شبکه‌های عصبی مصنوعی

فصل ۳۱

مقدمه‌ای بر یادگیری عمیق

Introduction to Deep Learning

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http://courses.fouladi.ir/nn

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مقدمه‌ای بر یادگیری عمیق

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مقدمات

What is Artificial Intelligence?

What is Artificial Intelligence?

Artificial Narrow Intelligence (ANI): Machine intelligence that equals or exceeds human intelligence or efficiency at a specific task.

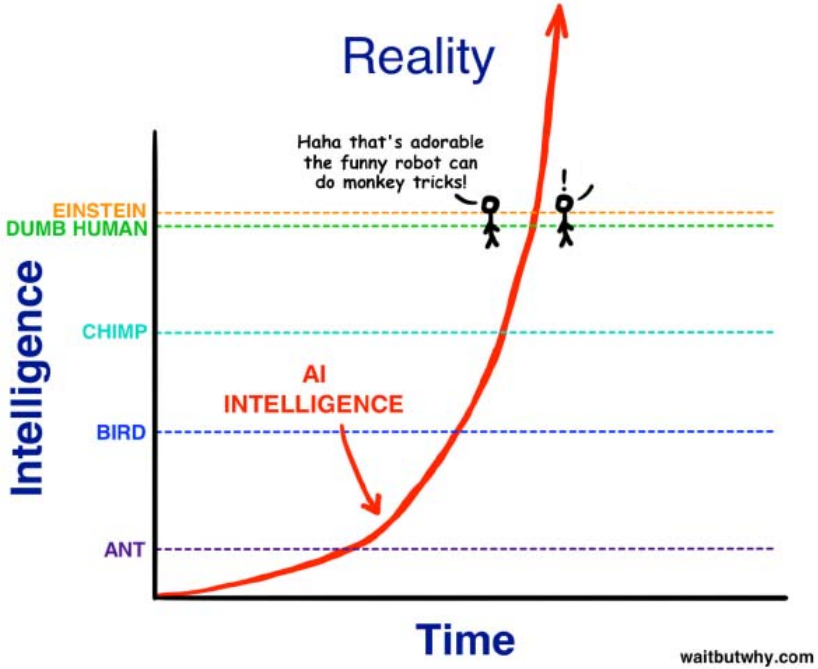
Artificial General Intelligence (AGI): A machine with the ability to apply intelligence to any problem, rather than just one specific problem *(human-level intelligence)*.

Artificial Superintelligence (ASI): An intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills.

http://waitbutwhy.com/2015/01/artificial-intelligence-revolution-1.html

What is Artificial Intelligence?

Superintelligence



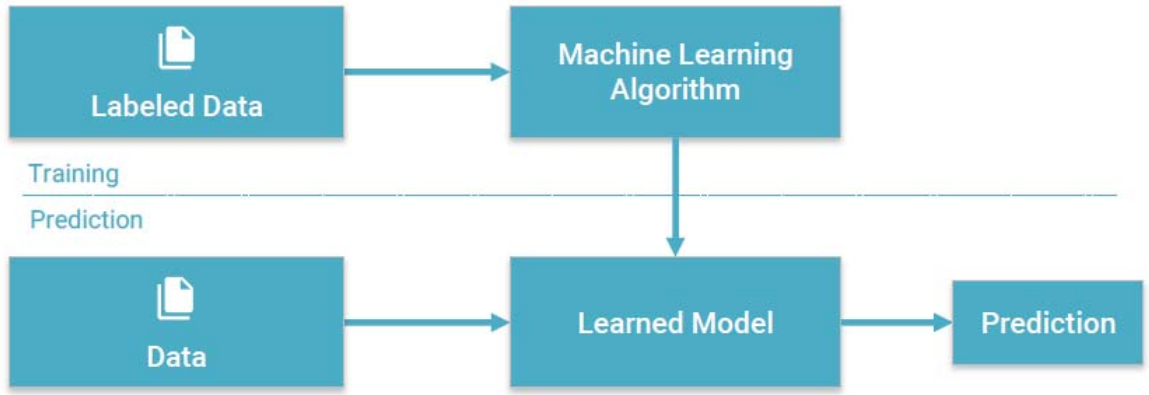
A superintelligence is any intellect that vastly outperforms the best human brains in practically every field, including scientific creativity, general wisdom, and social skills

Source

Machine Learning - Basics

Introduction

Machine Learning is a type of Artificial Intelligence that provides computers with the ability to learn without being explicitly programmed.



Provides various techniques that can learn from and make predictions on data

Machine Learning - Basics

Learning Approaches

Supervised Learning: Learning with a labeled training set
Example: email spam detector with training set of already labeled emails

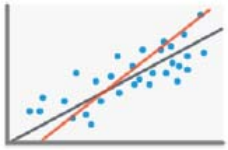
Unsupervised Learning: Discovering patterns in unlabeled data
Example: cluster similar documents based on the text content

Reinforcement Learning: learning based on feedback or reward
Example: learn to play chess by winning or losing

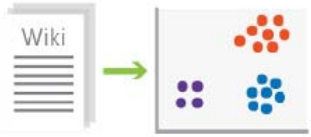
Machine Learning - Basics

Problem Types

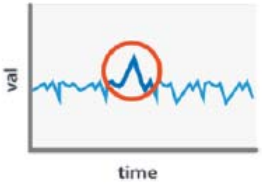
Classification
(supervised – predictive)



Regression
(supervised – predictive)



Clustering
(unsupervised – descriptive)



Anomaly Detection
(unsupervised– descriptive)

https://hbr.org/2016/11/what-artificial-intelligence-can-and-cant-do-right-now

Machine Learning - Basics

Problem Types – Mapping from A to B

What Machine Learning Can Do

A simple way to think about supervised learning.

INPUT A	RESPONSE B	APPLICATION
Picture	Are there human faces? (0 or 1)	Photo tagging
Loan application	Will they repay the loan? (0 or 1)	Loan approvals
Ad plus user information	Will user click on ad? (0 or 1)	Targeted online ads
Audio clip	Transcript of audio clip	Speech recognition
English sentence	French sentence	Language translation
Sensors from hard disk, plane engine, etc.	Is it about to fail?	Preventive maintenance
Car camera and other sensors	Position of other cars	Self-driving cars

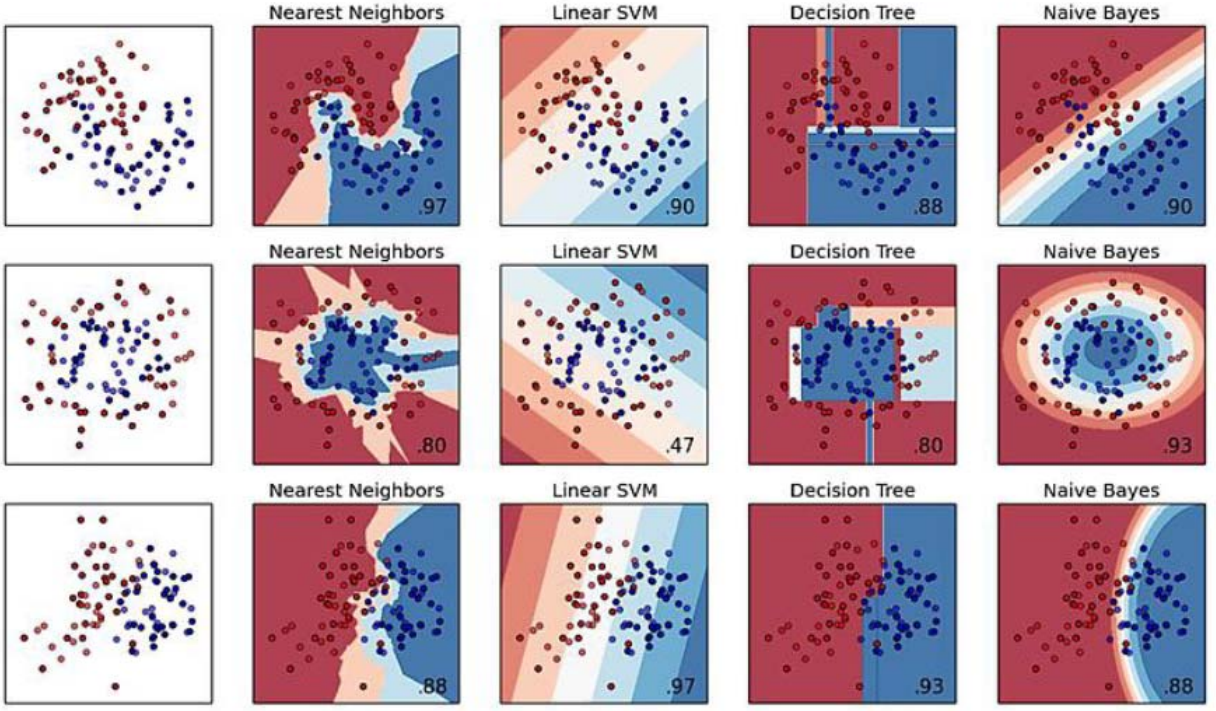
SOURCE ANDREW NG

Source

www.acttr.com/images/faq/scikit-learn-plot-classifier.png

Machine Learning - Basics

Algorithms Comparison - Classification



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مقدمه‌ای بر یادگیری عمیق

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یادگیری عمیق چیست؟

What is Deep Learning?

Part of the machine learning field of learning representations of data. Exceptional effective at learning patterns.

Utilizes learning algorithms that derive meaning out of data by using a hierarchy of multiple layers that mimic the neural networks of our brain.

If you provide the system tons of information, it begins to understand it and respond in useful ways.

یادگیری عمیق چیست؟

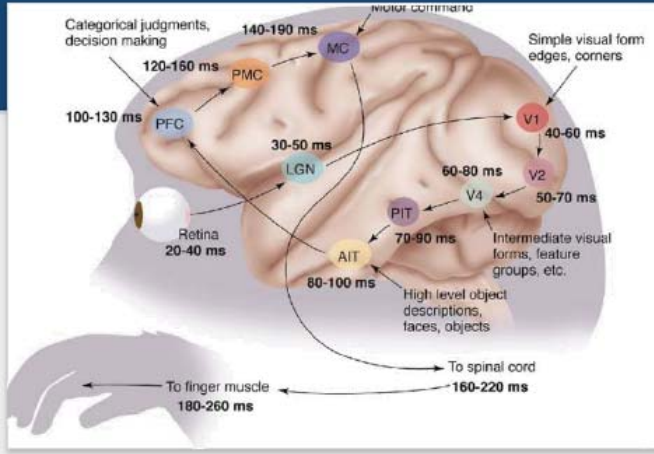
WHAT IS DEEP LEARNING?

بخشی از حوزه‌ی یادگیری ماشینی که به یادگیری بازنمایی داده‌ها می‌پردازد؛
و به‌طور استثنایی در یادگیری الگوها مؤثر است ...

یادگیری عمیق از الگوریتم‌هایی بهره می‌برد که
با استفاده از یک سلسله مراتب از چندین لایه، از داده‌ها معنا استخراج می‌کند
(با تقلید از شبکه‌های عصبی مغز انسان).

اگر برای این سیستم مقدار زیادی اطلاعات فراهم کنیم،
شروع به فهم آنها می‌کند و به‌صورت معمول پاسخ می‌دهد.

Inspired by the Brain

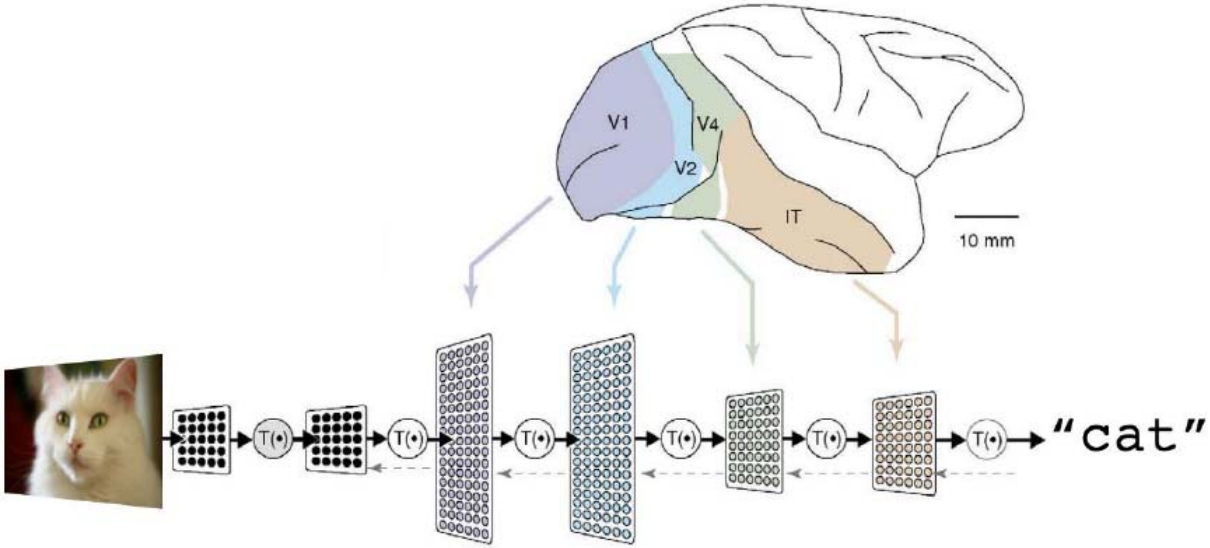


The first hierarchy of neurons that receives information in the visual cortex are sensitive to specific edges while brain regions further down the visual pipeline are sensitive to more complex structures such as faces.

Our brain has lots of neurons connected together and the strength of the connections between neurons represents long term knowledge.

Deep Learning - Basics

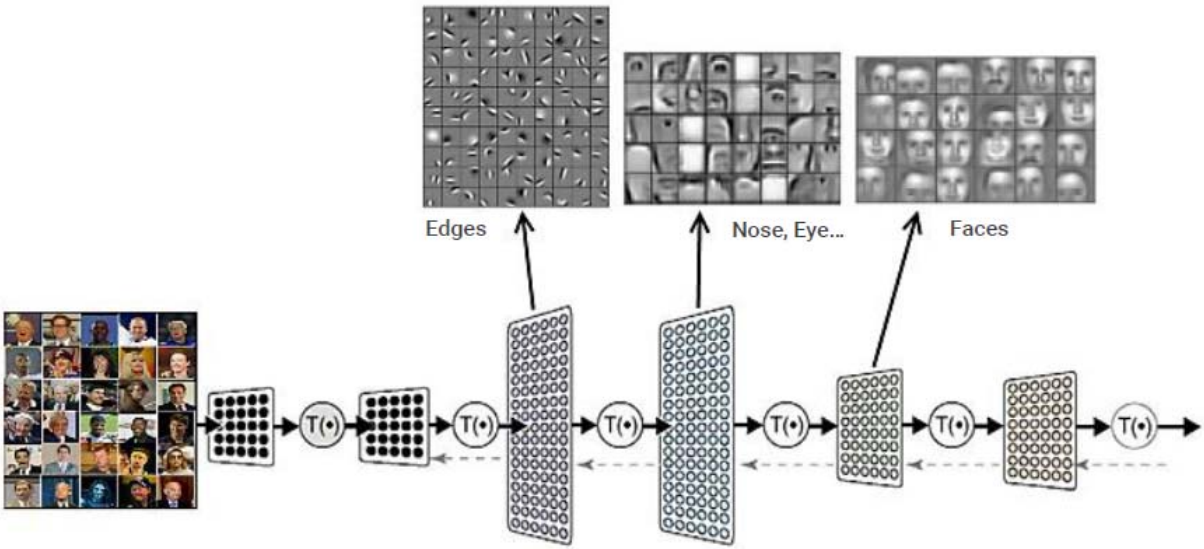
Architecture



A deep neural network consists of a hierarchy of layers, whereby each layer transforms the input data into more abstract representations (e.g. edge -> nose -> face). The output layer combines those features to make predictions.

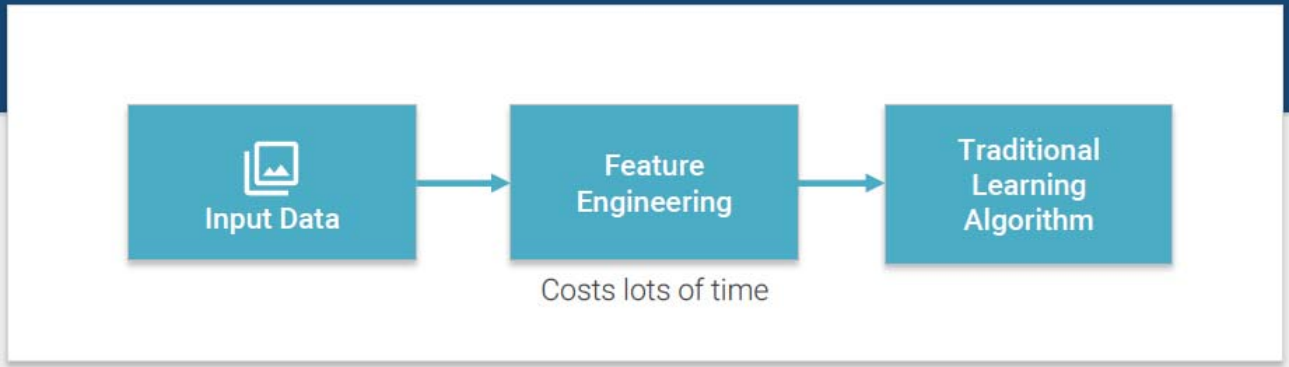
Deep Learning - Basics

What did it learn?



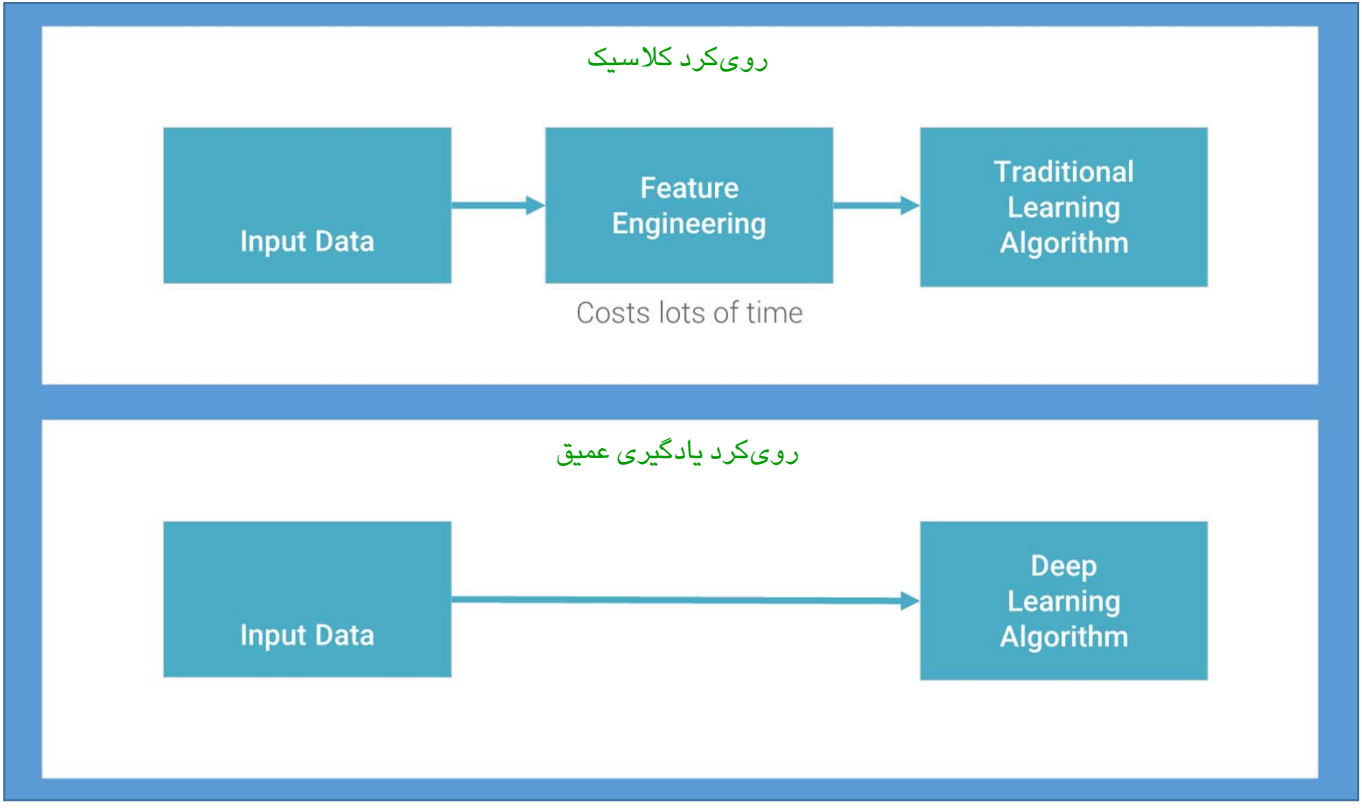
Deep Learning - Basics

No more feature engineering



مهندسی ویژگی‌ها

حذف مرحله‌ی مهندسی ویژگی‌ها در یادگیری عمیق



Why Deep Learning?

Applications

Speech/Audio Processing

Computer Vision

Natural Language Processing

شبکه‌های عصبی مصنوعی

مقدمه‌ای بر یادگیری عمیق

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یادگیری عمیق: وضعیت کنونی

A brief History

A long time ago...

1958 Perceptron

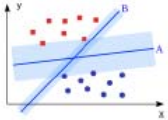
1969
Perceptron criticized

1974 Backpropagation

awkward silence (AI Winter)

Convolution Neural Networks for Handwritten Recognition
1998

1995
SVM reigns



2006
Restricted Boltzmann Machine

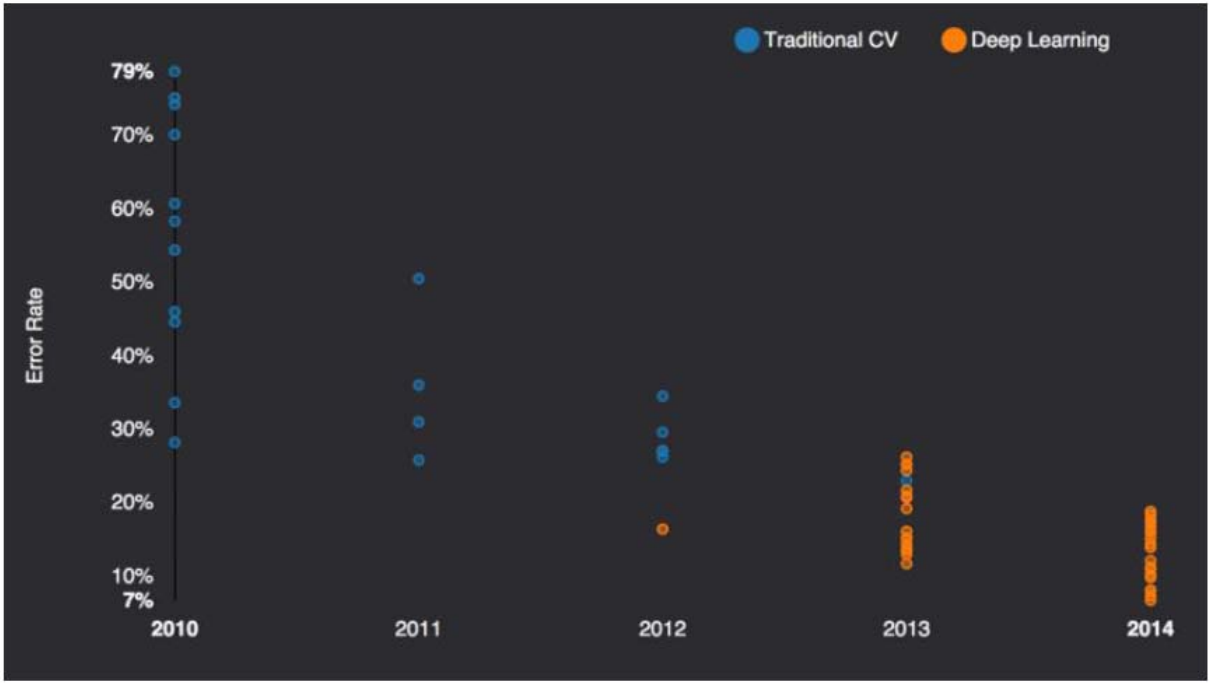
Google Brain Project on 16k Cores
2012

2012
AlexNet wins ImageNet
IMAGENET

https://medium.com/global-silicon-valley/machine-learning-yesterday-today-tomorrow-3d3023c7b519#.wd0gd11rl

A brief History

The Big Bang aka "One net to rule them all"



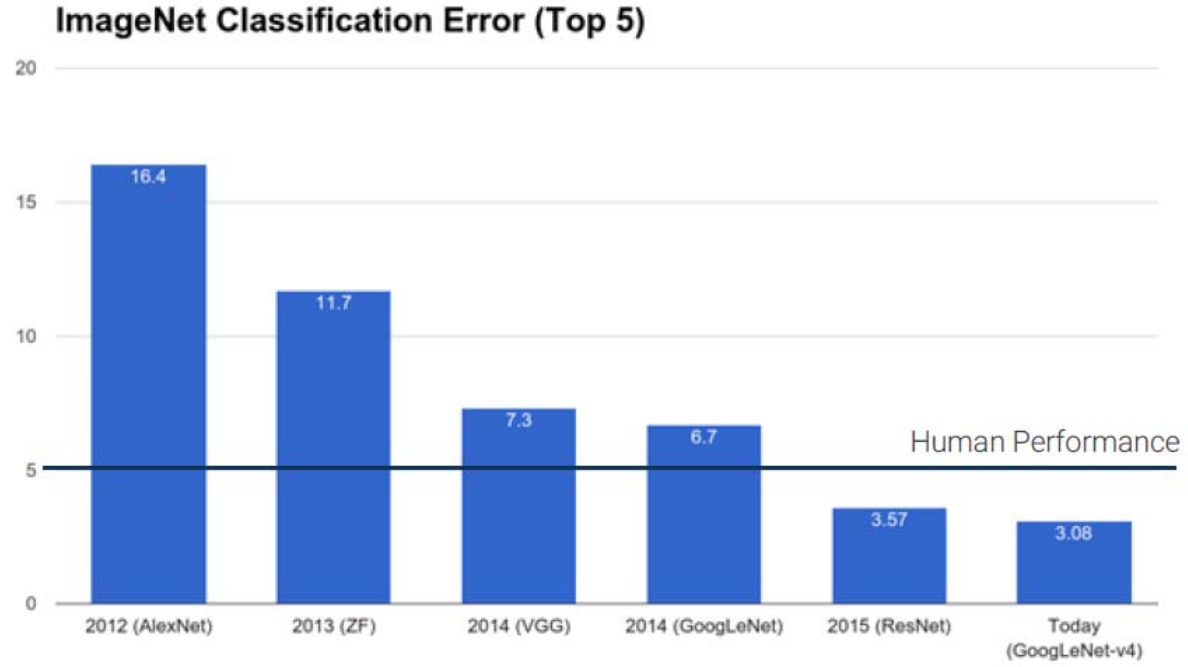
ImageNet: The "computer vision World Cup"

Source

https://www.quora.com/What-is-the-state-of-the-art-today-on-ImageNet-classification-In-other-words-has-anybody-beaten-Deep-Residual-Learning

A brief History

The Big Bang aka “One net to rule them all”



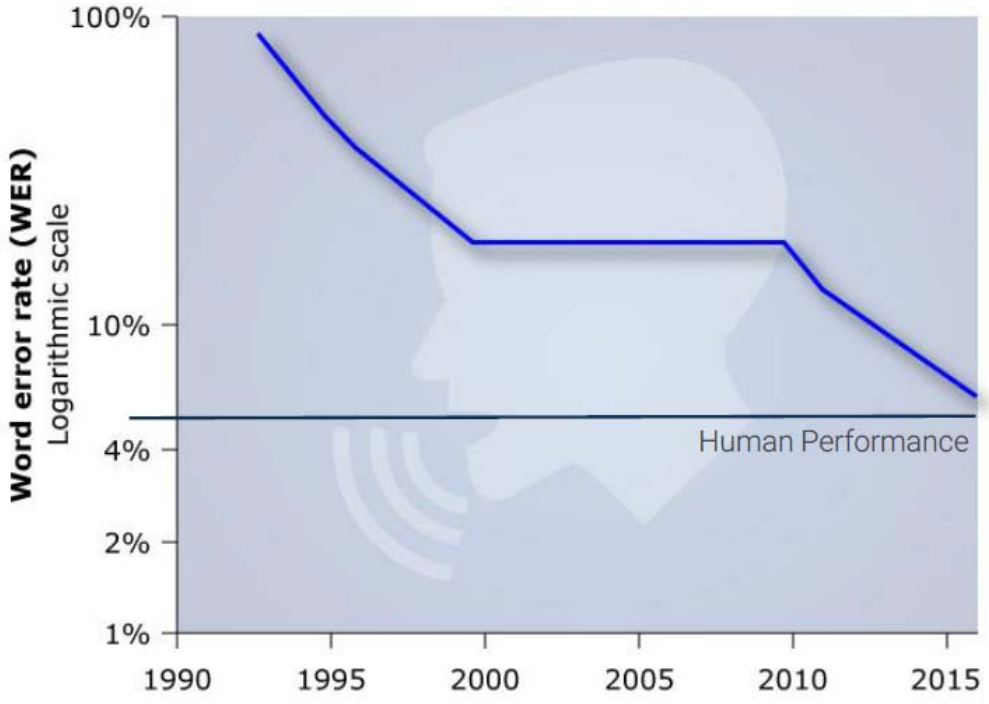
ImageNet: The “computer vision World Cup”

Source

https://arxiv.org/abs/1610.05256

A brief History

The Big Bang aka "One net to rule them all"



Deep Learning in Speech Recognition

Source

What changed?

Old wine in new bottles

Big Data
(Digitalization)

Computation
(Moore's Law, GPUs)

Algorithmic
Progress

The Big Players

Companies

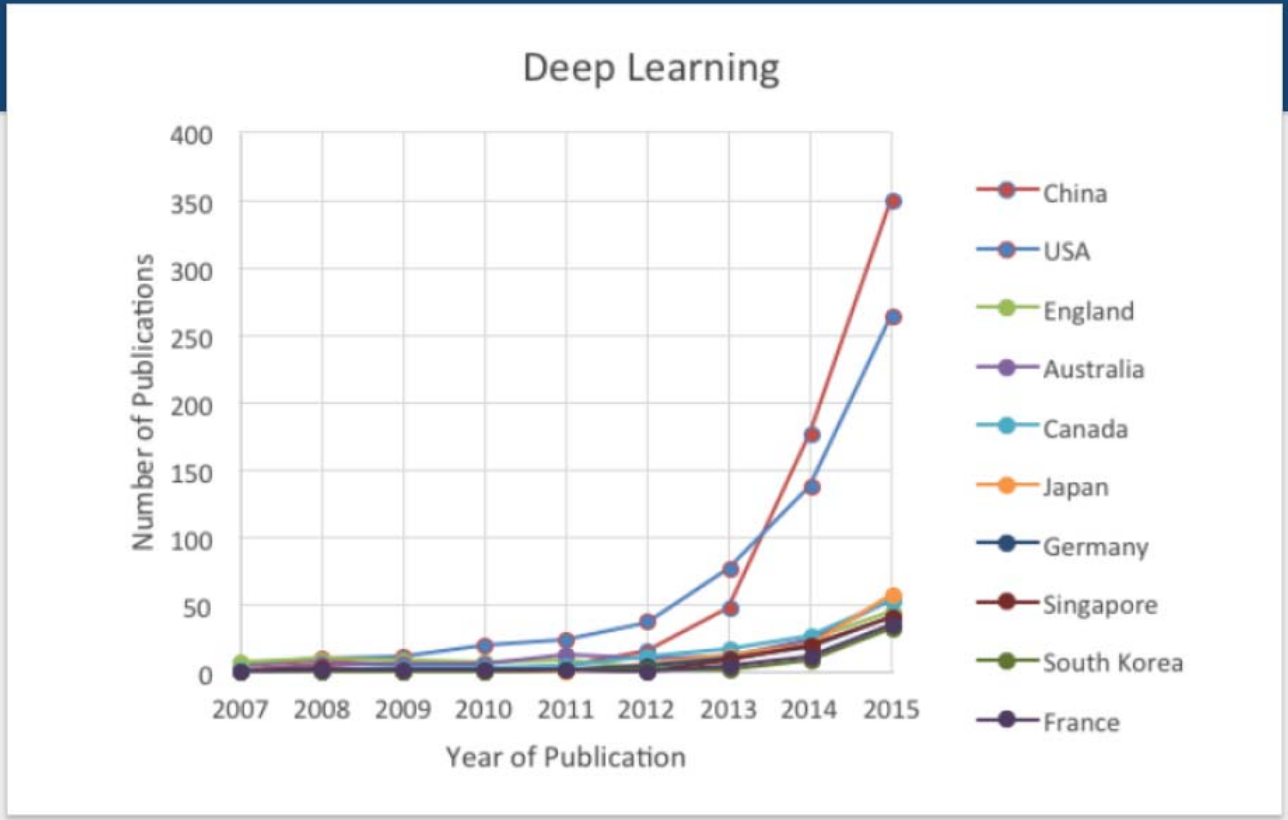
The Big Players

Startups

Source: national_ai_rd_strategic_plan.pdf

Hype or Reality?

Academic Publications about Deep Learning

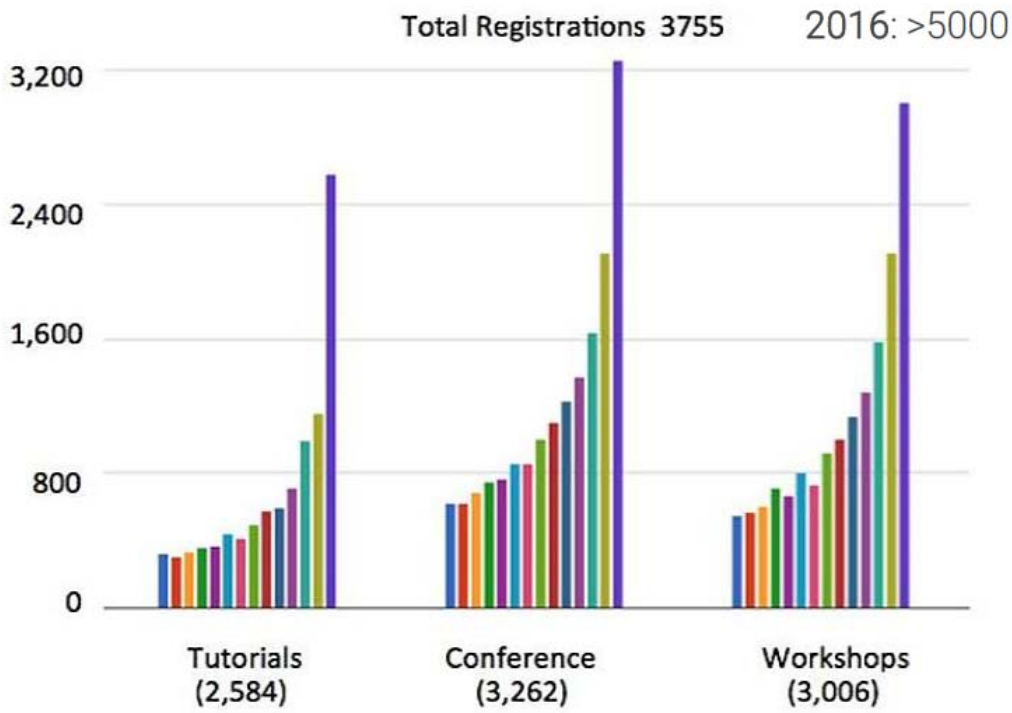


Source

https://www.facebook.com/neil.d.lawrence/posts/10153894875151042?fref=nf&pnref=story

Hype or Reality?

NIPS (Computational Neuroscience Conference) Growth

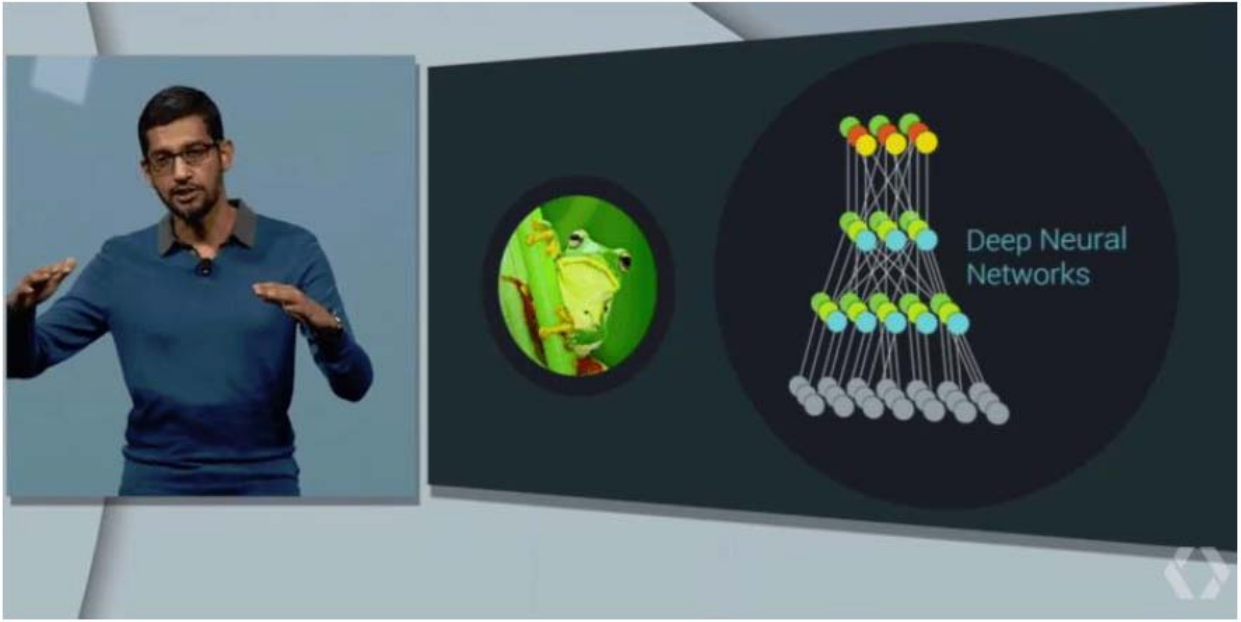


Source

https://www.wired.com/2016/06/how-google-is-remaking-itself-as-a-machine-learning-first-company/#.ekxlwoxis

Hype or Reality?

Google



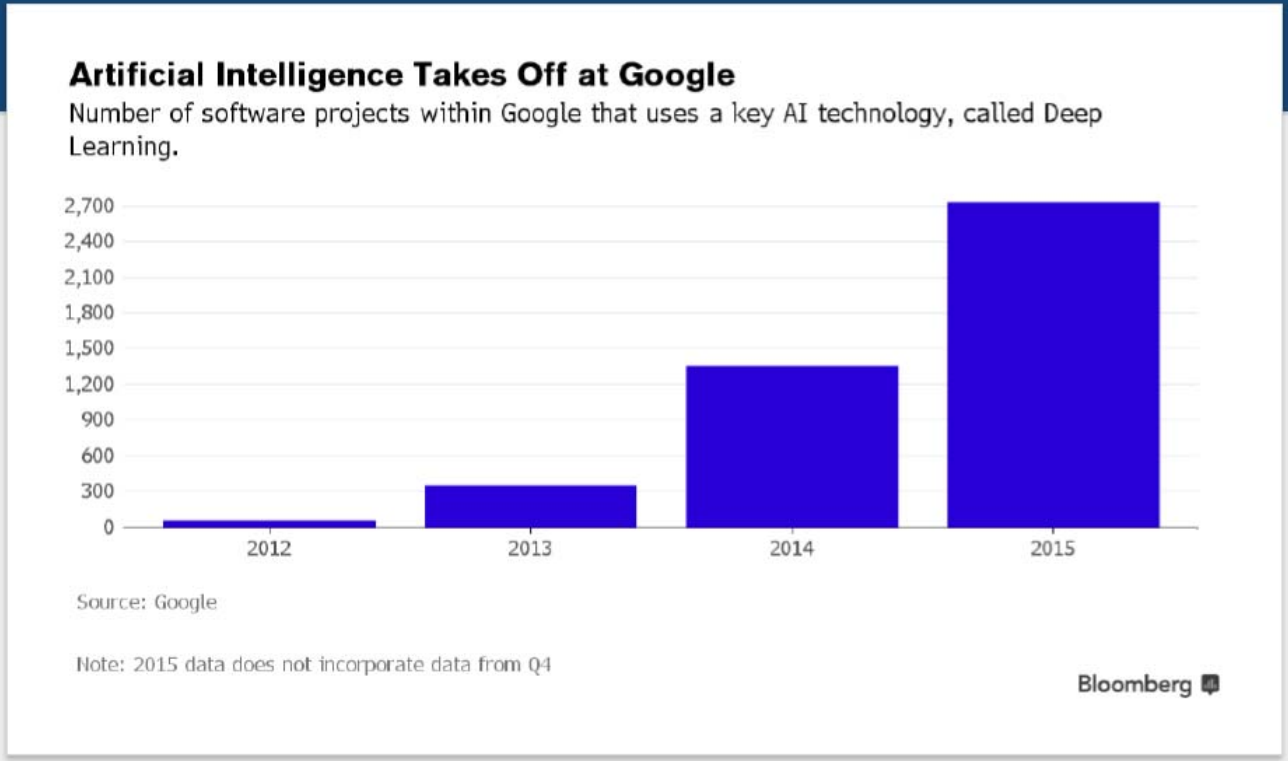
Machine learning is a core transformative way by which we are rethinking everything we are doing – *Sundar Pichai (CEO Google)*

Source

https://www.bloomberg.com/news/articles/2015-12-08/why-2015-was-a-breakthrough-year-in-artificial-intelligence

Hype or Reality?

Google

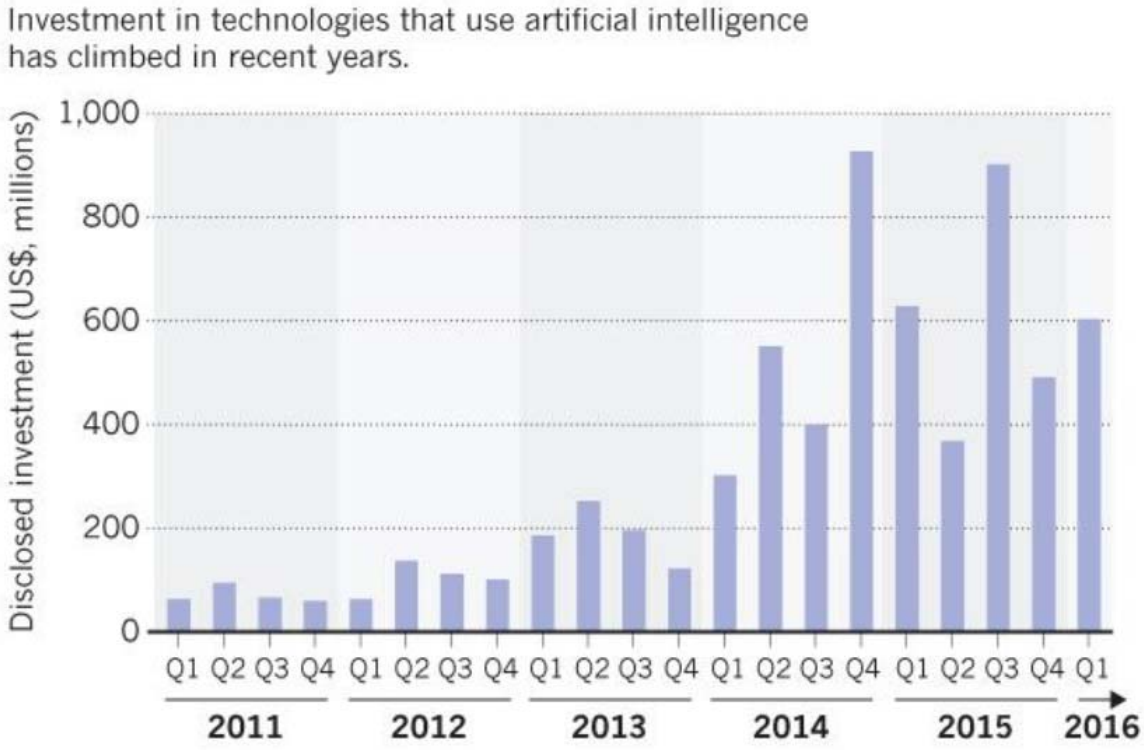


Source

http://www.nature.com/news/there-is-a-blind-spot-in-ai-research-1.20805

Hype or Reality?

Investments in AI technologies

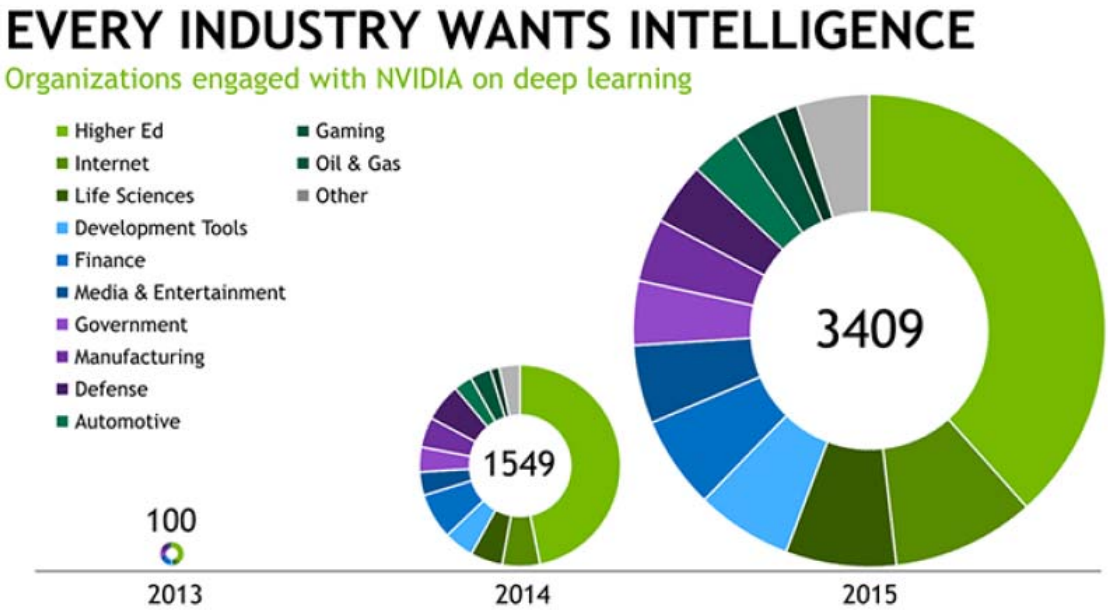


Source

https://blogs.nvidia.com/blog/2016/01/12/accelerating-ai-artificial-intelligence-gpus/

Hype or Reality?

Growing Interest from Organizations



Source

The Big Players

Superstar Researchers

Geoffrey Hinton: University of Toronto & Google

Yann LeCun: New York University & Facebook

Andrew Ng: Stanford & Baidu

Yoshua Bengio: University of Montreal

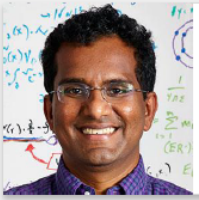
Jürgen Schmidhuber: Swiss AI Lab & NNAISENSE

Hype or Reality?

Quotes

I have worked all my life in Machine Learning, and I've never seen one algorithm knock over benchmarks like Deep Learning
– Andrew Ng (Stanford & Baidu)

Deep Learning is an algorithm which has no theoretical limitations of what it can learn; the more data you give and the more computational time you provide, the better it is *– Geoffrey Hinton (Google)*



Human-level artificial intelligence has the potential to help humanity thrive more than any invention that has come before it *– Dileep George (Co-Founder Vicarious)*

For a very long time it will be a complementary tool that human scientists and human experts can use to help them with the things that humans are not naturally good *– Demis Hassabis (Co-Founder* DeepMind*)*

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مقدمه‌ای بر یادگیری عمیق

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منابع

منبع اصلی


Deep Learning
The Past, Present and Future of
Artificial Intelligence
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