

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

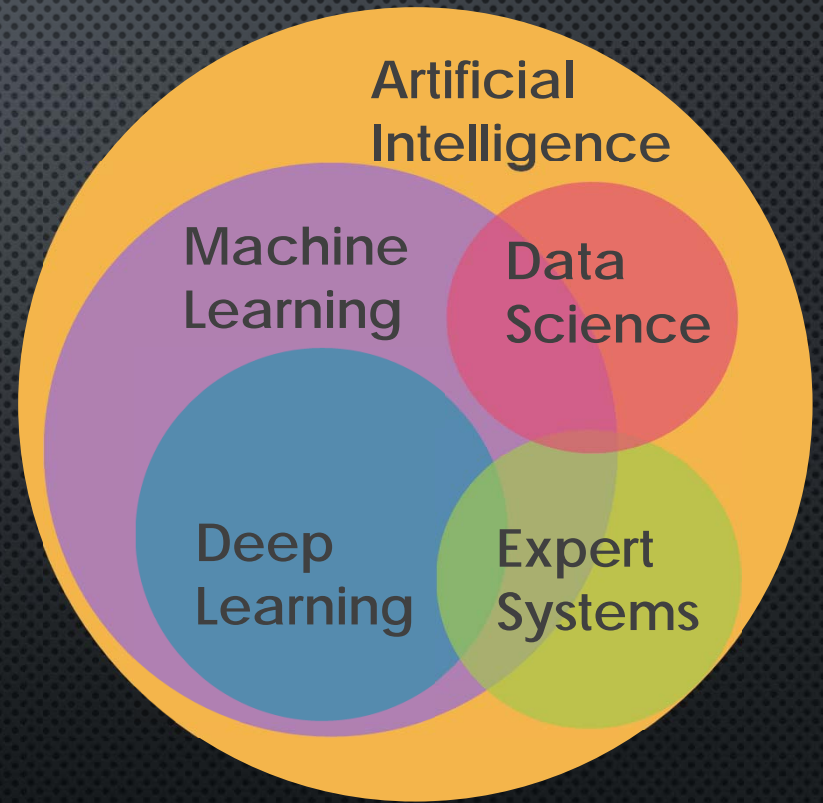
AI & ML really are improving

- 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

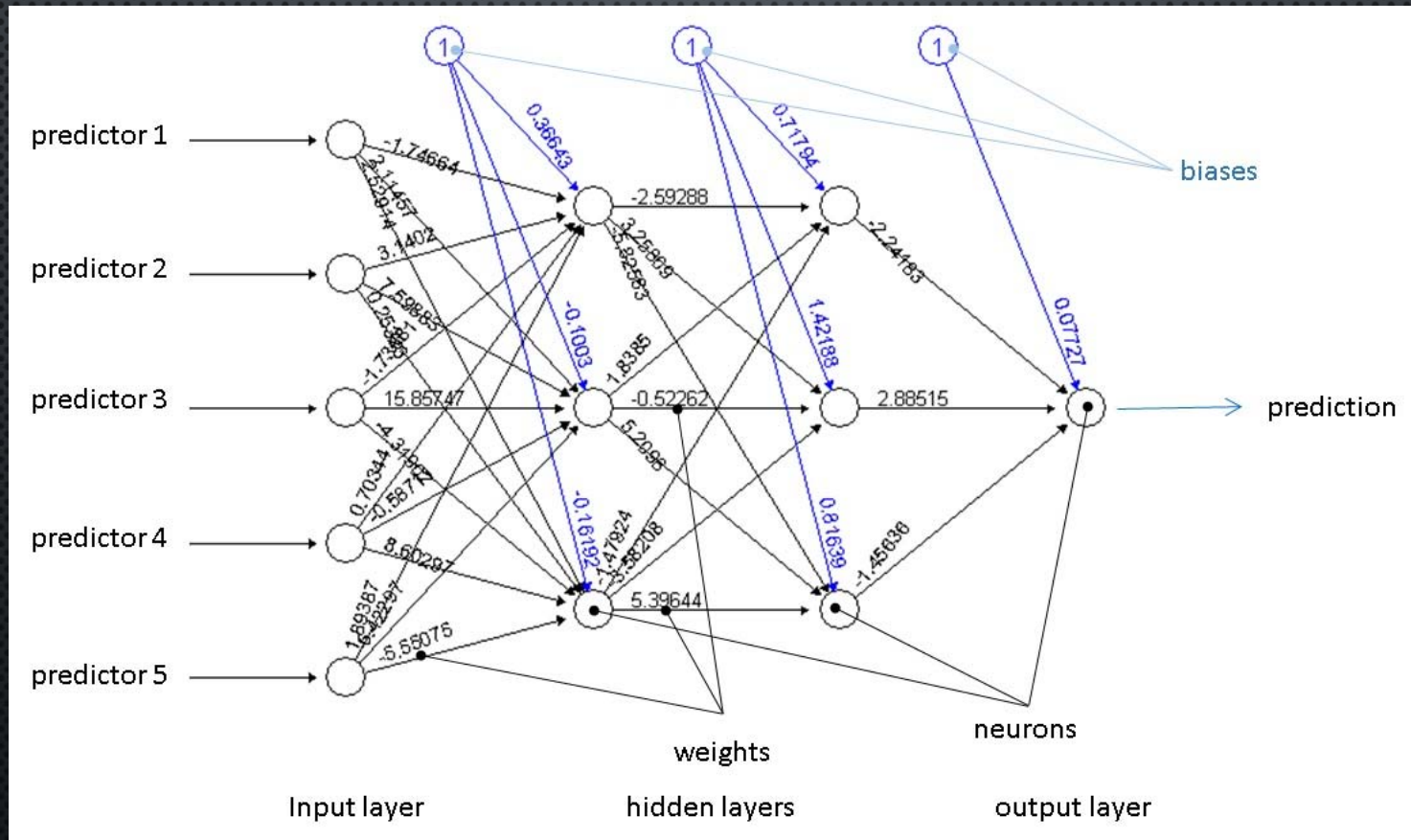
	Machine Learning	Deep Learning
Training Dataset	Small	Large
Choose your own features	Yes	No, it learns them
No. of classifiers available	Many	Few
Training Time	Short	Long
Compute, RAM, & Storage cost	Low	High

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

HOW A DEEP NEURAL NETWORK SEES

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

XAI may be required by EU law, under proposed regulations

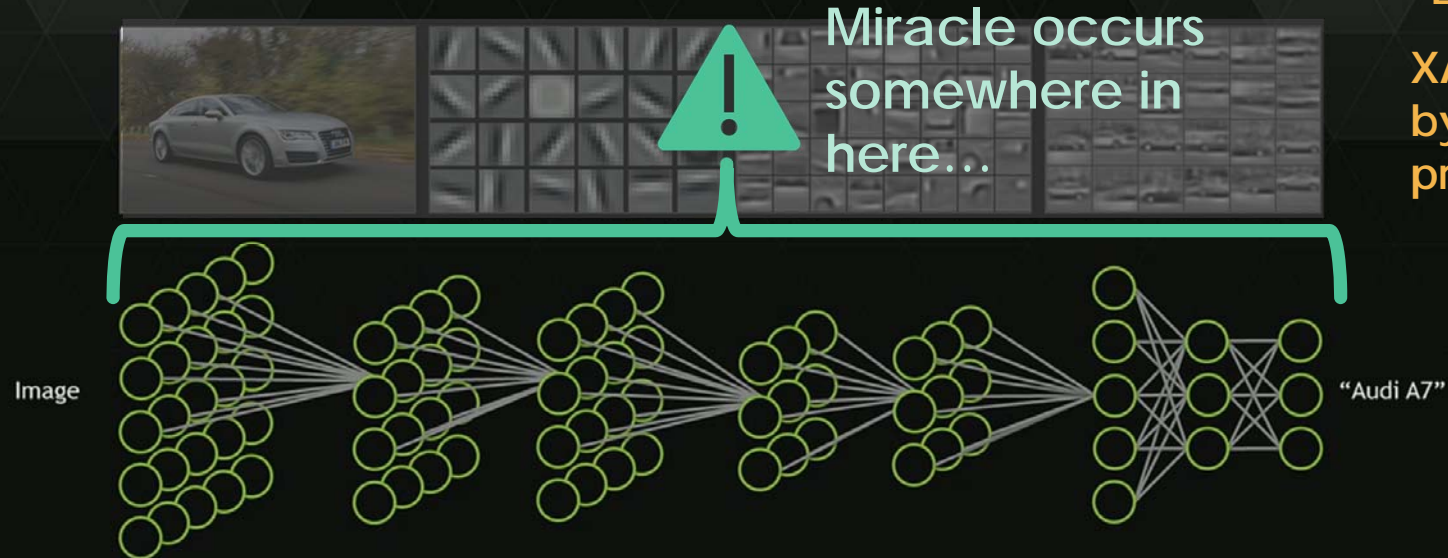
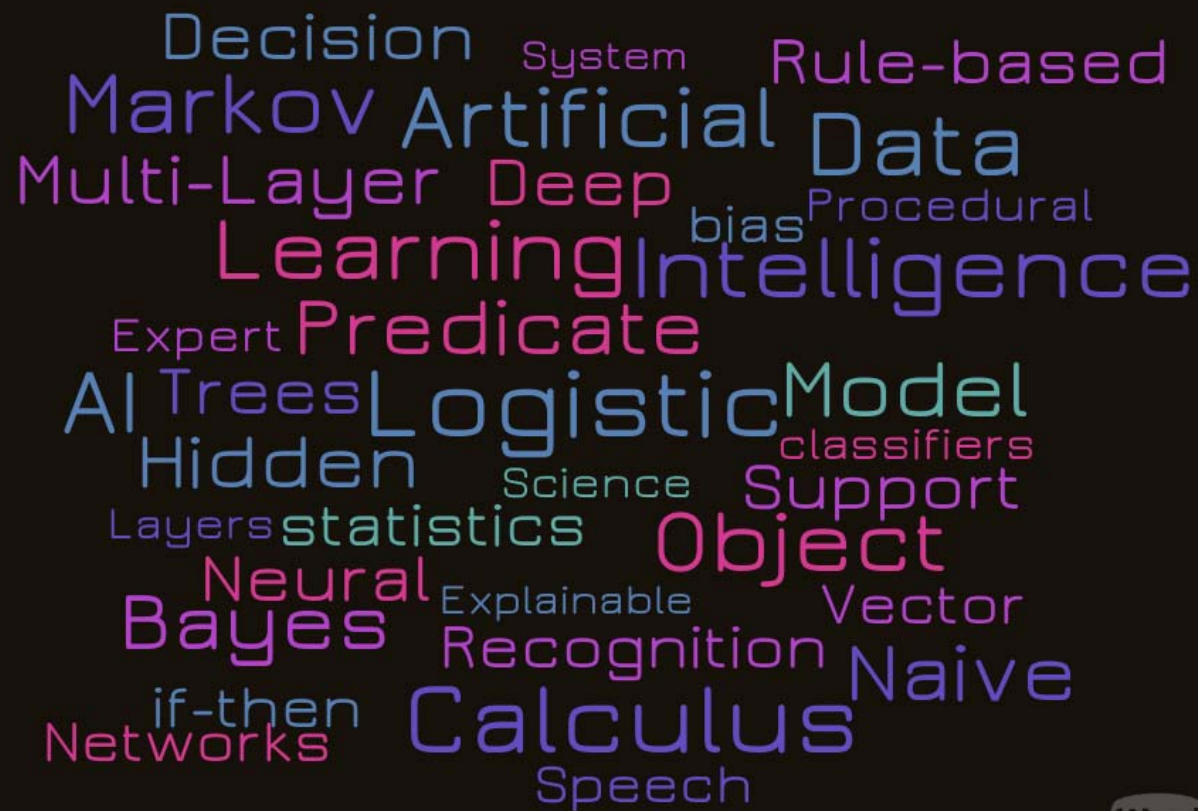


Image source: "Unsupervised Learning of Hierarchical Representations with Convolutional Deep Belief Networks" ICML 2009 & Comm. ACM 2011. Honglak Lee, Roger Grosse, Rajesh Ranganath, and Andrew Ng.

Source: extremetech.com

This stuff gets complicated in a hurry...



A word cloud on a dark background featuring various terms related to artificial intelligence and machine learning. The words are arranged in a dense, overlapping manner, with some appearing larger than others. The terms include: Decision, System, Rule-based, Markov, Artificial, Data, Multi-Layer, Deep, bias, Procedural, Learning, Intelligence, Expert, Predicate, AI, Trees, Logistic, Model, Hidden, Science, classifiers, Support, Layers, statistics, Object, Neural, Explainable, Vector, Bayes, Recognition, Naive, if-then, Calculus, Networks, and Speech.

WordItOut

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

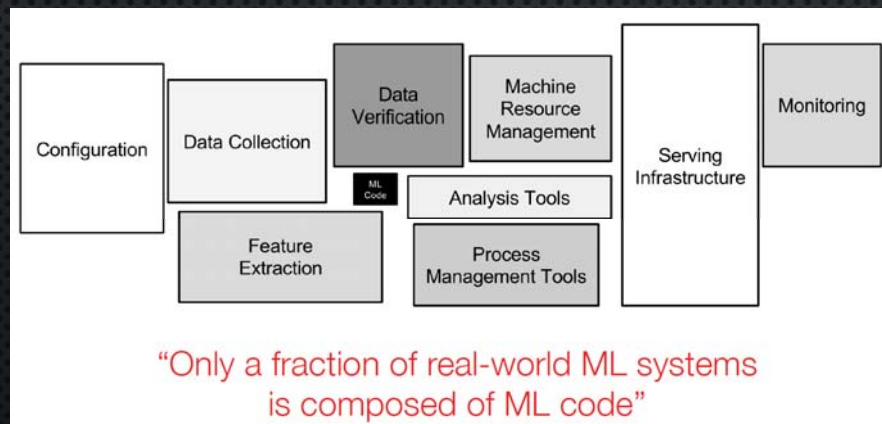
- Incredible advances in image recognition, natural language processing, planning, information indexing and retrieval
- Society-scale impact: autonomous vehicles, personalized medicine, identification of fraud, human trafficking, etc.
- No end in sight for advances in ML, and much research is using ML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

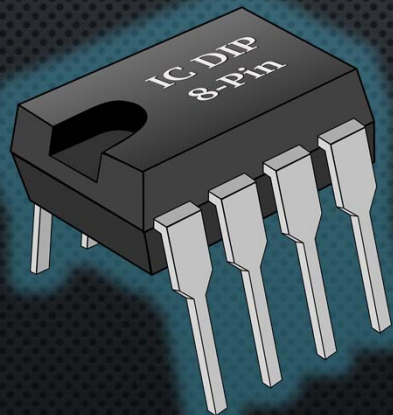


Image
Recognition
Cloud API

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)

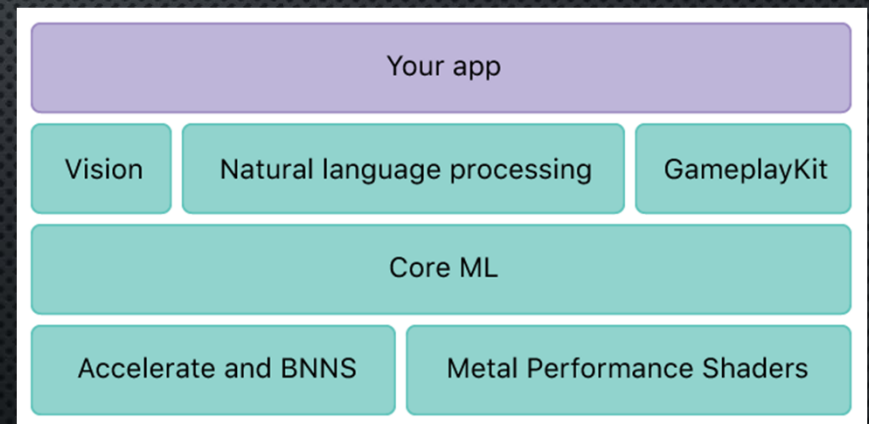
Google TensorFlow Object Detection API

- 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

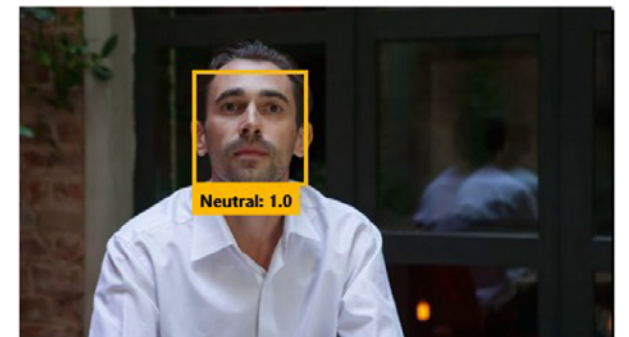


Amazon Polly API

- 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	✗	✓	✓

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	✓	✓	✓

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	✓	✗	✗

Everyone's playing – sometimes together...



IBM Watson Machine Learning

amazon web services & Microsoft



Introduces

GLUON



Facebook AI Research



Windows Azure

MACHINE LEARNING



Google

Machine Learning

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

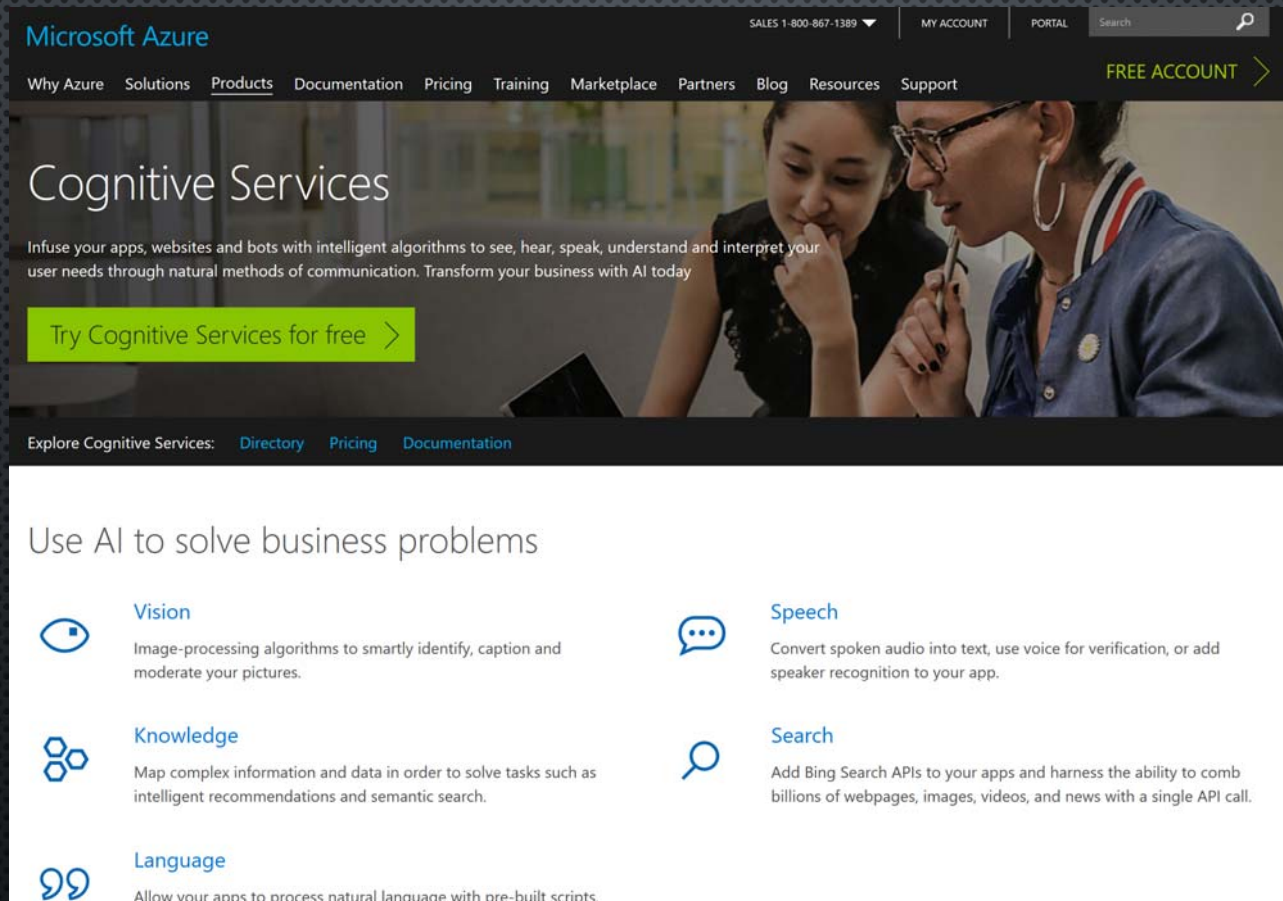
Deep learning-enabled video camera

Amazon Rekognition

Deep learning-based visual analysis service

Search, verify, and organize millions of images and videos

Example: MS Azure AI/ML Products



The screenshot shows the Microsoft Azure Cognitive Services landing page. At the top, the Microsoft Azure logo is on the left, and navigation links for 'SALES 1-800-867-1389', 'MY ACCOUNT', 'PORTAL', and a search bar are on the right. Below this is a secondary navigation bar with links: 'Why Azure', 'Solutions', 'Products' (highlighted), 'Documentation', 'Pricing', 'Training', 'Marketplace', 'Partners', 'Blog', 'Resources', and 'Support'. A 'FREE ACCOUNT' button with a right arrow is on the far right of this bar. The main hero section features a background image of two women looking at a tablet. The text 'Cognitive Services' is prominently displayed, followed by a descriptive paragraph: 'Infuse your apps, websites and bots with intelligent algorithms to see, hear, speak, understand and interpret your user needs through natural methods of communication. Transform your business with AI today'. A green button with the text 'Try Cognitive Services for free' and a right arrow is positioned below the text. A dark bar below the hero section contains the text 'Explore Cognitive Services:' followed by links for 'Directory', 'Pricing', and 'Documentation'. The lower section, titled 'Use AI to solve business problems', lists five services in a grid: Vision, Knowledge, Language, Speech, and Search, each with an icon and a brief description.

Microsoft Azure

SALES 1-800-867-1389 ▼ MY ACCOUNT PORTAL Search

Why Azure Solutions Products Documentation Pricing Training Marketplace Partners Blog Resources Support

FREE ACCOUNT >


Cognitive Services

Infuse your apps, websites and bots with intelligent algorithms to see, hear, speak, understand and interpret your user needs through natural methods of communication. Transform your business with AI today

Try Cognitive Services for free >


Explore Cognitive Services: [Directory](#) [Pricing](#) [Documentation](#)

Use AI to solve business problems




Vision

Image-processing algorithms to smartly identify, caption and moderate your pictures.




Speech

Convert spoken audio into text, use voice for verification, or add speaker recognition to your app.




Knowledge

Map complex information and data in order to solve tasks such as intelligent recommendations and semantic search.



Search

Add Bing Search APIs to your apps and harness the ability to comb billions of webpages, images, videos, and news with a single API call.



Language

Allow your apps to process natural language with pre-built scripts.

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 ANDREESSEN, IN THE WALL STREET JOURNAL, 2011

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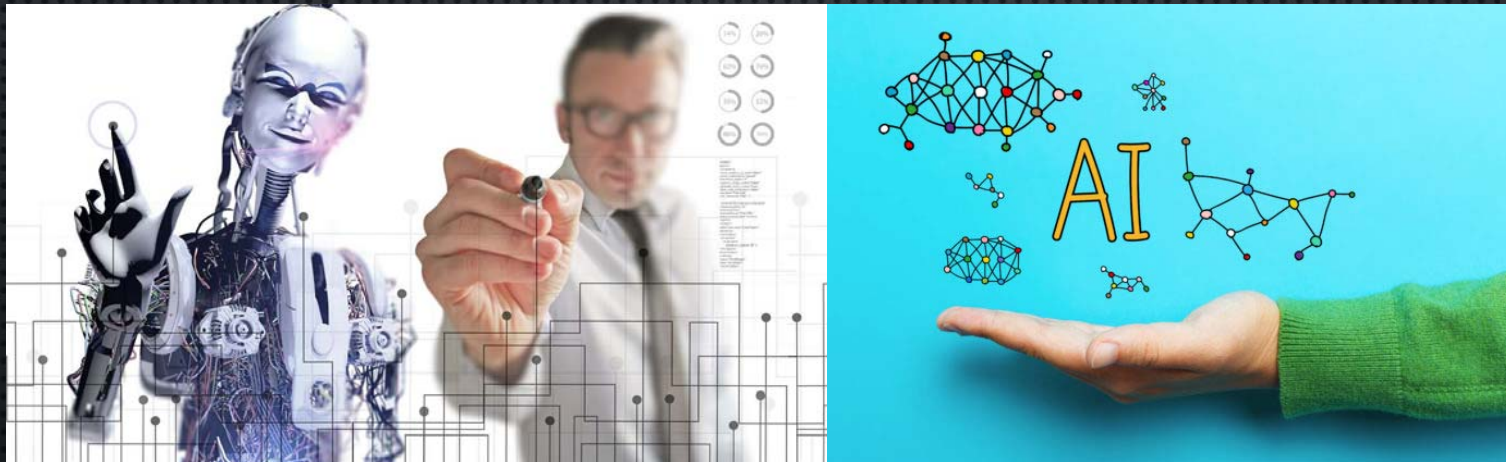


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Every company is a technology company.

— PETER SONDERGAARD, GARTNER SYMPOSIUM KEYNOTE, 2013

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Resources

- <http://nyti.ms/2Dxasrq> "Can AI Be Taught to Explain Itself?"
- <http://bit.ly/2E7iIF6> "AWS AI and ML Services"
- <https://ibm.co/2Amc2vI> "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

