

Questions to think about when reading papers (from Philip W. L. Wong, "How to Read a CS Research Paper," 2014)

Comprehension

The first lesson to reading research papers is learning to understand what a paper says. A common pitfall for a beginner is to focus solely on the technicalities. Yes, the technical content is very important, but it should in no way be the only focus of a careful reading. In general, you should ask yourself the following four questions when you are reading a research paper.

1. **What is the research problem the paper attempts to address?** What is the motivation of the research? Is there a crisis in the research field that the paper attempts to resolve? Is the research attempting to overcome the weaknesses of existing approaches? Is an existing research paradigm challenged? In short, what is the niche of the paper?
2. **What are the claimed contributions of the paper?** What is new in this paper? Is a new question being asked? Is there a new understanding of the research problem? A new methodology for solving problems? A new algorithm? A new breed of software tool or systems? A new experimental method? A new proof technique? A new formalism or notation? A new evidence to substantiate or disprove a previously published claim? A new research area? In short, what is original about this paper?
3. **How do the authors substantiate their claims?** What is the methodology adopted to substantiate the claims? What is the argument of the paper? What are the major theorems? What experiments are conducted? Data analyses? Simulations? Benchmarks? User studies? Case studies? Examples? In short, what makes the claims scientific (as opposed to being mere opinions)?
4. **What are the conclusions?** What have we learned from the paper? Shall the standard practice of the field be changed as a result of the new findings? Is the result generalizable? Can the result be applied to other areas of the field? What are the open problems? In short, what are the lessons one can learn from the paper?

Evaluation

An integral component of scholarship is to be critical of scientific claims. Fancy claims are usually easy to make but difficult to substantiate. Solid scholarship involves careful validation of scientific claims. Reading research paper is therefore an exercise of critical thinking.

1. **Is the research problem significant?** Is the work scratching minor itches? Are the authors solving artificial problems (toy problems)? Does the work enable practical applications, deepen understanding, or explore new design space?
2. **Are the contributions significant?** Is the paper worth reading? Are the authors simply repeating the state of the art? Are there real surprises? Are the authors aware of the relation of their work to existing literature? Is the paper addressing a well-known open problem?
3. **Are the claims valid?** Have the authors been cutting corners (intentionally or unintentionally)? Has the right theorem been proven? Are there errors in proofs?

Problematic experimental setup? Confounding factors? Unrealistic or artificial benchmarks? Comparing apples and oranges? Methodological misunderstanding? Do the numbers add up? Are the generalizations valid? Are the claims modest enough?

Synthesis

Creativity does not arise from the void. Interacting with the scholarly community through reading research papers is one of the most effective ways for generating novel research agendas. When you read a research paper, you should see it as an opportunity for you to come up with new research projects. The following is a list of questions you can ask to help in this direction. (Of course, this list is not supposed to be exhaustive.) *Be very skeptical of work that is so “novel” that it bears no relation to any existing work, builds upon no existing paradigm, and yet addresses a research problem so significant that it promises to transform the world. Such are the signs that the author might not be aware of existing literature on the topic. In such a case, the authors could very well be simply repeating works that have already been done decades ago.*

1. What is the crux of the research problem?
2. What are some alternative approaches to address the research problem?
3. What is a better way to substantiate the claim of the authors?
4. What is a good argument against the case made by the authors?
5. How can the research results be improved?
6. Can the research results be applied to another context?
7. What are the open problems raised by this work?
8. Bottom line: Can we do better than the authors?