Research Methodology

How to Write a Scientific Paper

Part One

Overview

- Why we write a paper

- Different types of papers

- How to write a paper

- Some tools

- Conclusion

Why we write a paper?

- To describe interesting new knowledge in an understandable way

- To get published. . .

- Must describe previously unpublished work (unless survey paper)

- Publications assist in final preparation of your thesis disseminating your knowledge and experience

Why paper?

- It gives you an academic profile and raises the profile of your institution

- Research publications generate income for the University

- Publications enhance your CV and may help in gaining employment

- You may even become rich and famous!

Type of Papers

- Journal papers
  - Often many pages (20 - 30)
  - Surveys or deeper papers
  - Letter
- Conference and workshop papers
  - Full papers (around 10 pages)
  - Short papers (around 5 pages)
  - Poster sessions
- Technical reports
  - Published at a university/company, not reviewed
- Magazines

Our Goals

- To improve the quality of articles
- To manage the submission procedure
- To evaluate Journal measuring factors
- To search and analyze the right journal to submit
- To identify journals to publish in or which journals are the best in a particular discipline

Our Goals

- To write and submit journal articles using time-saving bibliographic management tools
- To deal with the editor response

How to Write a Paper?

- Who is going to read this?
- What is the problem I have solved?
- Which method did I use?
- Is my work new and relevant?
- What are my contributions?
- Are there remaining unsolved questions?

How?

- The reader should be
  - Intrigued within the first 5 minutes of reading
  - Excited within 15 minutes
  - Satisfied after 45 minutes

Survey Paper

- Who is going to read this?

- What is the problem area?

- Which methods did people use?

- What are the most relevant contributions?

- Are there remaining unsolved questions?

Paper Structure

- Title
- Affiliation
- Abstract
- Keywords
- Introduction
- Materials and methods
- Results and Discussions
- Conclusions
- References

Check List

- Decide where to submit before writing the paper

- Formulate idea for paper or article

- Discuss with your supervisor and colleagues to determine if a paper should be written

- Search the literature to determine what has been written on the subject

- Write a comprehensive outline

Check List

- Think the article through. Ask yourself if your outline will allow you to present the right amount of data in the best manner

- Gradually expand outline headings into sentences and paragraphs

- Smooth transitions and expend on keywords and ideas

- Rough out illustrations

Check List

- Write the rough draft
- See if you have answered these questions,
  - Introduction
    - Did you properly orient the reader?
    - Did you tell why the study (device, etc.) was needed?
    - Why it is significant or unique?
    - What problem did you solve?

Check List

- Are the scope, limitations, and problems of the study well defined?

- Does the introduction generate enough interest in the reader for him to read the entire paper?

– Body of the Paper

- Have you given necessary background material?

- Is it too much?

- Is the problem, concept, or system adequately and accurately cover the theory, test results, applications, methods of implementation?

- Did you make a point ?

Check List

- Conclusion
  - What was the original problem?
  - How was it solved?
  - Has a conclusion really been made ?
- Revise the draft as required
- Follow the journal's or conference's format
- Proofread manuscript carefully
- Review with your supervisor and Submit

Title

- Must be informative, clear, and meaningful
- Don't be clever or cryptic
- Get the attention of your readers immediately
  - Bad: The effects of stress
  - Good: Is stress killing you?
  - Or: Stress: Is it killing you?
- Don't use symbols in titles
- Imagine someone searching for your paper

Affiliations

- Author and Co-Authors names
- Institutional affiliations
- Postal addresses
- Email addresses

An Example

Bandwidth- and Power-Efficient Multi-Carrier Multiple Access*

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The abstract (read by 87%)

- Summarizes problem, result, and uses
- Between 100–250 words
- Avoid references and acronyms
- Try to "sell" the paper!

Abstract

- A one sentence statement of the purpose
- A description of the participants used in the research
- The results
- Any conclusions being offered

Keywords

- Also named Index Terms
- Used to classify your paper
- Selecting keywords lead to get more citation
- Tools
  - Google AdWords
  - Google Wonder Wheel
  - Word Tracker/Gtrends
  - Keywords Plus (ISI indexed)

Introduction (Read by 43%)

- Explains the background/significance of the paper
- The opening paragraph should be your best paragraph
- The opening sentence should be your best sentence
  - Bad: An important method for internal sorting is quicksort.
  - Good: Quicksort is an important method for internal sorting, because . . .
- Ended by a summary of the organization of the paper

Introduction

- This is not the place for an extensive historical review of the important literature

- It should mention only the most important works that have been done and illuminate the important studies

Background Information (If needed)

- A short introduction to the area
  - Example: "A Brief Review of LR-Parsing"
- Cite references for more details

Problem Definition

- A concise statement of the problem you are solving

- Why it is useful to solve the problem?
  - If your problem is "develop an X algorithm capable of handling very large Y problems in reasonable time"
    - Explain "large problems" and "reasonable time"
    - Then show that other algorithms fail
    - Justify when a solution to this problem is useful

Summary of Contributions

- What was investigated/built and what you found out

- Don't make forward references to technical section

- You're writing a scientific paper, so . . .
  - Opinions must be backed up by arguments or references, otherwise they should be removed

Summary of Contributions

– Facts must be verifiable by the reader

– Be humble—don't use superlatives

- Bad: This is a great algorithm
- Good: We believe this algorithm is useful for the following reasons

Related Works

- Identify all relevant related work with references
  - even if it's old or doesn't solve exactly the same problem
- References must be locatable . . .
  - So don't use "personal communication"
- Compare your work with previous work
  - You must convince the reader that your work is original!
  - Examples and measurements are great for this

Related Works

- Clearly separate your results from their results
- Don't be condescending about other people's work

Method (Read by 12%)

- How you did it,
  - Tests, procedures, methods, experiments, processes, equipment, data structures, algorithms, etc.
- Proofs for algorithms
  - Termination
  - Correctness (soundness, completeness)
- Don't describe dead ends

Method

- This could be divided into several sections and subsections
- The method section of the manuscript describes how the study was conducted
- This information is reported in sufficient detail so that any one can refer to this section and duplicate the study exactly as it was originally done

Results and Discussion

- Convincing examples
- Figures and Tables
- Analysis
- Benchmarks
- Time/Space/Hardware complexity
- Performance

Results and Discussion

- In the Results section, the reader can find what statistical techniques were used to analyze the data and what the result of the analysis were

- In the Discussion section, the author is free to explore important relationships among what has been done in the past, the purpose of the study, the stated hypothesis, and the results of the current study

Results and Discussion

- It is time for an evaluation of what has been done and a "measuring up" to see if the reported results fit the researcher's expectations

- Most technical papers combined the Results and Discussion sections

Summary and Conclusion
(Read by 55%)

- Interpretation of your work: pros & cons
- Limitations of your solution
- Suggestions for "Future Work"
- Rejected alternatives
- Experiences
- Don't just re-word the abstract
  - You may reference figures, equations, etc.

Summary and Conclusion

- Sum up the purpose and findings reported in the manuscript

- Any statement as to what contribution might have been made by the current research and how well the original question was answered

- The implications and limitations of the current study are discussed

Acknowledgements

- Mention anyone who has helped you
- Typically mention grants

Examples

8   Acknowledgments

ACKNOWLEDGMENT

References

- A list of sources that were consulted during the course of the research and the writing of the manuscript
- Make sure all references are referenced
- What goes in the reference depends on the type of publication

Appendix

- Usually contains information that is not essential for understanding the content of the manuscript but it is important for getting a through picture of what happened

- Usually, an appendix will contain original data or drawings

Biography

- Author biography

Georgios B. Giannakis (S'84–M'86–SM'91–F'97) received the Diploma in electrical engineering from the National Technical University of Athens, Greece, in 1981. He received the MSc. degree in electrical engineering in 1983, M.Sc. degree in mathematics in 1986, and the Ph.D. degree in electrical engineering in 1986, from the University of Southern California (USC), Los Angeles.

His general interests span the areas of communications and signal processing, estimation and detection theory, time-series analysis, and system identification, subjects on which he has published more than 150 journal papers, 300 conference papers, and two edited books. Current research focuses on transmitter and receiver diversity techniques for single- and multiuser fading communication channels, comples-field and space–time coding, multicarrier, ultrawideband wireless communication systems, cross-layer designs, and distributed sensor networks.

Dr. Giannakis is the corecipient of four Best Paper Awards from the IEEE Signal Processing (SP) Society (1992, 1998, 2000, and 2001). He also received the Society's Technical Achievement Award in 2000. He co-organized three IEEE-SP Workshops, and guest co-edited four special issues. He has served as Editor in Chief for the IEEE SIGNAL PROCESSING LETTERS, as Associate Editor for the IEEE TRANSACTIONS ON SIGNAL PROCESSING and the IEEE SIGNAL PROCESSING LETTERS, as secretary of the SP Conference Board, as member of the SP Publications Board, as member and vice-chair of the Statistical Signal and Array Processing Technical Committee, and as chair of the SP for Communications Technical Committee. He is a member of the Editorial Board for the PROCEEDINGS OF THE IEEE, and the steering committee of the IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS. He is a member of the IEEE Fellows Election Committee, and the IEEE-SP Society's Board of Governors.

Any Question?

THANKS FOR YOUR ATTENTION