XCS224N: NLP with Deep Learning

Syllabus and Course Information

Welcome

Welcome to XCS224N: Natural Language Processing with Deep Learning! This professional course is based on graduate-level material from Stanford's on-campus course CS224N, adapted for a professional certificate format. In this course you will:

- Learn from Stanford classroom lecture videos that have been edited and segmented by topic for easier navigation, reference, and review.
- Complete coding assignments with additional scaffolding and support.
- Receive support from Stanford-affiliated Course Facilitators.
- Connect with a cohort of peers from diverse locations and professional backgrounds.

Course Launch

All lecture videos will be available on the first day of the course (February 14) at <u>12:00 pm Pacific Time</u>. Course assignments will be made live on the days indicated in the calendar below, without exception. Maintaining the assignment schedule enables Course Facilitators to be most effective in providing support and answering questions on subject matter throughout the course.

Getting Started

This course will use different tools to distribute content, run assignments, and deliver support. They are:

- **SCPD Learning Management System** – accessed via the mystanfordconnection site which you used to apply to and enroll in this course.
- **GitHub** – to distribute programming assignment code.
- **Azure Lab Services** – to provide cloud computing resources for **Assignments 4 and 5**.
- **Slack** – for additional course support and class discussions.

Accessing Your Course

1. On **February 14 after 12pm Pacific Time**, log in to the mystanfordconnection account you used when applying for the XCS224N course.
2. XCS224N: Natural Language Processing with Deep Learning will be visible as a live course. Click the link titled "Course Videos and Assignments" to enter our learning management system.
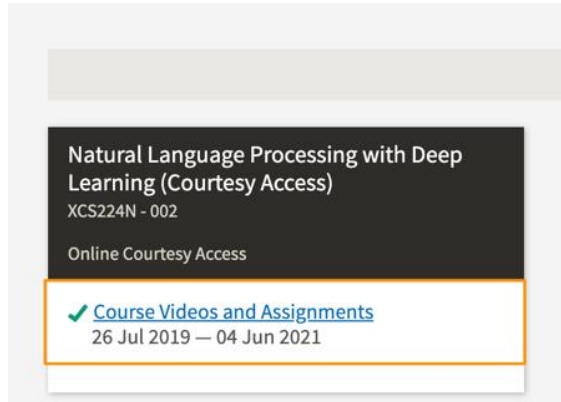
Joining Slack

In addition to direct small group support from Course Facilitators (more details and guidelines in Course Facilitators, Support, and Guidelines section below), the cohort will have a Slack workspace to ask additional questions and discuss course topics. An email invitation to the Slack workspace will be sent to your email address on file with SCPD on **February 11**.

If you have previously joined an SCPD/Stanford Slack Workspace for a previous course in the AI Professional Program, Slack does not send a notification when our staff 're-invites' you to this workspace. Instead, you are automatically re-activated, and on **February 11** should proceed directly to http://xcs224n-scpd.slack.com/ > I have a guest account > Log in using your credentials.

Joining GitHub

You will receive an email invitation to a GitHub team called "XCS224N-Wiinter-2022" at your address on file with SCPD. If you'd prefer to receive a GitHub invitation at a different address, just let us know at **xcs224n-staff@stanford.edu**

Please, accept the GitHub invitation as soon as possible, as it expires within 7 days. Once your invite expires, ask the team to resend it: xcs224n-staff@stanford.edu.

You will need to accept the invitation and be logged into your GitHub account in order to view course assignments and code.

The team's repository will be blank to begin with – code files will be added gradually as each assignment is released (see schedule below).

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Course Calendar and Potential Pacing Guide

Course videos are divided into two categories – core content and optional guest lectures. Below is a *potential* pacing guide if you are interested in watching all videos within a 10-week window. **However, you are free to view the videos at any pace you'd like.**

WEEK	POTENTIAL VIDEO PACING	ASSIGNMENT RELEASED	DUE DATE
2/14- 2/20	Module 1: Word Vectors	A1 & A2: Feb 14	
2/21 – 2/27	Module 2: Neural Network Learning	A3: Feb 25	A1: Feb 27
2/28 – 3/6	Module 3: Dependency Parsing	A4: Mar 4	A2: Mar 6
	Module 4: RNNs and Language Models		
3/7 – 3/13	Module 5: Neural Machine Translation and Attention		
	Module 6: Research in NLP		
3/14 – 3/20	Module 7: Transformers and Pretraining	A5: Mar 18	A3: Mar 20
	Module 8: Coreference Resolution		
3/21 – 3/27	Module 9: Integrating Knowledge in Language Models		
3/28 – 4/3	Module 10: Model Analysis and Explanation		A4: Apr 3
	Module 11: Improving NLP Models		
4/4 – 4/10			
4/11 – 4/17	Guest Lectures (Optional)		
4/18 – 4/24			A5: Apr 24

Assignments and Grading

Assignments will be made available via the SCPD course platform on the dates noted above in the course calendar. Below is a brief summary of what each assignment will entail:

Assignment 1 – Exploring Word Vectors

The first assignment is a warmup exercise that will include a short coding assignment focused on calculating co-occurrence matrices, as well as an exploration of word vectors in a Google CoLab notebook. The assignment also includes optional theory questions on dimensionality reduction with SVD that will be counted as extra credit.

Assignment 2 – Word2Vec

The second assignment consists of a coding assignment where you will implement Word2Vec and train your own word vectors with stochastic gradient descent (SGD). It also includes a short quiz and optional written questions counted as extra credit.

Assignment 3 - Neural Dependency Parser

The third assignment will include a multiple-choice quiz and a coding assignment in which you will use PyTorch to implement a neural-network based dependency parser, with the goal of maximizing performance on the UAS (Unlabeled Attachment Score) metric. Your implementation will be a transition-based parser, which incrementally builds up a parse one step at a time.

Assignment 4 – English to Cherokee NMT System

The fourth assignment includes a multiple-choice quiz and a coding assignment in which you will build a Neural Machine Translation system to translate Cherokee sentences to English using PyTorch on a GPU. You will implement a sequence-to-sequence (Seq2Seq) network with attention to build a Neural Machine Translation (NMT) system. SCPD has arranged for each learner to access Microsoft Azure resources for training – more information about how to access Azure will be provided by the course team.

Assignment 5 – Self-Attention, Transformers, and Pretraining

The fifth assignment includes a coding assignment in which you will explore attention and pretrained knowledge, along with training a Transformer to perform a task that involves accessing knowledge about the world not encoded in its trained data. You'll use PyTorch on a GPU. SCPD has arranged for each learner to access Microsoft Azure resources for training – more information about how to access Azure will be provided by the course team.

Grading

All assignments will be submitted via the Gradescope tool embedded within the SCPD learning management system. Both Multiple Choice Quizzes and Coding Assignments can be submitted unlimited times up until the due date.

Note on Final Projects

In the adaption from the CS224N graduate course to the XCS224N professional course, the final project has been removed. If completing a project-based course is your top priority, we recommend considering the CS224N graduate course or the XCS224U professional course.

Honor Code

Students will be asked to review and maintain the standards set forth by the Stanford Honor Code when completing quizzes and assignments in this course. You can review the section labeled Violations of the Honor Code for representative examples relevant to this course.

Students are strongly encouraged to form study groups, discuss, and work on homework problems in groups and help each other; However, each student must write down the solutions independently and cannot refer to written notes from the joint session. **In other words, you must understand the solution well enough in order to reconstruct it independently**. Further, because we occasionally reuse problem set questions from previous years, you are expected not to copy, refer to, or look at the solutions when preparing your answers. It is an honor code violation to intentionally refer to previous year's solutions.

After completing this course, you are welcome to share your experience and credential with others; However, it is considered a violation of the honor code to share assignment solutions including on public platforms such as GitHub. Faculty in the computer science department have strongly encouraged us to refrain from posting solutions for assignments, thus we ask that you **DO NOT** share the exact code.

Late Assignments and One-time Penalty Waiver

All assignments can be turned in **up to five days late and are assessed a penalty of -1 point per day**. After five days, the submission link will close, and entries will no longer be accepted.

We understand that personal or professional events may cause you to miss a deadline on an assignment. Each student can use a **one-time penalty waiver to remove a late penalty.** The penalty waiver <u>cannot</u> be split into smaller parts (e.g., you <u>cannot</u> use two days on Assignment 3 and three days on Assignment 4.). In order to use your penalty waiver, contact your Course Facilitator and SCPD staff.

Passing the Course and Earning the Certificate

In order to earn the Certificate of Achievement associated with this course, you must complete all quizzes and assignments with a total cumulative score of 70% or higher. Once you have successfully completed the course and the post-class survey, a digital Record of Completion will be emailed to you and the Certificate of Achievement will be mailed in a Stanford holder in approximately four weeks. If you are interested in calculating your progress along the way, it may be helpful to know:

- There are a total of 200 base points in the course (meaning 140 to achieve 70%)
- There are a total of 20 extra credit points in the course

Videos and Slides

As noted, this course utilizes content originally delivered in the CS224N graduate course. A few things you will notice about this adaptation process:

- At times you will hear instructors make reference to the final project or poster session. As noted above these have been removed for the current version of XCS224N and you need not worry about the reference.
- Instructors may make reference to "Week 1", "Week 2", "Week n" of the course – in general these references still hold due to the fact that the schedule/layout of the course has changed very little (except for Lecture 19) from the graduate course.
- Some sections of video have been removed, and accordingly those slides have been removed from the decks that accompany and play alongside each video. However, decks have not been re-numbered to ensure that they are still easy to match with the video segments. You will therefore see some slide decks that begin on a slide number other than 1 (often, as graduate course logistics videos have been cut) or slide decks that skip a few numbers due to removal of a clip (rarely, as much of the core lectures remain).
- In a few specific cases you may see names and/or faces blurred. In general, this is usually due to guidelines regarding student privacy.

Optional Supplementary Texts

We are often asked for text recommendations. There are no required texts for this course, however if you are interested, you may find these useful:

- Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft)
- Jacob Eisenstein. Natural Language Processing
- Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing
- Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning

Course Facilitators, Support, and Guidelines

You have a wide range of support available to you throughout the course. You will be assigned and receive contact information for an individual Course Faciltiator (CF) who will act as your primary point of contact. Below is a summary of the available resources and course support:

Office Hours

Your CF will be in touch with availability and scheduling logistics for video conference office hours. Office hours may be conducted using the Zoom conference service or via Slack video (more information below on the course Slack workspace). Your CF will provide further information on how they will schedule and run office hour sessions.

Email

Your CF will also be available to answer questions via email – a Stanford contact address will be provided when you are first connected to your CF.

Slack Workspace – Usage and Guidelines

In addition to the individual and small group support provided by CFs, Slack will be a place where questions may be posed to the entire community (this is the fastest way to get an answer!). **In order to keep the Slack workspace readable, searchable, and useful to all, please follow the following guidelines:**

==Reply in Threads to Keep Conversation Organized== – When you are replying to a post or joining a conversation, respond by starting or joining a threaded conversation, rather than responding in the full flow of the standard timeline. See below for an example of how to respond in a threaded conversation:
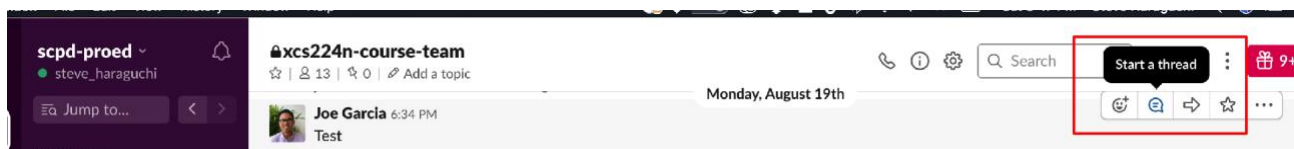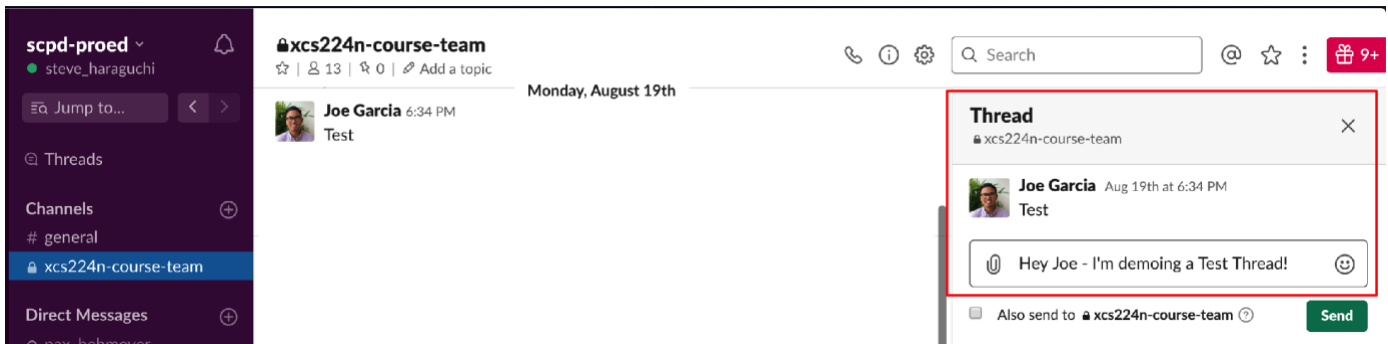
<mark>Use Multi-line Messages</mark> – Even if messages are threaded, you will soon see that Slack becomes unmanageable unless people use **single, multi-line messages instead of multiple, single-line messages**. Especially for mobile Slack users, it gets out of control!

Rather than the following:
"Hey all I have a question" [RETURN] <-- Creates new message
"I am a little confused about the quiz" [RETURN] <-- Creates new message
"I'm getting F for Question 40, but it seems like T is better" [RETURN] <-- Creates new message
----
Instead, try this!
"Hey all I have a question" [SHIFT+RETURN] <-- Creates new line in SAME message
"I am a little confused about the quiz" [SHIFT+RETURN] <-- Creates new line in SAME message
"I'm getting F for Question 40, but it seems like T is better" [SHIFT+RETURN] <-- Creates new line in SAME message
{RETURN} <-- Posts message

Note on Code Assignments and Debugging

While the course team is here to help and support your experience, it is ultimately your responsibility to write, test, and de-bug your own coding assignments. CFs may view and provide guidance on your work, however they will not send you exact answers on what to insert into your assignments. Additionally, before reaching out to a CF or Slack for help, it's expected that you have taken the reasonable step of performing an analysis yourself. This policy is meant to ensure that you leave the course having mastered the material and enable CFs to focus attention on questions where their guidance is most impactful.

Drop/Transfer Policy

You may drop this course for a full refund up until February 14, 2022 – the day the course starts. Once the course has begun, if you request to drop it by Friday at 5:00pm PST on the third week of the cohort (**March 4, 2022**) you will be reimbursed 100% of your tuition minus a drop fee of $100. Beyond the third week of the course, tuition refunds are not granted. Before **March 4, 2022,** you may also request a transfer to a future cohort of XCS224N or a different course in the AI Professional Program, also for a $100 transfer fee. To request a drop or transfer, send an email to xcs224n-staff@stanford.edu.

Questions

For course-specific questions or concerns (content, assignments, CF support), please contact your designated Course Facilitator.

For other course related questions, email xcs224n-staff@stanford.edu