [↑](#footnote-ref-2)
4. <http://mlg.eng.cam.ac.uk/zoubin/papers/ijprai.pdf> [↑](#footnote-ref-3)
5. <https://mi.eng.cam.ac.uk/~mjfg/mjfg_NOW.pdf> [↑](#footnote-ref-4)
6. <https://www.techopedia.com/definition/24061/backus-normal-form-bnf> [↑](#footnote-ref-5)
7. <https://searchenterpriseai.techtarget.com/definition/natural-language-generation-NLG> [↑](#footnote-ref-6)
8. <https://searchenterpriseai.techtarget.com/definition/natural-language-understanding-NLU> [↑](#footnote-ref-7)
9. <https://searchmicroservices.techtarget.com/definition/stop-word> [↑](#footnote-ref-8)
10. <http://stp.lingfil.uu.se/~nivre/master/NLP-Parsing.pdf> [↑](#footnote-ref-9)