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Overview of NLP

Definition of NLP in my own words

A subfield of Computer Science and Artificial Intelligence in which a computer gains the ability to process, analyze, and understand human (natural) language.

Relationship between AI and NLP

In NLP, humans train and program a computer to process and understand language the way a human does. The goal is to make a computer as artificially intelligent as possible so it behaves like a human would when reading a text. It is a subfield of AI since it is only concerned with language processing.

Natural language understanding vs. natural language generation

Understanding focuses on the reading comprehension of a machine/model. It is concerned with the input of a user. Generation focuses on the output instead. A machine/model is trained to "talk" like a human would in human language.

Examples of modern NLP applications

- Virtual assistants, such as *Siri, Alexa, Google Assistant,* and *Cortana,* that receive input from a user's voice and execute instructions
- Chatbots, such as ChatGPT or customer service bots (e.g., Amazon chat), which give the user to ability to chat with a machine that acts like a human to, for example, assist them.
- Auto correct: Machines use NLP to improve a user's writing

Main approaches in NLP

Rules-based approaches

These approaches consist of regular expressions (RE) and context-free grammar (CFG). RE's are patterns that are used to match character combinations in input strings. CFG is a formal grammar with a set of recursive rules used to generate syntactically correct sentences or to check whether sentences are grammatically correct. These approaches are old NLP techniques in the fields of compiler design and linguistics. These approaches dominated until the 1980s.

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Statistical and probabilistic approaches
These approaches followed rules-based ones and consisted of mathematical approaches to text. Words could be counted, and probabilities of words and sequences of words could be calculated which led to useful language models. Examples include the probability of what a user will search next in a search bar, which could be predicted with such models. These approaches include classic machine learning models, such as Naïve Bayes and Logistic Regression, which learn by statistical and probabilistic methods on moderate to large amount of data.

Deep learning
This approach evolved when huge amounts of data and larger processing power though GPU's and clout computing became available. Deep learning approaches include recurrent and convolutional neural networks. This is the modern, highly hyped, approach to NLP. New techniques to this approach are coming out every day, making this a fast evolving field of AI.

My personal interest in NLP
I've gotten more familiar with AI/ML over the past couple of months, especially after taking Intro to ML last semester. I've had a therefore increasing interest to learn more about other subfields of AI, and now, especially with the hype about things like ChatGPT and other chatbots, I wanted to learn more about NLP specifically. I am attending grad school after UTD, so I wanted to spend my undergraduate studies with finding out what I like the most about CS. AI has so far been the most interesting topic for me, that I could imagine working in eventually. Naturally, NLP was the next step in this "journey". I'm also attending TAMUhack this weekend, where my group and I are planning on doing something NLP related.