

AA 598B Special Topics

Decision-Making & Control for Safe Interactive Autonomy

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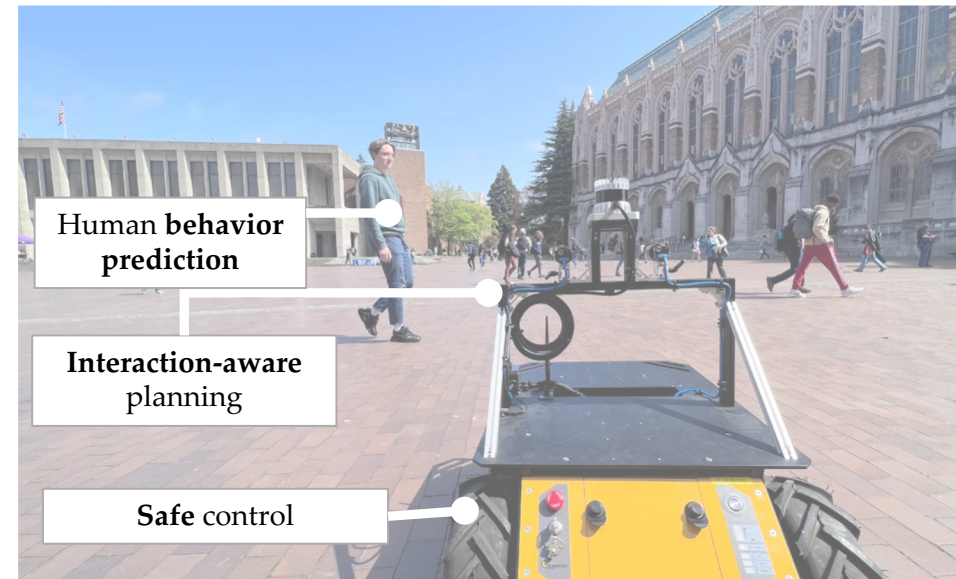
Autumn 2024

<https://faculty.washington.edu/kymleung/aa598/>



Last time & announcements

- Motivation & background & course logistics
- Course website:
 - <https://faculty.washington.edu/kymleung/aa598/>
 - Long paper discussion sign up sheet
 - Homework 1 out
- Small schedule change



Today

- Continue on “how to skim a research paper”
- Fundamentals
 - Dynamical systems
 - Optimization
 - ML / DL

How to ~~read~~ skim a research paper

Step 1: Understand the structure of a paper

Step 2: Know where to look

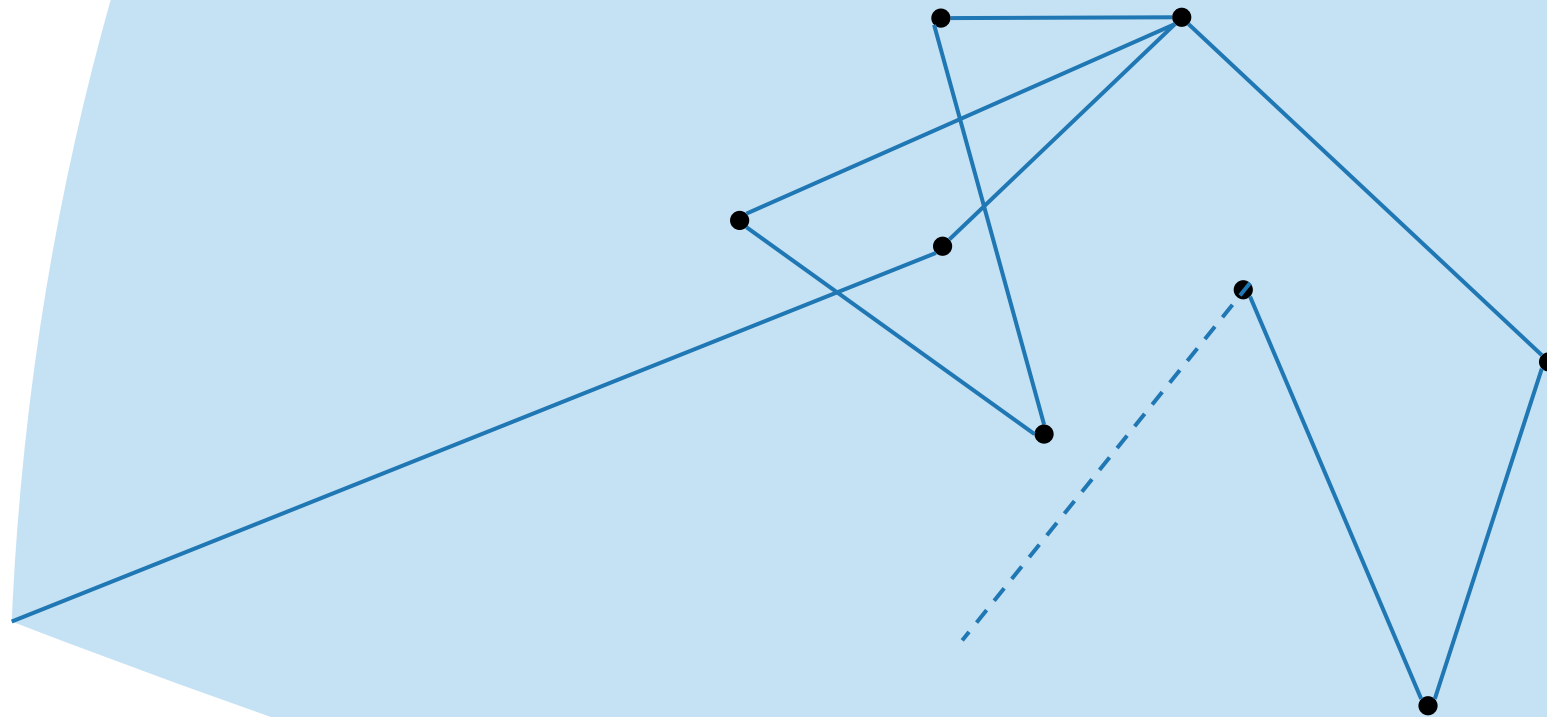


Research papers: The medium in which researchers contribute knowledge and advance the field



Navigating through the balloon

Advancing
the field



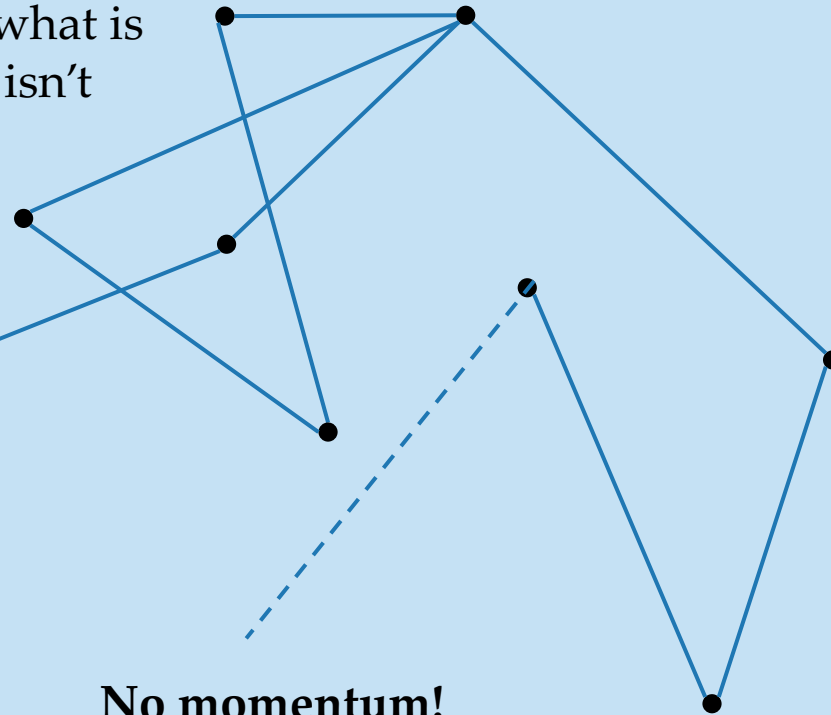
First year

Navigating through the balloon

Advancing
the field

Noisy!

Need to quickly determine what is
useful/relevant and what isn't



No momentum!

Need to make an impact and convince
others to help push you along



First year

The importance of writing *good* papers: Denoise & gain momentum

- Enables readers to precisely understand your research idea quickly and concisely
- Others can effectively leverage your work within the area or outside (cross pollination)
- Expand knowledge rather than reinvent it
- Establishes credibility and expertise
- Attracts more attention into the area

What makes a good paper?

- Clarity of thought, intuitive flow of ideas
- Clear visualizations, even if the ideas are “very technical”
- Positioning their contributions with respect to the field
- Organized description of methodology/theory
- Meaningful experiments that support the claims
- Transparency on limitations
- ...

A paper should tell a (predictable) *story*

Reader should know what to expect after reading the abstract

Abstract is an advertisement
for your paper

Relevance
Issue
Solution
Evidence

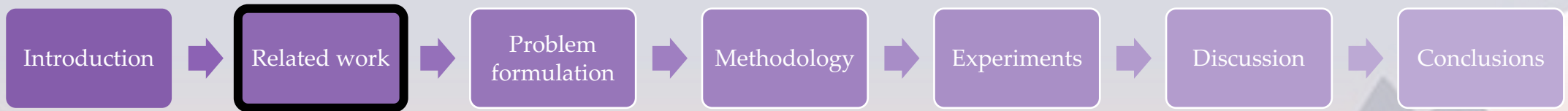




Introduction

- *(Establish relevance)* Motivate and state impact
- *(Identify issue)* What is the knowledge gap?
- *(Proposed solution)* Briefly introduce approach and highlight novelty
- *(Contributions)* What are the advancements? What new insights are gained?
- *(Visual aid)* Concise representative diagram summarizing the key idea

After reading the introduction, the reader should have the answer to:
Why should I care and what can I expect to gain from reading this?



Related work

- Describes the research (local) landscape
- Contextualizes contributions
- Helps readers know how to appreciate your work

General tips

- Avoid writing a laundry list
- Instead, find common themes/trends and structure
- If appropriate, a table comparing and contrasting properties



Problem formulation

- Precisely define the problem you seek to solve
- Define it mathematically/abstractly
- Introduce notation
- There is a difference between defining the problem and describing your approach
- If necessary, include preliminaries/background material



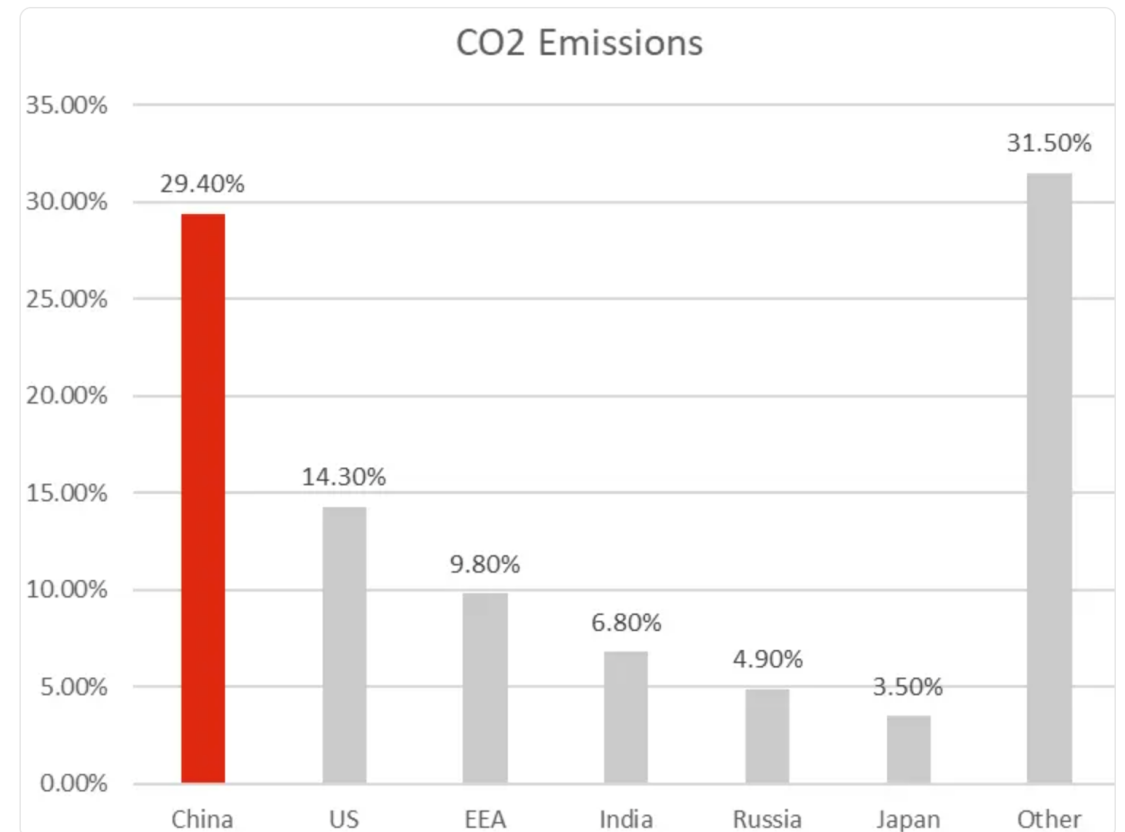
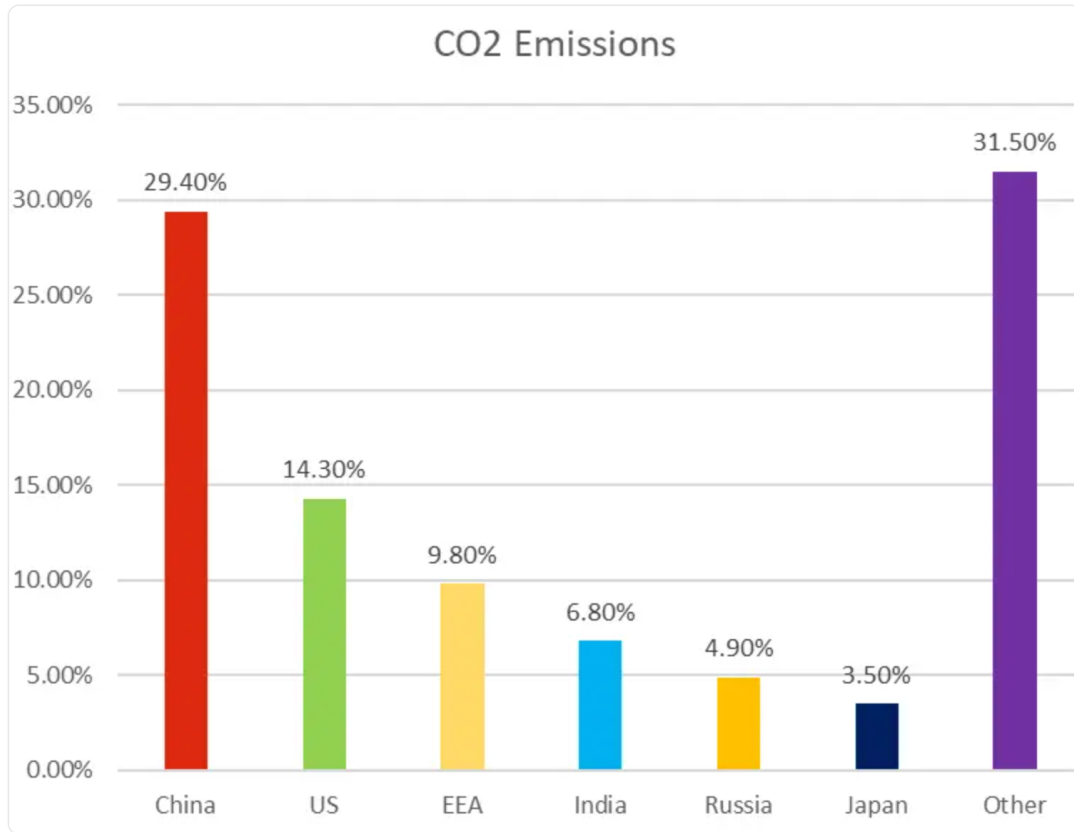
Proposed methodology

- What are you doing to solve the problem?
- Sketch out the high-level picture and how each component connects to each other
- Describe each component
- Diagrams/algorithm block can go a long way!



Experiments and discussion

- Provide evidence that your proposed approach solves the problem better
- State the questions you want answered
- Describe your experimental set up and justify its design
- Define what “better” means
 - Metrics and baselines
- Discuss results and key takeaways
- Think deeply about what is the best way to present the results
 - Table? Line plot? Column graph? What are on the axes?
- Highlight limitations (it’s not all rainbows and butterflies)



<https://www.polymersearch.com/blog/10-good-and-bad-examples-of-data-visualization>



Other bad visualization examples (5 mins discuss with neighbor)

- <https://github.com/garrettj403/SciencePlots>



Conclusions

- Summarize your contributions
- Present (exciting) future directions and future work
 - Beyond “do more experiments”, “optimize code”, “try more applications”, “implement on hardware”
 - Future directions to gain *deeper insights*

General tips to writing a paper (or proposal, or anything in general)

- Spend time thinking how to organize the story.
 - Creating a *storyboard* before filling in the details
- Topic sentences!! First sentence of each section should indicate the key takeaway of that section.
- Breaking up the chunks into smaller sections. Make use of subsections, subsubsection, paragraphs.
- Illustrations or running examples to convey complex ideas
- Avoid “filler words”. Every word, every sentence, should have a purpose.

So, how to read a paper?

- What is the problem they seek to solve?
- At a high-level, how are they approaching the problem?
- What is the “secret sauce”? What is the novelty?
- How effective is it?

If after skimming, you are still interested, then read more closely.



We will get more practice on reading papers in each module

Activity: Skim a paper

(~10 minutes)

- Pick a paper to skim and discuss with neighbor
- What is the problem? How are the authors approaching it? What is new? How well does it work?
- Stochastic Motion Planning for Hopping Rovers on Small Solar System Bodies
- Follow My Lead: Designing an ADAS that Shares Decision Making and Control with the Driver
- Navigating and 3D Surface Reconstruction from Passive Whisker Sensing
- RobotSweater: Scalable, Generalizable, and Customizable Machine-Knitted Tactile Skins for Robots

Fundamentals