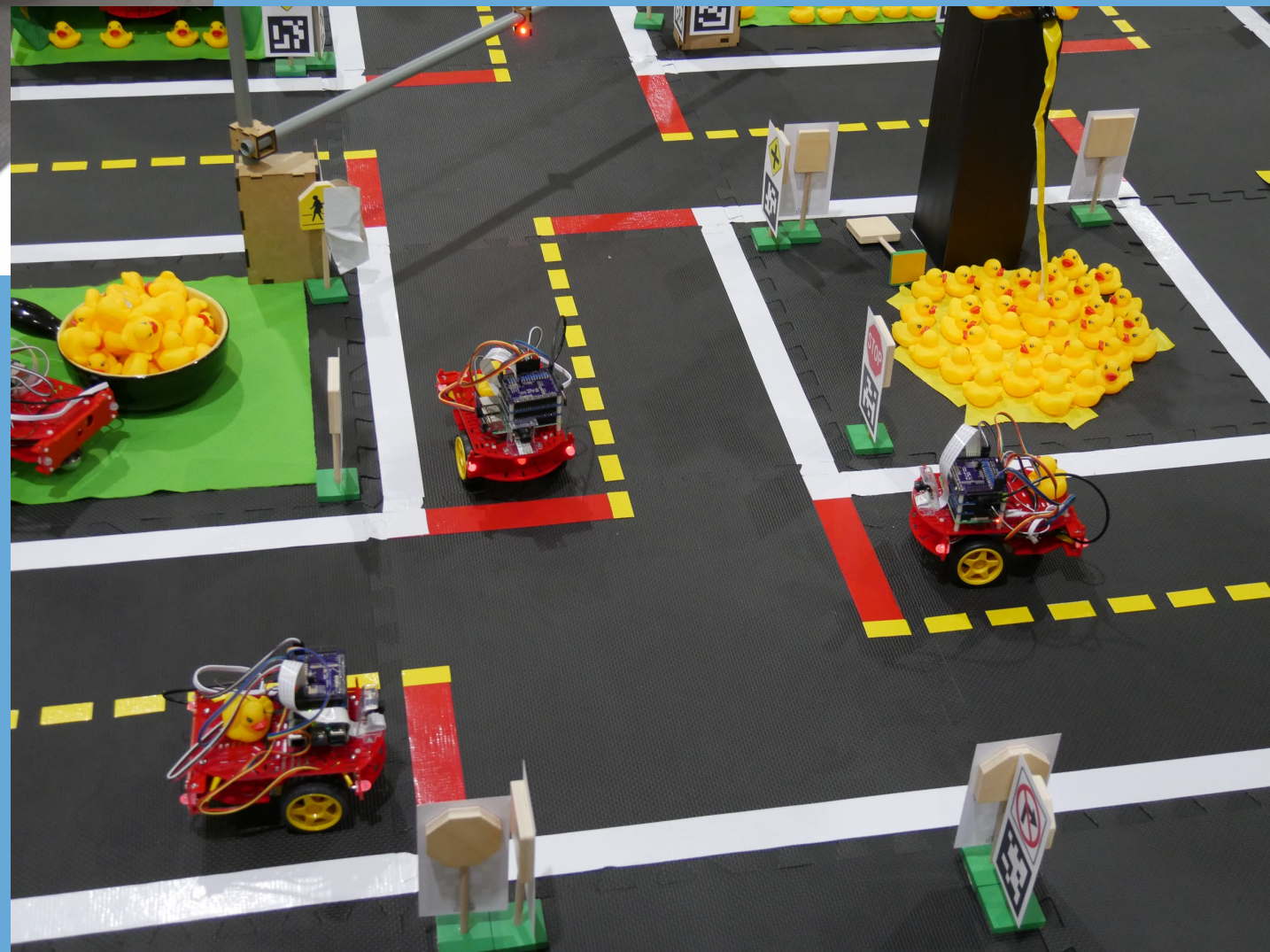
Welcome to CS 3630!



Spring 2021:

- ***Flipped class!***
- ***New projects!***
- ***A new course outline!***

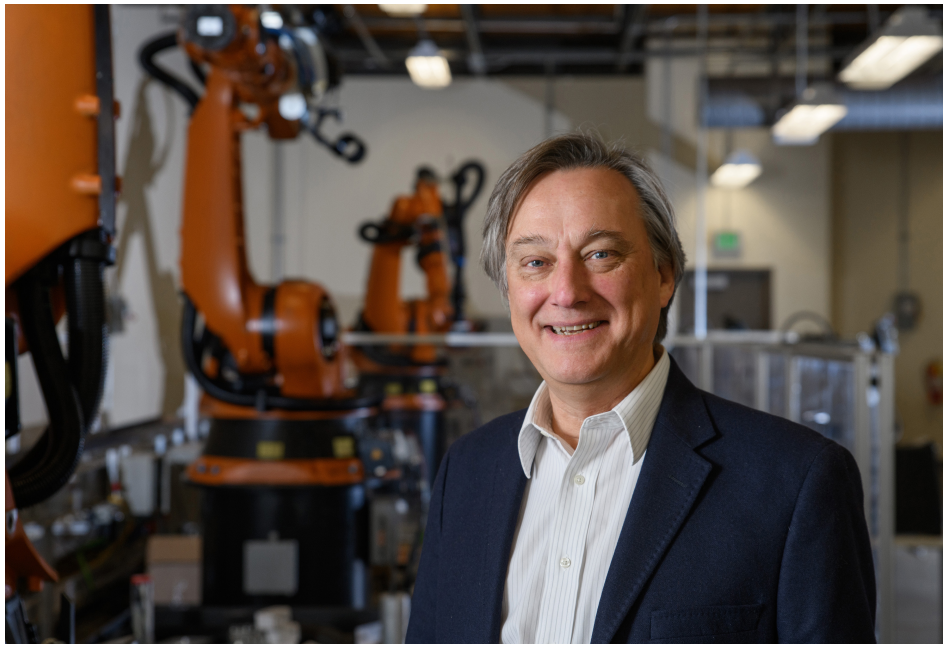
Course Instructors

Frank Dellaert, Professor

School of Interactive Computing

Seth Hutchinson, Professor

School of Interactive Computing



TAs: Binit Shah, Yetong Zhang, Rachit Bhargava, Dashiel Heidt, Pratyusha Karnati, Maya Rajan, John Yi

Robots are useful!

- Manufacturing
- Logistics (inventory, warehouse logistics, packaging)
- Transportation (self-driving cars)
- Consumer and professional services (cleaning, mowing)
- Health, independence and quality of life (exoskeletons, semi-autonomous wheelchairs)
- Agriculture

Robot Taxonomy

- **Industrial Robots**
- Service Robots
- Field Robots
- Humanoid Robots
- Medical Robots
- Self-Driving Cars
- Aerial Vehicles

http://www.kuka.com

Robot Taxonomy

- Industrial Robots
- **Service Robots**
- Field Robots
- Humanoid Robots
- Medical Robots
- Self-Driving Cars
- Aerial Vehicles

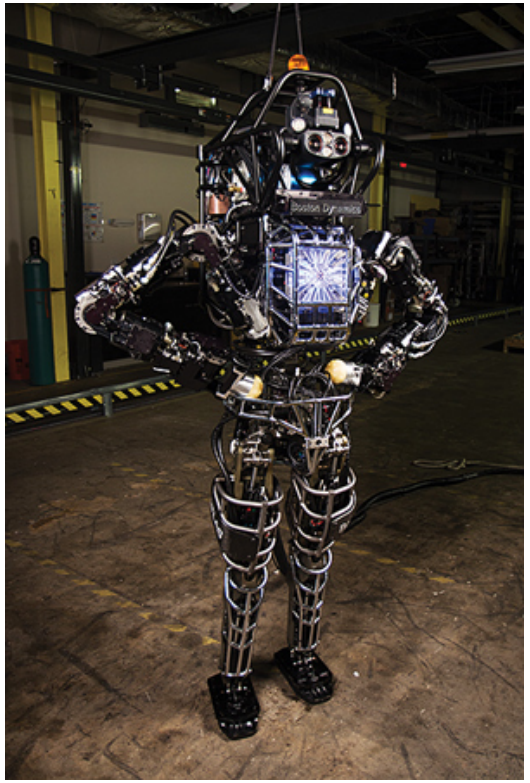
Robot Taxonomy

- Industrial Robots
- Service Robots
- **Field Robots**
- Humanoid Robots
- Medical Robots
- Self-Driving Cars
- Aerial Vehicles

http://www.frc.ri.cmu.edu/robots/

Robot Taxonomy

- Industrial Robots
- Service Robots
- Field Robots
- **Humanoid Robots**
- Medical Robots
- Self-Driving Cars
- Aerial Vehicles



Robot Taxonomy

- Industrial Robots
- Service Robots
- Field Robots
- Humanoid Robots
- **Medical Robots**
- Self-Driving Cars
- Aerial Vehicles

Robot Taxonomy

- Industrial Robots
- Service Robots
- Field Robots
- Humanoid Robots
- Medical Robots
- **Self-Driving Cars**
- Aerial Vehicles

Robot Taxonomy

- Industrial Robots
- Service Robots
- Field Robots
- Humanoid Robots
- Medical Robots
- Self-Driving Cars
- **Aerial Vehicles**

Schedule

5 Modules

- Agents
- Blind Duckiebot
- Car + LIDAR
- Seeing Duckiebot
- Drone

- Articulated Robots guest lecture

Agents

Mon, Jan 25	Agents	Dijkstra etc	Braitenberg	
Wed, Jan 27		Probabilistic Actions		
Mon, Feb 1		Markov Decision Processes		
Wed, Feb 3		Probability and Bayes Nets	2 out - 1 due	
Mon, Feb 8		Inference in HMMs	Agents	
Wed, Feb 10		Inference in Graphical Models		Quiz 1

Blind Duckiebot

Mon, Feb 15	Blind Duckiebot	Kinematics in the Plane		
Wed, Feb 22		RRT and Probabilistic Roadmaps	3 out - 2 due	
Mon, Feb 24		Growing Obstacles + Voronoi	Motion Planning	
Wed, Mar 1		Continuous densities and bananas		
Mon, Mar 3		Monte Carlo Localization		Quiz 2

Car + LIDAR

Wed, Mar 8	Car + LIDAR	Autonomous Vehicles	4 out - 3 due	
Mon, Mar 10		Motion Planning for Driving	Monte Carlo Localization	
Wed, Mar 15		Iterated Closest Points		
Mon, Mar 22		SLAM with LIDAR		Quiz 3
Wed, Mar 24		Minibreak	5 out - 4 due	

Seeing Duckiebot

Mon, Mar 29	Seeing Duckiebot	Computer Vision Fundamentals	SLAM with LIDAR	
Wed, Mar 31		Pinhole Cameras		
Mon, Apr 5		Visual SLAM		
Wed, Apr 7		Deep Learning for Vision	6 out - 5 due	Quiz 4

Drone

Mon, Apr 12	Drone	SE(3)	Object Detection	
Wed, Apr 14		Continuous Path Planning		
Mon, Apr 19		Stereo Vision -> 3D world		
Wed, Apr 21		3D Mapping	6 due (Fri mn)	Quiz 5

Syllabus

Learning Objectives

- Describe and explain what robots are and what they can do
- Describe mathematically the position and orientation of objects and how they move
- Develop a control architecture for a mobile robotic system
- Implement navigation and localization algorithms based on sensor fusion and environment representation
- Write moderately involved programs in Python and Java to control a robotic system
- Construct, program, and test the operation of a robotic system to perform a specified task

Prerequisites

- The only formal prerequisite is CS1332 Data Structures & Algorithms.
- Prior knowledge of fundamentals of linear algebra and probability is helpful, but not required.
- Background in AI and Machine Learning is not assumed.
- The course requires access to a computer.
- All programming assignments will be completed in Python.

Lecture Delivery and Grading Components

- **Lectures** will be pre-recorded and available 2 workdays before class time. Students are expected to watch the lecture *before* each class time.
- **Questionnaires**: to reinforce the lecture and prepare for class time, the students will be required to answer a short questionnaire by Sunday evening about the two lectures assigned for viewing. This will count for **5%** of your grade.
- **Quizzes**: there will be 5 modules, as indicated on the schedule. At the end of each module, there will be an online quiz worth 6% of your grade each, for a total of **30%**. Quizzes will have a combination of multiple choice and essay questions, as appropriate.
- **Q&A**: students are expected to attend each class period, Monday and Wednesday at 3.30. Class will start with a 30 minute quick review and Q&A, followed by project-related activities (see below).
- **Activities**: there will be six projects, each having an in-class activity component which forms an integral part of your participation grade, for a total of **5%**. For these activities, you will be placed in groups that will remain stable for two projects, then shuffled.
- **Projects**: each project will additionally have a powerpoint template that will have to be submitted on Gradescope as a pdf and, possibly accompanied with code and/or videos. Project are released and are due on Fridays, and project deliverables will make up **60%** of your grade.

Academic Integrity

- Academic dishonesty will not be tolerated. This includes cheating, lying about course matters, plagiarism, or helping others commit a violation of the Honor Code. Plagiarism includes reproducing the words of others without both the use of quotation marks and citation. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code and Student Code of Conduct, available online at www.honor.gatech.edu.
- You are expected to implement the core components of each project on your own, but the extra credit opportunities often build on third party data sets or code. That's fine. Feel free to include results built on other software, as long as you are clear in your hand-in that it is not your own work.
- You should not view or edit anyone else's code. You should not post code to Piazza, except for starter code / helper code that isn't related to the core project.

Grading

The grading distribution is:

Component	Nr.	Grade	Total
Questionnaires	12	5%/12	5%
Quizzes	5	6%	30%
Activities	23	5%/23	5%
Projects	6	10%	60%
			100%

Questions?