CSCI-699: Representation Learning for NLP
Units: 4.0
Fall 2021 Mon 3:00-6:20pm

Instructor: Xiang Ren
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Office Hours: by appointment
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Course Description
With recent advances in deep neueral networks, distributed representations of natural language text data in a vector space have achieved impressive performance in a range of natural language processing (NLP) applications. Such vector representations, derived from various neural achiectures (e.g., RNNs, CNNs, transformer) and learned based on different objectives (e.g., language modeling), largely automated the feature extraction process, which used to cost the major effort in constructing models for downstream applications. This seminar class will focus on introducing and studying recent advances in the scope of representation learning for NLP, with a focus on techniques that rely on weak or no human supervision from the end task (e.g., self-supervised language models, transfer learning, meta learning) and also on models that can demonstrate strong generalization capability and intepretability (e.g., structure-augmented RNNs, modularized networks, and other compositional models).

Learning Objectives
At a high level, through this seminar class students will have an idea of what distributed representation learning is about, what the state-of-the-art are, and what the open problems are. The class will select several topics of interests and curate a list of recent important papers for each topic for reading, presentations and discussions. Along the way, students will review milestone papers in distributed representation learning of language data, learning about important learning techniques and neural architectures for self-supervised language learning, multi-task learning, transfer learning, and meta leanring, as well as recent advances on interpretable, compositional neurla models that incorporate structured priors and models that can jointly induce the latent language structures. The hope is that by the end of this class students will have good understand about latest techqniues developed for representation learning in NLP, and can develp practical algorithms and implement systems for solving some NLP applications.

Prerequisite(s):
1. *CSCI 544 (Applied Natural Language Processing)
can also be co-requisites

Recommended Preparation: sufficient mathematical background; general background on optimization; good programming skills; familiarity with probability and algorithm.

Course Notes
Lecture notes will be available online after each class.

Required Readings and Supplementary Materials
- Deep Learning (Goodfellow & Bengio)
- Deep Neural Methods for NLP (Goldberg)

Grading Breakdown

Assigments	Points	% of Grade
In-class engagement	100	10%
Project survey report	100	15%
Project mid-term report	100	20%
Project final presenatation	100	20%
Project final report	100	35%

Project and Assignment Requirement

Students are expected to come up with a project idea ***individually***, related to representation learning for AI applications. They will conduct literature review on the topic and generate a survey paper, implement baseline models, present project method and results during the class, and generate a final project report based on the progress.

Project proposal slides. 2-3 slides on problem + "today" (status of literature) + challenges + directions to innovate.

Project survey report. A literature survey (e.g., "Related Work" section in a conference paper) of the relevant studies for your proposed problem/topic. At this point you should have a clear picture on whether people have done the problem you proposed and to what stage. If you find your proposed problem has been well addressed already, you should tweak your project to claim something novel; Otherwise, make it clear in your survey that: (1) what have been done related to your proposal (an organized view); (2) what are the limitations or challenges remained to be solved. *Format*: a 1.5-2 page (double-column) literature review write-up; will be graded by instructor and TA and accounts for 15% of the course grade. (latex template)

Project mid-term presenatation. A 5-min slide-based project presentation to briefly overview your proposed approach, the pilot results obtained so far, and analysis as well as interesting findings. *Format*: PPT presentation in class.

Project mid-term report. The project midterm report will involve reproducing the results of a state-of-the-art baseline model for the task of interest with code that you have implemented. In your report, also perform an analysis of what remaining errors this model makes (ideally with concrete examples of failure cases), and describe how you plan to create a new model for the final project that will address these error cases. *Format*: a 3-page (double-column, excluding references) report; will be graded by instructor and TA and worth 20% of the grade. (latex template)

Project final presenatation. A 10-min slide-based project presentation to briefly overview your proposed approach, the results obtained so far, and analysis as well as interesting findings. *Format*: PPT presentation in class. Project presentation will be graded between all students, and worths 15% of your grade.

Project final report. The final report will be expected to present a novel research contribution that either (1) introduces new ideas to improve machine learning techniques for one of the existing knowledge extraction/reasoning problem, with a clear piece of technical contribution/innovation, or (2) tackles a new and interesting problem setting (in a new domain) that is motivated by the unique problems posed by the application domain, using knowledge extraction/reasoning techniques. *Format*: an 8-page (double-column, excluding references) final report for the project. Can re-use content in your prior checkpoint reports. (latex template)

Grading Scale

A	95-100
A-	90-94
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	59 and below

Assignment Submission Policy
By email, before 11:59pm of the due date.

Grading Timeline
Assignments will be graded within one week after the due date.

Additional Policies
Late homework policy: **you are given 4 late days** for the assignments and project proposal/survey (no late days for the final project report), to be used in integer amounts and distributed as you see fit. Additional late days will each result in a deduction of 10% of the grade of the corresponding assignment.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Week 1 Aug 23	Class Introduction; Paper candidate discussion & presentation scheduling; **Project idea pitch.**	**Prepare a short pitch of project ideas (1-2 slides)**	
Week 2 Aug 30	Advances in self-supervised learning		**Project proposal due by end of Sep 2, 11:59pm PST**
Week 3 Sep 6	Label Day - no class		
Week 4 Sep 13	Prompt engineering and new advances on language learning		**Project survey due by Sep 13, 11:59pm PST**
Week 5 Sep 20	Zero-shot / few-shot learning in NLP		
Week 6 Sep 27	Advances on model robustness		
Week 7 Oct 4	ICLR deadline – no class		
Week 8 Oct 11	Transfer learning, domain adaptation, generalization		
Week 9 Oct 18	Meta learning in NLP		
Week 10 Oct 25	**Project mid-term presentation**		**Project mid-term report due by Oct 24 11:59pm PST**
Week 11 Nov 1	Advances on human-in-the-loop learning in NLP		
Week 12 Nov 8	Multi-modal learning I: representation learning		
Week 13 Nov 15	Multi-modal learning II: tasks, datasets, and new methods		
Week 14 Nov 22	Thanksgiving break – no class		
Week 15 Nov 29	**Project final presentation**		**Project final report due by Dec 15, 11:59pm PST.**

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention and Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED)- (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following *protected characteristics*: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations. The university also prohibits sexual assault, non-consensual sexual contact, sexual misconduct, intimate partner violence, stalking, malicious dissuasion, retaliation, and violation of interim measures.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
uscsa.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.