CS 309: Autonomous Robots
FRI I

Final Papers

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What goes into your paper?

- This depends on the type of content

- Does your paper evaluate
  - Software?
  - A device?
  - A machine learning algorithm?
  - Something about HRI?

- Is your algorithm the important thing, or the results of a study?

Sections (in general)

- Abstract
- Introduction
- Background
- Method/Approach/Methodology
- Experimental Setup / Evaluation
  - Experimental Setup – Testing a scientific hypothesis
  - Evaluation – Testing the performance of a system
- Results
- Discussion
- Conclusion

Abstract

- Very briefly summarizes the paper
  - Usually 2 paragraphs, hitting only the high points
  - “We designed a robot which uses a deep network and monocular computer vision to follow people in a hallway. We set up an experiment <details>. We found that the system works <details>.
- It is not a “teaser” for the rest of the paper. You tell the reader the results and how you found them.
- Building up drama and expectation in scientific papers is not rewarded. They want facts and clarity.

Introduction

- Introduces your problem, your approach, and how you evaluate your system.
- This should "motivate" your problem. Why do you want to solve it?
- This should be written for an audience who are educated in artificial intelligence or robotics in general, but not specifically familiar with your problem.
- Generally, this includes details about other previous work that you or others have done.
  - For instance, if I wrote a paper on deep networks solving Go, I should mention AlphaGo and AlphaGo Zero.

Background

- This is where you establish that your approach is unique.
  - Since this is an intro class, your work does not need to be unique.
- It also establishes that your approach is informed.
  - Your work needs to be informed.
  - You should show that you know what the basic approaches to your problem are, and how others have tried to solve it here, by discussing what they have done.
  - Try to base your background section on those of papers we've read in class.
- This should be FILLED with citations to other people's work, or detailed mathematics describing well-known approaches to your problem.

Method

- This is where you describe your software. Be detailed about the stuff that is unique to you, but skip boring details that aren't news.

- Tell the reader at a high level how your algorithm works, and software fits together.

- Do not tell the reader:
  - That you purchased hardware on eBay
  - Weird and unnecessary mathematics that do not help their understanding
  - Specifics about a previous study that has nothing to do with the current work.
  - **I've seen all 3, but only during peer review!**

Experimental Setup

- These are the details regarding how your system is tested.
- You do not include results here.

Results

- These are your results, both in terms of the raw statistics and how they are to be interpreted.
  - Classical formats divorce the results from their interpretation, but that has fallen out of favor in Computer Science.
  - “This number is lower, therefore, the robot was moving faster.”
- You should generally include statistical tests that demonstrate your point.
  - “Results were statistically significant ($F(32,3)= 8.2$, $p=0.01$).”

Discussion

- Why do people care about your results?
  - “Our finding that people are likely to tune out dull, humming noises, but attend to sharp, sudden noises tells us that alarms should be sharp and sudden.”

Conclusion

- Briefly recaps the paper, including what you have done and the results of any experiment.
- Discusses the significance of the finding.
- Discusses potential usage of the results or future work.
- ABSOLUTE MAX OF 3 PARAGRAPHS, GENERALLY 2.

Writing your papers

- Be brief, concise, and precise in your wording
- Do not write extraneous details, oversize your figures, or add unnecessary verbiage to take up space
- Write with clarity
- Do not hide information, try to build a story, or write for dramatic effect. The point is to convey the facts. Make your work interesting and exciting.

Writing your papers

- Start early.

- Think about what you will write in your paper right at the start. It will guide how you do your work.

- Your paper is not the place to beg for points or explain that you experienced compiler problems or setbacks during your project.
  - It should explain your system or experiment.
  - Would you want to go to the talk of a scientist who spends half of the time explaining that OpenPose was difficult to compile and that their computer was kind of slow?

Writing your papers

- Use figures that help people to understand your work. Omit figures that do not, save perhaps one figure that simply shows the robot or simulation.

- Use standard methods for presenting tables, numbers, and charts.

- Any table, chart, or figure appearing in the paper *must* be referenced in the text of the paper.

- Any table, chart, or figure must *also* be understandable simply by looking at the figure or its caption.

Writing your papers

- If you can, use error bars or standard deviation bars as appropriate on charts.

- If you can, establish statistical significance using standard statistical tests.

- If you know that your numbers are significant or not significant, mark them with asterisks on the chart.
  - 1 asterisk – $p <= 0.05$
  - 2 asterisks – $p <= 0.01$

Writing your papers

- In scientific writing, you are building an argument for either why your approach is good, or why you some hypothesis is true or false.

- You must back your argument with:
  - Citations
  - Proofs, logic, or other demonstrations of correctness in the text of the paper
  - Experiments (most papers will have at least 1 experiment)

Writing your papers

- When you use citations, they are not quotes from other papers.

- You state the fact that you care about, and put the citation directly after in the same sentence.

- Example:
  - Self-modeling processes can lead to more-accurate calibration between traditionally independently modeled components, as the systems are mutually-calibrated to each other during the self-modeling process [1].

Writing your papers

- Proofread your paper.

- Think about it like this. If you submit to a conference or journal, that paper will be there forever, and people will literally read it for the rest of your life.
  - Can you imagine a student coming up to you at a conference when you are 60 telling you that they noticed an embarrassing typo or error in your work from today?