Lecture 1
Introduction/Admin

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Welcome to CS546!

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What will you learn in this class?
CS546: Machine Learning in NLP

Questions you should be able to answer after CS546:
What Machine Learning (ML) techniques and tools work well for which Natural Language Processing (NLP) tasks?
What are the challenges in applying ML to NLP tasks?

What we’re aiming to cover in CS546 this year:
Focus on neural approaches (“deep learning”) to NLP
Background and current research
Overview of different types of neural models and NLP tasks

What you need to do in CS546:
Read, present and discuss research paper(s)
Do a research project
Prerequisites

CS447 Introduction to NLP (or equivalent)
  Basic understanding of NLP tasks and models

CS446 Machine Learning (or equivalent)
  Basic understanding of ML

Python programming
  Most neural network toolkits use it (Tensorflow, Pytorch)
How will we run this class?
This class consists of...

... lectures
  Tuesdays/Thursdays, 3:30-4:45, SC0216
  Many of these will be paper presentations by students

... office hours
  TA office hours are intended for research projects
  My office hours are mainly intended for paper presentations

... research projects
  These can be done in groups of up to four students

... a Compass page
  For grades and to submit reports and paper reviews

... a Piazza page
  For discussions
Assessment

Your grade will consist of
... 35%: your presentation of a research paper in class
... 50%: your research project
... 10%: your written reviews of research papers
   (graded for completion)
... 5%: your participation in class
Paper presentations

Everybody needs to prepare a 15-minute oral presentation and a two-page writeup about one research paper to be shared with the class.

NB: This paper shouldn’t come from your own research group, nor can it be a paper you presented in your qualifying exam.

- We will send out a sign-up sheet with dates and papers for each class.
- You will have to come to my office hours at least two day in advance with your slides to show them to me, otherwise you will only get half credit for your presentation.
- You have one week after your presentation to send in your writeup (so that you can reflect any in-class discussion)
Paper reviews

For 10 lectures where papers are discussed, you will have to submit a review of one of the papers that was discussed in class.

- Due to the size of the class, we can only grade you for completion.
- You will have to submit a PDF to Compass.
- We will distribute a LaTeX template with a few short questions that you should use for every paper.
- You can choose which papers you want to review.

We encourage you to get into the habit of taking notes about the papers you read. Hopefully this will get you started.
Research project

You will have to complete a sizable research project.

Due to the size of the class, you will have to work in groups (at least two, but up to 4 students).

There will be several milestones:
— Initial proposal
— Intermediate report and presentation
— Final report and presentation

We will have accounts and GPU hours on BlueWaters for these projects.
What is NLP?
NLP in the news…

Facebook AI Creates Its Own Language In Creepy Preview Of Our Potential Future

Computers can now describe images using language you'd understand

Barbie Wants to Get to Know Your Child

With the help of A.I., America’s most famous doll tries to fulfill a timeless dream — convincing little girls that she’s a real friend. What will happen if they believe her?
IBM’s Watson wins at Jeopardy!
Google Translate

Xi Jinping held talks with Zimbabwean President Robert Mugabe

Nakatsu do emphasize equality, mutual support, mutual benefit and common development, good friends, good partners and good brothers.

Xinhua Beijing, August 25 (Reporter Tan Jingjing) President Xi Jinping held talks on the 25th at the Great Hall with President Robert Mugabe. Xi spoke highly of the traditional friendship between the important contribution Zimbabwe and Mugabe made for the development of bilateral relations, stressing the friendship of the Chinese people is heavy, we will never forget once stood, mutual understanding and support of old friends. China is willing to Tianjin square one, carry forward the traditional friendship and strengthen cooperation in various fields, doing equal treatment, mutual support, mutual benefit and common development of good friends, good partners and good brothers.

Xi pointed out that President Mugabe is a famous leader of the national liberation movement in Africa, an important promoter of African integration, is also an old friend of the Chinese people. Nakatsu traditional friendship is condensed in our glory days alongside imperialism and colonialism and hegemonism, and reflects both countries followed independence, mutual respect, and oppose foreign interference and other basic principles of foreign relations. Establishment of diplomatic ties 34 years ago, the two sides understand each other on issues concerning each other's core interests and major concerns, mutual support, mutual help in the development process. Nakatsu traditional friendship is the common treasure of the two countries, we both cherish. Currently, Nakatsu are at an important stage of nation-building, friendship and cooperation between the two countries are embracing new opportunities. China is willing to work together with Tianjin efforts to promote comprehensive development of bilateral relations, to better benefit the two peoples.
Dialog systems
Siri [Jurafsky & Martin, 3rd ed]
Sentiment/opinion analysis

Customer Reviews
Haier HLT71 7-Inch Handheld LCD TV by Haier

Average Customer Rating

5 star: ★★★★★ (214)
4 star: ★★★★ (197)
3 star: ★★★ (69)
2 star: ★★ (55)
1 star: ★ (153)

Image quality: ★★★★★ (359)
Portability: ★★★★★ (359)
Ease of use: ★★★★★ (356)
Features: ★★★★☆ (353)

See and rate all 15 attributes.

The Most Helpful Reviews

The most helpful favorable reviews

FANTASTIC 7 inch portable LCD TV!
I am really thrilled with my purchase of this Haier HLT71 7-Inch, ATSC 2009 portable LCD TV! I have never heard of this name brand Haier, and I had heard some nightmare stories about some of the other brands having poor pictures on the little screens, so I thought I'd give the Haier a try.

I ordered this tv directly from Amazon and...
Have chatbots developed their own language?

https://code.facebook.com/posts/1686672014972296/deal-or-no-deal-training-ai-bots-to-negotiate/

Bob: “I can can I I everything else.”
Alice: “Balls have zero to me to me to me to me to me to me to me to me to me to.”

No, not really…
http://www.snopes.com/facebook-ai-developed-own-language/
How well does that Barbie do?

Barbie: “Do you have any sisters?”
Child: “Yeah, I only have one.”
Barbie: “What’s something nice that your sister does for you?”
Child: “She does nothing nice to me”
Barbie: “Well, what is the last nice thing your sister did?”
Child: “She helped me with my project — and then she destroyed it.”
Barbie: “Oh, yeah, tell me more!”
Child: “That’s it, Barbie,”
Barbie: “Have you told your sister lately how cool she is?”
Child: “No. She is not cool,”
Barbie: “You never know, she might appreciate hearing it”

(Thanks to Barbara Grosz for pointing out the example from the NYT)
What is the current state of NLP?

Lots of commercial applications and interest.
   Some applications are working pretty well already, others not so much.

A lot of hype around “deep learning” and “AI”
- Neural nets are powerful classifiers and sequence models
- Public libraries (Tensorflow, Torch, Caffe, etc.) and datasets make it easy for anybody to get a model up and running
- “End-to-end” models put into question whether we still need the traditional NLP pipeline that this class is built around
- We’re still in the middle of this paradigm shift
- But many of the fundamental problems haven’t gone away
Examples of NLP applications
(What can NLP be used for?)

Natural language (and speech) interfaces
  Search/IR, database access
  Dialog systems (e.g. customer service, robots, cars, tutoring), chatbots
  Image description/search

Information extraction, summarization, translation
  Process (large amounts of) text automatically to obtain meaning/knowledge contained in the text
  Translate text automatically from one language to another

Convenience, social science
  Grammar/style checking, automate email filing, autograding
  Identify/analyze trends, opinions, etc. (e.g. in social media)
Examples of NLP tasks
(What capabilities do NLP systems need?)

Natural language understanding
- Extract information (e.g. about entities or events) from text
- Translate raw text into a meaning representation
- Reason about information given in text
- Execute NL instructions

Natural language generation and summarization
- Translate database entries or meaning representations to raw natural language text
- Produce (appropriate) utterances/responses in a dialog
- Summarize (newspaper or scientific) articles, describe images

Natural language translation
- Translate one natural language to another
The NLP (NLU) Pipeline

An NLP system may use some or all of the following steps:

Tokenizer/Segmenter
  to identify words and sentences
Morphological analyzer/POS-tagger
  to identify the part of speech and structure of words
Word sense disambiguation
  to identify the meaning of words
Syntactic/semantic Parser
  to obtain the structure and meaning of sentences
Coreference resolution/discourse model
  to keep track of the various entities and events mentioned
NLP research questions redux

How do you represent (or predict) words?
- Do you treat words in the input as atomic categories, as continuous vectors, or as structured objects?
- How do you handle rare/unseen words, typos, spelling variants, morphological information?
- Lexical semantics: do you capture word meanings/senses?

How do you represent (or predict) word sequences?
- Sequences = sentences, paragraphs, documents, dialogs,…
- As a vector, or as a structured object?

How do you represent (or predict) structures?
- Structures = labeled sequences, trees, graphs, formal languages (e.g. DB records/queries, logical representations)
- How do you represent “meaning”? 