THE COMMODITIZATION OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

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AI & ML is in the Headlines

Google Sells A.I. for Building A.I. (Novices Welcome)

Stephen Hawking warns artificial intelligence could end mankind

Microsoft creates AI that can read a document and answer questions about it as well as a person

Researchers use AI to improve accuracy of gene editing with CRISPR

AI – hype or here today?

Microsoft Research developing an AI to put coders out of a job

This AI writes clickbait headlines, and its results may surprise you

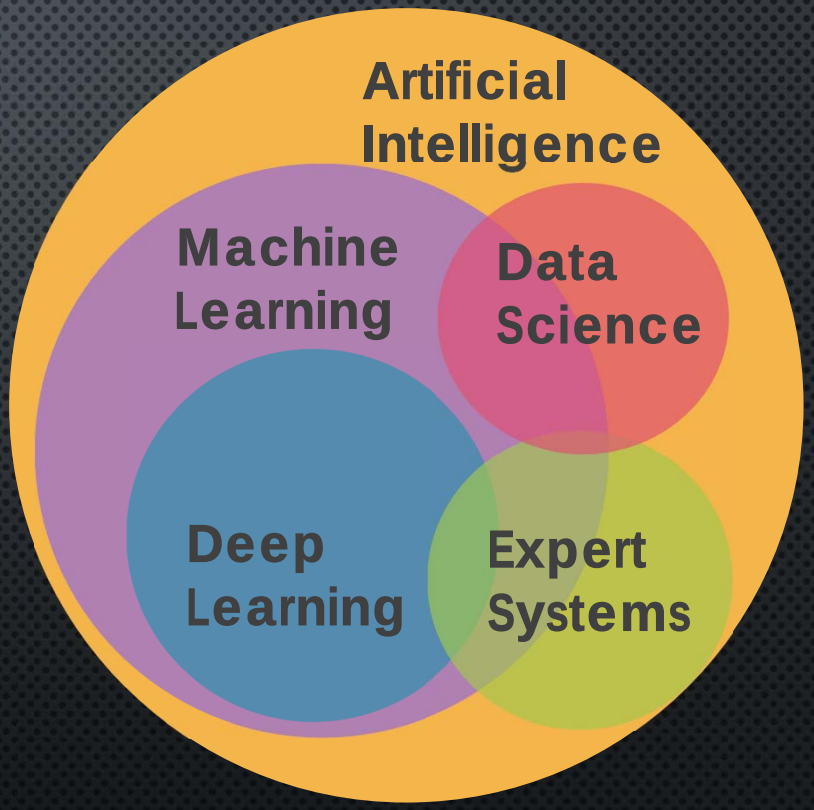
AI & ML **really are** improving

- Object Recognition
  - Up from ~35% accuracy to > 65% in last 3-4 years
  - Had previously been stuck at ~1%/yr
- Speech Recognition
  - Finally good, speaker-independent, w/ usable accuracy : Alexa, Cortana, Hey Google, Siri…
  - 2012-2015 Google's voice recognition error rate dropped from 22% to 8%
- "Supervised Learning" is "solved"
  - Well, for the academics, anyway…
  - But 80% Object recognition accuracy is not nearly good enough for an autonomous vehicle!

Source: Forbes, "Is AI Overhyped in 2017?"

Five Minute Artificial Intelligence Review/Primer...

- 1960s: Replicate human intelligence by defining many if-then rules. This is deterministic, but hard.
- 1980s: Machine Learning: algorithms that learn w/o explicitly programmed Instructions
  - Can produce non-deterministic results
- 2000s: Deep Learning
  - Multi-Layer Neural Networks



Marginally accurate Venn diagram

Artificial Intelligence vs. Machine Learning vs. Deep Learning

- **Artificial Intelligence** – Machines doing human-like things
- **Machine Learning** – An AI technique where the machine learns from data relationships
- **Deep Learning** – An ML technique using artificial neural networks

Deep Learning vs. Traditional Machine Learning

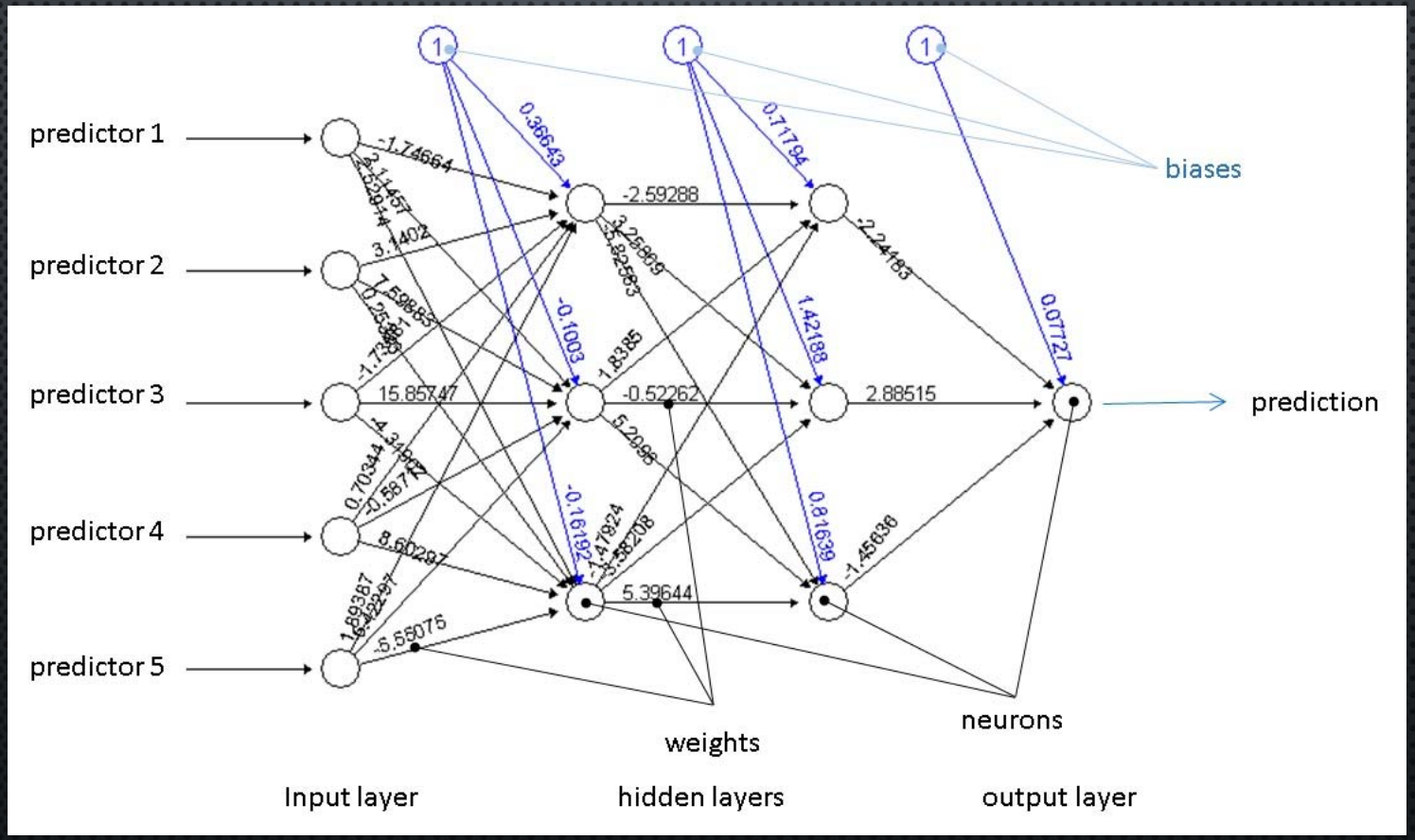
	Machine Learning	Deep Learning
Training Dataset	Small	Large
Choose your own features	Yes	No, it learns them
No. of classifiers available	Many	Few
Training Time	Short	Long
Compute, RAM, & Storage cost	Low	High

Source: Matlab

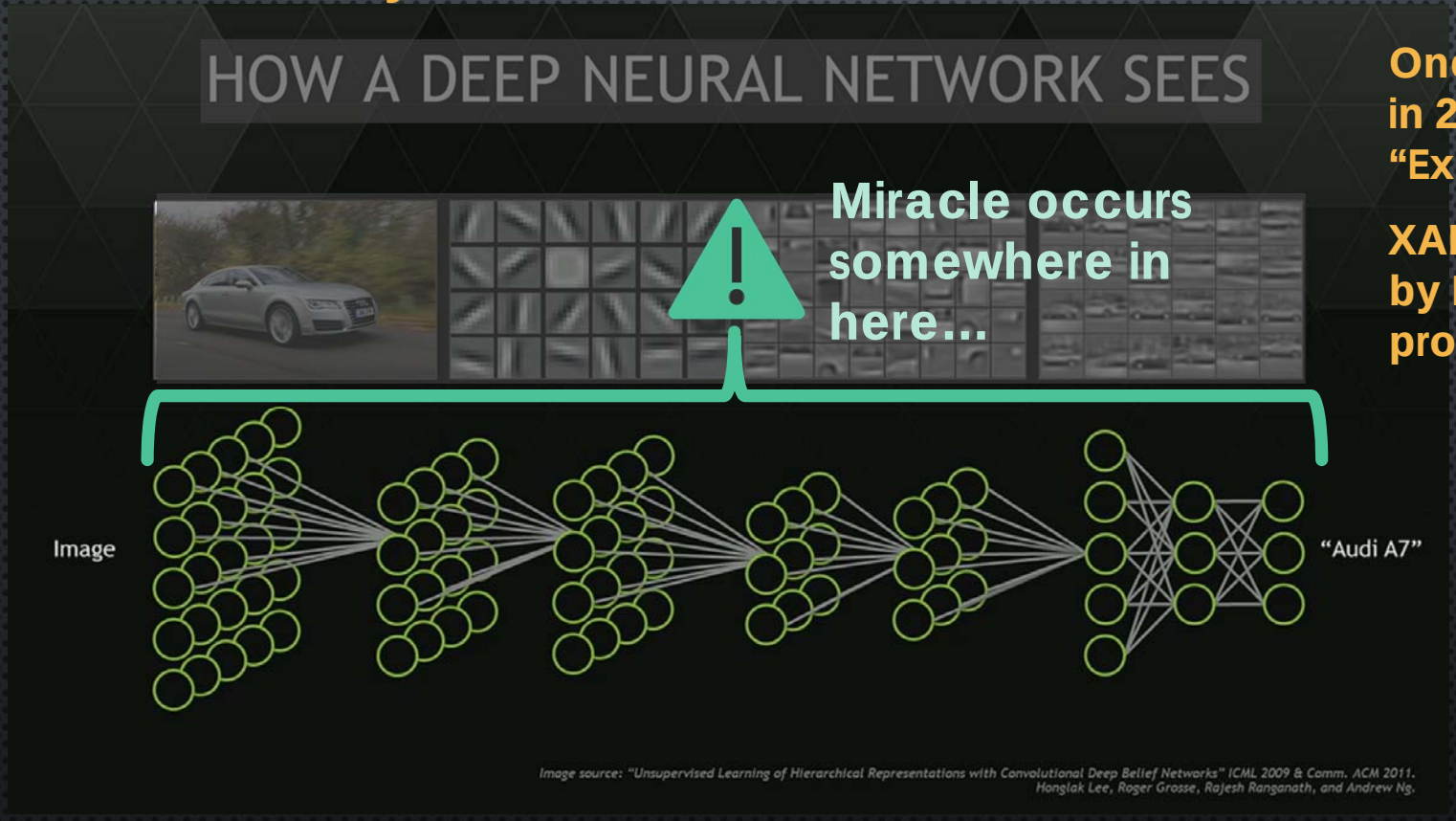
Why is Deep Learning moving so fast now?

- Requires a large amount of digital training data
- Smartphones, web apps, social networks, SaaS business apps, and cloud computing are creating mountains of such data
- Big Data storage, computation, and platforms only recently became cheap and flexible enough
- Because of this Deep Learning is still relatively expensive, but getting cheaper...

Multi-Layer Neural Networks



Multi-Layer Neural Networks

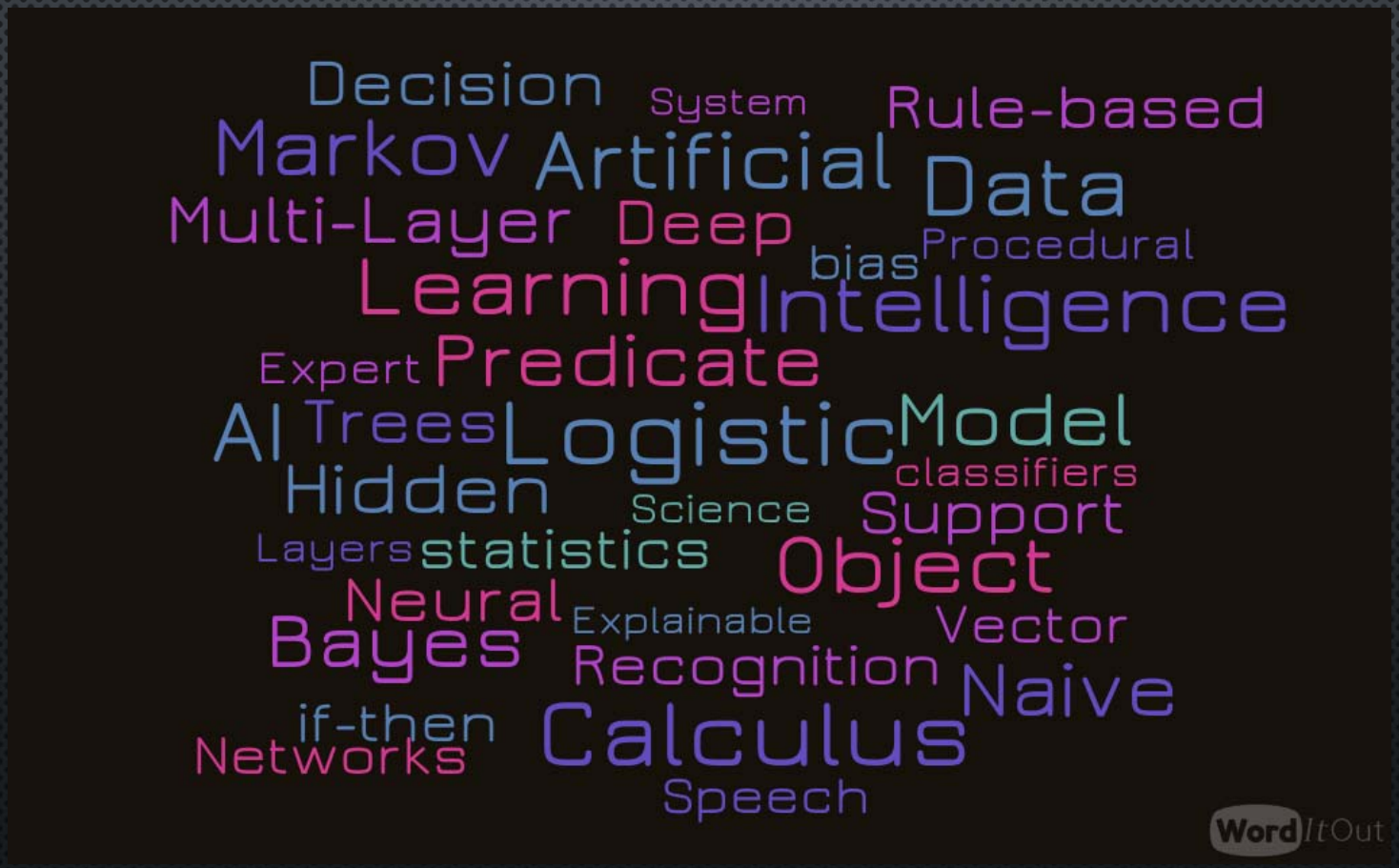


One of the big pushes in 2018 will be for XAI "Explainable AI"

XAI may be required by EU law, under proposed regulations

Source: extremetech.com

This stuff gets complicated in a hurry...



We're in the Golden Age of Data* and want to use it!

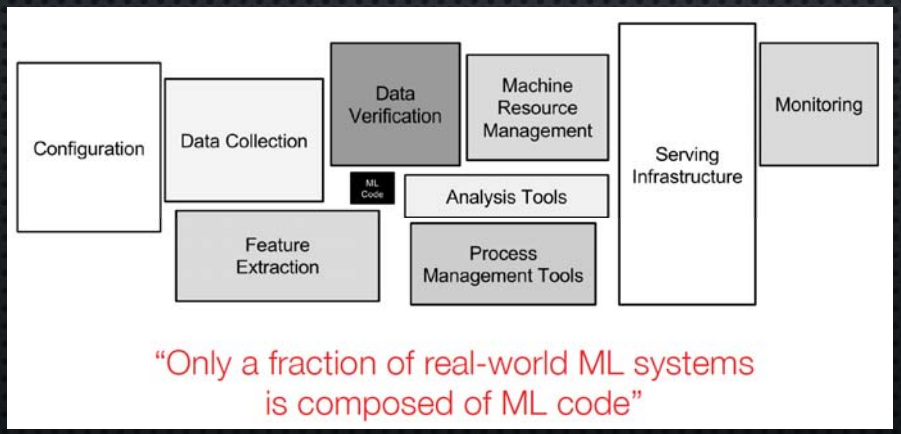
- Incredible advances in image recognition, natural language processing, planning, information indexing and retrieval
- Society-scale impact: autonomous vehicles, personalized medicine, identification of fraud, human trafficking, etc.
- No end in sight for advances in ML, and much research is using ML to build new ML...

* For the best-funded, best-trained engineering teams

Source: Stanford's DAWN White Paper

Good News – Everyone knows Building ML products is too hard…

- Major successes (e.g., AlphaGo, ImageNet require hundreds to thousands of engineers)
- Huge effort in data preparation, model tuning, experimentation, and productionizing
- *Domain experts cannot easily or cheaply build ML products*



Source: Stanford's DAWN White Paper

How to fix the problem?

What if *anyone* with domain expertise could build their own production-quality ML products?

- Without a PhD in machine learning
- Without being an expert in systems
- Without understanding the latest hardware

It's happened before:

- Search
- SQL
- The Web

Source: Stanford's DAWN White Paper

Easy way to do ML?
Just call a Library or API....

Just like an IC chip abstracts hardware complexity, new software libraries, APIs, and cloud platforms abstract software complexities. Both rely on well-defined interfaces.

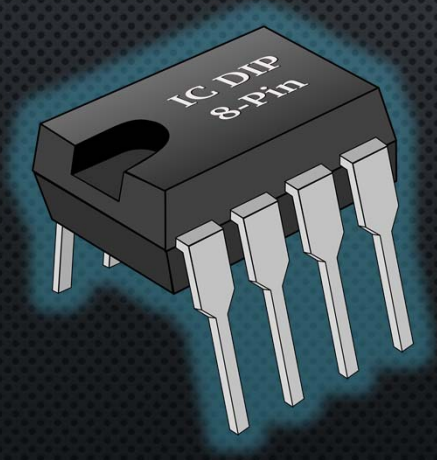


Image Recognition Cloud API

Rekognition: Facial Analysis

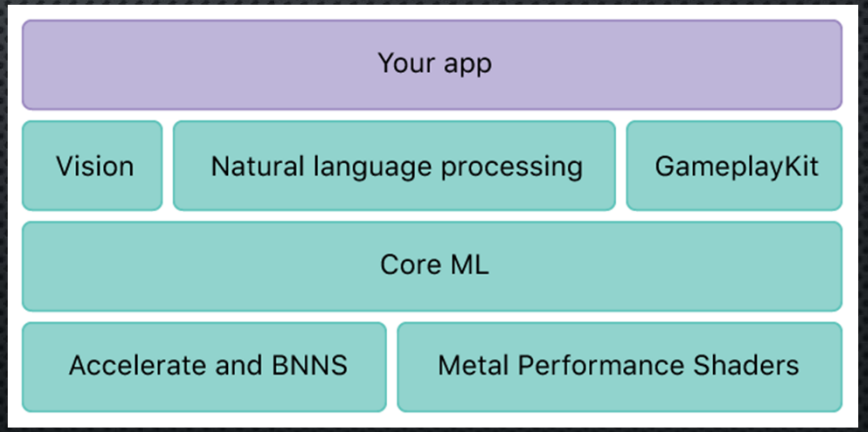
Emotion: calm: 73%
Sunglasses: false (value: 0)
Gender: female (value: 0)
Mouth open wide: 0% (value: 0)
Eye closed: open (value: 0)
Glasses: no glass (value: 0)
Mustache: false (value: 0)
Beard: no (value: 0)

Google TensorFlow Object Detection API

- Open Source software library for Machine Learning
- Identify objects using either Google's computer vision algorithms
  - Convolutional Neural Net (CNN) algorithm for desktops/servers, or
  - Algorithms optimized to run on mobile devices

Apple's Core ML

- Core ML makes AI faster on iPhone, iPad, and Apple Watch
- API covers many kinds of ML operations:
  - Image and face recognition
  - Object detection
  - NLP/NLG (Natural Language Processing/Generation)
- On-device, so more secure and independent of cloud



Amazon Polly API

- Part of the growing AWS AI suite
- Text-to-Speech tool as a cloud service
- Supports 24 languages with multiple voices (usually at least male and female)
- Can stream data to other AWS or other cloud apps via API, or save as audio files.

Microsoft Emotion API

- Part of Microsoft's Azure Cloud Services
- Recognizes Human emotions in images and videos
- API currently recognizes anger, disgust, contempt, happiness, fear, sadness, surprise, and neutrality

Competition...

IMAGE ANALYSIS APIs COMPARISON

	Amazon	Microsoft	Google
Object Detection	✓	✓	✓
Scene Detection	✓	✓	✓
Facial Recognition	✓	✓	✓
Facial Analysis	✓	✓	✓
Inappropriate Content Detection	✓	✓	✓
Celebrity Recognition	✓	✓	✓
Text Recognition	✓	✓	✓
Search for Similar Images on Web	✗	✗	✓
Logo Detection	✗	✗	✓
Landmark Detection	✗	✓	✓
Dominant Colors Detection	✗	✓	✓

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SPEECH AND TEXT PROCESSING APIs COMPARISON

	Amazon	Microsoft	Google
Speech Recognition (Speech into Text)	✓	✓	✓
Text into Speech Conversion	✓	✓	✗
Entities Extraction	✓	✓	✓
Key Phrase Extraction	✓	✓	✓
Language Recognition	100+ languages	120 languages	110+ languages
Topics Extraction	✓	✓	✓
Spell Check	✗	✓	✗
Autocompletion	✗	✓	✗
Voice Verification	✗	✓	✗
Intentions Analysis	✓	✓	✓
Sentiment Analysis	✓	✓	✓
Syntax Analysis	✗	✓	✓
Tagging Parts of Speech	✗	✓	✓
Filtering Inappropriate Content	✗	✓	✓
Low-quality Audio Handling	✓	✗	✓
Translation	6 languages	60+ languages	100+ languages
Chatbot Toolset	✓	✓	✓

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VIDEO ANALYSIS APIs COMPARISON

	Amazon	Microsoft	Google
Object Detection	✓	✓	✓
Scene Detection	✓	✓	✓
Activity Detection	✓	✗	✗
Facial Recognition	✓	✓	✗
Facial and Sentiment Analysis	✓	✓	✗
Inappropriate Content Detection	✓	✓	✓
Celebrity Recognition	✓	✓	✗
Text Recognition	✓	✓	✗
Person Tracking on Videos	✓	✓	✗
Audio Transcription	✗	✓	✗
Speaker Indexing	✗	✓	✗
Keyframe Extraction	✗	✓	✗
Video Translation	✗	9 languages	✗
Keywords Extraction	✗	✓	✗
Annotation	✗	✓	✗
Dominant Colors Detection	✗	✗	✗
Real-Time Analysis	✓	✗	✗

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Everyone's playing – sometimes together...

Example: AWS AI/ML Products (partial)

Amazon Comprehend

Amazon Comprehend is a continuously-trained natural language processing service.

Amazon Lex

Amazon Lex is a service for building conversational interfaces using voice and text. With Lex, the same deep learning engine that powers Alexa is now available to any developer, enabling you to bring sophisticated, natural language chatbots to your new and existing applications.

Amazon Polly

Amazon Polly converts text to lifelike speech in the cloud. You can download the generated audio from the console, or stream it directly to your applications and services through the API.

Amazon Machine Learning

Amazon Machine Learning makes it easy for developers of all skill levels to use machine learning (ML) technology. Amazon Machine Learning is a managed service for building ML models and generating predictions that enable the development of robust, scalable smart applications.

Amazon SageMaker

Build, train, and deploy machine learning models at scale

The quickest and easiest way to get ML models from idea to production.

AWS DeepLens

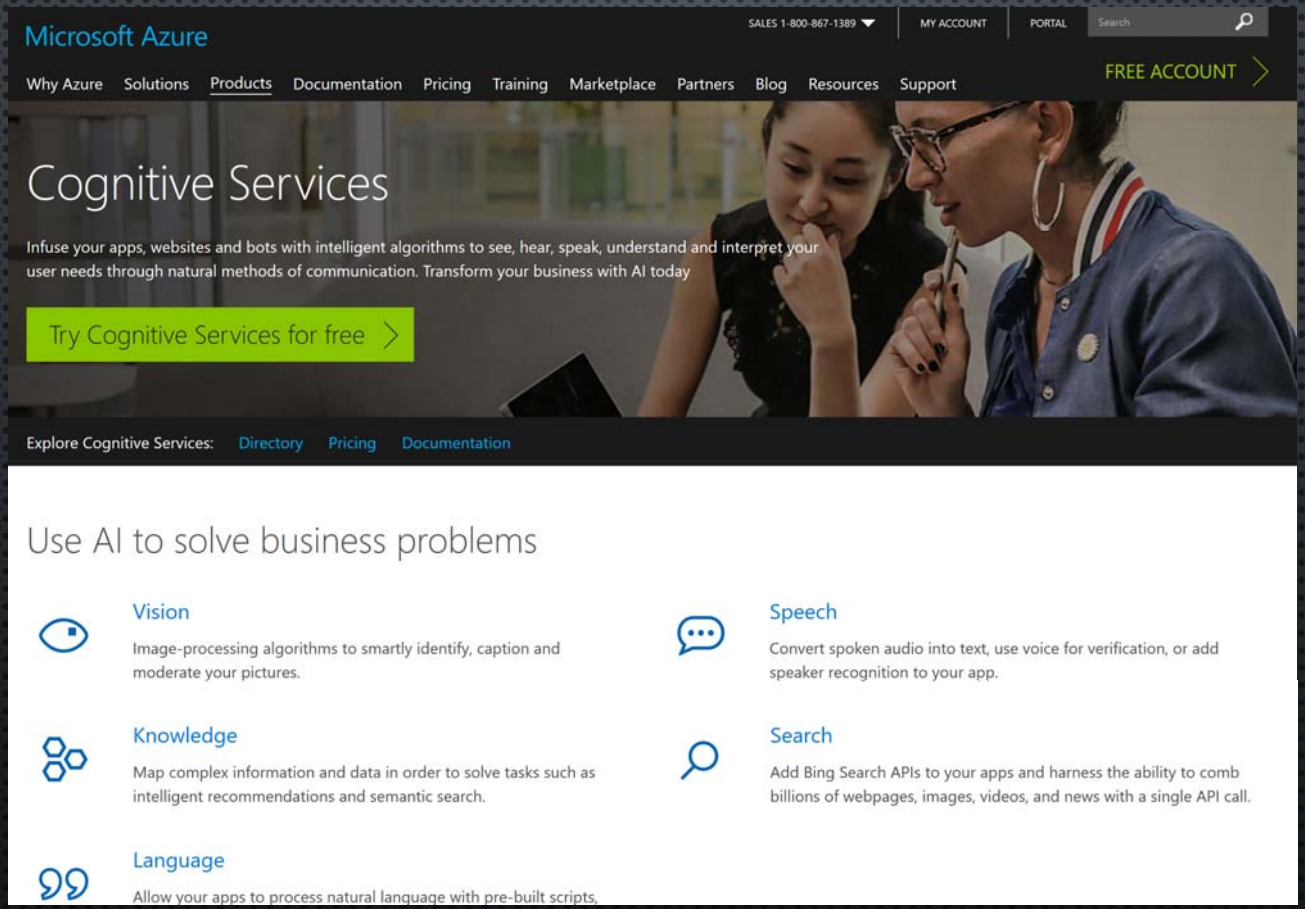
Deep learning-enabled video camera

Amazon Rekognition

Deep learning-based visual analysis service

Search, verify, and organize millions of images and videos

Example: MS Azure AI/ML Products



What's next?

- Watch for the rise of I.A. (Intelligence Augmentation) as a more valuable interim step to true AI
- AI and ML tools are likely to drive a resurgence of flow-based programming, since they are inherently data flow driven
- Continued development of voice, gestural, and touch user interfaces for all kinds of devices
- The need for contextual knowledge and understanding will become ever more obvious – tools like Cycorp's Cyc may be required to get to the next level
- Artificial Intelligence may finally approach Natural Stupidity

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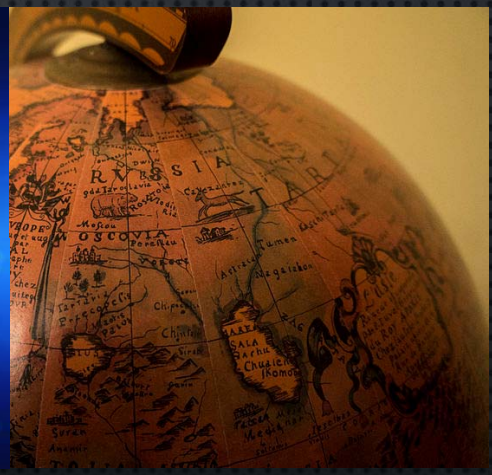
Software is eating the world.

— Mark Andreesen, in the Wall Street Journal, 2011 ”

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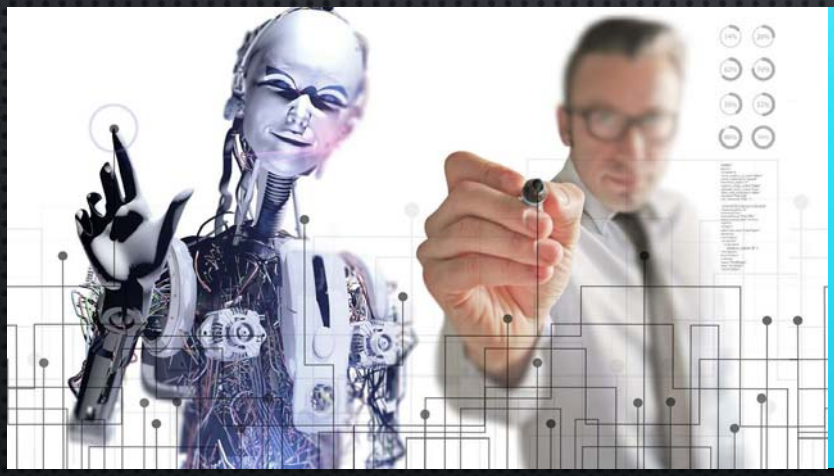
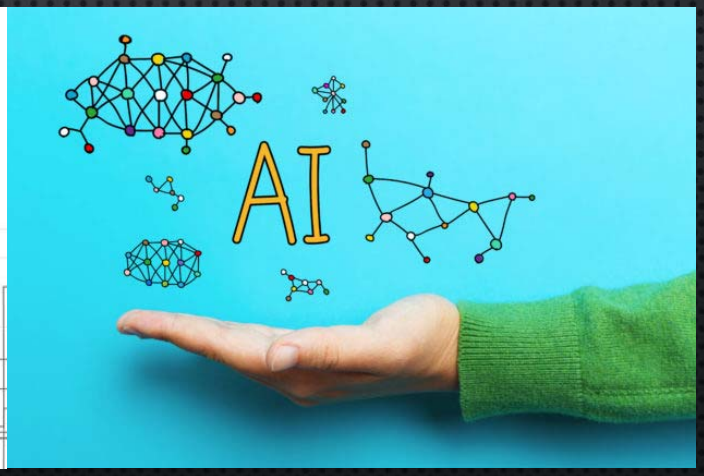
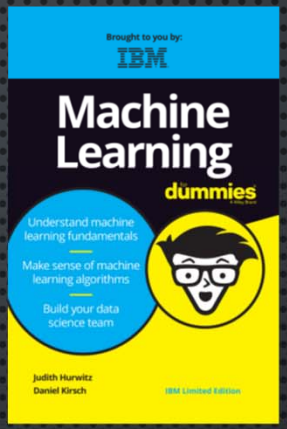
Every company is a technology company.

— Peter Sondergaard, Gartner Symposium Keynote, 2013 ”





Resources



- http://nyti.ms/2Dxasrq "Can AI Be Taught to Explain Itself?"
- http://bit.ly/2E7ilF6 "AWS AI and ML Services"
- https://ibm.co/2Amc2vl "IBM Book (PDF): Machine Learning for Dummies"
- http://bit.ly/2E6xeaL "Machine Learning for Humans"
- http://bit.ly/2E60KgL "Comparing Machine Learning as a Service: Amazon, Microsoft Azure, Google Cloud AI"
- http://bit.ly/2E8sqlg "Memristors power quick-learning neural network"
- http://dawn.cs.stanford.edu/ Stanford InfoLab DAWN Project Page