

CHAPTER 1

Introduction to Signals and Natural Language Processing with DL

Revised Approach to Official Syllabus

The official syllabus is a list of contents, the order of topic study may not follow the listed order in the official program, as we'll adapt to best support your learning.

Be prepared for a dynamic and application-driven approach to NLP and a more practical, hands-on learning experience.

Bring your laptop to classroom and try continuously.

Key Changes and Principles

1. **Flexibility:**

1. Official syllabus serves as a guideline
2. Content and order may be adjusted for improved pedagogy

2. **Non-chronological Official Program:**

1. The official program lists content topics, not a strict chronological order
2. Topics will be covered in an order that best supports practical learning

3. **Coordination with Other Courses:**

1. LSTM section streamlined (leveraging prior knowledge from “IA image” course)
2. Focus on application rather than re-explanation

4. **Practical Focus:**

1. Emphasis on hands-on, applied learning
2. Earlier introduction of practical applications

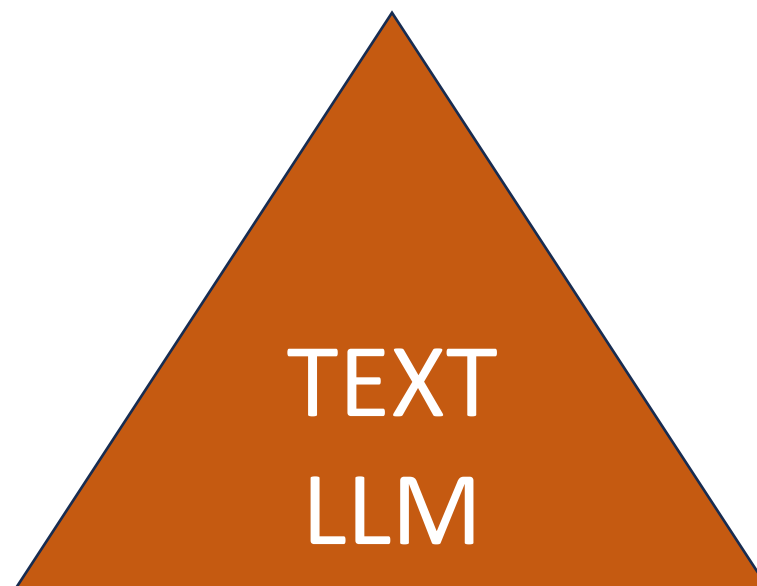
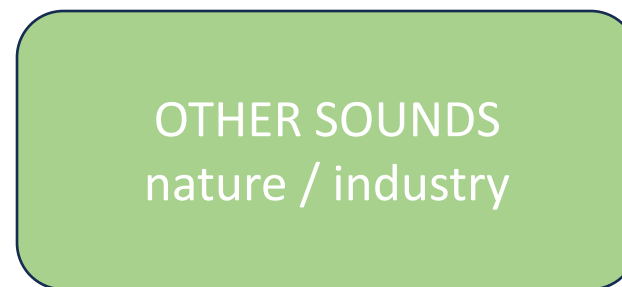
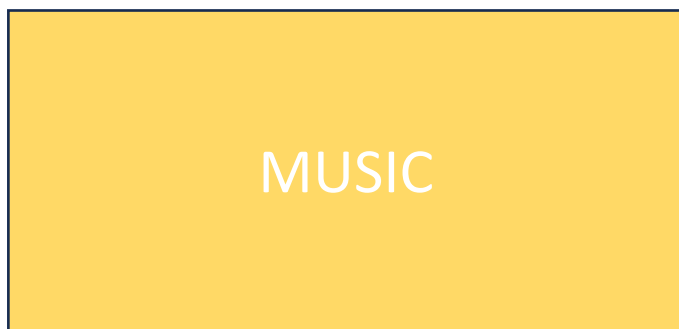
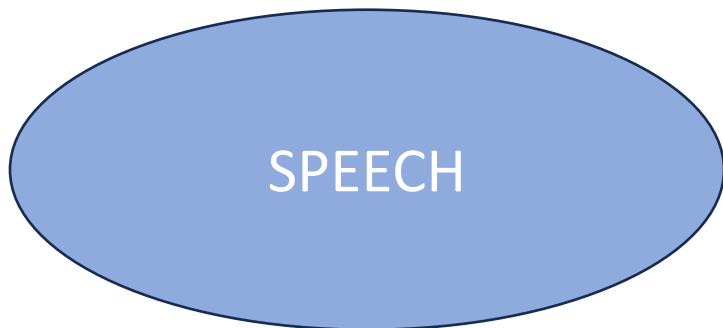
5. **Dynamic Progression:**

1. Course will advance alongside practical applications
2. Order of topics may be altered to facilitate this approach

6. **Learning Objectives:**

1. Prioritize practical, applicable skills in NLP
2. Ensure students can implement and use NLP techniques effectively

Signals to handle



Signals Processing

- Sound and Audio Signals

How to process and analyze various types of audio signals, including environmental sounds, complex audio scenes, industrial signals. Techniques to extract meaningful features from raw audio data, enabling machines to understand and classify different sound types.

- Speech Processing and Recognition

Delve into the specifics of speech signal processing, focusing on the extraction of features. Understand how to build and train deep learning models for automatic speech recognition (ASR) to convert spoken language into written text and explore applications like voice-controlled systems and transcription services.

- Music Analysis & Synthesis

Discover how deep learning can be used for music genre classification, beat tracking, and music recommendation systems. This involves feature extraction techniques that capture the rhythm, harmony, and timbre of music. Also, music generation.

Natural Language Processing

Processing Language

Explore the processing of written language starting from its most basic representation: ASCII text. Understand the challenges of converting raw text into numerical formats that can be fed into neural networks. Techniques such as tokenization, embedding (e.g., Word2Vec), and sequence modeling with Recurrent Neural Networks (RNNs) and Transformers will be covered.

Language Understanding and Generation:

Learn how to apply deep learning models to tasks like sentiment analysis, machine translation, and text generation. This includes understanding the syntactic and semantic aspects of language and building models that can understand and generate coherent text.

Applications for Sound Signals

- Speech to text (Speech recognition)
- Singing voice detection
- Spoken Language Identification
- Speaker Identification (Voice Biometrics)
- Speech emotion recognition (Sentiment Analysis in Speech)
- Speech Enhancement (Noise & Interference removal)
- Musical gender classification
- Music recommendation
- Song recognition (1. exactly the same recording 2. other version/cover)
- Querying by humming
- Sound to score or MIDI
- Song key recognition
- Text to speech (Speech synthesis)
- Speech imitation (Voice cloning)
- Music Synthesis (based on ML)

Applications in Language Processing

- Language identification
- Extract important information
- Mood
- Summarization
- Improvement of writing style
- Grammar mistake detection and correction
- Translation
- Word prediction / sentence completion
- Computer coding completion
- Topic classification
- LLM