FAST-NU Peshawar

Linear Regression Example

Sami Uddin Shinwari

`samu.shinwari@gmail.com`
`MS Data Science`

1 Introduction to Natural Language Processing

- What is NLP?

- Applications of NLP

- Basic text processing and manipulation

2   Text Preprocessing

- Tokenization

- Stemming and Lemmatization

- Stop Words Removal

- Text Normalization (Lowercasing, Removing Punctuation)

3   Text Representation

- Bag of Words (BoW)

- TF-IDF (Term Frequency-Inverse Document Frequency)

- Word Embeddings (Word2Vec, GloVe, FastText)

- Contextual Embeddings (ELMo, BERT, GPT)

4   NLP Tasks and Techniques

- **Classification Tasks:**
    - Sentiment Analysis
    - Text Classification
    - Spam Detection

- **Sequence Labeling:**
    - Part-of-Speech (POS) Tagging
    - Named Entity Recognition (NER)

- **Language Modeling:**
    - n-grams
    - Neural Language Models

- **Parsing:**
    - Syntax Parsing
    - Dependency Parsing

5   Advanced NLP Techniques

- **Sequence-to-Sequence Models:**

  – Machine Translation

  – Text Summarization

  – Chatbots and Conversational AI

- **Attention Mechanisms:**

  – Self-Attention

  – Transformer Model Architecture

- **Pre-trained Models:**

  – Fine-tuning BERT

  – GPT-2/GPT-3 for text generation

  – T5 for text-to-text tasks

6   Deep Learning for NLP

- **Recurrent Neural Networks (RNNs):**

  – Vanilla RNNs

  – Long Short-Term Memory (LSTM) Networks

  – Gated Recurrent Units (GRUs)

- **Transformers:**

  – Understanding the Transformer architecture

  – Applications of Transformers in NLP

- **Attention Models:**

  – Scaled Dot-Product Attention

  – Multi-Head Attention

7 Evaluation and Optimization

- Evaluation Metrics (Accuracy, Precision, Recall, F1 Score, BLEU, ROUGE)

- Hyperparameter Tuning

- Model Optimization Techniques

8 Practical Applications and Projects

- **Projects:**
  - Building a Sentiment Analysis Model
  - Developing a Chatbot
  - Creating a Text Summarizer
  - Implementing Machine Translation

- **Case Studies:**
  - Analyzing real-world NLP applications
  - Exploring case studies in healthcare, finance, and social media

9 Ethics and Fairness in NLP

- Bias in NLP models

- Fairness and ethical considerations

- Privacy and data protection

10 NLP Research and Trends

- Current research topics in NLP

- Future directions and trends

- Staying updated with the latest advancements

11   Tools and Libraries

- **NLP Libraries:**
  - NLTK
  - SpaCy
  - TextBlob

- **Deep Learning Frameworks:**
  - TensorFlow
  - PyTorch
  - Hugging Face Transformers

12   Capstone Project

- Implementing a comprehensive project combining various NLP techniques

- End-to-end application development

- Presentation and documentation of the project