NATURAL LANGUAGE PROCESSING (NLP)

What is NLP?

Natural Language Processing (NLP) is a field of artificial intelligence that focuses on the interaction between computers and humans through natural language. It involves the development of algorithms and models to enable computers to understand, interpret, and generate human language. NLP is essential for tasks such as machine translation, sentiment analysis, text summarization, and question answering. It's also used in large language models (LLMs), with ChatGPT being the most well-known example of an LLM.

Project Objectives

- Provide students with a comprehensive understanding of natural language processing and deep learning concepts.
- Teach students the basic flow of an NLP project and learn how to implement fundamental NLP preprocessing techniques and models in Python.
- Apply these techniques to practical NLP problems and datasets.

Prerequisites

Programming knowledge of Python and some familiarity with Machine Learning algorithms; it does not require any prior knowledge of linguistics or Natural Language Processing.

PROJECT PLAN

WEEK 1- Deep Learning Fundamentals

Introduction to Deep Learning

Feedforward Neural Networks and Backpropagation

Gradient Descent and Learning Rate

WEEK 2- Intro to NLP and Text Preprocessing

Introduction to NLP

- Intro to NLP and overview of basic NLP pipeline

Text Preprocessing Techniques

- Understanding all basic text preprocessing techniques like tokenization, stemming and lemmatization.
- Applying advanced preprocessing techniques like removing stop words, removing punctuations, removing URLs, lowercasing etc.
- Learning how to code them in Python libraries like SpaCy and NLTK.

WEEK 3- Text Representation

Understanding the importance of text representation

Basic Text Representation Techniques

- One Hot Encoding
- Bag of Words (BoW)
- n-Grams
- TF-IDF
- Word2Vec (CBOW and Skip-grams)

WEEK 4- Recurrent Neural Networks (RNNs) and GRUs (Gated Recurrent Units)

RNNs

- Understanding basic structure and functioning of RNNs
    - Difference between normal feed forward Neural Network and RNN.

GRUs

- Understanding GRUs and their structure
- Learning to implement GRUs in Tensorflow
- Comparing performance with that of RNN.

WEEK 5- LSTM and Transformers

LSTMs

- Understanding Long Short-Term Memory (LSTM) networks and their structure
- Differences between RNNs and LSTMs, and why LSTMs solve the vanishing gradient problem

Transformers

- Introduction to the Transformer architecture and self-attention mechanism
- Key components of Transformers: Encoder-Decoder structure, Multi-Head Attention

WEEK 6- FINAL PROJECT

Applying all the above NLP preprocessing methods, text representation methods, deep learning fundamentals, and any of the above models to a final project.

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Please feel free to reach out with any questions or for further discussion about this proposal. Thank you for considering our teaching services.