Data Science Training

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Conclusion

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http://data-science-optum17.tk

Data Science

Computer Science

Scalable databases for storing, accessing data.
E.g. Cloud computing, Amazon EC2, Hadoop.
Distributed and parallel frameworks for data processing.
E.g. MapReduce, GraphLab.

Mathematical Modeling

Design algorithms that transform data into knowledge.
Use Linear algebra, optimization, graph theory, statistics.

Personalized Services

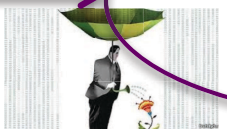
E.g. Healthcare (enhanced diagnostics)
Commerce (products)

Data Science

Multidisciplinary field: "1+1=3"

Knowledge Discovery

E.g. Physics, genomics, social sciences.



Data

Collection of massive amounts of data at increasing rate.
E.g. Social networks, sensor networks, mobile devices, biological networks, administrative, economics data

Issues of privacy, security, ownership

Domain Expertise

Sciences
E.g. Economy, Biology, Physics, Neuroscience, sociology.
Government
E.g. Healthcare, Defense, Education, Transportation.
Industry
E.g. E-commerce, Telecommunications, Finance.

Google

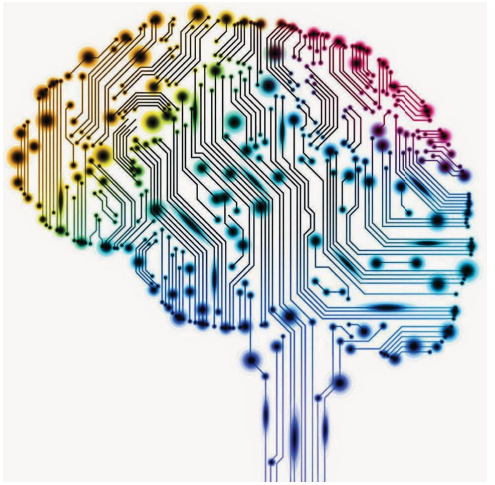
Intelligent Systems

E.g. Autonomous cars, security, interactive tools for data organization and exploration.

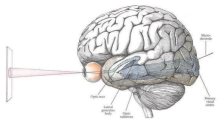
Major challenges: Multidisciplinary integration, large-scale databases, scalable computational infrastructures, design math algorithms for massive datasets, trade-off speed and accuracy for real-time decisions, interactive visualization tools.

Deep Learning is Hot

$$\textit{Deep learning} = \underbrace{\textit{Big Data}}_{\text{3rd industrial revolution}} + \underbrace{\textit{Computational Infrastructure}}_{\text{Cloud computing, GPU}} + \underbrace{\textit{Neural Networks}}_{\text{Math parts}}$$



A Brief History of Deep Learning



Visual primary cortex
Hubel-Wiesel
1959

First
NIPS

RNN/LSTM
Schmidhuber

CNN
LeCun

Big Data
Volume 2x/1.5 year

Hardware
GPU speed 2x/1.5 year

First
KDD
1989

First Amazon
Cloud Center

Kaggle
Platform

GAN, Goodfellow
ResNet, He
Deep RL, Mnih

Google AI
TensorFlow
Facebook AI
Torch

1958 Perceptron Rosenblatt

1962 Birth of Data Science Split from Statistics Tukey

1982 Backprop Werbos

1987 Neocognitron Fukushima

1995 SVM/Kernel techniques Vapnik

1997 1998

1999 First NVIDIA GPU

2006

2010

2012 Deep Learning Breal H

2014 Facebook Cer OpenAI Cer

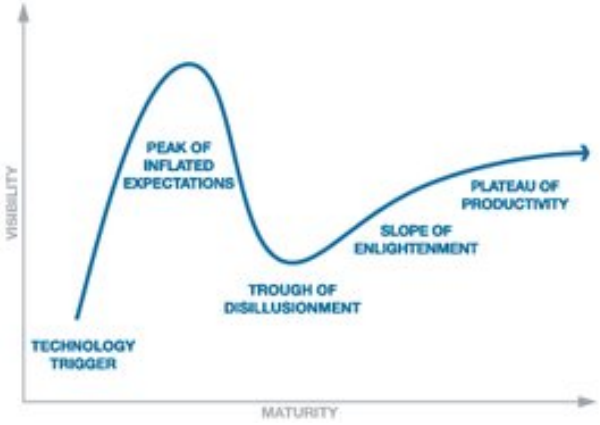
2015 ata scientist st Job in US

4th industrial revolution
Digital intelli ce

AI Birth

AI Winter [1960's-2012]

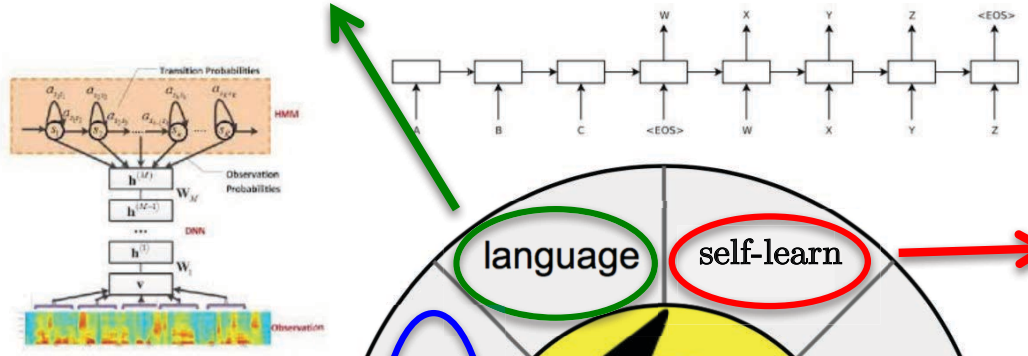
Kernel techniques
Graphical models
Wavelets, numerical PDEs
Handcrafted Features

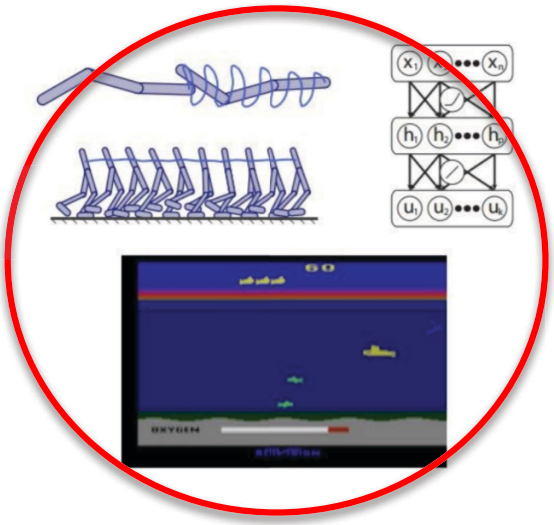


Current Deep Learning

Recurrent

Neural Networks





language

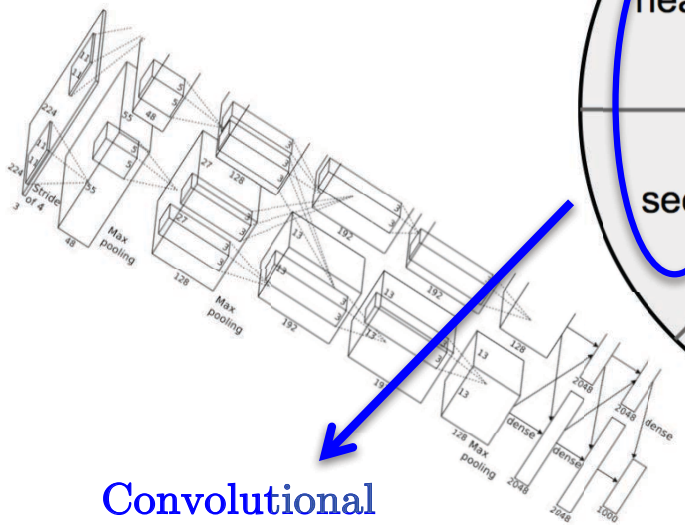
self-learn

hear

think

see

[A. Karpathy]



Convolutional

Neural Networks

Reinforcement

Learning

Rapid Developments

Arxiv Sanity Preserver
Built in spare time by @karpathy to accelerate research.
Serving last 37449 papers from cs.[CVICLILGIAIINE]/stat.ML

User: Pass: Login or Create

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New to arxiv-sanity? Check out the introduction video. X

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Only show v1

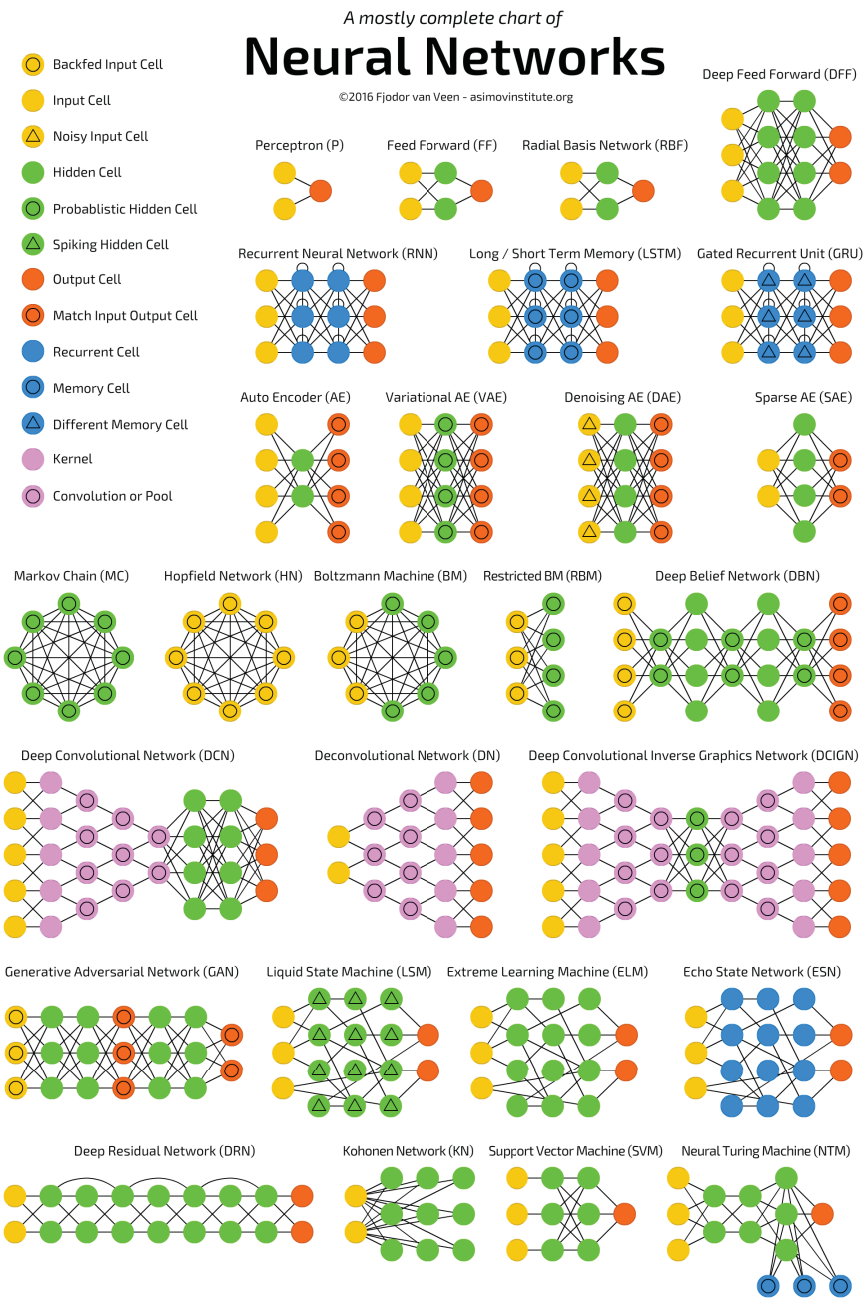
Showing most recent Arxiv papers:

Toward Depth Estimation Using Mask-Based Lensless Cameras
M. Salman Asif
11/9/2017 cs.CV

1711.03527v1 pdf
show similar | discuss

Recently, coded masks have been used to demonstrate a thin form-factor lensless camera, FlatCam, in which a mask is placed immediately on top of a bare image sensor. In this paper, we present an imaging model and algorithm to jointly estimate depth and intensity information in the scene from a single or multiple FlatCams. We use a light field representation to model the mapping of 3D scene onto the sensor in which light rays from different depths yield different modulation patterns. We present a greedy depth pursuit algorithm to search the 3D volume and estimate the depth and intensity of each pixel within the camera field-of-view. We present simulation results to analyze the performance of our proposed model and algorithm with different FlatCam settings.

Family Portrait

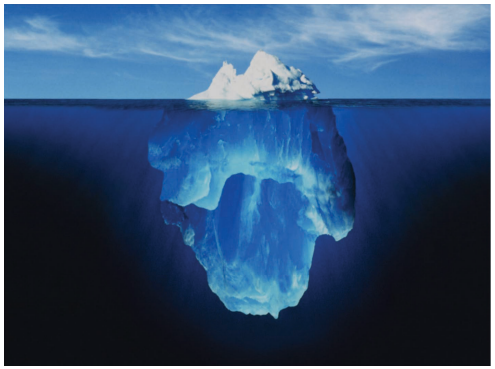


http://www.asimovinstitute.org/neural-network-zoo

Future of Deep Learning/AI

- Deep Learning is a new ***revolutionary*** paradigm in AI.

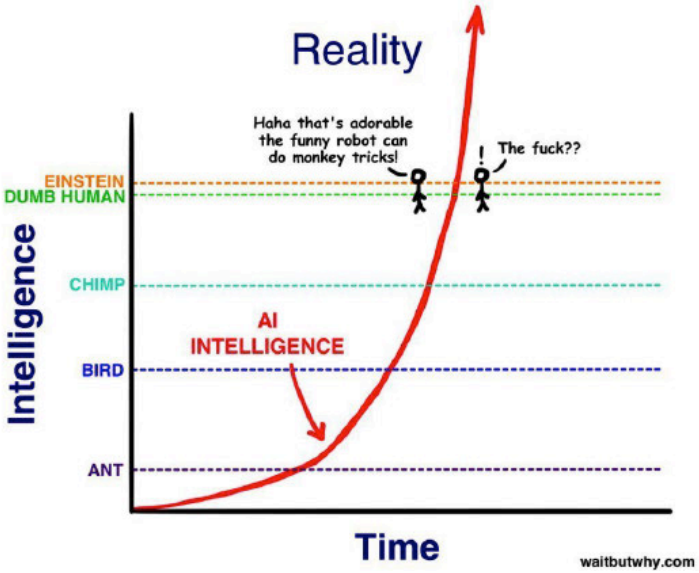
  It has the capability to find highly meaningful ***patterns in big data***.



- Deep Learning is a ***breakthrough*** in Computer Vision and Speech Recognition.

  However, it has ***not*** had yet the same breakthrough in other fields.

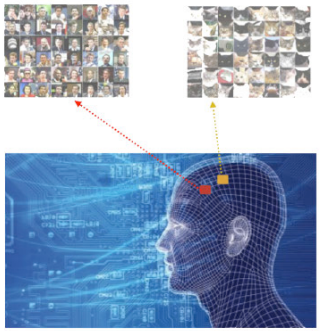
  We are *far away* from a true AI.

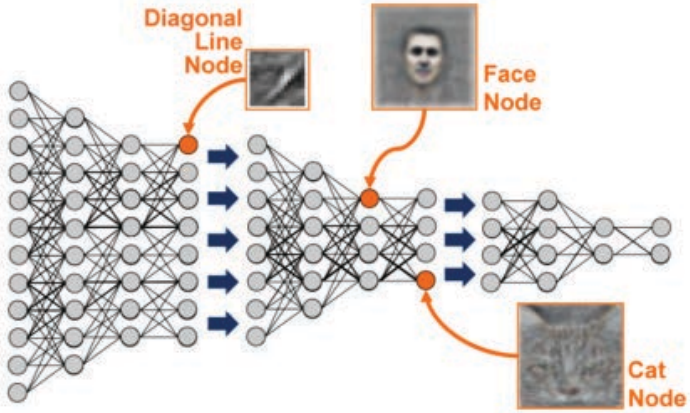


Future of Deep Learning/AI

- ***Unsupervised learning:***

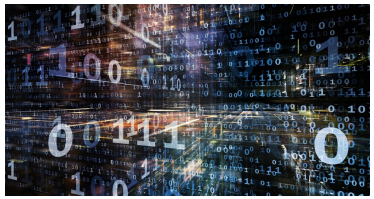
  Google Brain: Self-taught learning with unlabelled youtube videos and 16,000 computers



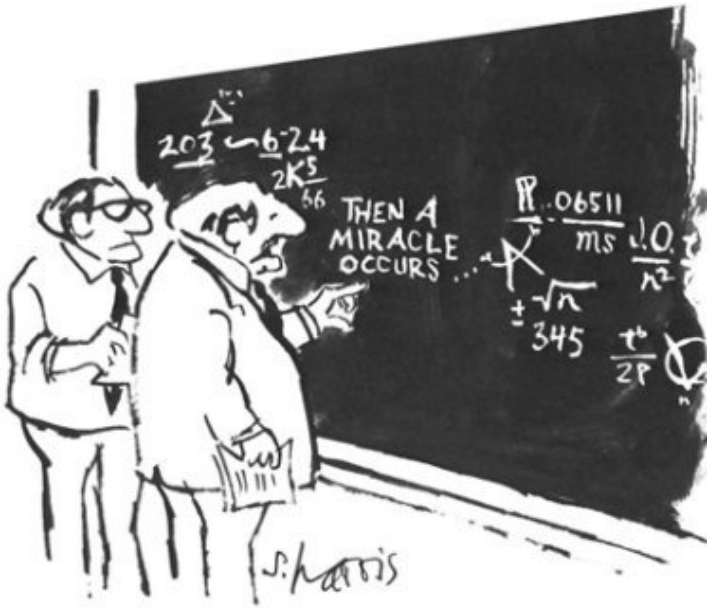


- Better **hardware** with bigger machines ☺

- Bigger **data** ☺

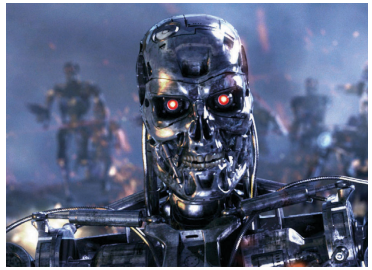


- Better **understanding** - *why it works?* ☹



"I think you should be more explicit here in step two."

Who is Afraid of AI?



- **Hollywood** has made a scary portrayal of AI ☹
  AI is *not* an imminent threat to humankind!

- Committee *"One Hundred Year Study on Artificial Intelligence - Stanford University"* has identified how AI had, does and will **benefit society**:
  - *(1) Self-driving cars (more secure than human drivers)*
  - *(2) Healthcare diagnostics and personalized treatments (extend and enhance people lives)*
  - *(3) Education (personalized tutors for math, language)*
  - *(4) Public safety (law enforcement, surveillance)*
  - *(5) Entertainment (Pokémon Go) and home services*
  - *(6) Industry (robots for agriculture, factories, hazardous jobs e.g. Fukushima cleaning)*
  - *(7) Transportation: self-driving trucks, flying drones (product delivery), no traffic jams*
  - *(8) Environment protection (animals, earth)*

https://ai100.stanford.edu

Challenges for AI Acceptance

- **Main difficulties:**
  - *(1) Creating safe and reliable hardware (transportation, robots)*
  - *(2) Overcoming fears of marginalizing humans (employment)*

    AI will replace jobs and also create new ones.
  - *(3) Interacting with human experts (doctors, teachers)*
  - *(4) Gaining public trust (public safety, security)*
  - *(5) Decreasing social interactions (entertainment)*

- **AI policy issues:** *ethics, privacy, transparency, freedom, equality.*

  Who is responsible for self-driving car accidents? for failed medical AI device? How can AI applications be stopped collecting data about people without consent? How can we prevent AI financial cheating?

- **Key question:** How to deploy AI technologies to guarantee economic and social benefits for all society?

AI and Jobs

- *Why AI could destroy more jobs than it creates, and how to save them?*
  Article by Nick Heath.

  "If you look back to the first machine age [1880-1940] the vast majority of Americans worked in agriculture. Now it's less than two percent," "Those people [working in agriculture] didn't simply become unemployed, they reskilled. One of the best ideas that America had was mass primary education."

  "We have to reinvent ***education and reskilling****, and people are going to have to take it upon themselves to more aggressively learn these skills. Because the technology is changing more rapidly, it's going to be a case of lifelong learning and continuously reskilling."*

- Lastly, *AI is already part of industry, government and academia.* And as any new innovation, fear and suspicion are natural but it will most likely transform society for the better in the long run.

Thank you!