Project Specification for SI231b Matrix Computations of 2022 Fall*

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SI231b projects are meant to be substantial and are, in fact, the significant part of the final grade in the course. They should contain an overview of a particular problem and some independent work.

1 Specifications

Some specifications for the project:

- The length should be at least 8 single-column pages with 10pt font. Be brief and to the point.
- The project should be written using LaTeX and submitted in PDF format (do not use MS Word, WPS Office, Mac Pages, ...).
- Keep a PDF copy of all the cited references (as you will have to send them together with the final project).
- The project should contain individual work by at most two students as a group.
- The amount of contribution/work of both students involved should be clearly stated.
- The student should read around 8 research papers on the chosen topic.
- The project should start with a description of the problem (citing at least 8 related papers): this should not be a separate overview of each of the papers one after another; instead, it should contain a unified problem formulation, explaining how each of the related papers fits within the general formulation.
- The related papers should be criticized: you should have an opinion on the papers that you read, you should be able to comment on the contribution and difficulty of each paper.
- Independent research: after the problem formulation and overview of the state of the art, the student should try to propose something new that improves on the existing approaches based on the contents learnt from this course.
- No plagiarism or self-plagiarism. The student is never allowed to reuse his/her own published papers as the final project.

*This is the basic requirement for the course "SI231b Matrix Computations" taught at ShanghaiTech University in the Fall semester of 2022 – 2023.

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2 Report Structure

In order to make the evaluation of the project as objective as possible, the written report should strictly adhere to the following structure with the sections (a penalty will be triggered if the report is not organised according to the guideline):

1. Introduction: 10% grade;
2. Literature review/overview of existing work (with unified notation): 20% grade;
3. Criticism of the existing work: 20% grade;
4. Your own contribution (if any): 20% grade;
5. Numerical results: 10% grade;
6. Conclusions: 10% grade;
7. References: 10% grade.

3 Schedule and Submission Guidelines

Please follow the deadlines below. They are strict and there will be penalties for not following them. In particular, the final reports late by 1 day will be penalized with 20% of the grade, late by 2 days will be penalized with 40% of the grade, and late by 3 days is most likely a Fail.

1. Proposal: by Nov. 18, 2022.

   The students should choose a topic (either inspired on the list of topics below or not, preferably the student will come up with a topic of his/her interest) and write a proposal to introduce their plan. The proposal should include the title, abstract, introduction, preliminary ideas, and references.

   The proposal should be uploaded with the filename

   "LASTNAME1-FIRSTNAME1+LASTNAME2-FIRSTNAME2+proposal.pdf" to the link

   http://pan.shanghaitech.edu.cn/cloudservice/outerLink/decode?c3Vnb24xNjY3MTM3Njc2NDUwc3Vnb24=

2. Pre-final report: by Dec. 19, 2022.

   The pre-final report should contain at least 90% completeness of your final project and be uploaded with the filename

   "LASTNAME1-FIRSTNAME1+LASTNAME2-FIRSTNAME2+pre-final.pdf" to the link

   http://pan.shanghaitech.edu.cn/cloudservice/outerLink/decode?c3Vnb24xNjY3MTM3NjMwMzEwc3Vnb24=

3. Final report: by Dec. 23, 2022.

   The pre-final report should be complete uploaded with the filename

   "LASTNAME1-FIRSTNAME1+LASTNAME2-FIRSTNAME2+final.pdf" to the link

   http://pan.shanghaitech.edu.cn/cloudservice/outerLink/decode?c3Vnb24xNjY3MTM3NzI0MDEyc3Vnb24=

4 Possible Topics

Some potential general topics for the projects include (be creative and come up with your own project):

- Applications on machine learning, classification, and SVM
- Applications on deep learning
- Applications on natural language processing (NLP)

- Applications on computer vision and graphics
- Applications on robotics and UAV
- Applications on sparsity and/or low-rank matrix decomposition
- Applications on image processing
- Applications on circuit design
- Applications on biomedical applications (e.g., DNA analysis)
- Applications on finance
- Applications on industrial engineering and logistics
- Applications on communications and networking