Welcome To . . .

PATTERN RECOGNITION

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What is Learning?

Using **Experience** to gain **Expertise** （专门知识或技能）

What The Course Is About (1)

Machine Learning is concerned with

- a large set of input vectors *x1, . . . , xN*, or a training set is used to tune the parameters of an adaptive model.
- The category of an input vector is expressed using a target vector t.
- The result of a machine learning algorithm: *y(x)* where the output *y* is encoded as the target vectors.

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What The Course Is About (2)

Pattern recognition is concerned with

- **The automatic discovery of regularities in data**
- **Through the use of computer algorithms and with the use of these regularities to take actions**
  - classfying the data into different categories.
- Example: handwritten recognition. Input: a vector x of pixel values. Output: A digit from 0 to 9.

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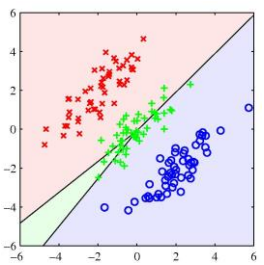
Example of a synthetic data set



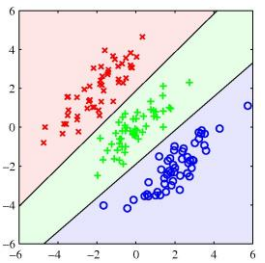


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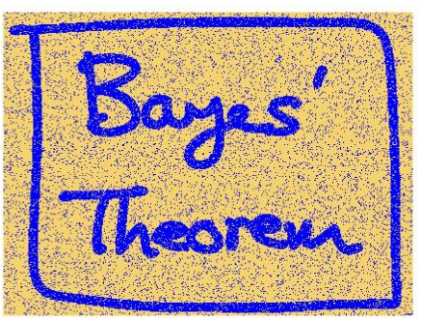
Illustration: Image De-Noising (1)

Original Image



Noisy Image

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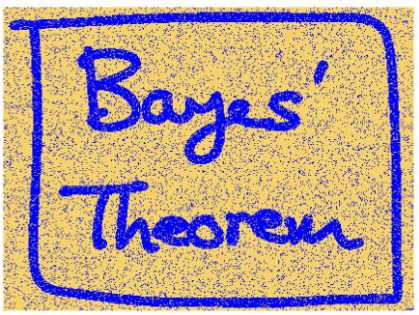
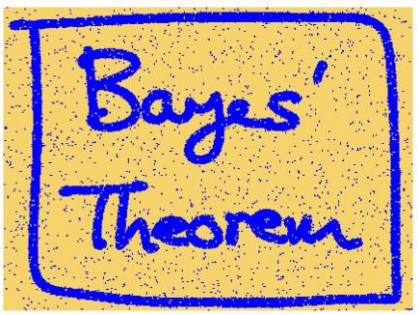
Illustration: Image De-Noising (2)



Noisy Image



Restored Image (ICM)

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Why do we need Machine Learning

- Tasks that are too complex to program!
  - Computer vision: we know to detect objects but have no idea how we do it!
  - Search engines: a human can't read the entire internet!
- Adaptivity and speed of development

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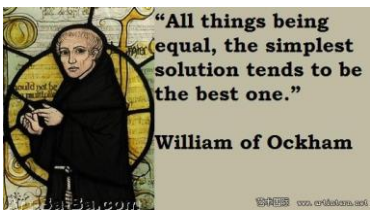
Occam's Razor

"A short explanation tends to be more valid than a long explanation"

若无必要 勿增实体



William of Ockham,

a 14th-century English logician

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No Free Lunch

No learning is possible without some prior knowledge

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Vapnik's Principle

"When solving a problem of interest, do not solve a more general problem as an intermediate step"

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Many applications

- AI: Object recognition, face detection, autonomous driving, text categorization, speech-to-text, voice recognition, ...!
- Science: Gene expression, drug design, medical imaging, climate, astronomy, …!
- Web applications: Search engines, spam detection, machine translation ...!
- Economy: E-commerce, trades, ...

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Example

You've just arrived in some small pacific island

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Example

You soon find that papayas are a significant ingredient in the local diet

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Example

How can you know if a papaya is tasty?

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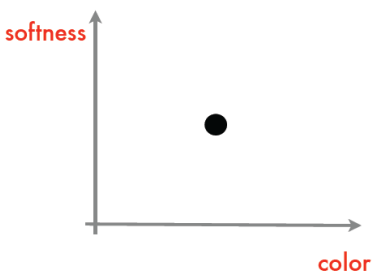
Example

Based on previous experience with other fruits, you decide to use two features:



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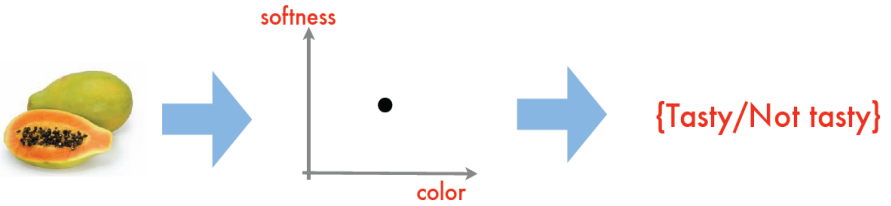
Example

Your goal is to find a prediction rule:



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Semester Schedule

Week1~Week19: Lectures

Tuesday 16:20pm-18:00pm, 1~19周

Thursday 16:20pm-18:00pm, 11~19周

Location: B205/ B103

Course material:

- ftp://222.200.180.156/方老师/PatternRecognition2019
- User name: student
- password: 2019s

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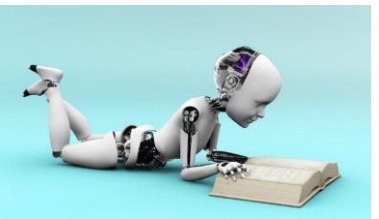
课程内容

- 贝叶斯决策论
- 参数估计和非参数估计
- 线性判别函数
- 深度神经网络
- 独立于算法的机器学习
- 聚类算法



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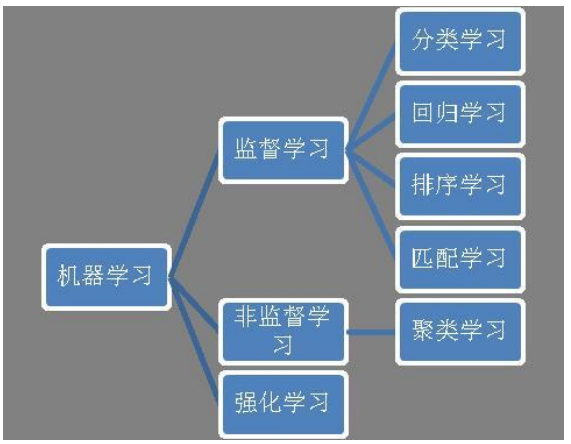
Machine Learning



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教材：

- **Pattern Classification, R. O. Duda, P. E. Hart, D. G. Stock, second edition, 2000;**
- **《模式分类》，R. O. Duda, P. E. Hart, D. G. Stock著，李宏东 姚天翔译， 机械工业出版社，2003；**
- *Pattern Recognition and Machine Learning*, Christopher M. Bishop, Springer Science&Business Media, LLC, 2006.

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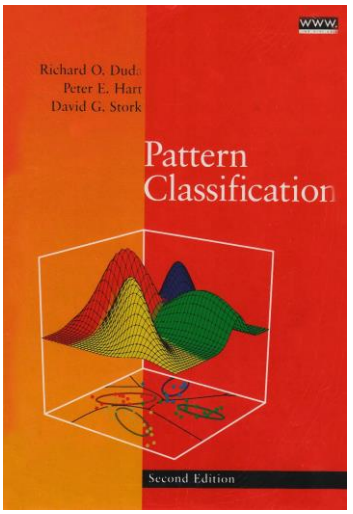
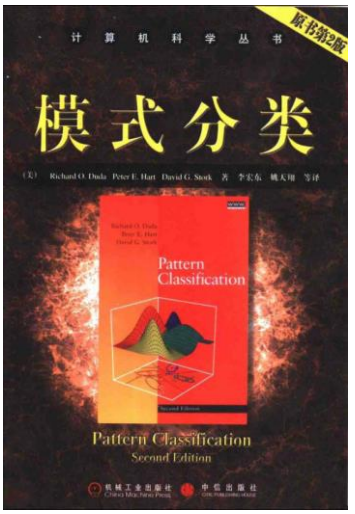

Richard O. Duda
Peter E. Hart
David G. Stork
Pattern Classification
Second Edition


计 算 机 科 学 丛 书
原书第2版
模式分类
Pattern Classification
Pattern Classification
Second Edition

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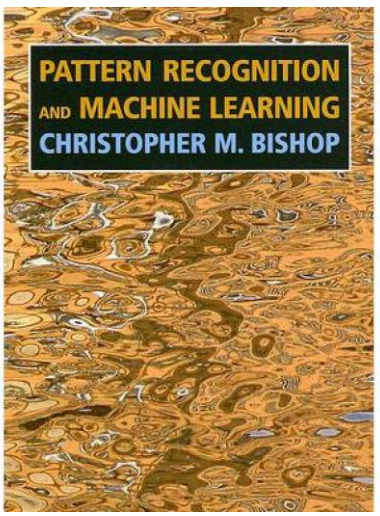
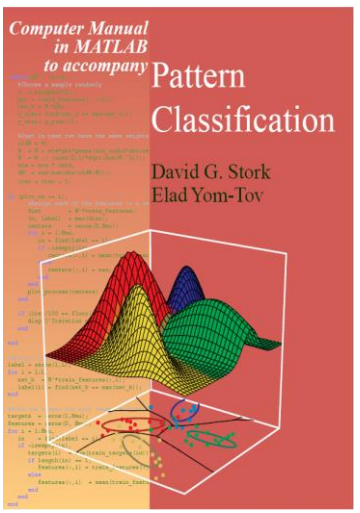

PATTERN RECOGNITION
AND MACHINE LEARNING
CHRISTOPHER M. BISHOP


Computer Manual
in MATLAB
to accompany
Pattern
Classification
David G. Stork
Elad Yom-Tov

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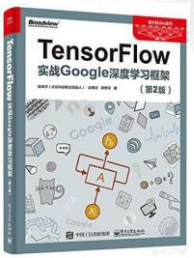
Many books … …



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成绩评定

•课程要求与成绩评定：

平时成绩：出勤、课后作业 **20%**；

编程作业：**20%**；

期末闭卷考试：**60%**。

总评成绩：平时成绩**40%**+期末成绩**60%**

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