AI, Deep Learning, and the Future of Business

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PossibilityResearch.com
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SelfAwareSystems.com

http://googleresearch.blogspot.com/2015/06/inceptionism-going-deeper-into-neural.html
Multi-Billion Dollar Investments

- **2013** Facebook — AI lab, DeepFace
- **2013** Yahoo — LookFlow
- **2013** Ebay — AI lab
- **2013** Allen Institute for AI
- **2013** Google — DNNresearch, SCHAFT, Industrial Perception, Redwood Robotics, Meka Robotics, Holomni, Bot & Dolly, Boston Dynamics
- **2014** IBM — $1 billion in Watson
- **2014** Google — DeepMind $500 million
- **2014** Vicarious — $70 million
- **2014** Microsoft — Project Adam, Cortana
- **2015** Fanuc — Machine Learning for Robotics
- **2015** Toyota — $1 billion AI and Robotics Lab, Silicon Valley
Estimated potential economic impact of technologies across sized applications in 2025, $ trillion, annual

1. Mobile Internet
2. Automation of knowledge work
3. Internet of Things
4. Cloud
5. Advanced robotics
6. Autonomous and near-autonomous vehicles
7. Next-generation genomics
8. Energy storage
9. 3-D printing
10. Advanced materials
11. Advanced oil and gas exploration and recovery
12. Renewable energy

http://www.mckinsey.com/insights/business_technology/disruptive_technologies
AI Knowledge Work: $25 Trillion to 2025

Marketing, ERP, Big Data, Smart Assistants
Internet of Things: $15 Trillion to 2025

100 Billion devices by 2025
Cars, Appliances, Cameras, Meters, Wearables, etc.


https://www.summitbusiness.net/images/Internet.jpg
Robot Manufacturing: $10 Trillion to 2025

Work 24 hours/day
No breaks, food, medical
Don’t quit, get bored, get depressed
Work anywhere
Hazards OK
Don’t leak secrets
Work well with others
Easy to replicate

Foxconn Technology Group

- World’s largest contract manufacturer
- Assembles 40% of all consumer electronics
- iPhone, iPad, Kindle, Xbox, Playstation 4, etc.
- 1.3 million employees, $8K salary
- Employee suicides
- “Foxbot” robots, cost $25K, 2nd generation now
- Building 30K robots/year

420 Chinese Robot Companies

1500 Dongguan “Robot Replace Human” factories

March 2015: China Brain

Robin Li Yanhong, CEO of Baidu proposed a state-level Chinese initiative to develop AI “comparable to the Apollo space programme”.

http://www.scmp.com/lifestyle/technology/article/1728422/head-chinas-google-wants-country-take-lead-developing
Health Care: $10 Trillion to 2025

Robot surgery, medical records, AI diagnosis

Self-Driving Vehicles: $10 Trillion by 2025

Disrupt Dealers, Insurance, Parking, Finance, Trucking, Taxis
10 million jobs

Tesla: “Autopilot” mode

Google: Fully Self-Driving in 2020

Mercedes, GM, Volvo, Apple, Uber,...
Uber valuation: $51 billion, 20% of fares
http://www.wsj.com/articles/ubers-new-funding-values-it-at-over-41-billion-1427715938

World’s largest job creator: 50,000 per month

Center for research on self-driving cars
http://bits.blogs.nytimes.com/2015/02/02/uber-to-open-center-for-research-on-self-driving-cars/?_r=0

36 second wait, $.50/mile, 100% of fares
"We jokingly play chicken with them when we're trying to cross the street," he said. "You see one about to make a right turn at a light, and they're obviously trying to decide if we're going to step into the street or not. It's so tempting to sort of step toward the curb, which makes the car stop instantly and wait for you to go, except you don't go.

"We're just messing with it," he said, "to see what it'll do."

– Zandr Milewski
3D Printing: $2 Trillion by 2025
April 2014: Chinese WinSun 3D printed 10 houses, 2100 sq ft, $4800

http://m.newsru.co.il/realty/20jan2015/3d_house_i101.html
WinSun 3D printed 12,000 sq ft villa

US Building construction: $1 Trillion/yr
5.8 million employees

Artificial Intelligence
633 Companies

Contact info@venturescanner.com to see all
Contact us at info@venturescanner.com to see all 855 AI Startups
2,700 Google Projects Use Deep Learning!

Artificial Intelligence Takes Off at Google
Number of software projects within Google that uses a key AI technology, called Deep Learning.

Source: Google
Note: 2015 data does not incorporate data from Q4

1957: Rosenblatt’s “Perceptron”

“The embryo of an electronic computer that [the Navy] expects will be able to walk, talk, see, write, reproduce itself and be conscious of its existence.”

- Office of Naval Research

https://en.wikipedia.org/wiki/Perceptron
1969: Perceptrons can’t do XOR!


http://hyperphysics.phy-astr.gsu.edu/hbase/electronic/ietron/xor.gif

Minsky & Papert


https://constructingkids.files.wordpress.com/2013/05/minsky-papert-71-csolomon-x640.jpg
1986 and 2007: Multilayer Neural Nets

Backpropagation
1986 Rumelhart
(1963 Bryson, 1974 Werbos)

Deep Learning
2007 Hinton
(1989 LeCun, 1992 Schmidhuber)

http://opticalengineering.spiedigitallibrary.org/article.aspx?articleid=1714547
http://www.nature.com/polopoly_fs/7.14689.1389093731!/image/deep-learning-graphic.jpg_gen/derivatives/landscape_400/deep-learning-graphic.jpg
Deep Learning Successes

- 2009 Speech Recognition TIMIT: Cortana, Skype, Google Now, Siri, Baidu, Nuance, etc.
- 2012 Image Recognition ImageNet
- 2012 Drug Discovery Merck Challenge
- 2013 Natural Language Sentiment
- 2014 Image Captioning
- 2014 Natural Language Translation
- 2015 Atari Video Games DeepMind

Feedforward Networks
2013: The Algebra of Meaning

*King – Man + Woman = Queen*

Mikolov’s Word2Vec

http://deeplearning4j.org/word2vec.html
Paris – France + Italy = Rome
https://code.google.com/p/word2vec/

Obama – USA + Russia = Putin
http://byterot.blogspot.com/2015/06/five-crazy-abstractions-my-deep-learning-word2doc-model-just-did-NLP-gensim.html

Picasso – Einstein + Scientist = Painter

Forearm – Leg + Knee = Elbow
http://deeplearning4j.org/word2vec.html
2015: Face Recognition

June: Google FaceNet
Record accuracy 99.63% on Labeled Faces in the Wild dataset
Cuts best previous error rate by 30%
22 layer feedforward net, 140M weights, 1.6 GFLOP/image, conv/pool/norm
Trained on triples pushing same faces together, different apart

Oct.: CMU OpenFace
Open Source version of FaceNet
84.83% accuracy, <.1 training faces
June 2015: Google Deep Dream

http://googleresearch.blogspot.com/2015/06/inceptionism-going-deeper-into-neural.html
Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks

Alec Radford, Luke Metz, Soumith Chintala

(Submitted on 19 Nov 2015)

https://github.com/Newmu/dcgan_code/tree/gh-pages
Nov. 2015: Synthetic Record Albums
smiling woman - neutral woman + neutral man = smiling man

man with glasses - man without glasses + woman without glasses = woman with glasses

https://github.com/Newmu/dcgan_code/tree/gh-pages
Biological Networks Have Loops

Brain Connectome

Human Metabolome

Gene network Chromosome 22

https://en.wikipedia.org/wiki/Hub_(network_science_concept)
https://41.media.tumblr.com/tumblr_m5l6rzIqwc1r1171mo1_1280.jpg
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0028213#pone-0028213-g010
Nov. 2015: NeuralTalk and Walk Demo

[Images]:
- A man is eating a hot dog in a crowd.
- A boat is parked on the side of a river.
- A view of a street from the side of a road.
- A man riding a skateboard down a street.

[Video]: https://vimeo.com/146492001
2015: DeepMind Deep-Q Networks

http://www.nature.com/nature/journal/v518/n7540/full/nature14236.html

Feb.: 49 Atari Games
Beat previous Ais
Beat humans on half

May: 100’s of games

May: 3D games
TORCS racing
Beat Ais from pixels

https://www.youtube.com/watch?v=08Cl7ii6viY&feature=youtu.be&t=15m31s
Nov. 2015: Kespry and Nvidia Deep Learning for Drones

Drones: $98 Billion by 2025
Dec. 2015: Fanuc Deep Learning Robots

Deep Learning to Bin Pick in 8 hours

http://www.bloomberg.com/news/articles/2015-12-03/zero-to-expert-in-eight-hours-these-robots-can-learn-for-themselves
Open Source Toolkits

2010-2014: a new deep learning toolkit is released every 47 days. 2015: every 22 days. tensorflow & caffe top github
Google and Microsoft Open Source Toolkits


https://www.linkedin.com/company/toobler
Deep Learning Hardware

NVIDIA GPUs
AMD GPUs
FPGAs

Intel ConvNet core
Movidius: embedded
Mobileye: automotive
Orcam: low power vision
Qualcomm: mobile
Samsung: mobile
Teradeep: startup
Nervana: startup
Cloud: MetaMind, Google, Microsoft, Amazon

MetaMind

Food Classifier
Upload a picture to classify it between 101 food classes: Apple pie, waffles...

Hamburger
Pulled Pork Sandwich
Fattie
Hot Dog
Clap Sandwich

Did we make a mistake?
Beard the correct label! Enter The Correct Label...

https://www.metamind.io/

Microsoft Azure Machine Learning
Machine learning with the power, simplicity and benefits of the cloud.

Focus on ability to develop & deploy predictive models as machine learning web services.

Target user is data scientist, specifically emerging data scientists.

Fastest time to deployed solution with ability to rapidly retrain & redeploy.

Support for collaboration, sharing of data, experiments, and web services.

http://www.slideshare.net/Azure4Research/azure-ml-webinarjuly2014

Deep Learning on Amazon EC2 GPU with Python and nolearn
by Adrian Rosebrock on October 13, 2014 in Deep Learning, Tutorials


Introducing Google Cloud Vision API

Google Cloud Platform

The Future Looks Bright!

- $50 trillion of value
- Hundreds of startups
- Billions of investment
- Rapid performance improvement
- Free and cheap software
- Rapidly improving hardware
- Many innovative applications
- Opportunity to improve the world