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September 4, 2022
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CS 4395.001

CS 4395: Overview of NLP

a. Define NLP in your own words

Natural language processing, NLP, is a field within artificial intelligence that is concerned with the understanding and generation of human languages. It can be used to process texts and documents at a large scale, as well as automate the generation of language.

b. Describe the relationship between AI and NLP

Natural language processing is a specific branch of artificial intelligence [1]. While artificial intelligence is the broad domain of using machines to “know” and apply knowledge like humans do, natural language processing deals specifically with the natural languages humans know and how they create and understand it.

c. Compare and contrast natural language understanding and natural language generation

Natural language understanding and natural language generation work in tandem but are distinct. Natural language understanding refers to the processing of language that has already been generated, while natural language generation deals with the actual creation of natural language, especially as a response. They both require translation between natural language and machine language via artificial intelligence and operate within the realm of natural language processing.

d. Modern NLP applications

Modern natural language processing applications are primarily in the realm of human-computer interaction. For example, devices such as Amazon’s Alexa and Google’s OK Google utilize natural language processing [2], as they understand human commands and are able to generate responses. Natural language processing is also used for providing automated customer assistance via phone call [2]. In emails, NLP is also used for filtering spam emails by recognizing words that may make an email be considered “spam” [1].

e. Main approaches to NLP: rules-based, statistical and probabilistic, deep-learning

The rules-based approach was primarily used in the 1960s up to the 1980s. It relies on strict “rules” used in language, such as for how words are altered for grammar and how sentences are structured, and implements them via regular expressions and exceptions [1]. It does not

capture any of the nuances of language when spoken. However, it is effective when used for spell check and simple chat boxes [1].

The statistical and probabilistic approach was used starting in the late 1980s. It applies machine-learning algorithms to recognize patterns in human language, such as how many times a word or phrase is used [1]. Some examples of how the statistical and probabilistic approach is used are for machine translations between different human languages, as well as predictive search and sentence completion [1].

The deep-learning approach uses extremely large amounts of data and strong processing to go beyond counting words and phrases. It aims to replicate human speech down to the context of conversation and individuals' speech preferences and memory [1]. It emerged in the 2010s and is the current cutting-edge approach to NLP. Its application is mainly improving the understanding and generation of natural language [1] to make what has been already achieved with rules-based and statistical and probabilistic approaches more human-like and nuanced.

f. Personal interest in NLP

My personal interest in NLP is particularly in the realm of language translations. As a Vietnamese-American, I was spoken to in Vietnamese at home but never received formal classes, so I turned to apps and websites to study Vietnamese along with other languages I found interesting. Many apps use chat boxes to allow you to "practice" speaking or texting in that language. I think it's amazing that my field of study, software engineering, is applicable to those apps and can connect you to a different culture via language using NLP. If I ever get the opportunity, I think it would be very rewarding to work on projects that improve language education so people can be more connected.

References:

[1] K. Mazidi, *Exploring NLP with Python: Building Understanding Through Code*, 1st ed. 2019.

[2] C. Dilmegani, "A Complete Guide to NLP: What it is, How it Works and Use Cases," *AIMultiple.com*. [Online]. Available: https://research.aimultiple.com/nlp/ [Accessed: September 1, 2022]