Administrative Notes
March 20, 2018

• Reminder: In the News Call #3- Individual is due tomorrow @ 11:59PM

• Midterm 2s were released on Friday. Regrade requests are due on March 23rd @ 5PM PST

• Our final exam is on April 17 @ 3:30PM in CIRS 1250
  • We are scheduling some exam office hours and will let you know soon!
Administrative Notes
March 20, 2018

• If your project team is interested in potentially presenting to the class for an extra 2% on top of your final mark, be sure to sign up before March 22 @ 11:59PM PST
• Link is on the class website
Midterm 2

- Mean: 42.66 (75%)
- Median: 44.0 (77%)
- Standard Deviation: 7.89
Midterm 2 Question

Think about the times when you have posted an article for the individual portion of In the News. What type of communication is it? Why?
NLP Semantics vs. Pragmatics

• Syntax and pragmatics both help machines “understand” meaning
• Syntax looks at “rules” that apply to sentences to figure out what the sentence is talking about
  • E.g., “The boy likes popcorn”. The fact that “the boy” comes first means the boy likes popcorn, not that popcorn likes the boy.
NLP Semantics vs. Pragmatics

• Pragmatics looks at the words surrounding the word or sentence the machine is processing and tries to figure out the meaning of an ambiguous word by the words around it.

• E.g., If you have the words baseball, sports, ball around the word bat, it’s likely you are talking about a baseball bat instead of a vampire bat.
Group activity

Go to Google translate. Pick some sentences or phrases that are tricky in a language you know. Translate it to another language. See if you can find ones that Google gets wrong.

If you only know English, try doing a round trip:

Step 1:

I am a Berliner

Step 2:

Ich bin ein Berliner
How many things did Google Translate get right?

A. It got all of them right
B. It got at some wrong, but less than half
C. It got at least some right, but more than half wrong
D. It got all of them wrong
Things that Google Translate got incorrect
Is this better or worse than you expected? Why?
Learning to translate between languages

- Traditional method (~20 years ago):
  1. Apply NLP to each sentence in each language
  2. Follow a set of rules that define how to translate
- Newer methods use **machine learning** techniques plus the vast amounts of data on the web (and indeed Watson uses such techniques, too)
- **Machine learning** describes the process of using data to help systems “learn” without being explicitly programmed how to do a task
This is why Google can translate from 102 languages

• This is only possible because of the huge amount of data on the web.

• However, they have to make sure that the translations are good! For a while, Google Translate had to stop learning from the web because there were so many bad Google Translations on the web.

• It probably can’t find enough documents to translate directly between languages, so it may translate through some others first. (think of it as hops on an airplane).

• Note that this can lead to hilarious mistakes – at one point Google’s Ukrainian to Russian translation referred to “Russia” as “Mordor” (from Lord of the Rings)
Limitations of traditional NLP

• Natural language is structurally *ambiguous*, so parsing alone cannot lead to understanding.

• Synonyms for words can’t be used interchangeably in every context, e.g., “minister of agriculture” isn't “priest of farming.”

• Natural languages have many exceptions to grammatical rules; there’s no agreed-upon grammar for all uses of a language.
Meanwhile, at Google Brain ... 

.. a different approach to language processing was being explored

• Even young children can easily process/understand natural language
• Babies don't learn language by explicitly learning the parts of speech, grammar and parsing...
• Why not try to simulate the brain?

See: The great AI awakening by Gideon Lewis-Krauss  
https://www.nytimes.com/2016/12/14/magazine/the-great-ai-awakening.html
The brain: a mass of highly interconnected neurons

- dendrites receive inputs
- axons carries output
- output is a simple function of the input
The brain: a mass of highly interconnected neurons

“What’s important are less the individual neurons themselves than the manifold connections among them. This structure, in its simplicity, has afforded the brain a wealth of adaptive advantages.”
Artificial neurons solve one tiny function and pass the information on to another neuron

An artificial neuron with four inputs and one output.

If the inputs from top to bottom are 1, 1, 1 and 0, then the weighted sum of inputs is

\[3*1+1*0-2*1+1*0=1.\]

This is less than the threshold of 2, and so the output is 0.
Is the sum of the weights of the input signals greater than or equal to the threshold in this example?

A. Yes  B. No
Artificial neural networks (ANNs)

Many interconnected artificial neurons: the outputs of some feed back into others
McCulloch and Pitts (1943) showed that simple artificial neural networks could carry out basic logical functions.
Artificial neural networks (ANNs) can recognize patterns
Artificial neural networks (ANNs) can learn

"With life experience, depending on a particular person’s trials and errors, the synaptic connections among pairs of neurons get stronger or weaker. An artificial neural network could do something similar, by gradually altering, on a guided trial-and-error basis, the numerical relationships among artificial neurons. It wouldn’t need to be preprogrammed with fixed rules. It would, instead, rewire itself to reflect patterns in the data it absorbed."
Let’s hear directly from Google researchers about artificial neural networks

https://www.youtube.com/watch?v=bHvf7Tagt18
If you took the entire space of the English language and the entire space of French, you could, at least in theory, train a network to learn how to take a sentence in one space and propose an equivalent in the other. You just had to give it millions and millions of English sentences as inputs on one side and their desired French outputs on the other, and over time it would recognize the relevant patterns in words the way that an image classifier recognized the relevant patterns in pixels.
From cats to language
Word embeddings

• One more big idea was needed to address the following problem:

• “The major difference between words and pixels, however, is that all of the pixels in an image are there at once, whereas words appear in a progression over time. You needed a way for the network to “hold in mind” the progression of a chronological sequence — the complete pathway from the first word to the last.”
Summary: ideas used to improve language translation at Google Brain

- Train artificial neural networks to recognize patterns across languages
- Use word embeddings, where a word is a point in a high-dimensional space, as the input to the networks
- Handle the “chronological” aspects of language
Canadian researchers were at the forefront of developing the underlying ideas

- Geoff Hinton (U. Toronto, Google)
- Yoshua Bengio (U. Montreal)
- Yann LeCun (former student of Hinton’s, now at Facebook)
Through Watson, we’ve covered a lot of Artificial Intelligence and related topics

- Machine Learning
- Natural Language Processing
- Information Retrieval
So.... will computers and robots take over the world?

• First, we have to decide what does that even mean?
• Let’s start by looking at one thing that’s in the news: jobs
Chances that a robot will take over your job in the next 20 years

![Bar chart showing the probability of job automation](http://www.businessinsider.com/likelihood-of-your-job-being-taken-over-by-robots-2016-8)
Do you want your career to be any of the jobs listed that are > 75% likely to be done by robots?

A. Yes  B. No

http://www.businessinsider.com/likelihood-of-your-job-being-taken-over-by-robots-2016-8
Quick individual exercise

Write down three careers that you’re interested in – for the long run, not just a temporary job. Note: we’re not asking for a deep commitment – just come up with things you’re interested in.
Quick *individual* exercise

Now, write down some day to day job tasks that your career would have.

For example, chefs have to:

- Run a kitchen
- Determine the menu based on availability of ingredients and cost
Group exercise

• Go to http://www.npr.org/sections/money/2015/05/21/408234543/will-your-job-be-done-by-a-machine (On lecture page, or search for “NPR robot job”)

• Check out at least one job for at least each person in the group and see how likely they are to be taken over by robots (keep track of percentages)
Clicker question

How many jobs that your group wanted were more than 50% likely to be taken over by robot?
A. All of them
B. More than half, but less than all
C. Half
D. Less than half, but more than none
E. None
Clicker question

How many jobs that your group wanted were more than 75% likely to be taken over by robot?

A. All of them
B. More than half, but less than all
C. Half
D. Less than half, but more than none
E. None
Let’s look at the top job to be automated: Loan Officer. What does a loan officer do?

1. Approve loans within specified limits
2. Meet with applicants to obtain information and answer questions
3. Analyze applicants' financial status, credit, and property evaluations to determine feasibility of granting loans.
4. Explain to customers the different types of loans and their terms
5. Obtain and compile copies of loan applicants' financial information.
6. Review and update credit and loan files.
7. Review loan agreements to ensure that they are complete and accurate according to policy.
8. Compute payment schedules.
9. Stay abreast of new types of loans

In a group, list what computers would have to do to automate this job. Divide the list into (a) things computers can do today and (b) things they can’t do yet.

http://job-descriptions.careerplanner.com/Loan-Officers.cfm
What would a computer need to do to automate a loan officer’s job?

<table>
<thead>
<tr>
<th>Can be done today</th>
<th>Can’t be done today</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1, 2, 3, 5, 6, 8</td>
<td>#4, 7, 9</td>
</tr>
</tbody>
</table>
Exhibit 8: Probability of a job becoming automatable

- Loan Officers: 98%
- Receptionists and Information Clerks: 96%
- Paralegals and Legal Assistants: 94%
- Retail Salespersons: 92%
- Taxi Drivers and Chauffeurs: 89%
- Security Guards: 84%
- Cooks, Fast Food: 81%
- Bartenders: 77%
- Personal Financial Advisors: 58%
- Computer Programmers: 48%
- Reporters and Correspondents: 11%
- Musicians and Singers: 7%
- Lawyers: 4%
- Physicians and Surgeons: 0.4%
- Elementary School Teachers: 0.4%

Note: Select occupations ranked according to their probability of becoming automatable.
Okay, that one’s pretty clear cut. Let’s look a little further down

“Taxi drivers and chauffeurs” – 89% chance

Obviously, this requires driving. In a group, list what computers have to be able to do in order to drive.

• Has to know traffic rules
• Visual input of signs, people, weather
• Adjust the speed to people around you or speed limit
• Physics of turning
• Signal
• Unexpected events
Driverless cars have come a long way in 15 years

https://www.youtube.com/watch?v=TsaES--OTzM
But it’s not all about technology

Group discussion: how safe would you feel riding in a driverless car? More, less, or the same than in a regular car?

A. More safe
B. Equally safe
C. Less safe
What about a steering wheel?

Group discussion: would having a requirement to have a licenced driver behind a steering wheel make you feel more safe, less safe, or the same? Why?

A. More safe
B. Equally safe
C. Less safe
What about a steering wheel?

Group discussion: would having a requirement to have a licenced driver behind a steering wheel make you feel more safe, less safe, or the same? Why?

• Whole purpose is to do anything else but drive
  • Violates the purpose of self driving cars
• Should make your own decision in critical moments
Uber’s Self Driving Cars

Just this morning, news broke of a car accident in Arizona.

We don’t know details yet but from what we do know, one of Uber’s self driving cars was traveling in autonomous mode with a safety driver behind the wheel. The car hit a pedestrian crossing the street. The pedestrian ultimately died from her injuries.