January 18, 2018

Administrative notes

- We’ll be doing in the news group work at the beginning of class today – sit with your group if possible
- Reminder: Midterm #1 February 1 in class
- Reminder: Project groups due February 7
- Reminder: In the News group component due Tuesday
- Reminder: reading quiz due Wednesday
- Reminder: You have 1 week to complete your lab (it is due at the beginning of your next lab). You must come in person to have your lab marked. Talk with your TA if you can’t do this.
- Reminder: If you want to request a regrade for a course component, you must do so within a week of the grade being released (see syllabus)
Today we’re going to start on the group component of In The News call #1

• Today we’re going to spend some time in class having your groups work on the group component
• Make sure that you’ve read the grade rubric: https://www.ugrad.cs.ubc.ca/~cs100/2017W2/in-the-news.html#rubric
• Make sure you comment on the CT Building Block, Application, and/or Impact!
• Picking an article/topic and then looking for related articles is both okay and encouraged
• You can pick an article that one of the people in your group did or any other article that has been posted
• Make sure that you cite articles that you use – pick any citation style – see discussion of Plagiarism on project page: https://www.ugrad.cs.ubc.ca/~cs100/2017W2/project.html#plagiarism
Algorithms and bias
Learning Goals

• CT Building Block: Students will be able to explain examples of how computers do what they are programmed to do, rather than what their designers want them to do.

• CT Impact: Students will be able to list reasons that an algorithm might be biased and what its impact will be.

• CT Impact: students will be able to list arguments why a company should or should not change its algorithms based on “fairness”
Algorithms can be compared based on many things

So far we’ve considered:
- Whether they work right
- Time and space they take

But what about if they’re fair?
For some “unambiguous” tasks, like sorting, fairness is a non-issue.

Example: Sorting cards:
- **Input**: pile of unsorted cards
- **Output**: pile of cards in sorted order from clubs, diamonds, hearts and spades, with ace's being highest

Example: Sorting flights:
- **Input**: list of flight options from A to B
- **Output**: list sorted by cost/departure time/arrival time/duration etc.
For other tasks, it’s not so clear what the right output is; there’s potential for bias.

Example: Classification tasks

- **Input**: individual's loan application (address, age, gender, credit rating...)
- **Output**: approve/deny a loan

- **Input**: digital image
- **Output**: cat/not a cat

- **Input**: genome sequence from cancerous biopsy tissue and success of treatment
- **Output**: proposed cancer treatments
How do classifiers work?

- Classifiers are derived from patterns or correlations from data.
- The data that classifiers learn the patterns has the “answer” – this data is called training data
  - Some of the training data is held back to check and see if the classifier works. This is called test data
- Classifiers then apply these patterns to new data with no “answer”
- Example:
  - Input: digital image
  - Output: cat/not a cat
  - Training data: labeled images of cats and images that are not cats
Example: Classification tasks

- **Input**: individual's loan application (address, age, gender, credit rating...)
- **Output**: approve/deny a loan
- **Training data**: list of loan applications, decisions made, and for those who were approved, whether they repaid the loan or not
Classification task training data example: cancer genes

• **Input**: genome sequence from cancerous biopsy tissue
• **Output**: Which cancer treatment is likely to work best
• **Training data**: labeled genome sequences and which treatments were successful from both cancerous tissue
Building a classifier from training data: Loan officer example

- You want to create a classifier to help you decide whether or not to give people loans.
- Here is your past (training) data on some loans:

<table>
<thead>
<tr>
<th>Applicant</th>
<th>Income</th>
<th>Gave loan?</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>$50,000</td>
<td>Yes</td>
</tr>
<tr>
<td>#2</td>
<td>$25,000</td>
<td>No</td>
</tr>
<tr>
<td>#3</td>
<td>$75,000</td>
<td>Yes</td>
</tr>
<tr>
<td>#4</td>
<td>$95,000</td>
<td>Yes</td>
</tr>
<tr>
<td>#5</td>
<td>$45,000</td>
<td>No</td>
</tr>
</tbody>
</table>

In a group, create an algorithm to decide what your classifier does: i.e., when will you give a loan, and when will you not give a loan?
Would your classifier give a loan if an applicant’s income was $78,000?

A. Yes
B. No
Loan officer clicker questions

Would your classifier give a loan if an applicant’s income was $48,000?

A. Yes
B. No
That was pretty straightforward. But what if I stack the deck?

Setup:

- I have a hand of cards (not necessarily chosen randomly from the deck – it may be biased in some way, e.g., fewer 8’s than average).
- I remove a small number of cards from the hand at random to form the *test data*. Note that the test data is biased in the same way as the training data.
- Your task: use the remaining cards (on the projector) as *training data* to build a classifier.
Building a classifier from training data: Simple example

First classification task: I pick a card from the test data and ask you to guess:

A. High-valued? (8 or above – including Aces)
B. Low-valued? (7 or below)

(Training data is on the projector)
Building a classifier from training data: Simple example

Second classification task: I pick a different card from the test data, tell you its colour (red or black) and ask you again:

A. High-valued?
B. Low-valued?

(Training data is still on the projector)
Your classifier
Discuss in your groups

• What was your classifier, i.e., your algorithm for deciding on an answer?
• How did you use the training data to decide on your classifier?
What can this tell us about classifier “fairness”?  

- Suppose that cards classified as high-valued are “rewarded” (loan approved), while those classified as low-valued are “penalized” (loan denied)  
- Is it fair if red cards are never rewarded, even though some are high-valued?  
- This is a silly question, but it’s not hard to extrapolate to situations where the stakes are higher…