

CS 162: Natural Language Processing — Winter 2024

Prof. Nanyun (Violet) Peng

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Announcements

- **1/5/24** Welcome! Please bookmark this page.
 - Start of class is **Monday, 1/8, 8:00 am**.
 - The main classroom is [BUNCHE 1209B](#).
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Course Information

Course objectives: Welcome! This course is designed to introduce you to some of the problems and solutions of NLP, and their relation to machine learning, statistics, linguistics, and social sciences. You need to know how to program and use common data structures.

It might also be nice—though it's not required—to have some previous familiarity with linear algebra and probabilities.

At the end you should agree (I hope!) that language is subtle and interesting, feel some ownership over some of NLP's techniques, and be able to understand research papers in the field.

Lectures:	M/W 08:00 - 10:00 am
Location:	BUNCHE 1209B .
Prof:	Nanyun (Violet) Peng Email: violetpeng@cs.ucla.edu
TAs:	Christina Chance Email: cchance@cs.ucla.edu Rohan Wadhawan Email: rwadhawan7@g.ucla.edu
Office hrs:	<i>Prof:</i> Mon. 10:00am - 11:00am at Eng VI 397A; or zoom: link <i>TAs:</i> Christina: Tuesday and Thursday 11:30am - 12:30pm, Boelter Hall, Room 3256S ; or zoom: link Rohan: Friday 4:00pm - 5:00pm, Eng VI 389; or zoom: link
TA discussion sessions:	Sec 1A: Friday 2:00pm - 3:50pm, Public Affairs Building 2232 (Christina Chance) Sec 1B: Friday 12:00pm - 1:50pm, Public Affairs Building 2232 (Christina Chance) Sec 1C: Friday 2:00pm - 3:50pm, Dodd Hall 170 (Rohan Wadhawan)
Discussion site:	Piazza https://piazza.com/ucla/winter2024/cs162 ... public questions, discussion, announcements
Web page:	https://vnpeng.net/cs162_win24.html
Textbook:	Jurafsky & Martin, 3rd ed. (recommended) Manning & Schütze (recommended)
Policies:	<i>Grading:</i> homework 35%, project 15%, midterm 20%, final 25%, participation 5% <i>Honesty:</i> UCLA Student Conduct Code

Schedule

Warning: The schedule below may change. Links to future lectures and assignments are just placeholders and will not be available until shortly before or after the actual lecture.

Project description out

Week	Monday	Wednesday	Friday (TA sessions)	Suggested Reading
1/8	<u>Introduction</u> <ul style="list-style-type: none"> Why is NLP hard? What's important? Levels of language NLP applications 	<u>Text classification and lexical semantics</u> <ul style="list-style-type: none"> Text classification Naive Bayes classifier Logistic Regression 	<ul style="list-style-type: none"> Review of linear algebra and calculus Intro to google cloud computing Intro to colab 	<ul style="list-style-type: none"> Intro: J&M chapter 1 Chomsky hierarchy: J&M 16 Prob/Bayes: M&S 2
1/15	No lecture (MLK holiday)	<u>Assignment 1 release</u> <u>Lexical semantics</u> <ul style="list-style-type: none"> Semantic phenomena and representations WordNet Thesaurus-based semantic similarity 	<ul style="list-style-type: none"> Data preparation and ML practice Overview of ML system components Project Milestone 1 Discussion 	<ul style="list-style-type: none"> Language models: J&M 3
1/22	<u>Distributional semantics</u> <ul style="list-style-type: none"> Word-Document Matrix LSA Semantic Similarity Word Vectors 	<u>N-gram language models</u> <ul style="list-style-type: none"> How to model language? What's wrong with n-grams? What do language models model? 	<ul style="list-style-type: none"> Neural network basics PyTorch Part (1) 	<ul style="list-style-type: none"> Smoothing: J&M 3; Rosenfeld (2000)
1/29	<u>Project planning report due</u> <u>Smoothing n-grams</u> <ul style="list-style-type: none"> Add-one or add-λ smoothing Cross-validation Smoothing with backoff 	<u>Assignment 1 due</u> <u>Log-linear models and neural language models</u> <ul style="list-style-type: none"> Log-linear models Neural network basics (recap) Feedforward neural language Models 	<ul style="list-style-type: none"> Deep learning workshop PyTorch Part (2) 	<ul style="list-style-type: none"> Neural language models: J&M 7 OpenAI blog post GPT-2 (with paper)
2/5	<u>Assignment 2 release</u> <u>Assignment 1 answer keys release</u> <u>RNN language models</u> <ul style="list-style-type: none"> Recurrent neural networks (RNNs) Long short-term memory networks (LSTMs) 	<u>Transformers</u> <ul style="list-style-type: none"> Long-short term memory networks (LSTMs) The transformer model 	<ul style="list-style-type: none"> Review session (Language Models) Project Milestone 2 Discussion 	<ul style="list-style-type: none"> Transformer paper; BERT paper

2/12	Midterm exam (12:00-1:50pm in class) Return assignment 1 gradings	<u>Pre-Trained Large Language Models</u> <ul style="list-style-type: none"> ELMo BERT GPT-(2,3) 	<ul style="list-style-type: none"> Intro to Huggingface
2/19	Assignment 2 due No lecture (Presidents' Day)	Project midterm report due <u>Syntax</u> <ul style="list-style-type: none"> Part-of-speech tagging NP Chunking Shallow Parsing 	Return midterm exam gradings <ul style="list-style-type: none"> John Lafferty's paper on CRF Midterm Solutions Discussion Project Milestone 3 Discussion
2/26	Assignment 3 release <u>Sequence tagging models</u> <ul style="list-style-type: none"> POS-tagging leftovers Hidden Markov Models (HMMs) The Viterbi Algorithm 	<u>Sequence tagging models (cont.)</u> <ul style="list-style-type: none"> The Viterbi Algorithm leftovers Maximum Entropy Markov Models (MEMMs) 	<ul style="list-style-type: none"> Review session (Syntax + Seq Tagging) The Viterbi Algorithm: J&M 8 Hidden Markov Models: J&M Appendix A;
3/4	<u>Named Entity Recognition</u> <ul style="list-style-type: none"> MEMM leftovers Intro to NER Nested NERs 	<u>Probabilistic parsing</u> <ul style="list-style-type: none"> What is parsing? Why is it useful? Brute-force algorithm CKY algorithms PCFG parsing 	<ul style="list-style-type: none"> NLP Application Case Study Attributes: J&M 12 Parsing: J&M 13
3/11	Assignment 3 due <u>Dependency Parser</u> <ul style="list-style-type: none"> Dependency grammar Dependency trees 	<u>Dependency Parser (Cont.)</u> <ul style="list-style-type: none"> Shift-reduce parser 	<ul style="list-style-type: none"> Final exam recitation CCG: Steedman & Baldridge; more TAG/TSG: Van Noord, Guo, Zhang 1/2/3 Prob. parsing: J&M 14