

Welcome to CS 3630!

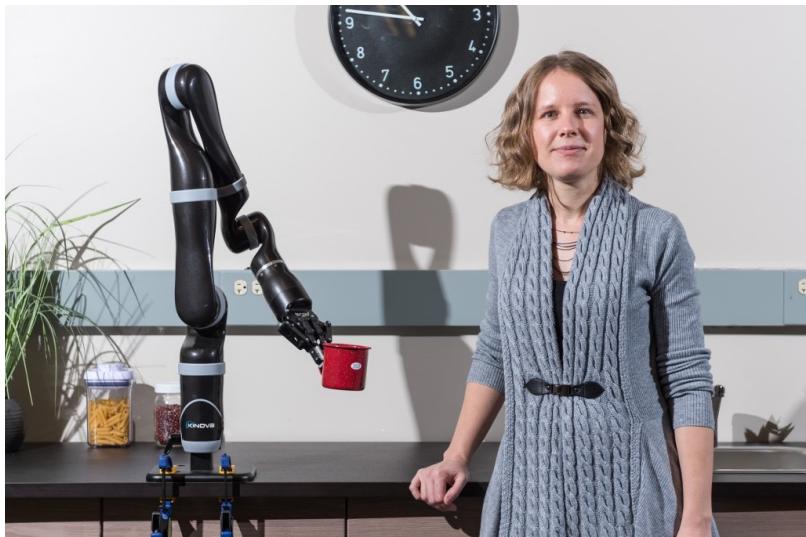
Introduction to Robotics and Perception



Course Instructor(s)

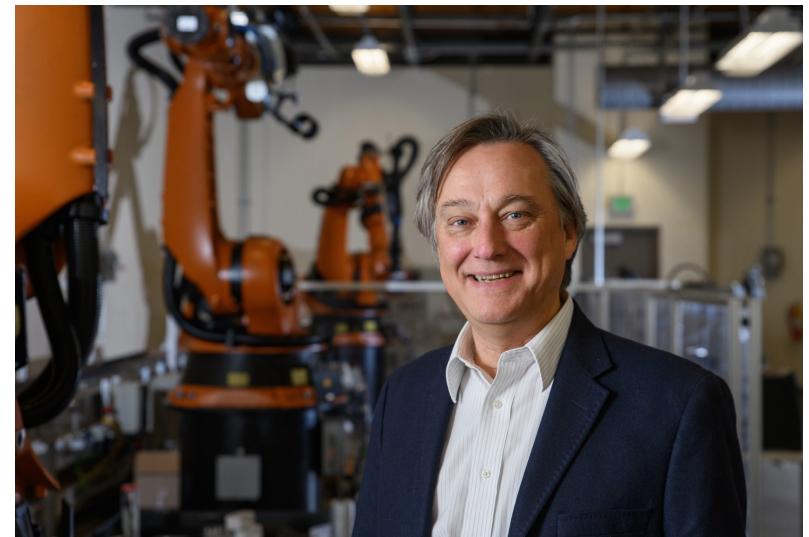
Prof. Sonia Chernova

School of Interactive Computing

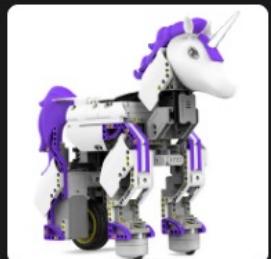


Prof. Seth Hutchinson

School of Interactive Computing



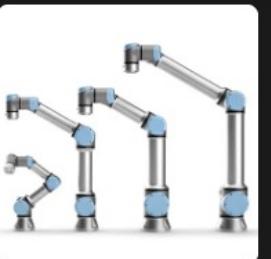
TAs: Tofunmi Sodimu, Ishan Chadha, Khalid Shaikh, Yetong Zhang, Reshma Ramachandra, Raj Patel, Abivishaq Balasubramanian, Abhinandan Krishnan, Shivika Singh, Prajwal Bhaskar, Chengkai Yao, Arjun Verma, Nina Moorman, Maithili Patel, Abhayram Nair, Rynaa Grover, Dipam Shah, Shivangi Deo, Sneha Maheshwari, Shalin Jain, Kevin Fu



○ UnicornBot



○ Unimate



○ UR



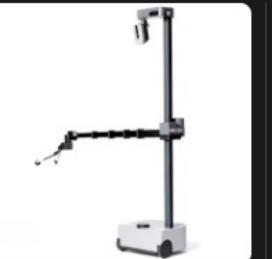
○ UVD Robots



○ Starship



○ Stretch



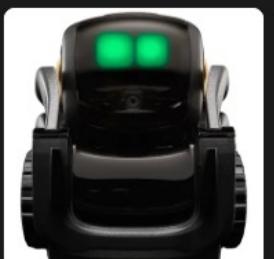
○ Stretch



○ Stuntronics



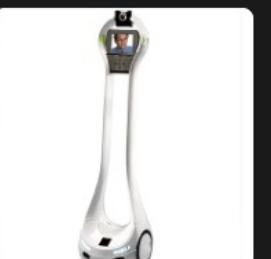
○ Valkyrie



○ Vector



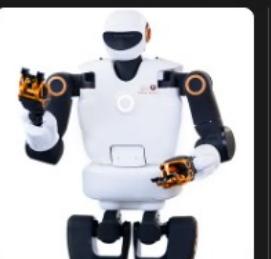
○ Versatrax



○ VGo



○ Surena 4



○ TALOS



○ Telegarden



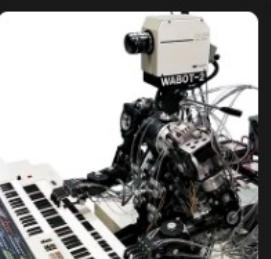
○ Telenoid



○ Viam Rover 2.0



○ Vita



○ Wabot 2



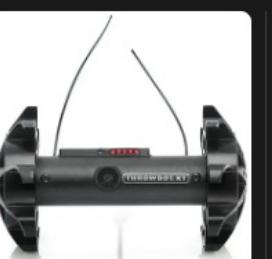
○ Wakamaru



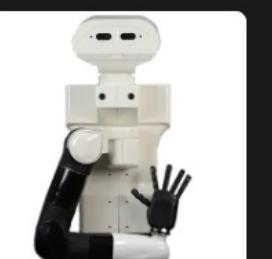
○ Temi



○ Tertill



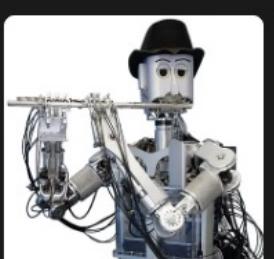
○ Throwbot



○ TIAGo



○ WAM



○ Waseda Flutist



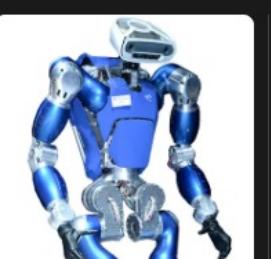
○ Watson



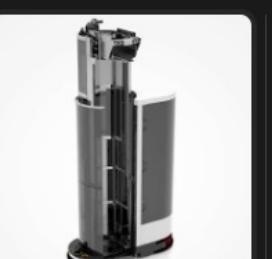
○ Wave Glider



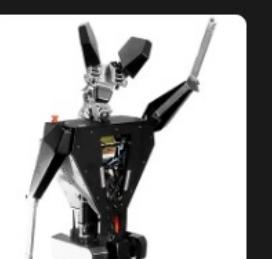
○ Titan



○ TORO



○ TORU



○ TULip

Robotics Applications

- 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

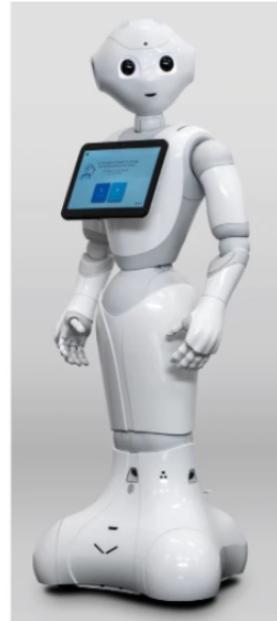
- **Industrial Robots**
- Service Robots
- Field Robots
- Humanoid Robots
- Medical Robots
- Self-Driving Cars
- Aerial Vehicles



<http://www.kuka.com>

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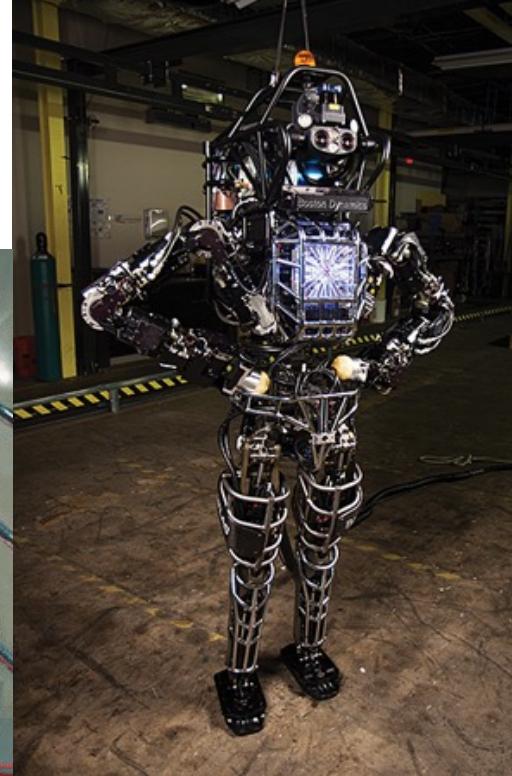
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<http://www.frc.ri.cmu.edu/robots/>

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Sensors

- Cameras
- Lidar
- Tactile
- Accelerometer
- Encoders
- ...

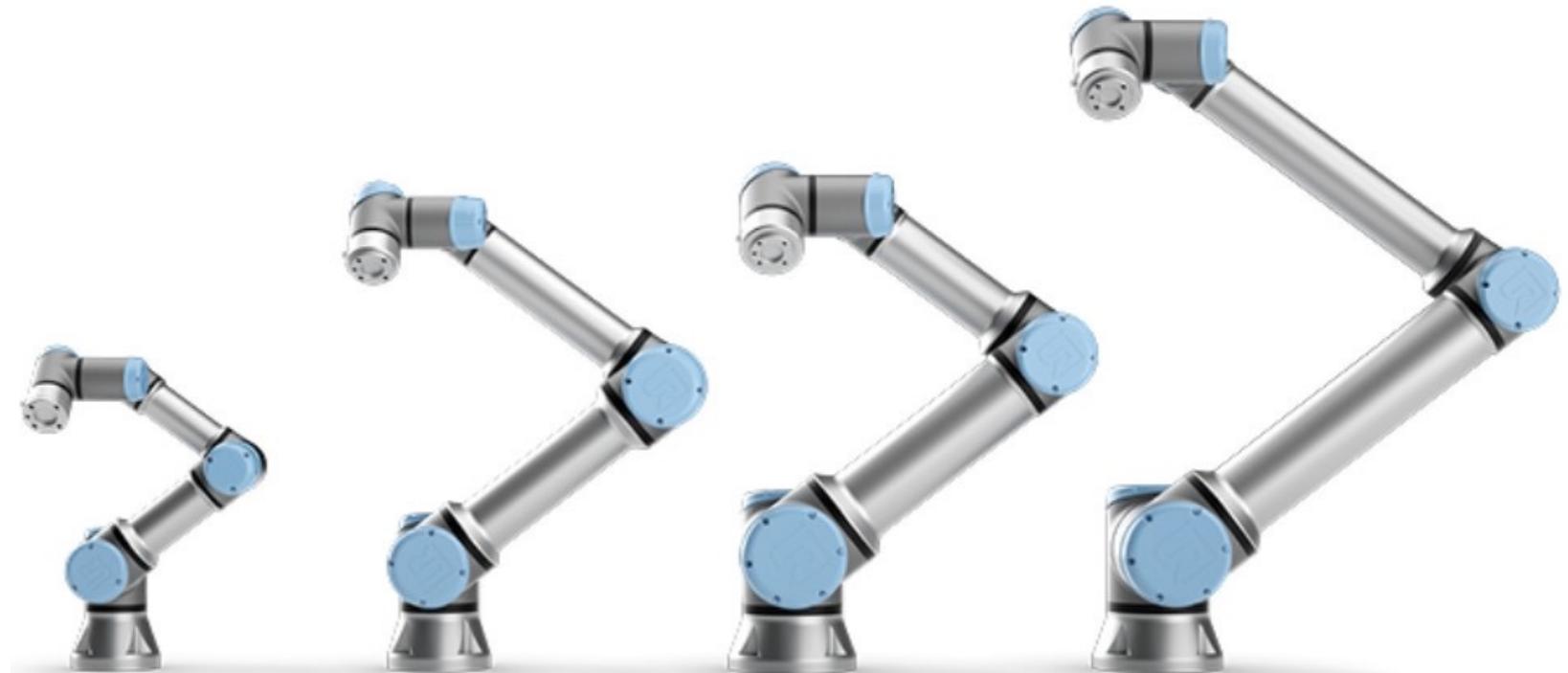


In this class...

- We will focus on capabilities of mobile robots
- The topics we cover will be platform-independent
 - The mathematical and computational tools that we introduce can be applied to any mobile robot
 - Likewise, the sensors and sensing methods that we will introduce can be applied to all problems described above.



Since we only have one semester, we will not cover robot manipulation, which is its own topic.



Course Logistics

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
- design a control architecture for mobile robots
- implement navigation and localization algorithms based on sensor fusion and environment
- representation
- write programs in Python to control a robot in simulation
- construct, program, and test the operation of robots to perform the 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**.

There are two sections of CS 3630 this semester, A and B.

- The two classes will have the same assignment and lecture content, and will share a single Piazza site, as well as the same pool of TAs.
- The syllabus lists the topic of each lecture and the schedule.
- The due dates for quizzes and take-home projects are the same for both sections
- Students will be able to access their assignments via Canvas.

CS 3630 Introduction to Robotics and Perception
Spring 2024

CS 3630-A

Instructor: Prof. Sonia Chernova,
chernova@gatech.edu

Lecture Time: Mo/We 3:30pm - 4:45pm

Lecture Location: Scheller Col. of Business 100

Head TA: Tofunmi Sodimu,
tofunmi.sodimu@gatech.edu

CS 3630-B

Instructor: Prof. Seth Hutchinson,
seth@gatech.edu

Lecture Time: Tu/Th 3:30pm - 4:45pm

Lecture Location: Howey Physics L1

Head TA: Ishan Chadha,
ichadha3@gatech.edu

Attending Lectures

- Students are allowed to attend either lecture
- **Note:** each class section is currently at capacity* for the room size, please give priority to the students in their own section

***Note for Wait Listed Students:** New seats in the class will open up only if/when current students drop. We can't add additional students due to fire code restrictions.

Topics Covered

- Sensor models
- Probabilistic state estimation
- Decision theory
- Image processing
- Multimodal sensing
- Path planning
- State estimation / localization
- Kinematics
- Odometry
- Control
- Learning
- ...

Robot simulator for 4 out of 6 projects.

- We are not using ROS (if you don't know what that is, don't worry about it, it won't be covered until more advanced courses)



Course Projects

1. Probabilistic State Estimation and Decision Making
2. Multimodal Sensing
3. Monte-Carlo Localization (part 1)
4. Monte-Carlo Localization (part 2)
5. Probabilistic Path Planning
6. Delivery Robot

Grade Distribution

- 60% from Projects (6 assignments, 10% each)
 - Individual assignment
 - **Late Policy:** All projects are due at the time and date indicated on the assignment document. Up to two late days are allowed, but a grade penalty of 50% and 75% will be applied at the first and second day, respectively. Late submissions beyond two days will not be accepted.
- 40% from Quizzes (7 quizzes - 2 lowest grades = 5 grades x 8% each)
 - Individual assignment
 - Lowest two grades automatically dropped
 - Because the lowest quiz grades are being dropped, we will not be rescheduling quizzes missed due to unexcused absences (travel, job interviews, etc.).

A look at the syllabus...

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.
- 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 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 a solution.

Questions?