CSCI 0150
(also known as, CS15)
A Gateway to Computer Science

Head TAs
- Helen (hcho8, junior, Computer Science & Cognitive Science)
- Amos (ajacks12, junior, Computer Science & Slavic Studies)
- Catherine (chabgood, junior, Computer Science & VISA)
- Jeff (jkennan, Computer Science)

New Member!
- Michael L. Littman
  - New member of our CS15 staff this year
  - Additional resource for help outside of TA Hours
    - Conducting research on various AI, robotics, machine learning topics

Monsters University, Pixar 2016 ©
Computer Science (1/2)

- CS15 is a start to understanding computer science
  - for your own intellectual interest
  - for its enrichment of other fields
  - for its combination of scientific, engineering, art and design concepts and practices, and as a "mode of thought" – "computational thinking"

Computer Science (2/2)

- IT, or information technology, including CS, is key to the "knowledge economy"

- Omnipresent in a breadth of various applications and fields

Stunning Special Effects

Pixar's "Incredibles 2"  
Pixar's "Finding Dory"
**Immersive Virtual Reality**

- Researchers can create fully immersive 3D environments via head-tracked stereo glasses, enabling realistic “field geology” on Mars!
- A state-of-the-art new “Cave”, the YURT (YURT Ultimate Reality Theater), at 180 George Street
  - much higher quality (e.g., 100Mpixels) and much more comfortable than Oculus Rift, VALE Vive and other VR headsets
  - but way more expensive!

**Augmented Reality**

- Creates virtual elements “on top of” the real world, blending a digital reality with an existing one!
- Microsoft HoloLens
  - special glasses with built-in head tracker that create a mixed reality
  - still in development
- Smartphone apps, e.g., Pokemon Go

**The Internet and Social Networks**

- Facebook
  - 2.2 billion active users worldwide
  - over 140 billion pieces of content (links, pictures, etc.) shared each month
  - 31.25 million messages sent per minute
  - open source API allows users to write their own Facebook applications
Opportunities/Threats of the Digital Age (1/4)

- Machines continue to replace human labor and decision-making
  - machines have increased human productivity, while reducing demand for routine, repetitive jobs
  - as middle-skilled, task-intensive jobs disappear, income gap widens
  - but new jobs are being created, old jobs “upskilled” to be more interesting
  - impacting not just blue-collar jobs such as factory work or driving, e.g., reading medical images (indeed medicine!)

- Education is key to economic survival
  - Should there be a “robot tax”?
  - Should there be a “guaranteed (universal) minimum income”?  

Opportunities/Threats of the Digital Age (2/4)

- Dangers of yielding too much control to algorithms, some too complex to be understood by most people
  - instability in the stock market due to trading algorithms
  - self-piloting vehicles (autopilot on planes, driverless cars...)
  - nuclear power plants

- Cyberfraud, Cybercrime, Cyberwarfare
  - Facebook-Cambridge Analytical Data Scandal
  - we keep experiencing huge data breaches
  - offense has the advantage over defense
  - schools in Russia, China, North Korea (at least) teach hacking...we’re well beyond amateur hacking
  - will the next war be fought by drones, and how controlled will they be?

- Brown is strong in cybersecurity technology and policy

Opportunities/Threats of the Digital Age (3/4)

- Big Data
  - “data mining”, “machine learning”, “deep learning”...
    - statistics-based algorithms for detecting patterns, anomalies, etc.
  - search
  - real-time language translation
  - face recognition
    - can identify faces in crowd photos
  - gesture recognition for user interfaces
  - credit card fraud detection
  - crime and terrorism anticipation
  - but what about privacy in the age of the “surveillance state”??
Opportunities/Threats of the Digital Age (4/4)

- Big data & personal privacy
  - Information now more accessible than ever
  - Threat to privacy represented by increasing storage of personally identifiable information – is there any real “anonymous data”?!?
  - Google search results and posting information influencing voter decision-making
  - Hosting companies have the right/duty to ban offensive websites (e.g., The Daily Stormer 8/14/17)
  - NSA/Snowden Controversy, what about Google, Facebook, Microsoft and their data collection and use of that data – digital stuff is permanent, and you have no control over how it is used (Sun’s Scott McNealy – “privacy is dead, get over it!”)
- Need an educated government, citizenry

Privacy and Security

Privacy and Security

Mathematics

Algorithms

Crypto

Systems

Politics

Law

CS: So Much More Than Programming!

- Computers are our only universal machine, through the magic of software…
  - If you can program it, a computer can execute it
- Programming is a means to an end, much like mathematics is…but they are both also fascinating topics in their own right!
- Big push to learn how to “code”, but there is no “royal road” to programming or CS – it requires serious, sustained effort
Computer Science at Brown Works on Hard Questions (1/3)

• How can robots understand language to answer questions and hold conversations?

Stefanie Tellex

Computer Science at Brown Works on Hard Questions (2/3)

• How can we use encryption to promote privacy?
• How can we analyze the efficiency of algorithms we use in encryption?

Seny Kamara (CS16)

Computer Science at Brown Works on Hard Questions (3/3)

• How can AI understand the intricacies of human language the way humans do?

Ellie Pavlick
Other Areas of Research at Brown

- Security (Seny Kamara, Vasileios Kemerlis, Shriram Krishnamurthi, Anna Lysyanskaya, Steve Reiss, John Savage, Roberto Tamassia)
- Comp Bio (Sorin Istrail, Eli Upfal)
- Data Science (Ugur Cetintemel, Tim Kraska, Stan Zdonik)
- Algorithms and Theory (Pedro Felipe Felzenszwalb, Sorin Istrail, Philip Klein, John Savage, Roberto Tamassia, Eli Upfal)
- Visual Computing (Andy van Dam, Jeff Huang, David Laidlaw, Barbara Meier, Daniel Ritchie, James Tompkin)
- And more…
  - http://cs.brown.edu/research/areas.html

CS: So Much More Than Programming! (2/2)

Why Should You Study Computer Science?

- For fun and intellectual excitement
- Really exciting era is just beginning
  - CS still a young discipline, computers just starting to act intelligently
- Fundamental “mode of thought”
- Increasingly important component of all other fields
- Plenty of enthralling and impactful jobs in established companies, start-ups, research labs, and academia

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