Ling 581
Jackson
Spring 2025

Advanced Computational Linguistics

Course Information

This is the continuation of LING/CSC/PSYC 538 *Computational Linguistics*. Students are given deeper understanding and practical experience with symbolic and analytic concepts, tools, and methods for working with natural language in computational systems. This course sequence (538-581) complements the statistical NLP course sequence (539-582).

Course objectives

This course will cover four main topics: modeling natural and artificial language with formal grammars; syntactic parsing; syntactic trees and treebanks; and lexical networks and relations of words & senses. Some of these topics were introduced in LING 538 but will be explored here in greater depth. Students will also practice using libraries and databases that are relevant for these topics.

Learning outcomes

Successful students in this course will...

1. be able to install and use natural language software packages.[†]
2. be able to pre-process language data for downstream tasks.[‡]
3. gain experience completing more complex and realistic projects than in 538.[‡]

[†] relates to Linguistics HLT program outcome #3.

[‡] relates to Linguistics HLT program outcomes #1 and #2.

HLT program learning outcomes

By completion of the HLT program, students will be able to:

1. **Write, debug, and document readable and efficient code** in programming languages commonly used to develop, implement, and evaluate HLT models, as demonstrated through course projects and a professional internship.
2. **Select and apply appropriate algorithms and core concepts** in HLT to perform common tasks and solve realistic problems, as demonstrated through course projects and a professional internship.

3. **Apply common tools and libraries** used in HLT by integrating them into course projects and real-world applications or workflows, as demonstrated through course projects and a professional internship.
4. **Demonstrate professional skills** in the field of HLT, including effective teamwork, clear and concise communication, professional networking, understanding of business procedures and team-based code development, leadership, and critical thinking, as demonstrated through course presentations, projects, and a professional internship.

Prerequisites

Students should have successfully completed LING/CSC/PSYC 538. This asynchronous online version of 581 is designed for students in the online *Masters in Human Language Technology* program who have successfully completed LING 529, 531, and 539, and that background will also help students gain the most from this course. These course materials assume proficiency with Python, Prolog, and Perl.

Instructor

name	Eric Jackson
email	ejackson1@arizona.edu
hours	Mondays 10:00am–12:00pm (Arizona time, UTC-7) in person (COMM 114A) and online via Zoom at `https://arizona.zoom.us/j/84420158691` (passcode 074337), and by appointment.

Requirements

Students are expected to actively participate in the course by watching the lecture videos, reading the assigned readings, completing the assigned homework—all by their due dates as listed on the D2L course site—and engaging with the instructor and other students in the course forum. You're all adults, and you're responsible for your own learning, which is all the more critical in this asynchronous online course.

Lecture videos will be available on the course website (D2L). You are expected to watch all lectures and understand the content. If the content of a lecture is not clear, you are expected to send a question to the instructor by email, meet with the instructor in regular office hours or arrange another time to meet, or post a question for clarification on the course forum.

Class assignments will consist of graded homework assignments, forum discussions that are graded for completion only, and ungraded tasks (for instance, practicing a task, or installing a library on your computer). Although attempting or completing the ungraded tasks will not affect your grade, they *will* affect how much of the course content you understand and retain. I have designed all assignments, both graded and ungraded, to aid your learning, and I expect everyone to complete them, to gain the most from the course.

Graded homework assignments will be given via the course website (D2L). Assignments will be given each week on Mondays and will be due the following Tuesday at noon, Arizona time (ie, you will have eight days to complete the assignment). Your completed homework will be collected through the course website and must be in PDF format; files submitted in any other format (.doc, .docx, .rtf, .odt, .txt, or any other) will not be accepted. Freely available options to convert files to PDF include Google Docs and LibreOffice; students also have free online access to Adobe Acrobat by signing in with their UArizona NetID.

Forum discussion items will be graded for completion, not for content. There will be one forum prompt per week, for a total of seven posts. Forum posts will be given each week on Mondays and will be due the following Monday by noon, Arizona time.

There will be no final exam or term project for this course. Instead, the final homework assignment will serve as the summative assignment that is required by university policy. My intent is that the final homework assignment would be more open-ended and give students flexibility to demonstrate their mastery of a range of course content, like a typical term project, but with a size that is more like other homework assignments.

The due date for each assignment will be posted with the assignment in D2L. All times will be given in Arizona time (Mountain Standard, GMT-7). Accepting late work would mean that I cannot give timely feedback to the rest of the class on the issues in that assignment. **Except for university-approved reasons listed below, late work will not be accepted.**

Your overall course grade will be calculated based on this weighting of assignments:

type	number	total
homework assignments	7	80%
forum interaction	7	20%
total		100%

Students may also earn a 2% overall bonus for reading the course syllabus and completing a short quiz on its contents in D2L.

Readings

A draft version of the textbook used in this course is available for free on-line.

> *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*, Jurafsky and Martin, `https://web.stanford.edu/%7Ejurafsky/slp3/`

Additional readings will be available digitally in the course D2L site.

Technology

This course will use Perl 5, Python 3 (I'll be using Python version 3.10), and SWI Prolog. All of these can be downloaded for free. If you've completed LING 538, you should already have

these installed. If you encounter problems with any of these, please contact the instructor as soon as possible.

You are free to use interpreters for these programming languages either directly in your system or indirectly via Docker, a virtual machine, a dual-boot linux system, etc. You just need to be able to run the commands that the homework asks of you.

Student Work Policy, Collaboration, and AI tools

The purpose of this course is to train **your** mind, and to do that, you need to **use** your own mind. You will gain the most benefit from the programming and other assignments in this course if **you** are the one who has come up with all the code, analysis, or examples, even if this requires a bit of mental struggle on your part to get it right. **Don't be afraid to struggle for a bit, because that struggle is likely helping you learn.** Beyond a reasonable amount of struggle, however, it's reasonable to seek outside help from the instructor or another source.

Students are encouraged to discuss problems and general approaches for solutions with the instructor and with others in the course, but everyone must turn in work that is the product of their own mind. You may not submit assignments that are substantially the same as any other source (your classmates, someone online, or an AI tool), including using someone else's code but simply changing the variable or object names.

If you do feel you need outside help, using portions of code you found online or created with Generative AI is acceptable, but it must constitute no more than 25% of your total code. If you obtain code other than writing it yourself, **you must evaluate it critically and cite where it came from**.

If you discuss an assignment with a peer, if you find inspiration from a web resource, or if you use AI for appropriate help (ie, not simply copying and pasting its answer as your own), you must cite that fact on your assignment:

- "I discussed this assignment with Jane Studentname and Joe Wildcat."
- "I used ChatGPT 4 for brainstorming of approaches to this coding task."
- "I wrote this code following a suggestion from StackOverflow at <URL>"

Generative AI is a useful tool, like a calculator is a useful tool for doing math, but generative AI for programming is like a calculator that is sometimes completely untrustworthy. In some contexts, being able to use a calculator is an important skill—while in other contexts, like when you're taking a math test to see whether you know basic math facts, solely using a calculator short-circuits your own learning. A bicycle is a tool that allows us to get from one place to another faster and more efficiently than running—but if you're going to be tested in your time for a 5k run, it won't help you to train for running solely by riding a bicycle. You will likely need to know how to use generative language models for tasks at some point, but having one write your homework or forum posts for this class is not appropriate. Put in the thinking yourself, so that you can reap the mental benefit for yourself. You need to know how

to perform these programming tasks on your own well enough that you can see where some AI-generated code is partially or completely off the mark, or introduces logic errors even if it runs without runtime errors.

The general principle in all such cases is that the majority of the work you turn in must be new and must be your own. Do your own work, and please ask me in advance if you are unsure whether something will be acceptable or not. Assignments that seem suspiciously similar, or those that seem to have been mostly produced using generative AI, will be forwarded to the Dean of Students office in accordance with the Code of Academic Integrity (linked below). Please be a responsible adult and don't run the risk of losing credit for an assignment by copying, by allowing others to copy from you, *or* by having ChatGPT do your assignment for you.

The UA Library has a guide for students as to what is and is not appropriate use of AI and similar resources:

`https://libguides.library.arizona.edu/students-chatgpt/`

Schedule

The course covers four major topics, with roughly two weeks per topic, and lectures and assignments for each module. Each week's material becomes available on a Monday, and with the exception of the final week (which is short), all assignments for that week are due by the following Monday (in the case of readings and forum posts) or the following Tuesday (in the case of written assignments).

Week	Topic
1	Grammars
2	Parsing
3	Trees: NLTK and treebanks
4	Trees: NLTK and treebanks
5	Words: WordNet and senses
6	Words: WordNet and senses
7	Final review
8	Short week (Mon - Wed only), submission of week 7 assignments

Authoritative due dates will be listed for each assignment in D2L. Check the D2L course calendar to make sure you don't forget or miss a deadline.

University boilerplate

All of the following items are required by the university to be included on syllabi. If you find something here that is surprising or unexpected, please bring it up with me as soon as possible.

By way of a brief summary:

Disabilities If you have a disability that affects how you will need to do the work in this class, please let me know *within the first week of class.*

Academic Code of Conduct Cheating and plagiarism are not remotely acceptable in any way. You are responsible for knowing whether your own behavior qualifies as plagiarism, and whether your use of AI is inappropriate. Disruptive behavior in class—which here includes audio, video, or text on any of our course websites or by email—is not acceptable. Please be respectful of others.

Sensitive Material This is a university and you are adults. It is possible that we may touch on topics that some students could find sensitive during the semester. Given the focus of this course, this seems unlikely, but I alert you nonetheless.

Health & Wellbeing

The university has a specific site for COVID information: `http://covid19.arizona.edu`. If you are experiencing personal or financial challenges from any health-related issue, let me know as soon as you can if we need to make accommodations, and please stay safe.

The semester ahead may come with ups and downs in both physical and mental health, but there are lots of ways to support yourself. Eat well, get regular exercise, and don't neglect things like self-care, talking with friends and family, or getting a fresh perspective from a supportive group. Stress is a normal part of life and may even motivate you sometimes, but chronic or overwhelming stress can affect your physical and mental health and wellbeing. Pay attention to your personal signs that you're overly stressed, like changes in your mood, appetite, sleep, behavior, or new physical symptoms (aches, pains, etc.) that interfere with school and daily life. If you notice these signs or have questions about helpful resources, I welcome you to talk with me. You can also visit `caps.arizona.edu/mental-health` for mental health tools and resources.

Mental Health & Wellness Resources

- **Health & Wellness:** Campus Health provides quality medical, mental health, and wellness services for students. Visit `health.arizona.edu` or call 520-621-9202 (520-570-7898 for help after hours)
- **Mental Health:** Campus Health's Counseling & Psych Services offers a range of mental health support tools and services like self-care strategies, peer support, groups and workshops, and professional mental health services. Visit `caps.arizona.edu/mental-health` or call CAPS 24/7 at 520-621-3334 to learn more.
- **Crisis Support:**

  Suicide & Crisis Lifeline: call 988 Crisis Text Line: text TALK to 741-741 Visit `preventsuicide.arizona.edu` for more suicide prevention tips and resources

Absence and Class Participation Policy

Attendance in an all-online course is not evaluated like attendance in an in-person course. For this course, attendance will be represented by active reading, completion, and participation in online course activities, including loading/viewing materials and completing activities posted on D2L, OpenClass, our course forum, and any other related websites.

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: `http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop`

The UA policy regarding absences is that any sincerely held religious belief, observance or practice will be accommodated where reasonable, `http://policy.arizona.edu/human-resources/religious-accommodation-policy`.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: `https://deanofstudents.arizona.edu/absences`

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities.

Students are asked to refrain from disruptive conversations with others in the course, including on asynchronous course platforms. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue inappropriate behavior will be removed from that venue and may be reported to the Dean of Students.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See `http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students`.

Accessibility and Accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, `https://drc.arizona.edu/`) to establish reasonable accommodations.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of

independent effort unless otherwise instructed. **If you use a code snippet that you came up with from discussions with a classmate, that you found online, or even that you got from a large language model, it's important to cite where it came from, whether that source was Sally Classmate, GitHub.com, stackexchange.com, or ChatGPT.**

Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: `http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity`.

The UA Library provides a helpful learning module for students to understand and avoid plagiarism: `https://libguides.library.arizona.edu/info-strategies/plagiarism`

The UA Library also has resources to guide you to appropriate and safe use of AI and large language models: `https://libguides.library.arizona.edu/students-chatgpt/integrity`

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see

`http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy`

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.