

CMSC 479/679 Fall 2014



Introduction to Robotics

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People



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- Professor: Dr. M
 - cmat@umbc.edu
 - ITE 331
 - Office hours: Mon 9:30-10:30, Wed 11-12
- TA: Nikhil Mengani
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My Research Topics



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- ◆ **Robotics**
 - ◆ How can we go from industrial robots to *useful* robots in human environments? (Nursing homes, hospitals, homes...)
- ◆ **Natural Language Processing**
 - ◆ How can computers learn to understand and speak human languages (English)?
- ◆ **Artificial intelligence**
 - ◆ How to get computers to behave in ways that we would consider to be "intelligent"
- **Human-Robot Interaction (HRI)**

Today's Class



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- ◆ Introduction and goals
- ◆ Review of syllabus and schedule
- ◆ Academic honesty policy
- ◆ Expectations
- ◆ Topics we'll cover
- ◆ What is a robot?

Sign up for Piazza:
<http://tiny.cc/robotics-piazza>

Where we will post links to the class page, the schedule, assignments, ...

Classroom Policies



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- ◆ Be courteous to classmates and instructors.
- ◆ **No devices in use** except when specified.
 - ◆ <http://tiny.cc/devices-in-class>
- ◆ No food or drink in this classroom.
 - ◆ Water is fine.



Grading



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	Class participation	5%
	Midterm	20%
	Homework	25%
	Quizzes and surveys	2%
	Project	30%
	Final exam	20%

- Grades in Blackboard
 - Know your grades *but also*
 - Keep track of what's left
- Grade questions:
 - 24-hour "cooling" period
- Grade change/regrade requests to **professor and TA**
 - TA cannot change grades!
- 90%+ is an A, etc; these may go down for exams

Participation

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- Attend class.
- Speak up!
 - Answer questions
 - Ask questions
 - Tell us your thoughts
 - There are lots of opportunities to talk here!
- Be active on Piazza.
 - Ask and answer questions
 - Post links to interesting material

Homework Assignments

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- ◆ Written, problem set, and programming
 - ◆ Due at 11:59pm the day before class
 - ◆ Late: 25% off /day
- ◆ Assignments will be turned in electronically
 - ◆ Blackboard / online forms / email
 - ◆ Assignment will specify
- ◆ 10% penalty for not following turn-in instructions
 - ◆ E.g., giving me a Word document
- ◆ Questions? Piazza, **then** TA

Time Management

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- ◆ Some things can be rescheduled
 - ◆ E.g., overlapping exams
- ◆ Individual extensions *may* be given:
 - ◆ With reasonable cause
 - ◆ When made in advance
- ◆ Please talk to me!

Readings

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- ◆ Pre-readings: Do these **before that class**
 - ◆ It will be hard to follow if you don't
- ◆ Readings: Do these after class
 - ◆ More detail on concepts

Before class

After class

CLASS	DATE	TOPIC	PRE-READINGS	READINGS	HOMEWORK	HANDOUTS / NOTES
1	9/1	Introduction and overview	Class with open literature articles	Ch. 1	Read chapter 1 and discuss literature out of class	Intro & L1, L2
2	9/6	Agents	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12	Ch. 2	Survey due Please submit this by 11:59 PM - see above	
3	9/13	...	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12	Ch. 3		

Academic Integrity

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- ◆ Instructor's responsibilities:
 - ◆ Be respectful
 - ◆ Be fair
 - ◆ Be available
 - ◆ Tell students **what they need to know, how they will be graded, and what happens if things go wrong**
- ◆ Students' responsibilities:
 - ◆ Know what is and is not academic dishonesty.
 - ◆ Be respectful
 - ◆ Do not cheat, plagiarize, or lie, or help anyone else do so
 - ◆ Do not interfere with other students' academic activities

Academic Integrity

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- ◆ I hate policing students, and I hope not to have to do so.
 - ◆ But, it is extremely unfair to the other students, so...
- ◆ **I take integrity very seriously.**
 - ◆ **Fabrication:** Fabricating sources or any other information in your assignments is academically dishonest.
 - ◆ **Aiding and abetting:** Providing another student with answers, or helping them to cheat.
 - ◆ **Plagiarism:** Using a source (for code, blocks of text, images, or designs) without appropriate citations and recognition.
 - ◆ **Copying:** Using another student's work for an assignment, exam, or project without acknowledgment.
- ◆ You can do a LOT of collaboration in this class!

Academic Integrity, UMBC



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*"By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community, in which everyone's academic work and behavior are held to the highest standards of honesty. **Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong.** Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal."*

[Statement adopted by UMBC's Undergraduate Council and Provost's Office]

Plagiarism



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- ◆ Representing someone else's work as your own – in writing, code, or any other artifact – is plagiarism.
- ◆ **What if the reference is in the bibliography?**
 - ◆ If you didn't explicitly quote the text you used and cite the source where you used the text, it is plagiarism.
- ◆ **What if I only use some of the words?**
 - ◆ Scattering some of your own words and rephrasing isn't enough. If the ideas are not restated entirely in your own words, it is plagiarism.

Plagiarism: More Examples



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- ◆ **The introduction and background material are borrowed; all of the research is original.**
 - ◆ If somebody else's words appear in any document that you claim is written by you, it is plagiarism.
- ◆ **It was a draft or not an official assignment**
 - ◆ If you represented somebody else's words as your own, even in an informal context, it is plagiarism.
- ◆ **"But the professor told me to use that source!"**
 - ◆ Unless you are explicitly told to copy a quote from a source, you must write your answers in your own words.
 - ◆ If it is not cited properly, it is plagiarism.

Integrity: Abetting



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- ◆ Helping someone to cheat, falsify, or plagiarize will result in you receiving the same penalty.
 - ◆ This includes putting someone's name on something when they didn't work on it.
 - ◆ "This is just everyone on our team" is wrong.
- ◆ Know what your project partners are doing.
 - ◆ Their cheating can hurt you.
- ◆ This is the most common and most distressing source of academic integrity problems.
 - ◆ Don't do this to your friends.

Integrity and Teamwork



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- ◆ 50% of your grade in this class involves teamwork.
- ◆ How can teamwork be unethical?
 - ◆ Not sharing the workload evenly
 - ◆ Not contributing to the group
 - ◆ Misrepresenting the source of your work to the team
 - ◆ Misrepresenting who did what
 - ◆ Working together on individual assignments
- ◆ Falsely claiming someone contributed to the group.

Integrity: Penalties



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- ◆ Penalties depend on the offense and whether it recurs
- ◆ **The minimum penalties are:**
 - ◆ Receiving a zero on the complete assignment
 - ◆ Being required to redo the assignment, without credit, in order to pass the class
- ◆ Additional penalties may include:
 - ◆ Receiving a full grade reduction in the class
 - ◆ Failing the class without possibility of dropping it
 - ◆ Suspension or expulsion from the program or university

Integrity: What To Do



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- ◆ You can **always** bring it to me
- ◆ Cheating off of you / in your group / etc:
 - ◆ You **may** talk to them about it
 - ◆ Unless it's fully reversible, you are abetting unless you report it
- ◆ You **do not have to** talk to anyone but me

Summary!
**Don't cheat; don't risk it; don't
 make me handle a cheating case.**

Group Work



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- ◆ Study groups are **encouraged!**
 - ◆ Talking about the homework is completely acceptable
 - ◆ Don't share code
- ◆ Programming must be done **individually**
 - ◆ Programs must be written entirely by you
 - ◆ Copying another person's code is never acceptable
 - ◆ You can help debug
- ◆ Some homework is for 2-4 students working together
 - ◆ The assignment will say so; otherwise, it's individual.

Communication



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- ◆ Post all questions to Piazza (unless it violates integrity)
 - ◆ We will try to respond to Piazza posts immediately
- ◆ Email takes 24-48 hours
 - ◆ Always send email to professor and TA
 - ◆ **Piazza, then TA, then prof + TA**
- ◆ Office hours
- ◆ I will remain after class when I can

Goals of This Course



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- ◆ Provide an overview of big problems in robotics
- ◆ Understand the elements of a robot system
- ◆ Get hands-on experience with robot software, hardware, and problem-solving
- ◆ Understand what robots can do now, could do better, and will be doing in future

Teamwork



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- ◆ Projects will be done in teams of 3-4
- ◆ Teams will be assigned based on skills and interests
 - ◆ Survey posted to Piazza
- ◆ Teams will:
 - ◆ Meet regularly
 - ◆ Do in-class *and* out-of-class group assignments
 - ◆ Share effort on project elements reasonably

Expectations



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- ◆ Attend class regularly
 - ◆ If you will miss class for a good reason (work commitment, religious holiday, serious illness), drop me an email in advance
 - ◆ Counterpoint: don't come to class sick.
- ◆ Complete the assigned reading before class
 - ◆ Class participation is hard otherwise
- ◆ Participate actively in class discussions
 - ◆ Let other people participate, and listen attentively
 - ◆ Ask questions!
 - ◆ Read and post to the forum

What's This Class Like?



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- ◆ Much like my AI, HRI, and ethics classes
- ◆ So ask around!
- ◆ It is not an **easy** class.
 - ◆ We cover a lot of material – robotics is a **big** topic
 - ◆ You'll need to put in the time and keep up
 - ◆ If you're taking a heavy load, don't expect this to be the "easy" one
- ◆ It is (mostly) a **fun** class

General Topics



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- ◆ Overview and Concepts
- ◆ Sensing
- ◆ Actuators
- ◆ Control software
- ◆ Motors/motor control
- ◆ Locomotion
- ◆ Manipulation
- ◆ Kinematics
- ◆ Localization
- ◆ Motion planning
- ◆ Machine learning
- ◆ Hardware Design
- ◆ Cognition
- ◆ Human-robot interaction

For Next Class



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- ◆ Read S&N Chapter 1
- ◆ Sign up for Piazza
- ◆ And then...
 - ◆ Read the academic integrity page
 - ◆ Read the syllabus
 - ◆ Make sure the schedule makes sense
 - ◆ Fill out the course survey

Familiar Robots



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Sentinel, X-Men,
Days of Future Past:
2014



ED-209, Robocop:
2014



Wall-E: 2008



Data, Star Trek: TNG: 1987



Optimus Prime, Transformers:
2007-current

Some 21st century robots

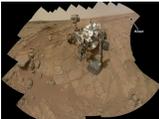


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What is a Robot?



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"A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks." (Robot Institute of America)

- ◆ Autonomous?
- ◆ Physical?
- ◆ Human-friendly?
- ◆ Humanoid?
- ◆ Sensory?
- ◆ Intelligent?
- ◆ Mobile?
- ◆ Manipulative?
- ◆ What else?

Robots Up to Now



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- ◆ Robots now:
 - ◆ Expensive
 - ◆ Complex
 - ◆ Special-purpose
- ◆ Environments
 - ◆ Dedicated
 - ◆ Constrained
- ◆ Use and Management
 - ◆ Controlled by trained experts
 - ◆ Slow and expensive to reconfigure/repurpose




Robots Now



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- ◆ As technology improves:
 - ◆ Smaller
 - ◆ Cheaper
 - ◆ More broadly capable
- ◆ Can consider deploying in human-centric environments
 - ◆ Homes
 - ◆ Schools
 - ◆ Care facilities
- ◆ Requires: flexibility and human-robot interaction (HRI).



What Should They Do?



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- ◆ Robots are moving away from factory floors to...
 - ◆ Entertainment, toys
 - ◆ Homes (personal robotics)
 - ◆ Medical, surgery
 - ◆ Industrial automation (mining, harvesting, warehouses, ...)
 - ◆ Hazardous environments (space, underwater, battlefields, ...)
 - ◆ Roads
- ◆ Research Trends
 - ◆ Manipulation of everyday objects
 - ◆ Complex household tasks
 - ◆ Object recognition, mapping, interaction
 - ◆ Human robot interaction



