

Deep Learning

Lecture 00: Course Information

Wanxiang Che

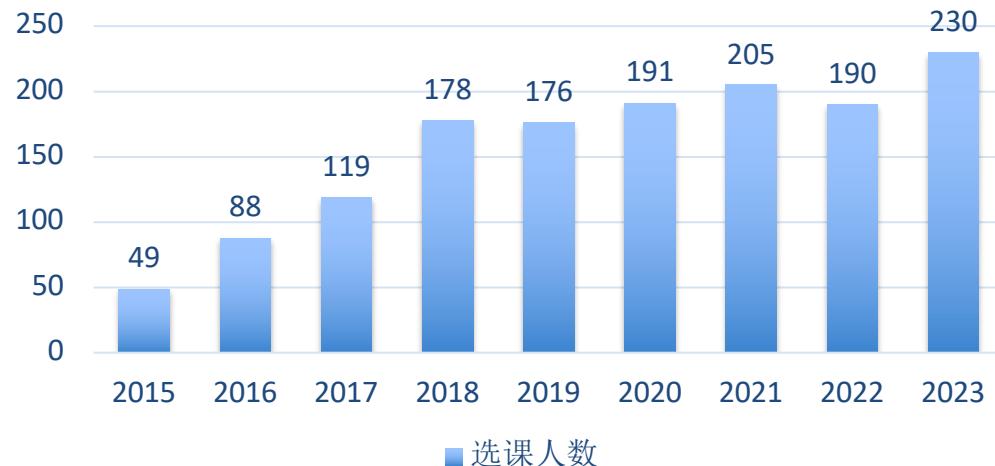


群聊：深度学习课程 2023



Course Information

- Lecturers
 - 车万翔、左旺孟
- Students
 - 计算学部
 - 航天工程与力学系
 - 航天学院
 - 自动化测试与控制系
 - 机电工程学院
 - 仪器科学与工程学院
 - 经济管理学院
 - 继续教育学院
 - 生命科学与技术学院
 - 土木工程学院



该二维码7天内(2月28日前)有效，重新进入将更新

Schedule

周次	星期三 (5-6节)	星期五 (7-8节)
1	深度学习概述	
2	神经网络基础	深度学习工具介绍
3	循环神经网络与Transformer	基于预训练模型的自然语言处理

Grade

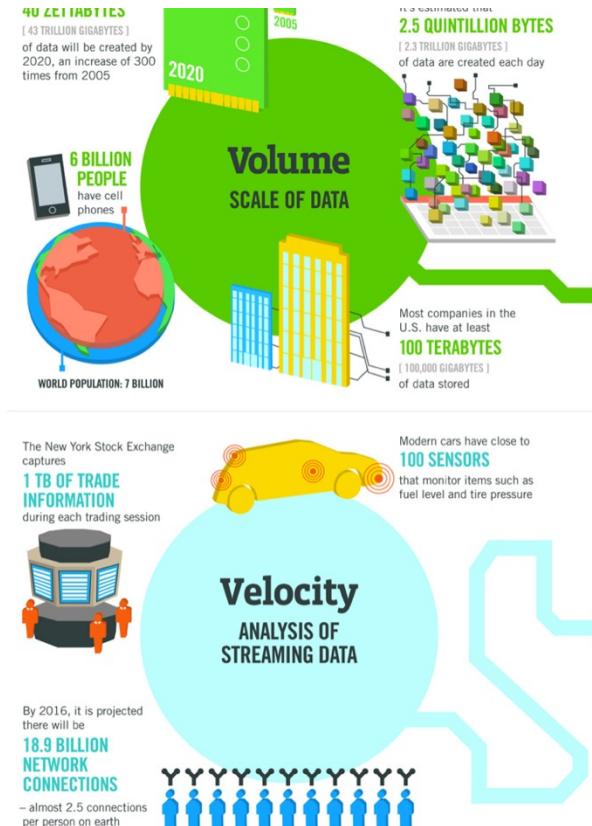
- A Project using or improving Deep Learning
 - Group: 1-3 people
 - Submission: Project slides with audio
 - Scoring: Novelty, Technology, Workload, Performance, Presentation
 - Examples
 - Stanford CS229 (Machine Learning Course)
 - CS224n (Natural Language Processing with Deep Learning)

Deep Learning

Lecture 01: Introduction

Wanxiang Che

The Age of Big Data



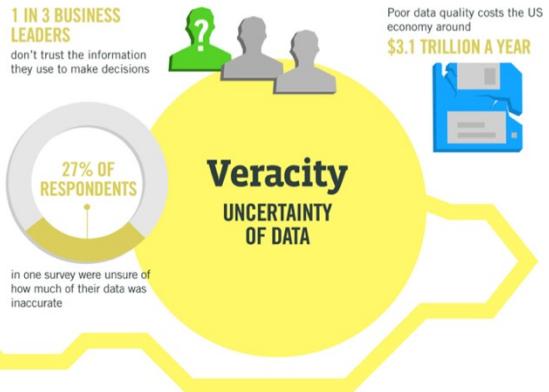
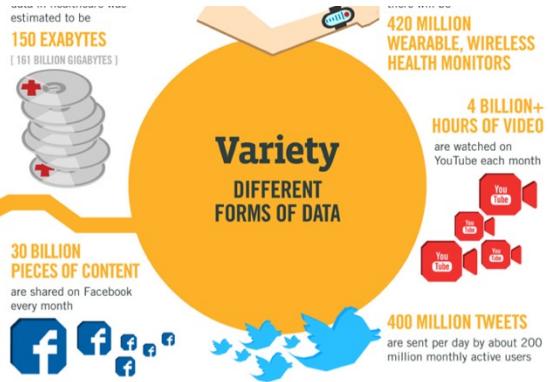
The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume**, **Velocity**, **Variety** and **Veracity**.

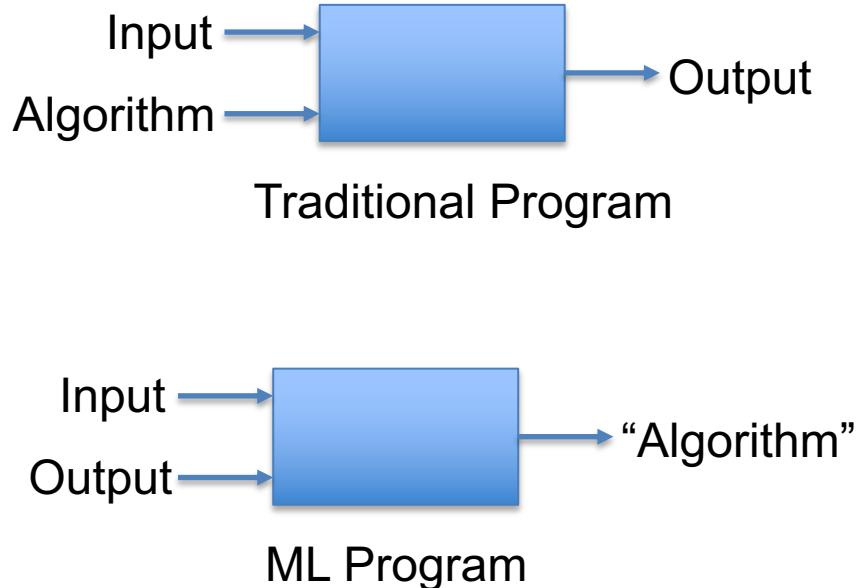
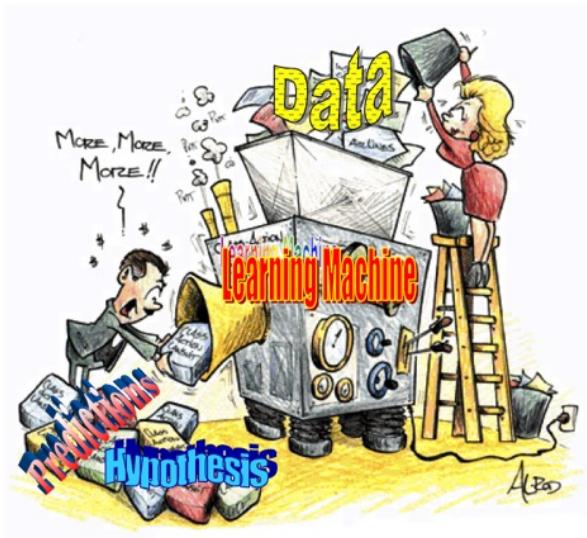
Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015
4.4 MILLION IT JOBS will be created globally to support big data, with 1.9 million in the United States



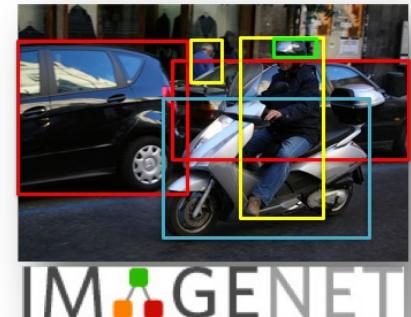
What is Machine Learning (机器学习)?

- From Data to Knowledge

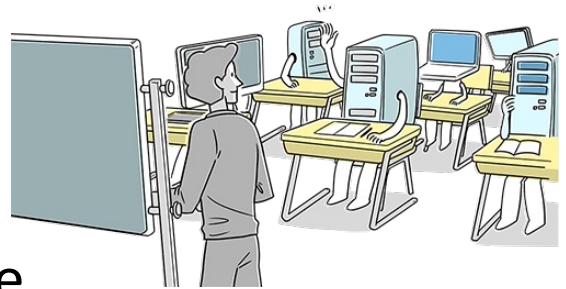


Some Applications of ML

- Recognizing patterns (识别模式)
 - Objects in real scenes
 - Facial identities or facial expressions
 - Spoken words
- Recognizing anomalies (识别异常)
 - Unusual sequences of credit card transactions
 - Unusual patterns of sensor readings in a nuclear power plant
- Prediction (预测)
 - Future stock prices or currency exchange rates
 - Which movies will a person like?



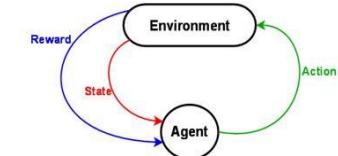
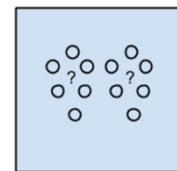
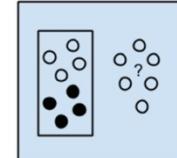
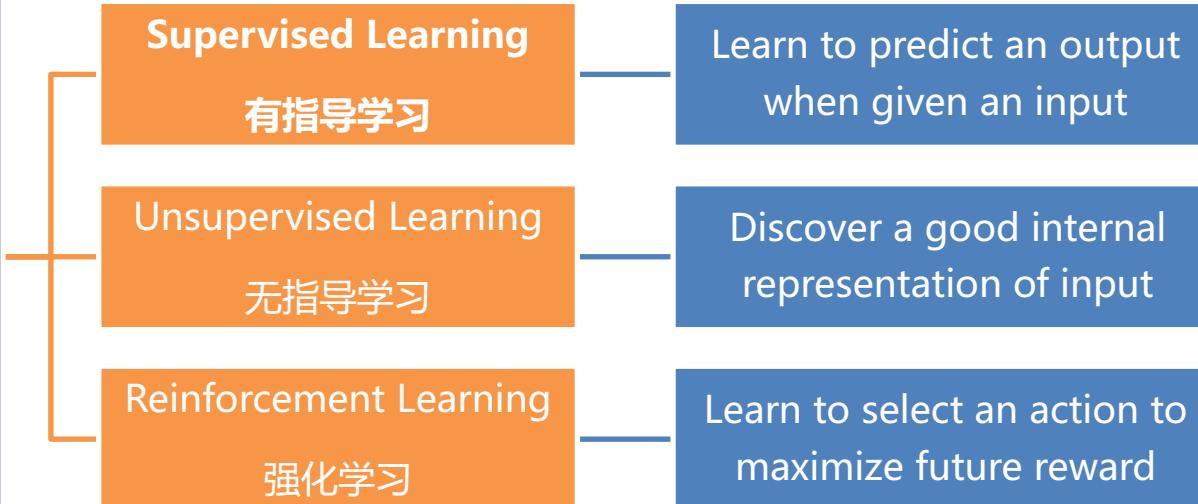
When to apply ML?



- Humans are unable to explain their expertise
 - e.g. speech recognition, vision, language
- The problem size is too vast for our limited reasoning capabilities
 - e.g. calculating webpage ranks, matching ads to Facebook pages
- Human expertise is absent
 - e.g. navigating on Mars
- Solution changes with time
 - e.g. spam detection, tracking, temperature control, preferences

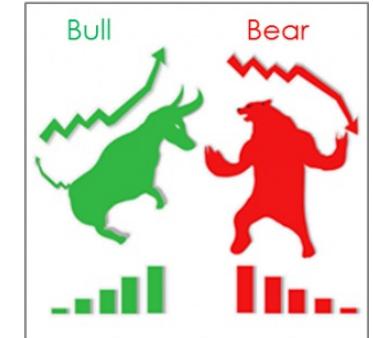
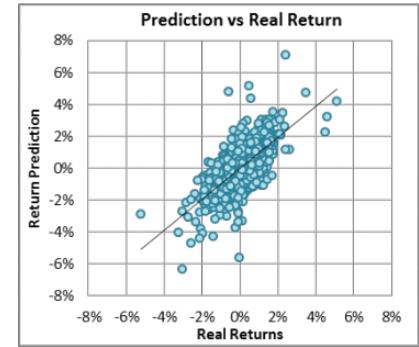
Machine Learning

Types of Learning Task



Two Types of Supervised Learning

- Training case/example/data
 - Input vector x and a target output y
- **Regression** (回归): The target output is a real number
 - The price of a stock in 6 months time
 - The temperature at noon tomorrow
- **Classification** (分类): The target output is a class label
 - The decision of email spam
 - The class of a news document

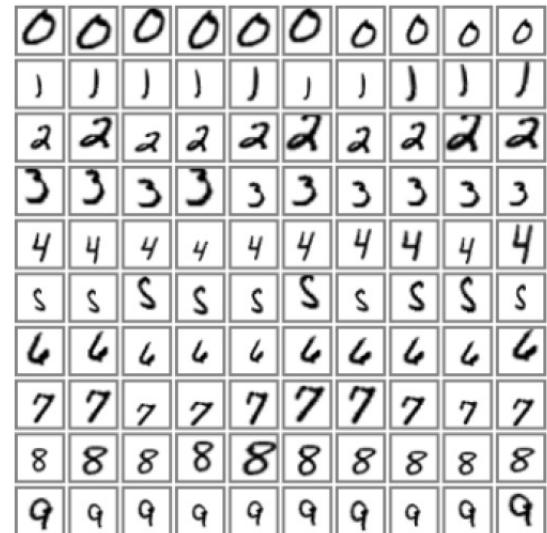


How Supervised Learning Typically Works

- Choosing a **model-class**: $y = f(\mathbf{x}; \mathbf{W})$
 - f is a way of using some numerical parameters (参数), \mathbf{W} , to map each input vector, \mathbf{x} , into a predicted output y
- Learning/optimizing (学习/优化)
 - Adjusting the parameters to reduce **loss/cost** (the discrepancy between the target output, y , on each training case and the actual output, y' , produced by the model)

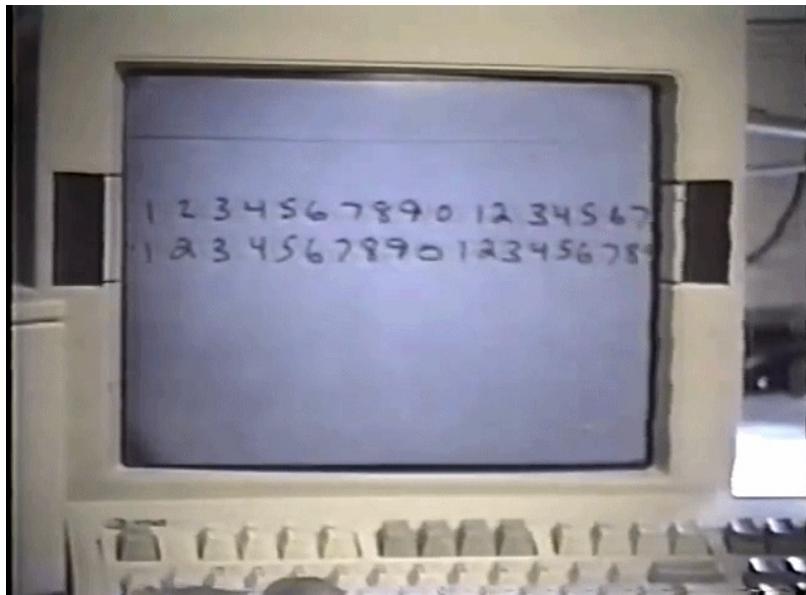
A standard example of machine learning

- The MNIST database of hand-written digits
 - They are publicly available and we can learn them quite fast in a moderate-sized neural net.
 - We know a huge amount about how well various machine learning methods do on MNIST.
 - 60,000 + 10,000 hand-written digits (28x28 pixels each)



A standard example of machine learning

- 1993 年 , 32岁的Yann LeCun (杨立昆) 使用CNN识别手写体数字



It is very hard to say what makes a 2

0 0 0 1 1 1 1 1 2

2 2 2 2 2 2 3 3 3

3 4 4 4 4 4 5 5 5

6 6 7 7 7 7 8 8 8

8 8 8 8 9 4 9 9 9

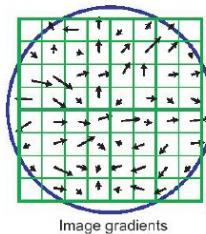
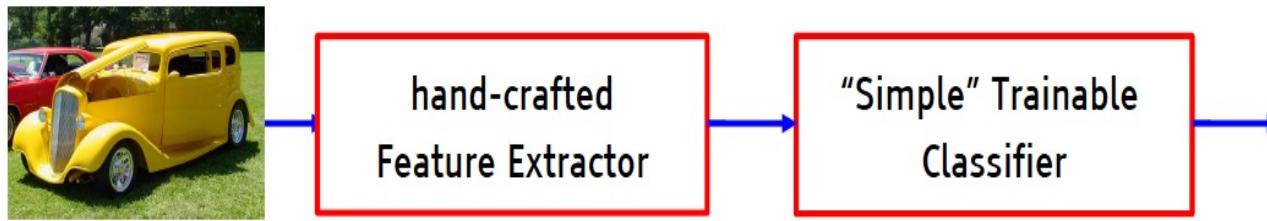


Beyond MNIST: The ImageNet task

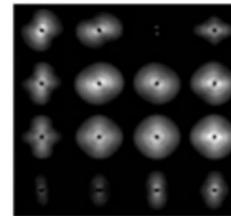
- 1000 different object classes in 1.3 million high-resolution training images from the web.
 - Best system in 2010 competition got 47% error for its first choice and 25% error for its top 5 choices.
- Jitendra Malik (an eminent neural net sceptic) said that this competition is a good test of whether deep neural networks work well for object recognition.
 - A very deep neural net (Krizhevsky et. al. 2012) gets less than 40% error for its first choice and less than 20% for its top 5 choices
 - Microsoft won 2015 LSVRC challenge
 - 152 layers (CNN), 19.38% error (top-1), 3.57% error (top-5) !!

Traditional Model

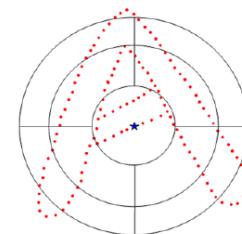
- Fixed/engineered features + trainable classifier
 - Designing a feature extractor requires considerable efforts by experts



SIFT



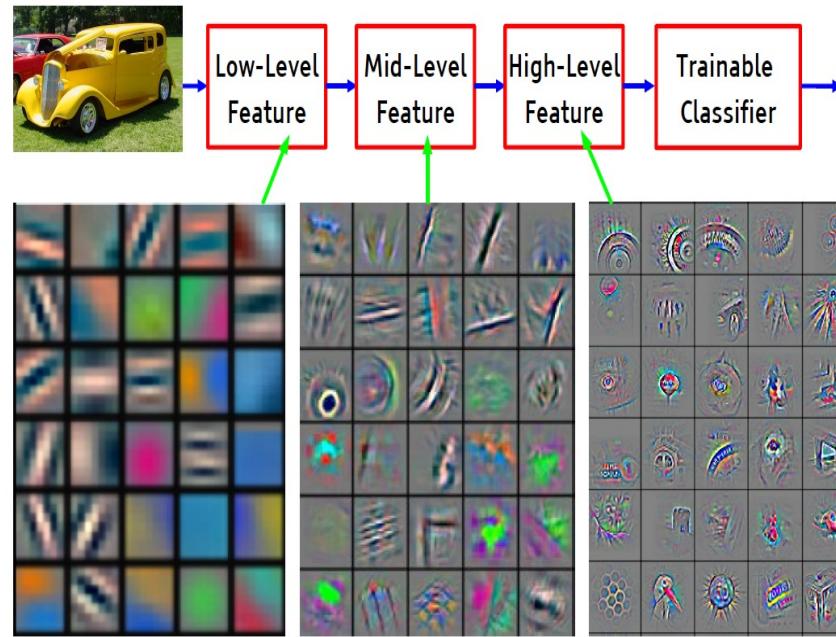
GIST



Shape context

Deep Learning = Learning Hierarchical Representations

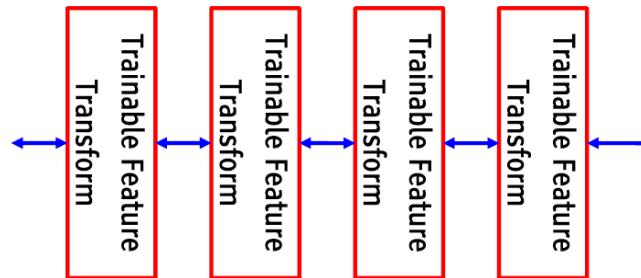
- It's deep if it has **more than one** stage of **non-linear** feature transformation



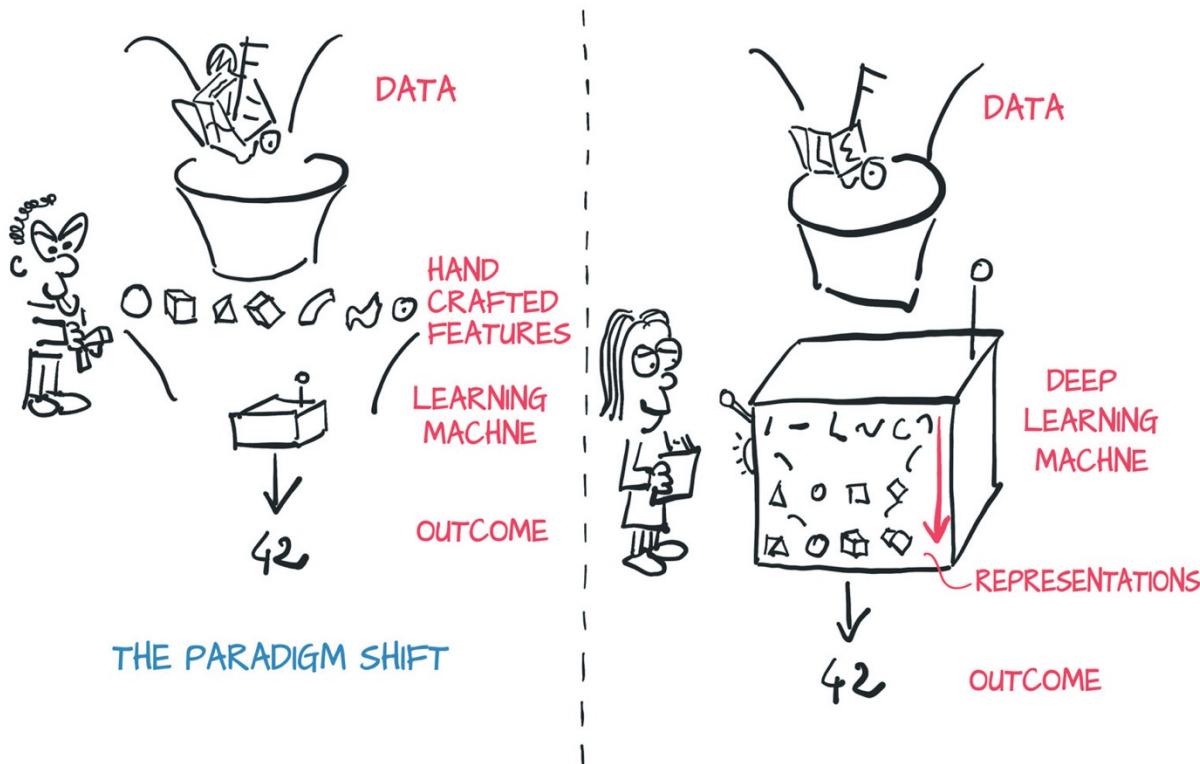
Feature visualization of convolutional net trained on ImageNet from [Zeller & Fergus 2013]

Trainable Feature Hierarchy

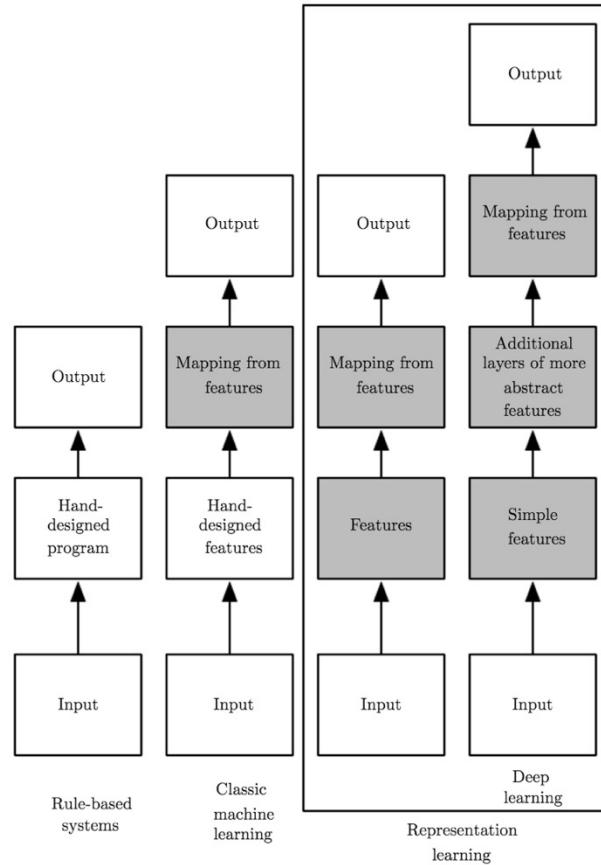
- Hierarchy of representations with increasing level of abstraction
- Each stage is a kind of trainable feature transform (转换)
- Image recognition
 - Pixel → edge → texton → motif → part → object
- Text
 - Character → word → phrase → clause → sentence → document
- Speech
 - Sample → spectral band → sound → ... → phone → phoneme → word



The change in perspective brought by deep learning

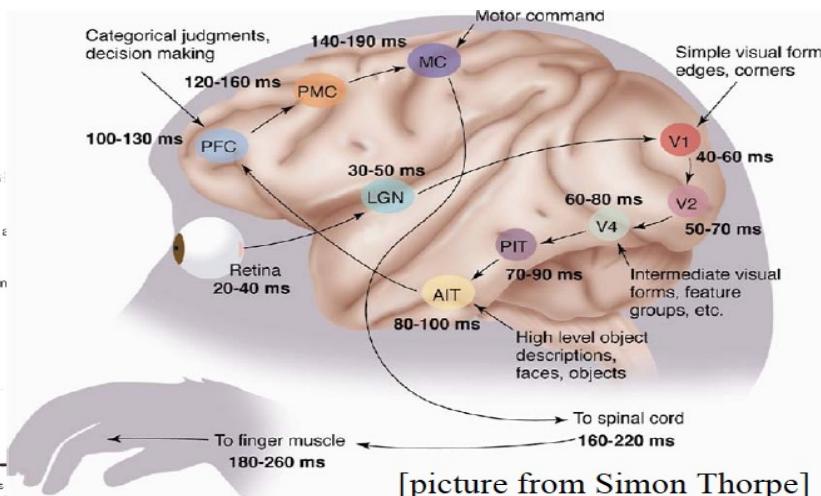
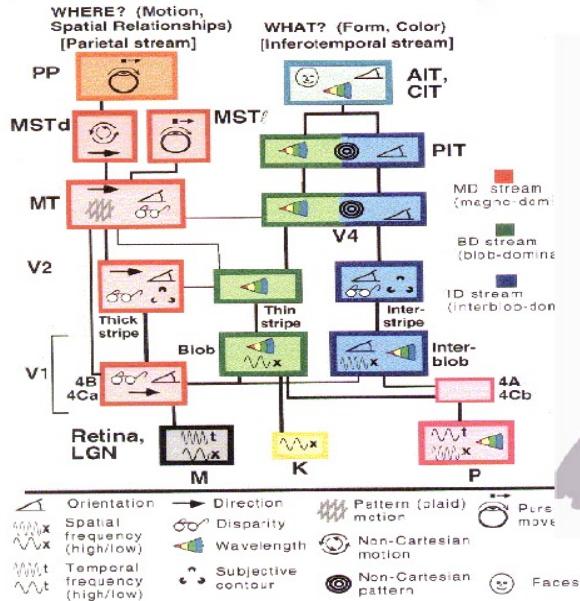


Different ML Disciplines



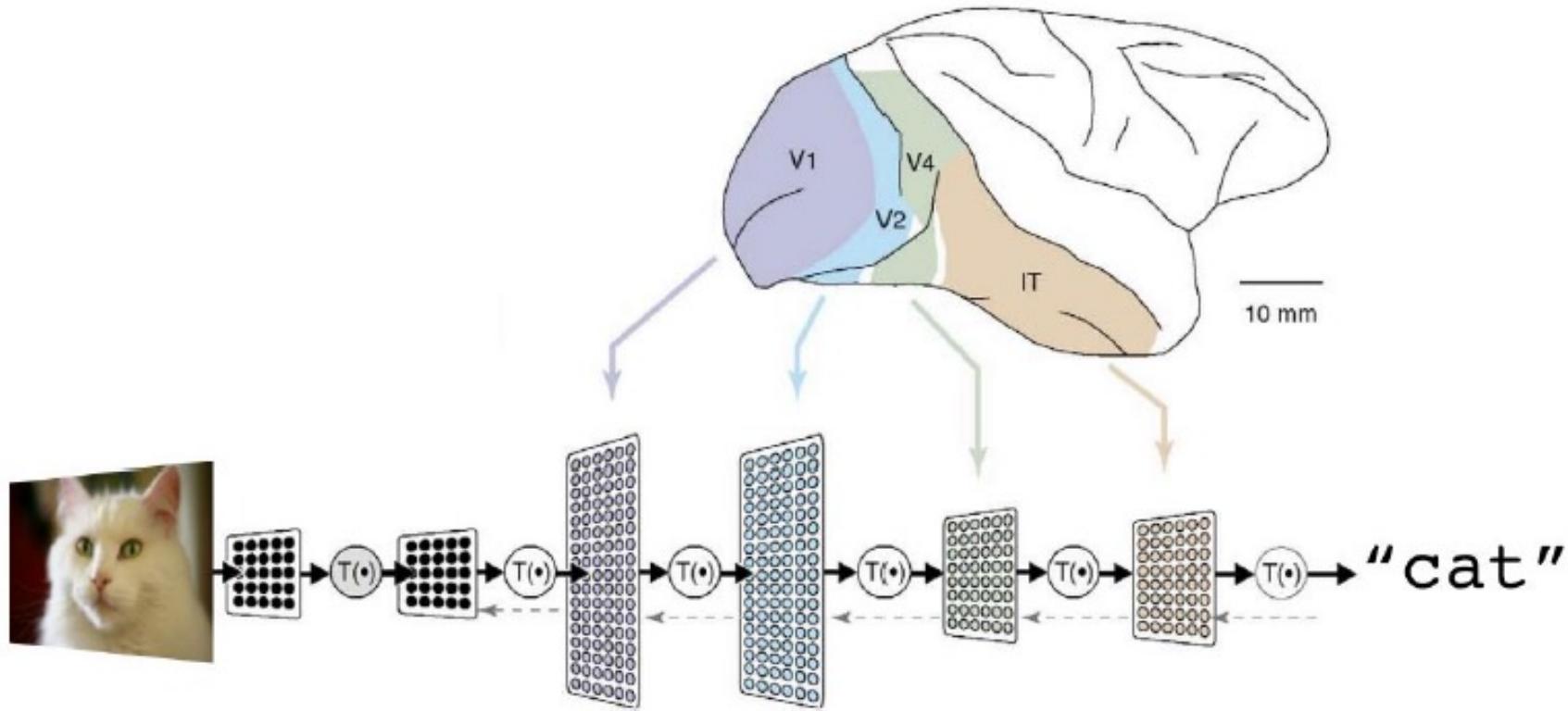
The Mammalian Visual Cortex is Hierarchical

- The ventral (recognition) pathway in the visual cortex has multiple stages
- Retina - LGN - V1 - V2 - V4 - PIT - AIT
- Lots of intermediate representations



[Gallant & Van Essen]

Deep Learning Architecture



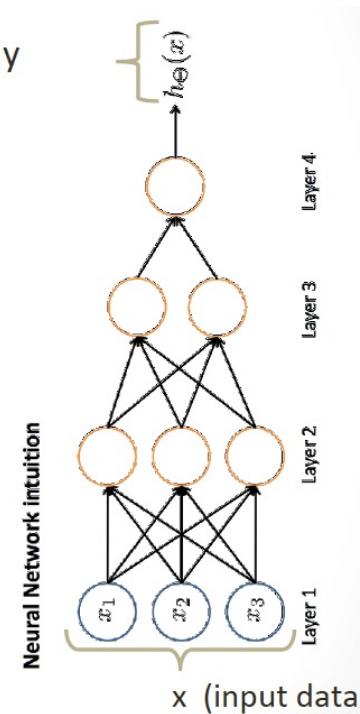
Deep Learning are Not New

- 1980s technology (Neural Networks, 神经网络)

Supervised learning

- Given x and y , learn $p(y|x)$
- Is this photo, x , a “cat”, y ?

$x =$



About Neural Networks

- Pros
 - Simple to learn $p(y|x)$
 - Results OK for shallow nets
- Cons
 - Does not learn $p(x)$
 - Trouble with > 3 layers
 - Overfits
 - Slow to train

The 2006 Breakthrough

1. Mainstream: shallow nets (3 or fewer layers) on small data
2. Slow training on CPUs
3. Near universal sigmoid neuron nonlinearities
4. Parameters initialized with random weights
5. Could only learn discriminative $p(y|x)$ no generative $p(x)$
6. Easy overfitting
7. Neural Nets: Yet another machine learning algorithm (yaml)
8. Some convolutional networks (LeCun et al.)

Hinton et al.'s RBMs

1. Mainstream: deep nets (6+ layers) on “Big Data”
2. Fast training on GPUs
3. Rise of the ReLU nonlinearity
4. Parameters initialized with generative model
5. Autoencoder/RBMs to learn generative $p(x)$
6. Dropout prevents overfitting
7. Deep nets outcompetes the best SOTA in the world (Image or speech recognition)
8. Deep learning moves out of academic to Google, Facebook, and so on

Deep Learning beats NN

- Pros
 - Simple to learn $p(y|x)$
 - Results good for shallow nets
- Cons
 - Does not learn $p(x)$
 - Troubles with > 3 layers
 - Overfits
 - Slow to train

Unsupervised feature learning: RBMs, DAEs, ...

- New activation functions: ReLU, ...
- Gated mechanism

- Dropout
- Maxout
- Stochastic Pooling

GPU

Deep Learning - History



1958 Perceptron

1974 Backpropagation



1969
Perceptron criticized



Convolution Neural Networks for Handwritten Recognition

1998

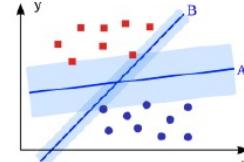


Google Brain Project on 16k Cores



2012

1995
SVM reigns



2006
Restricted Boltzmann Machine



2012
AlexNet wins ImageNet IMAGENET

Deep Learning Big Guys



Yann LeCun*
NYU & FB

Geoff Hinton*
U. Toronto & Google

Yoshua Bengio*
University of Montreal

Andrew Ng
Stanford & Baidu

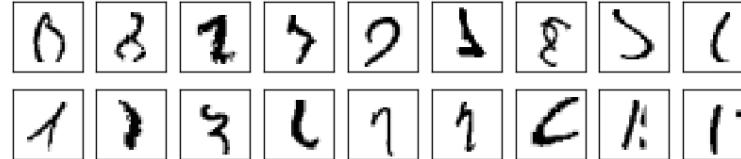


Jürgen Schmidhuber
Swiss AI Lab & NNAISENSE

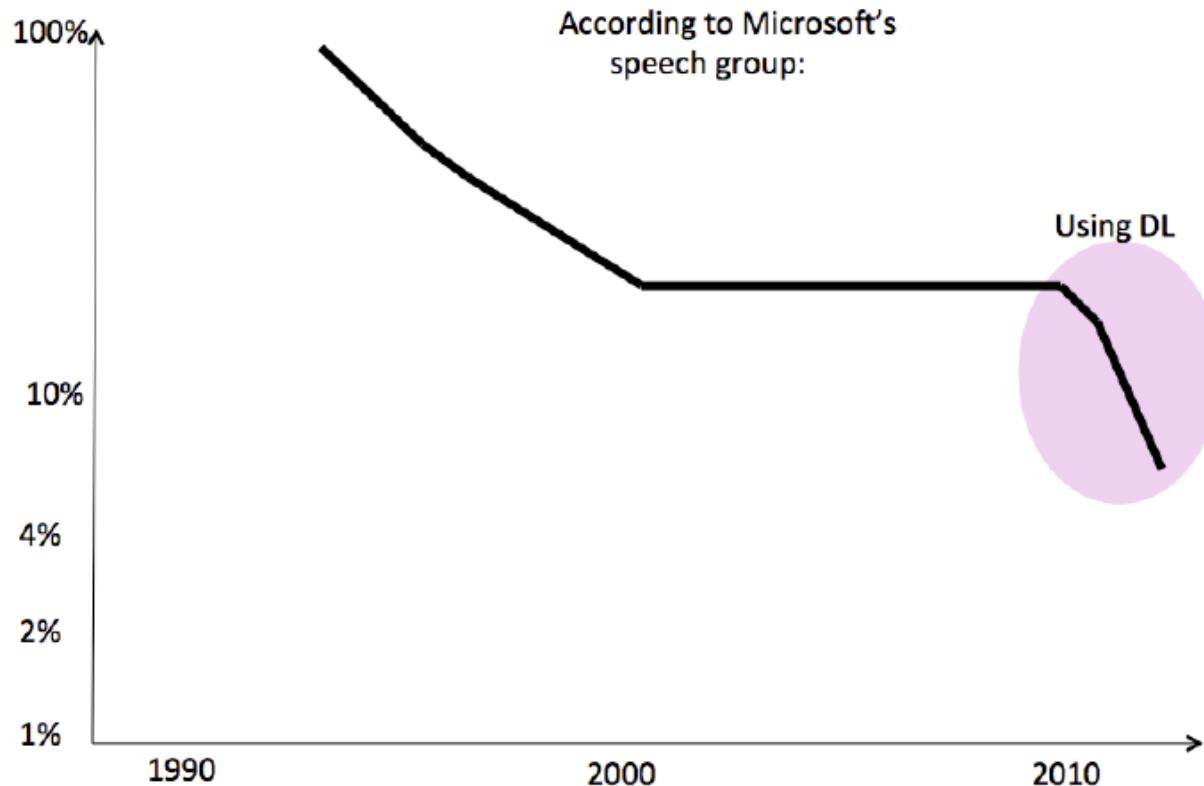
* 2019 Turning Award winners

Results on MNIST

- Naïve Neural Network
 - 96.59%
- SVM (default settings for libsvm)
 - 94.35%
- Optimal SVM (Andreas Mueller)
 - 98.56%
- The state of the art: Convolutional NN (2013)
 - 99.79%



Deep Learning for Speech Recognition



Speech Recognition

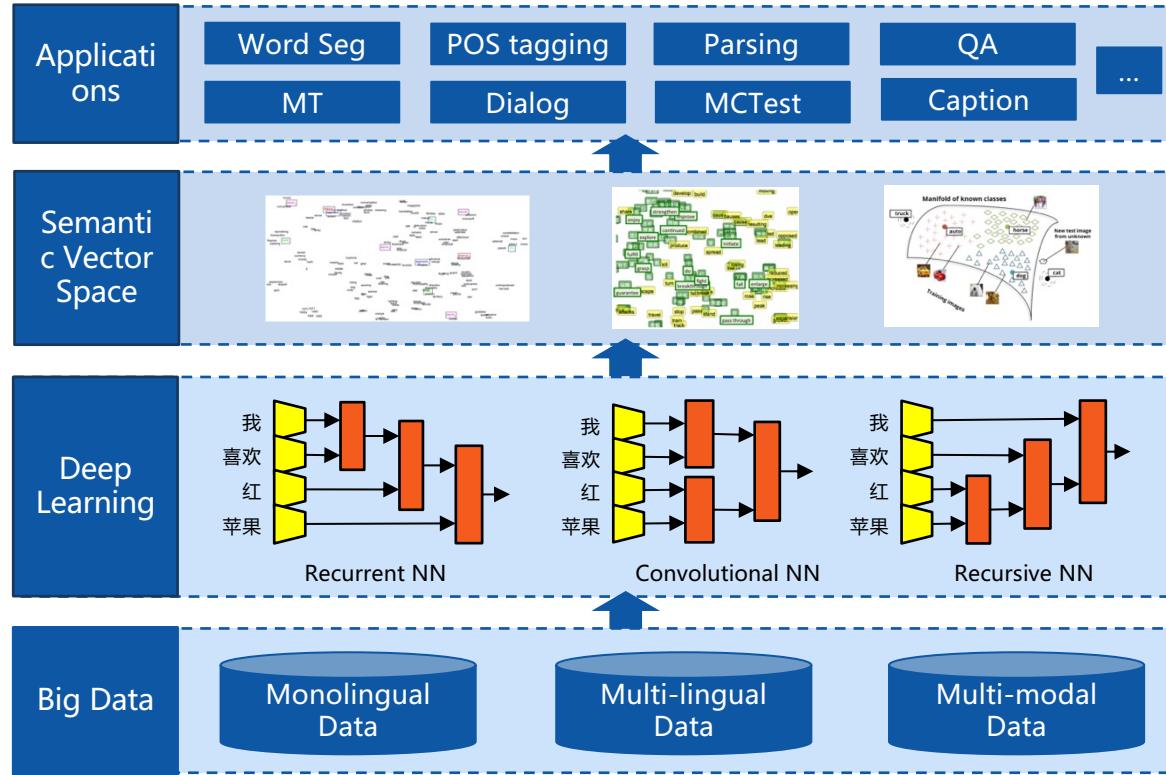
- Microsoft's Real-time Speech Translation



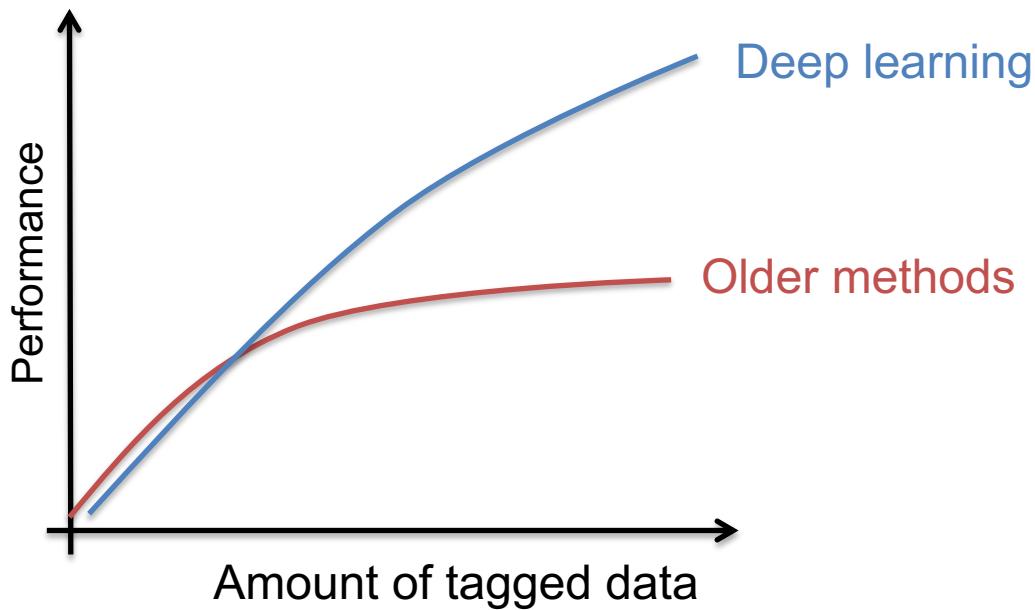
Rick Rashid in Tianjin,
China, October, 25, 2012

Skype real-time translator

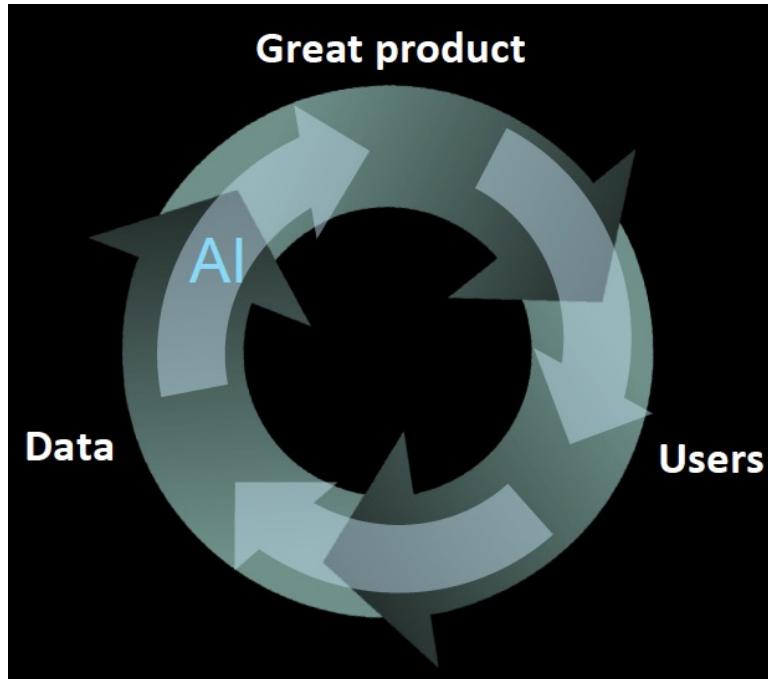
Deep Learning for NLP



Power of deep learning

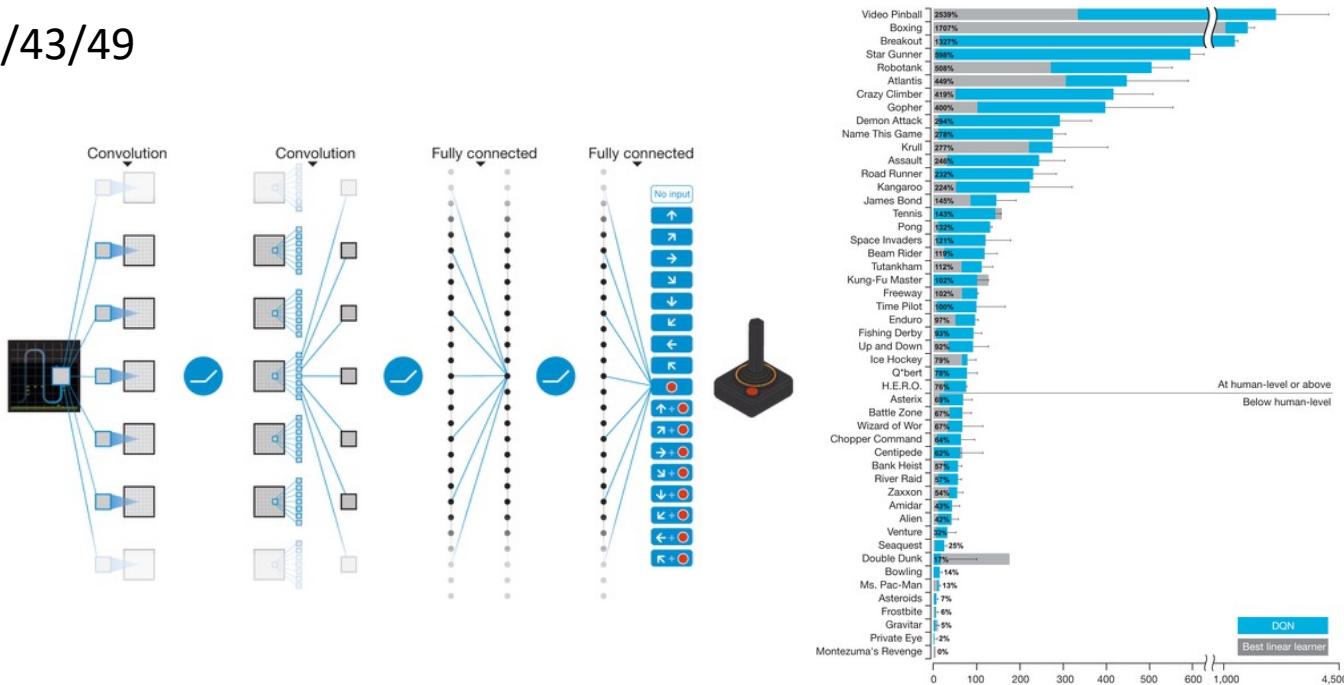


Andrew Ng: Virtuous circle of AI

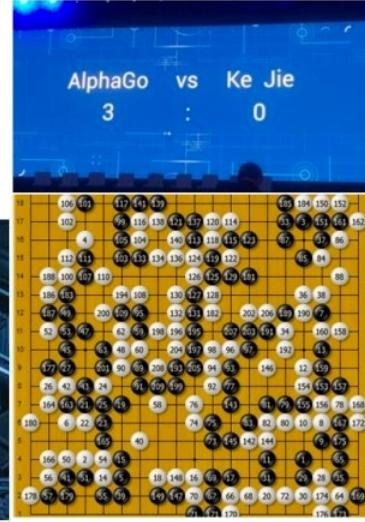
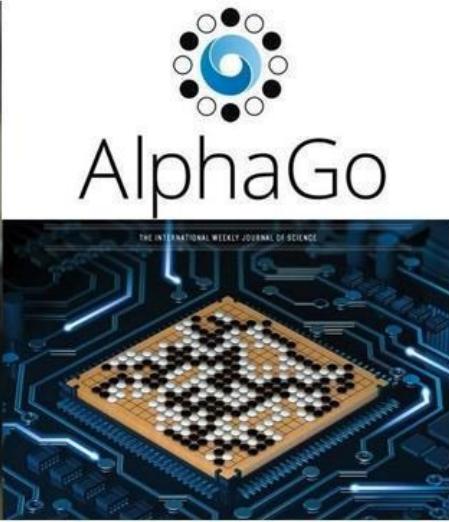


Google DeepMind

- Human-level control through deep reinforcement learning. Nature 518, 529–533 (26 February 2015)
 - 23/43/49

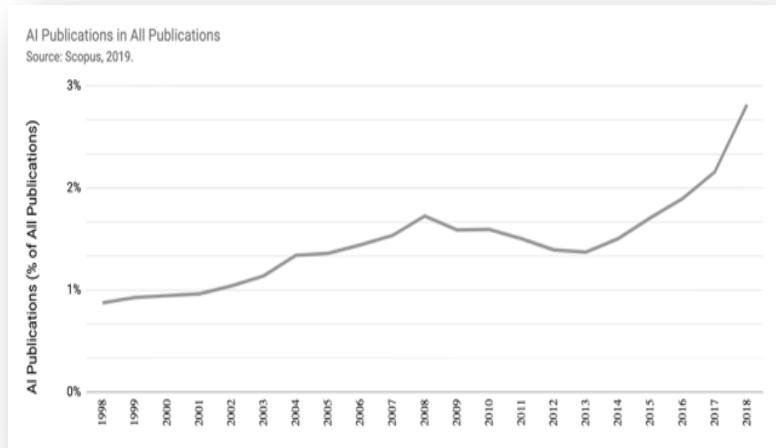


AlphaGo --> Master → Zero

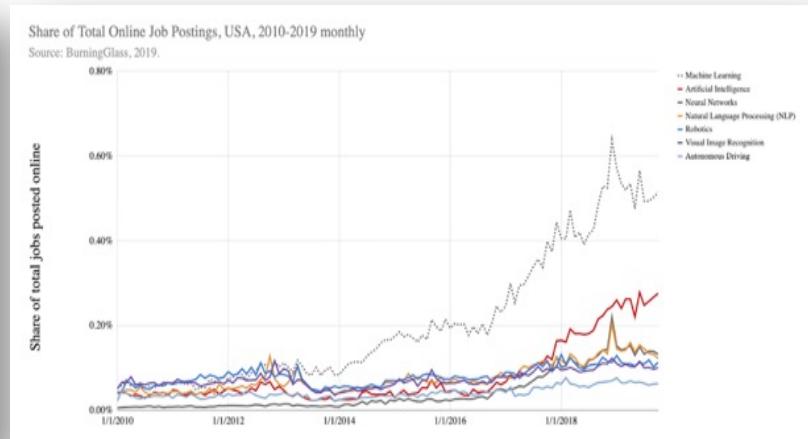


最新进展1：人工智能的研究越来越热

- 人工智能论文发表、相关领域岗位需求均呈逐年递增



发表论文占比

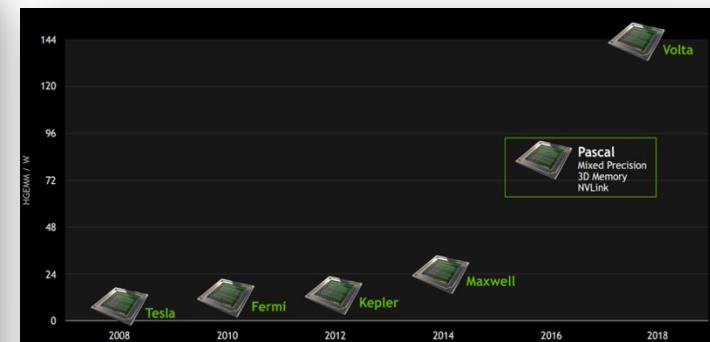
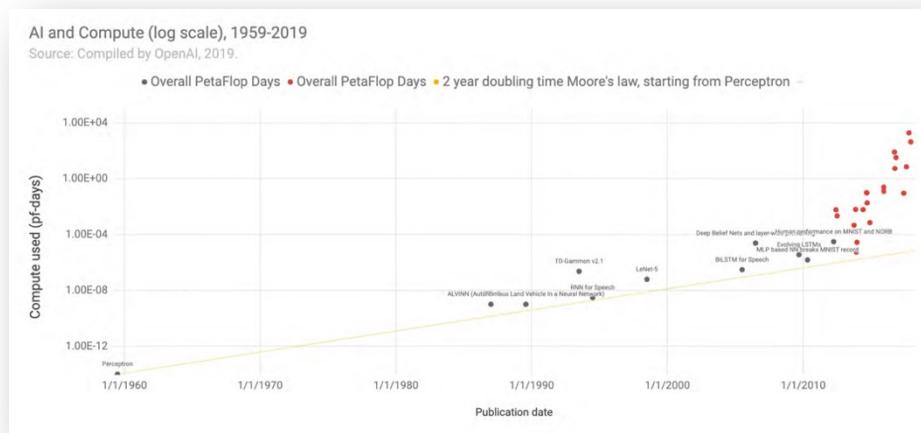


相关领域岗位需求数量

数据来源：斯坦福2019全球AI报告

最新进展2：深度学习算力提升速度超过了摩尔定律

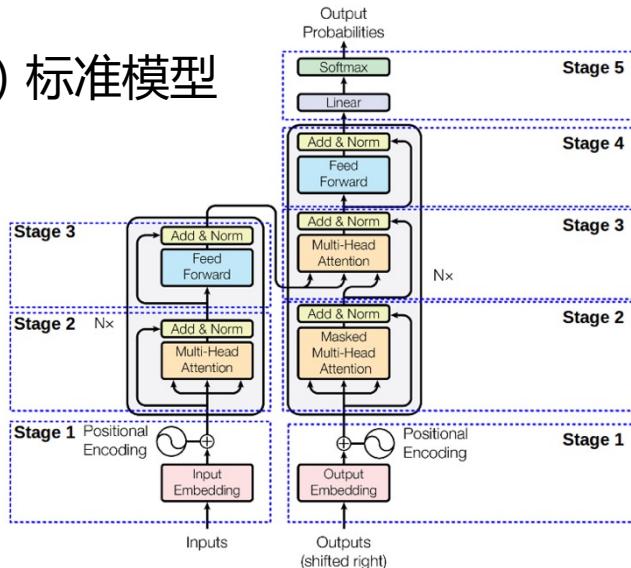
- 2012年之前，符合摩尔定律，平均每两年翻一番
- 2012年以后，超过摩尔定律，**平均每3.4个月翻一番**



数据来源：[OpenAI报告](#)

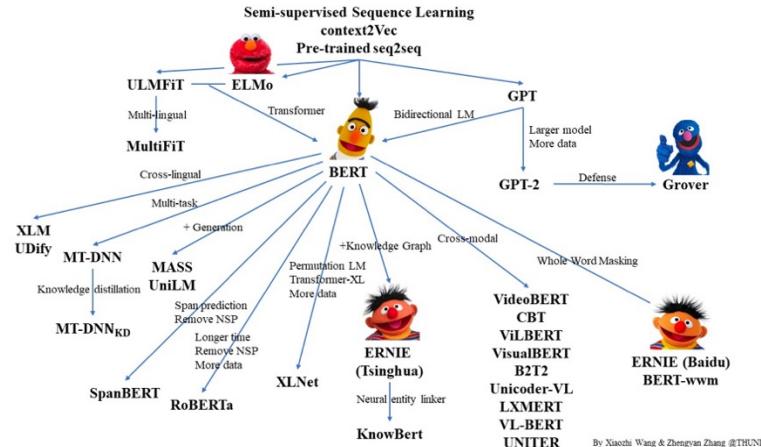
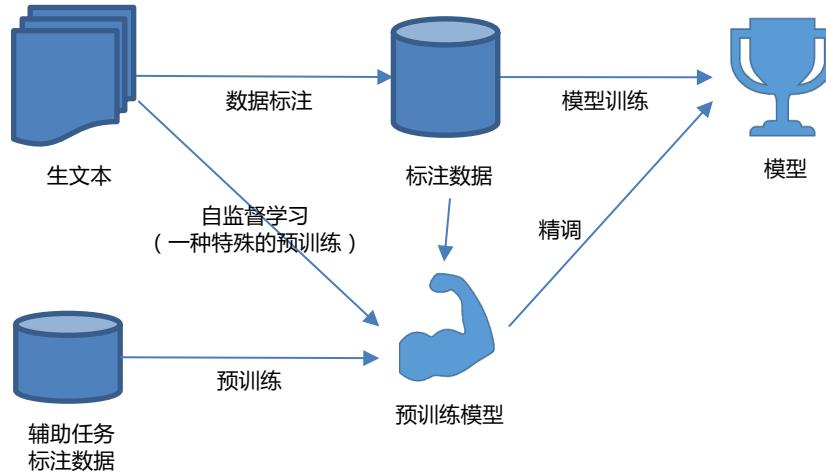
最新进展3：Transformer成为主流模型

- Google发表了《[Attention Is All You Need](#)》论文
 - 又称Transformer
 - 成功应用于机器翻译
- 已逐步取代卷积、循环神经网络成为NLP (AI) 标准模型
- 优势
 - 并行计算，提高训练速度
 - 建立直接的长距离依赖



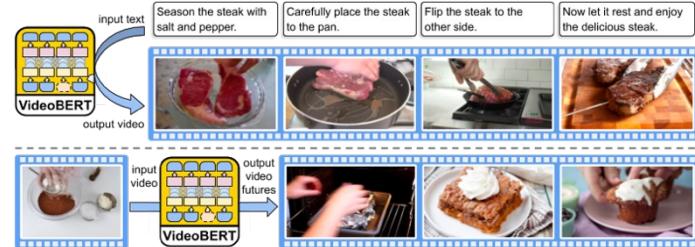
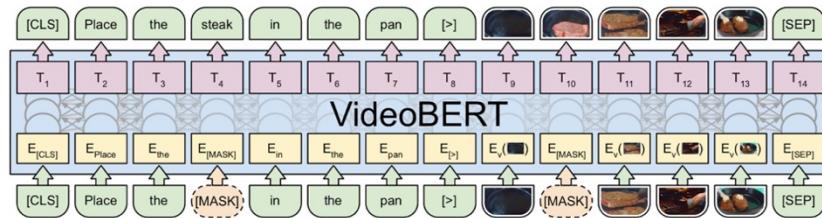
最新进展4：模型预训练成为新范式

- 使用辅助任务预训练，如语言模型
 - [ELMo](#), [BERT](#), GPT系列模型等
 - 类似图像处理中基于ImageNet的预训练
- 大幅提高多种NLP (AI) 任务的准确率**



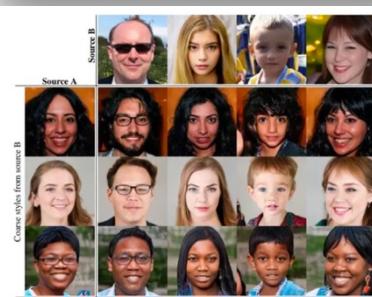
最新进展5：多模态融合势不可挡

- 人类不仅仅从文字中获取知识，还结合了语音和图像的信息
- 深度学习（表示学习）技术打通了文字、语音和图像的界限
- 以Google提出的VideoBERT为代表的一系列工作有力推动了多模态融合技术的进步



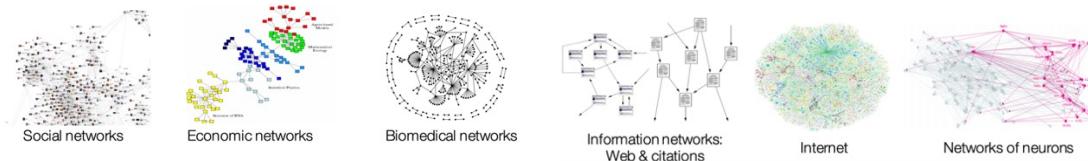
最新进展6：图像和视频生成几乎以假乱真

- 一批能够生成高度还原图像的模型陆续诞生
 - 如BigGAN和StyleGAN
- 基于深度学习技术生成的“Deepfake”视频

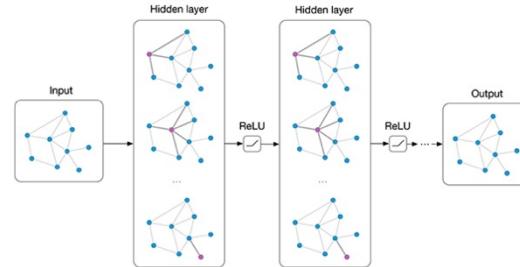


最新进展7：图神经网络（GNN）大放异彩

- 图是适用于许多种数据（例如，社交网络、知识图谱、互联网）的优雅而自然的表示形式

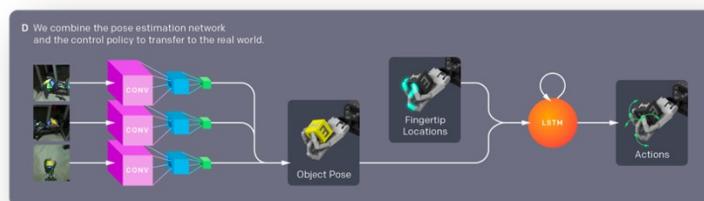


- 利用图神经网络表示图结构，已成功应用于推荐系统、药物副作用分析、文献计量学等众多领域



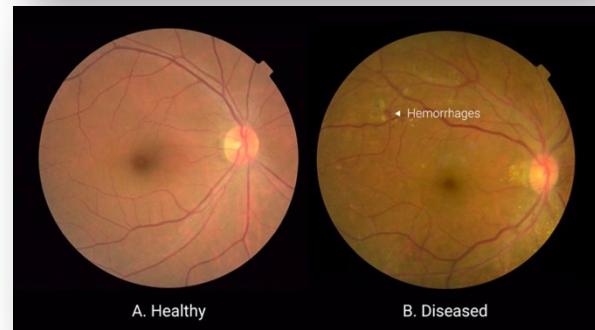
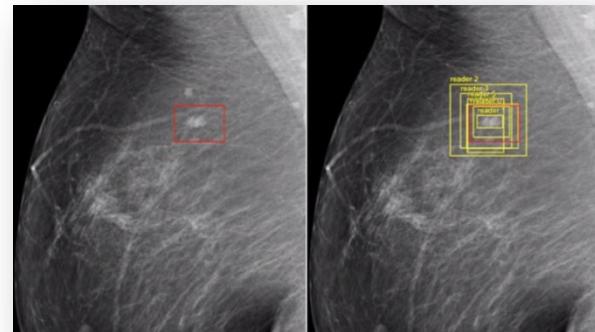
最新进展8：在复杂游戏中战胜人类玩家

- DeepMind的AlphaStar在复杂战略游戏《星际争霸II》中取得了特级大师段位 — 打败99.8%的人类玩家
- OpenAI Five打败了Dota 2的世界冠军
- OpenAI的Dactyl机械臂还原魔方成功率达到60%（需要15次以内的旋转时）



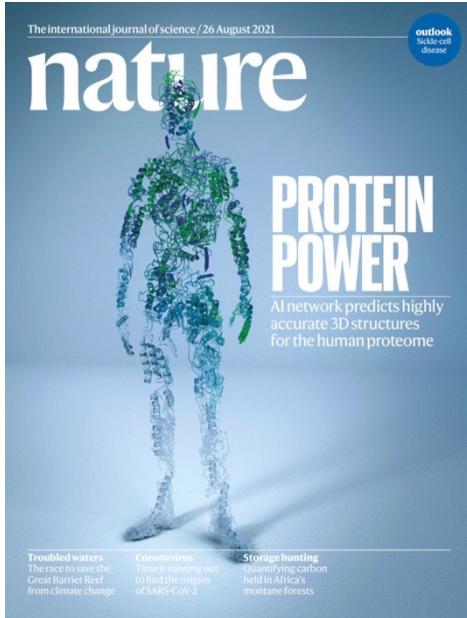
最新进展9：个别疾病诊断能力达到人类专家水平

- Google在《Nature》发表文章称其研发的人工智能**乳腺癌**检测系统，能力已经超过专业医生。之前他们还实现了比人类医生更准确的**肺癌**检测系统
- 通过判断一张眼底扫描照片是否有视网膜病变的征兆进行**糖尿病**筛查，目前已进入临床应用
 - 谷歌的合作伙伴 Verily 已经得到欧洲监管机构的批准，在医院里使用这项技术

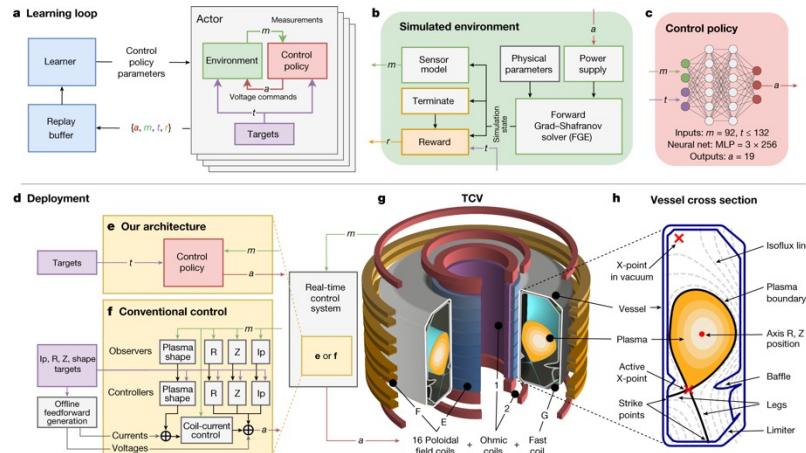


最新进展10：AI4SCI 取得重大突破

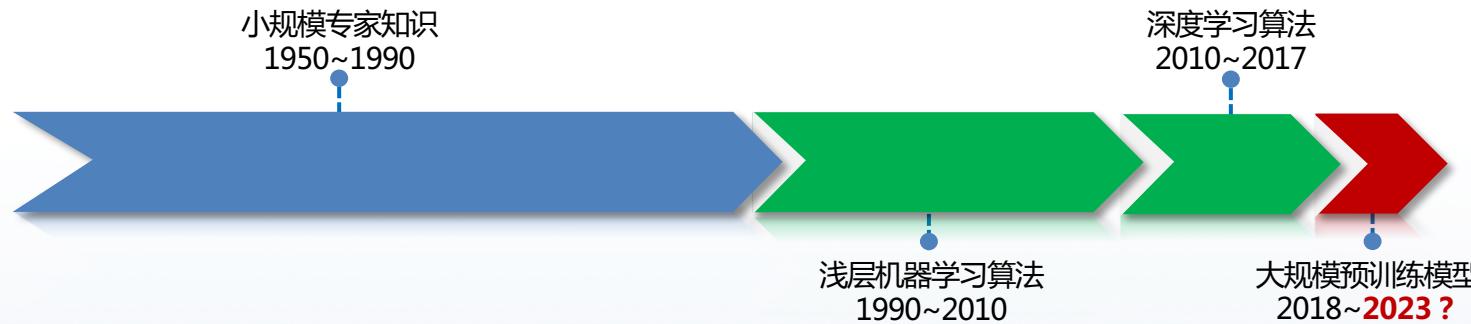
- DeepMind的AlphaFold2，用人工智能来预测蛋白质结构的真正突破，《Nature》
2021年7月15日



- DeepMind和瑞士洛桑联邦理工学院EPFL合作研究出第一个可以在托卡马克 (Tokamak) 装置内保持核聚变等离子体稳定的深度强化学习系统，为推进核聚变研究开辟了新途径，《Nature》 2022年2月16日



□ 自然语言处理范式变迁



□ 大规模预训练语言模型依赖**大模型**、**大数据**和**大计算**



最新的GPT-3有**1750亿**庞大参数

GPT-3没有接受过任何特定任务的训练，但是可以通过样例学习完成十余种文本生成任务（如：问答、风格迁移、网页生成、自动编曲等）
(OpenAI , 2020)

□ GPT-3测试样例

Qusetion: Which is heavier, a toaster or pencil? (烤箱和铅笔哪个更重?)

GPT-3 : A pencil is **heavier** than a toaster. (铅笔比烤箱重。)

Qusetion: How many eye does my foot have? (我的脚有几只眼睛?)

GPT-3 : Your foot has **two eyes**. (你的脚有两只眼睛。)



GPT-3原文指出，在**故事结尾选择**任务上比**哈工大丁效等**所提出的具有**知识推理能力的模型**低**4.1%**！

3.1.4 StoryCloze

预训练语言模型并不能真正克服现有深度学习模型

We next evaluate GPT-3 on the StoryCloze 2016 dataset [HCL16], which involves selecting the correct ending sentence for five-sentence long stories. Here GPT-3 achieves 83.2% in the zero-shot setting and 87.7% in the few-shot setting (with $K = 70$). This is still 4.1% lower than the fine-tuned SOTA using a BERT-based model [LDL19] but improves over previous zero-shot results by roughly 10%.

鲁棒性差、可解释性弱、推理能力缺失的瓶颈，故

[LDL19] Zhongyang Li, Xiao Ding, and Ting Liu. Story ending prediction by transferable bert. *arXiv preprint arXiv:1905.07504*.

在深层次语义理解上与人类认知水平还相去较远！



□OpenAI

□<https://chat.openai.com/>

71 烤箱和铅笔哪个更重?

一般来说，烤箱会比铅笔重得多。烤箱是一种电器，通常用于烘焙食物或加热食物，因此它
通常会比铅笔重得多。铅笔是一种小巧的文具，通常用于写字或画画，因此它通常不会很重。

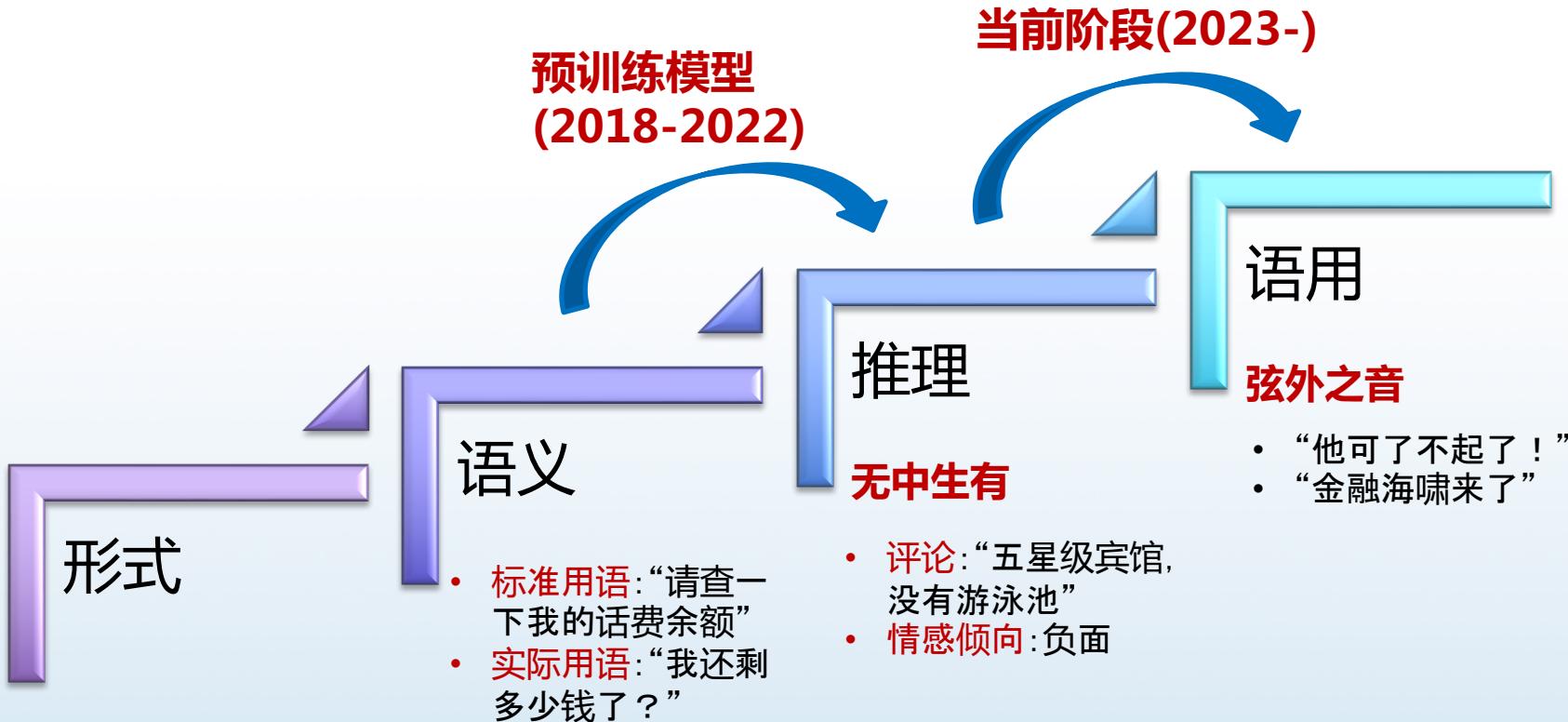
71 我的脚有几只眼睛?

人的脚并没有眼睛。人的脚是由脚趾、脚踝和脚跟组成的，它们可以帮助我们维持平衡，走
路和进行其他活动。人的脚趾上有许多小骨骼和肌腱，使我们能够抓地、走路和平衡。人的脚上并没有眼睛。



知识表示和调用方式的变迁

知识表示方式	表示方式的精确度	知识调用方式	调用方式的自然度	研究领域	代表应用	代表公司
关系数据库	高	SQL	低	数据库	DBMS	Oracle Microsoft
互联网	中	Keywords	中	信息检索	搜索引擎	Google Microsoft
大模型	低	自然语言	高	自然语言处理	ChatGPT	OpenAI Microsoft Google





从 GPT-3 到 ChatGPT

	OpenAI内部代号	训练方式	模型规模	语料库规模	发布时间	备注
GPT-3	davinci	预训练语言模型	175B	570GB文本	2020.05	语言理解能力较弱，适合语言生成
CodeX	code-davinci-001	在代码上继续预训练语言模型	12B	179GB来自GitHub的代码	2021.07	代码补全，应用于copilot
Instruct GPT	text-davinci-001	在大量有指导任务上精调	175B	7.7万人工标注的QA对	2022.03	zero-shot能力增强
GPT-3.5	code-davinci-002	在代码上继续预训练语言模型	>175B ?	179GB来自GitHub的代码	2022.07	涌现出COT形式的推理能力
	text-davinci-002	在code-davinci-002基础上，继续在大量有指导任务上精调	>175B ?	>7.7万人工标注的QA对？	2022.07	Zero-shot能力大大增强
	text-davinci-003	在text-davinci-002基础上增加RLHF，侧重in-context learning	>175B ?	>7.7万人工标注的QA对以及排序数据？	2022.12	生成更安全的结果
ChatGPT		在text-davinci-002基础上增加RLHF，侧重多轮	>175B ?	>7.7万人工标注的QA对以及排序数据？	2022.12	生成更安全的结果



- 大规模预训练模型
 - 模型规模足够大 (>60B ?) 才能涌现出推理能力
- 在代码上进行继续预训练
 - 涌现出逐步推理能力 (Chain-of-Thought , COT)
 - 代码分步骤、分模块解决问题
 - 代码语言模型需要更长的上下文
- Prompt/Instruction Tuning
 - 将各种任务用Prompt形式进行统一
 - 在众多 (成千上万) 类型任务的标注数据上精调语言模型 (Instruction Tuning)
 - 模型能够处理未见任务 (Zero-shot)
- RLHF (Reinforcement Learning from Human Feedback)
 - 结果更符合人类的预期 (多样性、安全性)
 - 利用真实用户的反馈 (AI正循环)



□OpenAI

□<https://chat.openai.com/>

二战期间，美国总统是谁？

二战期间，美国总统是罗斯福（Franklin D. Roosevelt）。二战始于1939年，罗斯福于1933年就任美国总统，并一直担任到1945年，于当年4月12日去世。他在位期间，美国首先对日本的珍珠港攻击作出回应，并积极参与二战。罗斯福曾多次发表演讲，激励美国人民在战争中作出奋斗，并宣布了四项基本原则，为战后的世界和平作出贡献。

都是哪四项基本原则啊？

罗斯福在二战期间发表的著名演讲中宣布了四项基本原则，包括：

1. 自由：为了维护人权和自由，每个人都应该拥有平等的权利。
2. 公平：所有人都应该得到公平的对待，不应该受到歧视。
3. 合作：所有国家都应该合作，共同维护世界和平。
4. 拯救：应该采取行动，拯救那些受到压迫和暴力影响的人们。

罗斯福认为，如果所有国家都遵循这四项原则，就可以为和平的世界作出贡献。



融入证据的回复

口基于RLHF生成带网页引用的回复

	单位	发布时间
WebGPT	OpenAI	2021.12
GopherCite	DeepMind	2022.03
Anthropic	Anthropic	2022.04
Sparrow	DeepMind	2022.09

YouChat

battery life, and a range of features that make them ideal for different users. For example, the Dell XPS 13 is an excellent choice for most users, offering powerful performance in a slim and lightweight design. The Razer Blade 15 Advanced is an excellent choice for gamers [1], featuring powerful components and an eye-catching design. The Asus ROG Zephyrus G14 is a great choice for students [1], offering good performance and portability in a sleek and lightweight design. The MacBook Air M2 is a great choice for those who want a highly portable laptop [4][5], while the Dell Inspiron 15 3520 is an excellent option for those who want a laptop with good performance and plenty of storage [3].

1. Best Laptops 2022 - Forbes
https://www.forbes.com/sites/forbes-personal-shopper/art...
2. The Best Laptops for 2022 | PCMag
https://www.pcmag.com/picks/the-best-laptops
3. The Best Laptops for 2022 - PCMag Australia
https://au.pcmag.com/laptops/62132/the-best-laptops
4. The best laptops you can buy in 2022 | Tom's Guide
https://www.tomsguide.com/best-picks/best-laptops
5. The best laptop for 2023: top portable picks for all budg...
https://www.techradar.com/news/mobile-computing/lapt...

Ask me anything...

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Perplexity BETA

Ask Anything </> Bird SQL

how does reinforcement learning from human feedback work in chatgpt?

PERPLEXITY

ChatGPT is a language model created with the purpose of holding a conversation with the end user [1]. It uses a combination of Supervised Learning and Reinforcement Learning, with the latter being what makes ChatGPT unique [2][3]. In particular, it uses a technique called Reinforcement Learning from Human Feedback (RLHF) [2][3][4], which involves humans providing feedback in the training loop [2]. This allows for ChatGPT to be more accurate than other models [3].

Is this accurate?

Share

CITATIONS

1. What is ChatGPT and why does it matter? Here's what you need to know
https://www.zdnet.com/article/what-is-chatgpt-and-why-does-it-matter-heres-what-you-need-to-know
ChatGPT is a language model created with the purpose of holding a conversation with the end user. A search engine indexes web pages on the internet to help the user find the information they asked ...

2. How ChatGPT actually works
https://www.assemblyai.com/blog/how-chatgpt-actually-works
The creators have used a combination of both Supervised Learning and Reinforcement Learning to fine-tune ChatGPT, but it is the Reinforcement Learning component specifically that makes ChatGPT unique. The creators use a particular technique called Reinforcement Learning from Human Feedback (RLHF), which uses human feedback in the training loop ...

3. How to Use ChatGPT by OpenAI - makeuseof.com
https://www.makeuseof.com/how-to-use-chatgpt-by-openai
ChatGPT was trained using a mix of machine learning and human intervention, using a method called reinforcement learning from human feedback (RLHF). In fact, the first stage of training involved humans playing the role of both a human user and an AI assistant having a conversation.

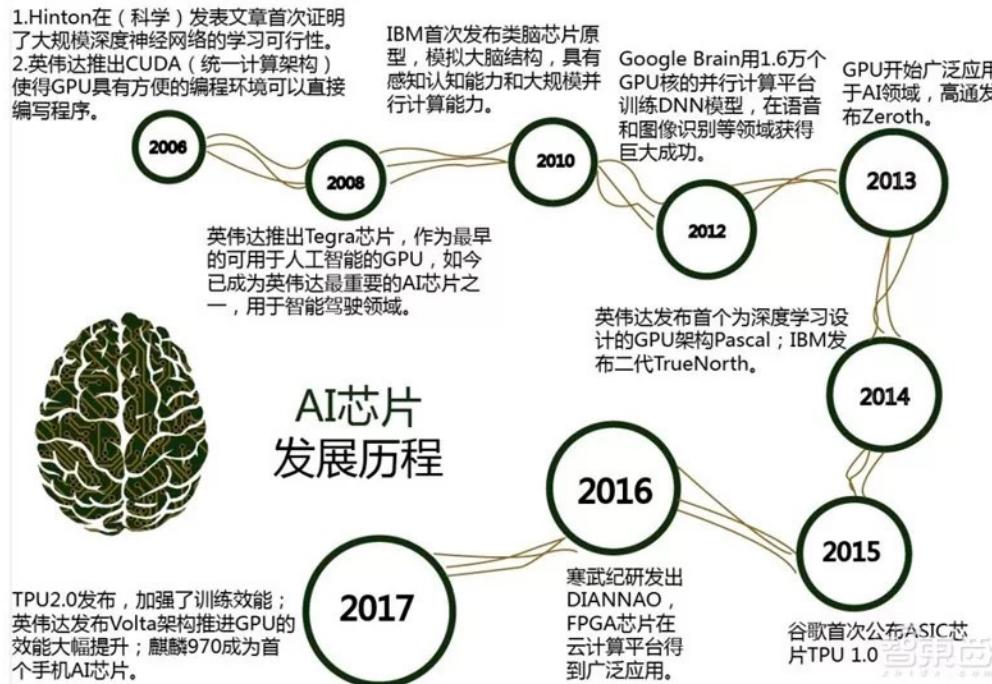
<https://www.perplexity.ai/>

挑战1：投资金额和初创公司数量开始下滑

- 猎豹全球智库统计分析，自2000年以来，人工智能企业的融资数量已持续18年上涨，在2013年至2018年出现大爆发，融资金额和数量直线飙升，且2014年后这一数据还以接近50%的幅度在增长
- 2019年却成为了人工智能资本环境冷与热的**分水岭**，人工智能的融资数量和融资金金融出现大幅下滑。与2018年相比，2019年中国人工智能企业的融资金额由1484.53亿下降至967.27亿，下降幅度达到34.8%，融资数量也由737下降至431，下降幅度达4成

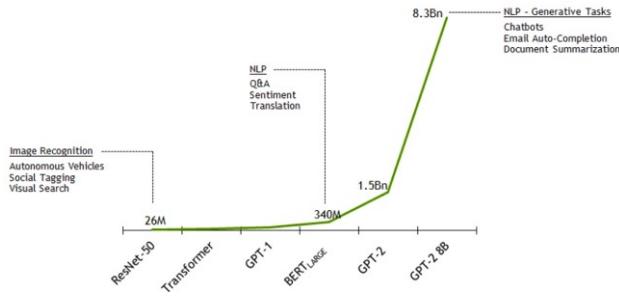


挑战2：更快的硬件



挑战3：模型压缩与加速

- BERT等预训练模型取得了非常好的效果，但是：
- 预训练模型参数数量越来越大
 - BERT-Large具有24层，1024个隐单元，16个head，340M参数
- 训练和预测速度非常慢，且需要大量计算资源
 - 使用16个V100 GPU的NVIDIA DGX-2训练BERT-Large需要2.8天

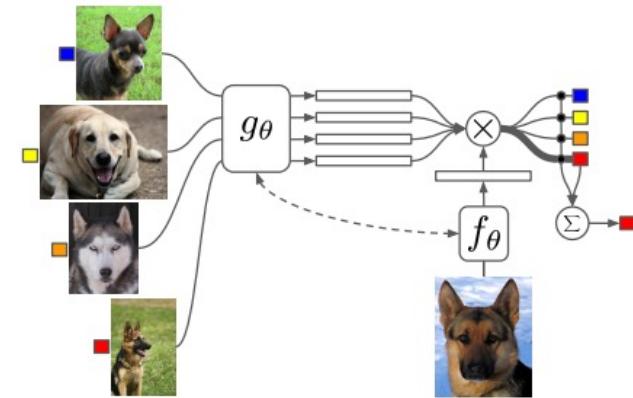


BERT-Large Training Times on GPUs

Time	System	Number of Nodes	Number of V100 GPUs
53 min	DGX SuperPOD	92 x DGX-2H	1,472
67 min	DGX SuperPOD	64 x DGX-2H	1,024
236 min	DGX SuperPOD	16 x DGX-2H	256

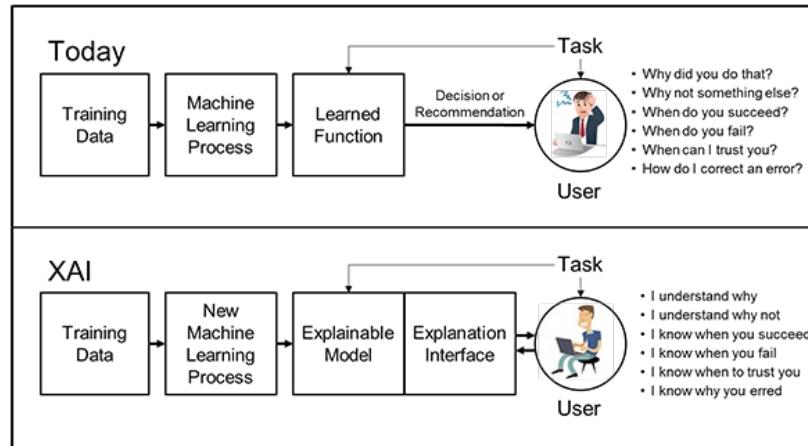
挑战4：基于小数据的学习问题

- 深度学习遇到的问题
 - 深度学习依赖大量的标注数据
 - 真实应用往往需要频繁适应**新领域和新需求**
 - 新领域数据不足、新需求有新的标签类别
- 自然语言处理面临更严重的小数据问题
 - 领域数量众多，新领域往往数据不足
 - 自然语言处理多为结构学习问题，标签之间存在复杂的依赖关系，新标签的关系难以学习



挑战5：模型可解释性问题

- 模型的可解释性
 - 深度学习基于大量已标注数据进行学习，无法解释自身的推断机制
 - 导致其预测结果难以被理解，可靠性也大打折扣
- 众多领域需要可解释性的AI系统
 - 司法、医疗、安全、金融、军事、交通



挑战6：如何获取和利用常识知识

数学题：“有若干只鸡兔同在一个笼子里，从上面数，有35个头，从下面数，有94只脚。问笼中各有多少只鸡和兔？”

鸡 (家禽种类) 编辑

本词条由“科普中国”百科科学词条编写与应用工作项目 审核。

鸡是一种家禽，家鸡源出于野生的原鸡，其驯化历史至少约4000年，但直到1800年前后鸡肉和鸡蛋才成为大量生产的商品。鸡的种类有火鸡、乌鸡、野鸡等。而且鸡也是12生肖中的一属。

中文学名	鸡	亚 纲	今鸟亚纲
拉丁学名	Gallus gallus domesticus	目	鸡形目
界	动物界	科	雉科
门	脊索动物门	族	雉族
亚 门	脊椎动物亚门	属	原鸡属
纲	鸟纲	种	红原鸡
		亚 种	家鸡

百度百科里也无法查到“鸡有2条腿”

Winograd测试实例

“小明的爸爸抱不动小明，因为他太重（腰扭了）了”

请问：“他”指的是谁？

需要常识：

- 因为**重**，所以**不能被抱动**
- 因为**腰扭了**，所以**不能抱**

挑战7：连接主义与符号主义之争

- 以纽约大学Gary Marcus教授（同时也是作家和企业家）为代表的学者认为，深度学习（链接主义）基于数据和算力，无法实现抽象、推理等高级智能
- 2019年12月23日，Gary Marcus与深度学习先驱、蒙特利尔大学Yoshua Bengio教授进行了一场现场辩论
- 连接主义与符号主义之争由来已久
 - 以感知机为代表的单层神经网络系统功能的局限导致的第一个AI寒冬
 - 以专家系统为代表的符号主义系统的失败导致了第二个AI寒冬
 - 接下来这两个派别将齐头并进、互相融合，亦或一个消灭另一个呢？

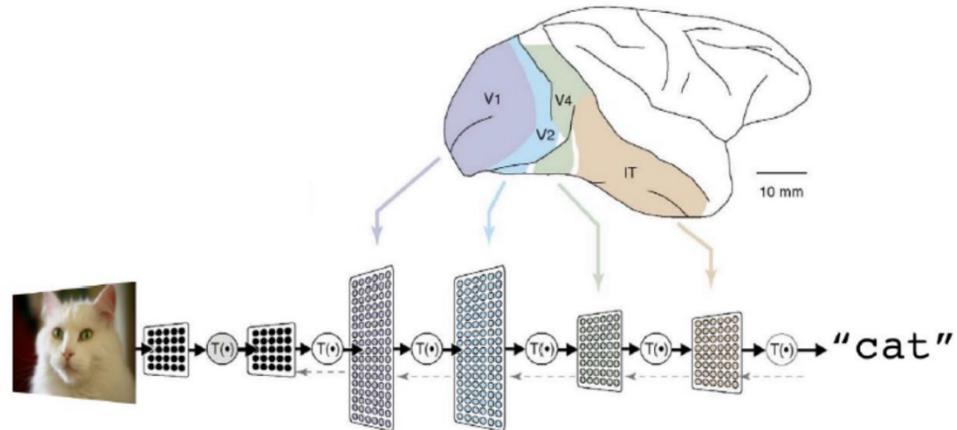
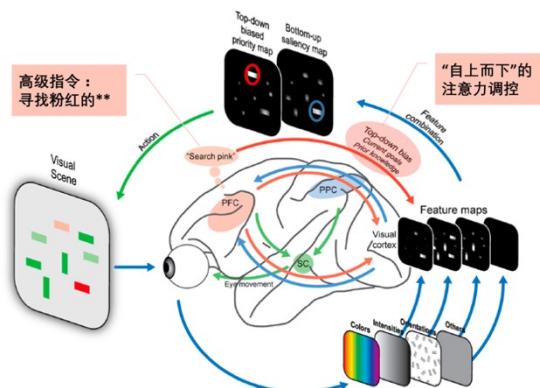


Gary Marcus
—
Yoshua Bengio



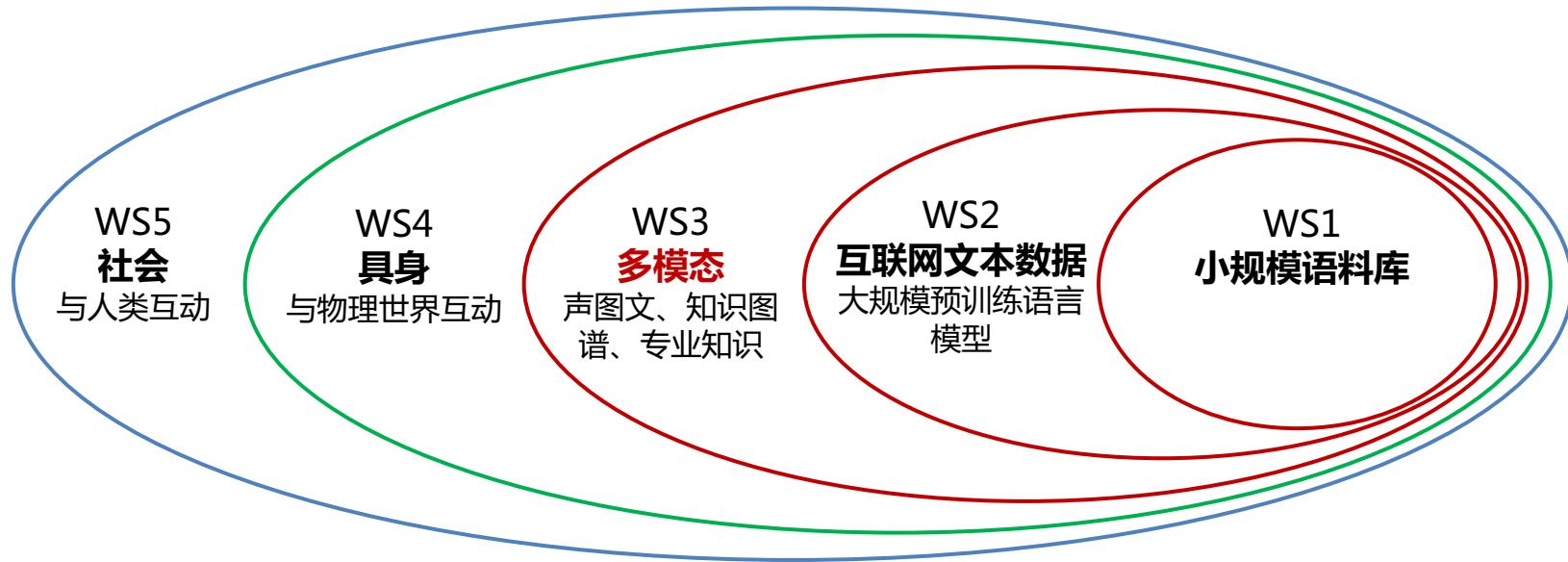
挑战8：受神经科学启发的机器学习

- 深度学习（**神经网络**）本身受到神经科学的启发
- CNN**等传统深度学习模型也受到视觉感知的启发
- 现代的**注意力机制**也能找到神经科学上的证据



挑战9：具身与社会

- 模型将继续沿着“**同质化**”和“**规模化**”的道路发展
- 拓展除语言之外的认知能力，寻找新的“**知识**”来源
 - Bisk等人（2020）将其称为“**世界范围**”（World Scope, WS）



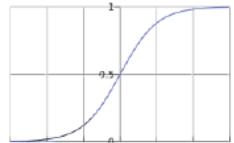
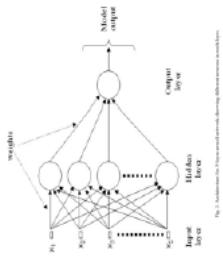
挑战10：应用的法律和伦理问题

- 1942年，阿西莫夫在短篇小说“Runaround”（《环舞》）中首次提出了机器人三定律
- 隐私问题
 - 多国立法限制人脸识别技术滥用
- 安全问题
 - 自动驾驶难以大规模推广
 - 自驾驶软件没能识别卡车的侧面导致特斯拉车祸



Past | Present

$p(y|x)$,
yaml



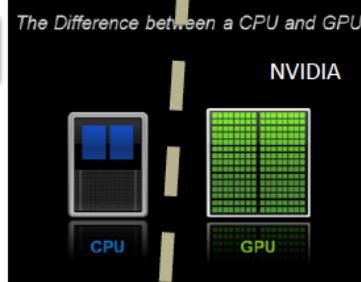
Tan-1, logistic



Backprop,
feature
engineering



C, Matlab



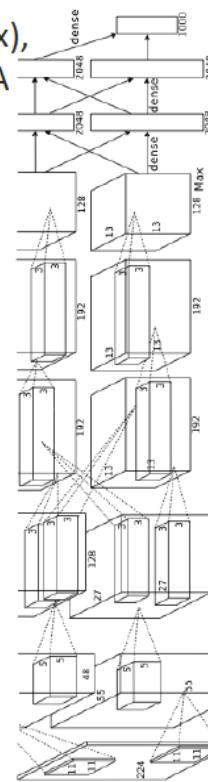
Caruana-like
academic
evaluations

Kaggle



CUDA, Torch, Cudamat,
Theano, pylearn2

$p(y|x)$,
SOTA



Labels

Data VVVV

What am I doing?

Textbooks

- Ian Goodfellow, Yoshua Bengio and Aaron Courville. Deep Learning. MIT Press. 2016
 - <http://www.iro.umontreal.ca/~bengioy/dlbook/>
- Michael Nielsen. Neural Networks and Deep Learning
 - <http://neuralnetworksanddeeplearning.com>
- Stanford Courses
 - CS230: Deep Learning
 - <http://cs230.stanford.edu/>
 - CS224n: Natural Language Processing with Deep Learning
 - <http://cs224n.stanford.edu/>
 - CS231n: Convolutional Neural Networks for Visual Recognition
 - <http://cs231n.stanford.edu/>

参考书

- 《自然语言处理：基于预训练模型的方法》
 - 出版社：电子工业出版社
 - 作者：车万翔，郭江，崔一鸣 著；刘挺 主审
 - 书号：ISBN 978-7-121-41512-8
 - 出版时间：2021.7
- 网购链接
 - <https://item.jd.com/13344628.html>
- 书中代码
 - <https://github.com/HIT-SCIR/plm-nlp-code>

