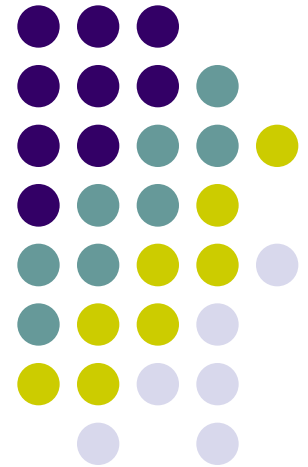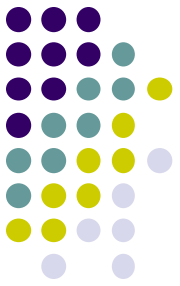# Mathematics in computer science
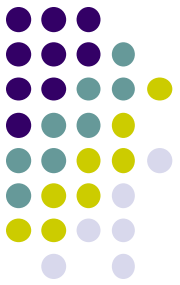
Hongxin Zhang

zhx@cad.zju.edu.cn

State Key Lab of CAD&CG, ZJU

2017-02-28

Syllabus

- This 2 months short course:
  - covers a set of data driven techniques
  - optimization methods
  - from basic and state-of-the-art.

- You will learn fundamental algorithms of multivariate analysis
- And see the stories behind these algorithms, theory and applications.
- It is going to be fun and hard work.

Rough schedule

- 02.28: Introduction & Point estimation
- 03.07: Component Analysis
- 03.14: Distance and similarity
- 03.21: Graphical models

- 03.28: Linear programming
- 04.11: Linear programming
- 04.18: Non-linear programming
- 04.??: Quadratic programming

反思

- It is NOT a machine learning course
  - Although we will discuss a lot on machine learning things

- We will focus on mathematical methods and their underlying motivation
  - Representation and presentation
  - Thinking in mathematical way
 - Happy working with mathematics

Principle

- Simple is beauty!

- Make a balance between theories and real applications

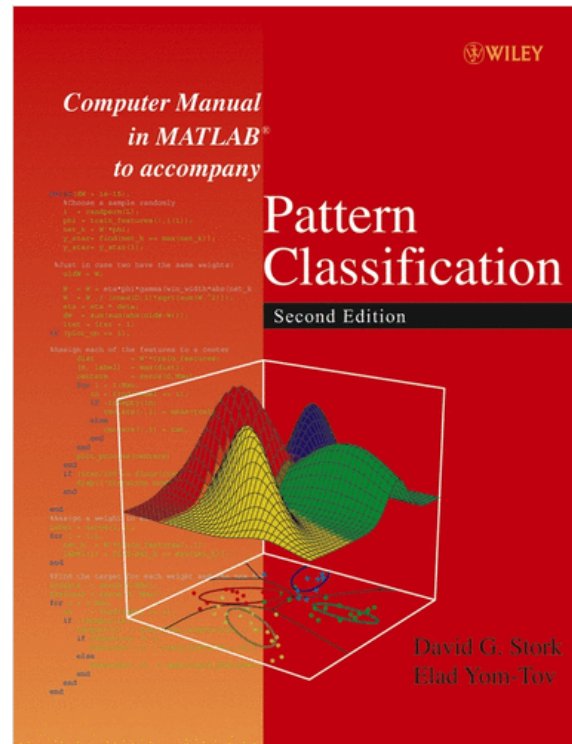- 哲學（***philosophy***）是從希臘字「**Φιλοσοφία**」（*philo-sophia*）轉變而來，意思為「**熱愛智慧**」，或是比較少用的「智慧的朋友」。
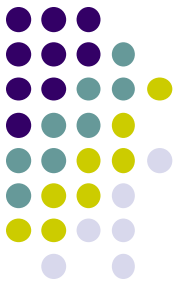
Prerequisites

- Probabilities
  - Distributions, densities, marginalization…
- Basic statistics
  - Moments, typical distributions, regression…
- Algorithms
  - Dynamic programming, basic data structures, complexity…
- Programming
  - Mostly your choice of language: C/C++, MATLAB, JAVA
- We provide some background, but the class will be fast paced
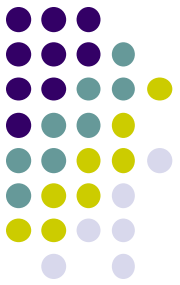
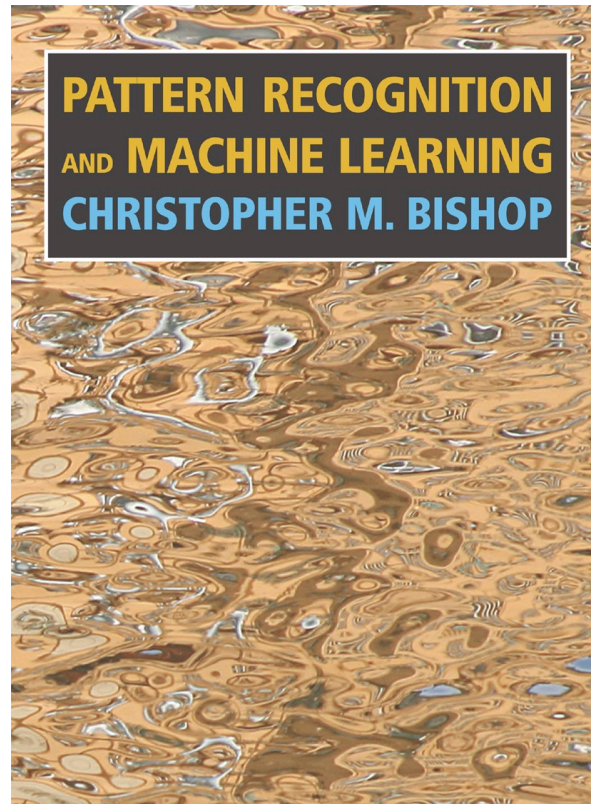- Ability to deal with "abstract mathematical concepts"
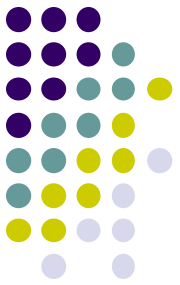
Text books

- **Pattern Classification (2nd Edition)**
    - by Duda, Hart and Stork
- **Information Theory, Inference, and Learning Algorithms**
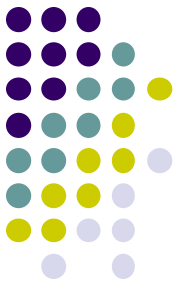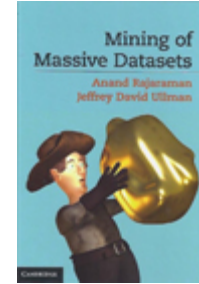   - by David MacKay

Text books
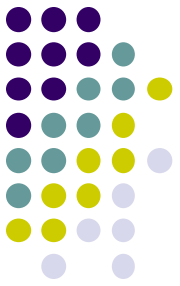
- http://research.microsoft.com/en-us/um/people/cmbishop/prml/

Text books

- From data mining area
  - Mining of Massive Datasets
  - http://infolab.stanford.edu/~ullman/mmds.html

Internet resources

http://www.cad.zju.edu.cn/home/zhx/csmath

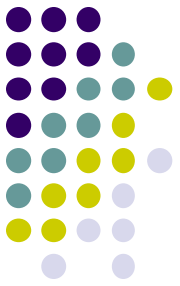https://github.com/ChristosChristofidis/awesome-deep-learning

Evaluation

- Homework: 40%
  - Python programming
  - Course notes
  - …
- Course paper: 40%
  - Read top-level (10 selected) papers,
  - and report main idea

- In class performance: 20%

Enjoy!

- Data driven is becoming ubiquitous in science, engineering and beyond

- This class should give you the basic foundation for applying DD and developing new methods

- The fun begins…

源自**88**上某位网友的签名档

- 鉴于大多数博士们在之后的生活中并没有从事博士生期间的课题的研究，甚至根本不再做研究工作，我想攻读博士的目标应该是：

  1. 成为一个身体强壮的人
  2. 成为一个意志强悍的人
  3. 成为一个能系统思考，从混沌的一堆问题中提炼主要的具体的问题的人
  4. 成为一个能解决具体问题的人

- 修行！

The End

新浪微博：@浙大张宏鑫

微信公众号：