

An Outline for Quantitative Research Papers

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Abstract.

About this document. I propose an outline for quantitative research papers. This is a difficulty I often observe in people starting a research career, particularly PhD students. Thus, I believe this outline might help to create a mental map of the work associated to writing a paper, as well as preparing the work necessary to write it. The proposed outline is by no means definitive and rigid. These are general guidelines that should be adapted to specific situations. I have further details on the topic of writing scientific papers in a tutorial I created on that subject (Paiva, 2013). It can be downloaded from my webpage at <http://rppaiva.dei.uc.pt/publications/Tutorials/papers%20-%20how%20to%20write.pdf>.

About abstracts in general. Most people only read the abstract before deciding whether it is worth reading the entire paper. Therefore, you should provide key information on the relevance of paper and why it is worth to read more:

- Problem to address: 1 sentence
- (Scope and Motivation: 1/2 sentences)
 - o Why it is important to address this problem? (only if space available)
- Methodology: 2/3 sentences
 - o How is the problem addressed? (brief overview)
- Results and Discussion: 2/3 sentences
 - o Summary of quantitative results
 - o Summary of key findings
 - o Impact of the results

Keywords: scientific research papers, quantitative research, scientific writing, general paper outline.

1 Introduction

Introduce the topic under study and the roadmap of the paper. You should provide answers to what, why, how (and maybe who, when, where), state the contributions of the paper to extend the state of the art and its impact.

- Problem to address: 1 sentence (what?)
 - o Similar to the abstract
- Scope and Motivation: (why?)
 - o Context (social, scientific, historical, economic, cultural, ...)

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- Motivation: Why is it important to address this problem?
 - Scientific, social, economic, cultural impact of addressing the problem
 - Critical analysis of the state of art and identification of current limitations (this could be in a specific section – see below)
- Objectives (what? - more detailed)
 - General objective: main research question
 - Specific objectives (if there are any)
- Methodology overview: (how?)
 - Hypotheses of solutions to the problem
 - Justification of the hypotheses
 - Brief description of proposed solution: similar to the abstract (to be detailed in the methods section)
- Summary of results: a bit more detailed than the abstract
 - Summary of quantitative results
 - Summary of key findings
 - Impact of the results
- Contributions of the paper (may be itemized)
 - Original contributions: methods, datasets, comparative analysis, etc.
- Outline of the paper

2 Literature Review

Depending on the nature of paper, e.g., conference paper, it may be placed in the introduction (see above). This section may also be called “Related Work”, “State of the Art Review”, etc.

- Critical analysis of the state of art
 - Organized according historical sequence, types of methods, etc.
 - Sometimes it is useful to organize the state of the art in a column according to relevant criteria
- Identification of current limitations in the state of the art
- How will this paper extend the state of the art on the theme under analysis?

3 Methods

3.1., 3.2., ... Description of the proposed methods

- Use diagrams, algorithms, equations to convey information
- Replicability should be a goal, so be detailed but concise and objective at the same time

4 Experimental Setup

This section might be included in the Results and Discussions section if the experimental setup is too simple. When the experimental setup can be regarded as a methodological contribution in itself, it can go to the methods section.

- Data acquisition protocol
- Data pre-processing
- Data annotation

5 Results and Discussion

- Outcome of the proposed methodologies, simulations, calculations, ...
 - o Use tables, figures, etc.
- Thorough data analysis and interpretation of results
 - o Compare your results to the state of the art
 - o Prove the validity of results using statistics (e.g., significance tests)
 - o Perform critical analysis of your findings
 - o Give reasons for observed facts
 - o Give evidence of generality
 - o Address the strengths and limitations of your work
 - o Discuss the theoretical implications of your work

6 Conclusions

- Summary of contributions of the paper (similar to the introduction)
 - o Original contributions: methods, datasets, comparative analysis, etc.
 - o Summary of quantitative results

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- Summary of key findings
- Impact of the results
- Possibilities of future work
 - Suggestions to overtake the current limitations of your work
 - Suggestions to explore other topics

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References

1. Paiva R. P. (2013). “How to Write Good Scientific Papers: A Comprehensive Guide”, Scientific Tutorial, University of Coimbra (Portugal) and National Polytechnic School.