

COMP 516

Research Methods in Computer Science

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Reading Research Papers

- **Research** aims to add the **world's body of knowledge**
 - ↪ Requires a researcher to be aware of what the **world's body of knowledge** (in the area s/he works in)
 - **Frontiers** of the **world's body of knowledge** are **not** documented in **text books**, but in
 - journal articles
 - conference papers
 - workshop papers
 - technical reports
- reliability ↑ ↓ timeliness

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Lecture 11: Reading Research Papers

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Get Organised

- Maintain a database of all the books and papers you read
- Data stored should at least include title, author, place of publication, and storage location
- Preferably you should also keep a record of the answers to some or all of the following questions:
 - 1 What is the main topic of the article?
 - 2 What was/were the main issue(s) that the author identified?
 - 3 Why did the author claim it was important?
 - 4 How does the work build on other's work, in the author's opinion?
 - 5 What simplifying assumptions does the author claim to be making?
 - 6 What did the author do?
 - 7 How did the author claim they were going to evaluate their work and compare it to others?
 - 8 What did the author say were the limitations of their research?
 - 9 What did the author say were the important directions for future research?

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Evaluating Research Papers

- Whenever you read a research paper, you should try to **evaluate** at the same time.
- Try to **answer the following questions**:
 - 1 Is the topic of the paper sufficiently interesting (for you personally or in general)?
 - 2 Did the author miss important earlier work?
 - 3 Are the evaluation methods adequate?
 - 4 Are the theorems and proofs correct?
 - 5 Are arguments convincing?
 - 6 Does the author mention directions for future research that interest you?
- Given the answers to these questions for a number of research papers, you should be able to construct a **research proposal** by considering how you could improve the work presented in them

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Structure of research papers: Questions

- 1 What elements constitute the structure of the papers?
- 2 Are the elements and their order identical for all the papers?
- 3 What characterises each of the elements of the papers?

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Structure of a Research Paper

- 1 Title
- 2 List of authors (and their contact details)
- 3 Abstract
- 4 Introduction
- 5 Related work (part of, or following introduction, or before summary)
- 6 Outline of the rest of the paper
- 7 Body of the paper
- 8 Summary and Future Work (often repeats the main result)
- 9 Acknowledgements
- 10 List of references

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Title

- As short as possible, but without abbreviations or acronyms (unless they are commonly understood)
- As specific as necessary and as general as possible
(e.g. **'The Complexity of Theorem-Proving Procedures'**
 ↪ introduced the notion of 'NP-Completeness'
 ↪ starting point of **complexity theory**)
- Include key phrases which are likely to be used in a search on the topic of the paper
(e.g. **'modal logic'**, **'calculus'**, **'decision procedure'**)
- Avoid phrases which are too common
(e.g. **'novel'**)
- Use phrases that describe distinctive features of the work
(e.g. **'Real-world Reasoning with OWL'**)

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Authors (1)

- An **author** of a paper is an individual who
 - 1 made a significant **intellectual contribution** to the work described in the paper
(in contrast, for example, to a **monetary contribution**);
 - 2 made a contribution to **drafting, reviewing and/or revising** the paper for its **intellectual contribution**
(in contrast, for example, to **spell checking** or **typesetting**); and
 - 3 approved the final version of the paper including references

Some organisations / publishers have strict rules regarding authorship

- Order of authors may depend on
 - subject area: pure theory \rightsquigarrow often alphabetical
 - applied research \rightsquigarrow often based on contribution
 - research assessment
(e.g. bibliographic measures associating order with contribution)
 - cultural context

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Abstract

- Typically not more than 100–150 words
- Should aim to **motivate** people to read the paper
- Highlight the **problem** and the **principal results**
- The abstract will be included in **literature databases**
 - Make sure **key phrases** which might be used in searches are included
(same principle as for titles)
- Keep **references** to a minimum
- Keep **equations** and other **mathematical expressions** to a minimum

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Authors (2)

- In Computer Science, **academic degrees** and **membership of professional organisations** are typically not indicated
- List of authors is typically followed by **contact information** consisting of **affiliation** and **e-mail address** (not postal address)
- Some journals allow authors to provide longer descriptions of themselves including photographs

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Introduction

- State the general **area of research**
(unless this is obvious from the context in which the paper appears)
- Introduce the **problem**
state why the problem is important and/or interesting
- Outline the **approach** taken to solve the problem
- Outline the **solution** or **principal results**
state why the results are important and/or interesting
- Do not repeat the **abstract**
- Avoid platitudes and cliches

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Related Work

- **Related work** is previous work by the same or other authors which addresses the same or closely related **problems** / **topics**
- Section on **related work** gives **credit** to such work and **establishes** the **originality** of the current work
- Extent depends on the **space available** and **relevance of the related work** to the work presented in the paper
Within these two constraints, make sure all related work is cited and correctly described
- Failure to give credit can result in a bad evaluation and kill your paper
- Section on related work is either part of the **introduction** or is placed **at the end of the body of the paper**

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Outline of the Paper

- Typically at the end of the **introduction**
- Describes the content of the **body of the paper** section by section

Example:

The remainder of the paper is organised as follows. In Section 2, we introduce . . . Section 3 describes . . . Finally, we describe future work in Section 5.

(Note that 'Section' is capitalised.)

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Body of the Paper

- Depends strongly on subject area and topic of the paper
- Typical structure of a Computer Science paper on **theoretical research**:
 - 1 Basic definitions
 - 2 Description of a new algorithm, calculus, or formalism
 - 3 Sequence of **theorems** accompanied by **proof** or proof sketches
 - 4 Applications / consequences of the results (optional)
- Typical structure of a Computer Science paper on **applied research**:
 - 1 Architecture of a new system
 - 2 Description of the realisation
 - 3 Evaluation
- Combinations of the two are possible and quite typical
- Papers on **action research**, **case studies**, **surveys**, **experiments** are also common and have their own structure

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Conclusion and/or Future Work

- Summarises the **contributions** of the paper
- Describes the **implications** and/or **applications** of the **contributions** made by the paper
- Outlines **future directions** of **research**

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Acknowledgements

- Acknowledges external [funding sources](#)
- Thanks [non-authors](#) that made a significant contribution
 - [colleagues](#) or [fellow researchers](#) with which the authors had discussions related to the topic of the paper
 - [anonymous referees](#) provided they have given exceptional level of feedback or important insights

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List of References

See lectures on citing and referencing

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Hints

- [Top-down design](#): Start with an outline, then fill in the details
- [Inside-out writing](#): Fill in the body of the paper first, then write introduction, related work, conclusion; finally, write the abstract
- [Diagrams/Tables](#): Are all diagrams and tables readable? Can they be understood?
- [Dependency analysis](#): Is the paper self-contained and are notions presented in the correct order?
- [Factuality](#): Make sure everything stated in the paper is factually correct
- [Interpretability](#): For each sentence check whether it could be misread; if so, try to fix it
- [Optimisation](#): Remove unnecessary parts, shorten exposition
- [Readability](#): Does it read well? Are all parts interconnected?

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Additional Guidance

- Alan Bundy. How to Write an Informatics Paper.
<http://homepages.inf.ed.ac.uk/bundy/how-tos/writingGuide.html>
(accessed 17 October 2011).
- Simon Peyton Jones. How to write a great research paper.
<http://tinyurl.com/6xry58>
(accessed 17 October 2011).
- Jennifer Widom. Tips for Writing Technical Papers.
<http://infolab.stanford.edu/~widom/paper-writing.html>
(accessed 17 October 2011).

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