

LT5429: ADVANCED NATURAL LANGUAGE PROCESSING

Effective Term

Semester A 2026/27

Part I Course Overview

Course Title

Advanced Natural Language Processing

Subject Code

LT - Linguistics and Translation

Course Number

5429

Academic Unit

Linguistics and Translation (LT)

College/School

College of Liberal Arts and Social Sciences (CH)

Course Duration

One Semester

Credit Units

3

Level

P5, P6 - Postgraduate Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

LT5411 Computational Linguistics (or equivalent foundational knowledge in NLP and basic programming)

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course builds upon the foundational principles of computational linguistics to explore the state-of-the-art deep learning models that power modern natural language processing (NLP). The focus is on understanding, interpreting, and critically evaluating these models from a linguistic perspective. The course delves into vector-space models of meaning (word embeddings such as word2vec and GloVe), the architecture of neural networks like Transformers (e.g., BERT, GPT), and their application to complex tasks in linguistics and machine translation. Special emphasis is placed on probing the models' knowledge about language, their inherent biases, and their practical use in areas such as sentiment analysis, machine translation (and its quality estimation), cross-lingual analysis, and other common text generation tasks. Through hands-on projects, students will learn to fine-tune pre-trained models and apply them to novel NLP tasks and research problems.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Critically evaluate the theoretical underpinnings of modern neural network-based NLP models, including vector semantics, attention mechanisms, and transformer architectures.	30%	x	x	
2	Apply advanced computational techniques to analyze complex linguistic phenomena and implement solutions for tasks in linguistics and translation (e.g., fine-tuning language models).	40%		x	x
3	Design a research project that addresses a linguistic or translation-related problem using advanced computational methods, and critically assess the ethical implications and inherent biases of these technologies.	30%	x	x	x

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures & Seminars	Lectures will cover the theory behind state-of-the-art models. Seminars will involve student-led discussions and critiques of recent, influential research papers from top-tier conferences (e.g., ACL, EMNLP).	1, 3

2	Lab Sessions	Guided, hands-on sessions where students learn to use modern NLP libraries (e.g., Hugging Face Transformers, PyTorch) to build, train, and analyze models.	2	
3	Readings	Students will read current textbook chapters, survey articles, and seminal research papers on topics like attention, BERT, and GPT.	1, 2, 3	
4	Research Project	Students will work independently or in small groups on a semester-long research project. This includes formulating a research question, collecting data, implementing a computational model, and presenting the results.	1, 2, 3	

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks ("- " for nil entry)	Allow Use of GenAI?
1	Research Paper Critiques (2)	1, 3	30	Students will submit two structured critiques of recent research papers, analyzing their methodology, claims, and contributions to the field.	No
2	Programming Assignments (2)	1, 2	30	Practical assignments involving the implementation and analysis of neural models for tasks like text classification or semantic similarity using pre-trained models.	Yes

3	Final Research Project	1, 2, 3	40	A comprehensive project including a proposal (10%), final presentation (10%), and a final paper in conference-style format (20%).	Yes
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Continuous Assessment (%)

100

Additional Information for ATs

Note on the Use of Generative AI (GenAI): The use of GenAI tools is encouraged as a productivity aid for brainstorming, debugging code, and improving writing. However, students are expected to critically evaluate all GenAI output. Any text or code generated by these tools and incorporated into assignments must be explicitly acknowledged and cited. The final research project, in particular, should demonstrate the student's original thought and critical analysis, which goes beyond the capabilities of current GenAI. Submitting unedited, unattributed GenAI output as one's own work constitutes academic dishonesty.

Assessment Rubrics (AR)**Assessment Task**

Research Paper Critiques (2)

Criterion

Ability to critically analyze and evaluate state-of-the-art research in computational linguistics.

Excellent (A+, A, A-)

Demonstrate excellent ability to critically analyze and evaluate state-of-the-art research in computational linguistics.

Good (B+, B, B-)

Demonstrate significant ability to critically analyze and evaluate state-of-the-art research in computational linguistics.

Fair (C+, C, C-)

Demonstrate moderate ability to critically analyze and evaluate state-of-the-art research in computational linguistics.

Marginal (D)

Demonstrate basic ability to critically analyze and evaluate state-of-the-art research in computational linguistics.

Failure (F)

Not even reaching marginal levels

Assessment Task

Programming Assignments (2)

Criterion

Ability to implement and analyze advanced computational models for linguistic tasks.

Excellent (A+, A, A-)

Demonstrate excellent ability to implement and analyze advanced computational models for linguistic tasks.

Good (B+, B, B-)

Demonstrate significant ability to implement and analyze advanced computational models for linguistic tasks.

Fair (C+, C, C-)

Demonstrate moderate ability to implement and analyze advanced computational models for linguistic tasks.

Marginal (D)

Demonstrate basic ability to implement and analyze advanced computational models for linguistic tasks.

Failure (F)

Not even reaching marginal levels.

Assessment Task

Final Research Project

Criterion

Ability to design, implement, and report on a research project that applies advanced computational methods to a problem in linguistics or translation.

Excellent (A+, A, A-)

Demonstrate excellent ability to formulate a research question, apply appropriate advanced models, analyze results critically, and present findings in a clear, scholarly manner.

Good (B+, B, B-)

Demonstrate significant ability to formulate a research question, apply appropriate advanced models, analyze results, and present findings.

Fair (C+, C, C-)

Demonstrate fair ability to formulate a research question, apply models, analyze results, and present findings, though some aspects may be underdeveloped.

Marginal (D)

Demonstrate basic ability to complete the project components, but with notable weaknesses in research design, implementation, or analysis.

Failure (F)

Not even demonstrating marginal ability to complete the research project as required.

Part III Other Information

Keyword Syllabus

- **Vector Semantics and Word Embeddings:** Distributional Hypothesis, Word2Vec, GloVe, fastText, Subword Models.
- **Neural Language Models:** Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), Gated Recurrent Units (GRUs).
- **Modern Architectures:** The Attention Mechanism, Self-Attention, The Transformer Architecture.
- **Large Language Models (LLMs):** Pre-training and Fine-tuning paradigm, Masked Language Modeling (BERT), Autoregressive Models (GPT), Transfer Learning in NLP.
- **Linguistic & Translation Applications:** Probing LLMs for linguistic knowledge, Machine Translation Quality Estimation, Cross-lingual Transfer, Text Summarization, Argument Mining, Stance Detection.
- **Human-Model Interaction:** Prompt Engineering, In-context Learning, Instruction Tuning.
- **Critical Analysis:** Ethics in NLP, Bias (gender, racial, social) in Language Models, Model Interpretability, Evaluating and Mitigating Harms.

Reading List

Compulsory Readings

Title	
1	Jurafsky, D. and Martin, J.H. (2025). Speech and Language Processing (3rd Edition, online drafts).
2	Eisenstein, J. (2019). Introduction to Natural Language Processing. MIT Press.
3	Goldberg, Y. (2017). A Primer on Neural Network Models for Natural Language Processing. Journal of Artificial Intelligence Research.
4	Hugging Face. (2025). The Hugging Face NLP Course. Online at https://huggingface.co/course .

Additional Readings

Title	
1	Vaswani, A., et al. (2017). "Attention Is All You Need." Advances in Neural Information Processing Systems (NIPS).
2	Devlin, J., Chang, M.W., Lee, K., and Toutanova, K. (2018). "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." Proceedings of the North American Chapter of the Association for Computational Linguistics (NAACL).
3	Brown, T., et al. (2020). "Language Models are Few-Shot Learners." Advances in Neural Information Processing Systems (NeurIPS).
4	Bender, E. M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?#" Proceedings of the ACM Conference on Fairness, Accountability, and Transparency (FAccT).
5	Liang, P., et al. (2022). "Holistic Evaluation of Language Models." arXiv preprint.
6	Journal and conference papers from the ACL Anthology: https://aclanthology.org/ (e.g., from ACL, EMNLP, NAACL, CoNLL).