Robotic Caregivers: From Dreams to Reality

Spring 2020
Lecture 1

Prof. Charlie Kemp

Conflict of Interest Statement

I own equity in and work for Hello Robot Inc., a company commercializing robotic assistance technologies.

The Dream

- Intelligent robots that care for us
- Help us overcome our limitations
- Help us flourish as human beings
- Are affordable and accessible

A Grand Challenge

- Multidisciplinary
  - Computational
  - Biomedical
  - Mechanical
  - Human factors
  - Sensing
  - Electronics
  - Business
  - ...

Topics I plan for us to cover

- Examples of robotic caregiving
- Common forms of assistance in healthcare
- Perspectives on caregiving provided by guest lectures.
  - Speakers may include caregivers, people with disabilities, clinicians, and researchers.
- Action
  - Planning, optimization, and control for robot actions.
- Perception
  - Robotic perception of the human body and human environments via vision, haptics, audition, and robot-specific modalities such as laser range finders and capacitive sensors.
- Human-Robot Interaction
  - Interfaces, human biomechanics, and physical cooperation
- Learning
  - Supervised and unsupervised machine learning from simulations and the real world.

My Background

- For this class, please call me Prof. Kemp or Dr. Kemp
- Trained in computer science, AI, and robotics at MIT with Rod Brooks
- Founded the multidisciplinary Healthcare Robotics Lab in 2007
  - ~14 years working on robotic caregivers
- Primarily taught biomedical engineering courses (e.g., biomechanics and PBL)
  - Hesburgh Award Teaching Fellow & Class of 1940 Course Survey Teaching Effectiveness Award
- Biomedical engineering faculty, adjunct faculty in interactive computing and electrical and computer engineering
- Co-founded startup in 2017

http://charliekemp.com

Share your stories

- Name
- Current status (e.g., undergraduate, master’s, PhD)
- Relevant background
- Why are you interested in this class?

You are the future

- Many dreams will become a reality in the next 10 years
- Surprisingly little education, research, and commercialization to date
- My goal is to enable you to help make caregiving robots a reality

You are the future

- Many dreams will become a reality in the next 10 years
- Surprisingly little education, research, and commercialization to date
- **My goal is to enable you to help make caregiving robots a reality**

I want your help

- This is a brand new course
- New for Georgia Tech
- New for the world?
- Help me make it something special that really matters

When I’m in class

- I’ll be fully committed to you
- Take advantage of it

Grades

Grading Philosophy

- I want everyone to make an A

Grading Philosophy

- I want everyone to make an A
- You have to earn it

Your Grade

- 34% : Class Participation
- 33% : Midterm Project
- 33% : Final Project

Conversion to Letter Grades

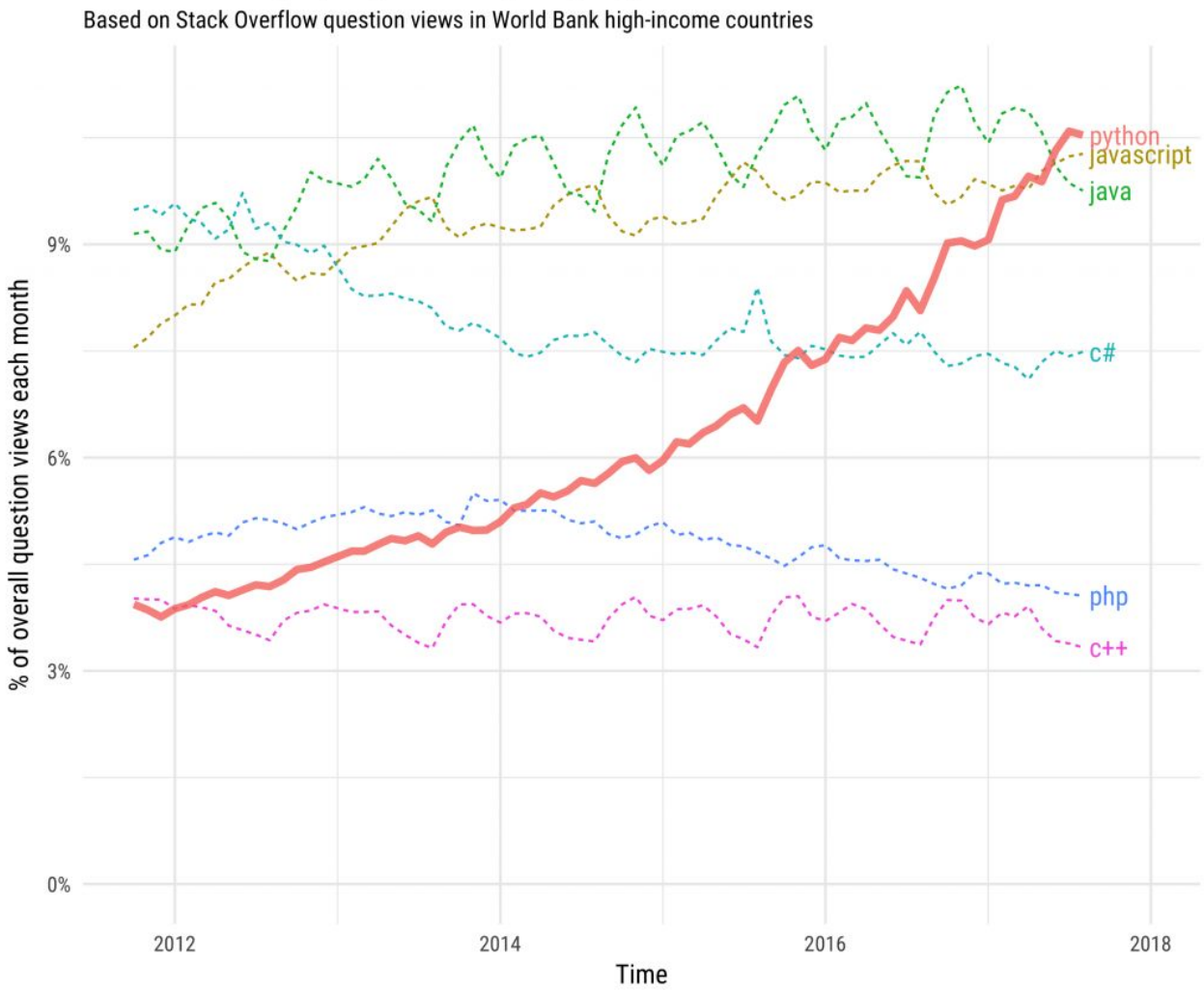
min		***max***	***letter grade***	***meaning***
85.0 <=	numeric_grade		A	“Excellent”
70.0 <=	numeric_grade	< 85.0	B	“Good”
60.0 <=	numeric_grade	< 70.0	C	“Satisfactory”
50.0 <=	numeric_grade	< 60.0	D	“Passing”
	numeric_grade	< 50.0	F	“Failure”

The words in quotes are the standard Georgia Tech interpretations of letter grades from the Registrar's website:
http://registrar.gatech.edu/info/grading-system

Your first assignment:

Make sure you know Python

https://stackoverflow.blog/2017/09/06/incredible-growth-python/



Examples of Learning Resources for Python

https://www.learnpython.org/

https://developers.google.com/edu/python/

https://www.codecademy.com/learn/learn-python-3

https://docs.python.org/3/tutorial/index.html

https://www.tutorialspoint.com/python3/

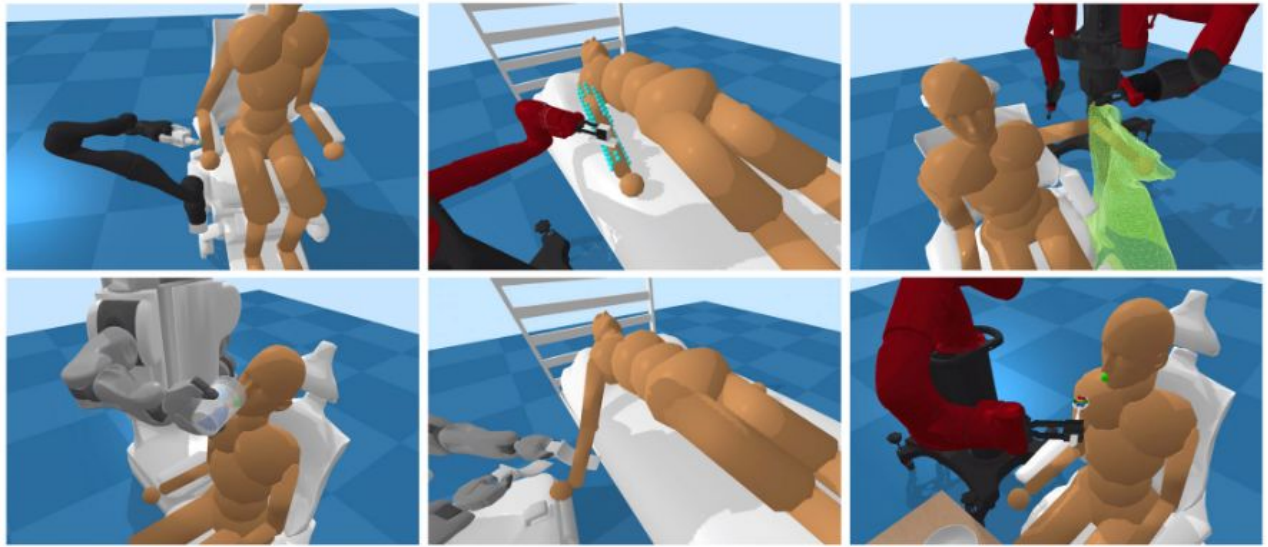
https://www.youtube.com/watch?v=YYXdXT2l-Gg&feature=youtu.be

Your first project

Midterm Project

Beat a baseline controller in Assistive Gym.

https://github.com/Healthcare-Robotics/assistive-gym



Midterm Project Milestones

- **Assistive Gym presentation by Zackory Erickson (Jan 13 & 15)**
- Install and go through tutorials
- Pick a task and a robot
- Teleoperate the robot to perform the task
- Identify weaknesses in the baseline controller
- Propose improvements
- **Midterm project status presentation (Jan 29)**
- Implement improvements
- Evaluate improvements
- Revise improvements
- Iterate
- **Midterm project presentation (Feb 24 & 26)**

Final Project

Details to be determined

- More open ended
- Based on what you've learned
- Use of real hardware encouraged
- **Final project status presentations (March 23)**
- **Final project presentations (April 13 & 15)**

Initial Class Structure

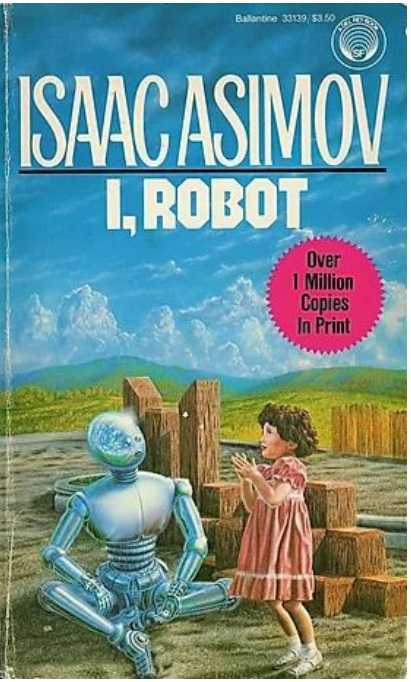
- First half will be a lecture
- Second half will be working in class on projects and possibly exercises

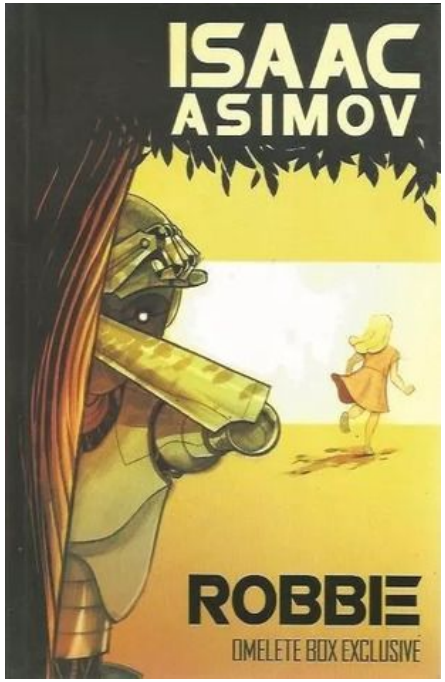
Remainder of Today

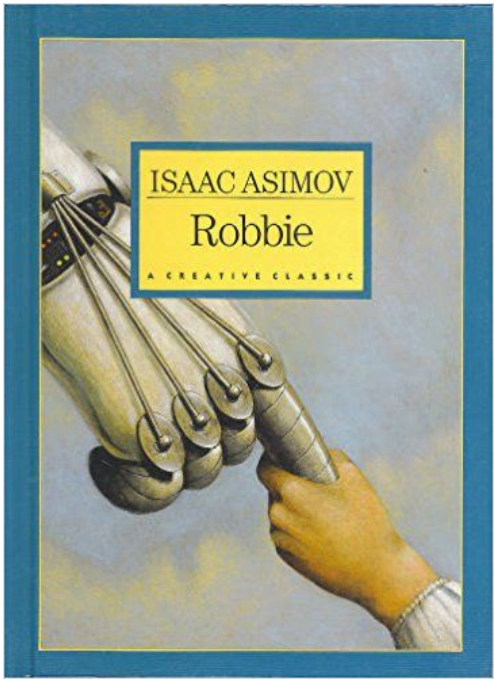
- A few examples of caregiving robots from science fiction
- A few quick videos from my lab

Examples from Science Fiction

1939 - “Robbie” short story by Isaac Asimov







1980 - Star Wars: The Empire Strikes Back

2009 - Moon

2012 - Robot & Frank

2014 - Big Hero 6 (Baymax)