



Recent Advances in Computer Architecture

How to Write a Paper in Computer Engineering

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Remarks

- These are tips for presenting the results of original research
- Review paper is not original research but tips might still be useful

- Paper structure
- Paper title
- Abstract
- Introduction
- Related Work
- The Design
- Experimental Evaluation
 - Methodology
 - Results
- Conclusions
- References

Paper Structure

In general, papers are structures along established lines

Paper Title

Abstract

1. Introduction
2. Related Work
3. The new method, algorithm, hardware design
4. Experimental Evaluation
5. Conclusions

References

Paper Title

- Title should be concise, to the point, reflect the contents of the paper, not too general, ...
- Recently “catchy” titles are in:
 - Debunking the 100X GPU vs. CPU myth: An evaluation of throughput computing on CPU and GPU
 - Translation caching: skip, don't walk (the page table)
- Common is also the name of a proposal, followed by a short description:
 - WiDGET: Wisconsin Decoupled Grid Execution Tiles
 - Aergia: Exploiting Packet Latency Slack in On-Chip Network
- Two recent ((to be) submitted) papers by the author:
 - Improving the Scalability and Capabilities of the Nexus Hardware Task Management System
 - Amdahl's Law for Predicting the Future of Multicores Considered Harmful

Abstract

- Brief summary of the research article
- Should help the reader quickly ascertain the paper's purpose
- Should arise interest

Wikipedia: An academic abstract typically outlines four elements germane to the completed work:

1. The research focus (i.e. statement of the problem(s)/research issue(s) addressed);
 2. The research methods used (experimental research, case studies, questionnaires, etc.);
 3. The results/findings of the research; and
 4. The main conclusions and recommendations
-
- Size: 100-500 words
 - Please try to avoid “In this paper ...”

Abstract Example

Recent advances in computing have led to an explosion in the amount of data being generated. Processing the ever-growing data in a timely manner has made throughput computing an important aspect for emerging applications. Our analysis of a set of important throughput computing kernels shows that there is an ample amount of parallelism in these kernels which makes them suitable for today's multi-core CPUs and GPUs. In the past few years there have been many studies claiming GPUs deliver substantial speedups (between 10X and 1000X) over multi-core CPUs on these kernels. To understand where such large performance difference comes from, we perform a rigorous performance analysis and find that after applying optimizations appropriate for both CPUs and GPUs the performance gap between an Nvidia GTX280 processor and the Intel Core i7 960 processor narrows to only 2.5x on average. **In this paper**, we discuss optimization techniques for both CPU and GPU, analyze what architecture features contributed to performance differences between the two architectures, and recommend a set of architectural features which provide significant improvement in architectural efficiency for throughput kernels.

Research focus

Research method

Research focus

Research method

Results / findings

Conclusions and
recommendations

Introduction

- The introduction, by definition, treats the same topics as the abstract but in more depth
 - Avoid using same sentences in abstract and introduction
- I often use 4 paragraphs:
 - §1: What is the problem addressed? Why is it an important problem?
 - §2: What do you propose? What are its main features? Often this paragraph starts with “In this paper we ...” or “This work presents ...”
 - §3: What are the main contributions? Highlights of results. Common is a bulleted list: “The main contributions of this work are:
 - ...”
 - §4: Paper organization: “This paper is organized as follows. Section 2 discusses related work. ...”
 - Please avoid “The remainder of this paper ...” because the paper has just started

Related Work

- Has two functions
 - Shows you are aware of the progress in the field (NOT if you forget an important related work)
 - Gives you the opportunity to indicate how your work advances the state of the art: “The work of X and Y [3] is restricted to shared memory systems, however, while our system ...”
- Some authors integrate related work in introduction, usual is Section 2, sometimes Section n-1:
 - Last section before conclusions
 - Not recommended, very late to show how work advances state of the art
- Nice is a table:

Work	Type of system	Type of apps	Hardware overhead	...
[3]	Shared-mem	Media	47%	...
This	Any	Any	8%	...

Method, Algorithm, Architecture, Whatever

- Very difficult to give a recipe
- Keep your audience in mind, it is read by someone with a background in CSE, but (s)he hasn't performed the work
- Focus on novel features
- Convince the reader that what you did is correct and makes sense
- If design is complicated, you can first present high-level design, then more detailed design ("top-down")
- Illustrate design using good figures
- Pseudo-code, but pseudo-code alone not sufficient, must be described

Experimental Evaluation

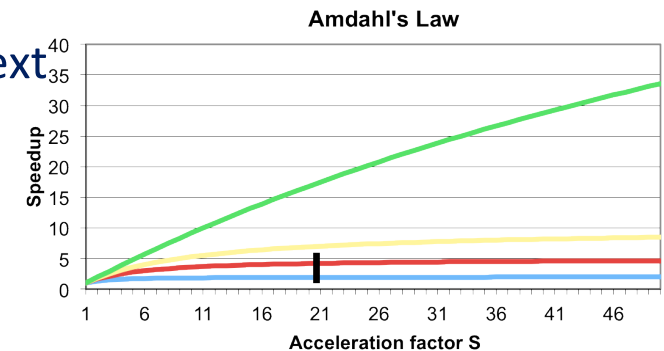
- Often split in two parts
 - Methodology
 - Results
- Sometimes methodology separate section

Experimental Methodology

- Describes benchmarks, simulator, tools, modeled processor, ...
- Benchmarks
 - Need to motivate benchmarks employed, e.g.,
 - Standard benchmark suite (e.g. SPEC). If not all explain why. If only few reviewer gets worried
 - Same benchmarks as X in order to be able to compare
 - Often a table with different features is presented
- Simulator
 - Describe what simulator models
 - If standard can refer to paper
- Tools, e.g.,
 - Often compiler used and option is mentioned
 - In ideal world, others are able to redo experiments
- Modeled processor
 - Model modern processors
 - Table with parameters (e.g., issue width, cache size, branch predictor, ...)
- In ideal world, others are able to redo experiments

Experimental Results

- Think about which experiments to perform and present
- Often zillion of parameters
 - Fix one important parameter and continue with next
 - Perform design space exploration
 - Often performance doesn't increase (a lot) anymore after certain parameter value
 - Assume that value for remainder
- Results need to be explained and discussed
 - Not sufficient to observe “we are 2x better”
 - Want to know **why** we are better
- Anomalies (e.g. sudden increase/decrease) need to be explained, not simply neglected
 - It is better to write “We cannot fully explain this behavior, but think it is due to ..” than to ignore it



Conclusions

Typical is again 4 paragraphs:

1. Summary, e.g.,

- “We have presented XYZ, a system that improves ABC in the following ways. First, ...”

2. Experimental results

- “The experimental results obtained using a cycle-accurate simulator show that XYZ is faster than ABC by a factor of 42. Furthermore, XYZ reduces the energy consumption by a factor of 37. ...”

3. Conclusions

- Dare to draw real conclusions. NOT “Our results potentially indicate that it might be important to ...” BUT “Our results indicate/show that it is important to ...”

4. Future Work

But avoid using the same words as in the introduction

References

- Make sure your references/citations are correct and consistent, i.e.
 - NOT lastname, firstname in 1 citation and firstinitial, lastname in another
 - Words correctly capitalized, NOT “The use of uml in cmp design”
 - NOT “Proceedings” in 1 citation and “Proc.” in another
- Downloaded citations not always correct
- Usual is author names, paper title, proceedings or journal, [if journal, volume, number, e.g., 35(2),] year.
- Use e.g. BibTeX
- I dislike “et al.” in author names, especially if I’m the second author
- I usually abbreviate e.g. “Proceedings of the 37th Annual International Symposium on Computer Architecture” as “Proc. Int. Symp. on Computer Architecture”