How to write academic papers

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2025-09-03

How to Write an Academic Paper

A crucial point for submitting to academic journals and international conferences is that the purpose of peer review is to evaluate whether a paper is written correctly, not to directly evaluate the research itself. It is rare for a research topic to have no significance. Most rejection reasons in peer review stem from the paper's failure to properly convey the research's significance, which may actually exist. While there may be some social significance in simply publishing a method without considering how to articulate it, in that case, it would be better to publish on a personal blog, arXiv, or in a competition, as there is no reason to submit to a peer-reviewed journal or academic conference. Therefore, the goal of evaluating whether a paper is written correctly is expected to become even more important in peer review. The following sections will explain each item separately, but all of them should be explained in this order in the introduction, and the subsequent sections should be structured to clearly cover all of these points.

Research Objective

First, the research objective must be clear in the paper. In many cases, the goal is to solve some kind of problem. First, the problem formulation itself must be clearly defined using both natural language and mathematical formulas (although mathematical formulas may not be necessary in the introduction, they should always be possible to formulate in computer science). Furthermore, the significance of solving that problem formulation must also be explained. At least one of the following is considered necessary:

- Provide specific examples of how solving it will contribute to society.
- Provide examples of related research that demonstrate how much it will stimulate the intellectual curiosity of the academic community to which it is submitted.

To be able to write this well, knowledge from all fields of humanities, social sciences, natural sciences, mathematics, and computer science may be necessary.

Common Rejection Reasons in Peer Review

- A clear definition of the problem formulation, understandable to researchers outside the specific field, is not provided in the paper.
- The paper fails to provide specific examples explaining why the problem formulation is significant to society or the academic community.

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Why Existing Research is Insufficient

After stating the research objective, you must explain why existing research is insufficient to achieve that objective. A common mistake here is to only discuss methods similar to the proposed one. It is often the case that the research objective can seemingly be achieved by a classical, well-known method, even if it is completely different from the proposed method. Therefore, you must explicitly state the reasons why those methods cannot achieve the research objective. To do this, it is not enough to only learn the latest methods; you must also have a balanced understanding of classical methods.

Common Rejection Reasons in Peer Review

- The research objective seems achievable with a classical, well-known method or a combination of them, yet the paper fails to explicitly explain why the author's proposed method must be chosen over such classical methods.

Idea and Rationale

After clarifying that existing research cannot achieve the research objective, you should state what kind of idea you have to solve the problem. Even more important is to state why that idea is suitable for the problem.

Common Rejection Reasons in Peer Review (Personally, the most common)

- The idea is based on some theory, but the paper does not clarify how that theory (often a mathematical theory not well-known to computer scientists) helps in achieving the research objective.

Proposed Method

After clarifying your idea and its rationale, you should state how your proposed method gives form to that idea. The idea and the proposed method must be as directly linked as possible. Otherwise, the explanation of the idea itself is insufficient. Conversely, it is often the case that a proposed method is derived using complex mathematical formulas, but can be derived much more simply and naturally from another idea, and the complex formulas are not essential to the core idea of the proposed method. Therefore, when you see complex formulas, you need the skill to not be swayed by their complexity and to constantly confirm their essential meaning.

Common Rejection Reasons in Peer Review (Personally, the most common)

- There is a gap between the explained idea and the actual proposed method. Some part of the proposed method's components is not explained by the idea. Or, the proposed method can be derived much more simply than the idea presented in the paper, and the idea does not represent the essence of the proposed method.

Selection of Evaluation Method for the Proposed Method

Once a method has been proposed, it is necessary to select an evaluation method (including the selection of baselines if comparisons are involved) to evaluate it. The evaluation is to determine

whether the research objective has been achieved. Therefore, in the paper, it must be made clear why the chosen evaluation method is suitable for evaluating whether the proposed method has achieved the research objective. It is very common for the research objective and what the evaluation method can evaluate to not align. Therefore, you need to know various evaluation methods and have a good understanding of what each one evaluates.

Common Rejection Reasons in Peer Review

- The paper does not explain why the selected evaluation method (including the choice of baselines) is appropriate for evaluating whether the research objective has been achieved. Or, the evaluation method is unrelated to the achievement of the research objective.

Selection of Evaluation Method for the Idea (Especially in Engineering Papers)

Even if the proposed method performs well, the reason for its success may not necessarily be due to the quality of the original idea. The contribution of the original idea to the performance of the proposed method is often confirmed through experiments with synthetic data or ablation studies.

Common Rejection Reasons in Peer Review

- Synthetic data experiments or ablation studies are vague, and the paper does not explicitly state why they connect to the evaluation of the proposed method's idea.

Evaluation Results

After conducting the evaluation, you should discuss the results. At this point, you must explicitly state what results are consistent with what would be naturally expected from the previous explanations in the paper, and what results were unexpected. Furthermore, for results that were not naturally expected from the previous explanations, the reason for them must be analyzed and stated in the paper.

Common Rejection Reasons in Peer Review

- There are unexpected evaluation results, but the reasons for them are not explained.

Limitations

After the research has been explained, you must state the research's limitations, that is, what was achieved and what was not achieved by the research. This, in turn, clarifies what future work is needed for the reader.

Common Rejection Reasons in Peer Review

- The research limitations are not stated.

Reason for Using Mathematical Formulas

Mathematical formulas are used to ensure the interpretation of the paper is as unique as possible, assuming a wide range of readers. The purpose is not to use a specific field of mathematics for its own sake.