MA1508E Group Project

Each group will work on one application of Linear Algebra in the real world. The group may choose any topic (related to your field of study).

Here are some suggested topics.

1. Fast Fourier Transform
2. Computed tomography
3. Google PageRank
4. Fourier approximation, least square approximation by Fourier series
5. Codes over finite fields
6. Cryptography
7. Optimising constraints
8. Image compression
9. Machine learning
10. Leontief Input–output model
11. Digital image processing
12. Convolution and image processing

Each group will have to submit one written report and do a presentation for the project.

The written report should consist of 4 sections.

- Section 1: Give an introduction of the application, what is it used for, and how it works. Provide the concepts and theories used and provide proofs of the mathematical theory if possible. If a theory is too hard to prove in general, give a heuristic explanation.
- Section 2: Pick small examples to demonstrate the theories or formula or algorithm. The matrices must be small enough to be displayed, and all computations must be shown clearly.
- Section 3: Implement the algorithm on some software and demonstrate it using some real-life data if possible. Otherwise, simulate a data to mimic the real world.
- Section 4: Discuss the limitation of the algorithm and theory, and if possible, suggest improvement. The improvement might not necessarily come from linear algebra.

The written report can be submitted using Microsoft words, it does support math formulas, using LaTeX, or any software that supports mathematical formulas. The submission file must be in PDF format. The deadline for submission of the written report is in week 12.

In week 13, each group will be given 10minutes to present their project (through zoom), followed by a 2-minute question and answer time. There are no restrictions on the number of people presenting per group. Groups will be graded according to the presentation as well as the written report. Students will be graded as a group. See next page for the grading rubrics.

Component	Needs improvement	Acceptable	Good	Excellent
Section 1: Theory	• Collects inaccurate materials • Materials lifted from a single source • Does not utilize resources effectively	• Materials are accurate, but little explanations were given • All theory needed was presented, but limited	• Content was cross checked with multiple sources • Able to demonstrate understanding of the materials	• Demonstrated evidence of extensive research effort and a depth of thinking • Able to contribute and incorporate own understanding with research materials
Section 2: Example	• Inaccurate examples • Examples do not demonstrate the theory • Examples lifted from a single source	• Modified examples from research material • Some aspects of the theory are demonstrated in the examples	• Able to provide examples that clearly demonstrate the theory • All aspects of the theory are demonstrated in the examples	• Able to give creative and original examples that clearly demonstrate the theory
Section 3: Implementation	• Data is unrealistic • Implementation was designed specifically for one data chosen/constructed	• Data is somewhat accurate to real life • Results generated are accurate to limited examples	• Data used accurately reflect real life examples • Results generated are accurate to most real-life examples	• Data was obtained from actual real life • Takes into account instability of real-life data
Section 4: Discussion	• Give vague or wrong limitations • No or inaccurate suggestion to overcome the limitations	• Able to point out limitations of algorithm • Vaguely discuss suggestion to overcome the limitations	• Accurately point out limitations of theory and algorithm • Able to discuss some suggestion to overcome the limitations	• Able to provide accurate and feasible suggestion to overcome the limitations
Presentation:	• Presentation was bland • Audience had to make considerable effort to understand the materials • Did not adhere to the time limit • Visual aids were not useful/no visual aids	• Appropriate presentation of materials, but only somewhat held audience attention • Visual aids presented the materials	• The materials could be understood from the presentation • Visual aids somewhat add to or clarify presentation • Members somewhat understand the materials • Somewhat adheres to the time limit	• Presentation was creative and clever • Engaging; captures interest of audience • Visual aids add to or clarify presentation • Adheres to the time limit • Members clearly understood the materials