Seminar High-Performance Computing with FPGAs

How to Write a (Seminar) Paper

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Overview

- goal of the paper
- structure
- language
- correct citations
- further information
- summary

Word-smithing is a much greater percentage of what I am supposed to be doing in life than I would ever have thought.

DONALD KNUTH

- acknowledgement
  - the contents of this lecture (very closely) builds on a presentation by Holger Karl, University of Paderborn.

Goal of a Scientific Paper

- **key point: scientific paper ≠ literature**

- primary goal: efficient communication and transfer of information
- presentation of technical facts
- discussion/comparison of different approaches
- assessments, recommendations
- presentation of conclusions

- goal of a seminar: training these skills by means of sufficiently complex materials

Structure

- paper is structured into distinct parts
- typical structure of a paper (technical report, Master's thesis, research paper, ...)
  - title
  - abstract
  - introduction
  - related work (variant 1)
  - body of the text
  - related work (variant 2)
  - summary, conclusions
  - outlook
  - bibliography
  - appendix
- can vary depending on situation

Title

- find a good balance between
  - accurate specification of the topic
  - bait to attract interested readers

Abstract

- very brief but
  - should contain the essence of everything presented
  - determines whether people will read the paper
  - probably the most important section (indexed by databases)
- structure recommended by Koopman
  - **motivation**: why should we care about the problem and the results? scope of the work (general or specific)?
  - **problem statement**: what problem are you trying to solve?
  - **approach**: how did you go about solving the problem? what methods are used (simulation, analytic model, prototype, ...)?
  - **results**: what is the answer? try to be specific, i.e., instead of "significantly improve" write "accelerate by 15%", leave judgment to readers
  - **conclusions**: what are the implications of your work?
- suggested reading: Philip Koopman, *How to Write an Abstract*, http://www.ece.cmu.edu/~koopman/essays/abstract.html

Introduction

- title and abstract give the reader a rough idea of the topic
- introduction
  - limits the scope of the topic
  - explains the importance of the problem and its relation to other problems
  - touches all areas and background that is relevant for understanding (but no additional areas)
  - creates interest of the reader
  - explains how the topic shall be discussed
  - summarizes the contents in more detail than the abstract
  - presents an overview of the structure of the paper
    - "In the following Section 2 we will introduce ... Section 3 defines our models ... Finally, we draw conclusions and outline future work in Section 9.

Related Work

- presents an overview of other work that is relevant for in-depth coverage of the topic
  - but can discuss each work only briefly
- provides a critical discussion of these works with the presented approach
  - describes the respective advantages and disadvantages, different assumptions, commonalities, possible syntheses
- sometimes presented as the last part before the summary and outlook
  - advantage: the increased background knowledge from reading the paper makes it easier for the reader to understand the connection to related work
  - disadvantage: relation of paper to other work becomes only clear very late in the paper
- special case: survey papers, consist basically only of related work

Body of the Paper

- actual core of the paper
  - precise definition of the assumptions
  - description of the chosen methods for study
    - analysis, simulation, experiment, prototype
  - description of the actual study, experiment or system
    - experimental setup, simulation parameters
  - if possible: presentation of results
    - measurement results
    - experiences with the proposed method, architecture, ...

- no common structure
  - varies strongly with topic
  - presentation usually divided into distinct sections

Summary and Conclusion

- summarizes the results
- discusses results in a wider scope or from a more general perspective
- can issue recommendations if appropriate
  - "the proposed method is promising when applied to ..."
- stresses what can be learnt from the work, which has not been known before
- discusses scope and limitations of the work
- apart from the abstract the most important part of the work

Language – Primary Goals

- **primary goals**
- precision and clarity
  - use the right word, the correct expression
  - use a proper dictionary
    - our University library has excellent online subscriptions: e.g. for Oxford English Dictionary, Oxford Dictionary of American Style, ...
  - consider connotations and associations, in particular in foreign languages
  - beware of synonyms with different connotation
  - present precise details (not everything, but everything relevant)
  - avoid ambiguity (be careful with pronouns, restrictive vs. non-restrictive clauses, ...)
    - that: restrictive clause, no comma
    - which (who, whom): non-restrictive clause, comma

Language – Primary Goals (2)

- **primary goals**
- guide the reader with structured explanations
  - no suspense needed
    - a paper is not a thriller
    - you don't have to save the best part for the end
  - start each section with a brief introduction and conclude with a brief summary
    - allows the reader to put the content into context
  - **explain your findings using a top-down structure**
    - most common problem in my experience
    - example: "*There is method A to do something. And there is method B. And finally, there is method C.*"
      better: "*There are three methods A, B, and C. A and B share property Y, while C uses approach Z.*" Then, for example, explain each method in a subsection
  - use enumerations and lists to express structure

Language – Secondary Goals (1)

- **secondary goals**
- familiarity
  - the reader must know your language and terms
  - define unknown terms and abbreviations on first use
  - beware of jargon
- forthrightness
  - direct language
  - don't use passive just to avoid the first person
    - "I, the author" or "we = we, the authors" is always acceptable
    - "we = you, the reader and I, the author" is acceptable most of the time
    - "we = we, the humanity" (or similar) is in general not acceptable
  - English allow to "activate" almost everything, e.g.,
    - "the algorithm computes .... " instead of " ... is computed by the algorithm"

Language – Secondary Goals (2)

- **secondary goals**
- conciseness
  - no embellishments – write sentences in their simplest form
  - eliminate unnecessary, empty, bloated phrases and repetitions, e.g.

    instead of *„In order to find the solution of the equation, we can use one of two alternative methods"* write
    "To solve the equation, we can use one of two methods“
- fluency
  - sentences and paragraphs connect logically to each other
  - take up and continue the flow of thought
  - use bridging words and phrases
  - use similar expressions for similar concepts
  - discuss one aspect or point of view in one paragraph and take up the discussion in the following paragraph from a different point of view

Language – Secondary Goals (3)

- **secondary goals**
- vividness
  - explain using examples or analogies
  - but stay precise!
- illustrations
  - ... are easy to remember
  - ... can explain, exemplify
  - ... need captions such as Figure 1, or Table 5 allowing to reference them in the text
  - label illustrations (axes, legends, ...)
  - try to avoid placing illustrations in the text before the first reference

Language – Secondary Goals (4)

- style
  - alternate between short and long sentences
  - use appropriate punctuation
  - avoid footnotes and endnotes

- note
  - content is more important then elegance
  - don't follow the rules blindly, but don't break the rules carelessly

Citing Correctly

- always cite with reference to original source – intellectual honesty
- bibliographic entries should make finding the sources as easy as possible
- different cases
  - bibliography contains all bibliographic information
  - reference in the text $\rightarrow$ index in the bibliography
    - in most cases, numerical reference: [17]
    - rarely abbreviations for author and year of publication: [MS97]
    - almost never: author, year (Müller und Schmidt, 1997)
  - wording
    - ... these results could be validated [17].
    - As discussed in [18], ...
    - As Müller und Schmidt [17] have shown, ...
    - Never: [18] discusses ... (an article doesn't discuss anything)

Citing Correctly (2)

- complete source
  - author(s)
  - title
  - kind of publication? (book, journal article, part of conference proceedings, part of a book, technical report)
    - title of the journal, book, etc.
    - editor (if appropriate)
    - page numbers
  - year, month and place of publication (location of the publisher)
  - publisher
  - URLs can be helpful, but should be persistent, if possible use doi (document object identifier)
  - additional information on demand
- use tools for collecting bibliographic information
  - recommendation: BibTeX

Summary

- the goal of a paper is efficient communication of information
  - everything else is just a means to an end
- structure of a paper
  - abstract, introduction, body of text, summary
- language
  - primarily: precision, clarity and structure
  - primacy of the content
  - take care of good style
  - write English
- cite correctly and completely