

Q1. Explain Natural Language Processing (NLP).
Discuss its main components and applications.

Ans. Natural Language Processing is a field of Artificial Intelligence that helps computers understand and process human language. It enables machines to read, analyze, and generate text or speech in a meaningful way. NLP acts as a bridge between human communication and computer systems.

The main components of NLP include lexical analysis, which breaks text into words, syntactic analysis, which checks grammatical structure, semantic analysis, which determines meaning, and pragmatic analysis, which considers context. NLP is used in applications such as chatbots, machine translation, semantic analysis, speech recognition and search engines.

Q2. Describe the Bag-of-words model. What are its advantages and limitations in text representation?

Ans. The Bag-of-words model is a technique used in NLP to represent text data as numerical vectors. It works by counting the frequency of each word in a document without considering the order of the words. Each document is represented using a fixed vocabulary.

An advantage of the Bag-of-words model is that it is simple and easy to implement. It is also computationally efficient for text classification tasks. However, the main limitation is that it ignores word order and context, which can cause loss of meaning. It also produces sparse vectors and cannot handle semantic relationships well.

Q.3. Explain how transformers work in Natural Language processing. Mention the role of the attention mechanism.

Ans. Transformers are deep learning models used in modern NLP tasks such as translation and text generation. Unlike RNNs, transformers process input sequences in parallel, which makes them faster and more efficient.

The attention mechanism is the key component of transformers. It allows the model to focus on important words in a sentence while processing each word. Self-attention helps capture long-distance dependencies and understand context better. Transformers use encoder and decoder layers and are the foundation of models like BERT and GPT.