

Systems Paper Writing

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Abstract

- What needs to be achieved and what will allow it? Give a one line example.
- Current setting, problem (even after taking precautions)
- Current approach, our point of view on current approach
- Our Solution: features, differences, and results
- What drove the solution?

Introduction

- Current Setting in detail. Provide Scale but do not put limits unless can be cited/justified.
- Why solve the Problem? List Applications and why they require the problem to be solved.
- Thesis statement should be clear.
- Other approaches and limitations.
- Give an example too why current approach is insufficient.
- The trend going in the future and how the limitations will hinder.
- Current requirements. If there are any complex requirements, how can we make it easier?
- Introduce new technologies.
- Our approach, how it is inspired by the past work.
- Any guarantees system provides? Why are these guarantees needed?
- Throw in a figure to give an overview of the system.
- Features, difference from current from current approach. If there are any drawbacks with our approach, how to overcome it?
- Any optimisations performed and when they are useful/useless?
- What do you achieve?
- Challenges faced and solution (also include limitation of the solutions)
- Installation and setup
- How evaluation is done and what do the results show.
- Any interesting observations
- List of contributions

Background and Motivation

- Traditional/Dominant design: Show comparison of both.

- Go by problem by problem
- Include the assumptions you take to generalise for your research.
- Include definitions.
- Show your testbed and how it is a reasonable equivalent of the industry.
- Trends observed in the test-bed. Show using graphs. Give reason for these trends.
- Mention features, scale, limitations, throw in figures and examples to illustrate it
- Limitation of features, size, and cost.
- Benefits of our approach

Design

- What do you want to achieve? How does it help? (Design Principles). This also may structure the design section.
- Give an overview of the solution: Key insight, define some definitions, how the solution is different from others
- Any changes to the regular system.
- Divide the solution into stages: Any variables you store and how is each stage different from other works, any assumptions you make. Show figure for edge cases.
- For each stage: What benefits it bring compare to related designs. Why it is well suited in the full design. How this stage will stay relevant in future.
- Show tables to illustrate the impact of design changes.
- Relate to current practices and how it will be useful.
- Nice to show in algorithmic form. Describe the steps too.
- Architectural constraints.
- Extensions

Implementation

- What are you validating?
- Hardware/Software used?
- Resources used in hardware/software?
- Make a separate subsection on how did you implement each component of design.
- Include any optimisations you made.

Evaluation

- What are you measuring?
- What are you comparing?
- Resources/Systems used?
- Configuration?
- Setup?
- Workloads
- Results and reasons for the results.

- Limitation of experiments

Related Work

- What work do you build on?
- Any papers, which attempt to solve similar problems?

Conclusion

- Setting, problem, solution, findings and potential.

General writing Tips

- Focus on communicating the idea rather than making it stylish and elegant for the first draft.
- Cut your words ruthlessly
- We want to avoid acronyms unless they're completely standard and well known throughout science
- Vague words: Reader cannot get a concrete picture of what the author is talking about. Some words have broad meanings and lead to confusion.
- Unless they are standard terms, most people aren't going to know your acronyms.
- Passive form is hard to read because it's not the way we talk.
- Omit needless proposition
- Affect is the verb form, effect is the noun form.
- When listing things, make sure all have the same grammar structure.
 - Search engine (noun) to machine learning (verb) is incorrect
 - Web search to machine learning is correct
- Avoid Dangling Modifiers.
- Well studied (might not be a fact, need citation). Well known (fact).
- Do not add 'the' to the system name.
- When in doubt how many examples to share, 3 is often a good number.
- Logical flow of ideas
 - Sequential in time
 - General to specific
 - Logical arguments
- Illustrations are more eye-catching than definitions. The term itself is less interesting, put it at the end.
- When drawing parallels, comparisons -> always draw the implication of it.
- If you are cautious about something; propose how to address it.
- Reviews generally jump directly to tables and figure. They have to be stand-alone. They have to be self-contained.
- The reader should not look at the text to understand what they mean. Acronym and experimental details should be defined.

- Cite or prove each claim
- Always explain why.
 - Why is X hard?
 - Why A lead to b?
- Use mathematics when it is more compact than words.

Figures/Tables

- Do not present the same data in a table and a figure
- Figures: Visual impact, Show trends and patterns, Tell a story, highlight a particular result
- Tables: Give many precise values
- Tables: Stick to 3 horizontal lines.
- Tables: Grey out alternate rows if necessary
- Repeat the same keywords in title, text and figure/table

Specific Writing Tips

- Eliminate there are/ there is. Example:
 - There are many ways in which we can ...
 - We can ... in many ways.
- Compared to: when pointing out similarities
- Compared with: when pointing out differences
- Which comes between commas and contains unimportant information.
- That comes without commas and contains important information.

Writing with verbs

- Verbs move the sentence along, whereas nouns slow down the reader.
- Using strong verbs, avoiding turning verbs into nouns, and not burying the main verb
- Don't put too much distance between the subject of the sentence and the main verb. User does not know where you are going with the sentence.
- Example: words in parentheses replace the words preceding it to make it better.
 - Loud music came (exploded) from speakers.
 - Entire arena moved (shook)
 - Hungry crowd gets (leaped) on its feet.

Sentence and paragraph structure

- Vary your sentence structure by using a variety of punctuations.
- Dashes are versatile, you can add description, extra tidbit, description in the middle of the sentence and it works.

- Power of separation: least (separation) to most => comma, colon, dash, parenthesis, semi-colon, period.
- Increasing formality: dash, parenthesis, rest.
- Use dash and parentheses sparingly.
- Use semicolons to separate items in the list. Specifically, when the items in the list contain internal punctuation.
- Parentheses are used to insert afterthought, an explanation, or some additional details. Sentence is complete without the parenthesis. You are giving permission to your reader to skip it.
- Use colon after an independent clause to introduce a list, quote, explanation, conclusion or amplification.
- In some cases, colon can replace the semi-colon, but only when amplifying or building on the first clause.
- And, or, but need to follow same grammatical structure
- Subject, verb, object (and, or , but) subject, verb, object
- 1 paragraph = 1 idea
- Keep paragraphs short
- Give away the punch line early - similar to topic sentence, but topic sentence requires to write aim of the sentence first, which does not work best every time.
- Avoid transition words - limit to just "but" and "and".
- Reader will remember the first and last sentence of the paragraph

Writing Process

- Set realistic goals:
 - Write 400 words
 - Write 2 paragraphs
- Pre-writing
 - Collect, Synthesize, and organize information
 - Brainstorm take home messages
 - Work out ideas away from computer
 - Develop a roadmap/outline
- First Draft
 - Putting your facts and ideas together in organized prose
 - Get down the ideas in complete sentences and in-order.
 - Focus on logical organization more than sentence-level details.
- Revision
 - Read the writing out loud. You can hear awkwardness, repetition etc.
 - Do a verb check - passive, to-be verbs, buried verbs
 - Organizational review: tag each sentence that sums up the main point.
 - Move around paragraphs to combine the ideas.

Additional Resources

- Writing in Sciences on coursera: <https://www.coursera.org/learn/sciwrite>
- Writing for computer science (Justin Zobel)
- Heuristics for Scientific Writing (a Machine Learning Perspective):
<https://approximatelycorrect.com/2018/01/29/heuristics-technical-scientific-writing-machine-learning-perspective/>
- Prof Sherry's Systems Research Paper Evaluation Rubric:
<https://docs.google.com/document/d/14g-4xTMwJ4YL61qOcaH6bJWKH59Pk1S-FB1KjeMS4/edit>