

# How to Read a CS Research Paper?

- This PPT highlights some points a young researcher should bear in mind when reading a CS research paper.

# -1- Comprehension

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

# Question 1

- What is the research problem the paper attempts to address?
- What is the motivation of the research work?
- Is there a crisis in the research field that the paper attempts to resolve?
- Is the research work attempting to overcome the weaknesses of existing approaches?
- Is an existing research paradigm challenged?

In short, **what is the niche**[ 壁龛;合适的位置  
(工作等) ;有利可图的缺口, 商机;] **of  
the paper?**



# Question 2

- What are the claimed contributions of the paper?
- What is new in this paper?
- A new question is asked?
- A new understanding of the research problem?
- A new methodology for solving problems?
- A new algorithm?
- A new breed of software tools 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?

# Question 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)?

# Question 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?



- Every well-written research paper contains an **abstract**, which is a summary of the paper. The role of an abstract is to outline the answers to the above questions. **Look therefore, first to the abstract for answers.** The paper should be an elaboration of the abstract.
- Another way of looking at paper reading is that every good paper tells a story. Consequently, when you read a paper, ask yourself, “**What is the plot?**” The four questions listed above make up an archetypical plot structure for every research paper.

## -2- 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 (aka strawman[a weak or sham argument set up to be easily refuted, 容易被驳斥的软弱或虚假的论点])?
- 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**?

- Are the claims valid?
- Have the authors been cutting corners[投机取巧] (intentionally or unintentionally)?
- Has the right theorem been proven?
- Errors in proofs? Problematic experimental setup? Confounding factors[混淆变量]?
- Unrealistic, artificial benchmarks?
- Comparing apples and oranges?
- Methodological[方法论] misunderstanding?
- Do the numbers add up?
- Are the generalizations valid? Are the claims modest[适度的, 适中的] enough?



## -3- Synthesis[综合]

- **Creativity** does not **arise** from the void. Interacting[交互作用] with the scholarly community through reading research papers is one of the most effective way for generating novel research agendas[议程]. 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.)

- What is the crux[症结] of the research problem?
- What are some alternative approaches to address the research problem?
- What is a better way to substantiate the claim of the authors?
- What is a good argument against the case made by the authors?
- How can the research results be improved?
- Can the research results be applied to another context?
- What are the open problems raised by this work?
- Bottom line: Can we do better than the authors?

## -4- Paper Review

- A **paper review** is a short essay (3–4 pages) reporting what you have learned from reading a research paper. Writing reviews for the papers you have read is a great way to sharpen your paper reading skills. Such a review is typically structured in three sections — summary, evaluation, and synthesis.



- 1. **Summary.** Give a brief summary of the work in your own words. This section demonstrates your understanding of the paper, and as such it should answer the four questions outlined in Section 1. It is imperative that you use your own words to summarize the paper. Another way to think of it is that you are writing an alternative, elaborate abstract for the paper.

- **2. Evaluation.** Evaluate the work by answering the questions outlined in Section 2. Learn to be fair: point out both the strengths and weaknesses of the work. If you are reading a classical paper that has been published for a while, make sure you are reading the paper in the right historical context: What seems to be obvious now might have been groundbreaking then.

- 3. **Synthesis.** Generate any interesting thoughts you have on the work by consulting the list of questions in Section 3.



# -5- Review for Publication

- When a research paper is submitted to a conference or a journal, it will undergo a peer review process, in which the paper is subject to the intense scrutiny[详细的检查] of peer researchers. The referees[审阅人] who review the submitted paper will read the paper in more or less the same way as we outlined in Sections 1 and 2, and then they will write up a referee report in a style similar to the paper review discussed in Section 4. Based on the referee reports, the program chair of a conference or the editor of a journal will then make the decision of whether to accept the paper. It is therefore instructional to understand how a referee go about reviewing a paper, and learn to read research papers like a professional.