

Report Writing for Technical Work

Lecture 8

(With reference to some notes from Dr. Robert D. Gregg)

Agenda

- Motivation for this lecture
- Standards, structure and expectations of technical reports*
- Useful tools and resources
- ROB 550 specific expectations

* This topic will cover the general process for writing papers and reports, all of which may not directly apply to ROB 550 reports.

Motivation

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- Preparing for writing technical work for conferences, journals or project reports
- Familiarizing with standard tools and softwares like LaTeX
- Introducing a brief set of “rule of thumb”s for technical writing

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- Grammatical consistency
 - Use consistent tenses across paragraphs/sections
 - Use active voice over passive voice whenever possible
- Number, and refer to each figure, table and equation
 - Each of these should appear in the report where references to them are made.
 - We shouldn't refer to a figure that will show up in the report 3 pages later!

Structure of a Technical Report

Typical Structure of a Technical Report

1. [Abstract](#)
2. [Introduction](#)
3. [Related Works](#)
4. [Methodology](#)
5. [Results](#)
6. [Discussion](#)
7. [Conclusion](#)

Abstract

- Should be a **concise summary of the work** in the report
 - Keep in mind that people doing literature review commonly start by reading the abstract, use it to best show off your work and describe the key points!

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- Should be a **concise summary of the work** in the report
 - Keep in mind that people doing literature review commonly start by reading the abstract, use it to best show off your work and describe the key points!
- Typically around a single paragraph, and should include the following:
 - Reason for writing
 - Problem statement
 - Methodology
 - Results
 - Implications

Example: Abstract

For autonomous service robots to successfully perform long horizon tasks in the real world, they must act intelligently in partially observable environments. Most Task and Motion Planning approaches assume full observability of their state space, making them ineffective in stochastic and partially observable domains that reflect the uncertainties in the real world. We propose an online planning and execution approach for performing long horizon tasks in partially observable domains. Given the robot's belief and a plan skeleton composed of symbolic actions, our approach grounds each symbolic action by inferring continuous action parameters needed to execute the plan successfully. To achieve this, we formulate the problem of joint inference of action parameters as a Hybrid Constraint Satisfaction Problem (H-CSP) and solve the H-CSP using Belief Propagation. The robot executes the resulting parameterized actions, updates its belief of the world and replans when necessary. Our approach is able to efficiently solve partially observable tasks in a realistic kitchen simulation environment. Our approach outperformed an adaptation of the state-of-the-art method across our experiments.

Problem statement

Reason for writing

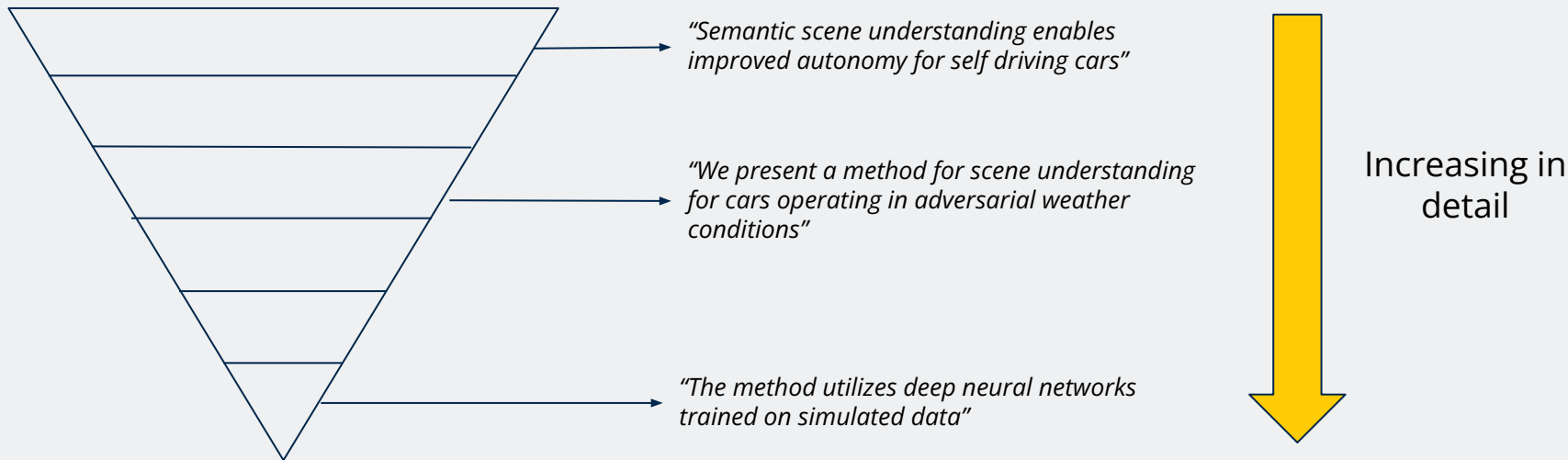
Methodology

Results

Implications

Introduction

- “Inverted pyramid” structure: **start general and get more specific with each paragraph.**



Introduction

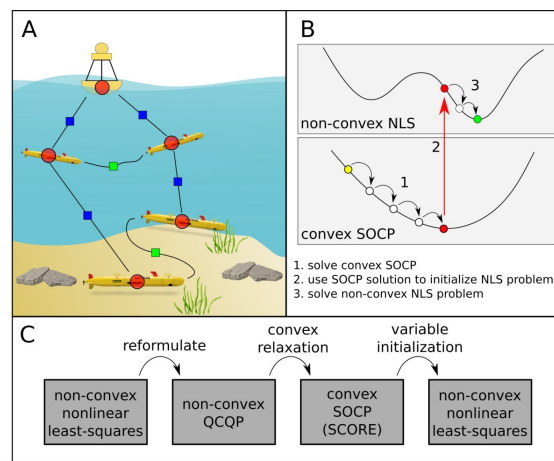
- “Inverted pyramid” structure: start general and get more specific with each paragraph.
- Should include a **clear definition of the problem** addressed in the report, along with the **contributions** made to solve this problem.

Example:

*“This work **aims** to address the simulation-to-real gap for improving the mobility of legged robots on slippery terrains through data-driven friction and contact models.”*

Introduction

- “Inverted pyramid” structure: start general and get more specific with each paragraph.
- Should include a clear definition of the problem addressed in the report, along with the contributions made to solve this problem.
- Create and include figures that concisely summarize your work on the first page.



Introduction: Extra Pointers

- Use the **first sentence of each paragraph as an introduction** to a topic discussed in the report.

Paragraph 1

Semantic scene understanding remains an unsolved problem for autonomous vehicles. ...

Paragraph 2

Sensor fusion for improving the performance of scene understanding has shown promise in this direction. ...

Paragraph 3

Simulation environments provide the flexibility to include a variety of sensors and test developed methods for autonomous vehicles. ...

Introduction: Extra Pointers

- Use the **first sentence of each paragraph as an introduction** to a topic discussed in the report.
- It is helpful to either summarize the rest of the report, or the contributions on the **last paragraph of the introduction**.

Example:

"The structure of the paper is as follows: Section II describes the methodology, Section III describes the experiment setup, ..."

Introduction: Extra Pointers

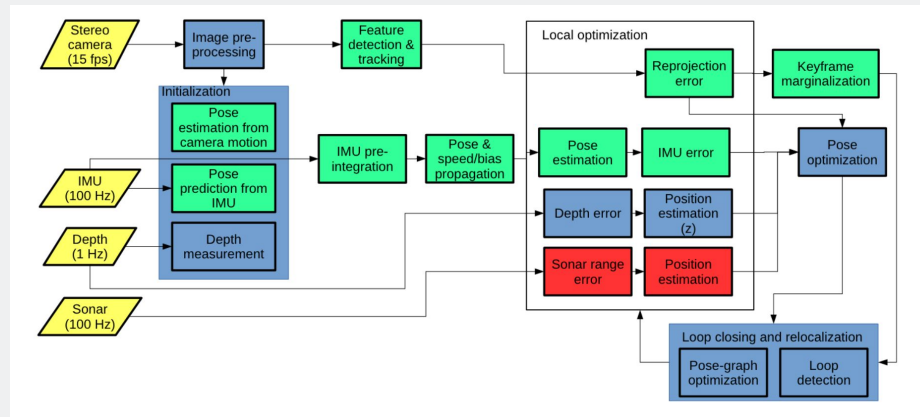
- Use the **first sentence of each paragraph as an introduction** to a topic discussed in the report.
- It is helpful to either summarize the rest of the report, or the contributions on the **last paragraph of the introduction**.
- When writing for a conference, journal or project, it is good to include citations to better motivate the problem being solved.

Related Works

- Should include previous, relevant work to the topic of the paper
- Utilize subsections to separate out the related works by topics
- **Key Point:** How does the work in the report relate to, differ or build upon these related works?
- Useful to mention which of the related works will be used as baselines.

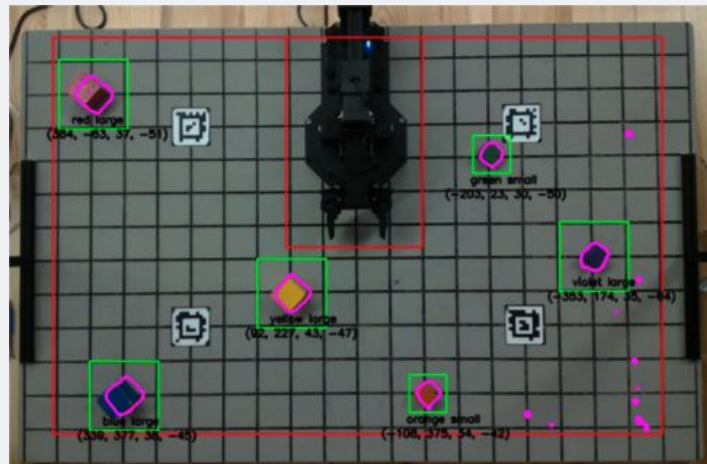
Methodology

- Where the technical work should be described.
 - Equations and figures should be used to convey the technical work.
- Always refer to equations before you write them.
 - Make sure to define each variable in the equations!
- Use present tense when describing the methods.



Results

- The results section should describe the experiments that were run to validate the methods.
 - Support the results through the use of figures, tables and plots.
- Use text in this section to present the experiments and clarify the results, do not comment on them in this section.
- Use past tense to describe observations and findings in this section.



Discussion

- This section should be used to include discussion on the results
- Include insights on the results, comparison to baseline and performance of the proposed method.
 - This can be a great place to highlight your understanding of the developed methods!

Example:

“Despite the high accuracy on color detection for blocks on average, the detection of the color red was noticeably lower compared to other colors, detecting the correct color only 38% of the time. This can be attributed to ...”

Conclusion

- Summarize the report, restating the contributions, results and conclusions.
- If applicable, include future work, while justifying its relevance and impact to the current work.

Tools and Standards

Platforms for Writing Technical Reports

- The most commonly used software for writing technical reports is with LaTeX.
 - Offers existing templates for formatting files
 - Easily integrate equations, figures and citations into your report
- Additionally, softwares like Google Docs and Microsoft Word can be used as well.

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Standards for Reports

- Standards and templates define the restrictions on the format of the reports.
- This includes:
 - Font + font size
 - Citations
 - Page margins
 - Captions on figures
 - Table structures
 - Equation labeling
 - ...
- Never edit these settings!

Using LaTeX

Available Software

- [Overleaf](#) provides an online LaTeX editor and compiler that makes it easy to collaborate across teams
- [TexStudio](#) is an LaTeX editor and compiler application that works across common OS platforms.

Available Software

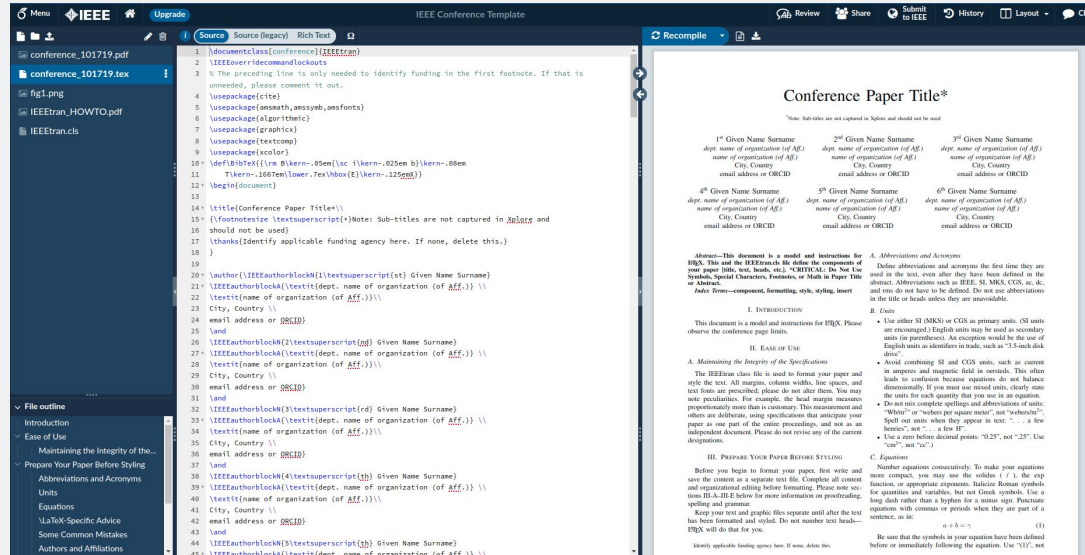
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Recommended

Using Templates In Overleaf

- Using Overleaf, one can import a standard template by using the [gallery](#) of templates.
 - Includes [IEEE official templates!](#)



Resources for Using LaTeX

- A great amount of documentation can be found in the [Overleaf Documentation](#)
 - For learning from scratch, would highly recommend the [Learn LaTeX in 30 Minutes](#) post!
- Would highly recommend importing themes and following their formats.

ROB 550 Specific Expectations

Technical Reports for ROB 550

- Template should follow the [IEEE Official Conference Paper Template](#)
 - **Do not** change the format
 - The report should be less than 8 pages

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 - **Do not** change the format
 - The report should be less than 8 pages
- In addition to the report, you can include an appendix that includes:
 - Any additional figures
 - References to your code from your report
 - i.e. which function implements the described methods
 - You **cannot** refer to the appendix in the report!

Objective for Reports in ROB 550

- To convey your understanding of the material, while showing it through tasks you completed throughout the labs
 - Use the methodology section to describe the material
 - Use checkpoints and competition for the results and discussion

Audience for ROB 550 Reports

- Assume the audience is someone who is **unfamiliar** with the material included in the report.
 - Good to think of it being yourselves at the beginning of the semester
- This means that you cannot refer to any terms commonly used in labs or lecture without defining them.

Writing the Report: Recommendations

- Utilize sections and subsections!
 - Makes it much easier to organize your thoughts and improves readability
- Do not assume readers' knowledge on material covered in lab and lectures.
- Write the sections on tasks that you worked on and make sure to peer review other sections.
 - To emphasize, peer review!
- Make sure to answer the recommended questions on the lab document to ensure that you are not missing any key points.

Addressing the Requirements of the Report

- We will provide a document that includes all the questions we recommend you answer within your report.
 - These should not be answered one-by-one, but integrated into the report in a readable manner.
 - i.e. some questions may best be answered in the methodology sections while some answered in the discussion section.
- Make sure to fill out this document with the specific pages and sections where you answer these questions.

Requirements for Submission

- A .zip file containing:
 - a. The latest version of your working code
 - b. A .pdf of an 8-page report with an optional appendix
 - c. The document containing the required questions to answer, filled with the location in the report where you answered them.
 - d. A .pdf of the following text with each members signature on them, including times at which the group regularly met:
 - *I participated and contributed to team discussions on each problem, and I attest to the integrity of each solution. Our team met as a group on **[DATE(S)]**.*