The Course Project Guidelines, Winter 2024

The project for this course includes a mini literature review about a specific problem selected by a student and approved by an instructor and a mini-research of this problem by a student. Topics should be relevant to the course content (i.e. include either an optimization problem or convex functions/sets), but otherwise arbitrary. Double submission of the same work (e.g. for thesis and as project for this course as well as two students submitting identical or nearly identical work) is not acceptable.

The project includes a brief presentation (about 5-10 min.) of the selected papers in **early March,** a final presentation (about 15-20 min.) of its activities by the end of the semester and a project report, by a student. Schedule and deadlines will be announced later on. In your brief presentation, you have to (i) introduce the topic you selected and explain why you believe this is good topic to study, and (ii) the papers you have selected and explain why you believe they are good papers. For your presentations, one slide approximately corresponds to 1 minute. Practice several times in advance to make sure your presentation is within the time limit and goes on smoothly. More guidelines are available on the course web page.

What to do:

1. Find and read 3-5 major, i.e. full-length (>=5pages), journal papers, preferably – by different authors/groups, published in major (reputable) journals (e.g. IEEE Transactions etc.). Use IEEE Xplore. Papers should be recent (i.e. within 5 years). Older papers are acceptable if they are of major value. Try to identify major papers (i.e. most important). Avoid IEEE Communication Magazine (and similar) papers as they do not provide enough details to repeat the simulations and have very limited value. Be aware that many conference papers are of low value and hence should be avoided (unless you make sure that the selected papers are of significant value). Looking for citation numbers on Google Scholar can give some indication of value (however, keep in mind that recent papers need time to collect citations and some low-value "review" papers can have disproportionally large citations).
2. Clearly identify key ideas/results in each paper (usually, not more than 3 per paper). What is their strength? Weakness? Importance? Are they correct/wrong? Why? Concentrate here and elsewhere on the results related to the course (optimization, convex functions/sets).
3. Compare the results/ideas in the different papers you read. Give comparative analysis.
4. Select one most important paper and repeat the key simulations. Do you get the same results? Why?
5. Explain how the results can be extended/improved? Justify this and do simulations for an extended case. Compare with the original results and make conclusions.
6. Summarize what you have learned in this project. Suggest directions for future research. If you would do MS/PhD research in this area, what in particular would you do?
7. For the presentation, prepare about 15-20 slides, which should fit into a 15-20 min. talk. Bring both ppt and pdf files of your presentation on a memory stick and a print-out (4 slides/page) for the instructor. See the course web page on how to prepare a good/bad presentation. It is essential that you practice presentation several times before making it in the class (also to make sure that you fit into 15-20 min. time slot, which will be strictly enforced).

A list of suggested papers will be provided, from which you should select one or more papers. However, since the list will not cover all the topics, you are not required to do so if your topic is not covered.

Things to remember when preparing your project report:

- The report must include the following parts: Title page, Table of contents, Summary (abstract), Introduction, Main part (review of the current literature, critical discussions and comparisons, your own contribution), conclusion, list of references, appendices. The papers you used must be attached as an appendix.
- Include explicit statement of the novelty at the beginning (after the abstract), explaining what is your own novel contribution to the field.
- All the ideas borrowed from other sources must include an explicit reference to those sources (otherwise it will be considered a plagiarism). If you use a word-by-word extract, you must use quotation marks rather than just a reference.
- When marking the report, I will be looking for your personal contribution to the field. Please keep this in mind when preparing the report.
- Please do not include just a re-phrased abstracts and conclusions of the papers you read. Include your own assessment of the results and techniques, emphasizing their advantages and drawbacks. Your report must indicate that you do understand those papers.
- Please remember what year is today. Hence, up-to-date references must be included (not just papers published 10-20 years ago). For the main papers, please include citation numbers (use Google Scholar to find it, scholar.google.com).
- There is a certain quality difference between journal and conference papers, the former being, as a rule, of much better quality. Keep this in mind when looking for the references.
- Do repeat some simulations reported in the references. This will insure that you understand the main techniques and will give you some ideas about the credibility of the results (in the papers as well as your own).
- Use 12 points font with 1 inch margins everywhere, single spacing and single column format. An approximate size of the report is about 20 pages without appendices. However, what matters is quality rather than just a page count.
- The report has to be bounded; the main 3-5 papers have to be attached as an appendix; all equations have to be numbered. Use standard book formatting as an example.
- Include the simulation code flaw chart in the main text (and explain it in details) and the source code in an appendix.
- Give clear and detailed enough explanations so that the report can be read without reading the references.

The points above are important as they are telling you what I am going to look for when marking the report.

Please keep in mind that copying (either from papers/books or from other students' reports) will be penalized and your mark will be significantly reduced. If you need to quote something, quotation marks and a reference to a source are mandatory.

Criteria for marking:

- Ability to clearly present the research topic, including concise literature review (in both the report and presentation)
- Ability to demonstrate good understanding of all key points
- Ability to critically analyze selected 3-5 papers (what is good, bad in each paper, which paper is the best, why so)
- Ability to support each conclusion/judgment by clear arguments
- Original contributions of the project
- Justified suggestions of how to improve the reported results and/or the problems found
- How efficient the report/presentation is in communicating the message to the audience
- How closely the guidelines above have been followed

Suggested Project Topics (feel free to suggest your own, but you will need my approval):

1. Optimization for communication systems/wireless communications
2. Optimization for wireless networks
3. Optimization for signal processing
4. Optimization for image processing/compression
5. Optimization for control/optimal control
6. Optimization for speech/audio processing/compression
7. Optimization for video processing/compression
8. Optimization for MIMO/massive MIMO systems
9. Optimization for cellular communications, 5/6G etc.
10. Optimization of WiFi systems
11. Optimization for antenna arrays/beamforming, smart antennas
12. Optimization for antenna design (e.g. electromagnetic)
13. Optimization for sensor networks
14. Optimization for compressed sensing
15. Optimization for power systems
16. Optimization in electronic design (e.g. IC etc)
17. Optimization in finance/investment/portfolio design
18. Optimization for machine learning

"Optimization" here does not have to be convex, but your project must have a significant optimization component (at least 50%).

If you wish, you can also concentrate on one specific problem and develop its numerical/analytical solutions (e.g. using CVX). Feel free to talk to me if you wish to do so.