AI, Deep Learning, and New Opportunities

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Piero Scaruffi

- 30+ years in Silicon Valley
- Written 20+ books
- Pioneered A.I. and Internet applications



PACIFIC TELECOMMUNICATIONS COUNCIL





Intelligence is not Artificial

Expanded Edition

Past. Present and Future of Artificial Intelligence



Why the Singularity is not coming any time soon. Life in the coming age of incredibly stupid machines.

The Age of A.I.?



Forbes Sep 5, 2018 The New **Burning Man** - The AI Conference That Sold Out In 12 Minutes









Deep Learning

- Invented in 2006-07
 - Geoffrey Hinton
 - Yoshua Bengio
 - Yann LeCun



• The Year of Deep Learning: 2012











Deep Learning

Why did it take until 2012?

- 1. The computational power (the GPU!)
- 2. The training datasets
- 3. Open-source platforms





2006: PASCAL VOC 2007: Tiny Images Dataset 2009: ImageNet 2013: Atari games 2014: COCO 2016: SOuAD 2016: MARCO







. . .



Status

- CNN = Convolutional Neural Networks (face recognition, object identification, disease detection)
- RNN/LSTM = Recurrent Neural Networks (speech recognition, translation, caption generation)
- DRL = Deep Reinforcement Learning (robot training, game playing)
- GAN = Generative Adversarial Networks (image generation, style transfer)











Image Recognition



Deep Reinforcement Learning (DRL)

- AlphaGo (2016)
- AlphaZero (2017)
- AlphaStar (2019)



DeepMind's StarCraft 2 Al is now better than 99.8 percent of all human players

• OpenAl Five (2018)

• Robotic arm that solves Rubik's Cube (2019)



Microsoft to invest \$1 billion in OpenAI



Sam Altman, CEO of OpenAI (left), and Microsoft CEO Satya Nadella



Solving Rubik's Cube with a Robot Hand









Generative Adversarial Networks (GANs)

What does it mean to "learn" a concept? If you know what a dog is, you can draw a picture of a dog that doesn't exist:



GANs generate images

Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks

Alec Radford, Luke Metz, Soumith Chintala All images in this paper are generated by a neural network. They are NOT REAL











Generative Adversarial Networks (GANs)

GANs generate images from descriptions

Generative Adversarial Text to Image Synthesis

Scott Reed, Zeynep Akata, Xinchen Yan, Lajanugen Logeswaran Honglak Lee, Bernt Schiele

this small bird has a pink this magnificent fellow is breast and crown, and black almost all black with a red primaries and secondaries. crest, and white cheek patch



the flower has petals that

are bright pinkish purple with white stigma



this white and vellow flower have thin white petals and a round vellow stamer



Figure 1. Examples of generated images from text descriptions. Left: captions are from zero-shot (held out) categories. Right: captions are from training set categories.



MAX-PLANCK-GESELLSCHAF

GANs generate videos from scripts



a set of four-second synthesized video clips



Karen Simonyan DeepMind









Generative Adversarial Networks (GANs)

Style transfer

Unpaired Image-to-Image Translation using Cycle-Consistent

Adversarial Networks Jun-Yan Zhu* Taesung Park* Phillip Isola Alexei A. Efros



In ICCV 2017 **UC Berkeley**





Summer C Winter

Zebras C Horses



Scene generation

NVIDIA.

Stroke of Genius: GauGAN Turns Doodles into Stunning, Photorealistic Landscapes



VB

JULY 30, 2019

Nvidia's GauGAN has been used to create 500,000 images







Natural Language Processing

Text Understanding

- Transformer (2017)
- ELMO (2018)
- BERT (2018)
- BiDAF++ (2018)



Text Generation

- PGNET (2017)
- GPT2 (2019)











Natural Language Processing

Example: GTP2

Question	Generated Answer	Correct	Probability
Who wrote the book the origin of species?	Charles Darwin	1	83.4%
Who is the founder of the ubuntu project?	Mark Shuttleworth	1	82.0%
Who is the quarterback for the green bay packers?	Aaron Rodgers	1	81.1%
Panda is a national animal of which country?	China	1	76.8%
Who came up with the theory of relativity?	Albert Einstein	1	76.4%
When was the first star wars film released?	1977	1	71.4%
What is the most common blood type in sweden?	Α	×	70.6%
Who is regarded as the founder of psychoanalysis?	Sigmund Freud	1	69.3%
Who took the first steps on the moon in 1969?	Neil Armstrong	1	66.8%
Who is the largest supermarket chain in the uk?	Tesco	1	65.3%
What is the meaning of shalom in english?	peace	1	64.0%
Who was the author of the art of war?	Sun Tzu	1	59.6%
Largest state in the us by land mass?	California	×	59.2%
Green algae is an example of which type of reproduction?	parthenogenesis	×	56.5%
Vikram samvat calender is official in which country?	India	1	55.6%
Who is mostly responsible for writing the declaration of independence?	Thomas Jefferson	1	53.3%
What us state forms the western boundary of montana?	Montana	×	52.3%
Who plays ser davos in game of thrones?	Peter Dinklage	×	52.1%
Who appoints the chair of the federal reserve system?	Janet Yellen	×	51.5%
State the process that divides one nucleus into two genetically identical nuclei?	mitosis	1	50.7%
Who won the most mvp awards in the nba?	Michael Jordan	×	50.2%
What river is associated with the city of rome?	the Tiber	1	48.6%
Who is the first president to be impeached?	Andrew Johnson	1	48.3%
Who is the head of the department of homeland security 2017?	John Kelly	1	47.0%
What is the name given to the common currency to the european union?	Euro	1	46.8%
What was the emperor name in star wars?	Palpatine	1	46.5%
Do you have to have a gun permit to shoot at a range?	No	1	46.4%
Who proposed evolution in 1859 as the basis of biological development?	Charles Darwin	1	45.7%
Nuclear power plant that blew up in russia?	Chernobyl	1	45.7%
Who played john connor in the original terminator?	Arnold Schwarzenegger	×	45.2%







Reality Check: Not much "I" in "A.I."











Reality Check: The "I" is often outside

What really "does it" is not the machine: it's the environment that we structure for the machine











Reality Check: How can you be so smart?

DeepMind's AlphaGo

What else can AlphaGo do besides playing Go? Absolutely nothing. What else can you do besides playing Go?

AlphaGo consumed 440,000 W to do just one thing Your brain uses 20 W and does an infinite number of things











Reality Check: The self-crashing car



MARCH 30, 2018

Tesla says crashed vehicle had been on autopilot prior to accident





MARCH 19, 2018

Self-driving Uber car kills Arizona woman crossing street



Tesla Model 3 crashes into police car with Autopilot

December 9, 2019

ROAD SHOW









Reality Check: No common sense













Two dogs play in the grass.

over the puck.

Two hockey players are fighting A group of young people playing a game of frisbee.



A herd of elephants walking across a dry grass field.



A close up of a cat laying on a couch.



side of the road.

Somewhat related to the image

A skateboarder does a trick

on a ramp.

A little girl in a pink hat is

blowing bubbles.





A dog is jumping to catch a

frishee

A refrigerator filled with lots of

food and drinks.

https://research.googleblog.com/2014/11/a-picture-is-worth-thousand-coherent.html









A refrigerator filled with lots of food and drinks.

Reality Check: Unnatural Learning

Supervised Learning: requires a lot of data - UNNATURAL

Reinforcement Learning: requires a lot of self-play -UNNATURAL

Unsupervised Learning: the way humans and animals learn!

Self-Supervised Learning, Yann LeCun, Facebook AI Research

After a brief presentation of the state of the art in deep learning, some promising principles & methods for selfsupervised learning will be discussed.



Wednesday, October 24, 2018 3:30pm-4:30pm Carpenter 013







• Disease detection

2017



Deep learning algorithm diagnoses skin cancer as well as seasoned dermatologists





Self-taught artificial intelligence beats doctors at predicting heart attacks 2017



Artificial Intelligence Improves Stroke and Dementia Diagnosis in Brain











• Genomic Analysis



Why is Hydra immortal? Why can the Turritopsis reverse its life cycle and rejuvenate? Why did Jeanne Calment live to 122?











- Scientific discovery depends on
 - Studying the literature
 - More than 1.2 million papers are published yearly in life science journals alone, on top of the 25 million already in print
 - A new article is being published every 30 seconds
 - Experimenting new ideas

Artificial Intelligence to Win the Nobel Prize and Beyond: Hiroaki Kitano, Systems Biology Institute - SBI



15th International Semantic Web Conference (ISWC), Kobe 2016







- Drug discovery
 - It takes an average of 12 years and about \$2.6 billion to put a new drug on the market.



- Robots for an aging society
 - More than 1 million people in the USA require daily physical assistance to get dressed because of injury, disease, and old age
 - Examples: a robot that learns to dress people; assisted feeding; etc





Personal Robotics Lab W UNIVERSITY of WASHINGTON Food Manipulation for Assisted Feeding By Tapomayukh Bhattacharjee



Awards NeurIPS 2018







Caution:

- There seem to be many more "Reports about Applications of A.I." than there are actual applications
- Calling old-fashioned software A.I. is like calling a restaurant "Ristorante"
- If you are using A.I. as glorified statistics, you are probably wasting time and money
- Beware of any tech consultant who had no A.I. until recently (and maybe even discouraged investment in A.I.)

What is encouraging:

 Lots of data: from devices, networks, mobile applications, geolocation, customer profiles, service usage, billing data, ...







• The hype

The Amazing Ways Telecom Companies Use Artificial Intelligence And Machine Learning







The Reality

- Network optimization (Sedona's NetFusion, Aria, ...)
- Preventive maintenance (Nokia's Ava, Avanseus CAN, ...)



NOKIA



Offering predictive and proactive services across care and operations



Cognitive Assistant for Networks (CAN)







The Reality

- Virtual Assistants (Vodafone's TOBi, Nokia's MIKA, Telefónica's Aura ...)
- Fraud detection (CSG Detect, Oculeus, SKLOIS ...)







NOKIA

Nokia MIKA Multi-purpose Intuitive Knowledge Assistant (MIKA)

Published: 31 August 2018

Detecting telecommunication fraud by understanding the contents of a call

Qianqian Zhao 🖂, Kai Chen 🖂, Tongxin Li, Yi Yang & XiaoFeng Wang









- The Reality
- Anomaly detection

scífòrce Anomaly Detection — Another Challenge for Artificial Intelligence

https://medium.com/sciforce/anomaly-detection-another-challenge-for-artificial-intelligence-c69d414b14db

ELEMENT^{AI}



JEAN-CHRISTOPHE TESTUD March 26

Modern recipes for anomaly detection

https://www.elementai.com/news/2019/modern-recipes-for-anomaly-detection



How to use machine learning for anomaly detection and condition monitoring

https://towards datascience.com/how-to-use-machine-learning-for-anomaly-detection-and-condition-monitoring-6742f82900d7







The End (for now ...)



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