Alejo Vinluan
Abv210001
CS 4395.001 – Human Language Technologies

Overview of NLP

Natural Language Processing is the act of computers processing natural human language. A computer has the ability to read individual words. However, extra care must be taken in processing the string of words and understanding the string. AI is a broad category where computers can predict outcomes or generate results. NLP sits within AI and helps computers process text-based responses made by humans.

NLP can be broken into two parts: Natural Language Understanding and Natural Language Generation. Natural Language Understanding and Natural Language Generation are part of the same approach within NLP, but require two different solutions. Natural Language Understanding is the process in which a computer or a person understands what a third-party is communication to them. On the flip side, Natural Language Generation occurs when a human or a computer want to create a sentence, whether as a response or isolated.

An example of NLP would be Google Assistant. Google Assistant works by telling a supported device, "Hey Google!" The statement would wake up the device. The user can then follow up the statement with a question or a statement. "Hey Google! Set an alarm for 7:30am." would set an alarm at 7:30am while "Hey Google! What is the powerhouse of the cell?" would prompt Google to tell you about the mitochondria. When speaking to Google Assistant, Natural Language Understanding has to take place. Google Assistant must understand what your request or statement is. Then, Natural Language Generation must occur so that Google Assistant would have a proper response for you

Another example of NLP would be autocompletion of phrases or statements in an email. When writing an email in Outlook, Outlook will attempt to autocomplete the sentences it believes you are attempting to write. Natural Language Understanding occurs since Outlook is attempting to understand what you are typing in the email. Then, Natural Language Generation occurs as Outlook will suggest ways to complete your sentence. If I were to type, "Best re" into my

email, Outlook may suggest to complete the statement, "Best regards, Alejo Vinluan".

There are three main approaches to NLP: the rules-based approach, the statistical and probabilistic approach, and the deep learning approach.

The rule-based approach to NLP uses set rules to give responses back to the user. A rule-based approach can use context-free grammar in order to determine whether or not the sentence is grammatically correct. The rule-based approach was also able to generate syntactically correct sentences, although the sentences may not make sense. For example, "The pig was flying." Is both syntactically correct and physically impossible. This rule works because a statement is created using a subject and a predicate.

Another approach to NLP is the statistical and probabilistic approach. This approach is similar to classic machine learning models like Logistic Regression, Decision Trees, and small Neural Networks. These probabilities could work in order to determine how to complete a sentence. For example, starting a sentence with "Today's date is," can allow an autocompletion model to complete the sentence with "01/25/2023". Since there is a high probability that "Today's date is," within a statement is followed by a date on the calendar, a statistical and probabilistic approach could be utilized.

Finally, a deep learning approach is utilized since large amounts of data and stronger processing power have become available. These algorithms can include recurrent neural networks and convolutional neural networks. A deep learning approach to NLP would be the Google Assistant example noted above. Google has access to all of the statements made to its Google Assistant platform. It could utilize all of the statements from Google Assistant to help build and teach itself.

I'm personally interested in NLP since it's a science of how humans communicate with each other and how computers can process these communications. The advancement of personal assistants such as Siri, Alexa, and Google Assistant is interesting. The idea that they can seamlessly breakdown requests and statements in seconds is impressive. They can help us in everyday life, like changing a song while driving or setting a timer while cooking. I'd love to be able to work on a team that develops these personal assistants.