Signal and Natural Language Processing with Deep Learning

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Syllabus

1. Introduction to Signals and Natural Language Processing with DL
2. Features Extraction
3. Development of DNN Models for AUDIO with KERAS
4. Natural Language Processing: Word Embeddings
5. Transformers & Large Language Models
6. Speech Processing

Prerequisites

1. **Proficiency in Python Programming**:
    1. Understanding of basic Python syntax and data structures.
    2. Familiarity with libraries like NumPy, Pandas, and Matplotlib.
    3. Basic experience with data manipulation and file handling in Python.
2. **Foundations of Neural Networks**:
    1. Basic concepts of neural networks, including neurons, activation functions, and layers.
    2. Understanding the architecture and working of a Multilayer Perceptron (MLP).
    3. Knowledge of backpropagation and gradient descent algorithms.
3. **Training Concepts**:
    1. Understanding the process of training a neural network.
    2. Concepts of loss functions, optimization, and learning rate.
    3. Awareness of overfitting and underfitting issues.
    4. Knowledge of how to split data into training, validation, and test sets.
    5. Understanding the purpose of each set and how they contribute to model evaluation.
4. **Basic Signal Analysis**:
    1. Familiarity with fundamental concepts of signal processing such as Fourier Transform and frequency analysis.
    2. Basic understanding of how signals can be represented and analyzed in the frequency domain.
5. **Deep Learning Frameworks**:
    1. Basic knowledge of at least one deep learning framework such as TensorFlow or PyTorch.
    2. Ability to build and train simple neural network models using these frameworks.

Evaluation

1. **Assignments**:
    1. Regular assignments given throughout the course to assess understanding of key concepts.
    2. Practical coding exercises involving the implementation of neural networks, signal processing, and natural language processing tasks.
2. **In-Class Presentation**:
    1. Presentation of a selected project or research topic related to signal processing or natural language processing with deep learning.
    2. Evaluation based on clarity, depth of understanding, and the ability to communicate complex concepts effectively.
3. **Final Exam**:
    1. A comprehensive exam covering all topics discussed during the course.
    2. Combination of theoretical questions and practical problems, including coding and data analysis tasks.
    3. Multiple answer questions abcd + Exercises