

# CS 309: Autonomous Robots

## FRI I

Instructor: Justin Hart

[http://justinhart.net/teaching/2020\\_spring\\_cs309/](http://justinhart.net/teaching/2020_spring_cs309/)

# Class Introduction

- Basic Information, Preliminaries
- FRI – Autonomous Robots Overview

# Basic Information

Instructor	Justin W. Hart	
Class Times	Tuesday & Thursday	3:30-5:00pm
Classroom	RLM 5.118	
Website	<a href="http://justinhart.net/teaching/2020_spring_cs309/">http://justinhart.net/teaching/2020_spring_cs309/</a>	
Course Syllabus	On website	

# Contact Information

Instructor			
Justin W. Hart	hart@cs.utexas.edu	Monday	4:00pm-5:00pm
		Thursday	5:15pm-6:15pm

Peer Mentors			
Parth Chonkar	parthchonkar@gmail.com	TBD	TBD
Blake Holman	blake.holman@utexas.edu	TBD	TBD
Jeffrey Huang	jeffreyhuang23@gmail.com	TBD	TBD
Joseph Moyalan	joseph.moyalan.057@utexas.edu	TBD	TBD
Mayuri Raja	mraja7@utexas.edu	TBD	TBD
Anwasha Roy	t.anwasha@gmail.com	TBD	TBD
Connor Sheehan	c-she@utexas.edu	TBD	TBD
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Stone Tejeda	stonetejeda@utexas.edu	TBD	TBD

# FRI: Autonomous Robots

- CS 309 – FRI I
  - Basic exposure to research, preparation and classroom instruction on ROS, final robotics project
- CS 378 – FRI II
  - Project-based course participating in the BWI Lab doing research
- Peer-mentoring, Research Assistantships, RoboCup@Home
  - Performing research after course completion

# FRI: Autonomous Robots

- CS 309 – FRI I
  - Structure
    - No experience is assumed
    - Primarily classroom-based
    - Includes a month-long group final project
  - Objectives
    - Discuss themes in robotics research
    - Learn to read scientific papers
    - Learn tools
      - C++
      - Robot Operating System (ROS)
    - Work with robots

# FRI: Autonomous Robots

- CS 309 – FRI II
  - Structure
    - Work in laboratory
    - Weekly lab meetings (during class) & group meetings
    - Progress check-ins
    - Semester-long research project
  - Milestones
    - Project proposal
    - FRI Autonomous Intelligent Robotics Student Workshop
      - Paper, Talk, Peer-Reviewing, PC Meeting
    - FRI Autonomous Intelligent Robotics Student Conference
      - Paper, Talk

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Panel

# Quick Thoughts

- What is the purpose of research?
  - Learn new things for your **organization** or for **humanity**
  - In a class, you learn things that are already known
    - That's what we're doing right now
- What makes a good scientific paper, project, or presentation?
  - Nobody wants to hear about how smart the presenter is
  - It should answer:
    - What is the question?
    - How was the hypothesis developed and why?
    - How was the hypothesis tested?
    - What was learned?

# Quick Thoughts

- What makes a good scientist?
  - Being the smartest person in the room really isn't the thing
    - You really only need to be smart enough to do your work
  - Mostly, it is willingness to do the work
    - Learning what else has been done
    - Developing good hypotheses
    - Not avoiding the difficult task
    - Making your results clear to others
  - Understanding the limit of the current knowledge, then pushing past that limit

# Quick Thoughts

- Work on the important part of the problem
  - At some point, I'm going to ask you how progress is going
    - "Well, we did a lot of work this week.."
    - That's not an **answer**. How close are you getting to completing the real work?
  - Ask your self, what's the thing that actually needs to get done
    - Put the bulk of your effort on that. The other stuff is in service to that.
- Don't hide when you don't know something
  - Admit you don't know it and learn it
  - Learn to figure out what you don't know quickly, and then learn what you need to know
- If you can learn it yourself, learn it yourself
  - Of course the mentors and I know how to do your homework better than you do. The point is that you learn how to do it.
  - Get help when you need it.

# Quick Thoughts

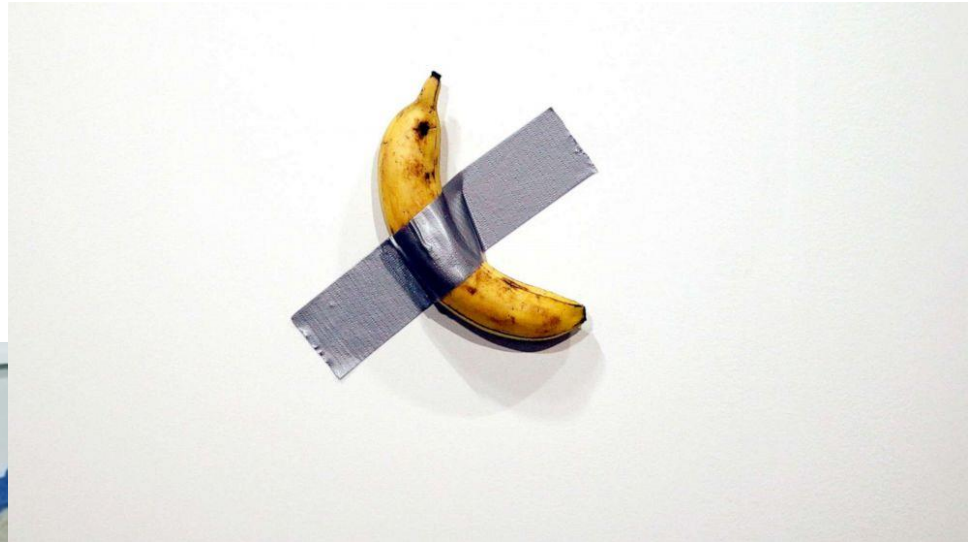
- The university is not a sieve
  - You have spent your entire education being evaluated, but the point was to teach you stuff, not to evaluate your existing aptitudes.
    - If it was, we would skip the lecture, give you a test, and just keep the people who passed.
- Hard work will get you ahead.
  - 10,000 hour rule – Malcolm Gladwell
- Professors want you to be smart, but they want you to be motivated & hard-working more.
- Great researchers are respected for what they taught others, not simply for being smart.

# What does good research look like?

- The way things are portrayed, can lose the underlying meaning



Artist David Datuna ate it



This isn't actually a \$120,000 banana  
(Artist: Maurizio Catalan)

# This can happen in research too

- **Bad**

- “This is the most expensive super-cool robot ever.”
- “Let me baffle you with mathematics..”
- The point is the science, not the price or that the person is super-smart.

- **Good**

- “People are more likely to do what an embodied robot asks them to do rather than a virtual agent.”
- “Eye motion follows Listing’s Law.”
- “This is a method for autonomous..”



# What research do we do here?

- **Learning Agents Research Group**
  - Reinforcement learning
  - Multi-agent reasoning
  - Robotics
- **Building-Wide Intelligence**
  - Autonomous service robots
- **RoboCup@Home**
  - Competition of domestic service robots

# Building-Wide Intelligence

- **BWIBots**

- Segway base
- LiDAR
- Depth Cameras

- **Tasks**

- Autonomous semantic mapping
- Scavenger Hunt
- Provide directions



# Building-Wide Intelligence

- **Current Directions**
  - Humans & robots passing each other
  - Gaze & communication
  - Long-term autonomy
  - Getting robots out into the real-world
  - Self-modeling



# Building-Wide Intelligence



# RoboCup@Home

- Domestic Standard Platform League
  - Toyota Human Support Robot
- Housekeeper
  - Take out the garbage
  - Store groceries
- Party Host
  - Serve drinks
  - Restaurant



# RoboCup@Home



[https://www.youtube.com/watch?v=VWup\\_VTSJqI](https://www.youtube.com/watch?v=VWup_VTSJqI)

# What makes this interesting?

- Robots can't do these things yet
  - Robots in general.
  - If they could, someone would sell them.
- The goal here is not to build an awesome robot.
  - That target motivates our research questions.
  - What must be accomplished for this robot to exist?
- RoboCup@Home accelerates development
  - Get domestic service robots into the real world
  - I'm the one who has been pushing this.

Questions?



# Class Mechanics

# Grading

Attendance & Participation	10%
Reading Responses	10%
Homework	55%
Final Project	25%

Plus and minus grades will be used in final grading of the course.

# Attendance and Participation

Students are expected to attend every class session and to actively participate. This includes in-class discussions and effective use of laboratory time to pursue semester projects.

If you miss a session:

- Email Prof. Hart in advance if possible
- Independently find out what you missed
  - It's all posted on <http://justinhart.net>

# Homework Policy

- Penalties for late work begin at 12:00am the following day
  - (1 minute late)
- Late homework or projects are subject to a 15 point per day penalty
  - (Out of 100)
- Work that is 4 days late will receive a zero
- Late reading responses will receive a zero
  
- You may discuss the homework
- You may not share answers
  
- Soft-Gilligan's Island Rule
  - If a classmate shows you their source code, you must not take notes based on the source code, and you must go watch an episode of Gilligan's Island prior to working on your implementation.
  - Peer-mentors are exempt from this policy, but shouldn't give you the answers.

# Final Projects

- A good grade requires
  - A working, complete final project
  - A scientific paper
  - A group scientific presentation.
- Every component must be good.
- The project is evaluated as an overall thing.
  - Not as several things that add to 100%

Presentations	Friday, May 15 9:00am-12:00pm
Papers	Friday, May 15 11:59pm

# Academic Integrity

Cheating, plagiarism, and other academic misconduct will be handled according to UT's guidelines.

<http://www.cs.utexas.edu/users/ear/CodeOfConduct.html#honesty>

# Students with Disabilities

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities.

To determine if you qualify, please contact the Dean of Students at 471-6529; 471-4641 TTY.

I will work in conjunction with you and them to make appropriate arrangements.

# Missed Work Due to Religious Holy Days

As per UT policy.

- Notify the instructor (me) in advance
  - 14+ days prior
  - Or on the first day of the semester
- No penalty for the absence, but you must complete any work within a reasonable amount of time

See the exact language on the course website.



If there's time, we'll now jump into  
a primer on  
artificial intelligence