



JHU vision lab

# Unsupervised Learning

Spring 2017

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# Course Information: Syllabus

- Introduction (Chapter 1)
- Part I: Single Subspace
  - Principal Component Analysis (Chapter 2)
  - Robust Principal Component Analysis (Chapter 3)
  - Kernel PCA and Manifold Learning (Chapter 4)
- Part II: Multiple Subspaces
  - Algebraic Methods (Chapter 5)
  - Statistical Methods (Chapter 6)
  - Spectral Methods (Chapter 7)
  - Sparse and Low-Rank Methods (Chapter 8)
- Part III: Applications
  - Image Representation (Chapter 8)
  - Image Segmentation (Chapter 9)
  - Motion Segmentation (Chapter 10)



<http://link.springer.com.proxy1.library.jhu.edu>

<http://www.springer.com/us/book/9780387878102>

<https://www.amazon.com/dp/0387878106/>

# Course Information: Background

- Graduate-level course: 600.692
- Required background
  - **Linear algebra**: range, basis, nullspace, eigenvalues, eigenvectors, **singular value decomposition**, least squares, positive definiteness, trace, determinant, etc.
  - **Optimization**: first and second order conditions for minima/maxima, gradient descent, alternating minimization, **Lagrange Multipliers**
  - **Probability and statistics**: random variables, expectation, variance, covariance, maximum likelihood, expectation maximization, mixture models, model selection
  - **Programming**: MATLAB
- Prior exposure to machine learning (e.g., 600.475) is a plus

# Course Information: Administrative

- Administrative
  - Class meets: MF 12-1:15 pm in Hodson 313
  - Make up classes: W 12-1:15 pm in Hodson 313, Feb 22nd, March 1st
- Instructor
  - René Vidal
  - Office: Clark 302B
  - E-mail: [rvidal@jhu.edu](mailto:rvidal@jhu.edu)
  - Web: [www.vision.jhu.edu](http://www.vision.jhu.edu)
- Teaching assistant: TBA
- Late policy
  - Homeworks and projects are due on the specified dates.

# Course Information: Grading

- Homeworks (30%)
  - Roughly every other week
  - Will include analytical problems as well as MATLAB exercises
  - To be done individually unless otherwise specified
- Exams (40%)
  - Exam 1: Friday March 31st, Chapters 2-4 + Appendices A and B
  - Exam 2: Friday May 12, Chapters 5-7 + Appendix C
- Project (30%)
  - Application of the techniques in the class, e.g., Chapters 8-11
  - To be done in groups of 3
  - Project reports and presentations on Friday May 12th 10:15-12noon

# Honor Code

- You must not misrepresent someone else's work as your own. You can avoid this in two ways:
  - Do not use work (including code) from someone else.
  - Give proper credit if you do use someone else's work.
- Naturally, even if you give appropriate credit, you will only receive credit for your original work, so for this class you should stick with option #1.
- All cases of confirmed cheating/plagiarism will be reported to the Student Ethics Board.
- Homeworks and exams are strictly individual.
- Projects can be done in teams of three students.

# JHU Honor Code

- The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition.