

Natural Language Processing

Course description:

Natural language processing (NLP) is one of the most important and useful application areas of artificial intelligence that models how we share information. Applications of NLP are everywhere because people communicate almost everything in language: web search, advertising, emails, customer service, language translation, virtual agents, medical reports, politics, etc. With the recent development in deep learning and availability of textual data, NLP is going through rapid evolution. In this course, you will explore fundamental to cutting edge concepts and their role in emerging technologies. By mastering the NLP skills, you will gain the skills to design advance and complex NLP systems.:

Course structure

- Lecture: (4 hours)
 - Learn about theoretical concept of NLP and cutting-edge deep learning for NLP.
- Workshop: (1 hours)
 - Learn how to use Python-based tools to support lecture and project topics.

Course goals:

- Computational properties of natural languages
- Neural network models for language understanding tasks
- Word vectors, syntactic, and semantic processing
- Coreference, question answering, and machine translation
- Transformers and pretraining
- Recent development in NLP

Prerequisites:

- Machine Learning and Deep Learning: Knowledge of machine learning and deep learning.
- Proficiency in Python: All coding assignments will be written in Python. You should be familiar with numpy and matplotlib.
- Calculus and Linear Algebra: You should understand the following concepts from multivariable calculus and linear algebra: chain rule, gradients, matrix multiplication, matrix inverse.

Assessment: 20%

- Assignment-1: to evaluate the understanding basic of natural language processing.
 - Target Learning Outcomes: CLO-1, CLO-2, CLO-5
- Assignment-2: to assess the concept and implementation skills of basic of NLP such as text normalization, NER, parsing and semantic processing.
 - Target Learning Outcomes: CLO-3, CLO-4, CLO-5
- Project: 40%: to evaluate the skills to teckel advance natural language processing problems in real world
 - Target Learning Outcomes: CLO-2 CLO-3, CLO-4, CLO-5
- Final Exam: 40% evaluate the proficiency and skills in dealing the complex problems through case studies.

Target Learning Outcomes: CLO-1, CLO-2 CLO-3, CLO-4, CLO-5

Course Learning Outcomes:

1. Understand the basic concepts and basic algorithms of Natural language processing.
2. Ability to use existing natural language processing tools to conduct basic natural language processing, such as text normalization, named entity extraction, syntactic parsing and semantic processing.
3. Ability to interpret the results and decompose a real-world problem into subproblems in natural language processing and identify potential solutions.
4. Ability to design system to tackle advance NLP problems using state of the art natural language processing solutions.
5. Analyze large volume text data generated from a range of real-world applications

Course Topics:

Week	Topic		Alignment with CLOs
Week 01	Introduction to NLP		CLO-1, CLO-2
	Basic Text Processing		CLO-1, CLO-2
Week 02	Lexicon and lexical processing		CLO-1, CLO-2
	Syntax and syntactic processing		CLO-1, CLO-2, CLO-5
Week 03	Semantics and semantic processing	Assignment 1 (10%)	CLO-1, CLO-2, CLO-5
Week 04	Sentiment Analysis	Project Proposal	CLO-2, CLO-3
	Named Entity Recognition and other information extraction		CLO-2, CLO-3
Week 05	Data and evaluation		CLO-3
Week 06	Break		
Week 07	Feature Extraction and Embedding		CLO-3, CLO-4, CLO-5
	Word Vector and word sentence		CLO-3, CLO-4, CLO-5
Week 08	Deep Learning in NLP	Assignment 2	CLO-4, CLO-5
	Modelling		CLO-4, CLO-5
Week 09	Contextual Word Representations		CLO-4
	Transformers		CLO-4
Week 10	Guest Lecture: Natural Language Generation	Project submission	CLO-4
	Guest Lecture: Conversational System		CLO-4