Linguistics 193 (Social Sciences Topics in Linguistics): Human Language and Computers
Fall 2021
      Class: Tue and Thu 4:00-5:30 pm (471 LORCH)
      Main Office: TBA
      Instructor: Charlie O'Hara
                    Office hours (remote): TBA
                    E-mail: cohara@umich.edu
(Last Updated 8/30/2021)

<u>**Description**</u>:
In the 21st century, the prevalence of personal computers, smartphones, and the internet has changed nearly every aspect of human life. We can use Siri and Google Voice to set alarms, play songs, and write text messages without pressing a button. We can use Google Translate to translate from English into 127 other languages. We can ask Google "what day does the University of Michigan Fall semester start" and the correct date is at the top of the page. But sometimes it goes wrong; catastrophically or hilariously wrong. Why is it hard for computers to understand us? How do these systems work? Why do they fail when they do?

In this course, we will explore these questions by investigating how the science of linguistics applies to the engineering challenges of natural language processing. By understanding how humans learn, use, and understand human languages we can get a better understanding of the challenges our computer programs face, and potentially think of new ways to improve them. We will discuss the basics of how machine learning, neural networks, and other cutting-edge technologies work and how they are limited.
Note: this course is designed for students with all ranges of coding experience: from those with absolutely no experience or interest in coding to experienced coders.

Course assessment:
This course is graded using a skills-based grading paradigm described below.

Instruction Mode
This course will be taught *in person* for the majority of course dates. This may be subject to change based on current rates of COVID-19 on campus and/or changes in university policy. Some individual class dates may be held remotely via Zoom rather than in person, for safety and pedagogical purposes. Usually, I will let you know whether a course will be held online or in person by the end of the previous course. In the cases of some emergencies, I will let you know before noon of the day of the class. If an emergency arises after noon on the day of a scheduled in person class, the class will be cancelled and potentially be rescheduled.

Mask Mandate
U-M requires all students, staff, faculty, and visitors to wear a face covering that covers the mouth and nose when indoors on U-M property. This course is no exception. If a student comes to course without a suitable mask or otherwise refuses to wear their mask, I reserve the right to cancel the day's course for the safety of the other students and myself. If you have some documented exemption from the mask mandate (through the Office for Institutional Equity),

please let me know remotely via e-mail at least 48 hours before coming to course without a mask so I can work out safe accommodations for you and the other students.

In the event that the University changes its mask mandate during the course of the semester, I intend to maintain a mask mandate for in person meetings of this course barring unanimous consent from all participants in the course, and will reinstitute the mandate at any point any participant in the course rescinds their consent.

Classroom Culture of Care

LSA is committed to delivering our mission while aiming to protect the health and safety of the community, which includes minimizing the spread of COVID-19. Our entire LSA community is responsible for protecting the collective health of all members by being mindful and respectful in carrying out the guidelines laid out in our Wolverine Culture of Care and the University's Face Covering Policy for COVID-19. Individuals seeking to request an accommodation related to the face covering requirement under the Americans with Disabilities Act should contact the Office for Institutional Equity.

In our classrooms all students are expected to adhere to the required safety measures and guidelines of the State of Michigan and the University of Michigan, wearing a face covering that covers the mouth and nose in all classrooms, and not coming to class when ill or in quarantine. It is important to also be thoughtful about group gatherings as well as about classroom activities and exercises that require collaboration.

Any student who is not able and willing to comply with campus safety measures for this [in-person/hybrid] course should contact the course instructor or their academic advisor to discuss alternate participation or course options. Students who do not adhere to these safety measures while in a face-to-face class setting, and do not have an approved exception or accommodation, may be asked to [participate on a remote basis or - include if available option] disenroll from the class.

For additional information refer to the LSA Student Commitment to the Wolverine Culture of Care and the OSCR Addendum to the Statement of Student Rights and Responsibilities on the OSCR website.

ASSIGNMENTS & GRADING
Skill-based Grading
Traditional grading has a number of pitfalls that I'm sure you are well familiar with:
- High stress exams.
- If you do poorly on, or miss a homework assignment or test early on, your grade can feel like a lost cause.
- Can be unclear which aspects of the material will be covered on the exam or assignments.
- Can be unclear why one mistake cost you three points and another cost you 5.
- Assessments end up testing your test-taking skills rather than how well you understand the material.

Put short, it is inaccurate at testing how well you've learned the material and can be ineffective at promoting learning.

To try to alleviate many of these issues, I am going to use a less traditional style of grading, which I will call *skills-based grading.*
The fundamental idea of skills-based grading are as follows:
- There are 25 skills that I believe you should have acquired by the end of this course.
- You can earn *proficiency* and *expertise* in each skill.
- In order to demonstrate *proficiency* in each of these skills, you must correctly answer at least one question testing that skill.
- Each skill will be tested multiple times throughout the course, so if you miss a skill the first time, you can make it up later.
- Some skills will be tested 5 or more times with basic questions on assignments: if you get such 5 or more of those questions correct you will earn expertise in that skill.
- At several points throughout the semester we will have "Skills Days." These days are similar to conventional exams: you will come to class and be given a list of challenging questions about the topics covered so far in the course. Particularly advanced questions will automatically give you expertise in a skill if you answer them correctly.
- I will update the Canvas site regularly with the skills you've demonstrated proficiency in, so you can know how to focus your studying on the skills you're having issues with.

Grade Calculation
Your grade is calculated as a sum of the number of skill proficiencies and expertises you have along with your score on the final project. Each skill proficiency and expertise is worth 3 points, and the final project is worth 15 points. If you get expertise and proficiency in every skill and get full points on the final project, you would earn 165 points---well above the 93 points necessary for an A. Feel free to choose which assignments you attempt in order to get the grade you desire.

One way of getting up to 100 points:

25 skills that you have demonstrated proficiency in once	3 points each	75 points
5 skills that you have demonstrated expertise in	3 points each	15 points
1 Final Project	15 points	15 points
Total:		100 points

The table below shows the conversion from points to letter grades.

A	A-	B+	B	B-	C+	C	C-
93-100	90-92	88-89	83-87	80-83	78-79	74-77	70-73

Attendance and participation:
In my experience, the best way to learn the material in a course like this is by coming to class and participating. However, attendance is not mandatory. If you feel ill, show any symptoms of COVID-19 please stay home. There are many other reasons why you may need to miss a class, ranging from religious holidays, family obligations, athletic events, extracurriculars, or even just not feeling up to it one day. I am planning on having video recording of each classes lectures available on Canvas shortly after the class. If you miss a class, I suggest watching the video you missed, and try to come visit my office hours (or make an appointment at another time to meet) to go over any content you might find confusing.

Final Project:
At the end of the course there will be a final research project. For this project, you will critically examine an ethical issue raised by natural language processing and the interaction of humans and computer, focusing either on an issue discussed in class or another issue that sparks your interest. The final project itself can be a standard academic paper or it can be a less formal means of spreading information, such as a mock Twitter thread, Reddit post, series of infographics, podcast, etc. No matter the format, the final project should include references to other work found in your independent research on the topic of your choice.

Assignments:
Assignments will likely be posted on Canvas on Thursdays, to be due the following Thursday. These assignments will test your proficiency at some of the skills covered in the previous week, and may offer some additional opportunities on skills that students have been having trouble with.

Latework:
Getting your assignments in promptly is helpful for both you and me. Doing the assignments when the material is freshest in your brain will help you perform your best. If you turn in your assignments on time, I'll be able to grade them faster, allowing you to have a better idea of your current standing in the course. However, I fully understand that challenges might arise to turning in assignments on time. If you need to turn in an assignment late, I ask that you send me an e-mail notifying me that the assignment has been turned in (so I can go find it and grade it.) Assignments turned in more than a week late will receive less personalized feedback than assignments turned in on time. I can only commit to grading two late assignments per week for each student, so if you leave many assignments to the end of the semester, they may not all be graded. All late work must be submitted by 12/16 at 11:59pm Eastern.

Take Home Skills Day:
At the end of the semester, instead of having an in-class skills day there will be an optional take home assignment to help you get the skills you need. Before thanksgiving break, each student

can submit to me a list of skills you would like additional opportunities to get proficiencies or expertise in. You will then receive a personalized take-home assignment due the last day of class.

Course Recordings
Course lectures may be audio/video recorded and made available to other students in this course. As part of your participation in this course, you may be recorded. If you do not wish to be recorded, please contact [instructor/gsi email address] the first week of class (or as soon as you enroll in the course, whichever is latest) to discuss alternative arrangements.

Discussion Conduct
In our structured and unstructured discussions and dialogues, we also will have many opportunities to explore some challenging, high-stakes issues and increase our understandings of different perspectives. Our conversations may not always be easy; we sometimes will make mistakes in our speaking and our listening; sometimes we will need patience or courage or imagination or any number of qualities in combination to engage our texts, our classmates, and our own ideas and experiences. Always we will need respect for others. Thus, an important secondary aim of our course necessarily will be for us to increase our facility with the sometimes difficult conversations that arise inside issues of social justice as we deepen our understandings of multiple perspectives – whatever our backgrounds, experiences, or positions.

STUDENTS WITH DISABILITIES
The University of Michigan recognizes disability as an integral part of diversity and is committed to creating an inclusive and equitable educational environment for students with disabilities. Students who are experiencing a disability-related barrier should contact Services for Students with Disabilities https://ssd.umich.edu/; 734-763-3000 or ssdoffice@umich.edu). For students who are connected with SSD, accommodation requests can be made in Accommodate. If you have any questions or concerns please contact your SSD Coordinator or visit SSD's Current Student webpage. SSD considers aspects of the course design, course learning objects and the individual academic and course barriers experienced by the student. Further conversation with SSD, instructors, and the student may be warranted to ensure an accessible course experience.

STUDENT MENTAL HEALTH AND WELLBEING
The University of Michigan is committed to advancing the mental health and wellbeing of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact Counseling and Psychological Services (CAPS) at (734) 764-8312 and https://caps.umich.edu/ during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus. You may also consult University Health Service (UHS) at (734) 764-8320 and https://www.uhs.umich.edu/mentalhealthsvcs, or for alcohol or drug concerns, see www.uhs.umich.edu/aodresources. For a listing of other mental health resources available on and off campus, visit http://umich.edu/~mhealth/.

TITLE IX:

Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here:

- UM Sexual Assault and Prevention Center (SAPAC) 24-hour confidential crisis line
  - (734) 936-3333
  - http://sapac.umich.edu/
- UM Counseling and Psychological Services (CAPS)
  - (734) 764-8312
  - http://caps.umich.edu/
- UM Office of Student Conflict Resolution
  - (724) 936-6308
  - http://oscr.umich.edu
- UM Newnan Academic Advising Center
  - (734) 764-0332
  - https://lsa.umich.edu/advising

L E O

LECTURERS' UNION

AFT–MI LOCAL 6244

THIS COURSE IS TAUGHT BY
A LEO LECTURER

Class schedule (Topics may move around throughout the semester)

Date	Day	Class	Topic	Due
8/31	Tue	1	Syllabus; introductions	
9/2	Thu	2	How do Computers see Language/Writing Systems	
9/7	Tue	3	Spell Check: What do we need? What is a word?	
9/9	Thu	4	Prescriptivism vs. Descriptivism: What is incorrect?	
9/14	Tue	5	Autocorrect: How do you correct spelling?	
9/16	Thu	6	Minimum Edit Distance	
9/21	Tue	7	Error Penalties: Are certain errors more likely?	
9/23	Thu	8	Phonology & Sounds of the World	
9/28	Tue	9	What don't we write down?	
9/30	Thu	10	**Skills Day**	
10/5	Tue	11	Frequency – tie-breaker and beyond	
10/7	Thu	12	Speech Perception Models	
10/12	Tue	13	Regressions	
10/14	Thu	14	Bigram Context	
10/19	*Tue*		*No Class: Fall Study Break*	
10/21	Thu	15	Syntax: Parts of Speech	
10/26	Tue	16	Syntactic Context	
10/28	Thu	17	Predictive Texting	
11/2	Tue	18	**Skills Day**	
11/4	Thu	19	Neural Networks	
11/9	Tue	20	Noise Mining and Unethical Machine Learning	
11/11	Thu	21	Machine Translation	
11/16	Tue	22	Sign Language Gloves	
11/18	Thu	23	Text to Speech/ Speech Recognition	**TakeHome Request Due**
11/23	Tue	24	*No Class*	
11/25	*Thu*		*No Class: Thanksgiving*	
11/30	Tue	25	Natural Language Understanding	
12/2	Thu	26	**Final Paper Brainstorming**	
12/7	Tue	27	Flex Day	
12/9	Thu	28	Work on Final Papers	**TakeHome Due**
12/15	*Wed*		*(official date of final exam)*	*10:30-12:30*

List of Skills: (Some minor changes may be made to the skill list throughout the semester.)

1. Describe the difference between prescriptivist and descriptivist perspectives on language and grammar
2. Explain how dialects and idiosyncratic language use are linked to speech communities
3. Recognize how linguistic discrimination is rarely based on scientific fact, and replicates discrimination against underrepresented and oppressed groups
4. Identify the aspects of spoken languages that are (and are not) represented in English writing
5. Describe the ways that spoken and signed languages have analogous structures and similar underlying properties
6. Identify ways that common natural language processing procedures fail to work for sign languages
7. Identify ways that common natural language processing procedures fail to work for understudied spoken languages.
8. Describe some ways that languages can differ in the way they encode phonological material into written language
9. Discuss the ways that languages differ in morphological and syntactic structure
10. Recognize how IPA transcriptions of English words differ from English spellings
11. Describe how syntactic structure can resolve ambiguities

    Algorithm Skills
12. Describe the differences between basic types of natural language processing algorithms
13. Distinguish between tasks that can be handled by simple algorithms and which require more power
14. Demonstrate the calculation of minimum edit distance
15. Explain the mechanisms behind a regression algorithm
16. Explain the mechanisms behind a neural network

    Ethics Skills
17. Differentiate between linguistic uses of linguistic data and noise mining
18. Describe some ways that human computer interaction can change the way humans communicate
19. Discuss the ways that technology can be used to build understanding of understudied languages (and the ways that it fails to do so)
20. Argue against uses of statistical results to promote normative ways of language use

    Coding Skills
21. Utilize a variable in Python
22. Utilize a for loop in Python
23. Utilize lists and dictionaries in Python
24. Implement a lookup algorithm in Python
25. Implement a minimum edit distance algorithm in Python