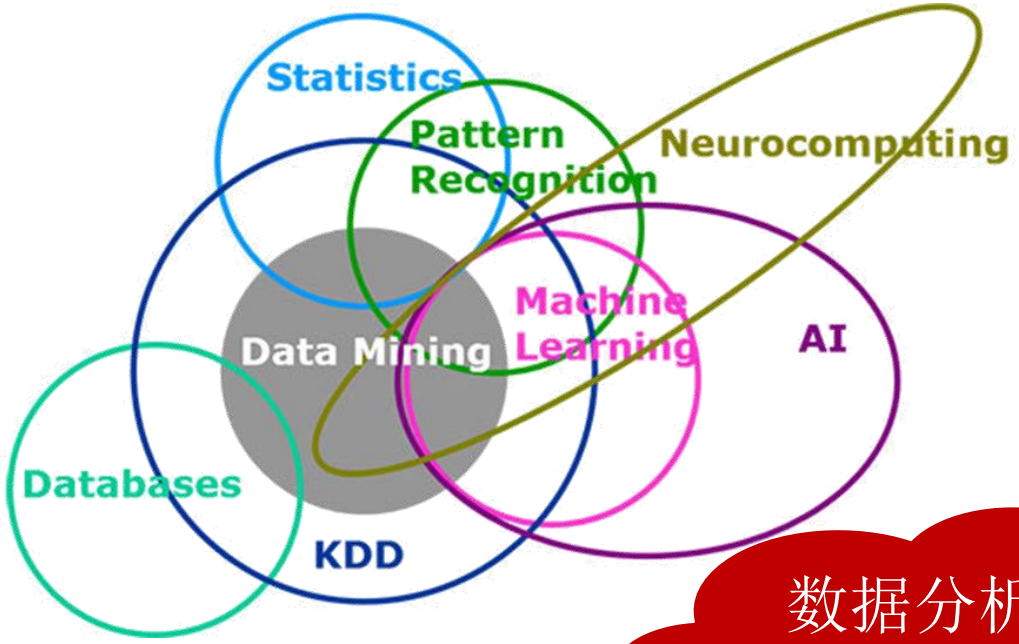
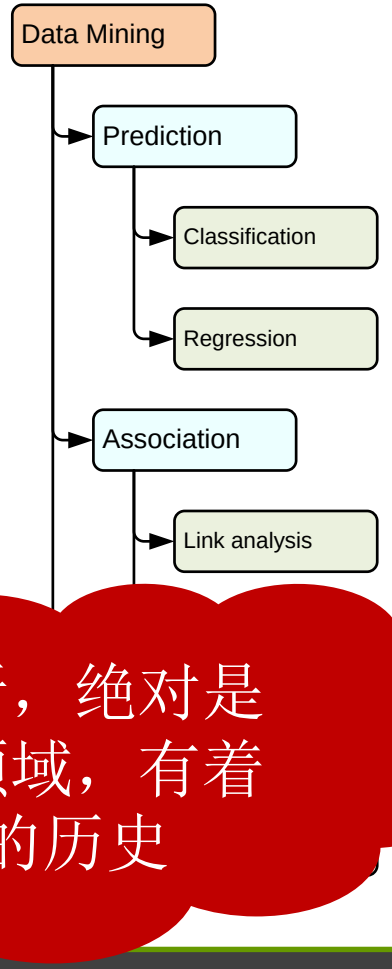
“商务视角下的数据分析”课程所覆盖的专题

1. **简介**
2. **商务思维 (Business thinking)**
   - 所谓的“商务 (BUSINESS)” – 其实就是学会做出获得更多利润的决策 (making decisions to earn more profit)
   - 管理技巧 (Management skills) – 如何落实那些决策
   - 试试创业? – 可以！但是要慎重！！
3. **数据分析的方法概览 (Data Analytics methods)**
   - 其实，数据分析有着悠久的历史 (HISTORY view about Data Analytics)
   - 理解数据分析方法的 – 一点优化的技巧 (OPTIMIZATION)
   - 来自统计学的数据分析方法 (STATISTICS) – 基于抽样的推断 (一个有趣的视角来梳理而已，不重复)
   - 来自机器学习的数据分析方法 (BASIC + ADVANCED) – 基于数据的知识发现 (KDD)
4. **实用技巧 (Practical skills)**
   - 大商务，需要大数据
   - 大商务的两个挑战: “秒杀” 和 “精准广告/推荐”
5. **课程总结**

而应对那些商务问题，数据分析能力必不可少！ - 决策 (Decision Making)！





Learning Method	Popular Algorithms
Supervised	Classification and Regression Trees, ANN, SVM, Genetic Algorithms
Supervised	Decision trees, ANN/MLP, SVM, Rough sets, Genetic Algorithms
Supervised	Linear/Nonlinear Regression, Regression trees, ANN/MLP, SVM
Unsupervised	Apriory, OneR, ZeroR, Eclat
Unsupervised	Expectation Maximization, Apriory Algorithm, Graph-based Matching
Unsupervised	Apriory Algorithm, FP-Growth technique
vised	K-means, ANN/SOM
Unsupervised	K-means, Expectation Maximization (EM)

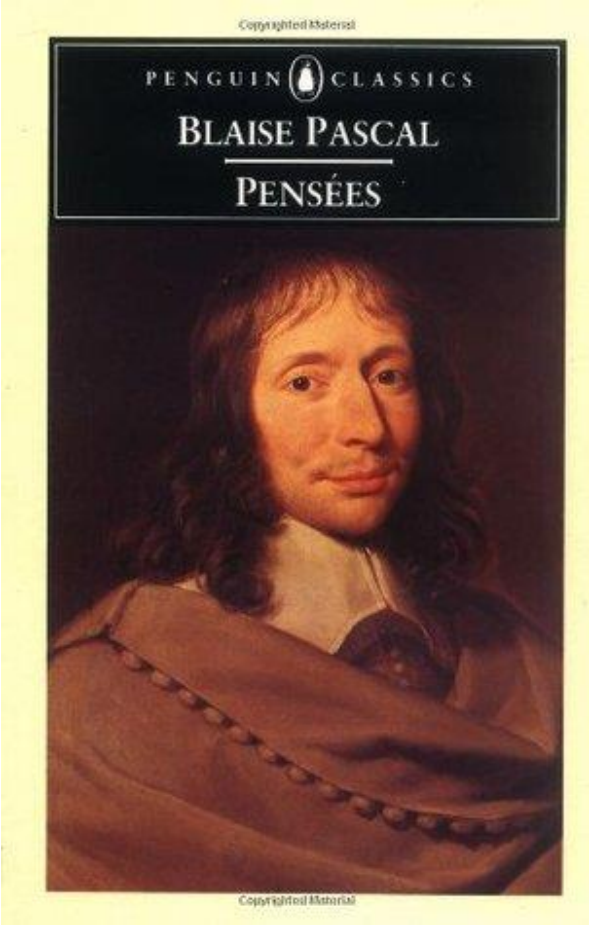
数据分析，绝对是个交叉领域，有着悠久的历史

数据分析有着悠久的历史
(HISTORY view about Data Analytics)

- **数据分析的历史，体现了人类对智慧永不止歇的追逐 – 3 个阶段**
  - 计算机出现以前，人是主体 – 发现和构建理论(知识)以理解宇宙和我们自己
  - 有了计算机 – 至今(3个小阶段)，人们尝试将计算机作为知识发现的主体 … 但，也还是计算参数而已
  - 未来，还在路上
- **一点建议 –如何学习机器学习 (Machine Learning)**

Data Analytics? Part of human wisdom 人是会思考的芦苇

- **The unique personality of human is its wisdom**



"Man is only a reed, the weakest in nature, but he is a thinking reed. *There is no need for the whole universe to take up arms to crush him*: a vapor, a drop of water is enough to kill him. but even if the universe were to crush him, man would still be nobler than his slayer, because he knows that he is dying and the advantage the universe has over him. The universe knows none of this."

- — Blaise Pascal, Pensées

http://www.goodreads.com/quotes/394587-man-is-only-a-reed-the-weakest-in-nature-but

Human construct theories

Before IT

Human use computers to compute parameters

IT ---------- till now

Computers construct (theories)

Future

Mathematics (including **Statistics**)

Big picture of pursuing wisdom

Other areas are also wisdom – physics etc., I mean math is the kernel

Wisdom? – 3 stages: Before IT

- **Wisdom appears first as the knowle**
  world/universe/human being … philo
- **3 stages – Wisdom 1: before Computers/I**
  - Human constructs theories to know the principles behind facts

Mathematics is the crown, and everywhere

Operational Research, (E)**MBA**/MPA, …

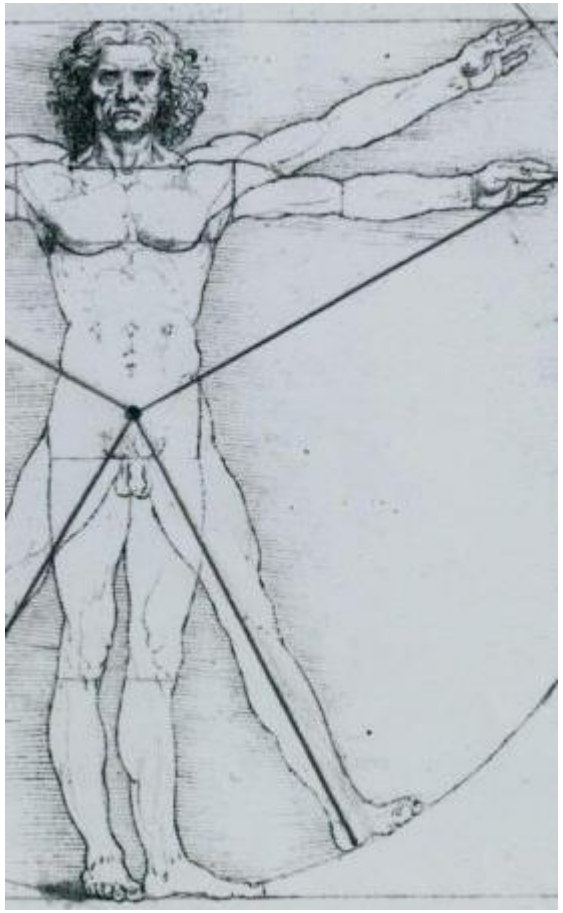
Linear Algebra, **Statistics**, Stochastics processes,, …

Algebra, Geometry, Calculus, Probability, **Optimization**, Graph theory, …

Set theory, Mathematical logic

And mankind could make tools ☺

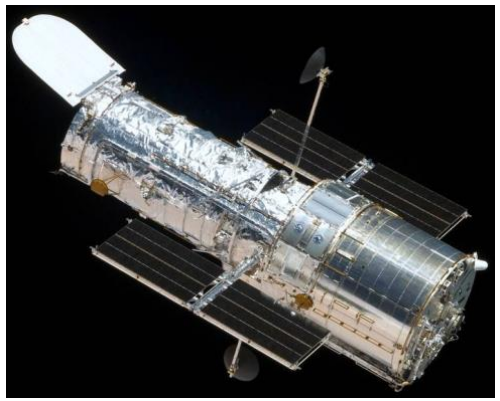
- **Wisdom also appears as the capability to make tools/machines which extend our abilities**



See farther

https://www.nasa.gov/mission_pages/hubble/story/index.html

the Hubble Space Telescope



Our Sky-eye

中國「天眼」望遠鏡

https://cn.nytimes.com/china/20160926/china-telescope-fast-space-seti/zh-hant/

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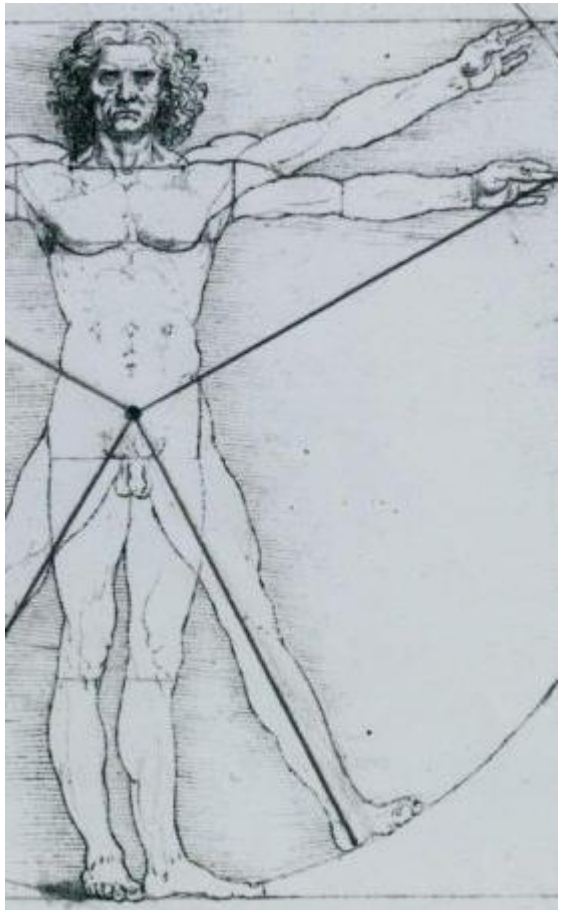
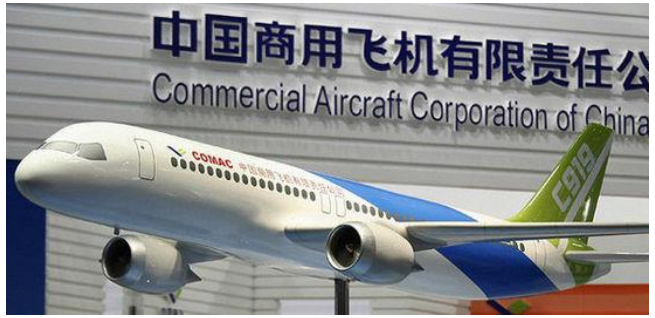
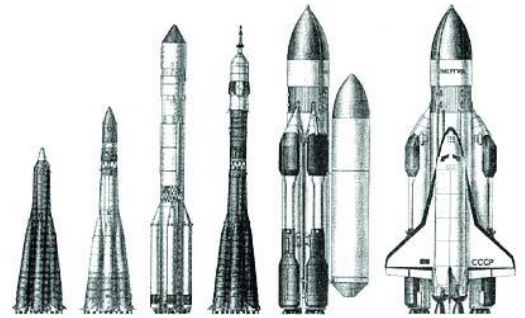


Run faster

CRH (China Railway High-speed: 中国铁路高速列车)





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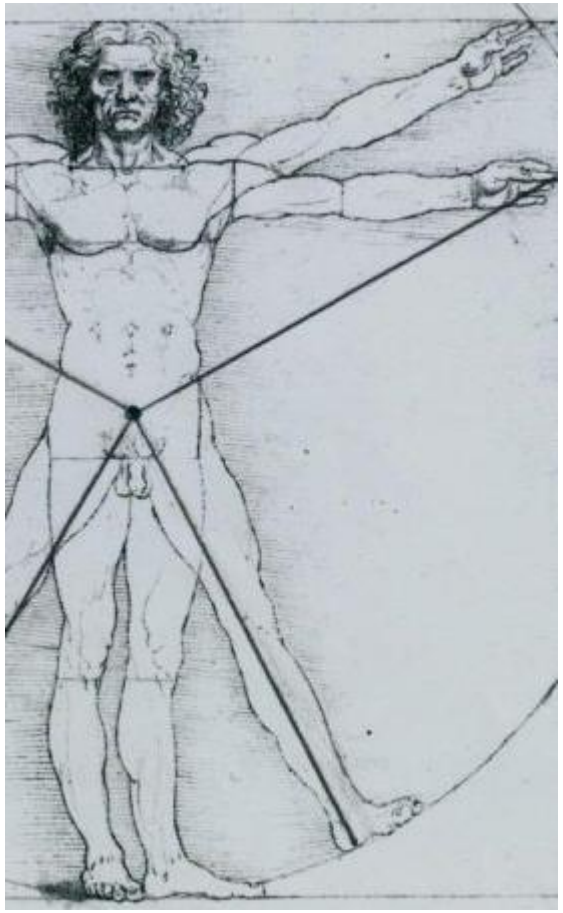
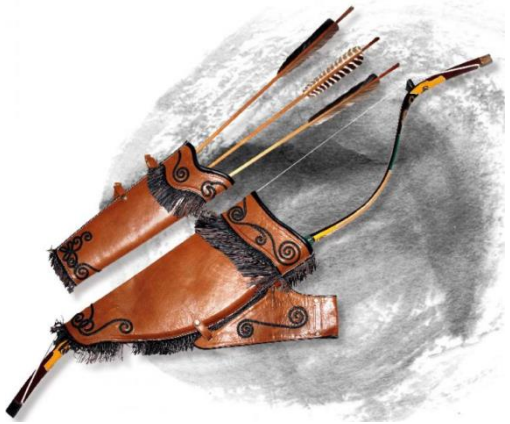


Sadly, many tools to kill ☹



Computers should be the most exciting/powerful tool mankind ever builds so far!


Alan Mathison Turing

Theoretical model of modern computer

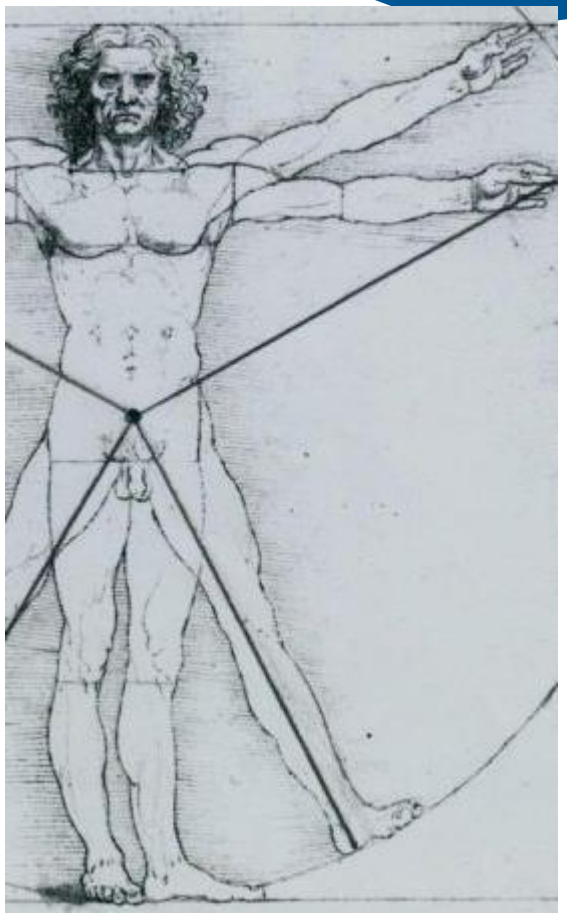

John Vincent Atanasoff

Combine the electronics and binary together

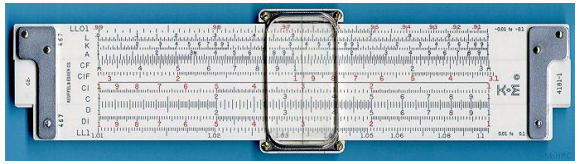

John Von Neumann

Common architecture of modern computers

capability to make xtend our abilities



Computing …



IBM 7094

1673: 4-function mechanical calculator (addition, subtractions, multiplication, division)

IBM 360

Big picture of pursuing wisdom

Human construct theories	Human use com		Computers construct (theories)
Before IT	IT ----------------------------	till now	Future

Mathematics (including **Statistics**)

AI **(1956)**
Ambitious then to make computers having human capability

Perceptron **(1957)**
Optimistic Simulate nerve cell

- **LI** **(1950-70)**
- **KE/ES** **(1975-85)**

XOR **(1969)**
Nonlinear challenge

HMM, MDP **(1960s)**

数据分析有着悠久的历史
(HISTORY view about Data Analytics)

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- **一点建议 –如何学习机器学习 (Machine Learning)**

Wisdom? – 3 stages: In Computers/IT now

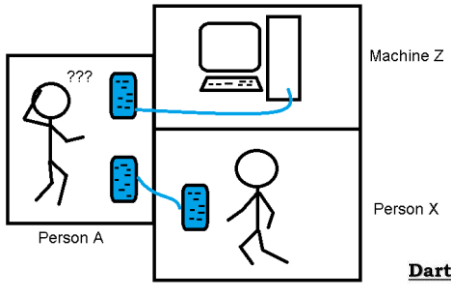
3 stages – Wisdom 2: In Computers/IT now (1940s – present)

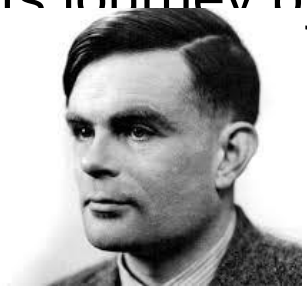
Human teaches computers to learn wisdom – AMBITIOUS!

- **AI**: Artificial Intelligence is the logo for this, which starts its journey by simulating **human brain**.
- 1950: AI? – Turing test

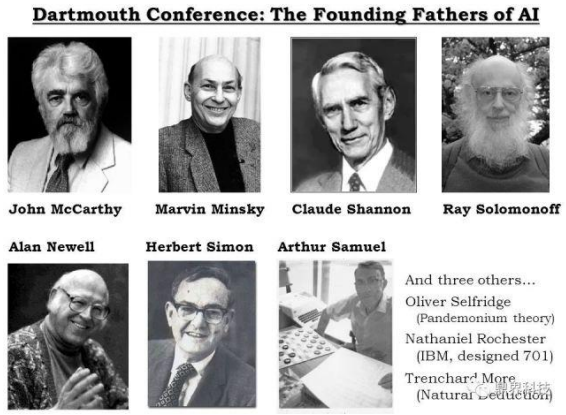
  https://en.wikipedia.org/wiki/History_of_artificial_intelligence

  https://zh.wikipedia.org/wiki/人工智能史





- 1956: the term "artificial intelligence“ was formed
  - ✓Dartmouth conference



https://www.linkedin.com/pulse/goedels-incompleteness-theorem-emergence-ai-eberhard-schoeneburg

AI has many definitions…

- *Behavior by a machine that, if performed by a human being, would be considered intelligent*
- *"…study of how to make computers do things at which, at the moment, people are better*
- *Theory of how the human mind works*

AI Objectives

- Make machines **smarter** (primary goal)
- Understand what **intelligence** is
- Make machines more **intelligent** and **useful**

After 1956, many amazing inventions are proposed

- *达特茅斯会议之后的数年是大发现的时代。对许多人而言，这一阶段开发出的程序堪称神奇：计算机可以解决代数应用题，证明几何定理，学习和使用英语。当时大多数人几乎无法相信机器能够如此“智能”。*
  https://zh.wikipedia.org/wiki/人工智能史

- *The years after the **Dartmouth conference** were an era of discovery, of sprinting across new ground. The programs that were developed during this time were, to most people, simply "astonishing":[44] computers were solving algebra word problems, proving theorems in geometry and learning to speak English. Few at the time would have believed that such "intelligent" behavior by machines was possible at all.* https://en.wikipedia.org/wiki/History_of_artificial_intelligence

AI 1. LI period – Logic Inference is hot then

John McCarthy

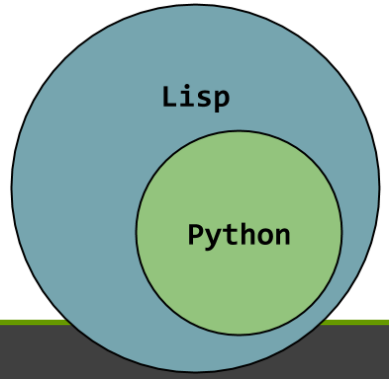
- **1950s-1970**
  - Human conclude the rules to do inference, and then finish them as programs for computers
  - Many logic language – **LISP**
    - Lisp (**LIS**t **P**rocessor) was invented by John McCarthy in 1958 at the MIT.
    - Lisp is the second-oldest HPL after **Fortran**.
    - Today, the most widely known general-purpose Lisp dialects are **Common Lisp** and **Scheme**.
- **NB: there are still other ideas**

Example: MEMBER

As an example we define MEMBER, which tests whether an atom is in a list of atoms

```
(DEFUN MEMBER (X LIST)
  ;; X is a top-level member of a list if it is the first
  ;; element or if it is a member of the rest of the list.
 (COND ((NULL LIST) NIL)
       ((EQUAL X (CAR LIST)) T)
       (T (MEMBER X (CDR LIST))) ) )
```

MEMBER is typically a built-in function



Do you want to try this? – your turn ☺

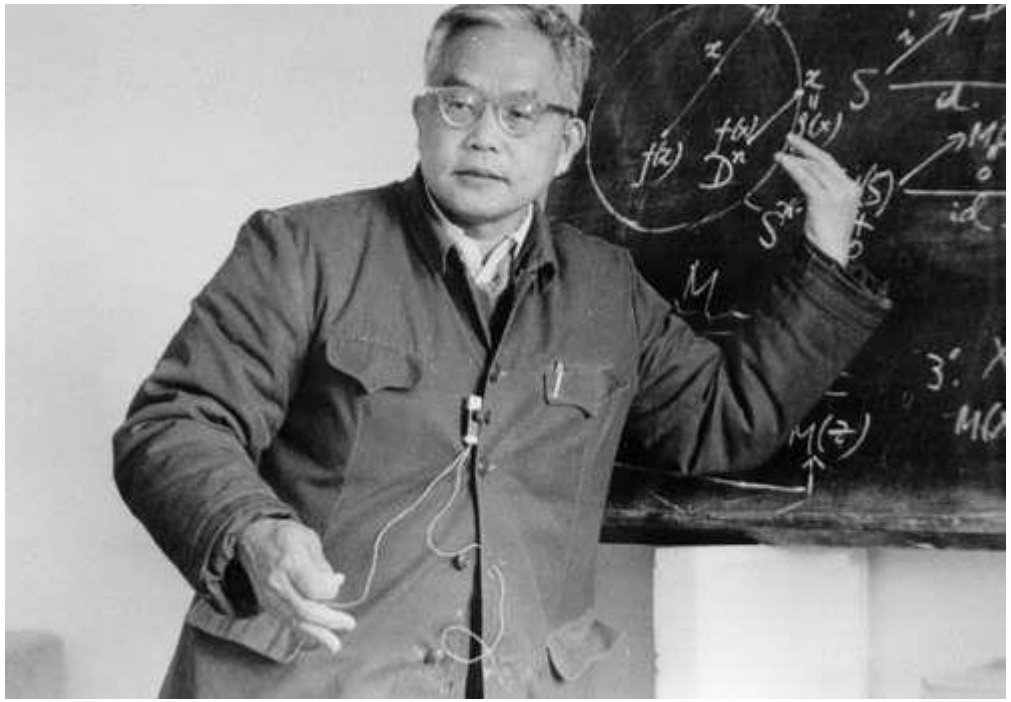
Later researchers are aware that LI for everything is too ambitious. They then try to only focus on some specific domains

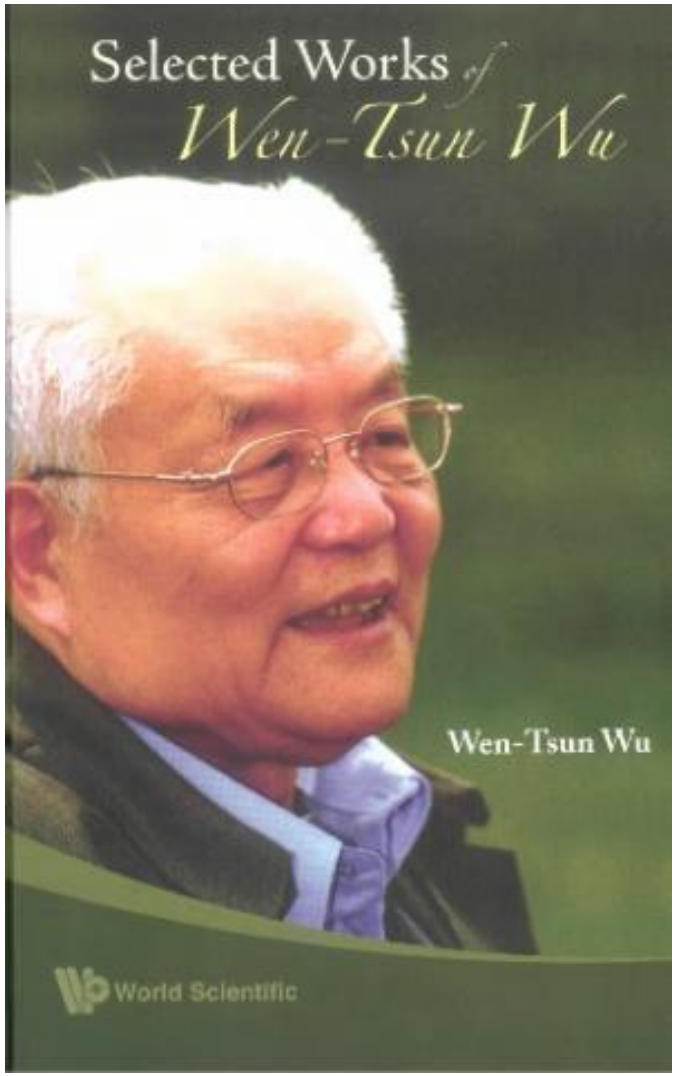
Example E

```
(define (reduce f a x y b fx fy)
  (cond ((close-enough? a b) x)
        ((> fx fy)
         (let ((new (x-point a y)))
           (reduce f a new x y (f new) fx)))
        (else
         (let ((new (y-point x b)))
           (reduce f x y new b fy (f new))))))
```

SICP, Technical Report 735, 1983

- **吴文俊先生的工作仍然值得纪念 – 虽然对推动AI似乎没那么大，但是，毕竟曾经在世界之巅**
  - 不过，美欧有一段时间不资助 AI 也是情有可原的 ☺
    https://zh.wikipedia.org/wiki/人工智能史



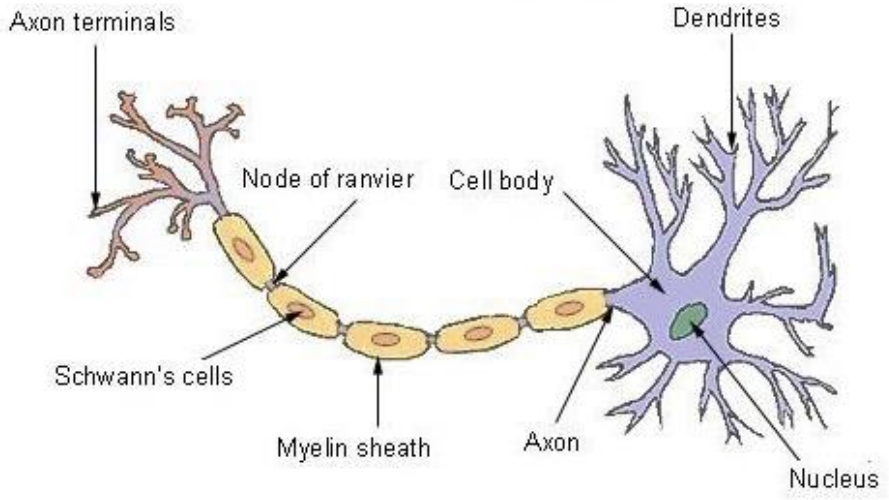


- SELECTED WORKS OF WEN-TSUN WU
- *Wen-Tsun Wu*
- 2008

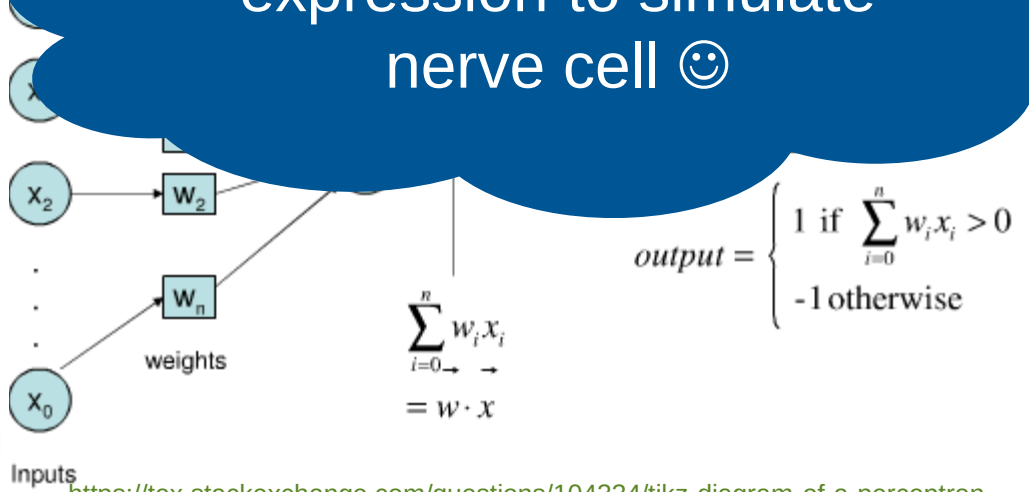
Later as ML A: Simulate brain …

Frank Rosenblatt
The Perceptron: A Perceiving And Recognizing Automaton (Project Para). January, 1957
IBM 704
https://en.wikipedia.org/wiki/Frank_Rosenblatt

- **Human teaches computers to learn wisdom – AMBITIOUS!**
  - Among the AI ideas, Perceptron (1957) [感知器(设计来表现或模拟大脑识别和区别能力的计算机或计算机控制的机器)] is proposed to simulate neuron/Nerve cell [神经元]
    - Sketch NC as a multivariable function



Simple but beautiful math expression to simulate nerve cell ☺



https://tex.stackexchange.com/questions/104334/tikz-diagram-of-a-perceptron

https://zh.wikipedia.org/wiki/人工神经网络

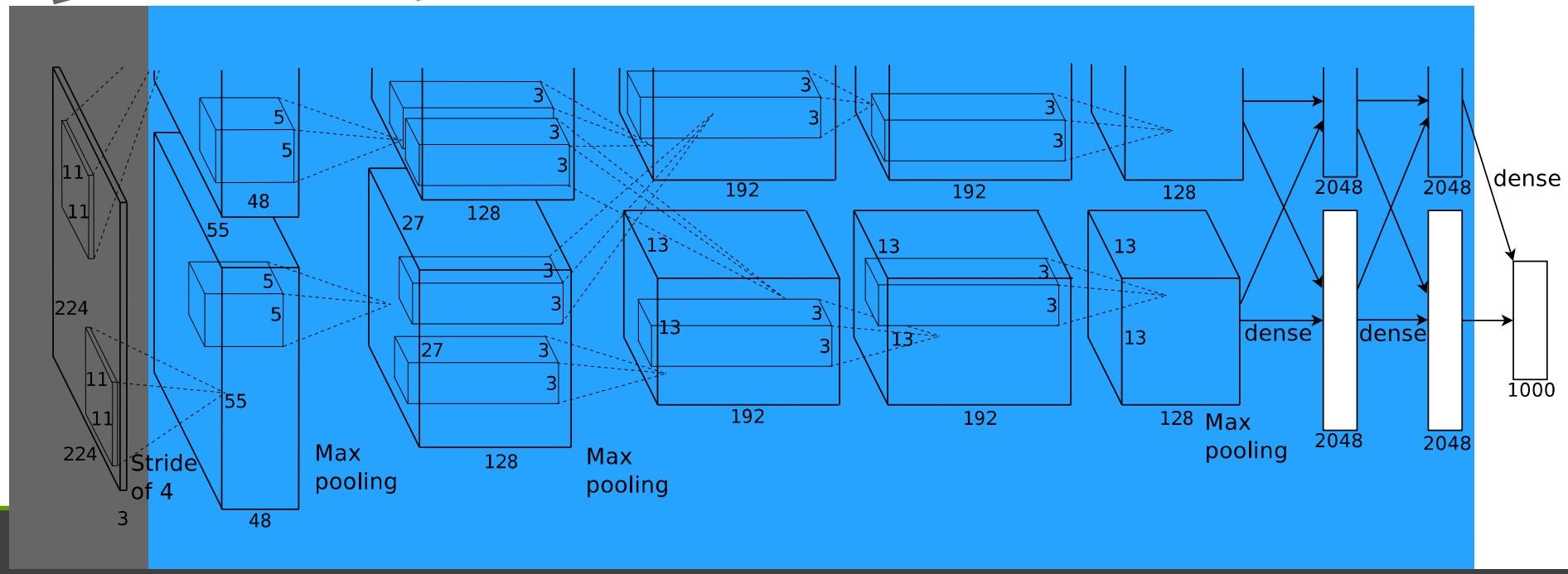
And now Deep Learning!

CNN for Image Classification
(Krizhevsky, Sutskever & Hinton, 2012)
15.3% error on ImageNet LSVRC-2012 contest

Input image (pixels)

- Five convolutional layers (w/max-pooling)
- Three fully connected layers

1000-way softmax

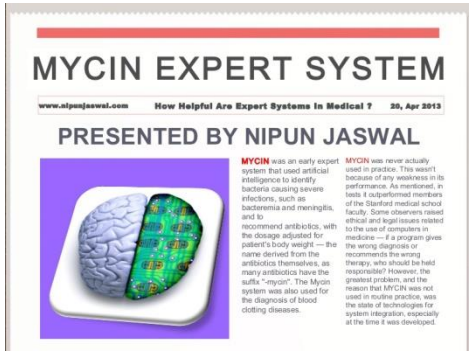


AI 2. KE/ES – Knowledge Eng

Knowledge concluded by human is too inefficient. How about if computers learn knowledge by themselves? – Here comes ML

1975 – 1985

- LI may be too high – like … ers went further to construct ES for pra…
  - Human concluded knowledge related to some domain and constructed
- Mycin： https://en.wikipedia.org/wiki/Mycin
  - written in Lisp as the doctoral dissertation of Edward Shortliffe under the direction of Bruce G. Buchanan, Stanley N. Cohen and others.
- Siri
  - 一个通过辨识语音作业的专家系统，由苹果公司收购并且推广到自家产品 ·个人秘书功能



AI 3: Machine learning - 1983 - now

1983 - now

- Machine learning becomes the focus, till now.
  - In KE/ES, domain knowledge is the key to ensure the applicability of a system for real life. But, ***it's too tedious and challenging to conclude or derive knowledge by human***
  - How about **the machine could learn knowledge by itself**?
    - ✓ Here comes the so-called machine learning

- Two major ways to propose machine learning methods
  - Statistical learning – simulate statistics
  - Neural networks – simulate brain

Human construct theories

Before IT

IT ---

Human use com

Big picture of pursuing wisdom

till now

Computers construct (theories)

Future

Mathematics (including **Statistics**)

AI (1956) **Ambitious** then to make computers having human capability

- **LI** (1950-70)
  - **KE/ES** (1975-85)
    - **ML** (1983-)
      - **- Statistic learning (+other ideas) SVM** (1985/98)

Perceptron (1957) Optimistic Simulate nerve cell

XOR (1969) Nonlinear challenge

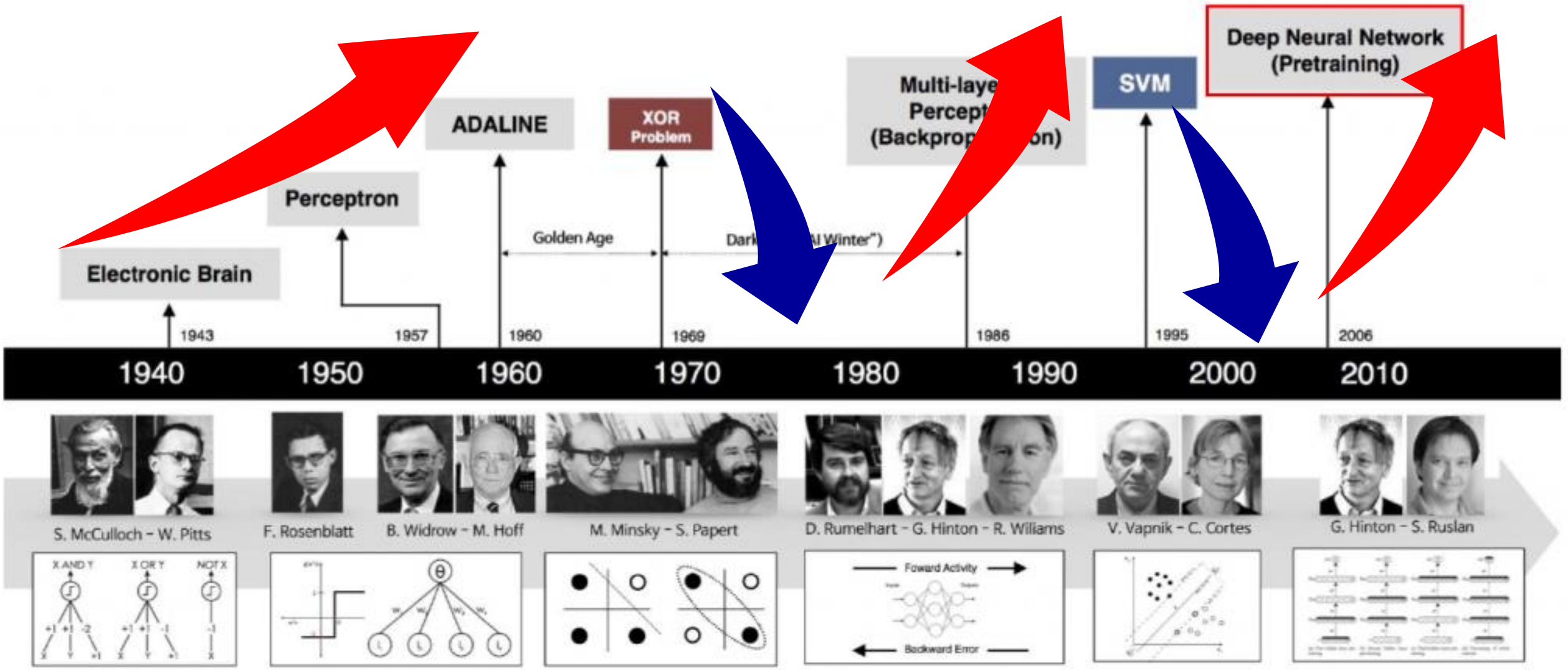
HMM, MDP (1960s)

- (BP)NN (1975) **DL** (2006/12)

ML A: Simulate brain in 1980s…

- **Achievements**
  - Connection of Back Propagation into multi-layer (Deep now) NN originally discovered by Werbos in 1974 *was rediscovered in 1986* with the book *Learning Internal Representation by Error Propagation* by Rumelhart, **Hinton** and Williams.
  - NN of having memory is also studied, which could learn features – Hopfield NN (1982), Boltzmann machine (1985), …
- **However, slow down again – *not better than others, and adapt to be overfitting***
- **But the researchers concluded two ways to improve MLNN (Multi-Layer NN) → Basic idea of Deep Learning now**
  - More layers – either parallel (并联 –DBM, CNN) or series (串联 – RNN/LSTM)
  - Except for the last layer, other layers aim to learn/memorize features

3 waves


Deep Neural Network
(Pretraining)
SVM
Multi-laye
Percept
(Backprop on)
XOR
Problem
ADALINE
Perceptron
Electronic Brain
Golden Age
Dark
Winter")
1943
1957
1960
1969
1986
1995
2006
1940
1950
1960
1970
1980
1990
2000
2010
S. McCulloch - W. Pitts
F. Rosenblatt
B. Widrow - M. Hoff
M. Minsky - S. Papert
D. Rumelhart - G. Hinton - R. Williams
V. Vapnik - C. Cortes
G. Hinton - S. Ruslan
X AND Y
X OR Y
NOT X
Foward Activity
Backward Error

ML B: Simulate Statistics – Hypothesis and Estimation

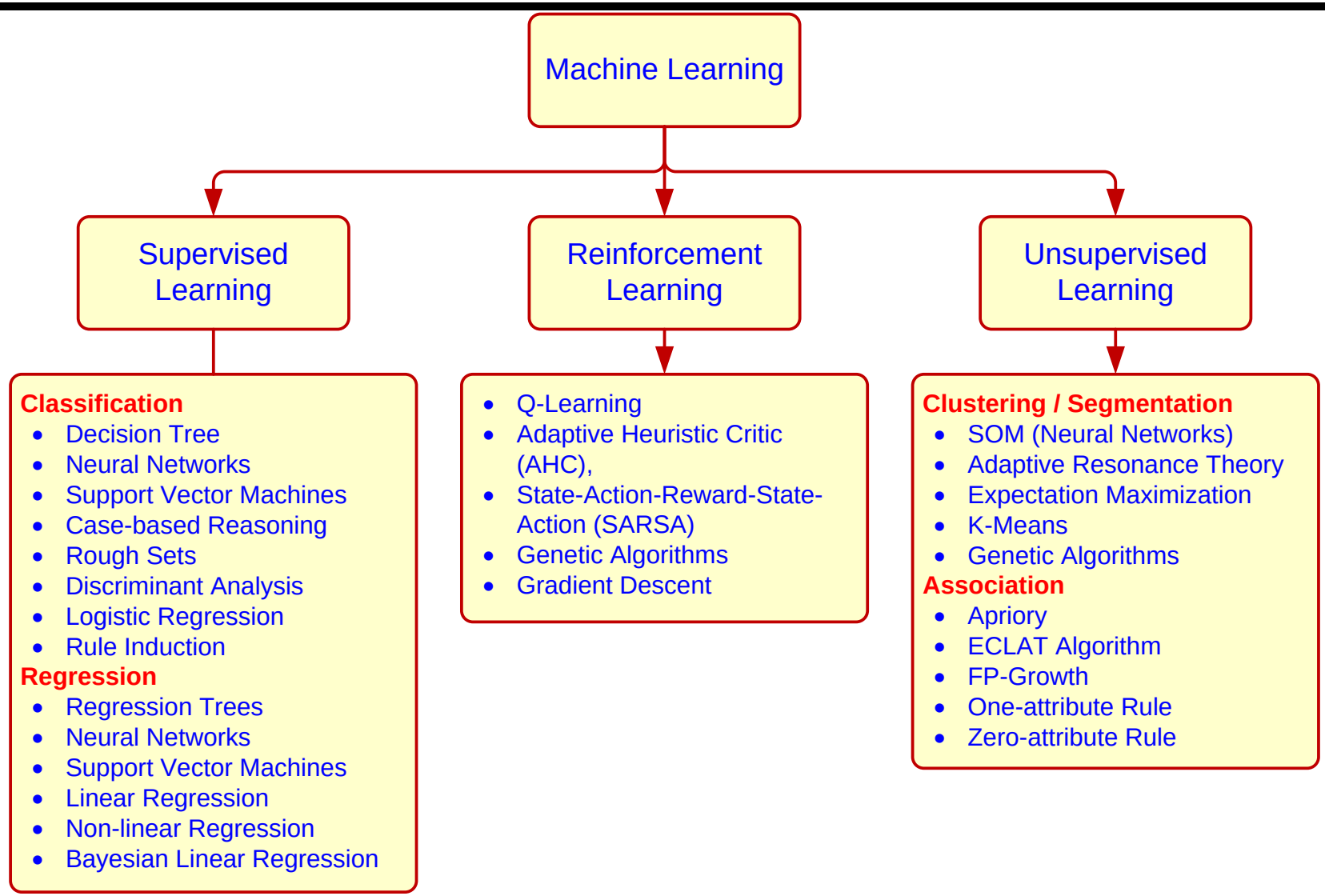
Statistical learning

- For **PURE** statisticians, they think the methods with clear **DEDUCTION (推演)** could be called ML methods.
  - **SVM** (Support Vector Machine) is one of the pearls (another is **NN**)
  - Among many other methods –
    - ✓ Guess distribution/possibility [$P(y|x;\Phi)$ or $P(x|y;\Phi)$],
    - ✓ Decision trees ……

Open minded

- For some researchers, they agree that all methods (from different sources) could be understood as ML methods if they could learn something from data. So **NN is part of ML**.
  - Interdisciplinary – Statistics, Pattern Recognition, Neural Network, Optimization, Operational Research, …

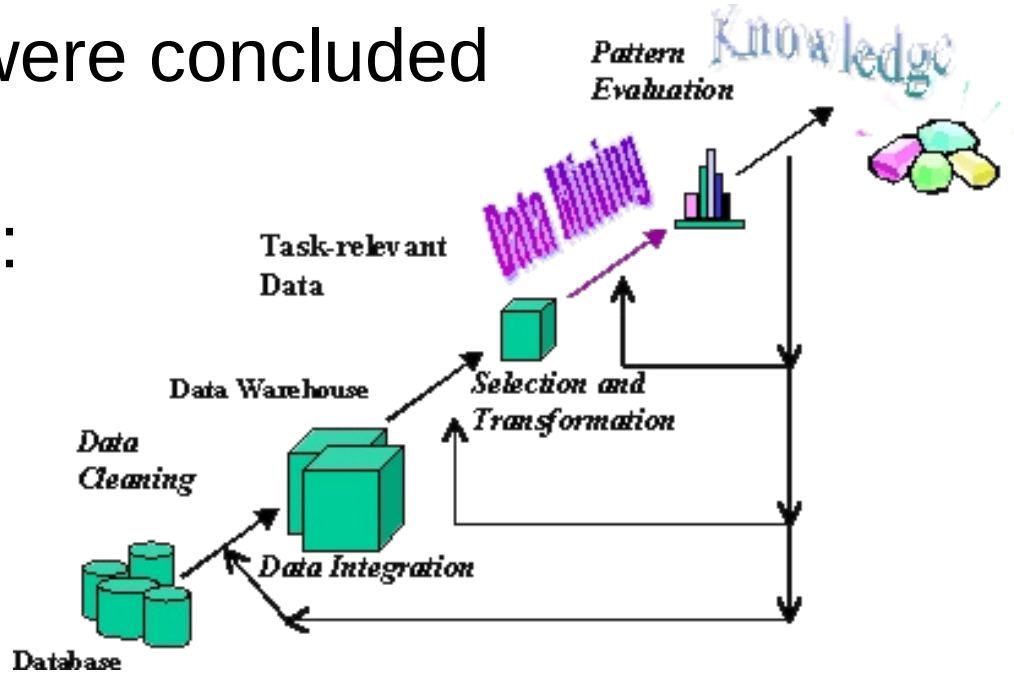
Machine Learning Methods



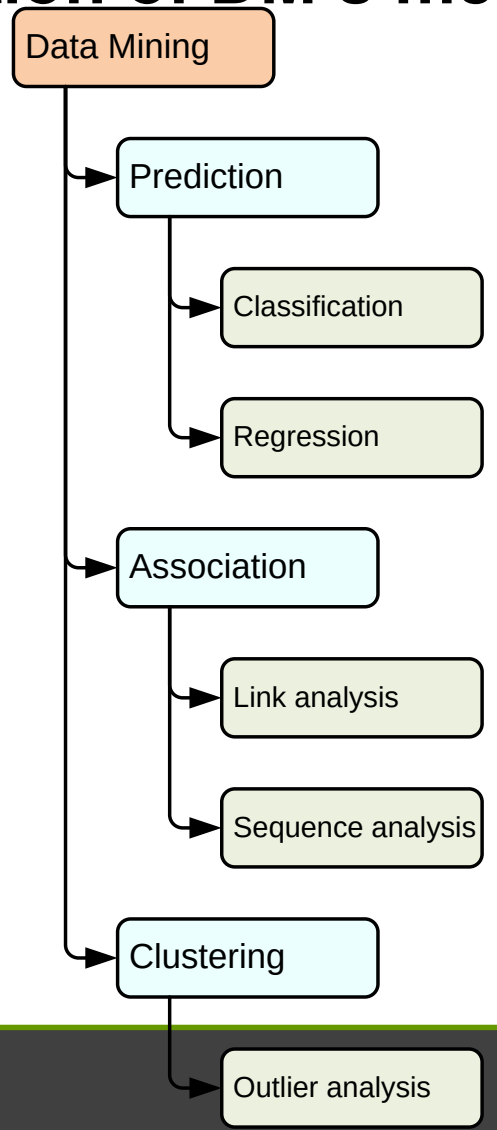
More will be discussed in later “DBMS, ERP, DW, BD” chapter

Data Mining emerged as th

- During **1990s**, (R)DBMSs were widely u much data were collected. How to dig valuable rules/knowledge from the data to improve business is becoming more and more interesting.
- Methods related to this goal were concluded as **Data Mining**.
- The framework is called **KDD**: Knowledge Discovery from Data
- Suite of integrating DM and DBMS is called **Data Warehouse**



Categorization of DM's methods



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Unsupervised	Apriory, OneR, ZeroR, Eclat
Unsupervised	Expectation Maximization, Apriory Algorithm, Graph-based Matching
Unsupervised	Apriory Algorithm, FP-Growth technique
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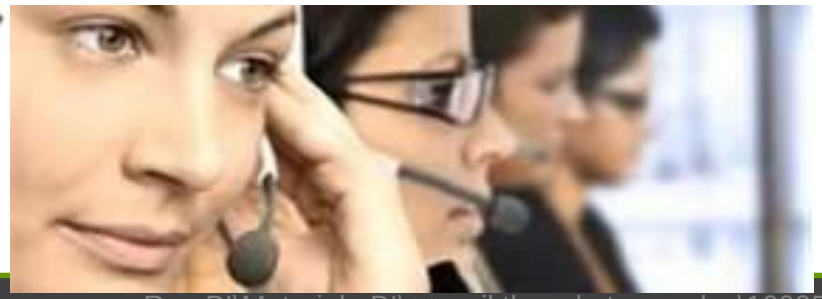
Unsupervised	K-means, Expectation Maximization (EM)

"AI" (ML algorithms) is often transparent in r… commercial products

- **Anti-lock Braking Systems (ABS)**
- **Automatic Transmissions**
- **Video Camcorders**
- **Appliances**
  - Washers, Toasters, Stoves
- **Help Desk Software**
- **Subway Control…**

For me, I think the ML methods are not real intelligence. They just the tools to compute the BEST parameters catering for the data.



数据分析有着悠久的历史
(HISTORY view about Data Analytics)

- **数据分析的历史，体现了人类对智慧永不止歇的追逐 – 3 个阶段**
  - 计算机出现以前，人是主体 – 发现和构建理论(知识)以理解宇宙和我们自己
  - 有了计算机 – 至今 (3个小阶段)，人们尝试将计算机作为知识发现的主体 … 但，也还是计算参数而已
  - 未来，还在路上
- **一点建议 –如何学习机器学习 (Machine Learning)**

Human construct theories

Human use com

Computers construct (theories)

Before IT

IT

till now

Future

Big picture of pursuing wisdom

Mathematics (including **Statistics**)

AI (1956)

Ambitious then to make computers having human capability

- **LI** (1950-70)
  - **KE/ES** (1975-85)
    - **ML** (1983-)
      - **Statistic learning (+other ideas) SVM** (1985/98)

Perceptron (1957)
Optimistic Simulate nerve cell

XOR (1969)
Nonlinear challenge

HMM, MDP (1960s)

- **(BP)NN** (1975)

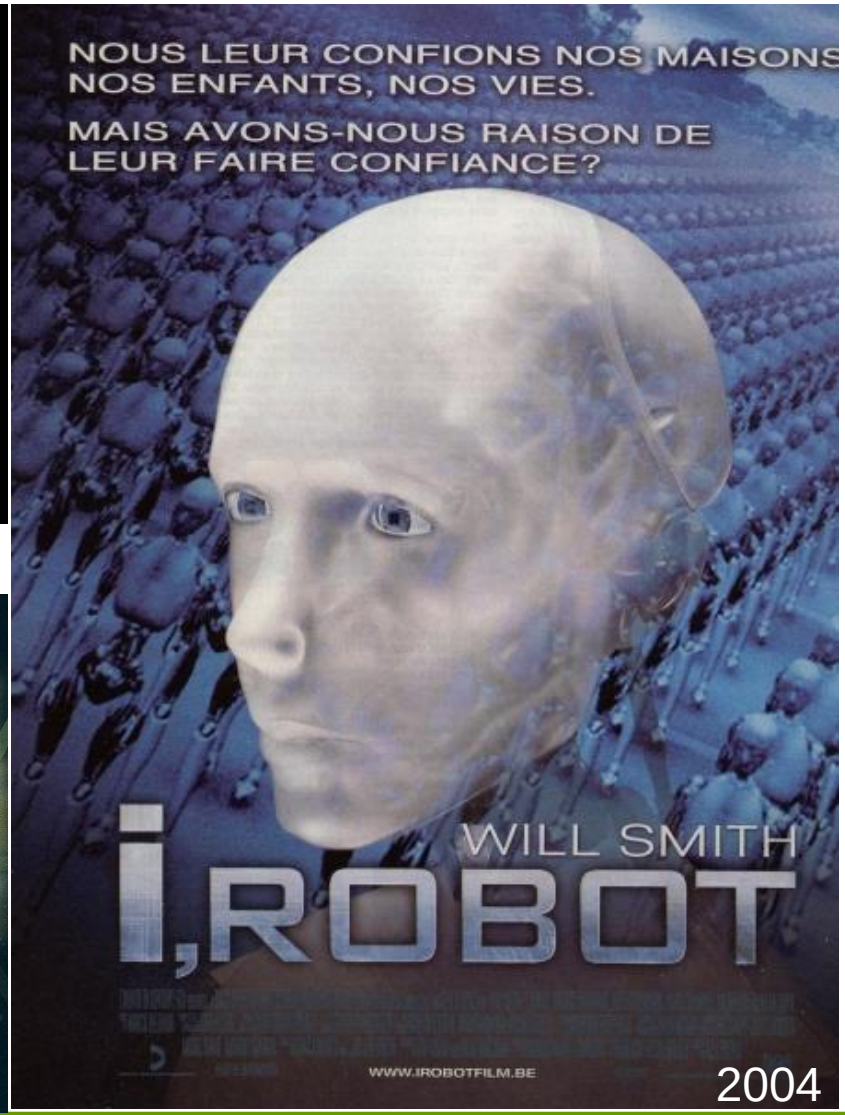
DL (2006/12)

Still to make computers having human capability

Wisdom? – 3 stages:
Wisdom 3: Future … Terminator or Saver?

1984-2015

Interstellar 2016

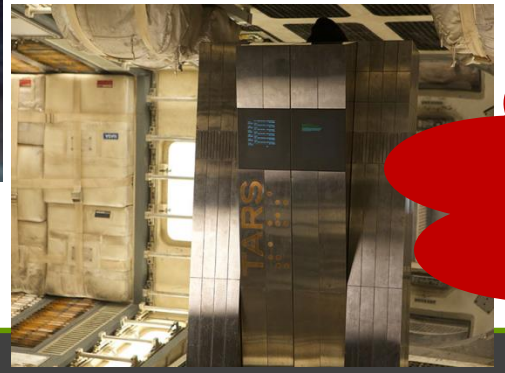


2004

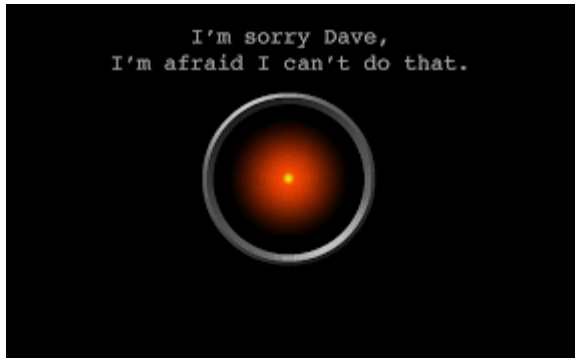
But, this is a paradox [悖论]

钢铁侠
中的
贾维斯
(JARVIS)

星际穿越
中的
TARS



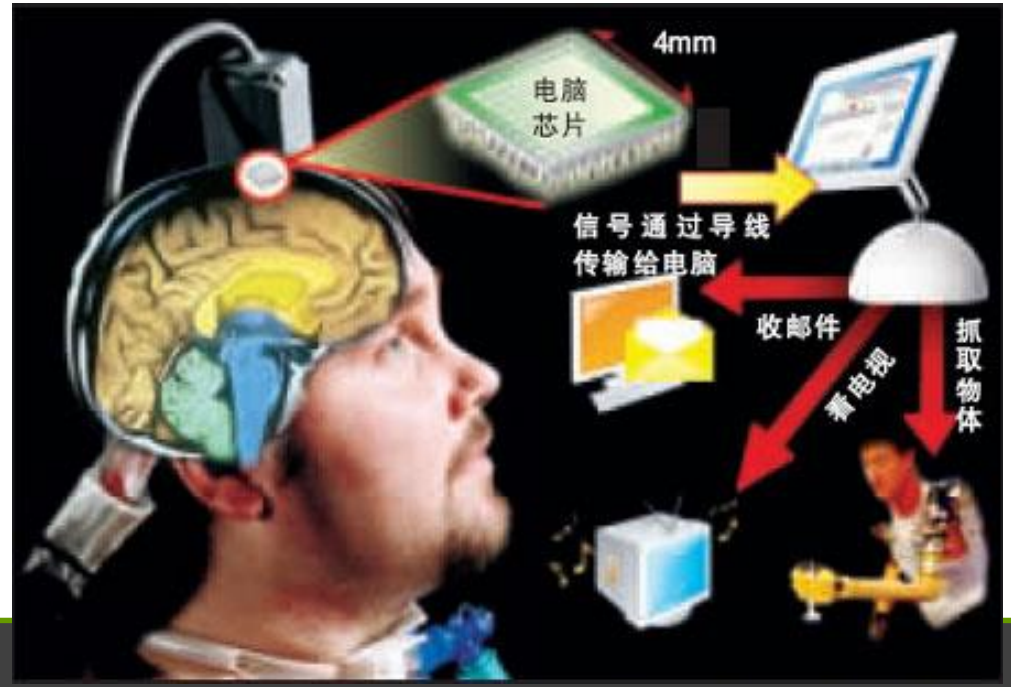
HAL-9000
in 2001: A
Space
Odyssey



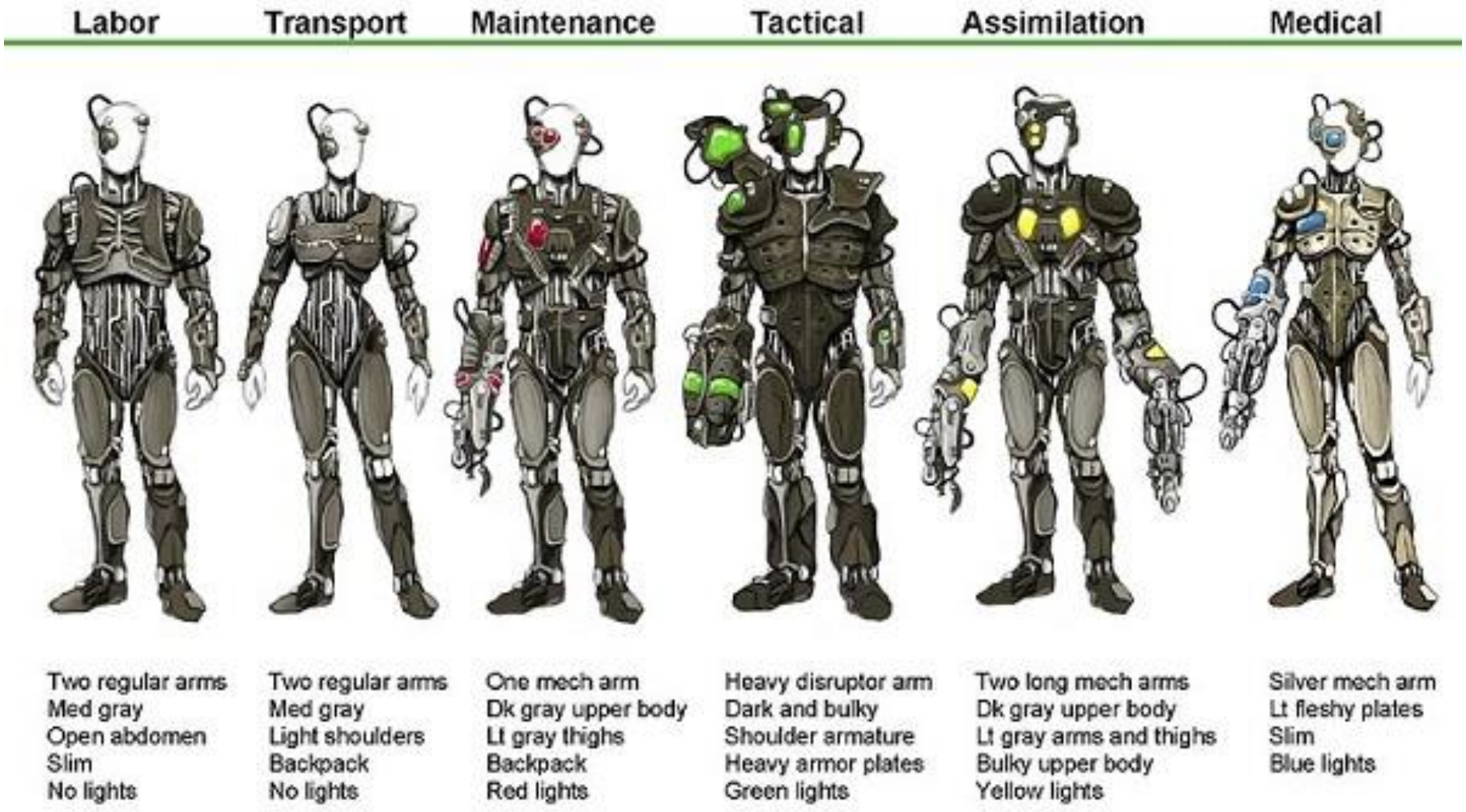
We should have powerful intelligent machines to reach powerful intelligence

My guess …

- **Maybe, one trend could be – direct brain-computer interaction**
  - Our brain is in charge of creativity, while computers are responsible of efficient computing, possibility evaluation, etc., - carrying out and verification what we human want

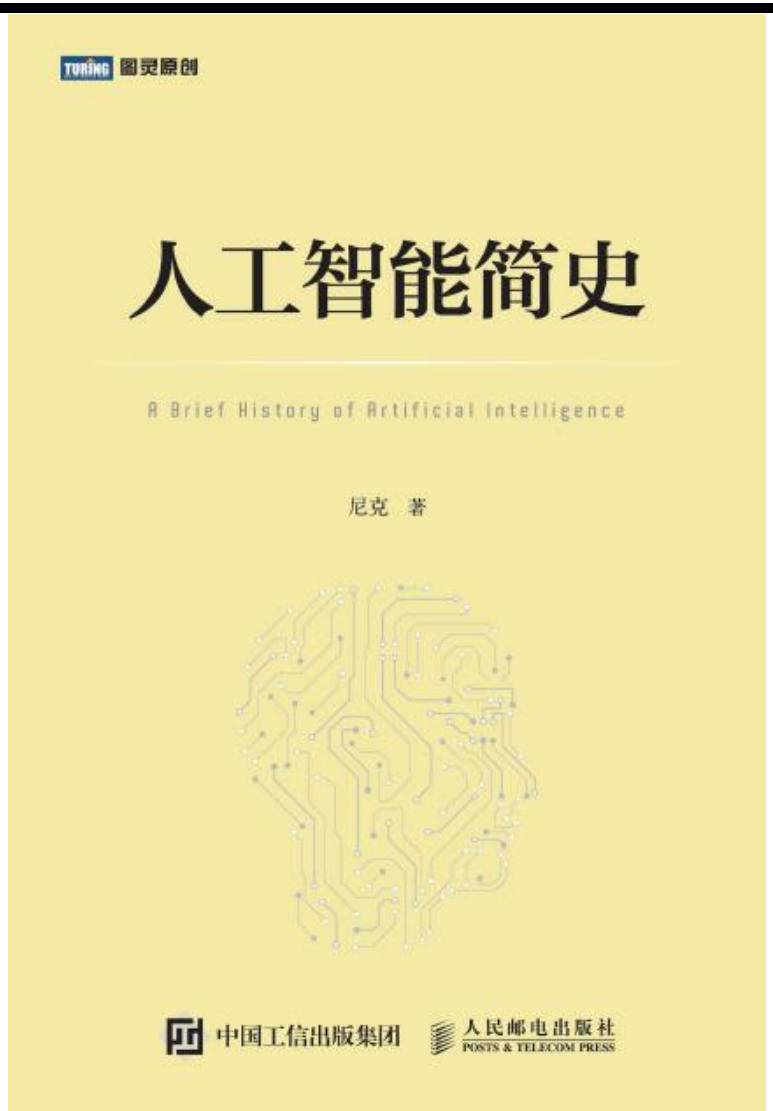


Borg – Half human, and half machine

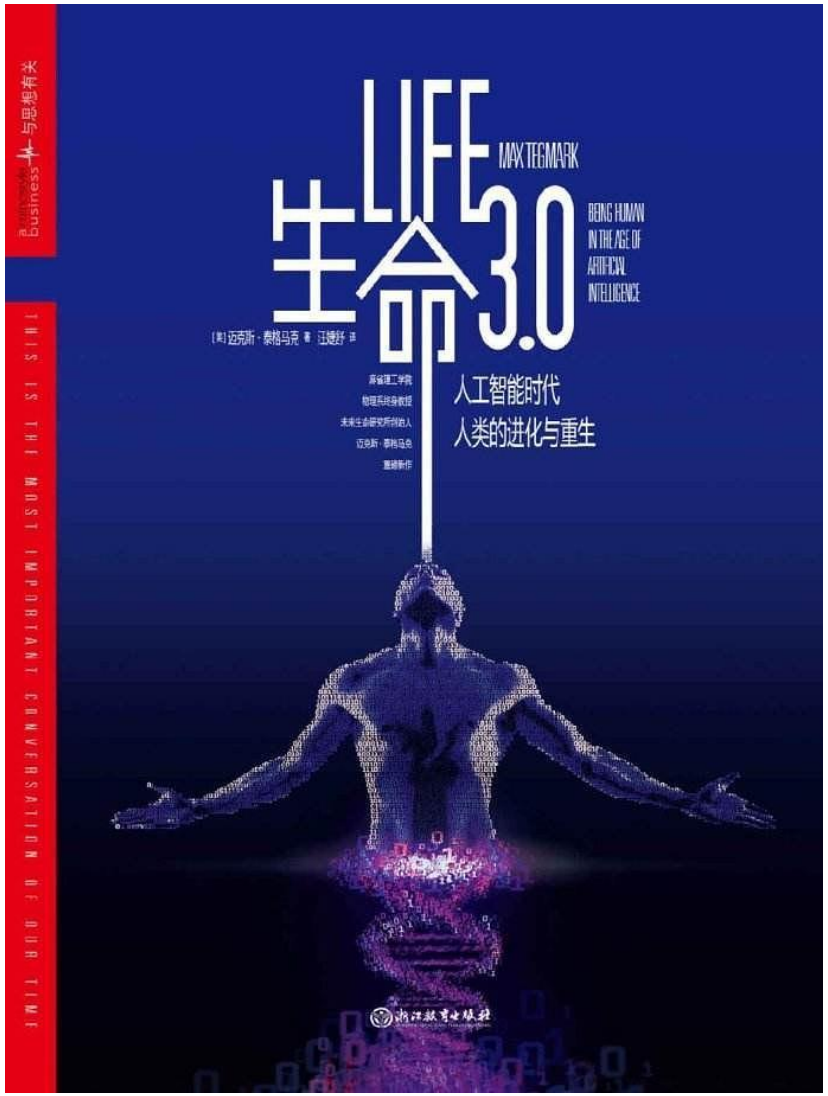


https://en.wikipedia.org/wiki/Ten_percent_of_the_brain_myth

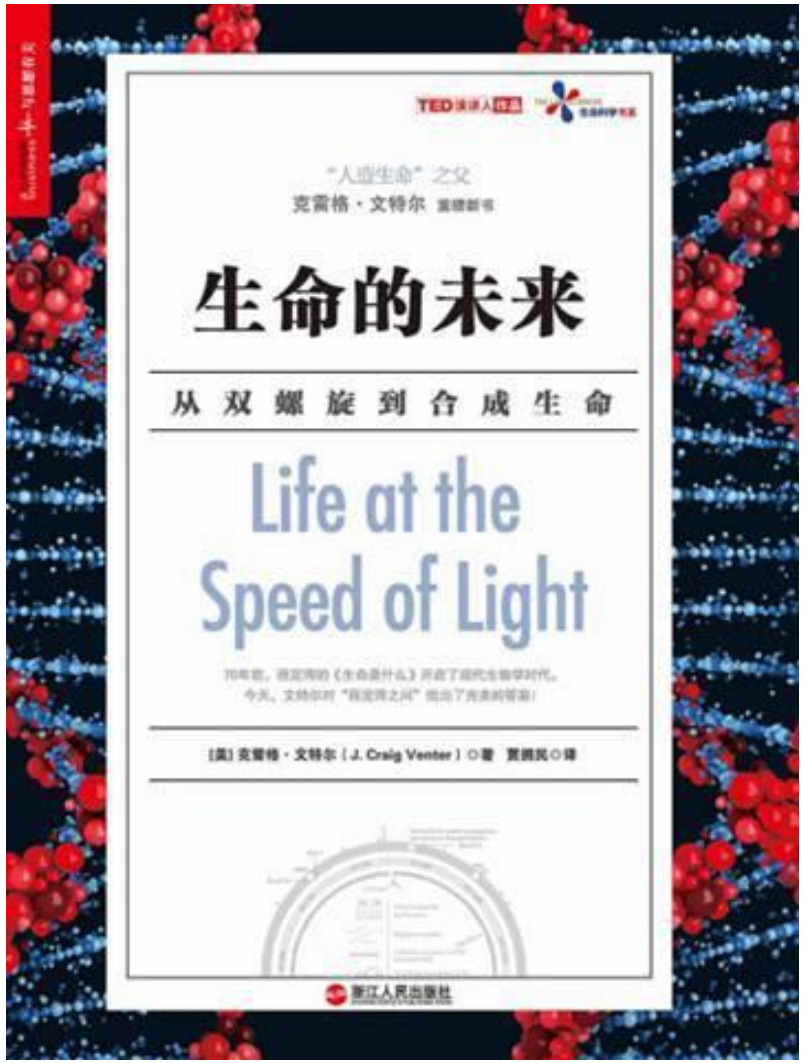
- **Another trend would be and should always be to improve the usage of our brains**
  - **Neurologist Barry Gordon describes the myth as false**, adding, "we use virtually every part of the brain, and that (most of) the brain is active almost all the time."



- 人工智能简史
- 作者: 尼克
- 出版社: 人民邮电出版社
- 出品方: 图灵教育
- 出版年: 2017-12
- 页数: 320
- 定价: CNY 49.00
- 装帧: 平装
- 丛书: 图灵原创
- ISBN: 9787115471604



- 生命3.0
- 作者: [美] 迈克斯·泰格马克
- 出版社: 浙江教育出版社
- 副标题: 人工智能时代，人类的进化与重生
- 原作名: Life 3.0: being human in the age of artificial intelligence
- 译者: 汪婕舒
- 出版年: 2018-6
- 定价: 99.90元
- ISBN: 9787553672786



- 70年前，诺贝尔物理学奖得主薛定谔提出了著名的“薛定谔之问”——生命是什么。70年后，“人造生命之父”克雷格•文特尔通过合成第一个“人造细胞”的方式给出了最 完美的解答。
- 从解码生命、开创全基因组霰弹测序法到合成噬菌体phi X174。从合成第一个完整的基因组，到把一个物种转变为另一个物种，最 终到合成第一个人造细胞。文特尔和他的团队完成了一个又一个“不可能完成的任务”，他们在某种意义上，“扮演了上帝的角色”。
- 假设火星上的生命与地球上的生命都是基于 DNA 的,假设火星有生命或者曾经有过生命,假设火星上有一 个基因测序设备,可以读取任何有可能存在于那里的“火星人”的 DNA 序列。只需要 4.3 分钟把“火星人” 的基因序列发送回地球,我们就可以在地球上的实验室里重造“火星人”！生命的未来值得我们每一个人期待，不是吗?

数据分析有着悠久的历史
(HISTORY view about Data Analytics)

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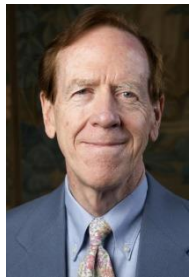
- **一点建议 – 如何学习机器学习 (Machine Learning)**

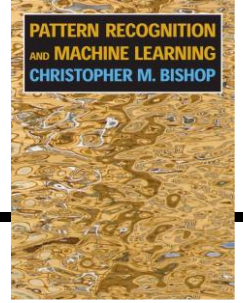
How to learn DA? – My experience

- You should have **a big picture first**!
  - I hope you've learned something from this PPT ☺
- **Optimization + Linear Algebra = basis**



- Optimization: Prof. **LU WuSheng (陆吾生)** has a good book (In English) and video (in Chinese)
  - ✓ You'd better to see this – helpful for you to know what you should understand about LA
  - ✓ Another one – Convex Optimization by Boyd
- LA: Prof. Gilbert Strang @ MIT also has a course video (in English)

Machine Learning

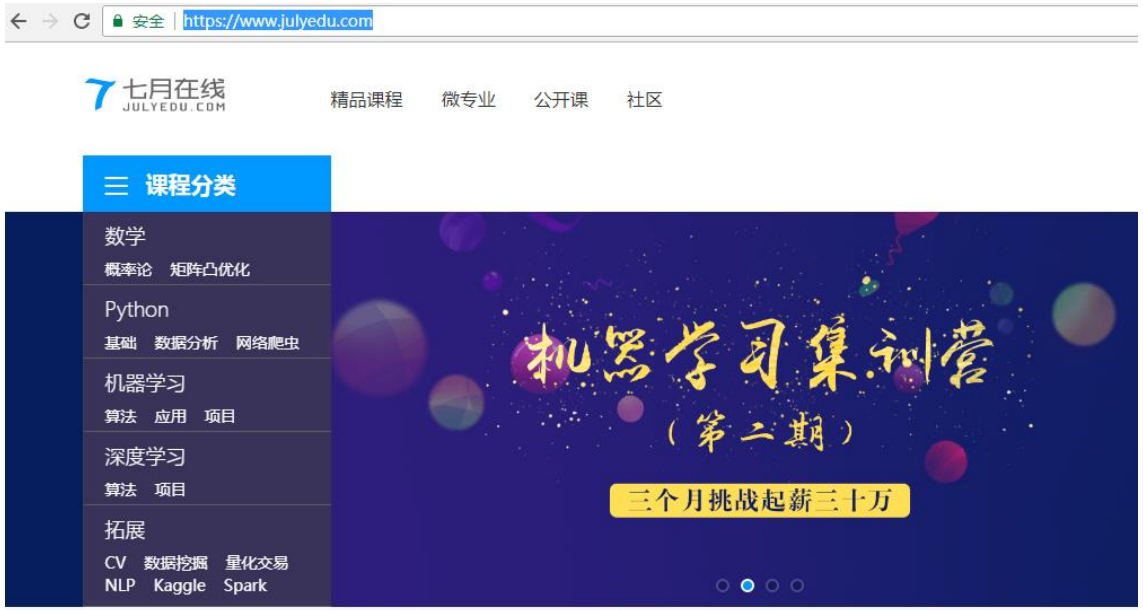


- Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer-Verlag, 2006
- Kevin P. Murphy, Machine Learning:A Probabilistic Perspective, The MIT Press, 2012
- 李航，统计学习方法，清华大学出版社，2012
- 周志华，机器学习，清华大学出版社，2016
- Machine Learning，Andrew Ng，coursera
- 机器学习基石/技术，林轩田，coursera

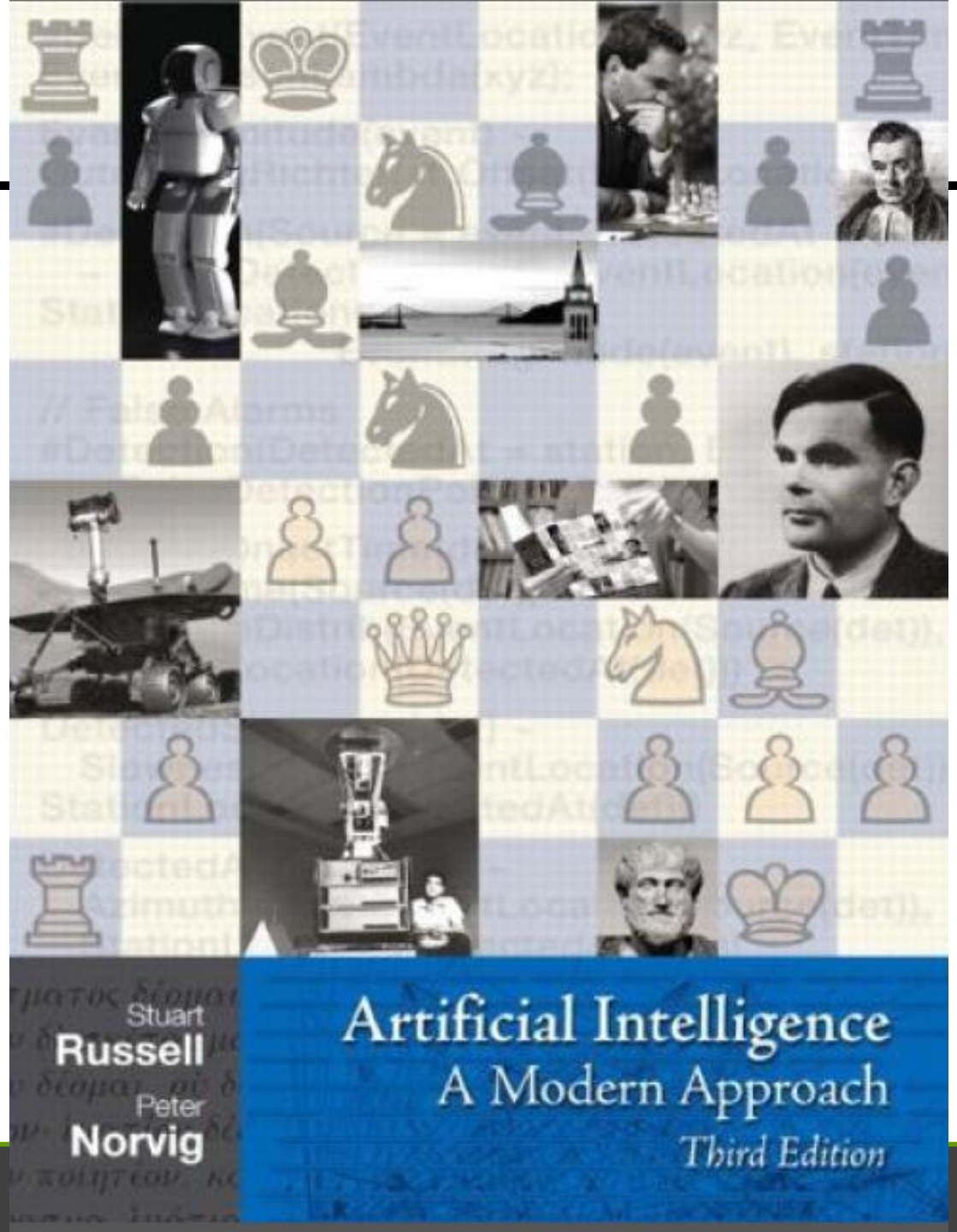
- Then you can watch course video (in English with Chinese caption) of Machine Learning by Andrew Ng @ Stanford
  - Data mining? – So easy now ☺

- There are other videos about ML and DL by JulyEdu (in Chinese)

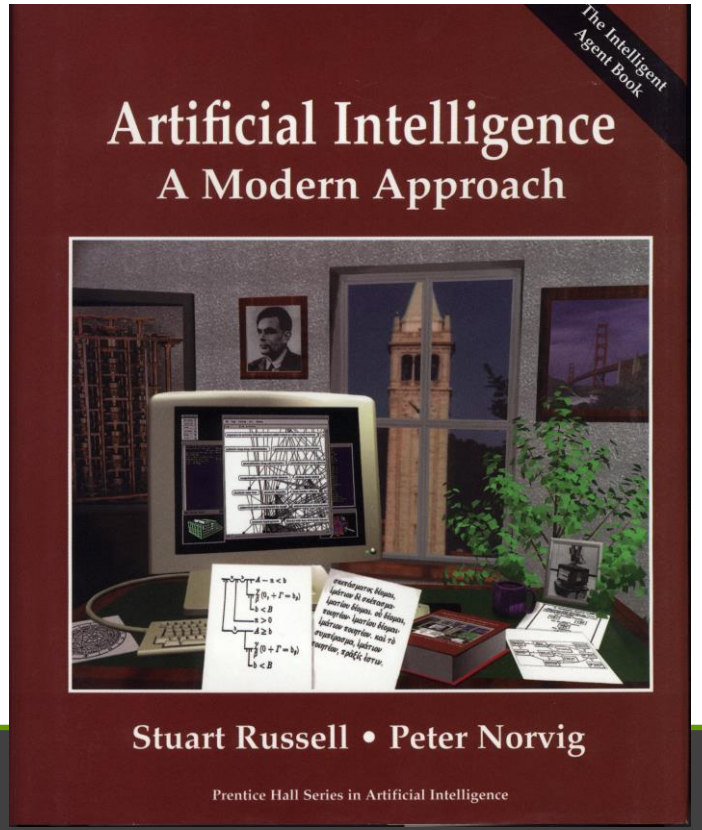
  https://www.julyedu.com/

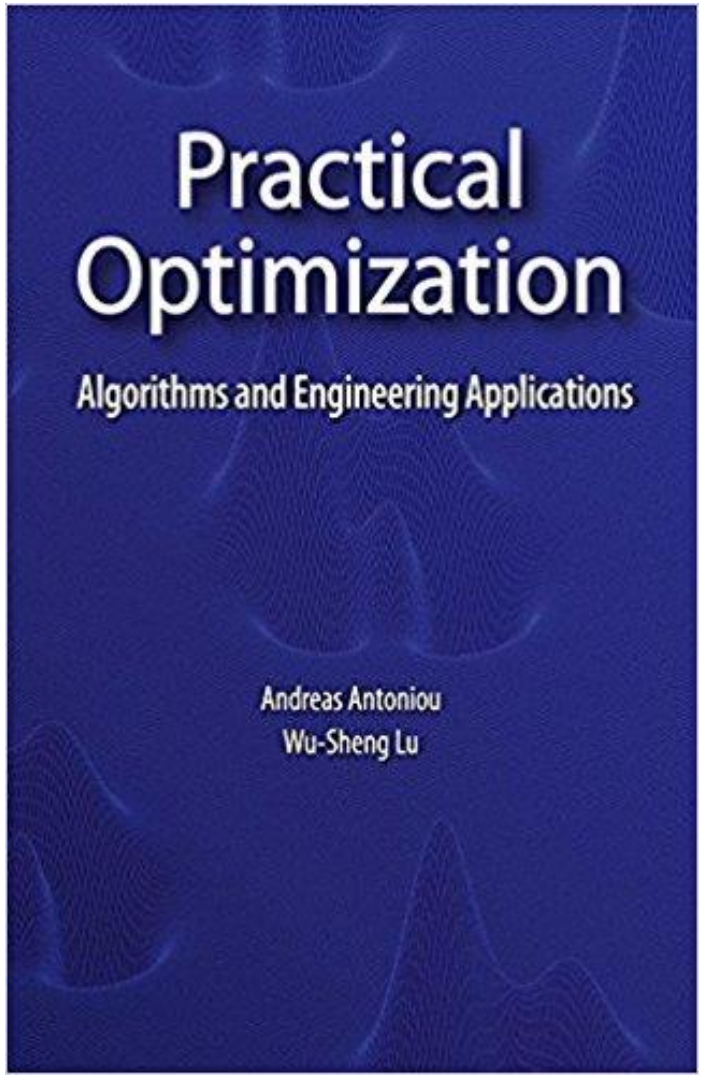


七月在线 JULYEDU.COM

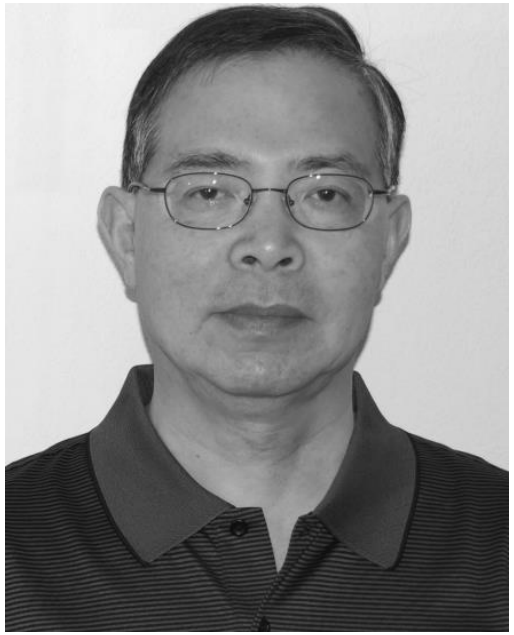


- Artificial Intelligence: A modern approach
- Stuart Russell, Peter Norvig
- Downloaded



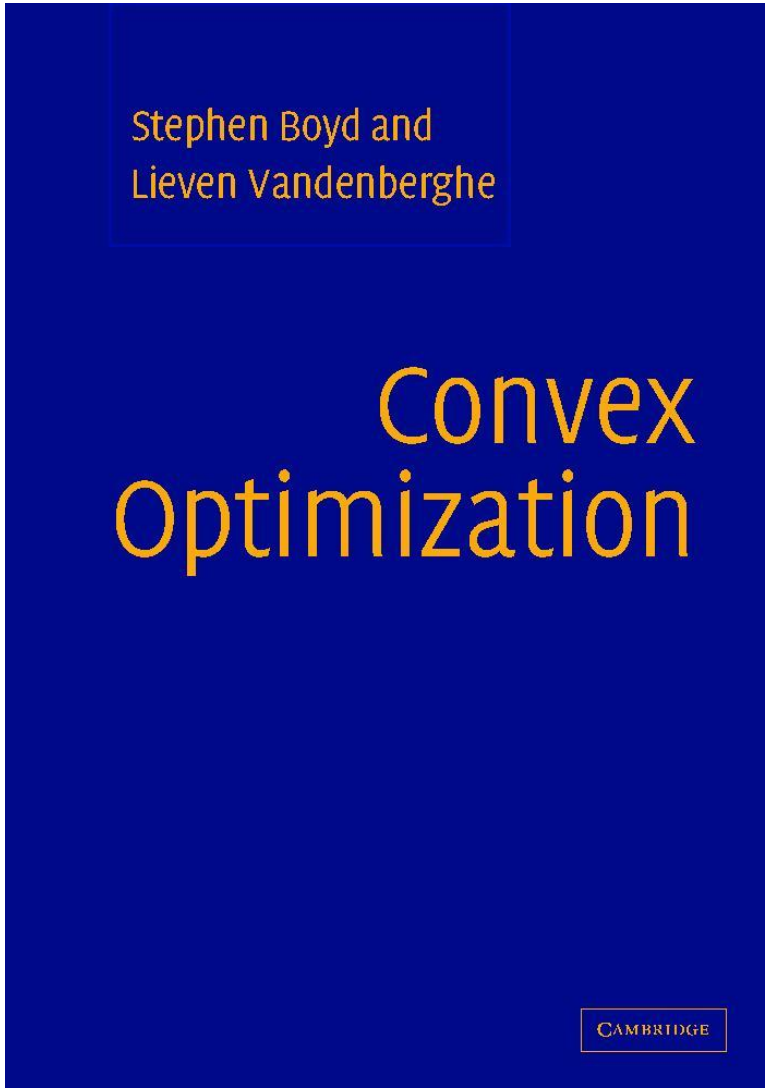


- **Practical Optimization: Algorithms and Engineering Applications 2007th Edition**
- **by Andreas Antoniou, Wu-Sheng Lu**



http://www.ece.uvic.ca/~andreas/Books.html

https://stanford.edu/~boyd/cvxbook/



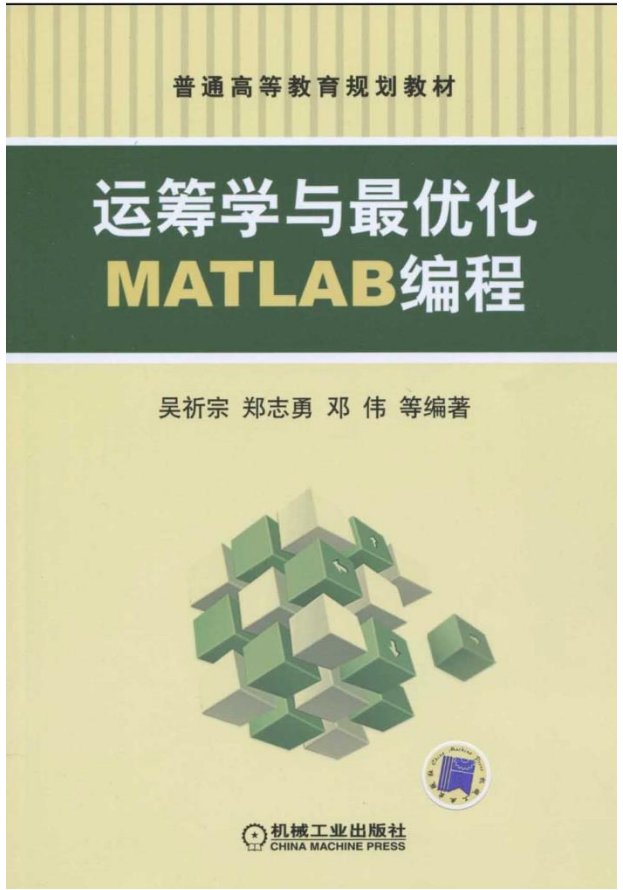
- *Convex Optimization*
  Stephen Boyd and Lieven Vandenberghe

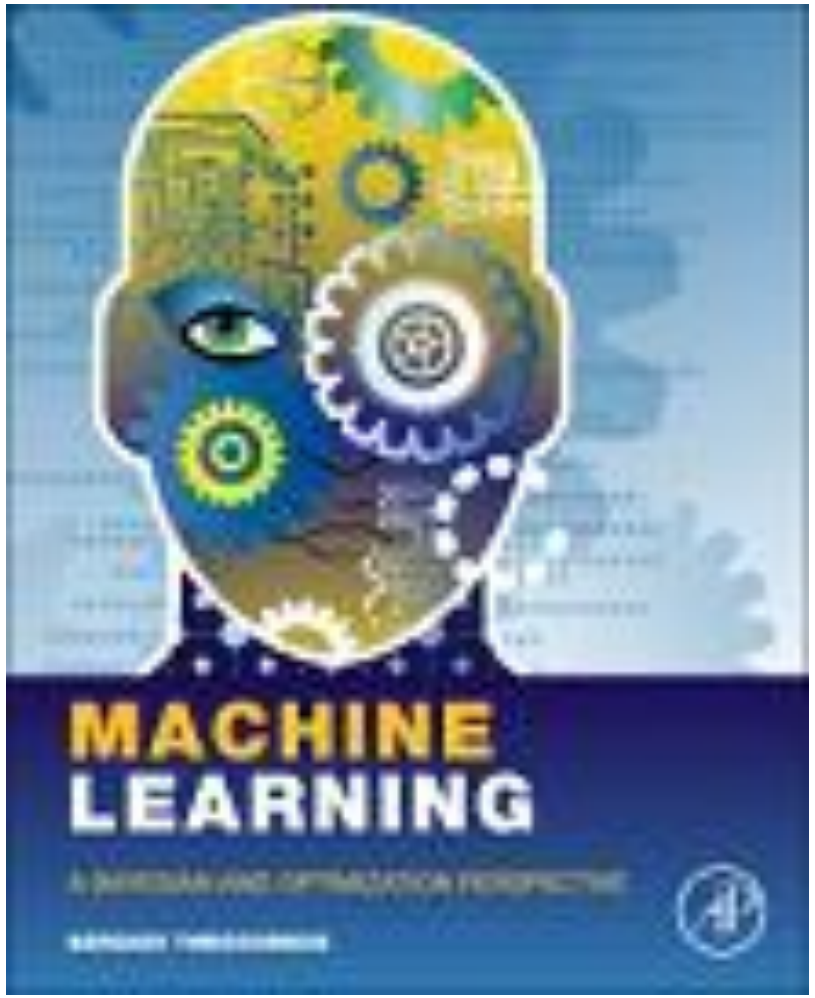
  Cambridge University Press

- **Operational Research 本身有很多内容：**
  - 上面的运筹和优化，偏优化。实际运筹常见如下内容 – 在简单介绍优化后，按照应用来的
  - 那些规划：线性，非线性，整数，目标, 动态
  - 启发式优化：模拟退火，遗传，particle, 。。。
  - 存储问题，网络流，。。。

第1章 线性规划及单纯形法
第2章 线性规划的对偶理论
第3章 运输问题
第4章 整数规划与分配问题
第5章 目标规划
第6章 图与网络分析
第7章 计划评审方法和关键路线法
第8章 动态规划
第9章 存贮论
第10章 排队论
第11章 决策分析
第12章 博弈论

- Operational Research 本身有很多内容：
  - ，



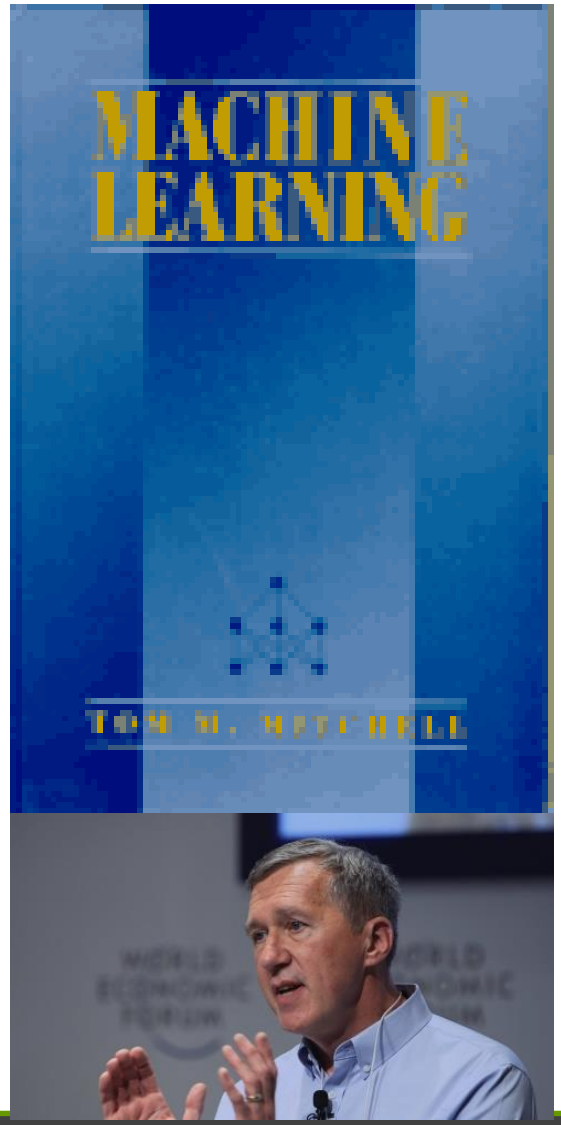


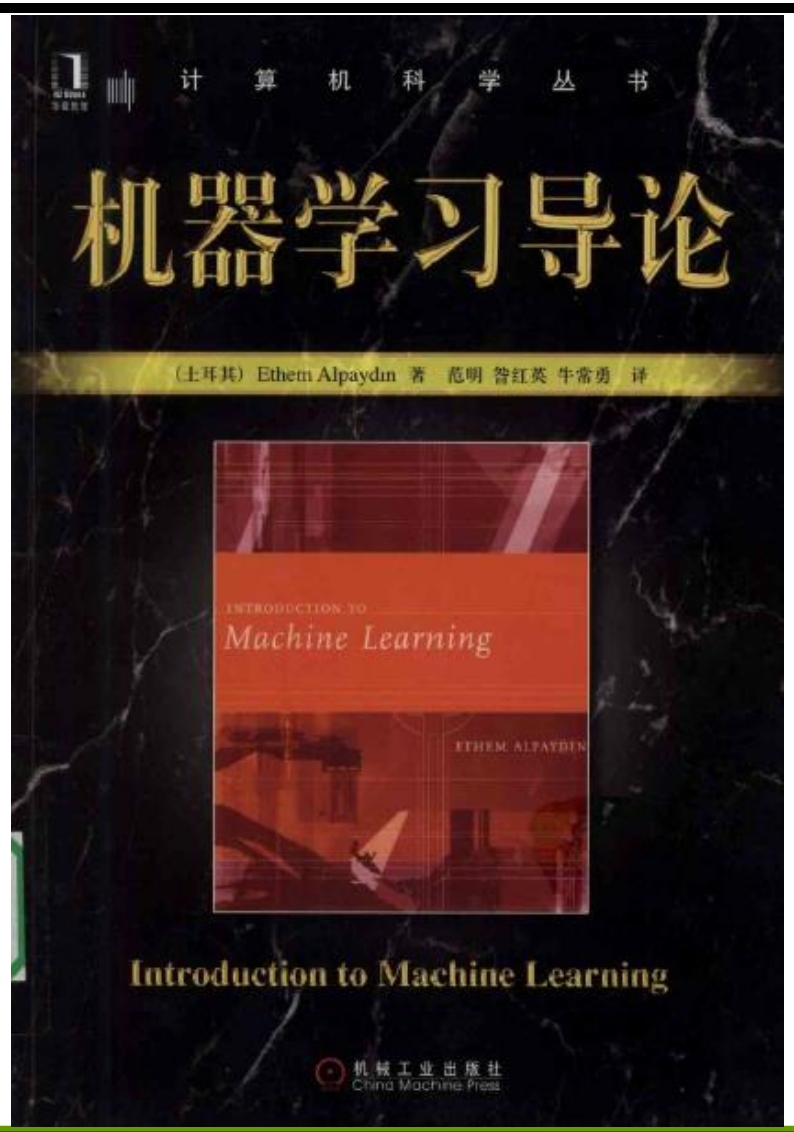
- Machine Learning: A Bayesian and Optimization Perspective
- Sergio Theodoridis,

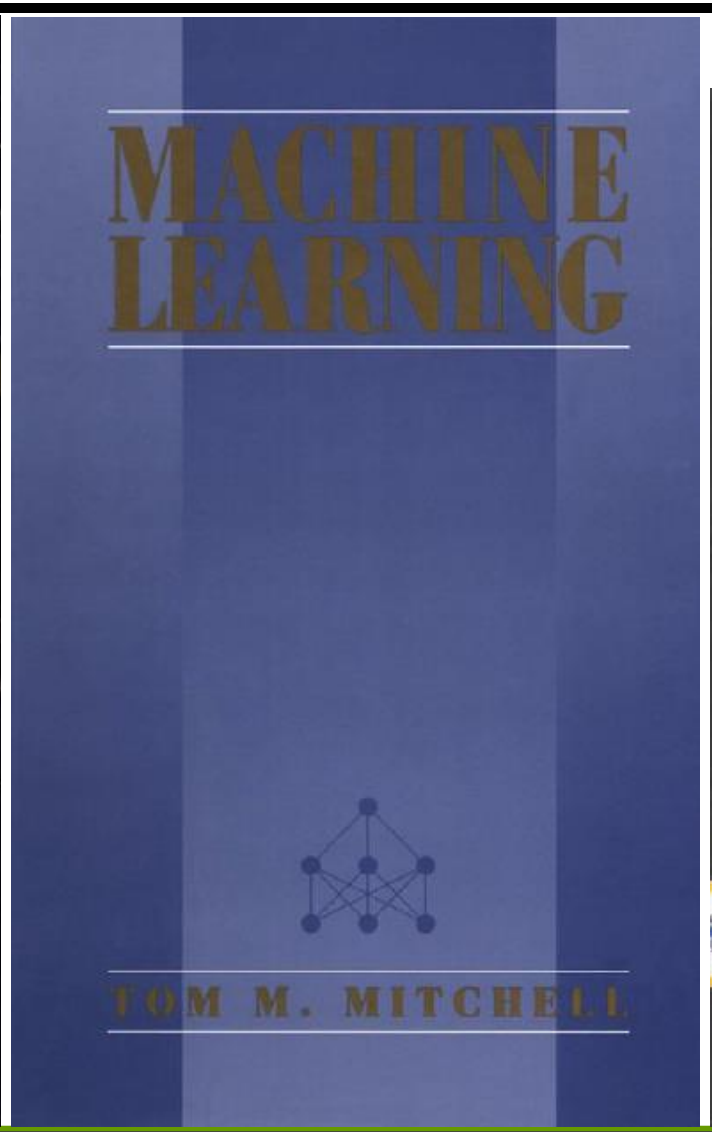
http://cgi.di.uoa.gr/~stheodor/

- University of Athens
- ISBN: 978-0-12-801522-3
- 2015

- **ML**: Machine Learning, by Tom Mitchell, McGraw Hill, 1997.
  - http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mitchell/ftp/mlbook.html
- **ELS**: The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Springer, 2001 (2nd ed, 2017)
- **PRML**: Pattern Recognition and Machine Learning, by Christopher M. Bishop, Springer, 2006



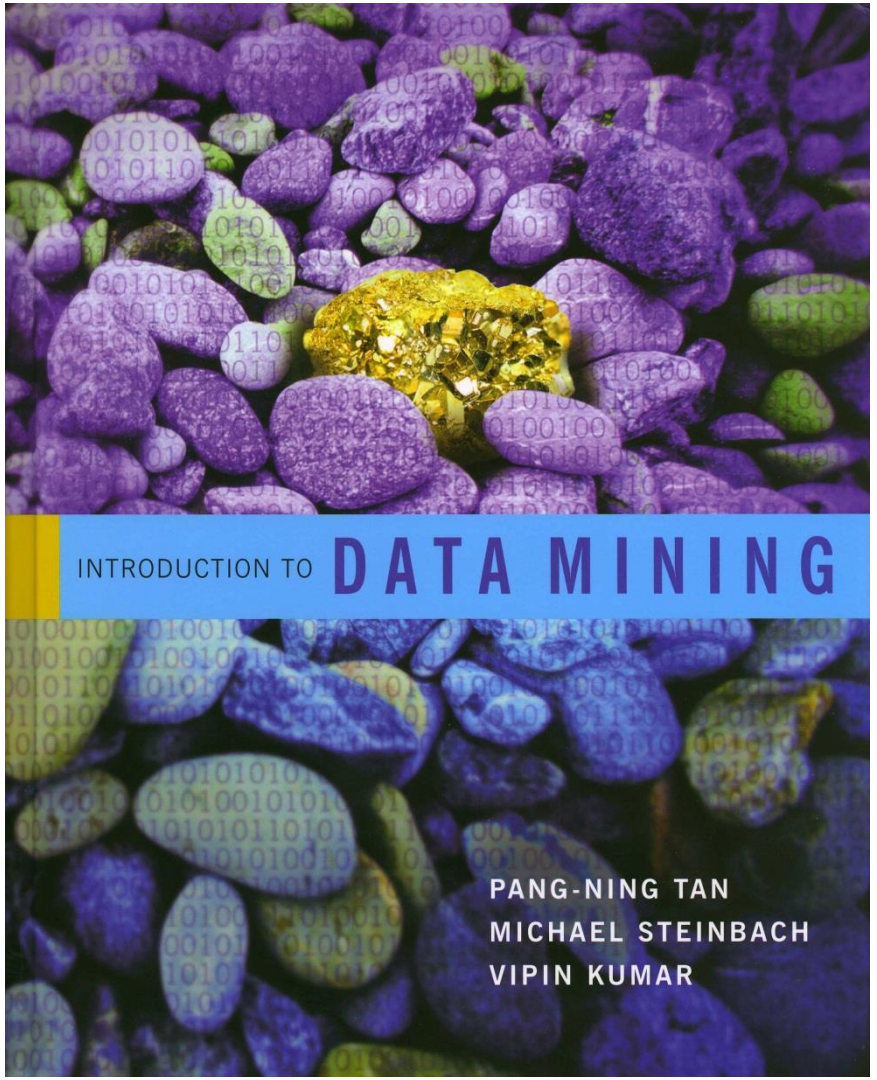

计 算 机 科 学 丛 书
机器学习导论
(土耳其) Ethem Alpaydın 著 范明 昝红英 牛常勇 译
INTRODUCTION TO
Machine Learning
ETHEM ALPAYDIN
Introduction to Machine Learning
机械工业出版社
China Machine Press


MACHINE
LEARNING
TOM M. MITCHELL


计 算 机 科 学 丛 书
机器学习
(美) Tom M. Mitchell 著 曾华军 张银奎 等译
卡内基梅隆大学
MACHINE
LEARNING
TOM M. MITCHELL
Machine Learning
机械工业出版社
China Machine Press

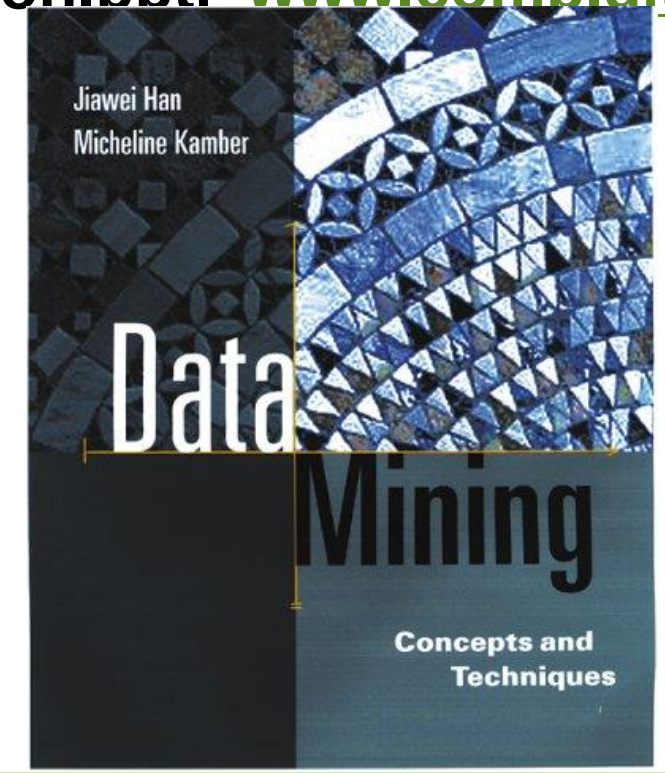
Data Mining

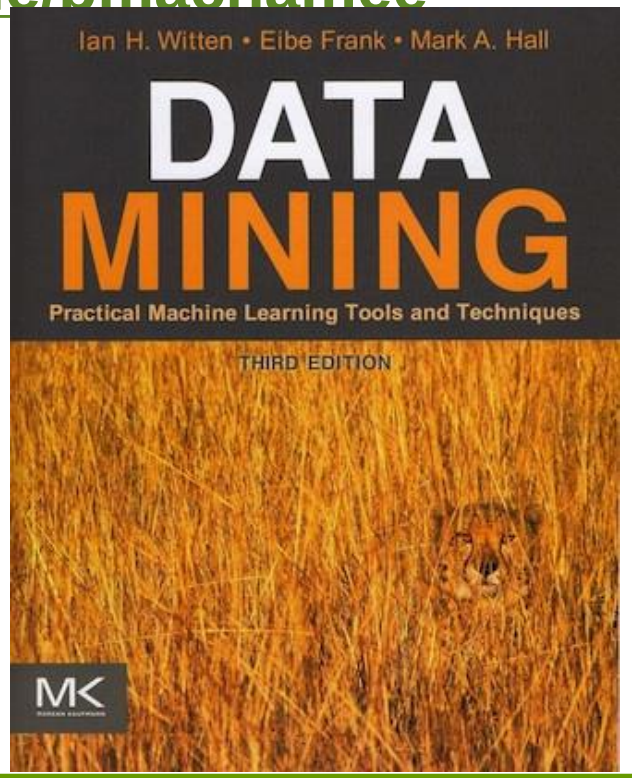
- **Introduction to Data Mining**
- **By**
  - Pang-Ning Tan, Michigan State University,
  - Michael Steinbach, University of Minnesota
  - Vipin Kumar, University of Minnesota

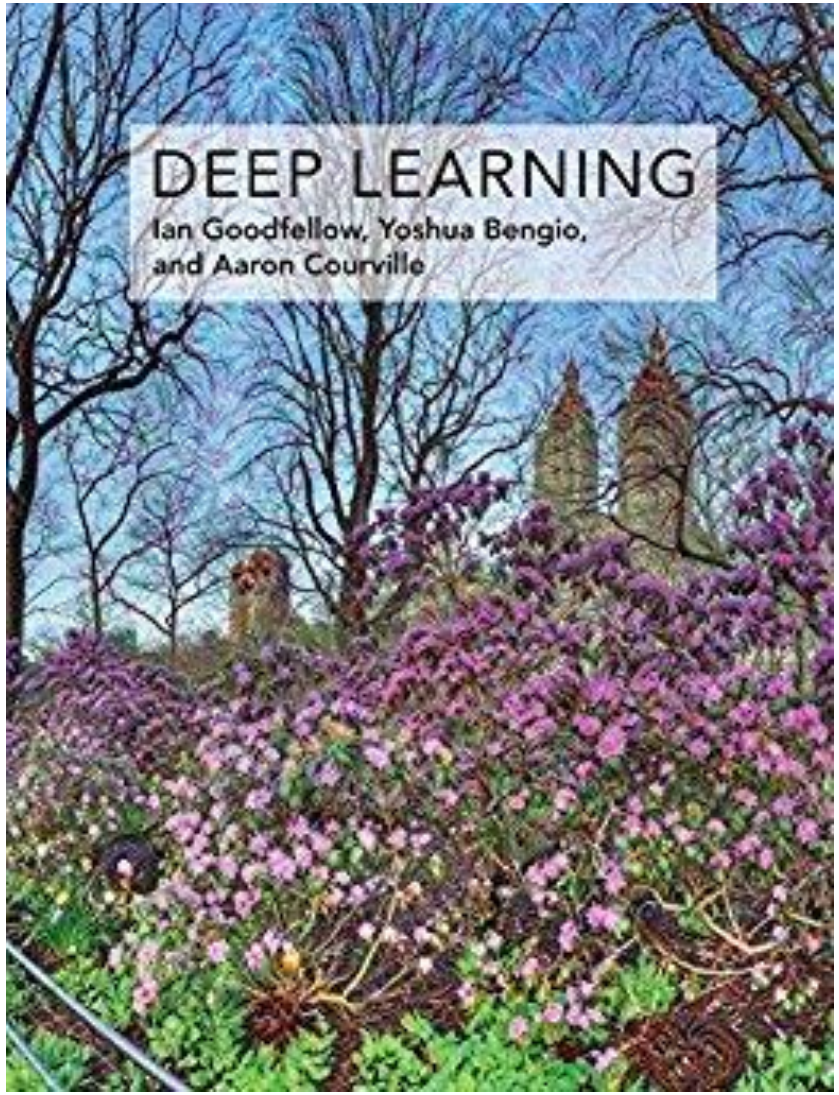


http://www-users.cs.umn.edu/~kumar/dmbook/index.php

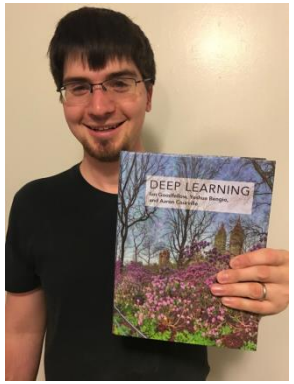
- J. Han and M. Kamber. Data Mining: Concepts and Techniques. 2nd ed., Morgan Kaufmann, 2005.
- Brian Mac Namee. Business Systems Intelligence: 1. Introduction.ppt. www.comp.dit.ie/bmacnamee



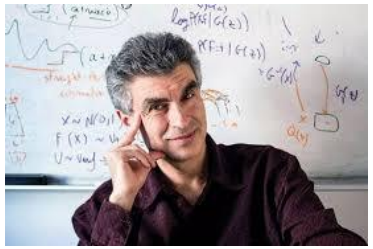


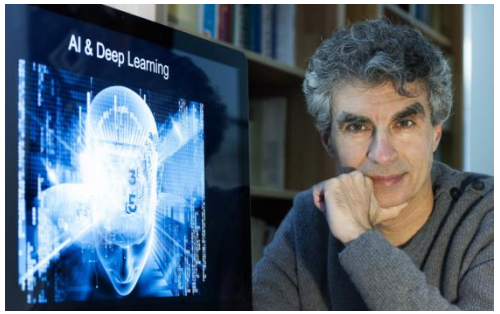


- Deep Learning
- by Ian Goodfellow,

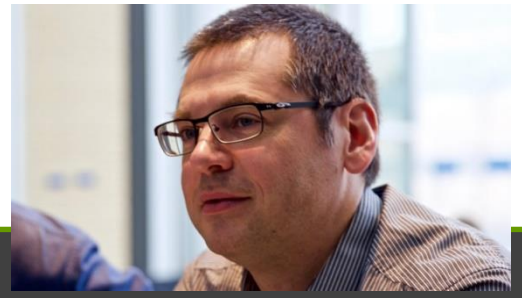


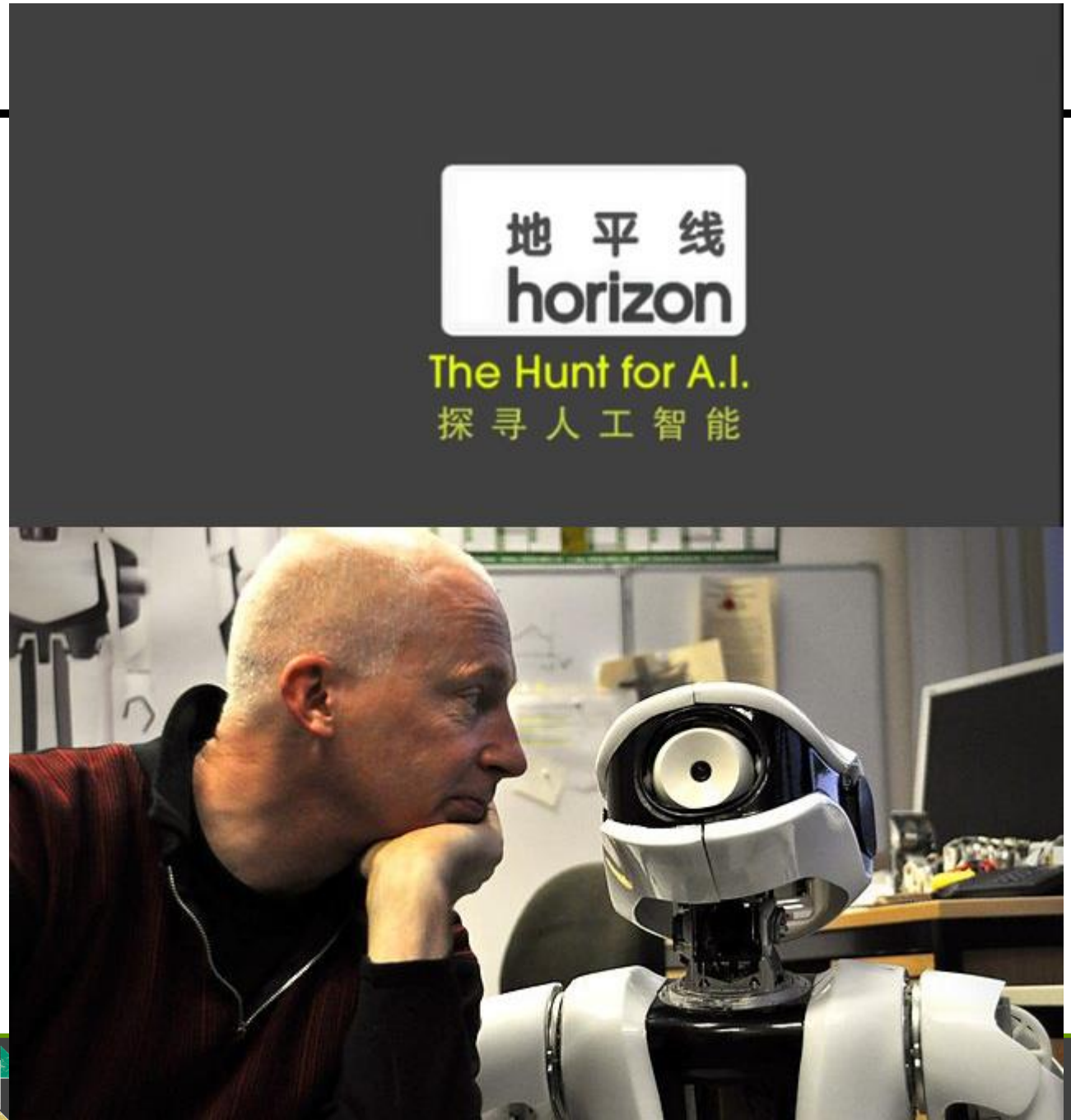
- Yoshua Bengio



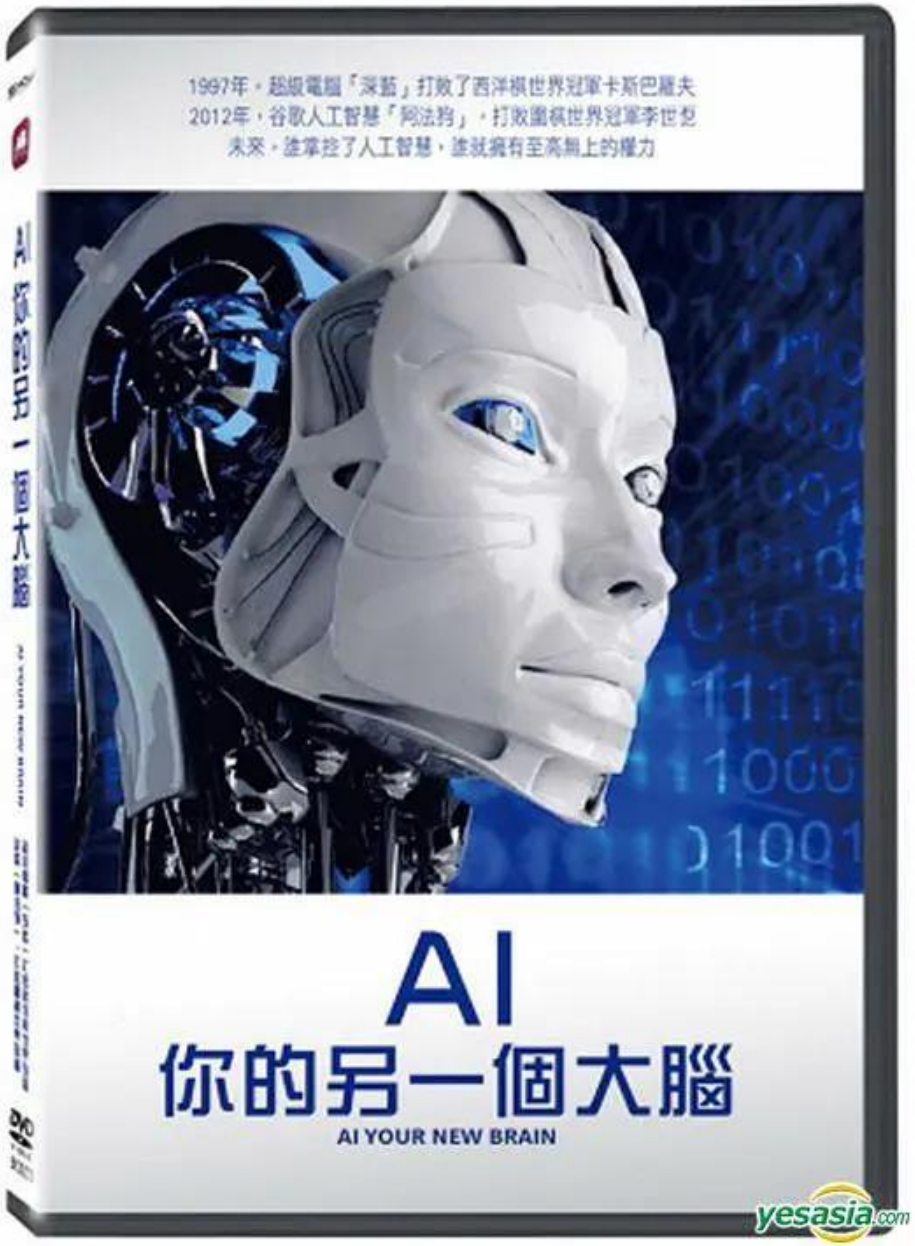


- Aaron Courville





- **地平线系列：寻找人工智能 Horizon: The Hunt for AI (2012)**
  - 导演: Helen Sage
  - 主演: 马库斯·杜·桑托伊 / Dan Brown / Simon Colton / David Ferrucci / Owen Holland ...
  - 类型: 纪录片
  - 官方网站: http://www.bbc.co.uk/programmes/b01fmbvb
  - 制片国家/地区: 英国
  - 语言: 英语
  - 上映日期: 2012-04-03(英国)



- **AI：你的另一个大脑 AI Your New Brain (2018)**
- 类型: 纪录片
- 制片国家/地区: 美国
- 语言: 英语
- 上映日期: 2018-11-03(美国)

Machine Learning

what society thinks I do

what my friends think I do

what my parents think I do

$$L_p = \frac{1}{2}\|\mathbf{w}\|^2 - \sum_{i=1}^{l} \alpha_i y_i (\mathbf{x}_i \cdot \mathbf{w} + b) + \sum_{i=1}^{l} \alpha_i$$

$$\alpha_i \geq 0, \forall i$$

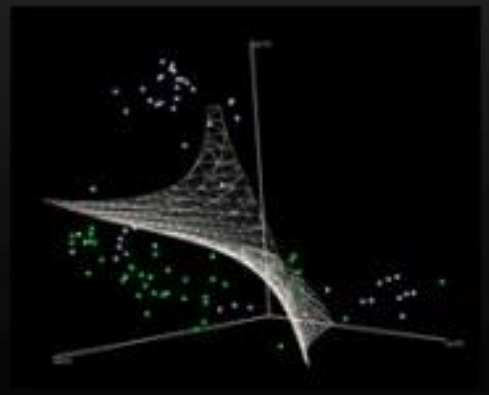
$$\mathbf{w} = \sum_{i=1}^{l} \alpha_i y_i \mathbf{x}_i, \sum_{i=1}^{l} \alpha_i y_i = 0$$

$$\nabla \hat{g}(\theta_t) = \frac{1}{n} \sum_{i=1}^{n} \nabla \ell(x_i, y_i; \theta_t) + \nabla r(\theta_t).$$

$$\theta_{t+1} = \theta_t - \eta_t \nabla \ell(x_{i(t)}, y_{i(t)}; \theta_t) - \eta_t \cdot \nabla r(\theta_t)$$

$$\mathbb{E}_{i(t)}[\ell(x_{i(t)}, y_{i(t)}; \theta_t)] = \frac{1}{n} \sum_i \ell(x_i, y_i; \theta_t).$$

what other programmers think I do



what I think I do

```
>>> from sklearn import svm
```

what I really do

Deep Learning

What society thinks I do

What my friends think I do

What other computer scientists think I do

What mathematicians think I do

What I think I do

```
from theano import *
```

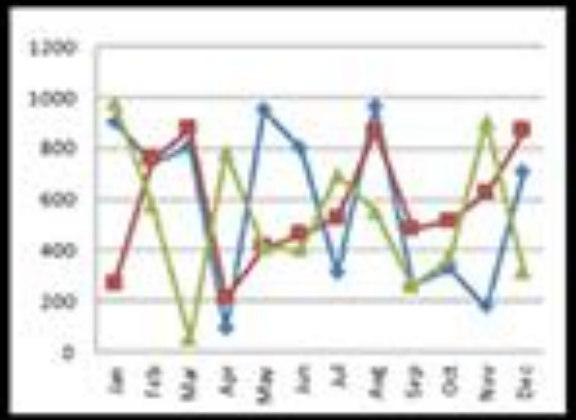
What I actually do

I'm a Data Scientist

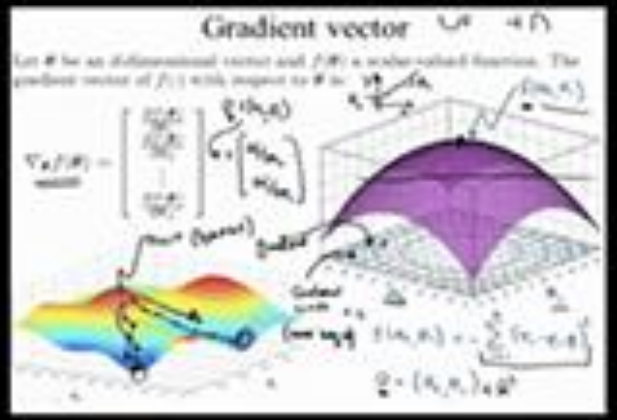
What my friends think I do

What my mom thinks I do

What society thinks I do



What my boss thinks I do



What I think I do

What I actually do