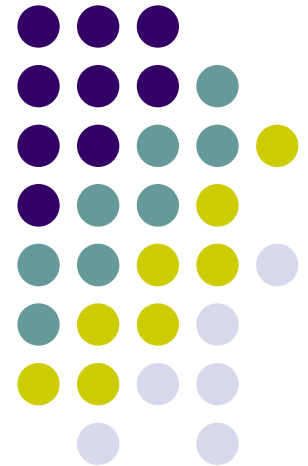


# Mathematics in computer science

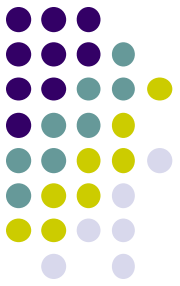
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Hongxin Zhang  
zhx@cad.zju.edu.cn

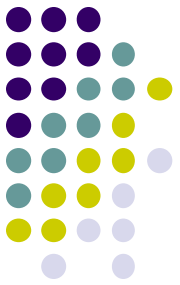
State Key Lab of CAD&CG, ZJU  
2022-02-22



# Syllabus



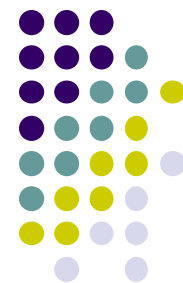
- This 2 months short course:
  - covers a set of data driven techniques
  - optimization methods
  - from basic and state-of-the-art.
- You will learn fundamental algorithms of multivariate analysis
- And see the stories behind these algorithms, theory and applications.
- It is going to be fun and hard work.



# Rough schedule

- 02.22: Introduction & Point estimation
- 03.01: Component Analysis
- 03.08: Distance and similarity
- 03.15: Graphical models
- 03.22: Linear programming (I)
- 03.29: Linear programming (II)
- 04.05: Non-linear programming (TBD)
- 04.12: Quadratic programming

# 反思

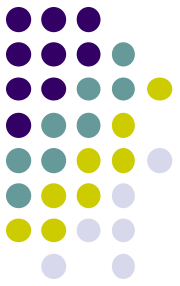


- It is NOT a machine learning course
  - Although we will discuss a lot on machine learning things
- We will focus on mathematical methods and their underlying motivation
  - Representation and presentation
  - Thinking in mathematical way
  - Happy working with mathematics

# Principle

- Simple is beauty!
- Make a balance between theories and real applications
- 大道无形：大音希声，大象无形，道隐无名。

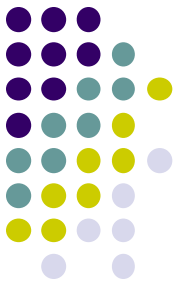




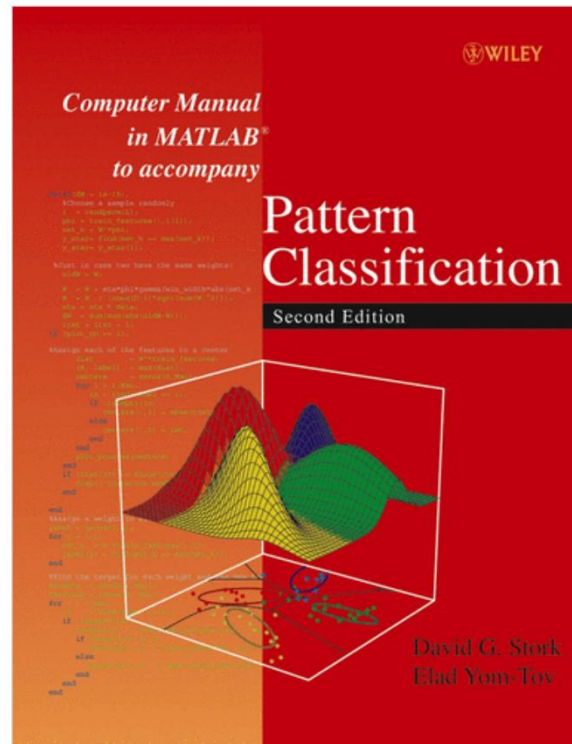
# Prerequisites

- 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”

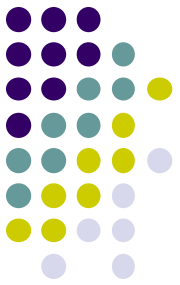
# Text books



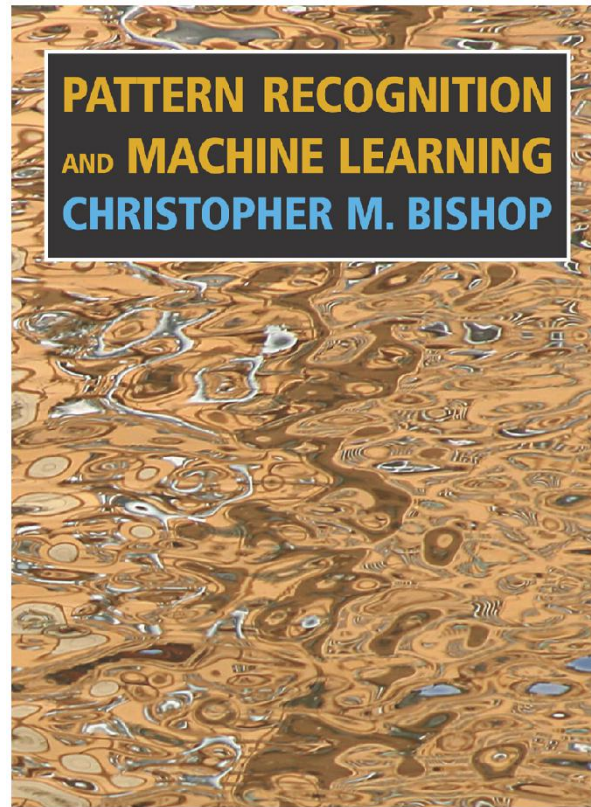
- Pattern Classification (2nd Edition)
  - by Duda, Hart and Stork
- Information Theory, Inference, and Learning Algorithms
  - by David MacKay



# Text books

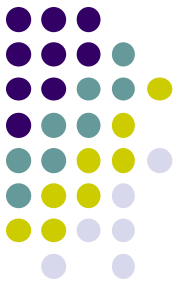
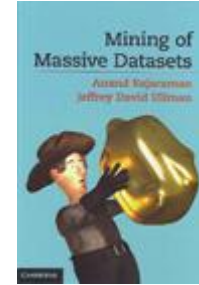


- <http://research.microsoft.com/en-us/um/people/cmbishop/prml/>

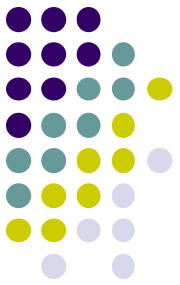




# Text books

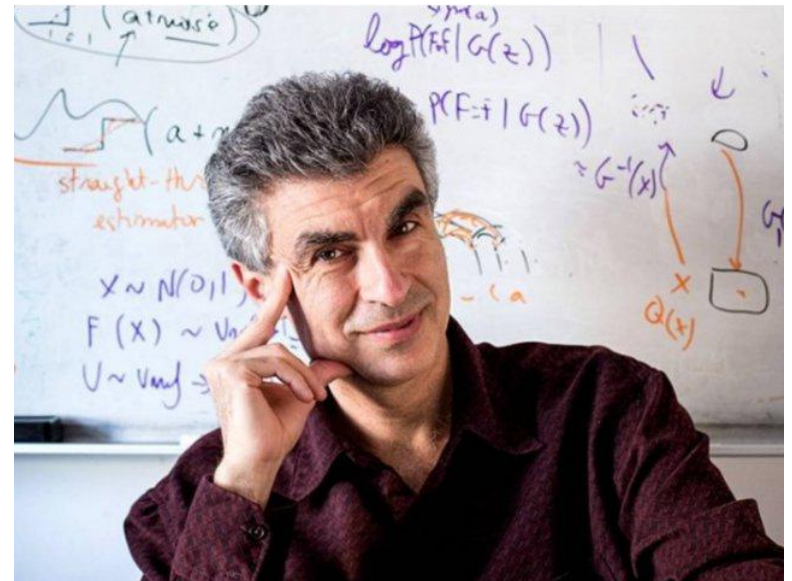


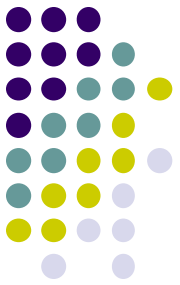
- From data mining area
  - Mining of Massive Datasets
  - <http://infolab.stanford.edu/~ullman/mmds.html>



# Text books

- From the HOT deep learning field:
- Written by Yoshua Bengio
  - <http://www.deeplearningbook.org/>
  - <https://github.com/exacity/deeplearningbook-chinese>



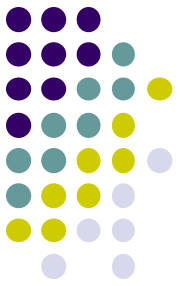


# Internet resources

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

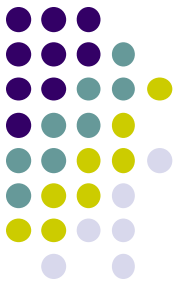
<https://github.com/ChristosChristofidis/awesome-deep-learning>

# GitHub

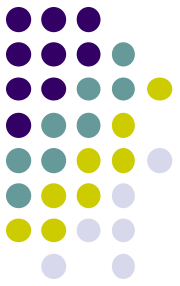


- <https://github.com/hongxin/csmath-2022>

# Evaluation



- Homework: 40%
  - Python programming
  - Course notes
  - ...
- Course paper: 40%
  - Read top-level (10 selected) papers
  - and report main idea
- In class performance: 20%
  - check-in
  - Short talk (optional)



# Homework 0: registration

- Say hello to me and TA:
  - Link: [course.zju.edu.cn](http://course.zju.edu.cn)
  - Title:
  - Content: say something about yourself
  - Attachment: one CLEAR frontal photo of yourself, we will use it for further functions based on face-recognition

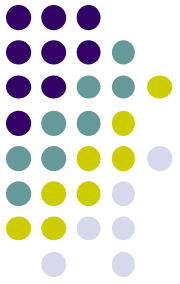


# 源自88上某位网友的签名档

- 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！

# NPNG

- 业精于勤荒于嬉
- 行成于思毁于随





# The End

新浪微博: @浙大张宏鑫

微信公众号:

