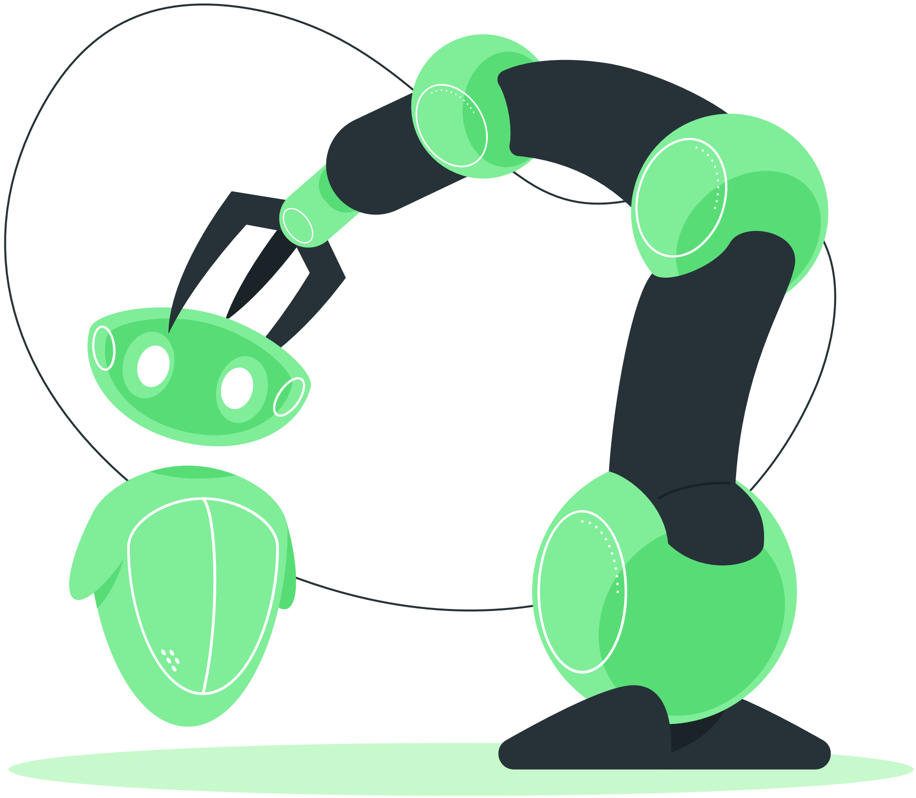
EECS C106B
Week 2 Lab



Welcome to Lab Section!

Lab sections are for:

- Paper presentations
- Project introductions

Lab section etiquette:

- Show up (sections are **synchronous** and **not recorded**)
- Come prepared to discuss the papers for the week
- Be respectful

Agenda

1 Paper Presentation Logistics

Info about paper presentation assignment

2 Intro to Paper Reading

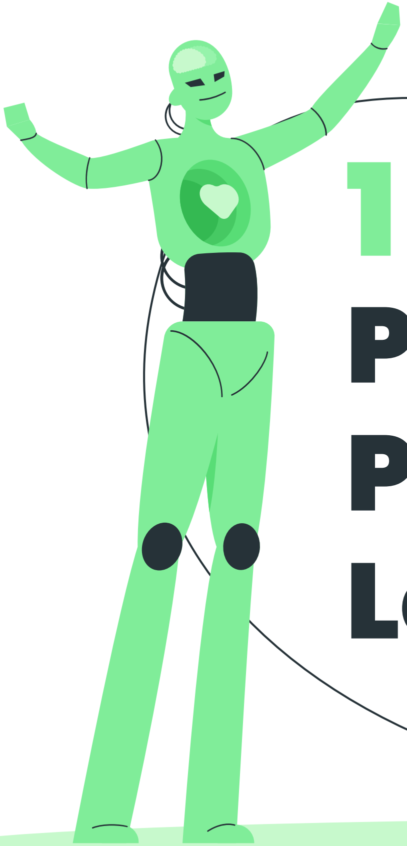
Discuss strategies for reading papers

3 Example Paper Presentation

Watch and critique a previous presentation

4 Free Time

Hopefully you started Project 1A! Feel free to leave or work on the project and ask questions. Find project partners if you haven't yet!



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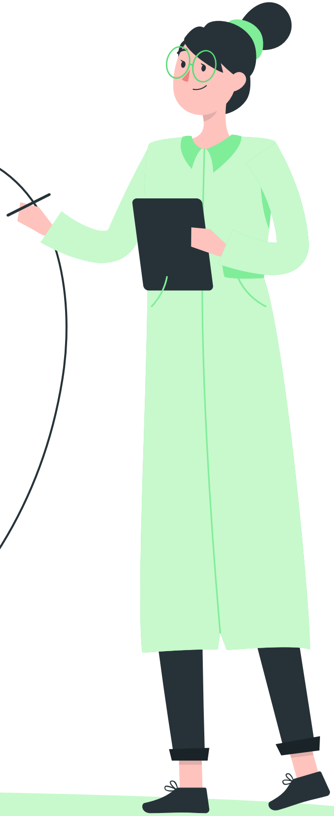
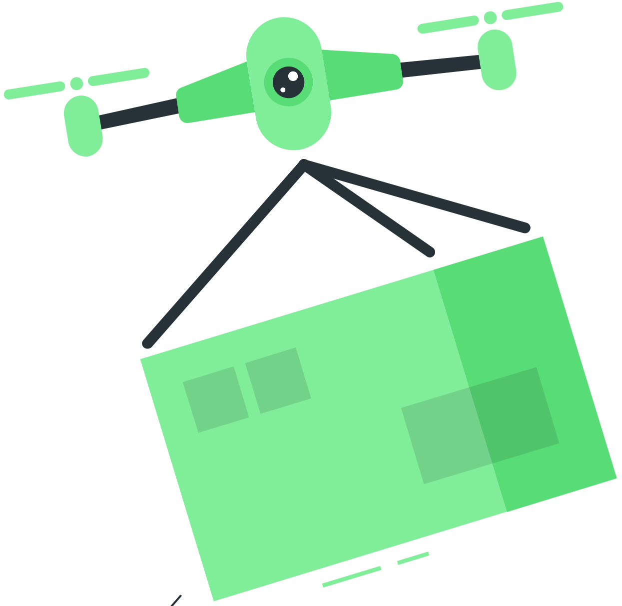
Paper Presentation Logistics



Paper Presentations

Explain your chosen paper in as simple terms as possible so others can understand it

Sign-up sheet will open after we finalize sections!



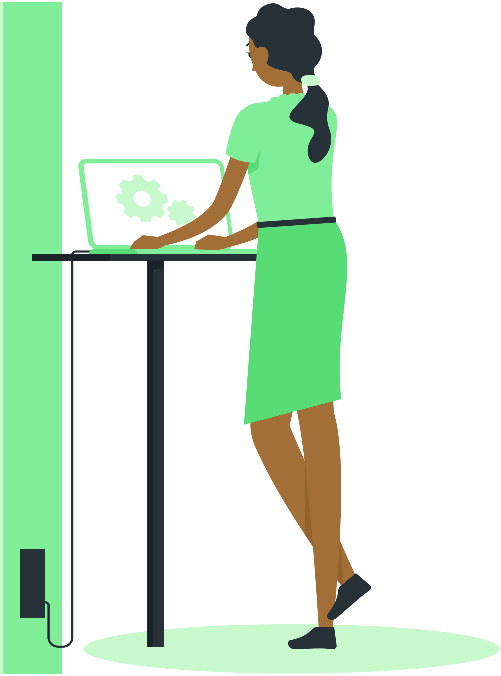
Paper Presentations

- 1-2 paper presentations per week in lab section
- Sign-up sheet will open after we finalize sections
  - 1 paper **before** Spring Break
  - 1 paper **after** Spring Break
- Grade breakdown (5% total)
  - 4% for paper presentations (2% each)
  - 1% for participation in discussions

Presentation Logistics

- Present as group of 2* in the same lab section
  - Meet people who have the same interests as you
  - Doesn't have to be same partner for both presentations
- 10-15 mins for presentation
- 5-10 mins for questions/leading a discussion

* Depending on the circumstances groups of 1 or 3 are ok but should be rare and approved by your TA first. Ideally max 1 group of 3 per lab section.



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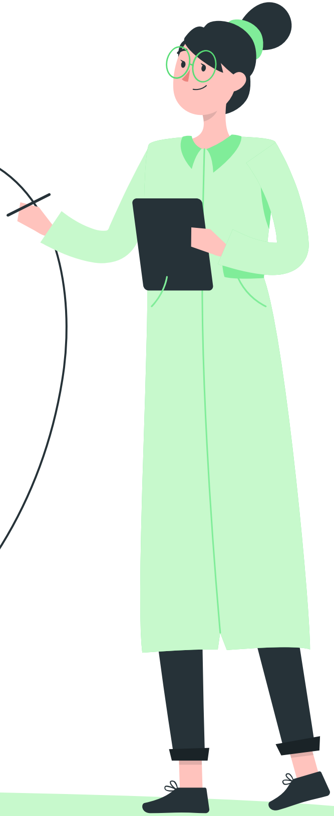
Intro to Paper Reading



Advice from Prof. Terry Johnson

Nobody Understands the Whole Paper

It takes a LOT of time to digest the information packed into a paper

Read the Abstract, Skim the Results

Do a first pass and just look at the important context, figures, and results

Read the Paper, Taking Notes as You Go

Do a second pass now that you know what to look for

Triage Your Ignorance

Don’t fall down irrelevant information rabbit holes

Link to video on the last slide

Advice from Fangyu

Build your knowledge base with a good textbook

Textbooks are more approachable and systematic

Reading by doing

Implement the method you read or attempt to prove it before checking proof

Read papers with a mindset of pull request

Only focus on the part you do not know

Papers are like codes, they can be wrong too

Papers can be underspecified, poorly written, and can often be partially wrong

Let’s Do An Example

Today’s Paper:

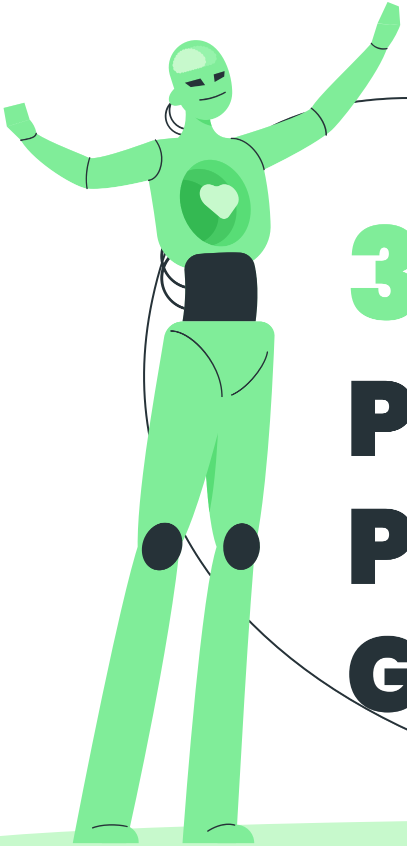
Learning How to Autonomously Race a Car: A Predictive Control Approach

Let's Do An Example

Today's Paper:

Alexis K, Nikolakopoulos G, Tzes A. Model predictive quadrotor control: attitude, altitude and position experimental studies. IET Control Theory & Applications. 2012 Aug 16;6(12):1812-27.

Reading Papers is HARD



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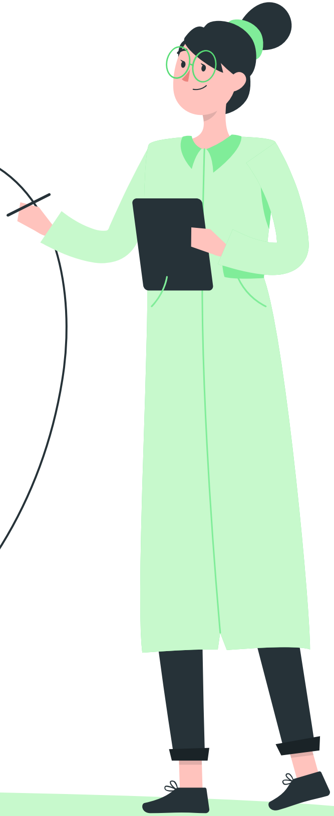
Paper Presentations Guidelines



Presentation

A

Why did they do it?

What were their motivations? What was currently missing? What was already out there?

B

What was their solution?

What did they leverage? Where did they draw inspiration from? Why did they do it this way?

C

What were the results?

Did they run any experiments? Did they list any applications? Are there videos of experiments?

D

What next?

What were the drawbacks? How can this be improved on? What questions do you have for the audience?

Discussion

A

What did you learn?

What were you able to take away from this presentation?

C

What went well?

What presentation strategies made you understand the content?

B

What was confusing?

What were you unable to understand from this presentation? (You are not expected to fully understand it right now)

D

How could it have been better?

What presentation strategies could have made you understand the content better?

Timeline of the Near Future

Homework 1

Due 1/24

Sign up for Papers!

Signups will open after
we finalize sections!

Project 1A

Due Tues 1/31

Project 1B

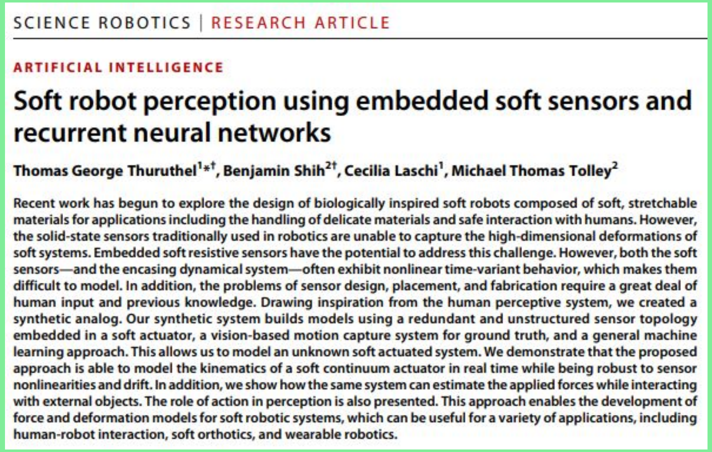
Coming soon

Video Resources:

Terry Johnson: How to Read a Scientific Paper
D. Livingston McPherson: How to read all of research (a lit review)

Soft Robots

- primarily composed of materials with compliance similar to the compliance of soft biological materials
- traditional robotics techniques assume rigidity, so soft materials require different methods



SCIENCE ROBOTICS | RESEARCH ARTICLE

ARTIFICIAL INTELLIGENCE

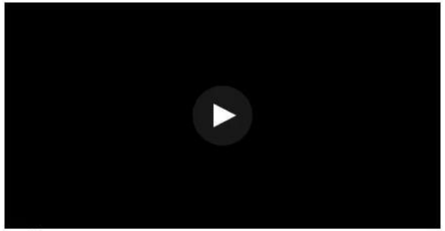
Soft robot perception using embedded soft sensors and recurrent neural networks

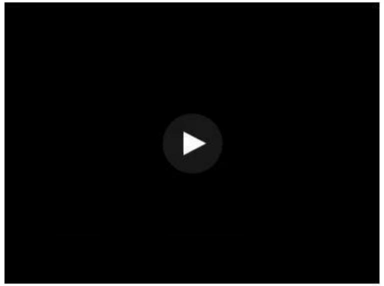
Thomas George Thuruthel[1*†], Benjamin Shih[2†], Cecilia Laschi[1], Michael Thomas Tolley[2]

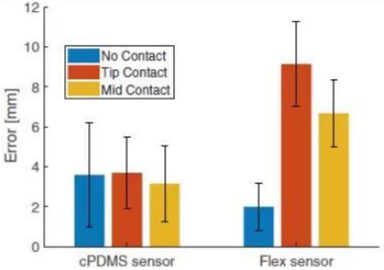
Recent work has begun to explore the design of biologically inspired soft robots composed of soft, stretchable materials for applications including the handling of delicate materials and safe interaction with humans. However, the solid-state sensors traditionally used in robotics are unable to capture the high-dimensional deformations of soft systems. Embedded soft resistive sensors have the potential to address this challenge. However, both the soft sensors—and the encasing dynamical system—often exhibit nonlinear time-variant behavior, which makes them difficult to model. In addition, the problems of sensor design, placement, and fabrication require a great deal of human input and previous knowledge. Drawing inspiration from the human perceptive system, we created a synthetic analog. Our synthetic system builds models using a redundant and unstructured sensor topology embedded in a soft actuator, a vision-based motion capture system for ground truth, and a general machine learning approach. This allows us to model an unknown soft actuated system. We demonstrate that the proposed approach is able to model the kinematics of a soft continuum actuator in real time while being robust to sensor nonlinearities and drift. In addition, we show how the same system can estimate the applied forces while interacting with external objects. The role of action in perception is also presented. This approach enables the development of force and deformation models for soft robotic systems, which can be useful for a variety of applications, including human-robot interaction, soft orthotics, and wearable robotics.

Results: Kinematic Modeling

- In general, cPDMS better than commercial flex when kinematic modeling with contact, but worse when no contact
- Slight phase lag of sensor predictions with cPDMS sensors







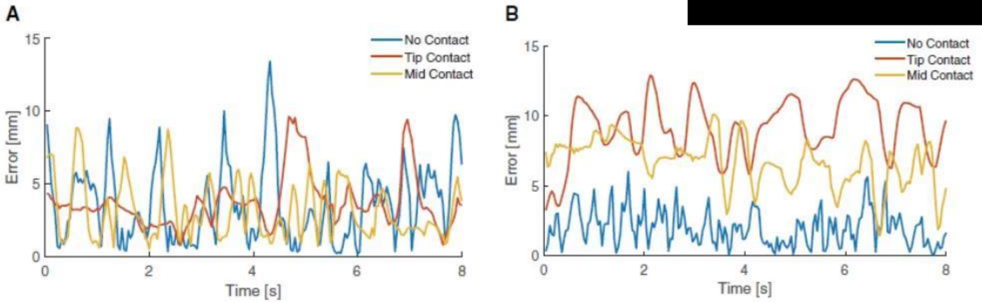


Fig. 4. Error plots for tracking. (**A**) With the soft cPDMS sensor. (**B**) With the commercial flex sensor.