

CSE 494 CSE/CBS 598 (Fall 2007): Numerical Linear Algebra for Data Exploration

General Course Information

- Instructor: Dr. Jieping Ye
- Office: BY 568
- Email: jieping.ye@asu.edu
- Meeting Times: MW 10:40AM - 11:55AM
- Office Hours: MW 2:30PM–4:00PM
- Location: BYAC 110
- Prerequisite: Basics of linear algebra.
- Web: <http://www.public.asu.edu/~jye02/CLASSES/Fall-2007/>
- Course Textbook: Matrix Methods in Data Mining and Pattern Recognition, by Lars Elden, SIAM, 2007.

Catalog Description

Vectors and matrices, linear systems and least squares, singular value decomposition, tensor decomposition, non-negative matrix factorization, clustering, classification, text mining, and ranking.

Objective

An in-depth understanding of many important linear algebra techniques and their applications in data mining, machine learning, pattern recognition, and information retrieval.

Reference Books

- The Matrix Cookbook, by Kaare B. Petersen and Michael S. Pedersen. Available on-line at http://www2.imm.dtu.dk/pubdb/views/publication_details.php?id=3274.
- Introduction to Linear Algebra, by Gilbert Strang, 2003.
- Applied Numerical Linear Algebra, by James W. Demmel, 1997.
- Matrix Computations, by Gene H. Golub and Charles F. van Loan, 1996.
- Pattern Recognition and Machine Learning, by Christopher M. Bishop, 2006.
- The Elements of Statistical Learning: Data Mining, Inference, and Prediction, by T. Hastie, R. Tibshirani, and J. Friedman, 2001.

Grading

- Homework (6): 30%.
- Project (1): 10%.
- Exam (2): 40%.
- Quiz (2): 10%
- Class participation: 10%. Students are required to attend the lecture and participate in the class discussion.

Tentative Class Schedule

| Week | Topic |
|------|--|
| 1 | Introduction, Basics linear algebra |
| 2 | Basics linear algebra |
| 3 | QR, least squares, linear regression |
| 4 | Singular Value Decomposition |
| 5 | Principal Component Analysis |
| 6 | Linear Discriminant Analysis |
| 7 | Text mining & Information Retrieval |
| 8 | Clustering & Information Retrieval |
| 9 | Non-negative matrix factorization |
| 10 | Mining the web: PageRank and Power Iteration, HITS |
| 11 | Mining the web: PageRank and Power Iteration, HITS |
| 12 | Tensor decomposition |
| 13 | Microarray gene expression data analysis |
| 14 | Gene expression pattern image analysis |
| 15 | Project presentation |

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Violations of the University Academic Integrity policy will not be ignored. Penalties include reduced or no credit for submitted work, a failing grade in the class, a note on your official transcript that shows you were punished for cheating, suspension, expulsion and revocation of already awarded degrees. The university requires that should I implement any of these penalties, I must report the matter to the Dean's office. The university academic integrity policy can be found at <http://library.west.asu.edu/refguides/integrity/asu-policies.html>