Overview of NLP

a. define NLP in your own words

Natural Language Processing, or NLP, is the process of using a computer to decode the meaning of natural language, such as English, as opposed to a formal programming language, such as C. There are multiple approaches that can be taken that allow for varying levels of complexity. The three main approaches are:

1. Rules based approaches
2. Statistical approaches
3. Deep learning

b. describe the relationship between AI and NLP

Artificial intelligence and Natural Language Processing often work hand-in-hand. AI is a powerful tool that can be used extensively for natural language processing, especially for statistical/probabilistic and deep learning approaches. AI can be trained to form a network to interpret the loose rules often found in natural languages.

c. write a sentence or two comparing and contrasting natural language understanding and natural language generation

NLU and NLG are the two core components of NLP. The goal of NLU is to determine the syntactic and semantic meaning of a natural language statement. NLU creates an ontology that is used to keep track of the relationships between words and phrases. This can be a difficult task when languages have words with several meanings depending on the context.

NLG is the inverse of NLU. The goal is for the computer to generate syntactically and semantically correct text that can be understood by humans. Another use of NLG is to shorten long text, such as news articles. To do this, it must be able to understand what information is relevant and break it down into more concise language.

d. list some examples of modern NLP applications

1. Virtual assistants (Siri, Cortana, Alexa)
2. Email filters
3. Predictive text
4. Text summarizers
5. Grammar checkers

e. write 3 paragraphs describing each of the 3 main approaches to NLP, and list examples of each approach

Rules based approaches utilize predefined rules of language syntax to determine what parts of a sentence are relevant. Rule based NLP utilizes dictionaries, thesauruses, and large libraries of existing rules to help decipher natural language. One of the key downfalls of this method is that rules must be defined. The processor cannot adapt to change unless the libraries are updated. This makes it difficult to use in environments where there is unique jargon or shorthand.

Statistical approaches utilize probability to determine meanings. This approach is useful when there are spelling or grammatical errors. Statistical models are used extensively in everyday applications such as spell checkers and autocomplete.

Deep learning is the most recent approach to NLP. It utilizes different artificial intelligence models to "train" a network on what natural language looks like. It can take existing rules and manipulate them based on actual examples, so that slang and jargon are both accounted for and understood.

f. write a paragraph describing your personal interest in NLP and whether/how you would like to learn more about NLP for personal projects and/or professional application

Natural language processing technologies are showing up in more and more areas. As a software engineer, tools such as Intellisense or Copilot have proven to be extremely useful in both my job and my hobby. In one of my recent work assignments, I worked with a python script that would analyze large amounts of text and categorize any information that it identified as relevant to intelligence officers. My goal in this class is to deepen my understanding of NLP so that I can further improve the products I work on in my job.