SYDE 312: Applied Linear Algebra

Winter 2022 - Applied Assignment

The objective of this assignment is to explore an application of some aspect of linear algebra, preferably something you have studied in class. The application area should be of personal interest to you. There is a numerical computation requirement. Something beyond utilitarian topics is required (e.g not simply Gaussian elimination or solving linear systems).

Motivation behind this course component is that there is not sufficient time to present many detailed applications in class, and also it's not practical to grade numerical computation skills on exams.

The assignment is to be done in groups of TWO. The amount of effort put into the assignment should be commensurate with the 20% weighting in the course grade.

A good assignment will:

- select an interesting[1] and well-defined application area (engineering, economics, biology, science, numerical methods etc.)
- describe meaningful analytical use of linear algebra
- demonstrate computational skill with Matlab in some (non-trivial) aspect(s) of SYDE 312 course material
- present the work in a report with careful attention given to prescribed content and format

The report is to be submitted on or before the last day of classes: Tuesday 5 April 2022. Submission is in the form of a printed copy: (a) given to me at the last lecture, or (b) given to Sandy (department secretary) at the front office, or (c) under my office door E3-3158.

The topic

The most suitable topics are related to the latter part of the course, which covers the more advanced ideas starting with unit II and leads to a vast array of applications. Some of the

[1] This applies to your level of interest, not necessarily mine. Try to come across as inspired rather than going through the motions. So choose the topic wisely. Linear algebra hides in many disguises in things you are already familiar with.

best application topics (e.g. SVD) unfortunately aren't in class work until the last lectures.

If you're stuck I recommend looking at the textbook lists of applied projects as a starting point to get ideas. Check it out. There are numerous applications described there. Also try google with 'linear algebra applications + a subject area'!

The report

The deliverable is a report in TWO-COLUMN format with a mandatory maximum of four pages. The title, your name and ID, and a short abstract should appear on the first page, formatted across both columns. The paper will include the following numbered sections after the abstract:

1) Background and discussion of the application area.

2) Use of linear algebra in the analysis.

3) Presentation of a specific case study or problem (real or invented).

4) Mathematical solution and selection of appropriate numerical technique(s).

5) Analysis and interpretation of the results in the context of the application.

6) Conclusions etc

Any references you feel are appropriate can be provided as footnotes, but these should be minimal.

There is no cover page. No computer code is to be included in the report. No appendices are permitted. Any figures, such as plots, should be selected with discrimination, and must be clear and legible.

There are LaTeX templates floating around that will do the formatting appropriately.

Given the page limit the report is clearly intended to be illustrative and not comprehensive. This does NOT mean the work should be casual or superficial. The expectation is for a concise presentation of a significant application of linear algebra, and an original computational example to demonstrate.

Your grade will reflect the quality of the report and how well you have condensed your work without trivializing it. Think carefully about every sentence you include. There is no room for padding in a 4-page report.