CMPS 10: Following National NSF Initiative for CS Principles

Introduction to Computer Science

Prof. Marilyn Walker. Office E2 267. OH Tues 2 to 4
Introductions ...

- Instructor: Marilyn Walker, Prof. of CS
- Teaching Assistants:
  - Gabby Halberg
  - Zhichao Hu
- ... and you?
- We will tell you a lot more about us in a minute BUT first ....
This class: Computer Science Principles

- A new way of teaching CMPS 10 to align with a new AP course
- Supported by NSF and College Board
- Started three years ago ... number of different pilot courses. We started here at UCSC changing CMPS 10 last spring
- In a few years (2015) there will be a standard AP high school course and an AP exam
- We are trying to understand what people think is interesting about computer science (or not)
- SO......
To start: we want to know what you are like and what you think about computer scientists

- I have a survey here about you and what you think of computer science here at the beginning.
- We will do the same survey (or similar one) at the end
- We will do some surveys in the middle as well

- I will take class time to do it now
- Then we will talk about it
- Should take less than 15 minutes
- You don’t have to fill it out, but please do!
- We are really interested in what you think, and it could help us improve this class.
What did you say?

- What are the most interesting things happening in computing right now?
- Social Media?
- Chatbots?
- Mobile Computing?
- Your Ideas Here!!
The most interesting things in Computer Science are.....

- Easy speak, download text, text to speech
- Cloud computing, pushes everything, google knows everything about me, but you can get your stuff from anywhere
- Wolfram alpha. TED video. Question answering
- Facebook, google plus.
- Music programs, correct automatically
- Identify in virtual spaces,
The most interesting things in Computer Science are.....

- Cybercrime, state surveillance
- Nanobots, health applications
- Potential for quantum computing. Processing what kind of data. Encrypting and decrypting
- Simulate a human mind
- Computer game programming
- Hacking, sony playstation, computer security
More Introductions … We’ll tell you what we think is interesting

- Teaching Assistants:
  - Gabby Halberg
  - Zhichao Hu

- Instructor: Marilyn Walker

- What we are doing in computer science
- What we think is exciting
Natural Language Processing with Dialogue Adaptation

Gabrielle Halberg
ghalberg@soe.ucsc.edu

http://users.soe.ucsc.edu/~ghalberg/
NLDS lab - UC Santa Cruz

speakers mutually adapt linguistic style across dialogues - language generation models can use linguistic cues to do the same
Chao: Lifelogging with SenseCam

- Computer Science + Social Media
- Wear an “automatically-taking-photo” thing
- Reflections
  - Aid to memory
  - Beauty finder
  - Curious angle
  - Good way to show family and friend
Lifelogging with SenseCam
Julia Kelly: Multidisciplinary background

Multidisciplinary interests (a bit of background):

- Anthropology
- Computer Science
- Education

Intent upon arrival at UCSC:

- Researching gaming in order to apply games at a higher level of education
- Address how games are important to education and apply CS to it

Current Research:

- Machine Learning and Psychology of Social Media:
  - *World of Warcraft* data from Nicolas Ducheneaut studying how personality traits lead to gameplay types
  - Studying *WOW* data to find whether or not personality traits lead to character creation
- Research for Professor Marilyn Walker:
  - How to encourage more participation in CS

Julia Kelly
juchkell@ucsc.edu
Instructor: Marilyn Walker, Prof. of CS

- Academic Degrees:
- Industrial Research Labs: Hewlett Packard Labs, Mitsubishi Electric Research Labs, AT&T Bell Labs, AT&T Labs Research

- More about me at the end

- Research Interests: Language and Dialogue, dialogue in interactive stories and games, mobile location aware applications, social media, online debate

- Teaching this class because interested in this national initiative.
AIMS: Cover the **Seven Big Ideas** in computing

- As defined by the College Board for new AP test
  1. Computing is a creative human activity that enables innovation
  2. Abstraction is a way to understand and solve problems
  3. Data and information help to create knowledge
  4. Algorithms are tools for developing and expressing solutions to computational problems
  5. Programming is a creative process that produces computational artifacts
  6. Digital devices, systems, and the networks that interconnect them enable and foster computational approaches to solving problems
  7. Computing enables innovation in other fields, like sciences, engineering, humanities, etc.
    - We will have pre- and post-surveys
    - We want your feedback about what in computing you find exciting and interesting
Two Aspects to the 7 Big Ideas

- **Computational Principles** – “bits can represent all information” – that everyone should know
- **Computational Thinking** – thinking approaches you can use to solve (your) problems with computers
- Two homeworks a week. Need to keep up and keep on top of them
- Class should not be ‘too hard’, similar classes being taught at 8th grade and high school level
- At the end: understand much better what is going on inside your phone, computer, facebook, google
- Hope you might even consider a double major in CS
Technology is actively transforming the world, and the epicenter of the computer industry is Silicon Valley. Your CS degree from Baskin School of Engineering at UC Santa Cruz is your key to the future.

STARTING SALARIES FOR OUR GRADUATES

- Computer Science graduates: $60,000+ a year
- C.S. Computer Game Design major: $69K to $80K+ a year, plus stock options

Contact the engineering undergraduate advising office to find out more: advising@soe.ucsc.edu

HAS CURRICULA LINK FOR DOUBLE MAJORS WITH CS BA
BACKGROUND:

- Why teach a new version of CS Principles?
- Projected National SHORTAGE: 150K jobs in 2015
Why teach a new version of CS Principles?
Why teach a new version of CS Principles?
One part of the solution:

- Attract students not typically attracted to CS
Most Exciting Things in Computing Now

- What did you say?

- What I think: Part 1
  - **Social Media**, e.g. Facebook, LinkedIn,
  - **Artificial Intelligence (AI)**: Intelligent Agents
  - **Web & Crowdsourcing**, e.g. Wikipedia
  - **Collaborative Systems**: Collaborative filtering, recommender systems, e.g. Netflix, Ebay, Amazon’s recommendations
  - **Mobile Computing**: Pervasive, Personalized, Location and User aware
Computing as part of our lives

“Computing capacity is increasing at 58% annually, telecommunications at 28%, and storage at 23% per year. The former rate is approximately the rate of Moore’s Law, a doubling every 18 months. Communications are doubling every 34 months and storage every 40 months. Information has been expanding at this rate for the past decade.”
Increase of Computing Power
What does increased computer power really mean?

- Computing techniques same, but can do it now
- Miniaturization & Mobile
- Apple SIRI:
  - Speech recognition and Text to Speech as in
  - PERSONALIZED & CONTEXT: who and where the user is
Big Data is here

THE WORLD'S CAPACITY TO STORE INFORMATION

This chart shows the world's growth in storage capacity for both analog data (books, newspapers, videotapes, etc.) and digital (CDs, DVDs, computer hard drives, smartphone drives, etc.)

In gigabytes or estimated equivalent

1986
ANALOG
2.62 billion

1993

1993

2000

ANALOG STORAGE

DIGITAL

CDs and minidisks: 6.8%

Computer servers and mainframe hard disks: 8.9%

Digital tape: 11.8%

DVD/Blu-ray: 22.8%

DIGITAL

0.02 billion

COMPUTING POWER

In 1986, pocket calculators accounted for much of the world's data-processing power.

Percentage of available processing power by device:

Pocket calculators
Personal computers
Video game consoles
Servers, mainframes

PC hard disks: 44.5%

123 billion gigabytes
How big?

- The full scale of how much information we make is hard to appreciate. We humans collectively now have capacity to store approximately 300 exabytes of information. This is close the total amount of information stored in one person’s DNA. Or, as Hilbert puts it, it’s the equivalent of 80 Library of Alexandrias per person on the planet. And remember, the technium is doubling its capacity every year and a half, and your DNA is not. Broadcasting has grown at about the same speed as world’s GDP; but our information storage capacity has grown 4 times faster and telecommunication capacity has grown roughly 5 times faster than the world’s economic power.
Why might you be interested in CS? A job?


- Although the economy continues to face many challenges, the startup and tech industries are very much alive. The IPO window slightly opened up for companies like LinkedIn, Pandora, Groupon, Zynga, and Carbonite. We saw monster rounds of funding for companies like Facebook, Twitter, Dropbox. The appetite for seed and angel investing was extremely active. Tech incubators and accelerator programs kept popping up.

- 2011 was a very busy year for hiring at startup companies, and it doesn't look like that will slow down in 2012.
What areas are the most competitive areas for talent (hiring challenges) these days?


- **Software Engineers and Web Developers**: The demand for top-tier engineering talent sharply outweighs the supply in almost every market especially in San Francisco, New York, and Boston. This is a major, major pain point and problem that almost every company is facing, regardless of the technology "stack" their engineers are working on.

- **Creative Design and User Experience**: After engineers, the biggest challenge for companies is finding high-quality creative design and user-experience talent. Since almost every company is trying to create a highly compelling user experience that keeps people engaged with their product, it is tough to find people who have this type of experience (especially with mobile devices including tablets) and a demonstrated track record of success.

- **Product Management**: It is always helpful for an early-stage company to hire someone who has very relevant and specific experience in your industry. This is especially true for product management, since the person in this role will interface with customers and define the product strategy and use cases. However, be prepared, as it will be a challenge to find people with experience in these high-growth industries: consumer web, e-commerce, mobile, software as a service, and cloud computing.
More missing talent

- **Marketing**
  I'm not talking about old-school marketing communications. Companies are looking for expert online marketers who know how to create a buzz of inbound marketing or viral traffic through the web, social media, and content discovery. Writing a good press release just doesn't cut it anymore, as everyone is looking for the savvy online marketing professional who understands how the current state of the web operates and knows how to make it work to their benefit.

- **Analytics**
  Since data is becoming more and more accessible, smart companies are increasingly making decisions driven by metrics. Analytics is becoming a central hub across companies where everything (web, marketing, sales, operations) is being measured and each decision is supported by data. Thus, we are seeing a high level of demand for analytics and business intelligence professionals who almost act like internal consultants; they help determine what should be measured and then build out the capability for a company.

  - Big Data: Even Safeway wants to be able to predict what you might buy from your past spending patterns, and spending of others like you
The designer who programs?


The powerful fusion of great design, great engineering, and real authority in the hands of those people, results in magical user experiences.
This class
Introduction to this class ... me at the end

- http://www.bitsbook.com/excerpts/
- Getting started with Processing: Reas and Fry (buy it)
- Supplemented with reading/watching online sources, e.g. Wikipedia, You Tube
This class is modelled on UW Class

- Pilot class: taught by Larry Snyder, CSE 120
  - Only 30 people
  - Only people with no background in CS or programming at all
  - We will use and modify most of the homeworks and some of the lectures of Larry’s!!
- Follow-on to Pilot: taught by Kelvin Sung, UW Bothell
  - Also taught to 8th grade class
- Changes being made here at UCSC last spring and fall
Class Structure

- 2 lectures a week– I will talk, show you how stuff works, discuss various topics
- Lectures will be put online after the lecture
- Homework – exercises that help you learn the material ... plan to spend about one hour a day
  - M, W from 2 to 5 Chao
  - T, Th from 2 to 5 Gabby
  - Can go once or twice a week. Put it on your schedule!
- Quizzes – to make sure you are getting the core ideas
- One one week pair programming creative project
- One 2-week project, pair programming
- Midterm, Final
How to do well in this class

- Come to class & go to section every week at least once
- Make a sincere effort to understand the material
- Ask a lot of questions. If you don’t understand you are probably not the only one.
- Go online to work on this class each day …
  - Submit work that you alone created, except for the pair programming assignments
  - Do your pair programming as a pair. Always work together.
  - Make constructive comments about improving this class
A Brief Word About Programming

- Some people panic at the mention of the word *programming* ... as if saying it would cause them to become social outcasts, nerdy, ...
A Brief Word About Programming

- Some people panic at the mention of the word *programming* ... as if saying it would cause them to become social outcasts, nerdy, ...
- Programming is actually fun, and creative!
  - You get immediate feedback if what you are doing is working
  - Programming is solving a puzzle, have to stick to it
- Programming’s a career; it takes years to learn
- We teach some programming in this class as part of teaching computational thinking
  - You won’t be a programmer at the end
  - You will, I hope, think differently as a result
Announcements

- Please note that we are no longer receiving Accommodation Authorization forms from the DRC.
- **DRC students must bring form to me, to turn in to the Faculty Services desk.**
- To DO: Familiarize yourself with the class Web page on Ecommons, and at
- Also see classes.soe.ucsc.edu/cmps010/winter12
- **Know**
  - The location of announcements, assignments, etc.
  - Look at the syllabus for the whole quarter, midterm etc
  - The Academic Conduct guideline
FIRST HOMEWORK: DUE THURSDAY!!! GO TO SECTION!
Assignment 1: Lightbot 2.0

- Lightbot shows up on many gaming sites but whether or not it’s a “game” is a topic for Thursday
  - You direct a robot around a “blocks world”
  - It’s pretty easy, and should be fun. I will explain Thursday what the homework is intended to show.
Assignment 1: Lightbot 2.0

- **Goal:** The point of this exercise is to start class enjoyably, and to set the context for the second lecture. Have fun!


- After the opening visuals, click “Play.”

- **Assignment, Parts A, B, Challenge C**
  - PLUS SURVEY and writeup
Introductions …

- Instructor: Marilyn Walker, Prof. of CS
- Research Interests: Language and Dialogue, dialogue in interactive stories and games, mobile location aware applications, social media, online debate
- What I think is exciting about computer science
Currently Funded Projects

- **SpyFeet** *(NSF Robust Intelligence)*
- **Character Creator** *(NSF Creative IT)*
- **Persuasion in Online Chat** *(Navy, IARPA)*
- **Skipper** *(NSF Robust Intelligence/HCC)*
- **Gestural Entrainment in Virtual Agents** *(NSF HCC)*
Intelligent Dialogue Agents need to be more expressive and characterful

- Authoring bottleneck for interactive narrative (gaming)

- Achieving system goals relies on engaging user affect
  - Serious Games involving persuasion, motivation. Learning
  - People react socially to computational agents, thus social norms such as liking people like yourself often hold (Nass & Lee, 2001)
  - People make attributions beyond social level: task competence
  - Personality matching in a robotic exercise coach increased the time that stroke victims spent on their recommended exercises (Tapus & Mataric 2008)
  - Learning gain increased when tutoring style oriented to the student’s ‘face needs’ (Porayska-Pomsta & Mellish 2004; Wang et al., 2004)
Intelligent Dialogue Agents need to be more expressive and characterful

- Siri is surely completely handcrafted

- Every change in how it talks has to be made by hand

- No general purpose technology that could be used in a new system

- Not easy to make many new systems or new competencies for existing system
Procedural Language Generation: A Key Technology

- Lets us programmatically control how an intelligent agent talks
- Let’s us adapt to users
- Let’s us learn from user feedback and from examples how to get better at being expressive

- We use basic experimental Methods from psychology to test Social Perceptions
- We start out with a psychological theory!
PERSONAGE Generator: BIG FIVE Theory

- Conscientiousness: Dutiful vs. impulsive
- Emotional stability: Calm vs. anxious
- Openness to experience: Imaginative vs. conventional
- Agreeableness: Kind vs. unfriendly
- Extraversion: Sociable, assertive vs. quiet
Linguistic Reflexes of Personality: 50 years of studies

- **Extraversion** (Furnham, 1990)
  - Talk more, faster, louder and more repetitively
  - Fewer pauses and hesitations
  - Lower type/token ratio
  - Less formal, more references to context (Heylighen & Dewaele, 2002)
  - More positive emotion words (Pennebaker & King, 1999)
    - E.g. happy, pretty, good

- **Neuroticism** (Pennebaker & King, 1999)
  - 1st person singular pronouns
  - Negative emotion words

- **Conscientiousness** (Pennebaker & King, 1999)
  - Fewer negations and negative emotion words

- Low but significant correlations
PERSONAGE Architecture: 67 Parameters

**INPUT:** Dialog Act, Content Pool

- **Content Planner**
  - Verbosity
  - Restatements
  - Content polarity
  - Syntactic complexity
  - Self-reference

- **Syntactic Template Selection**
  - Contrast: e.g. however, but
  - Justify: e.g. so, since
  - Period

- **Aggregation**
  - Exclamation
  - Hedges: e.g. kind of, rather, basically, you know
  - Filled pauses: e.g. err...

- **Pragmatic Marker Insertion**
  - Swear words: e.g. damn
  - In group markers: e.g. pal
  - Stuttering: e.g. Ri-Ri-River

- **Lexical Choice**
  - Frequency of use
  - Word length
  - Verb strength

**OUTPUT**
**Utterance**

**Realization**
# Recommendation: A Persuasive Task

<table>
<thead>
<tr>
<th>Alt</th>
<th>Realization</th>
<th>Extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Err... it seems to me that Le Marais isn’t as bad as the others.</td>
<td>1.83</td>
</tr>
<tr>
<td>4</td>
<td>Right, I mean, Le Marais is the only restaurant that is any good.</td>
<td>2.83</td>
</tr>
<tr>
<td>8</td>
<td>Ok, I mean, Le Marais is a quite french, kosher and steak house place, you know and the atmosphere isn’t nasty, it has nice atmosphere. It has friendly service. It seems to me that the service is nice. It isn’t as bad as the others, is it?</td>
<td>5.17</td>
</tr>
<tr>
<td>9</td>
<td>Well, it seems to me that I am sure you would like Le Marais. It has good food, the food is sort of rather tasty, the ambience is nice, the atmosphere isn’t sort of nasty, it features rather friendly servers and its price is around 44 dollars.</td>
<td>5.83</td>
</tr>
<tr>
<td>3</td>
<td>I am sure you would like Le Marais, you know. The atmosphere is acceptable, the servers are nice and it’s a french, kosher and steak house place. Actually, the food is good, even if its price is 44 dollars.</td>
<td>6.00</td>
</tr>
<tr>
<td>10</td>
<td>It seems to me that Le Marais isn’t as bad as the others. It’s a french, kosher and steak house place. It has friendly servers, you know but it’s somewhat expensive, you know!</td>
<td>6.17</td>
</tr>
<tr>
<td>2</td>
<td>Basically, actually, I am sure you would like Le Marais. It features friendly service and acceptable atmosphere and it’s a french, kosher and steak house place and if its price is 44 dollars, it just has really good food, nice food.</td>
<td>6.17</td>
</tr>
</tbody>
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Rule-Based Extraversion Generation

- Use correlations in literature to set parameters
- Significant perceptual differences \( p < .01 \)
- As binary classification, 90% accuracy
Facial Dominance Behaviors & Linguistic Personality

Hypoth: Persuasiveness could be increased by expressing dominance with personality (Marwell, 1967, Mehrabian, 1995)

Disagreeable, Hi Dominance  Extravert, Low Dominance

Bossy or Wimpy: Expressing Social Dominance by Combining Gaze and Linguistic Behaviors (Bee, Pollack, Andre’ & Walker, Intelligent Virtual Agents 2010)
Evaluating the Effect of Gesture and Language on Personality Perception in Conversational Agents

Intelligent Virtual Agents, 2010
Michael Neff, Yingying Wang (UCD), Rob Abbott, Marilyn Walker (UCSC)
Example Gestures Clips Used in the Experiment

This is a labelled version of the prologue shown to subjects.
Aren’t there aspects of characters or agents that aren’t captured by personality parameters?

What about all those things that authors and screenwriters know?
Character In Film: One utterance tells it all
Character Creator

- Create parameter models by data mining utterance sets from lead characters in film dialogues.
- Perceptual Experiments last summer show that humans can tell which character we modelled, even though what the character is saying is for SpyFeet (not film).
Spy Feet: Using mobile gaming to promote physical activity

- Project with Kurniawan & Wardrip-Fruin
- Hypotheses: Dynamic elements will increase self-efficacy for exercise, replayability, and immersion
- Personage 2.0: Extensions to support dynamic adaptive dialogue generation for characters in role playing games

- What types of motivational elements influence behavior change?
- What is the role of social interaction vs. narrative
Game Mechanics for Movement

- Find Sparrow (or Tortoise, Wolf)
- Quests:
  - Walk distance D in time T with manner M
  - Do movement X, N times
- Prove to Wolf you can move like a hunter for 5 minutes
- Collect 10 cabbages for Tortoise
- Walk along with Tortoise, slow and steady, to keep her talking
- Track a suspect (keep distance D from a moving dot indicating the suspect on your screen)
Okay that’s me!

- Do your homework
- Come to class on Thursday prepared to talk about your experiences with Lightbot!