Introduction to Computation for the Humanities and Social Sciences

CS 3

Chris Tanner

Lecture 1

What is Computation?

Lecture 1

- People
- Motivation
- Course Topics
- Assignments
- Ex: Political Media Bias
- Computation vs Computer Science vs Programming vs Python

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Who am I?

Who am I?

- PhD student (graduating in May)
- Research Area: AI / Machine Learning,
  Natural Language Processing
- Call me Chris
- christanner@cs.brown.edu

HTAs and TAs

HTAs and TAs

- From 91 applicants, 54 were interviewed

People

HTAs and TAs

- From 91 applicants, 54 were interviewed
- cs0030tas@lists.cs.brown.edu
- **HTAs:**
  - Anna Nakai — Political Science & Comp Sci
  - Dylan Sam — Math & Comp Sci
- **TAs:**
  - Caroline Ribet — History
  - Milla Shin — Comp Sci
  - Dylan Tian — Visual Art & Comp Sci

Supervising Faculty

Tom Doeppner

twd@cs.brown.edu

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Motivation

Why is it important?

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- With the ability to use this data, one may:
  - pose new questions
  - compute things with the data
  - draw new conclusions
  - provide quantitative results — allowing one to even complement qualitative problems

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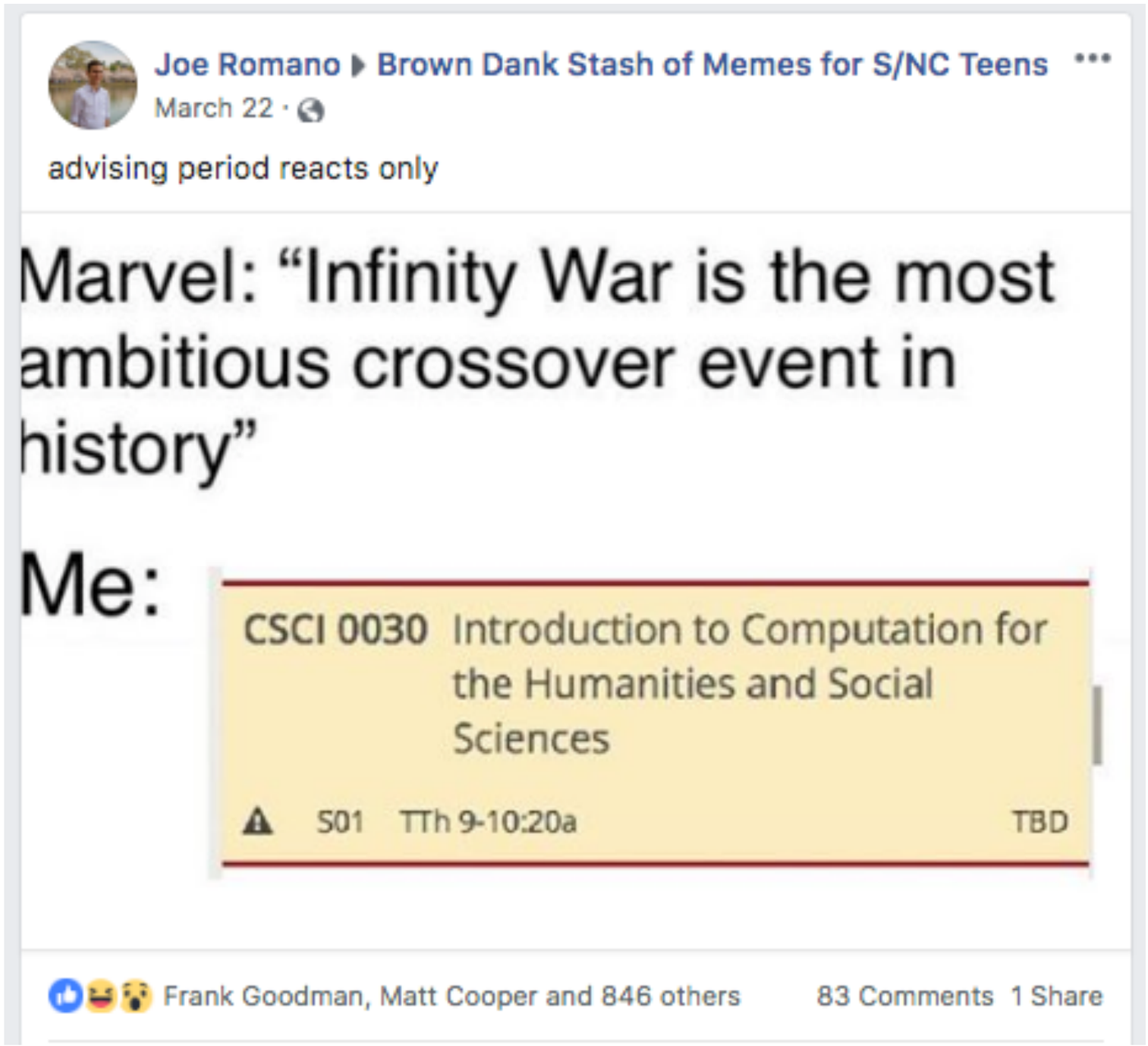
- With the ability to use this data, one may:
  - pose new questions
  - compute things with the data
  - draw new conclusions
  - provide quantitative results — allowing one to even complement qualitative problems

- Useful to everyone

Motivation


Joe Romano ▸ Brown Dank Stash of Memes for S/NC Teens
March 22 ·
advising period reacts only
Marvel: “Infinity War is the most ambitious crossover event in history”
Me:
CSCI 0030 Introduction to Computation for the Humanities and Social Sciences
S01 TTh 9-10:20a TBD
Frank Goodman, Matt Cooper and 846 others
83 Comments 1 Share

Real-world Examples

1. *Paper Machines* — Jo Guldi (former History professor at Brown):

Paper Machines is a free toolkit for historians who wish to perform a "distant reading" of large-scale textual corpora, particularly those associated with modern institutions like Parliament or the World Bank, by using algorithms to visualize how the official mind's concerns change over time and space. I designed Paper Machines to help with my next monograph, *The Long Land War,* with funding from Harvard and Google in 2012 […] The technology has been widely adopted and taught.

Real-world Examples

2. *Migration Research* — Becca Wang (Sociology PhD student at Brown):

Given collected data:

- census data (who lives where)
- migration data (who migrated from rural South Africa to Johannesburg)
- quantitative assessment of how kids' well-being

Compute:

- analysis which shows the effects migration has on kids, dependent on children's relationships to the given migrant(s) in their family (e.g., mother, father, older sister, uncle, etc).

What this course teaches

- Problem-solving workflow to build defensible arguments backed by relevant data sources and appropriate methods

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- High-level understanding of core concepts (e.g., data structures, algorithms, computer science vs programming, machine learning, deep learning)

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- How to solve computational problems using Python (programming language)

- High-level understanding of core concepts (e.g., data structures, algorithms, computer science vs programming, machine learning, deep learning)

- How to implement a basic Machine Learning algorithm to classify text documents

Motivation

What this course does not teach

- Advanced math

  (math will be roughly limited to summing, averaging, and some fractions)

- Rigorous study of what truly qualifies as being logically sound/ statistically significant results

  (courses in Statistics, Logic, and Philosophy is best for such)

- Rigorous study of Computer Science programming

  (CS15/16/17/18/19 are great for that)

Who Should Take this Course

Course is designed for humanities and social science concentrators [who are interested in the aforementioned topics].

No programming background is expected.

How to Enroll

1. Add your name to the pre-registration waitlist (link was available March 23)

2. Each lecture, sign the sign-in sheet, indicating that you're still interested

3. Turn in each homework assignment

4. After 2 weeks, the first 30-35 students (per the waitlist) who have completed each homework and attended each lecture will receive an override code.

5. Goal is to admit students who are interested in the course and will likely not drop — contact Head TAs at anytime time to find your approximate chance

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Course Topics

1. **Problem Solving and Python**
   - Forming computational problems
   - Finding datasets
   - Getting started with Python
   - Designing and writing programs
   - How data is stored and changed
   - **Project 1:** Computation

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   - Iterating through text data
   - Data Structures
   - Building a concordance of large texts
   - Sentiment Analysis
   - **Project 2:** Text Analysis

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3. **Data Visualization and using APIs**
   - Plotting Data in informative ways
   - Visualizing data on maps
   - Accessing Data from APIs
   - **Project 3:** Final Project

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1. **Problem Solving and Python**
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   - Accessing Data from APIs
   - **Project 3:** Final Project

4. **The Extended Landscape**
   1. What is Machine Learning?
   2. Naive Bayes Classifier
   3. The Academic Landscape

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Assignments

Class: Tuesdays and Thursdays @ 9am - 10:20am

Lab Time:

- last ~30 minutes of each class
- intended for starting on homework
- credit given for good effort
- all TAs available to help

Homework:

- issued Tuesday, due by Mon @ 11:59pm
- will give students hands-on experience
- start working on it during Lab Time

Assignments

Projects:

- 3 projects (programming-based)
- some freedom in designing each project
- intent is to apply skills towards real-world data/scenarios which interest you
- ~3 weeks to work on each project

Pop Quizzes:

- in lieu of exams, there will be a few (~5) pop quizzes
- issued at beginning of lecture

Grading

- In-class lab time: **10%** (for good effort)
- Homework assignments: **45%**
- Projects:
  - Project 1: **7%**
  - Project 2: **13%**
  - Project 3: **20%**
- Pop Quizzes: **5%**

NOTE: Some extra credit will be possible on many assignments

Late Policy

- Each student is **allowed a total of 3 late days,** which can be used toward any homework or project

- Each subsequent late day on a given assignment drops the max. possible grade by 10%

- Project #3 must be turned in by Dec 15, 11:59pm, regardless of how many late days you have

- If you are sick, provide notification from Health Services before the due date to receive an extension.

Late Policy

- Don’t get behind! Material continuously builds.

What to do if you'll miss a class

- E-mail me for slides
- Try to complete the homework ASAP so you have sufficient time to go to TA hours

Laptop/Tablets Policy

- Research has shown that laptops usually have adverse affects in classroom

- Brown end-of-course evaluations have indicated that students are often distracted/bothered by others' screens

- **Policy:** please refrain from using laptops in class (other than lab time), unless it's important or you find it highly beneficial — in which case, be considerate to others around you.

Resources

- **Website:** http://cs.brown.edu/courses/csci0030/

- **E-Mail:**
  - **HTAs and me** for issues related to course infrastructure: cs0030headtas@lists.cs.brown.edu
  - **TAs** for individual matters: cs0030tas@lists.cs.brown.edu
  - Grading issues? Email the TA who graded your work

- **Piazza:** for questions about assignments or general help:
  - piazza.com, then search for **csci0030** and sign-up

- **TA hours** should be the preferred method for in-depth questions or help

Resources

- **Meet with me:** by appointment

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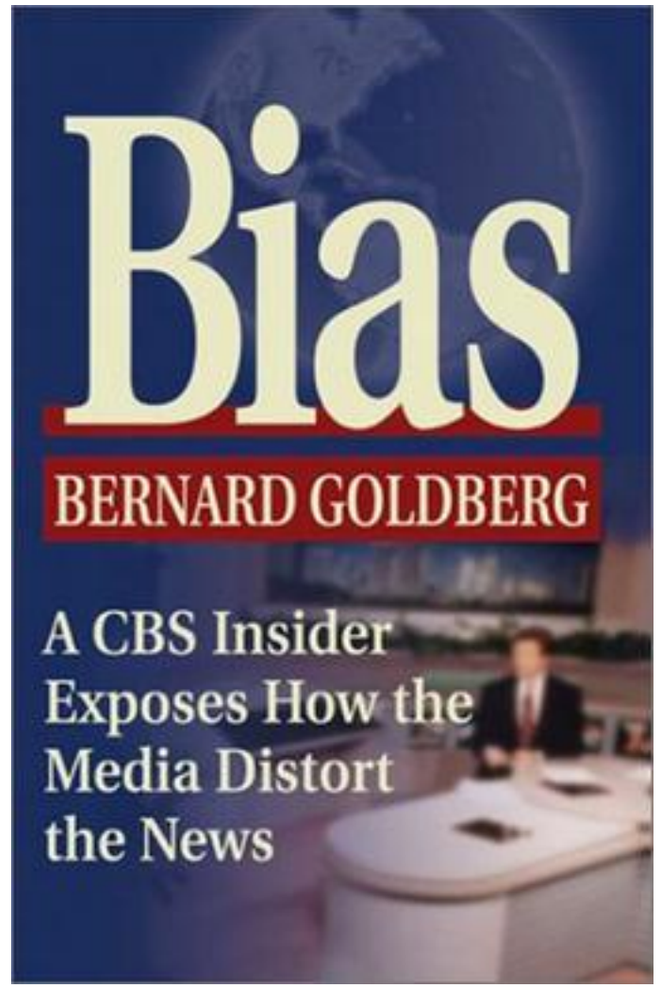
Political Media Bias

Observations inform Research

"In 1981 … I was named a national correspondent, which allowed me to cover bigger, more important stories anywhere in the country … It was in New York that for the first time I started noticing things that made me feel uneasy.

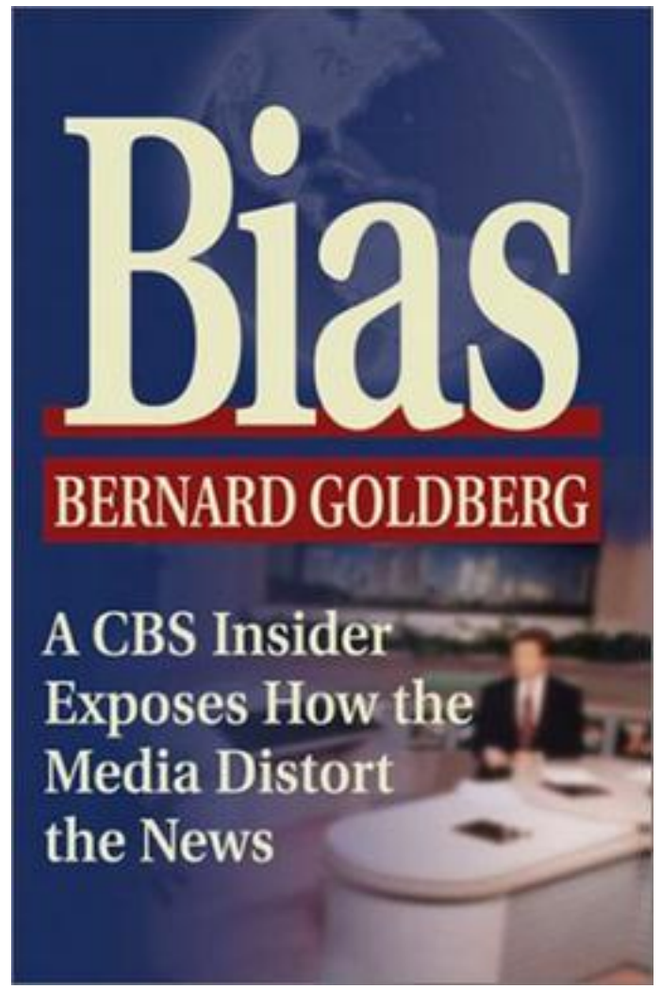
"I noticed that we pointedly identified conservatives as conservatives, for example, but for some crazy reason we didn't bother to identify liberals as liberals […] in the world of the Jenningses and Brokaws and Rathers, conservatives are out of the mainstream and need to be identified. Liberals, on the other hand, are the mainstream and don't need to be identified."



Let's turn this into a research problem

Think, then discuss with your neighbor:

- What claim did he make?
- What was his justification for why that claim held true?
- How could we verify his claim?



An Example: Political Media Bias

What is our question?

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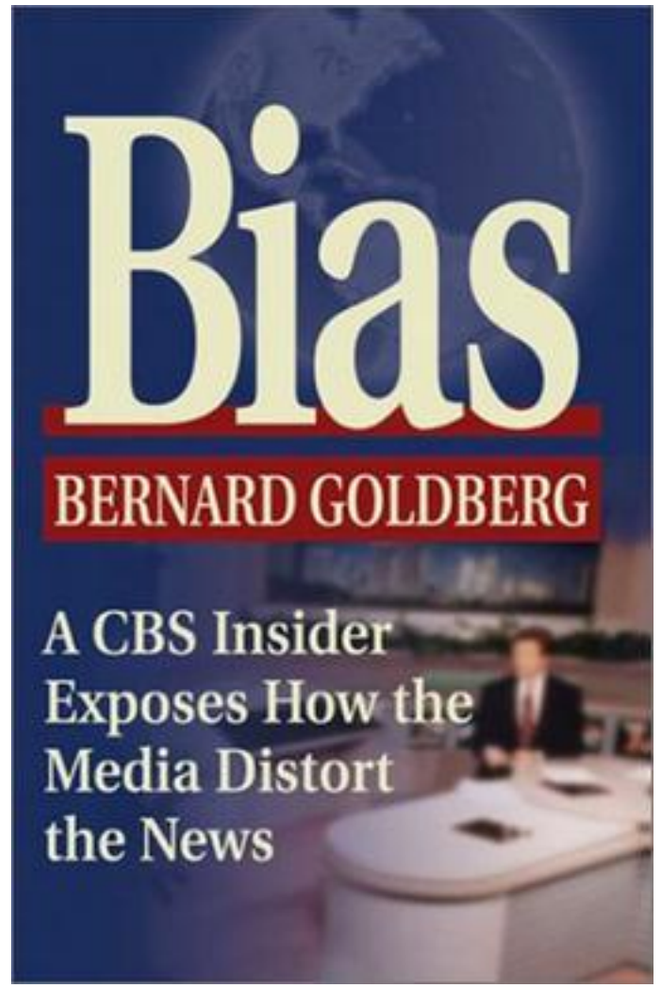

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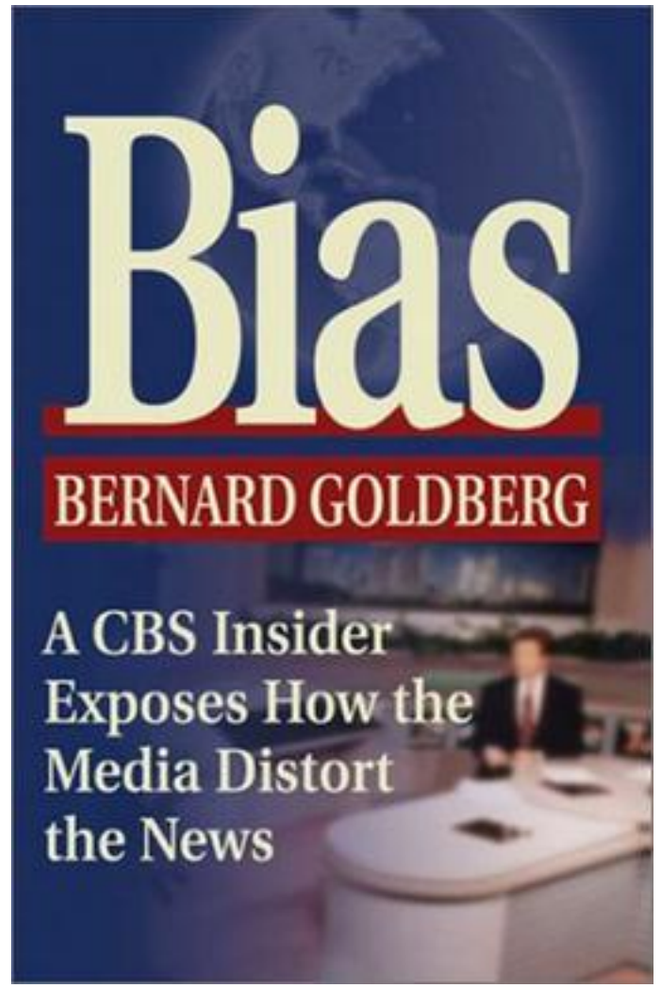


An Example: Political Media Bias

"On The Bias"
Geoffrey Nunberg, *Fresh Air*

"Bernard Goldberg is hardly the first person to claim that the media have a liberal bias, and his Bias is far from the best-written or best-argued book to try to make that point. Even so, it has climbed to the top of the New York Times bestseller list, maybe because Goldberg is himself a CBS insider with lots of tell-all tidbits to offer about the likes of Dan Rather and Bob Schieffer.

"For the most part, Goldberg's book is a farrago of anecdotes, hearsay, and unsupported generalizations. But at one point he strays into territory that can actually be put to a test. That's when he claims that the media "pointedly identify conservative politicians as conservatives," but rarely use the word "liberal" to describe liberals."

[1] http://people.ischool.berkeley.edu/~nunberg/table.html

Problem Solving Workflow

- Define our question with precise, defined terms that can be proven true or false
- Select a relevant data source
- Design a feasible method that would answer your question
- Evaluate and analyze results
- Communicate your results to the intended audience

Clarifying our question

Think, then discuss with your neighbor:

- What is media bias?
- How might bias manifest in different ways in the media?
- To whom/what are they biased?
- What types of media are we interested in analyzing?

Types of Bias

- **Omission**: Using only arguments from one side

- **Source selection:** Include more sources or more authoritative sources for one side over the other

- **Story selection:** Regularly including stories that agree or reinforce the arguments of one side

- **Placement**: Using the benefit of the perceived importance of position to highlight certain stories

Types of Bias

- **Labeling**: (two types)
  - Using labels to categorize sources or individuals as extreme
  - Labeling people on one side of the argument with labels and not the other

- **Spin**: Story provides only one interpretation of the events

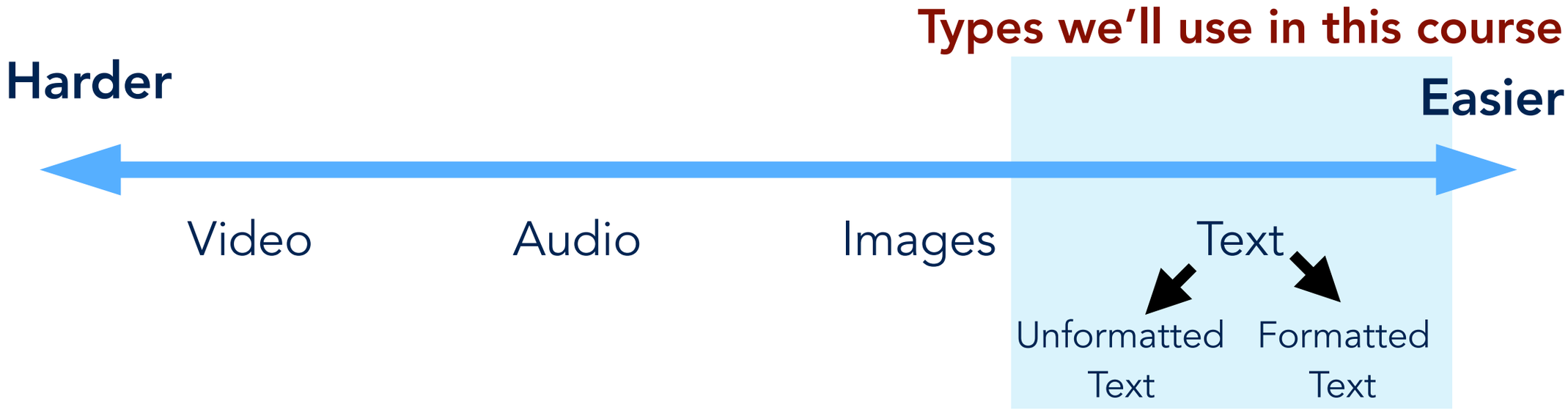
What is our question?

Instead of “Is the media biased toward liberals”,

“In major newspapers, are liberal politicians identified as liberals more or less often than conservatives are identified as conservatives?”

An Example: Political Media Bias

What data sources should we use?



- TV video segments are very hard to analyze, but TV transcripts are significantly easier
- Text from newspaper articles is easy, but newspaper layout and organization is harder
- This course will teach you how to analyze text data, both formatted and unformatted (e.g., websites, Twitter, newspapers, etc)

What data sources should we use?

- What would be relevant, accessible data sources to solve this problem?

- How do we measure labeling bias in this dataset?

- How do we avoid introducing our own bias by the selection of data sources?

An Example: Political Media Bias

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What data sources should we use?

Nunberg: 30 Major Newspapers

- The New York Times
- The LA Times
- The Washington Post
- The Boston Globe
- The Miami Herald
- The San Francisco Chronicle

[1] http://people.ischool.berkeley.edu/~nunberg/table.html

Measuring Label Bias

"In major newspapers, are liberal politicians identified as liberals more or less often than conservatives are identified as conservatives?"

Nunberg's Method

- Choose a representative set of politicians from each side
- Find mentions of politicians in the dataset
- Look at seven words before and after the politician's name
- Compute fraction of times these words around their name contain the politician's appropriate label

[1] http://people.ischool.berkeley.edu/~nunberg/table.html

An Example: Political Media Bias

Nunberg's chosen politicians to follow

Liberal Politicians

- Sen. Barbara Boxer
- Sen. Paul Wellstone
- Sen. Tom Harkin
- Sen. Ted Kennedy
- Rep. Barney Frank

Conservative Politicians

- Sen. Jesse Helms
- Sen. Tom DeLay
- Sen. John Ashcroft
- Sen. Dick Armey
- Rep. Trent Lott

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Looking at words around a politician's name

- There will inevitably be false positives
- e.g., the political label may not be referring to the politician

An Example: Political Media Bias

Looking at words around a politician's name

- There will inevitably be false positives
- e.g., the political label may not be referring to the politician

Which of these examples will be correctly categorized by the method?

- "'And now it's gone too far,' said John Ziegler, a conservative radio host"
- "When David [Brooks] complains that 'conservative opinion-meisters began to value politics over everything else,'"
- The system rates Mr. Obama as being slightly more conservative than Jimmy Carter

An Example: Political Media Bias

	Total instances in newspapers database	Pct within 7 words of relevant label	Total instances in "liberal" papers	Pct. within 7 words of label in "liberal" papers
Liberal Legislators				
Paul Wellstone	2939	10.9%	578	8.48%
Barney Frank	8501	4.7%	1439	3.89%
Tom Harkin	10,147	3.7%	1784	2.02%
Ted Kennedy	17,197	3.0%	2444	2.74%
Barbara Boxer	8977	2.0%	3093	1.78%
Avg. pct. for liberals, all papers	***4.8%***		***Avg pct. In "liberal" papers***	***3.78%***
Conservative Legislators				
Jesse Helms	19,874	9.1%	4718	6.02%
Tom DeLay	6351	3.6%	1859	2.90%
John Ashcroft	10,187	2.1%	1157	3.03%
Dick Armey	9222	2.1%	1460	1.44%
Trent Lott	18,048	1.4%	4976	1.05%
Avg. pct. for conservatives, all papers	***3.6%***		***Avg pct. in "liberal" papers***	***2.89%***

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Conclusion:

Liberals are labelled more often than Conservatives

An Example: Political Media Bias

What did we compute?

The word co-occurrence of political labels and specific members of congress.

Why?

As an approximation of how often members of congress are identified by their political affiliation

Assumption / Possible Weaknesses

As mentioned, there are probably errors:

- False Positives — a political label is present but does not represent the given, nearby politicians affiliation
- False Negatives (misses) — a politician is mentioned in the text but there is no political label nearby

An Example: Political Media Bias

How well did we do?

- 85% accuracy [1]
- Can calculate accuracy by manually inspecting many examples, then extrapolate.
  - e.g., look at 100 mentions of politicians, and if 85 of them were correct, it's fair to say we have 85% accuracy
- Error calculation is **not mandatory, but it's largely useful,** both to you and the audience which will receive your results.

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What is Computation?

- To compute, is to calculate something (e.g, to count, add, find mutual items, etc).

- It's a specific operation, or set of operations, performed by a well-defined model or function.

- One can build a model/function to compute the following:
  - How many distinct Presidents has the United States had?
  - What's the avg. age of US Presidents upon their taking office?
  - Is there a correlation between (a) the number of yearly daylight hours a a country receives and (b) their citizens' life expectancy?
  - Correlation between a country's GDP and life expectancy?

Computation vs Comp Sci vs Programming vs Python

What is Computation?

- The answer should not be subjective or non-deterministic
    - e.g., your computation should be repeatable/reproducible.
- For Example:
    - Who makes better pizza? Fellini's or Antonio's?

    (we could compute an approximate answer via polling, and we ought to explain how we calculated it)

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- For Example:
    - Who makes better pizza? Fellini's or Antonio's?

      (we could compute an approximate answer via polling, and we ought to explain how we calculated it)
    - Do students rate Fellini's or Antonio's more favorably?

      (more specific question, which leaves less room for incorrect computation, and less lengthy explanation of our calculation).

What is Computer Science?

- Computer Science is horribly named. Computational Science is a more appropriate a name

- “Computer Science is no more about computers than astronomy is about telescopes” — **Edsger Dijkstra, 1970**

- Computer Science is a broad field with many distinct sub-fields, but a commonality is computation, as it’s the main vehicle that drives all areas.

- aka “How do you compute stuff?”

Computation vs Comp Sci vs Programming vs Python

What is Computer Science?

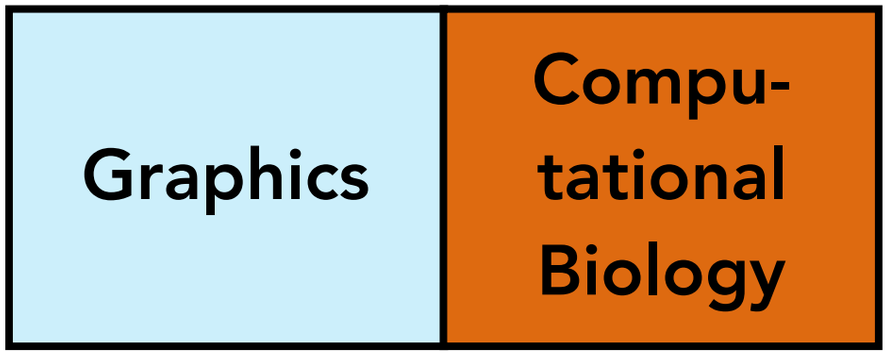
Graphics

• • •

- How do you calculate which a photo from an unprecedented point-of-view would look like? **(graphics)**

Computation vs Comp Sci vs Programming vs Python

What is Computer Science?



. . .

- How do you calculate which a photo from an unprecedented point-of-view would look like? **(graphics)**
- How can you very quickly calculate the sub-sections of human DNA which are most likely to concern pancreatic cancer? **(comp. bio)**

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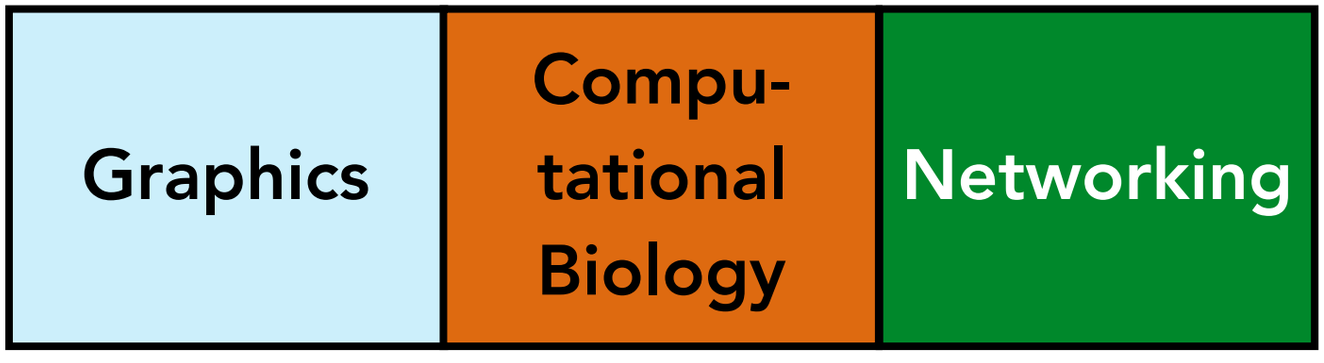

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- How can you robustly handle internet traffic when 1,000 computers try to simultaneously connect to a website? **(networking)**

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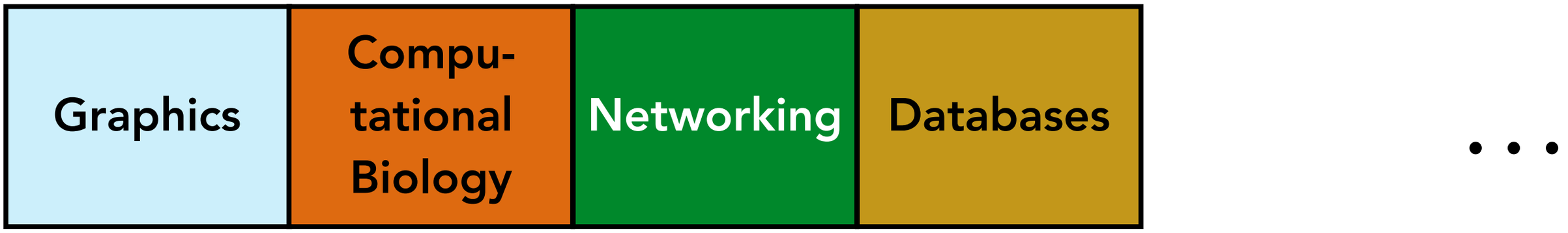
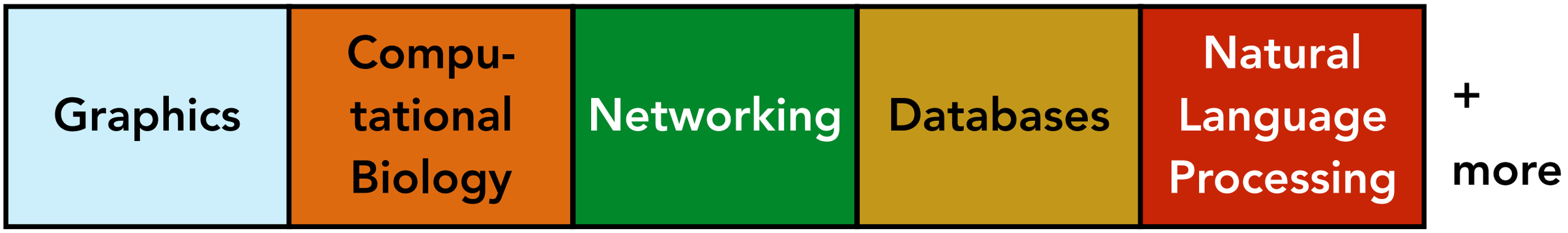


- How do you calculate which a photo from an unprecedented point-of-view would look like? **(graphics)**
- How can you very quickly calculate the sub-sections of human DNA which are most likely to concern pancreatic cancer? **(comp. bio)**
- How can you robustly handle internet traffic when 1,000 computers try to simultaneously connect to a website? **(networking)**
- How can you store 1 billion names such that one can quickly determine if any queried name exists in it? Or the closest match? **(databases)**

Computation vs Comp Sci vs Programming vs Python

What is Computer Science?



- How do you calculate which a photo from an unprecedented point-of-view would look like? **(graphics)**
- How can you very quickly calculate the sub-sections of human DNA which are most likely to concern pancreatic cancer? **(comp. bio)**
- How can you robustly handle internet traffic when 1,000 computers try to simultaneously connect to a website? **(networking)**
- How can you store 1 billion names such that one can quickly determine if any queried name exists in it? Or the closest match? **(databases)**
- How can you determine if two names within a document refer to the same underlying person or not? **(natural language processing. my dissertation)**

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What is Computer Science?

Graphics	Compu-tational Biology	Networking	Databases	Natural Language Processing

Main Takeaway: Computer Science has a bunch of areas, but computation is at the root of it all.

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Pursuing education in History

- In the field of History or Literature, **the language of text is the medium of communication** — it's the currency to exchange ideas
- As long as one can understand the language, one has sufficient skills to start digesting (and maybe contributing) knowledge
- Then, one can learn the skills of the field, e.g.,:
  - how to draw inferences
  - how to make insightful comparisons
  - how to understand cultural references, metaphors, etc
  - deep knowledge of bodies of works
  - etc

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Computer Science

Pursuing education in ~~History~~

Computer Science

programming

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  - how to compute stuff, and to do so in smart ways (i.e. efficient)
  - make the code compute more and more stuff, until it's a complete product that does high-level things that you want (e.g., iPhone App, social network website, an autonomous car).

What is Programming?

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What is Programming? What is Python?

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- **synonym**: coding
- There are many different distinct computer languages that one can program in.

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- Each has their purpose:
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  - **Python** is arguably the best language from the latter case

Computation vs Comp Sci vs Programming vs Python

- **Computation** — a calculation; a specific operation, or set of operations, performed by a well-defined model or function.
- **Computer Science** — a field of study which is deeply centered around computation, including the interest of both the computation itself, and applying computation towards various problems and tasks.
- **Programming** — the act of typing words (instructions) in a specific computer language, in a way that a computer can understand and execute (i.e., compute). This is the vehicle of communication within the field of computer science.
- **Python —** a specific, high-level yet powerful and easy-to-use programming language

Homework #1

1. **Visit the course website for the assignment:**
   a. Complete the Collaboration Policy
   b. For your own reading pleasure:

   https://www.nytimes.com/2018/08/10/opinion/politics/giuliani-trump-chicago-data-crime.html

Lecture 1: Last Words

Please be vocal. My goal is to make this content as digestible, rewarding, and enriching as possible.