第8章 更上一层楼—人工智能AI基础

8.1 人工智能产生背景

传感器　物联网

数据采集手段丰富

存储器　云计算

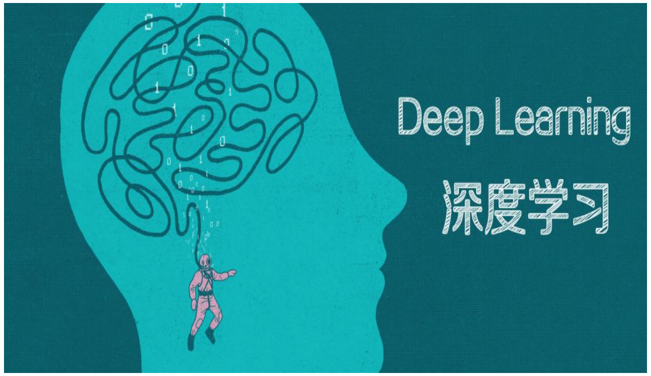
数据存储计算条件具备

人工智能 深度学习

数据处理方法成熟

人脸识别 自动驾驶

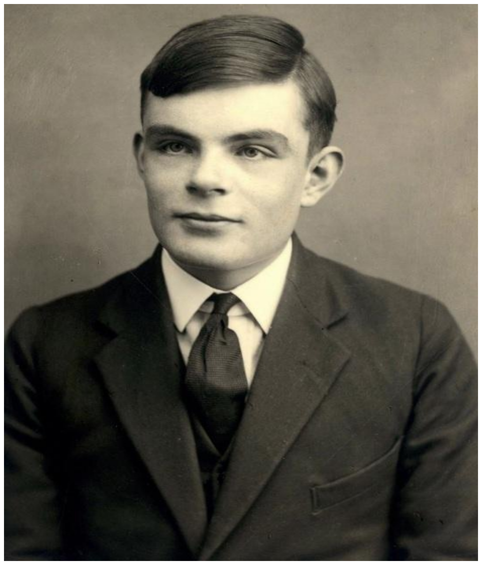
应用需求迫切



8.1 人工智能产生背景

- 人工智能的诞生

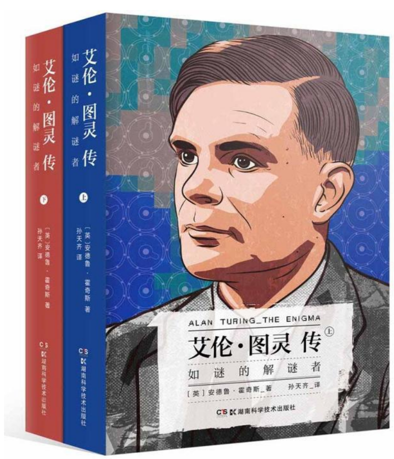
诺贝尔
图灵的

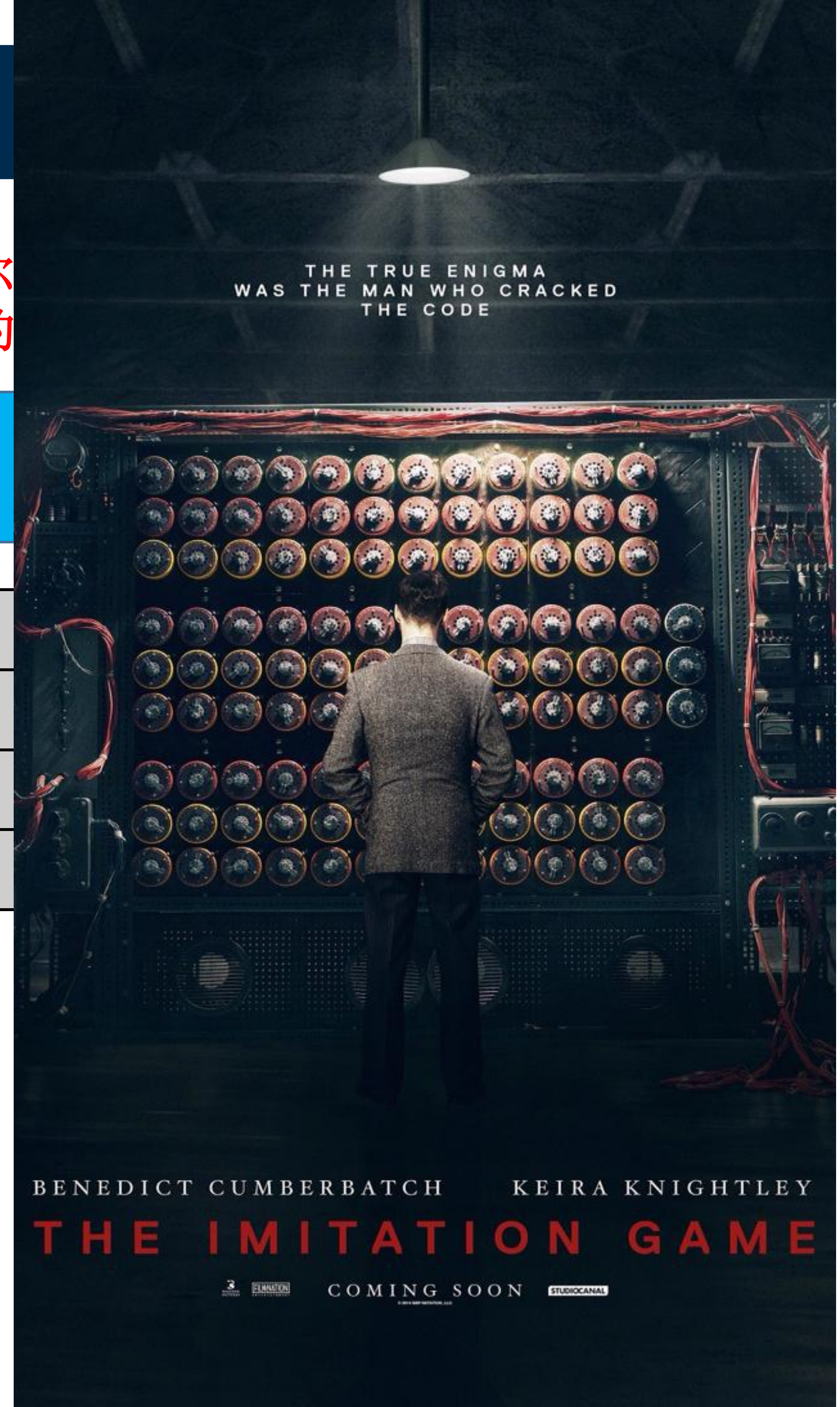


Alan Mathison Turing 阿兰●图灵
（1912.6-1954.6）

KHOOR

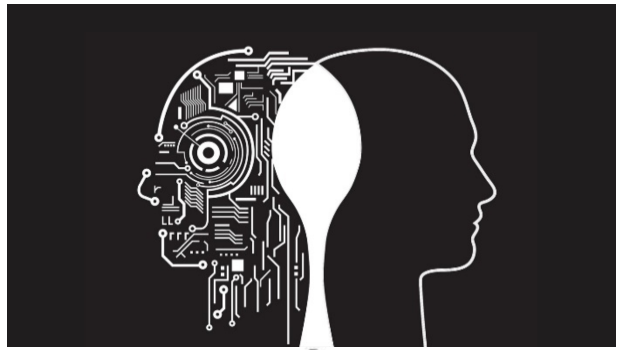
A	B	C	D	E
H	I	J	K	L
O	P	Q	R	S
V	W	X	Y	Z



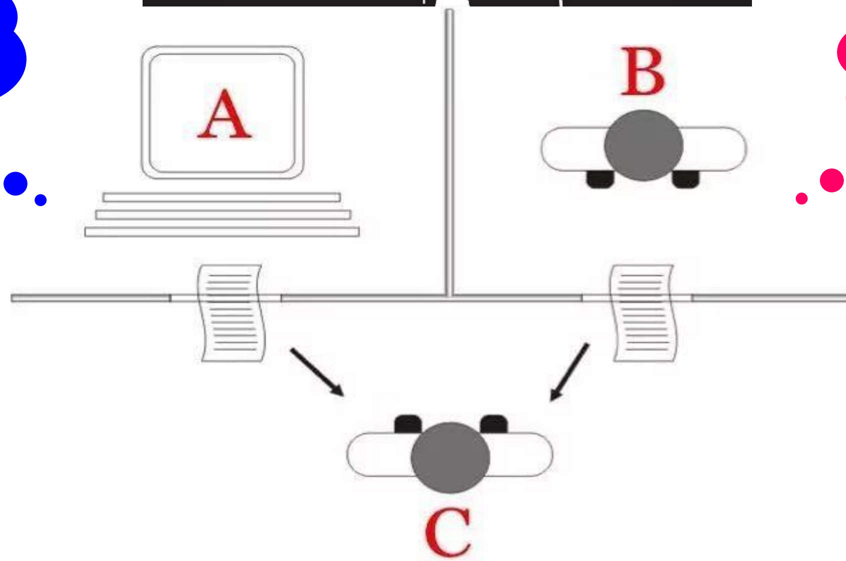


8.1 人工智能产生背景

- 人工智能的诞生



机器能像人一样思考



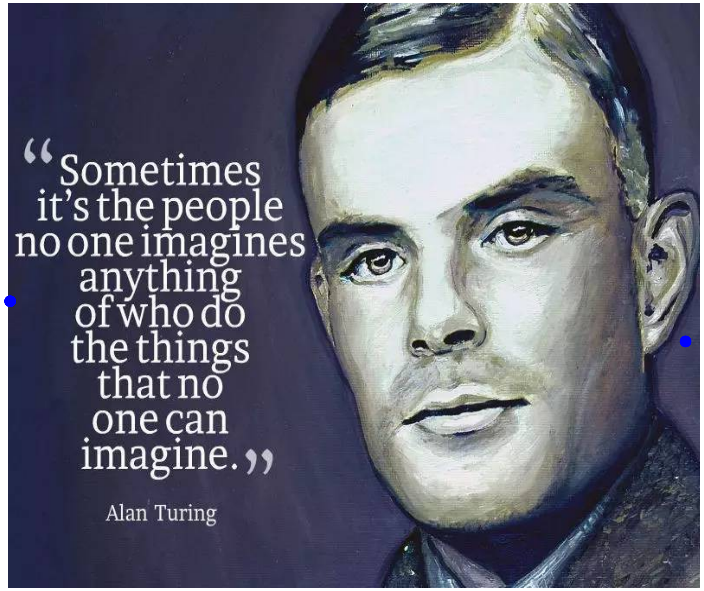
图灵测试

1950

8.1 人工智能产生背景

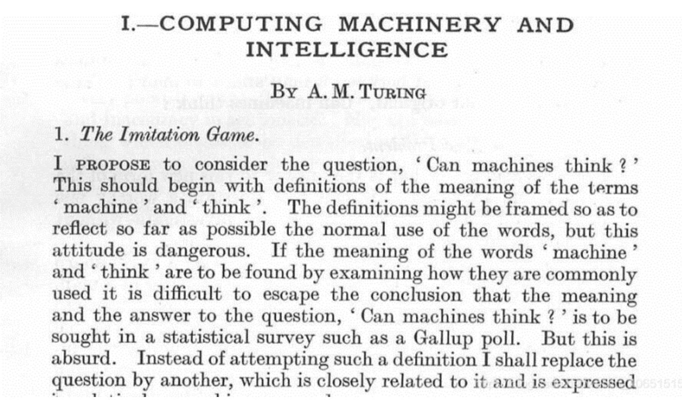
● 人工智能的诞生

计算机科学
之父



人工智能
之父

"有时候正是那些最意想不到的人，才能做出最超乎想象的事"

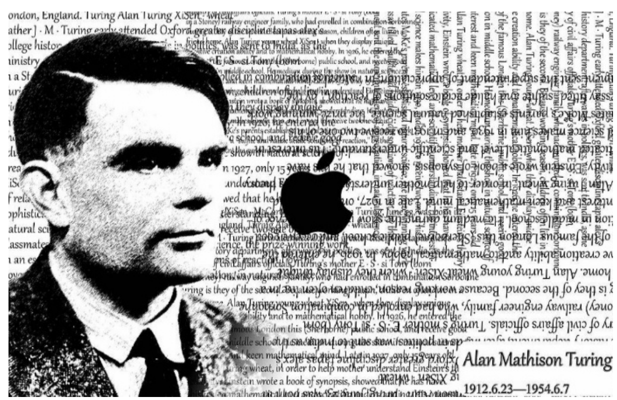


I.—COMPUTING MACHINERY AND INTELLIGENCE

By A. M. Turing

1. *The Imitation Game.*

I propose to consider the question, 'Can machines think ?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, 'Can machines think ?' is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed



8.1 人工智能产生背景

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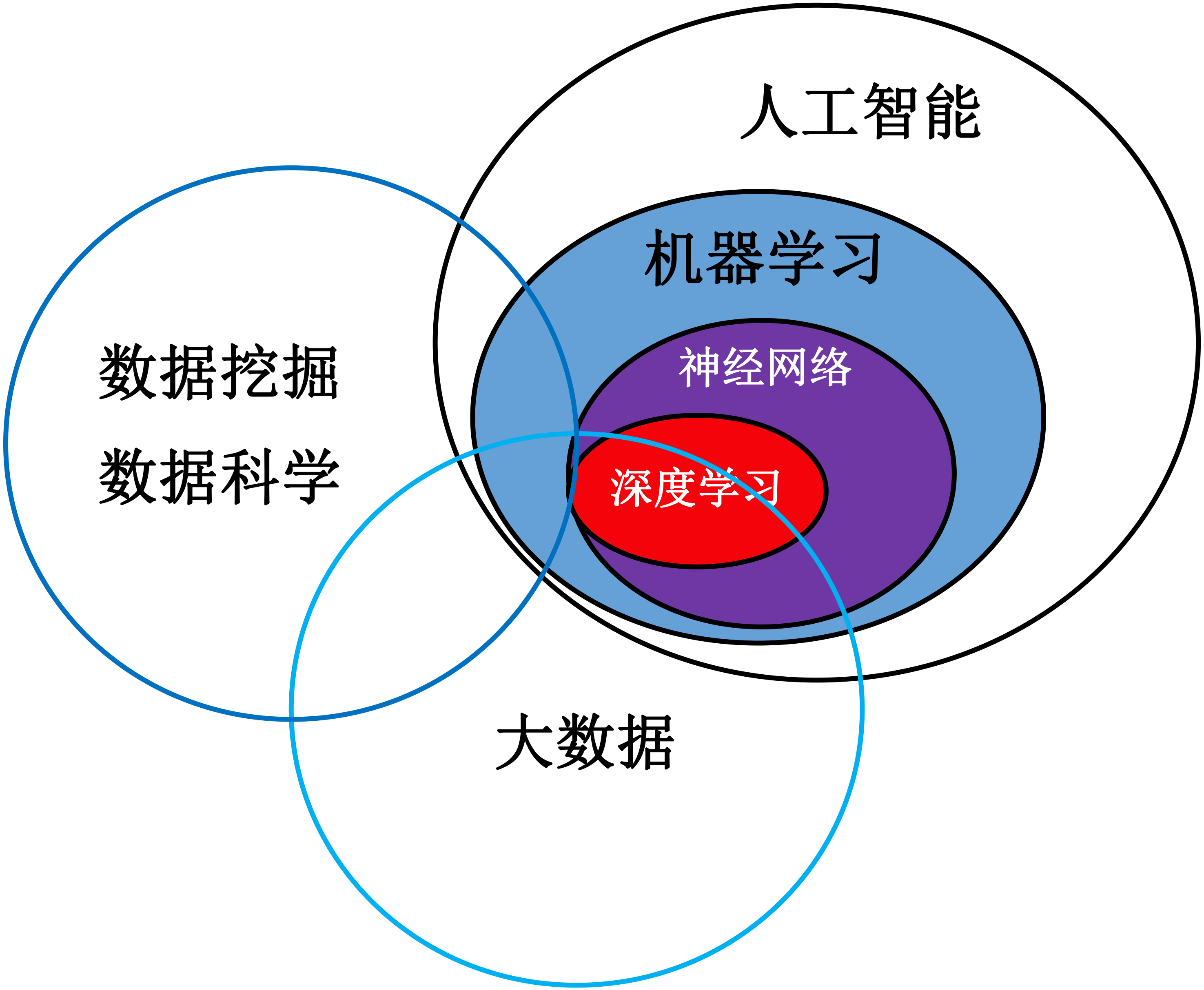


8.2 机器学习

想要让机器像人一样思考，基本思路就是将人总结出来的规律变成规则教给计算机

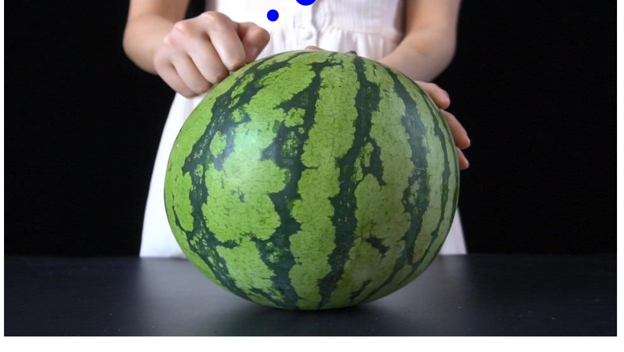
8.2 机器学习

怎么挑西瓜？

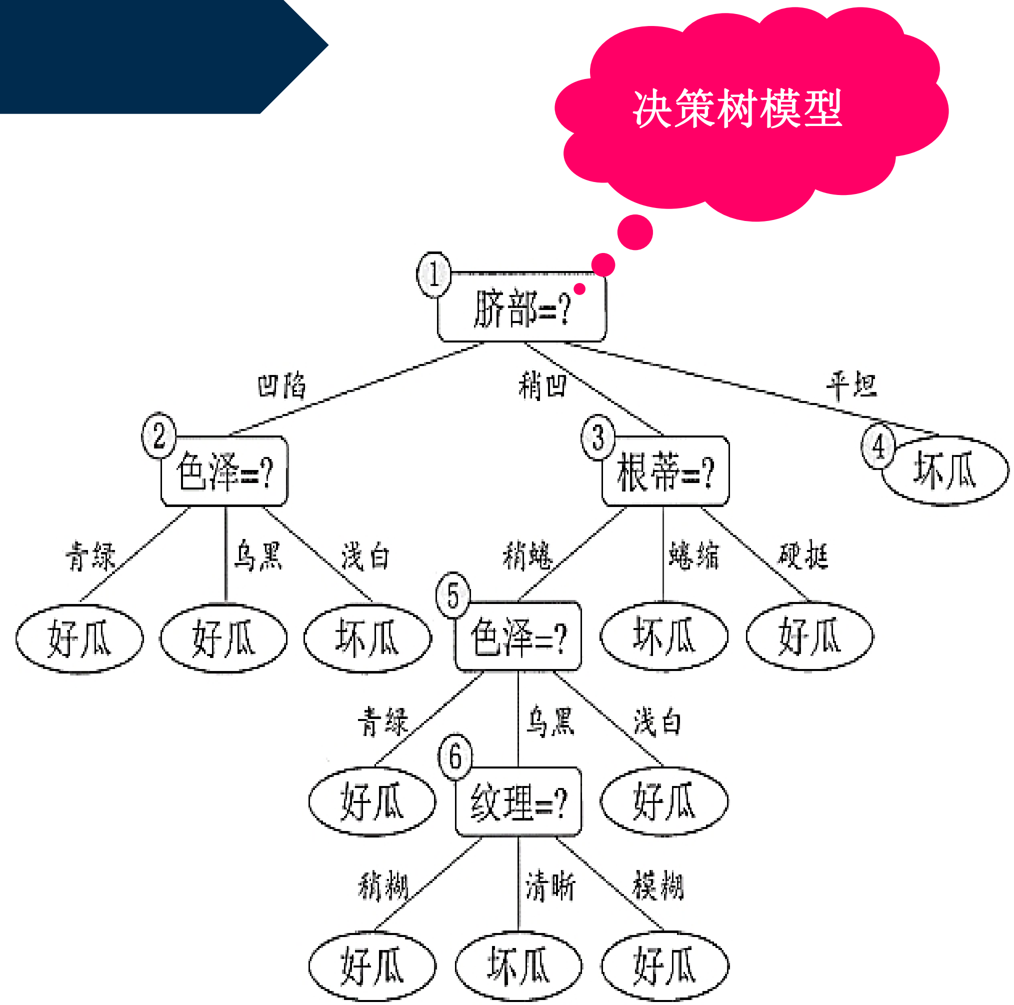
声音脆的好

藤新鲜的好

尾圈小的好



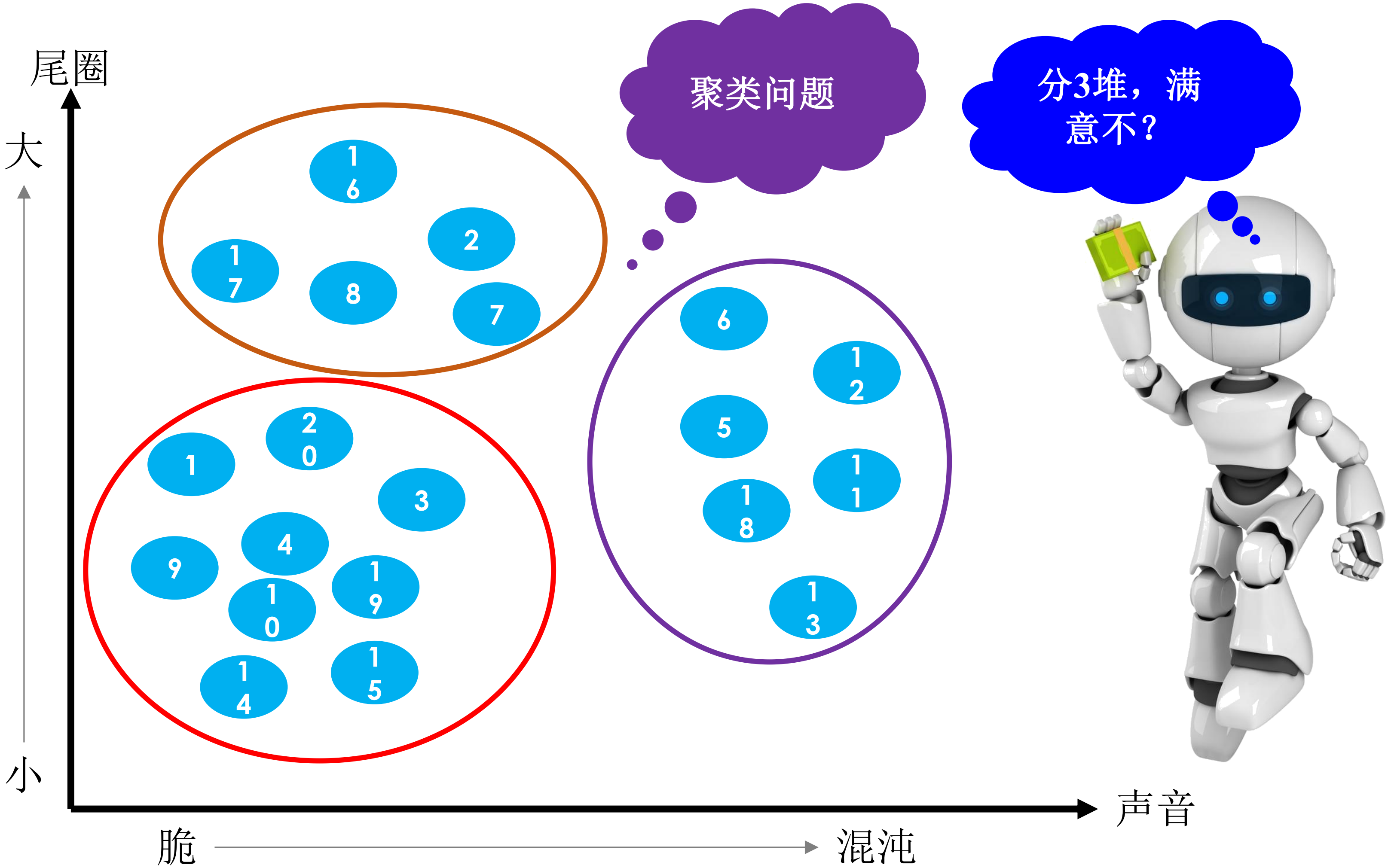
8.2 机器学习



决策树模型
1 脐部=?
凹陷
稍凹
平坦
2 色泽=?
3 根蒂=?
4 坏瓜
青绿
乌黑
浅白
好瓜
好瓜
坏瓜
稍蜷
蜷缩
硬挺
5 色泽=?
坏瓜
好瓜
青绿
乌黑
浅白
好瓜
6 纹理=?
好瓜
稍糊
清晰
模糊
好瓜
坏瓜
好瓜

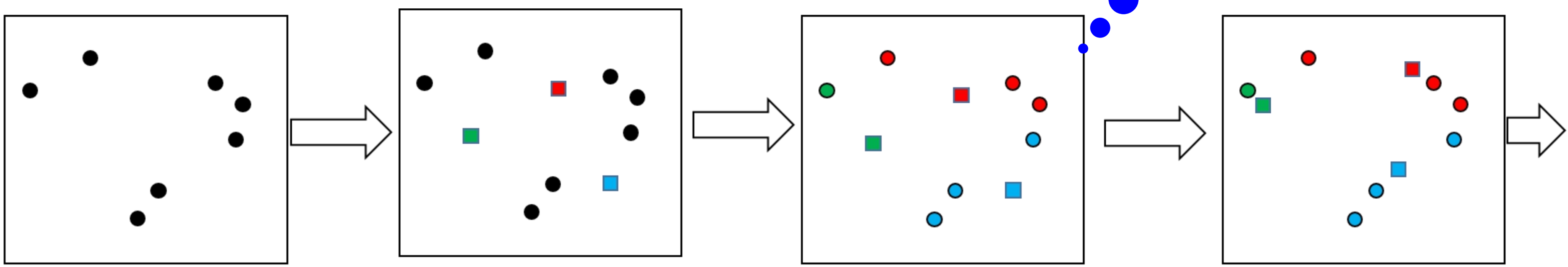
8.2 机器学习

8.2 机器学习


尾圈
大
小
声音
脆
混沌
聚类问题
分3堆，满意不？
16
2
17
8
7
20
1
3
4
9
19
10
14
15
6
12
5
11
18
13

8.2 机器学习

聚类方法(K-means聚类)

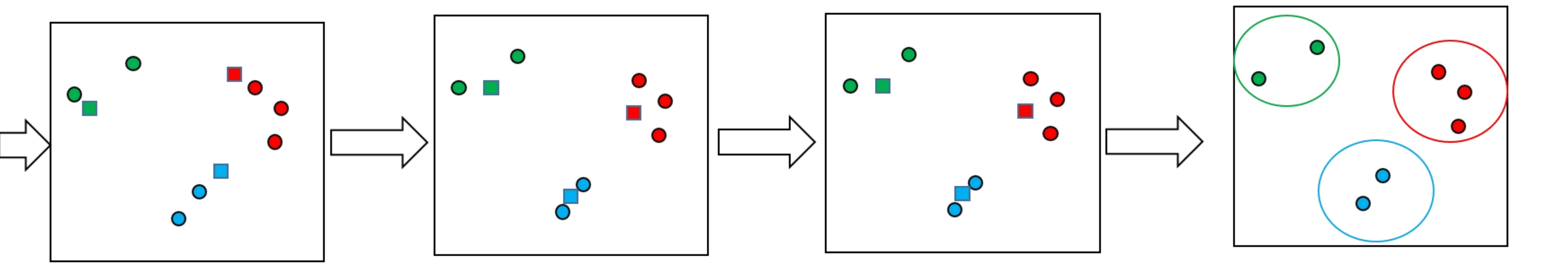


待聚类样本，
目标聚成3类

选取3个中心点

对每个样本，找到距离自己最近的中心点，完成一次聚类。判断此次聚类前后样本点的聚类情况是否相同，若相同，算法终止，否则继续下一步

根据该次聚类的结果，更新中心点



对每个样本，找到距离自己最近的中心点，完成一次聚类。判断与此次聚类前样本点的聚类情况是否相同，若相同，算法终止，否则继续下一步

根据该次聚类的结果，更新中心点

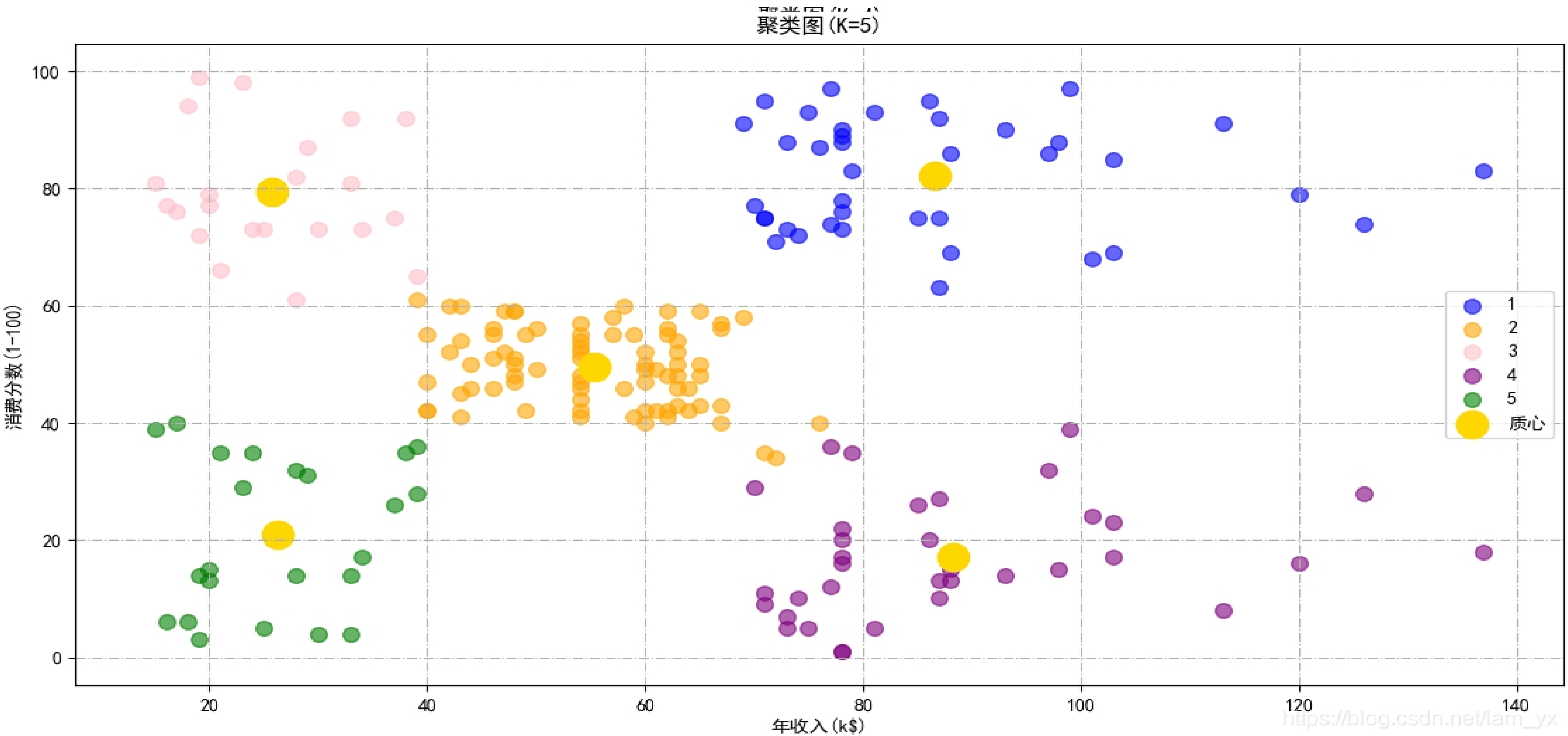
对每个样本，找到距离自己最近的中心点，完成一次聚类。判断与此次聚类前样本点的聚类情况是否相同，若相同，算法终止（否则继续下一步）

算法在上一步终止，
最终的聚类结果如图

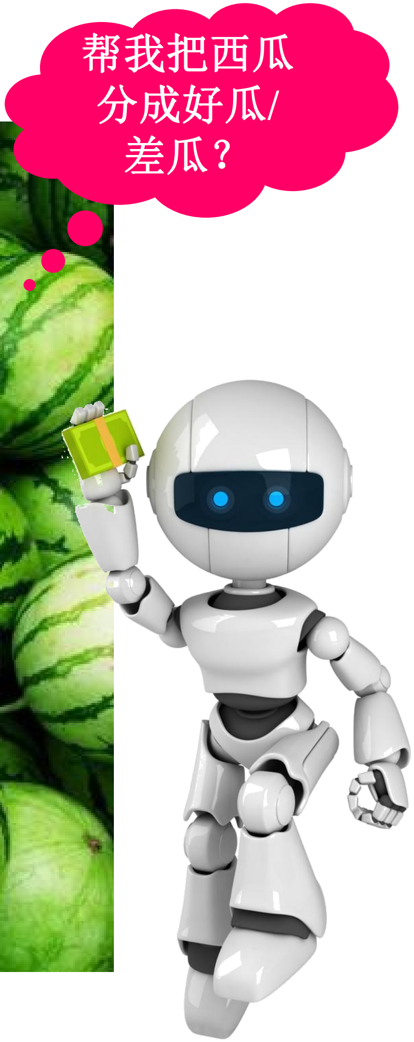
8.2 机器学习

● 聚类方法(K-means聚类)

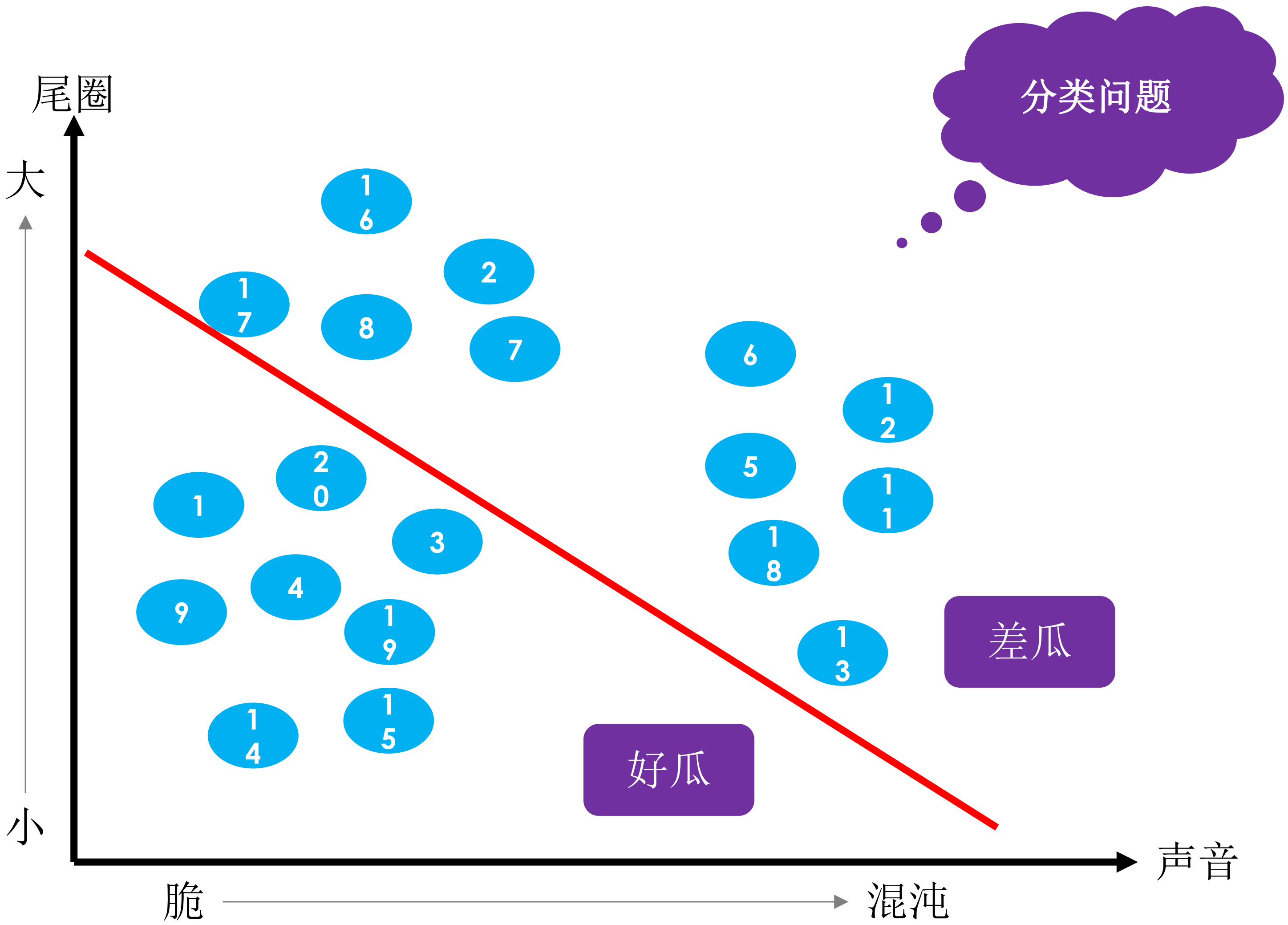
你拥有一个超市(Supermarket Mall)，通过会员卡，拥有一些关于你的客户的数据，如**客户ID**，**年龄**，**性别**，**年收入**和**消费分数**，其中消费分数是根据购买数据等定义的。问题陈述：你想要了解怎么样的顾客可以很容易地聚集在一起(目标顾客)，以便可以给营销团队以灵感指定营销策略。



8.2 机器学习



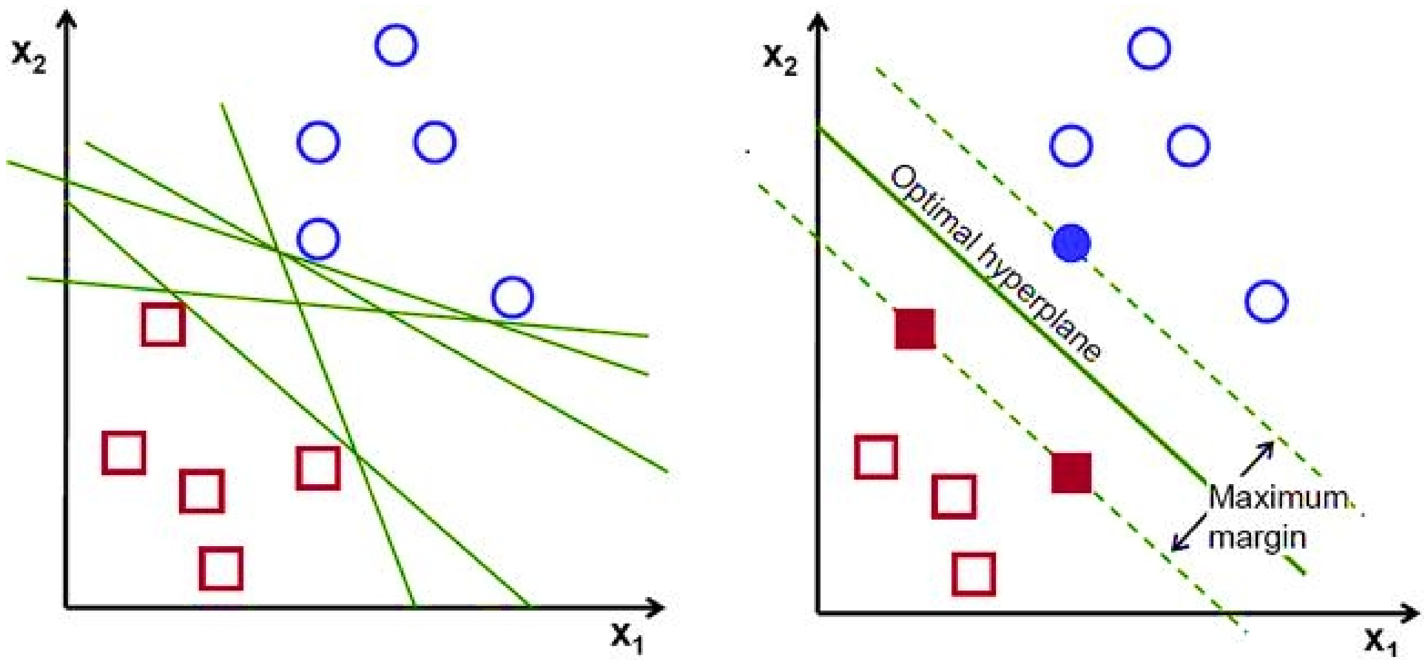
8.2 机器学习



8.2 机器学习

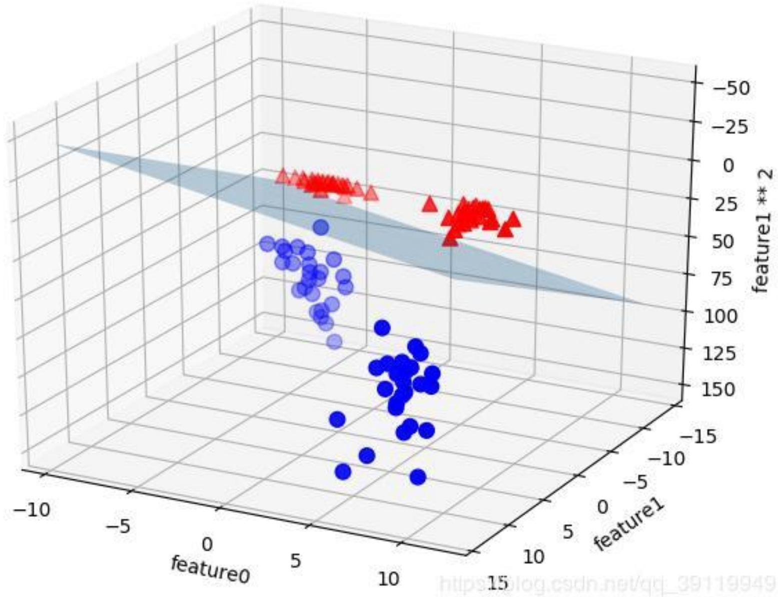
● 分类方法-支持向量机SVM

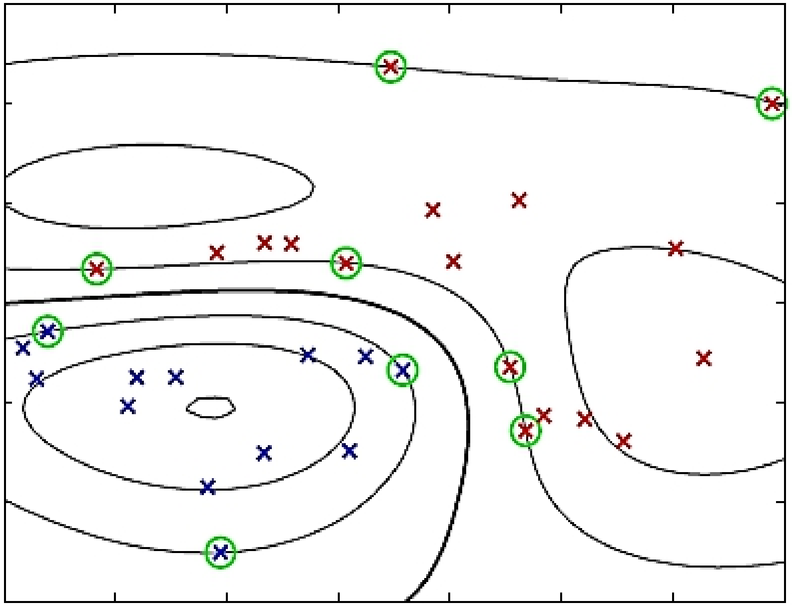
在很久以前的情人节，一位大侠要去救他的爱人，但天空中的魔鬼和他玩了一个游戏。魔鬼在桌子上似乎有规律放了两种颜色的球，说：“你用一根棍分开它们？要求：尽量在放更多球之后，仍然适用。”



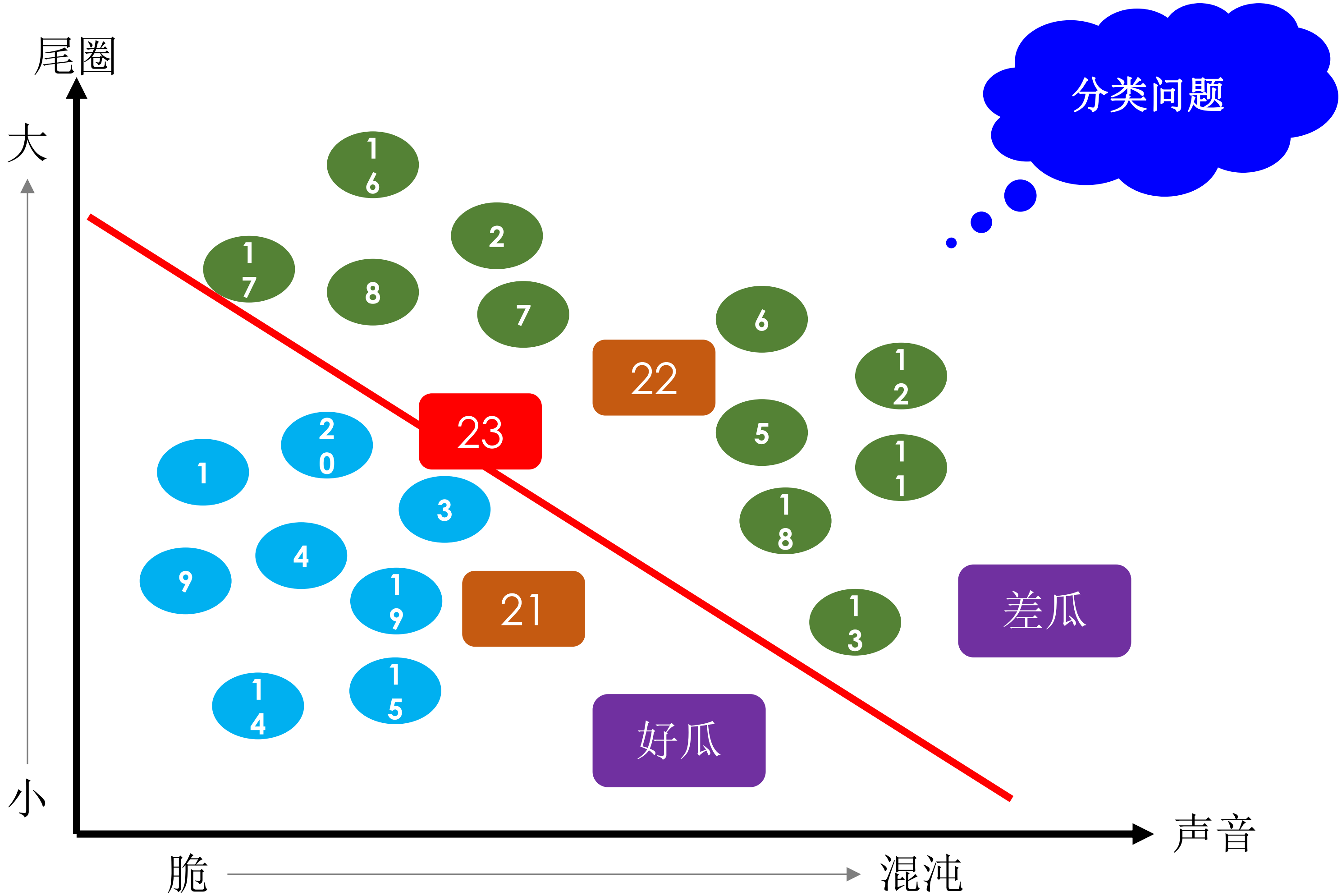
8.2 机器学习

- 分类方法-支持向量机SVM



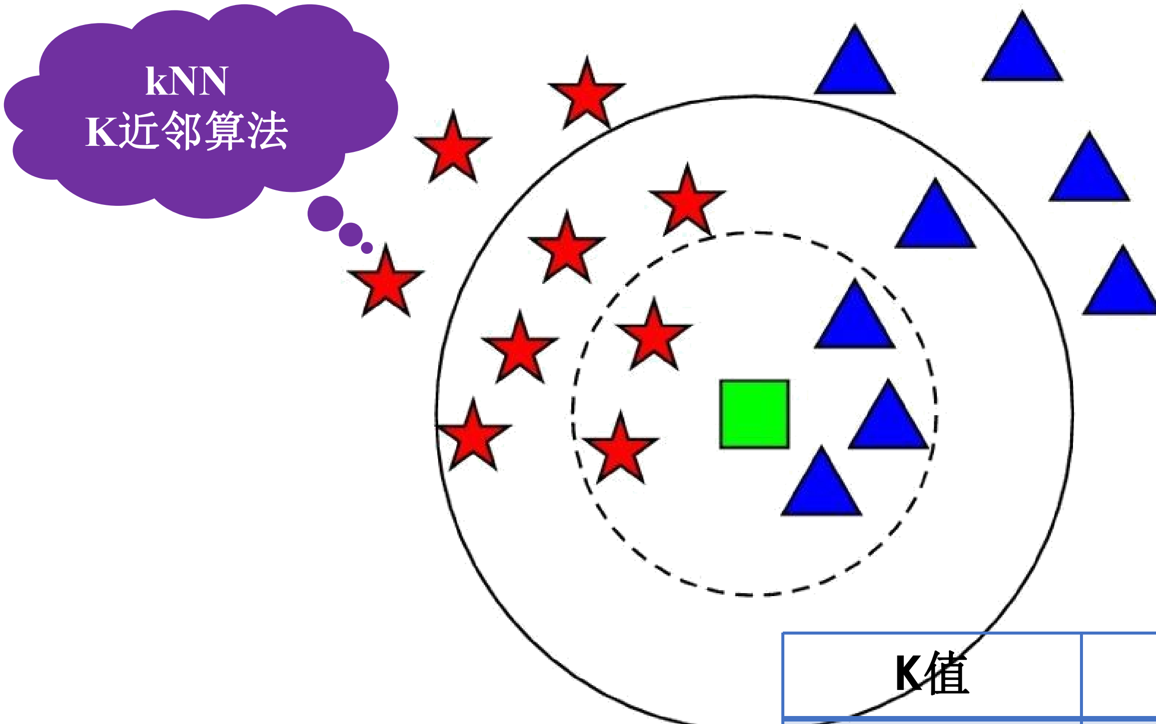


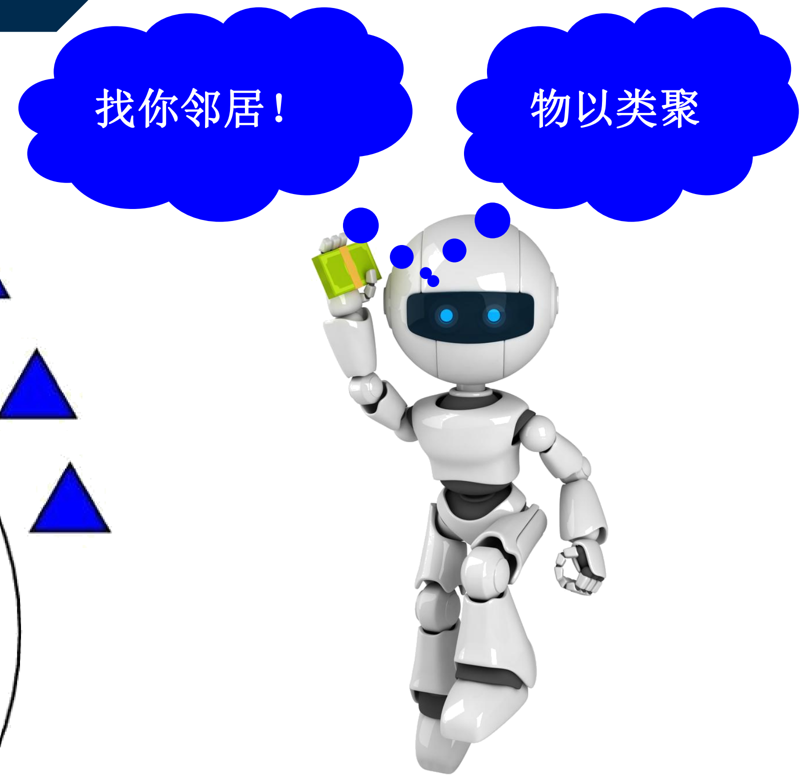
8.2 机器学习



分类问题
尾圈
大
小
声音
脆
混沌
1
6
2
1
7
8
7
6
22
1
2
23
5
2
0
1
1
1
3
1
8
9
4
1
9
21
1
3
差瓜
1
4
1
5
好瓜

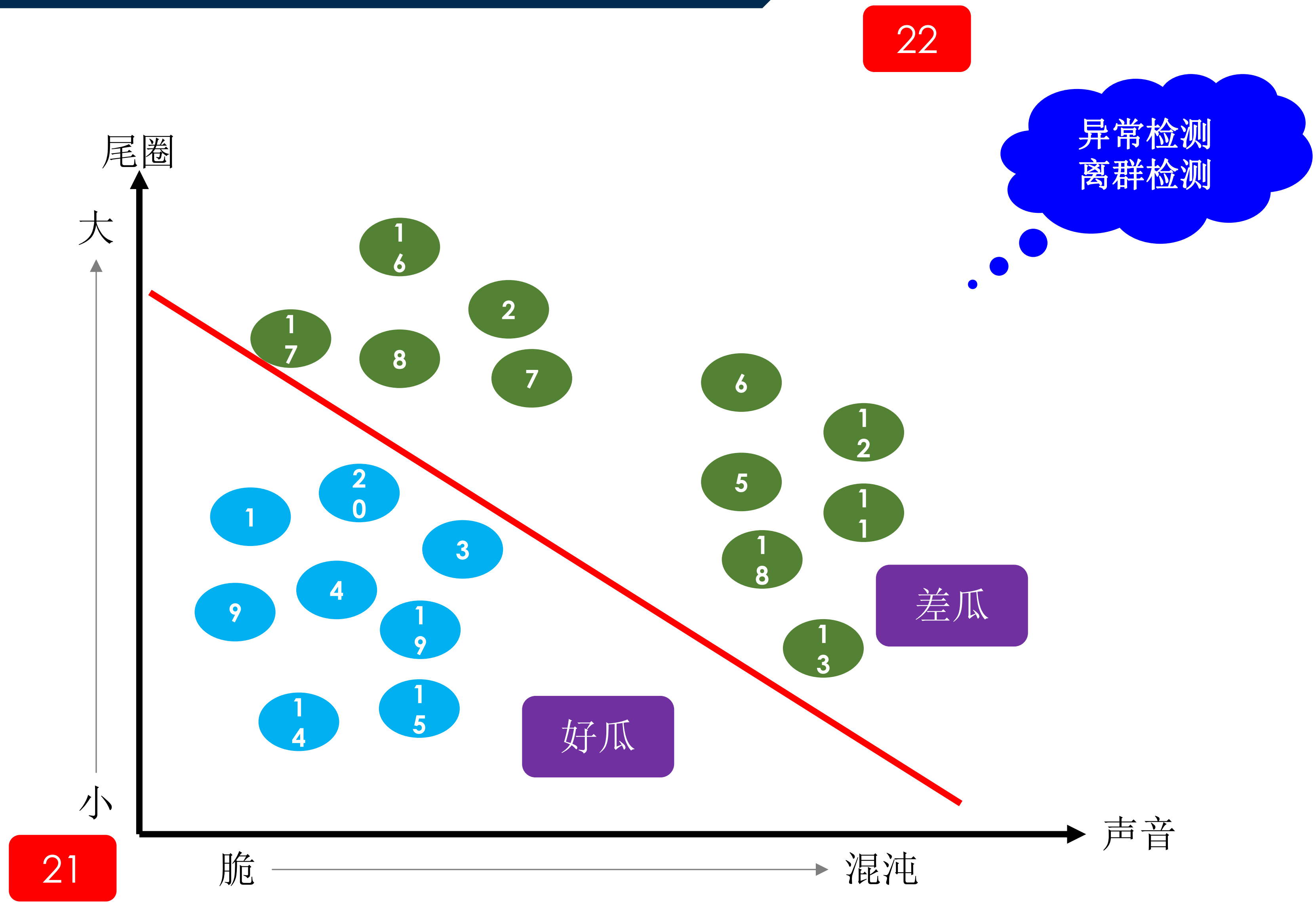
8.2 机器学习





K值	概率	分类
5	2/5,3/5	三角形类
10	6/10,4/10	五角星类
17	9/17,8/17	五角星类

8.2 机器学习

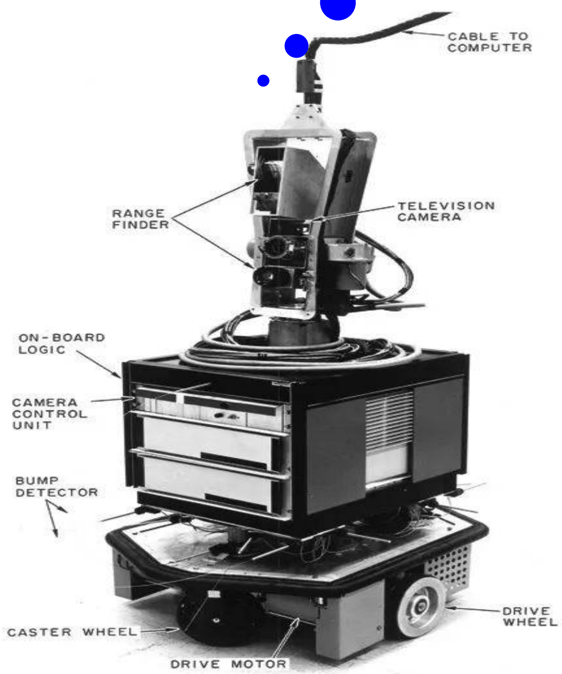

22
异常检测
离群检测
尾圈
大
小
16
2
17
8
7
6
12
5
11
18
13
差瓜
20
1
3
4
9
19
14
15
好瓜
声音
脆
混沌
21

8.2 机器学习

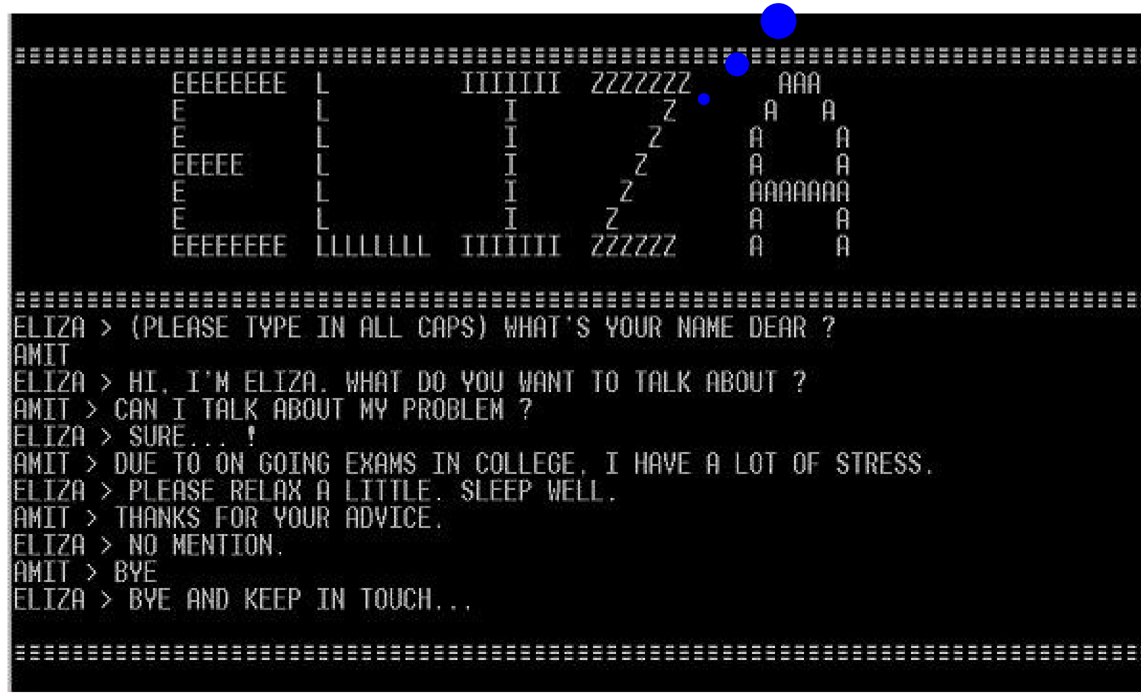
8.2 机器学习

第一个循迹
机器人
Shakey

第一个聊天
机器人
ELIZA



shakey机器人



eliza聊天机器人

8.2 机器学习

1997

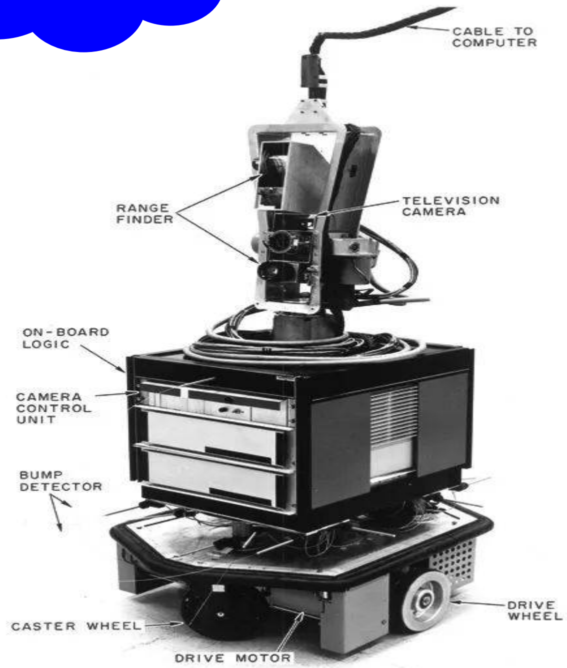
Deep Blue
深蓝

深蓝计算机重1270公斤，有32个大脑（CPU），每秒钟可以计算2亿步。1997年的深蓝可搜寻及估计随后的12步棋，而一名人类象棋好手大约可估计随后的10步棋。

8.2 机器学习

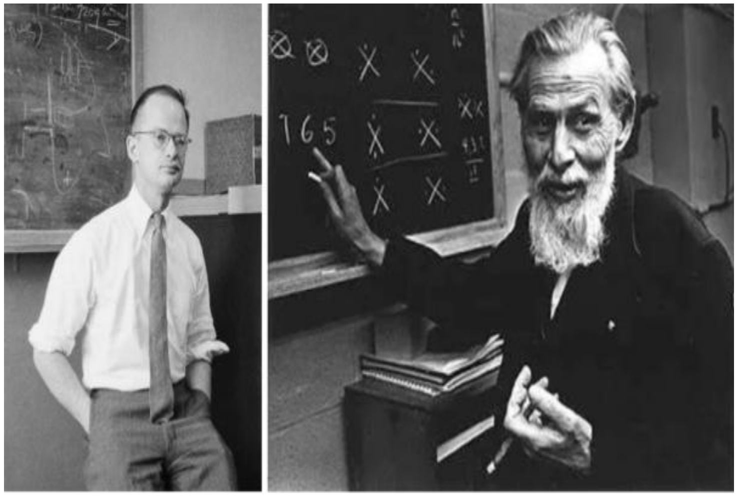
规则说能过

规则说不能过



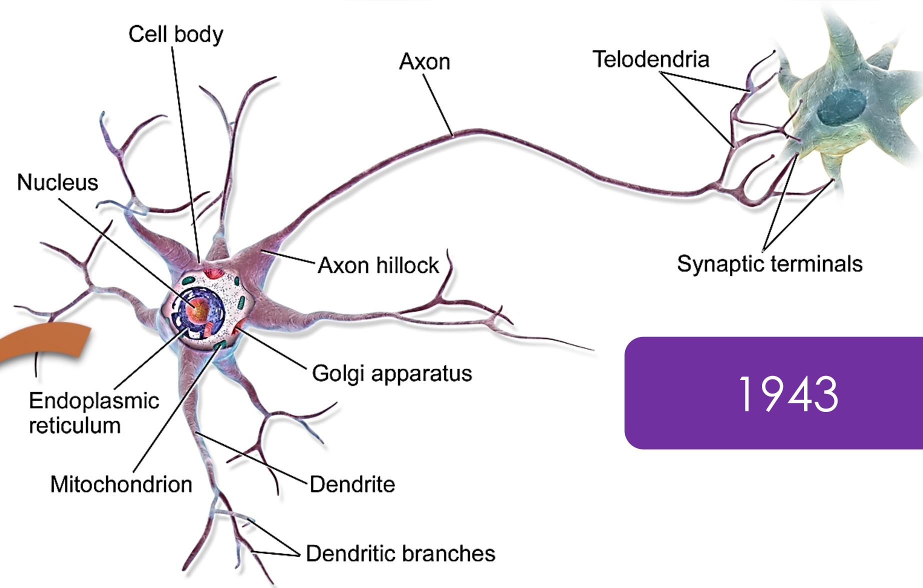
规则是死的，人是活的！！

8.3 神经网络



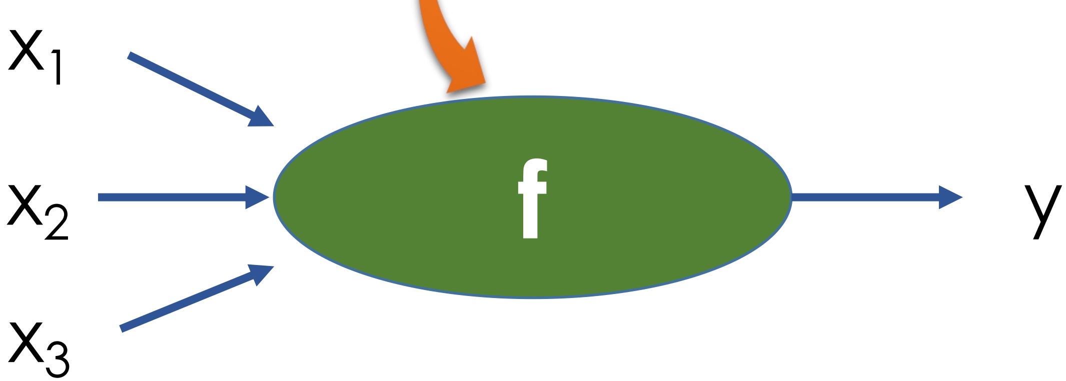
W.Pitts W.S.McCulloch

M-P模型（人工神经网络的起点）



1943

神经元

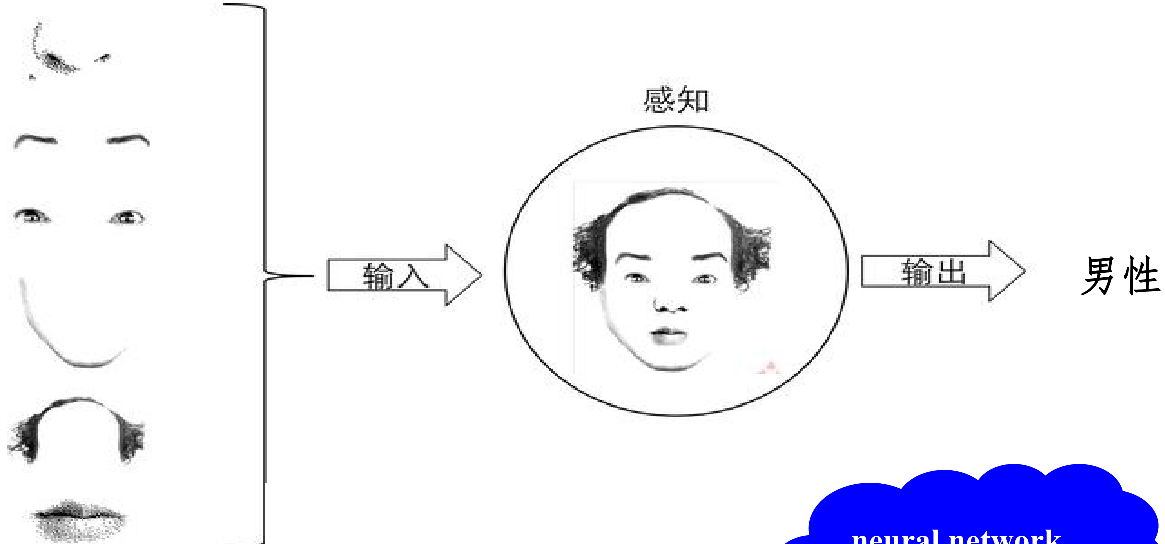


将神经元抽象出来与计算机进行结合

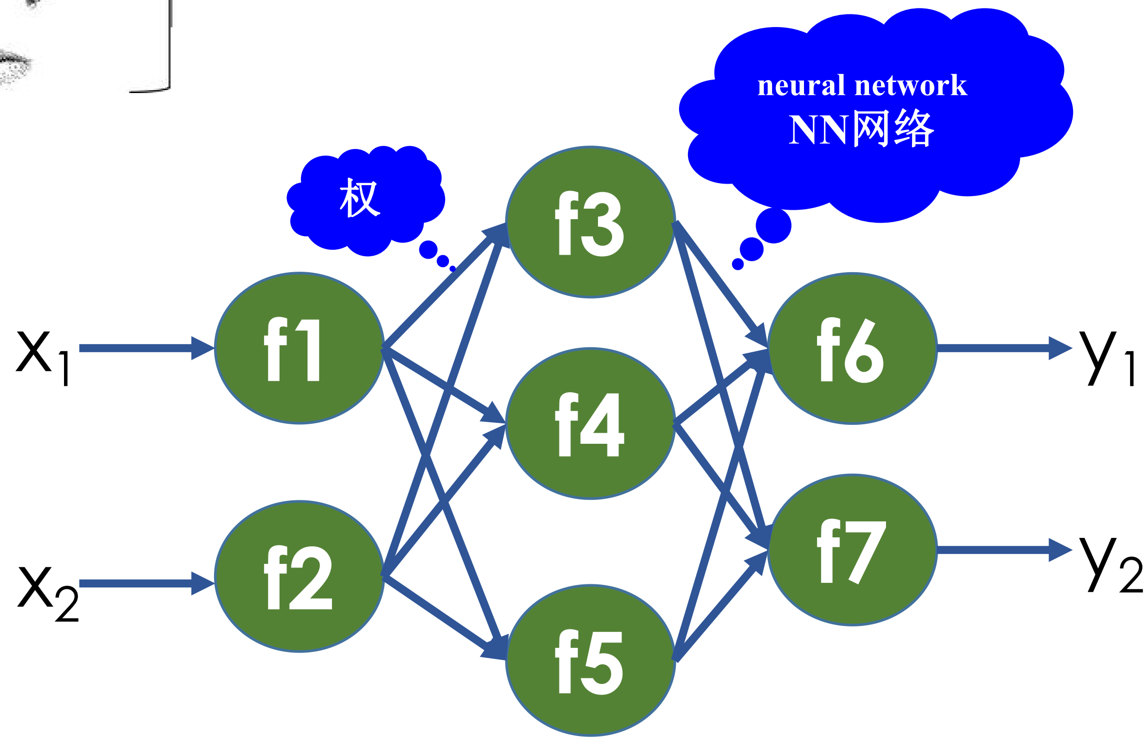
8.3 神经网络

感知机模型

Frank Rosenblatt (1928 - 1969)



能够模拟人类感知能力的机器



8.3 神经网络

B-P反向传播模型

1986

Learning representations by back-propagating errors

David E. Rumelhart*, Geoffrey E. Hinton† & Ronald J. Williams*

* Institute for Cognitive Science, C-015, University of California, San Diego, La Jolla, California 92093, USA
† Department of Computer Science, Carnegie-Mellon University, Pittsburgh, Philadelphia 15213, USA

We describe a new learning procedure, back-propagation, for networks of neurone-like units. The procedure repeatedly adjusts the weights of the connections in the network so as to minimize a measure of the difference between the actual output vector of the net and the desired output vector. As a result of the weight adjustments, internal 'hidden' units which are not part of the input or output come to represent important features of the task domain, and the regularities in the task are captured by the interactions of these units. The ability to create useful new features distinguishes back-propagation from earlier, simpler methods such as the perceptron-convergence procedure[1].

解决了困扰人工智能领域发展的十年寒冬，人类迈入新人工智能时代

8.4 深度学习

多层大规模神经网络(深度学习)，2006

Reducing the Dimensionality of Data with Neural Networks

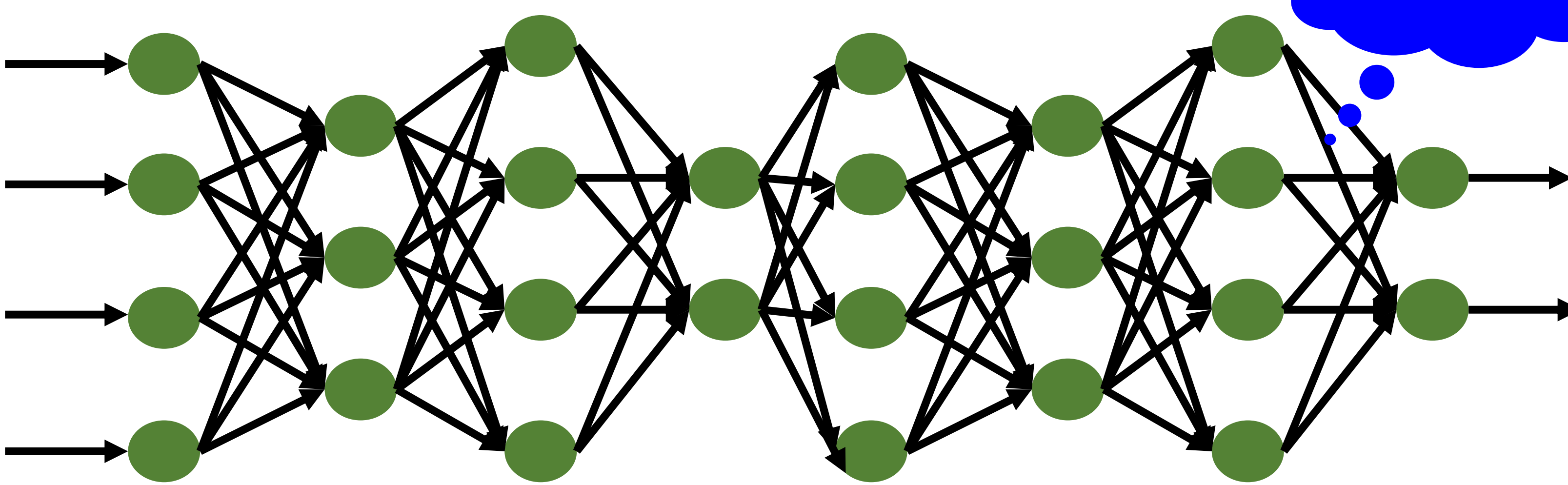
Science

G. E. Hinton* and R. R. Salakhutdinov

High-dimensional data can be converted to low-dimensional codes by training a multilayer neural network with a small central layer to reconstruct high-dimensional input vectors. Gradient descent can be used for fine-tuning the weights in such "autoencoder" networks, but this works well only if the initial weights are close to a good solution. We describe an effective way of initializing the weights that allows deep autoencoder networks to learn low-dimensional codes that work much better than principal components analysis as a tool to reduce the dimensionality of data.

Dimensionality reduction facilitates the classification, visualization, communication, and storage of high-dimensional data. A simple and widely used method is principal components analysis (PCA), which finds the directions of greatest variance in the data set and represents each data point by its coordinates ... We describe ... uses a ...

Deep Learning
DL



8.4 深度学习

狗

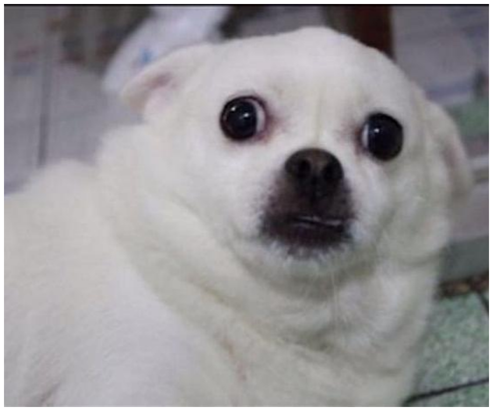
猫

8.4 深度学习

卷积神经网络
CNN

0

1	0	1
0	1	0
1	0	1



1

1 ×1	1 ×0	1 ×1	0	0
0 ×0	1 ×1	1 ×0	1	0
0 ×1	0 ×0	1 ×1	1	1
0	0	1	1	0
0	1	1	0	0

4		

2

3.25	**3.5**
2.75	3.5

3

动物	概率
猫	0.1
狗	0.6
大象	0.02
蚂蚁	0.02
蜗牛	0.04
……	……

4

狗

8.4 深度学习

智慧医疗

1100094140 增值税专用发票 №87654321 1100094140 87654321

此联不作报销、扣税凭证使用

机器编号 000000000001 开票日期：2010年11月18日

购货单位 名称：测试购方企业
纳税人识别号：410305123456789
地址、电话：北京市海淀区知春路60号 81234567
开户行及帐号：建行-0000123456789

密码区
1*6<+81+574+9*2+/>0-39063/*
-*0/968*624582>91*3/*1<6*42
2477</ 42**0+7-2</24-630-391
611+>/51433*124*5-+44><9/94

货物或应税劳务名称	规格型号	单位	数量	单价	金额	税率	税额
计算机	A6100	台	1	5999.00	5999.00	17%	1019.83
合计					¥5999.00		¥1019.83

价税合计（大写） ⊗柒仟零壹拾捌圆捌角叁分 （小写）¥7018.83

销货单位 名称：测试销方企业
纳税人识别号：410305012345678
地址、电话：北京市海淀区知春路61号 68744498
开户行及帐号：工行123455668-234222256111

备注 备注信息

收款人：收款人 复核：复核人 开票人：开票人 销货单位：（章）

财务管理

网络安全

头条 今日头条

信 息 创 造 价 值

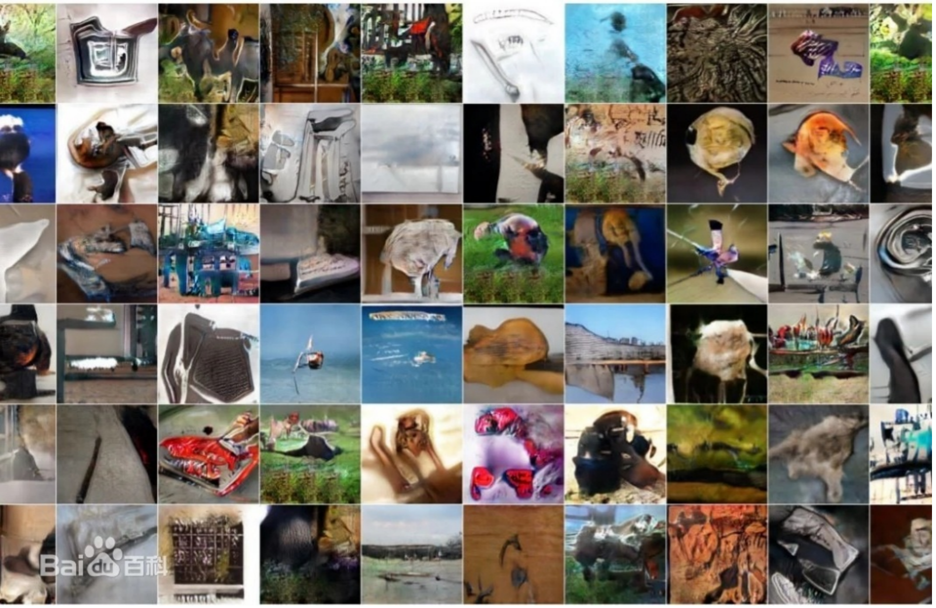
文本生成

关键词提取

商品推荐

8.4 深度学习

大规模图像识别数据集，2009



Our town
Parsippany

Daily Record, Morris County, N.J. Tuesday, January 17, 1995 A7

Parsippany factoids

■ The largest increase in township population since 1980 is among Asians or Pacific Islanders. More than 10 percent of the population of 48,478 – about 4,900 – identified themselves as such in the last census. That's up from less than 4 percent in 1980.

'American dream come true'

Teen masters new language to excel

By Aron Pilhofer
Daily Record

Ask Parsippany High School senior Fei Fei Li about herself and she'll say she's just like everyone else.

But those who knew the 18-year-old say that's not true.

"Talk about the American dream come true, this is it," said Melvin Zirkes, the school's principal.

An honors student who scored

Li and her mother moved to Parsippany from mainland China in May 1992.

"My father came first for several years, then my mom and I came," she said. The family chose Parsippany "because there is a big Chinese population and my father's research showed that Parsippany High School was a good school."

At first, the transition was difficult.

"I was never not able to commu-

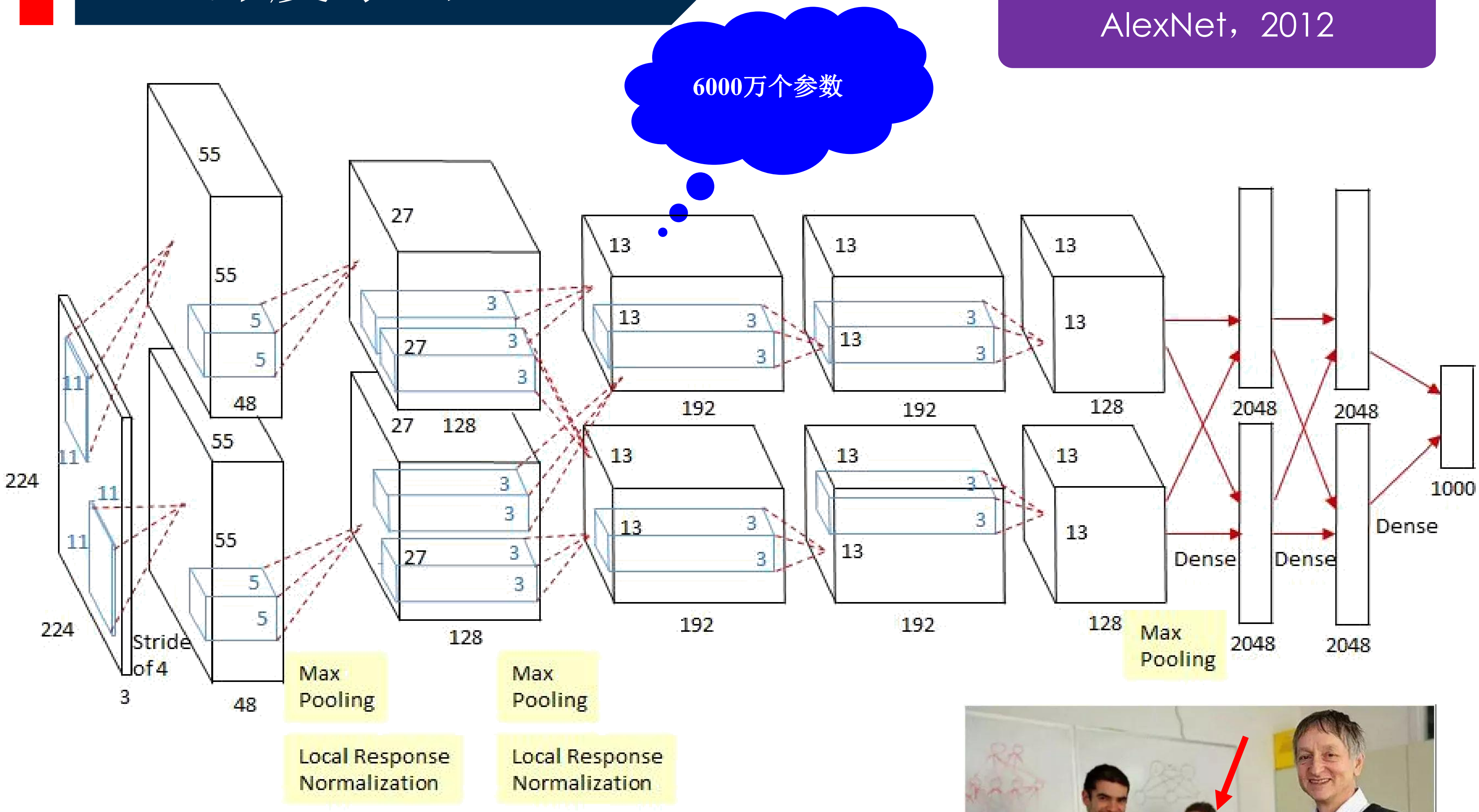
"You are so much a part of your culture, and all of a sudden you're going to a place you're not familiar with," Li said. "In a way, I don't feel I totally belong here still. I had my own life for 15 years in China. It's a big change."

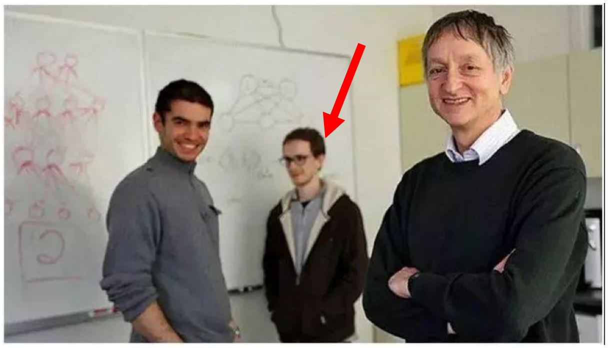
Li has been documenting her experiences in a series of articles she has written for the Chinese magazine "Teenagers in China and Abroad."

"To a Chinese teenager, everything I have experienced is new," she said. "The underlying reason I

8.4 深度学习

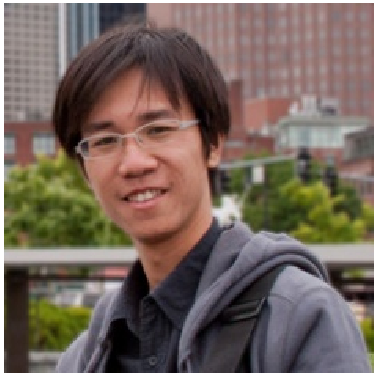
AlexNet，2012



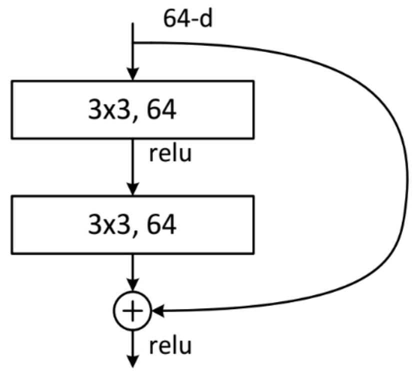


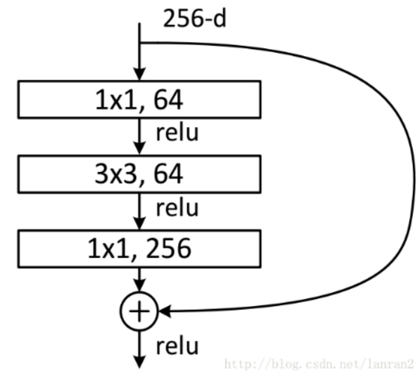
8.4 深度学习

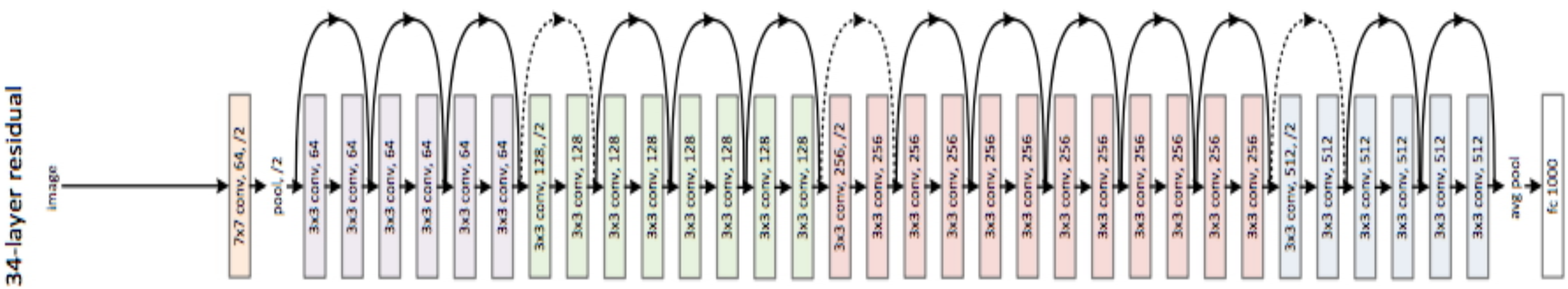
ResNet，2015



何凯明







ResNet10（BasicBlock）：14356544　　ResNet18（BasicBlock）：33161024

ResNet34（BasicBlock）：63470656　　ResNet50（Bottleneck）：46159168

ResNet101（Bottleneck）：85205312　　ResNet152（Bottleneck）：

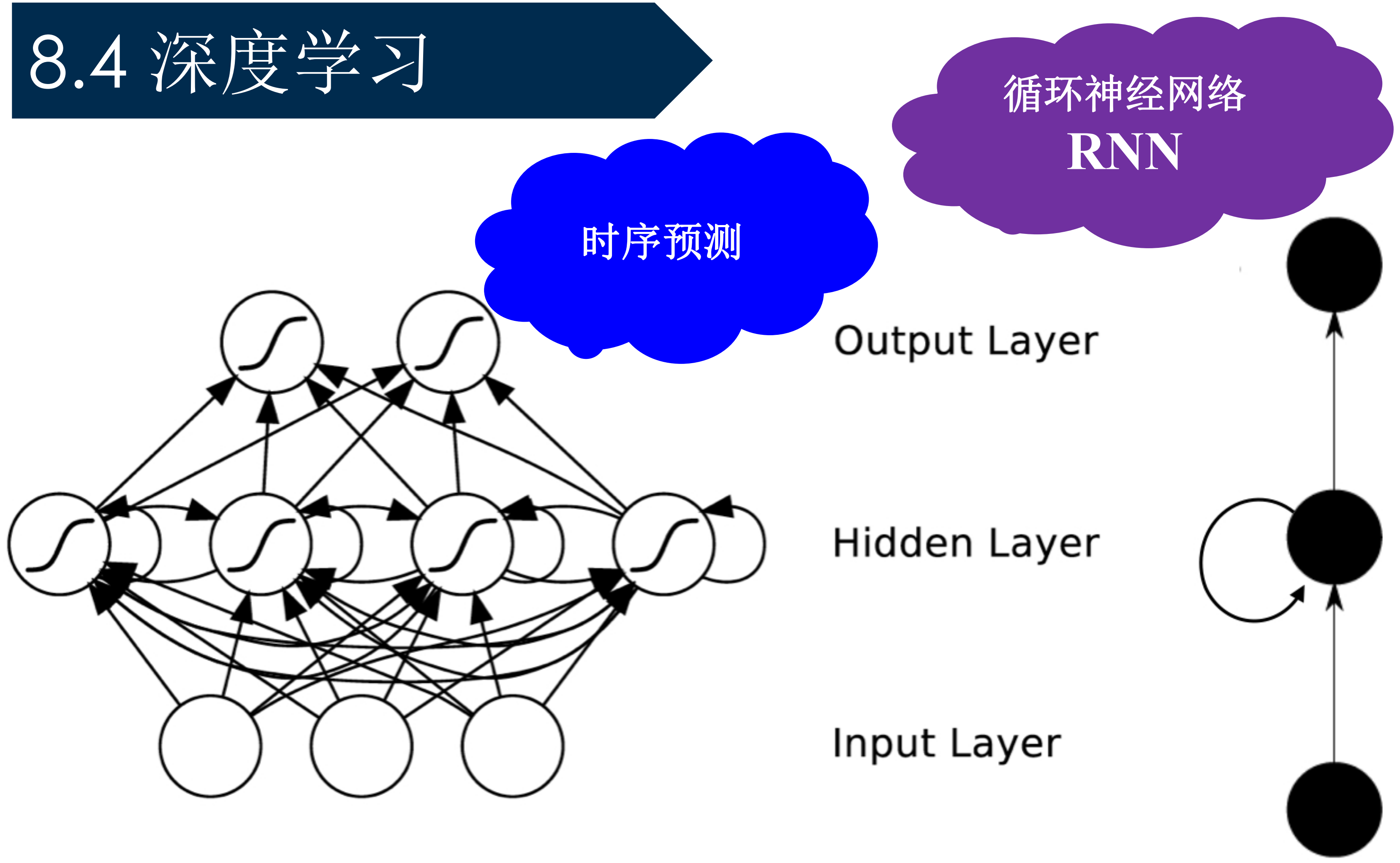
8.4 深度学习

AlphaGo，2016

2016年3月，Alpha Go Master击败最强的人类围棋选手之一李世石。击败李的版本，在训练过程中使用了大量人类棋手的棋谱。

2017年10月19日，DeepMind公司在《自然》杂志发布了一篇新的论文，AlphaGo Zero——它完全不依赖人类棋手的经验，经过3天的训练，Alpha Go Zero击败了Master版本。

8.4 深度学习



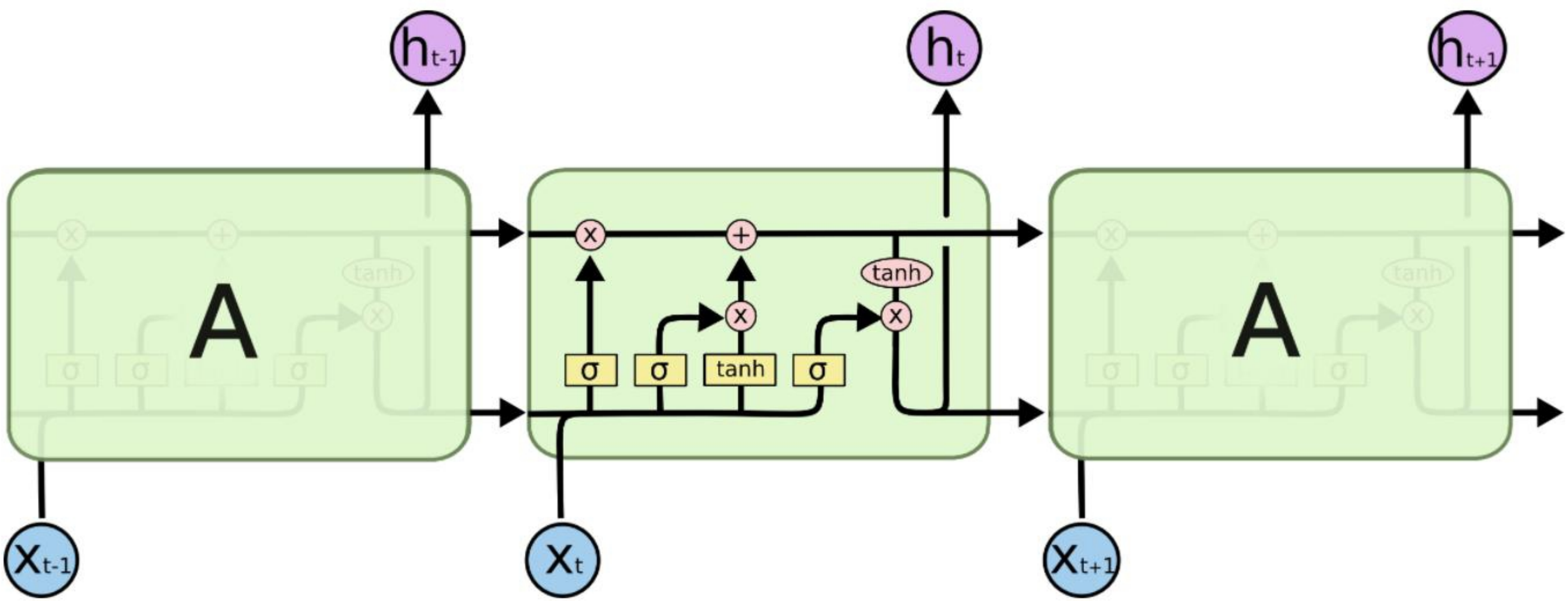
细想BP算法、CNN(卷积神经网络)，我们会发现 他们的输出都是只考虑前一个输入的影响而不考虑其它时刻输入的影响, 比如简单的猫,狗,手写数字等单个物体的识别具有较好的效果. 但是, 对于一些与时间先后有关的, 比如视频的下一时刻的预测,文档前后文内容的预测等, 这些算法的表现就不尽如人意了.因此, RNN就应运而生了.

8.4 深度学习

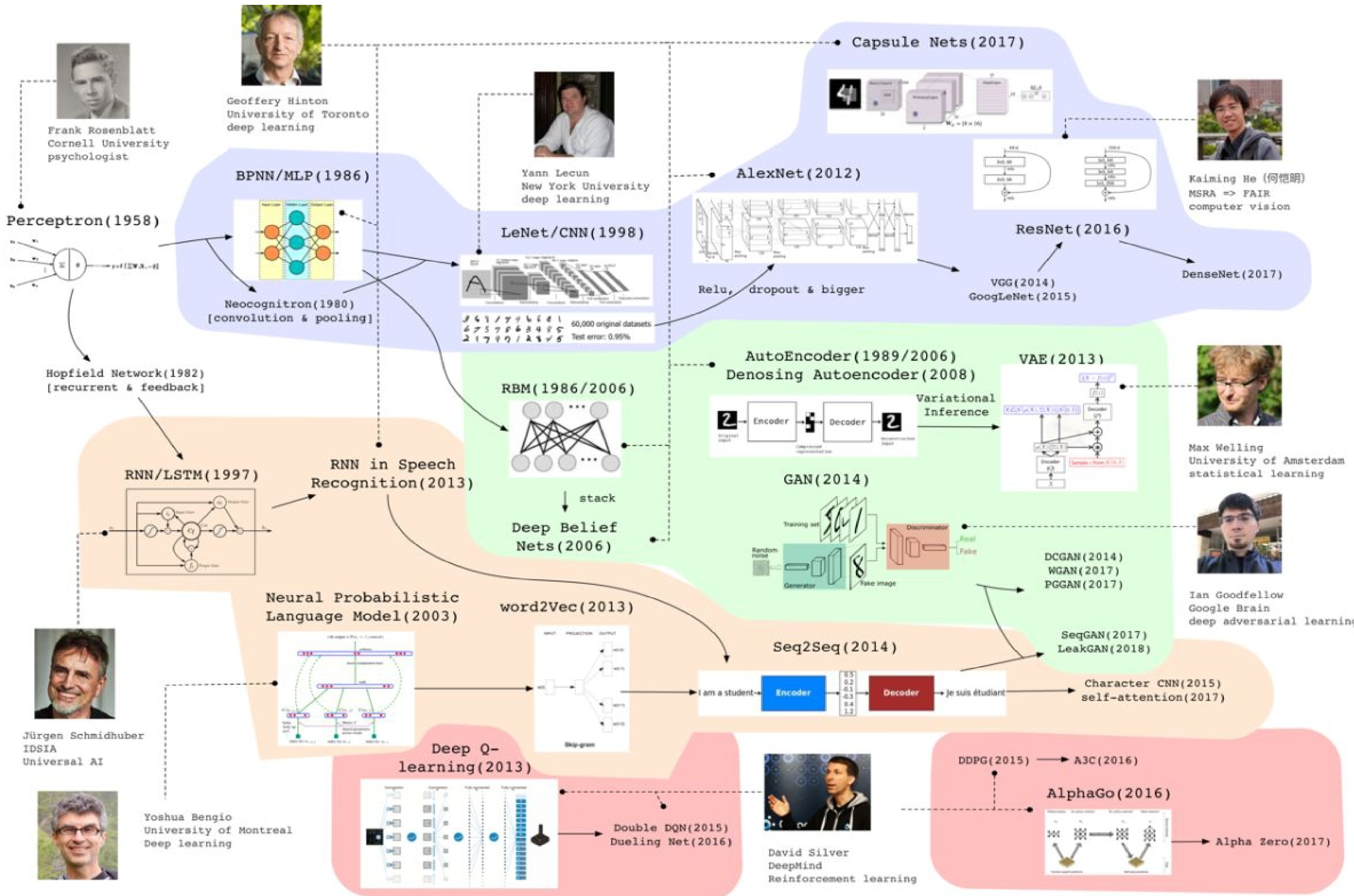
Jürgen Schmidhuber

时序预测

长短期记忆网络
LSTM



8.4 深度学习



Capsule Nets(2017)
Geoffery Hinton
University of Toronto
deep learning
Frank Rosenblatt
Cornell University
psychologist
Yann Lecun
New York University
deep learning
Kaiming He (何恺明)
MSRA => FAIR
computer vision
BPNN/MLP(1986)
AlexNet(2012)
Perceptron(1958)
LeNet/CNN(1998)
ResNet(2016)
Neocognitron(1980)
[convolution & pooling]
Relu, dropout & bigger
VGG(2014)
GoogLeNet(2015)
DenseNet(2017)
60,000 original datasets
Test error: 0.95%
AutoEncoder(1989/2006)
Denosing Autoencoder(2008)
VAE(2013)
Hopfield Network(1982)
[recurrent & feedback]
RBM(1986/2006)
Variational Inference
Encoder
Decoder
Max Welling
University of Amsterdam
statistical learning
RNN/LSTM(1997)
RNN in Speech Recognition(2013)
GAN(2014)
stack
Deep Belief Nets(2006)
Training set
Random noise
Discriminator
Real
Fake
Generator
Fake image
DCGAN(2014)
WGAN(2017)
PGGAN(2017)
Ian Goodfellow
Google Brain
deep adversarial learning
Neural Probabilistic Language Model(2003)
word2Vec(2013)
Seq2Seq(2014)
SeqGAN(2017)
LeakGAN(2018)
I am a student
Je suis étudiant
Character CNN(2015)
self-attention(2017)
Jürgen Schmidhuber
IDSIA
Universal AI
Deep Q-learning(2013)
DDPG(2015)
A3C(2016)
AlphaGo(2016)
Double DQN(2015)
Dueling Net(2016)
Alpha Zero(2017)
Yoshua Bengio
University of Montreal
Deep learning
David Silver
DeepMind
Reinforcement learning

8.4 深度学习

University of Montreal

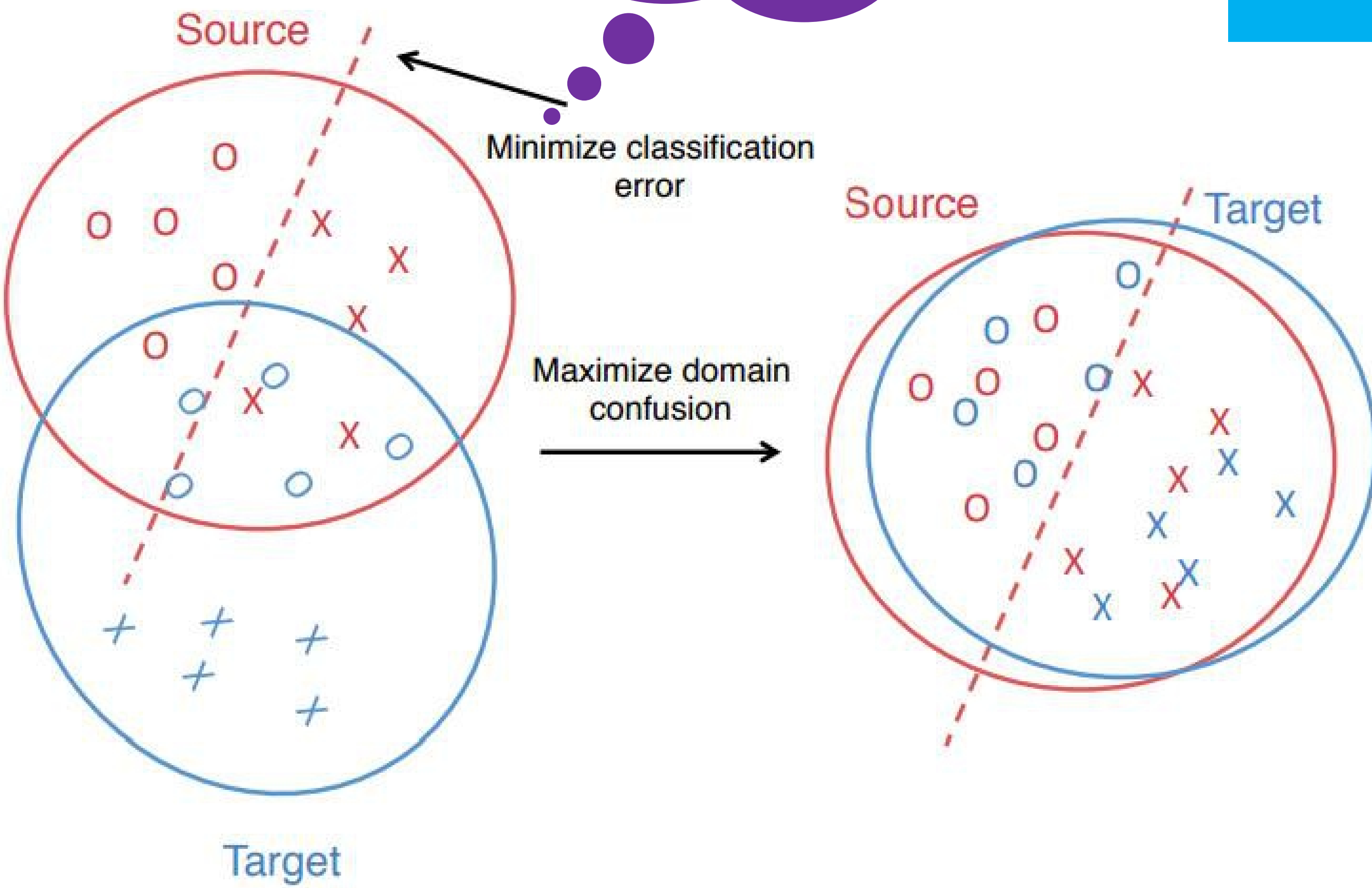
Google & University of Toronto

New York University

2018图灵奖获得者，人工智能三大教父

8.4 深度学习

迁移学习
Transfer Learning

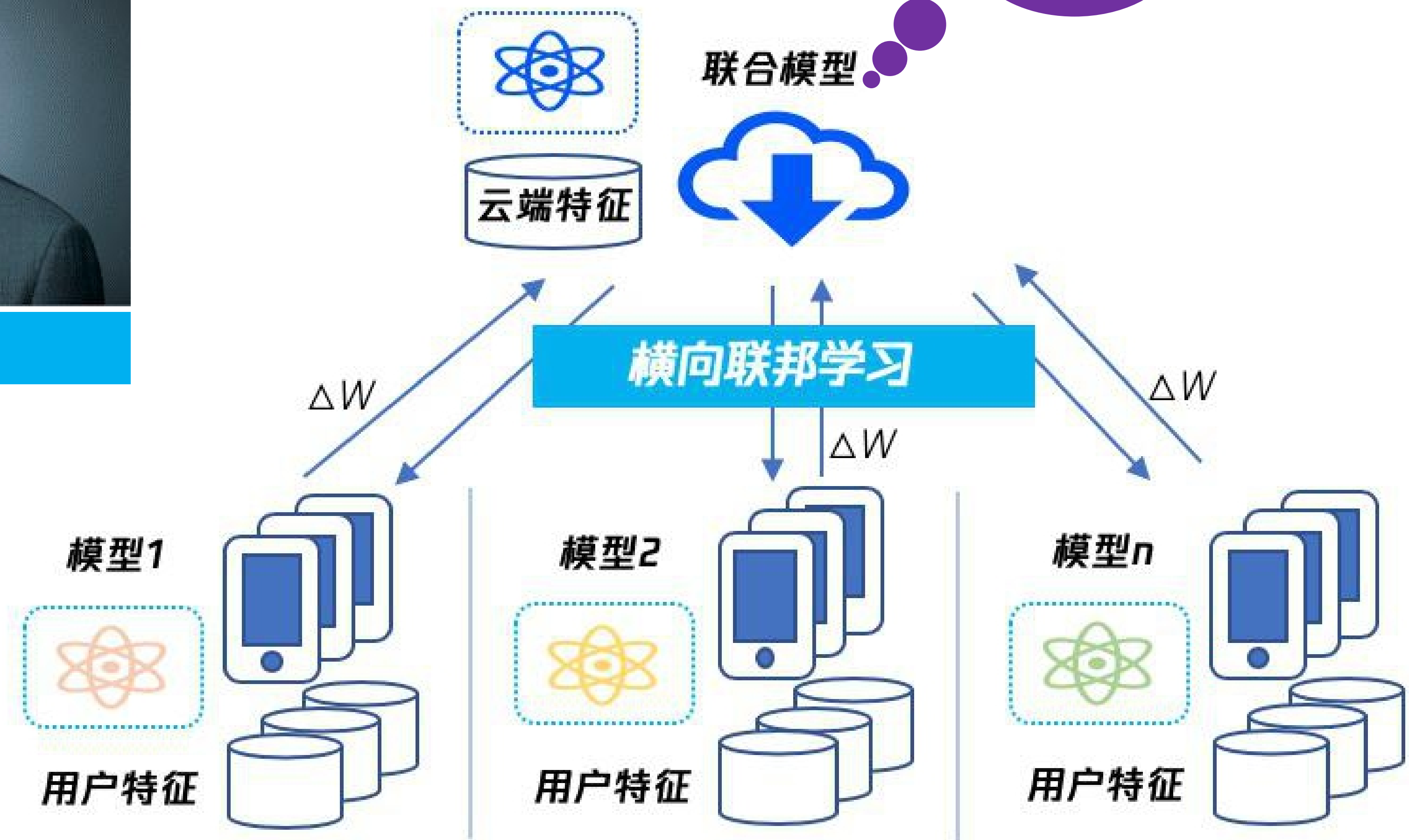


杨 强

8.4 深度学习

杨 强

联邦学习
Federated Learning



客户端

8.4 深度学习

8.4 深度学习

信息化浪潮	发生时间	标志	解决问题	代表企业
第一次浪潮	1980年前后	个人计算机	信息处理	Intel、AMD、IBM、苹果、微软、联想、戴尔、惠普等
第二次浪潮	1995年前后	互联网	信息传输	雅虎、谷歌、阿里巴巴、百度、腾讯等
第三次浪潮	2010年前后	物联网、云计算和大数据	信息爆炸	将涌现出一批新的市场标杆企业

商汤 sensetime

https://www.sensetime.com

Face++ 旷视

https://www.megvii.com/

科大讯飞 iFLYTEK

https://www.iflytek.com

SeetaTech 中科视拓

http://www.seetatech.com/

最新研究进展

序号	刊物名称	刊物全称	地址
1	AAAI	AAAI Conference on Artificial Intelligence	http://dblp.uni-trier.de/db/conf/aaai/
2	NeurIPS	Annual Conference on Neural Information Processing Systems	http://dblp.uni-trier.de/db/conf/nips/
3	ICML	International Conference on Machine Learning	http://dblp.uni-trier.de/db/conf/icml
4	IJCAI	International Joint Conference on Artificial Intelligence	http://dblp.uni-trier.de/db/conf/ijcai/