18-740 Project Guidelines (Fall 2015)

Important Dates

Please check the course website for all dates and updates.

Introduction

In this project, you will improve the state-of-the-art and understanding in computer architecture by developing new architecture techniques or designing extensions to techniques presented in class or a recent architecture conference. The purpose of this project is to propose, conduct, and generate publication-quality research and to analyze and/or improve the state of the art. The project report will be in the form of a research article similar to those we have been reading and discussing in class. High-quality projects and reports will likely have a chance to be submitted to a top computer architecture conference (ISCA, MICRO, ASPLOS, HPCA) or systems conference (OSDI, SOSP, USENIX, USENIX Security, DSN, Hot*).

The project will account for a significant portion of your final course grade. All components affect the grade. Please check the syllabus and talk with the instructors for further information.

Advice

When in doubt, meet with us during appointment or office hours. Conducting research is a time-consuming experience and choosing a topic you are excited about is an important part of it. Carefully choose your topic and write up your proposal after doing extensive literature search and consulting with the TA and me.

Project Topics Handout

You will receive a handout on suggested project topics in class. You are strongly encouraged to choose projects from this handout or in related areas. The final project topic of each group needs to be approved by the instructor.

Pre-Proposal

The pre-proposal is a simple email statement. The subject of your email should be [18-740 Project Pre-Proposal]. It should include:
1. The team members of your project group.
2. A brief summary of the anticipated project topic and goal.

Proposal

The proposal is a written 2-3 page document (using the provided double-column single-space LaTeX conference template on the course website), including at least the following:

1. The Problem: What is the problem you are trying to solve?
    a. Define clearly.
2. Novelty: Why has previous research not solved this problem? What are its shortcomings?

      a. Describe/cite all relevant works you know of and describe why these works are inadequate to solve the problem.
3. Idea: What is your initial idea/insight? What new solution are you proposing to the problem? Why does it make sense? How does/could it solve the problem better?
4. Hypothesis: What is the main hypothesis you will test?
5. Methodology: How will you test the hypothesis/ideas? Describe what simulator or model you will use and what initial experiments you will do.
6. Plan: Describe the steps you will take. What will you accomplish by Milestone 1, 2, and Final Report? Give 75%, 100%, 125% and moonshot goals.

All research projects can and should be described in this fashion. Concrete proposals are required.

Literature Survey

We will have a literature survey poster/presentation session related to your project. Check the website as course progresses.

Milestone 1

In this milestone, you need to show preliminary experiments for your ideas. The format will be a short written report or a short presentation to the instructor/TA.

Milestone 2

The purpose of this milestone is to ensure that you are well ahead in executing your research plan. The format will be a short written report or a short presentation to the instructor/TA.

Final Report

You will hand in a report in the conference submission style. **Your final report should be formatted and written as if you are submitting the report to a top computer architecture conference.** The report should include the following:

- A descriptive title and author names
- Abstract
- Introduction (Problem and Motivation)
- Related Work and its Shortcomings
- Proposed Mechanisms (Overview, Design, and Implementation)
- Evaluation Methodology
- Results and Analyses
- Conclusion/Summary
- Lessons Learned, Shortcomings, and Future Work
- Acknowledgements (if any)
- References (cited throughout the paper)

The page limit is 12 double-column, single-spaced pages in the provided LaTeX template. Make sure your document is spell-checked and grammatically sound. Polished work is critical in getting a good grade in your project.

Advice: The key characteristic that distinguishes a "good" research paper from a "bad" one is the existence of "clearly explained insight." I expect the highest quality of writing as well as clear descriptions of the ideas and techniques from the final report. Even if your research results in a "negative result" (not all research ideas pan out to be useful – in fact few of them do) writing it in a very insightful and intuitive manner can make the research very powerful and important. So, please do spend a significant amount of time and effort to ensure that your report is insightful and explains the ideas very clearly (possibly with examples and good analogies).

Examples of good final reports:

http://users.ece.cmu.edu/~omutlu/pub/atlas_hpca10.pdf

http://users.ece.cmu.edu/~omutlu/pub/tldram_hpca13.pdf

Final Presentation/Poster

We will hold presentation session(s) and/or a poster session in which teams get to present their projects and findings orally. More information on this will follow.

Best Projects

The top projects in class will be selected for submission to various computer systems conferences for publication. In the past a number of papers from 740/741/742 have become full-blown research projects were published at top venues including ISCA, MICRO, HPCA, SIGCOMM, DSN.

Evaluation Techniques and Infrastructures

You are welcome to use any infrastructure, tools, and benchmarks/applications that satisfy the needs of your project and that satisfy the instructor. However, you will need to justify why you use the infrastructure you choose. There are many simulation infrastructures available to perform experimental computer architecture research. The easiest way to started would be to use the simulators and infrastructures already available and being worked on at CMU.

Note that your proposed project does not *have to* use a simulator for evaluation. You can design real hardware, FPGA implementations, or even provide theoretical analyses. You need to convincingly justify that your methodology is valid and satisfactory for the purposes of the project you propose.