How to Read and Write Computer Science Papers

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Reading Computer Science

1. Find out what subject matter is covered by the article.
2. Identify the purpose of the article.
3. Identify the individual parts or components of the article and analyze these parts in the same way as the whole.

Determine the Subject matter

- First reading of the paper
  - Read the
    - title/abstract
    - introduction
    - conclusions
- Use the first reading to determine the subject matter of the paper and the relevance of the paper to your topic.

Identify Purpose

- Second Reading of the Paper
  - Read all sections of the paper (including those already read)
    - Skim through proofs or algorithms
    - Read all other area for understanding and comprehension
- Be able to summarize the paper when done with the second reading.
  - Examples
    - Determine whether it is trying to solve a specific problem or problems.
    - Does it provide an exposition of a particular field of computer science?

Identify Individual Components

- Third Reading of the paper
  - Carefully read the entire paper
    - make sure to understand every step of the proofs, algorithms and computations
- Be able to
  - identify the different components and parts of the content
  - make sure you see how everything ties together

Deciphering Proofs

- Determine the proof method used by the author
- Read over the proof making sure that you see how the author proceeded from each step to the next
- Try to prove the claim yourself.
  - Usually takes at least three or four attempts before making headway
  - When you are honestly stuck, refer to the article
  - At some point, a new fact will come to light
    - reference to lemma or theorem
    - knowing the point of a lemma or theorem
    - an unusual algebraic manipulation
  - Annotate both your notes and the article as you work through the proof yourself

Over View of a Paper

1. The aim of a paper is to stake out a claim.
    1. The writer will state and prove as strong a version of its main theorem as possible.
    2. Often slightly weaker theorems are easier to prove
2. Emphasis is on novelty.
    1. Don't discuss that which is already known (for you that is high school and lower division undergraduate information)
    2. Don't give the routine arguments (again these are arguments which you would expect high school students to be able to do)
3. Focus is very specific
4. A paper contains new ideas

Definitions of Problem Articles

1. An article is **uninformed** if it ignores a known fact that, had it been used by the author, would have improved the text significantly.
2. The article is **misinformed** if it uses other material incorrectly or in an inappropriate way, therefore rendering its own claims invalid.
3. The article is **illogical** if its arguments are invalid.
4. The article is **incomplete** if it leaves important aspects unaddressed

Things to Avoid

- Too much motivational material - three reasons are enough - one really good reason is best
- Describing the obvious/unnecessary parts of the results
    - "Obvious" is defined as any result that an undergraduate from the SAU CS program would suggest as a solution if you pose the problem to them
    - a detail is unnecessary if its omission will not harm the reader's ability to understand the important novel aspects of the result.
- Spelling errors
- Text in Arial: Arial and other sans-serif fonts are fine for slides and posters, but are harder to read in continuous text. Use Times Roman or similar serif fonts.

Outline of a Paper

- Abstract - typically not more than 100-150 words. Identify the problem through specific motivation and describe what you solve.
- Introduction
  - Be Brief!
  - Introduce the problem, outline the solution, include a clear statement about why the problem is relevant and how your work differs from other work.
  - This Section is all about capturing interest!
- Related Work - always try to tie it to work done by the organizers of a conference, journal or class
- Implementation - Completely describe the solution
  - What we did: Our solution
  - How our solution works

Outline of a Paper Continued

- Evaluation
  - How we tested our solution.
  - How our solution performed
  - Comparisons to that of other solutions mentioned in related work, how do these results show that our solution is effective
  - Context and limitations of our solution (should lead up to summation in next section)
- Conclusions and Future Work
  - The Problem we solved: the most succinct statement of the problem in the paper, ideally ONE sentence
  - Our solution: again succinct.
  - Why our solution is valuable
  - What will we do next to
    - Improve our solution
    - Apply our solution to a harder or more realistic versions of the problem
    - Apply our technique to a related problem.
- Bibliography - follows the conclusions section

Body of the Paper and Bibliography

See Dr. A's resources online:

- `brain.scotnpatti.com/computingwiki/WritingTechnicalPapersInLaTeX`
- `brain.scotnpatti.com/computingwiki/DrAndersonsRulesForWritingPapers`

Acknowledgements

This presentation contains information compiled by Alet Rout, Jonathan Shewchuk, Henning Schulzrinne, and Scot Anderson. You will find the web page links below.

1. Alet Roux: `www.math.ucdavis.edu/\char126\relaxtlewis/rfg/jclub/read_math.pdf`
2. Jonathan Shewchuk: `www.cs.cmu.edu/\char126\relaxjrs/sins.html`
3. Henning Schulzrinne: `www1.cs.columbia.edu/\char126\relaxhgs/etc/writing-style.html`
4. Scot Anderson: `brain.scotnpatti.com/computingwiki/DrAndersonsRulesForWritingPapers`