



Robot backflip

<https://youtu.be/9IXgVmLxVtQ>



AlphaGo Zero

<https://youtu.be/9IXgVmLxVtQ>



Agent learn to Walk

<https://youtu.be/9IXgVmLxVtQ>



Programme

Section 1:	Overview of Artificial Intelligence (45 mins)
Section 2:	Different types of learning (Machine Learning, Deep Learning, Reinforcement learning) (45 mins)
Section 3:	Technology Hands-on (30 mins)
Section 4:	Use cases sharing (30 mins)
	Lunch Break
Section 5:	AI Services (15 mins)
Section 6:	Hands-on Training Custom Computer Vision (1.5 hour)
Section 7:	Hands-on building a telegram chatbots with a QnA Knowledge base (1.5 hour)



Resources

- Goto <http://bit.ly/2LHdQad>
 - Download pdf (this presentation deck and activity sheets)
 - Download sample scripts
 - Links to other resources. Save you the typing!
- Goto <http://bit.ly/2RCLYEV>
 - Training and testing images for activity. Remember to unzip!
 - You will need Telegram. Download and install on your phone/laptop. <https://desktop.telegram.org/>



Introduction of trainer



Name
Seow Khee Wei

Telegram
@kwseow

Email
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Bachelor
BEng major in computer
engineering
(Nanyang Technological
University)



Master
MBA
University of Melbourne



Post Graduate Certificate
Network Engineering
(NTU)



Nano Degree
Artificial Intelligence



What is Artificial Intelligence?

DATA MINING



ARTIFICIAL
INTELLIGENCE

3D RENDERING PERSPECTIVE DESIGN

LAYOUT DESIGN

PATTERN
RECOGNITION



PROBLEM
SOLVING



MACHINE
LEARNING

Google

ALGORITHM



NEURAL
NETWORKS

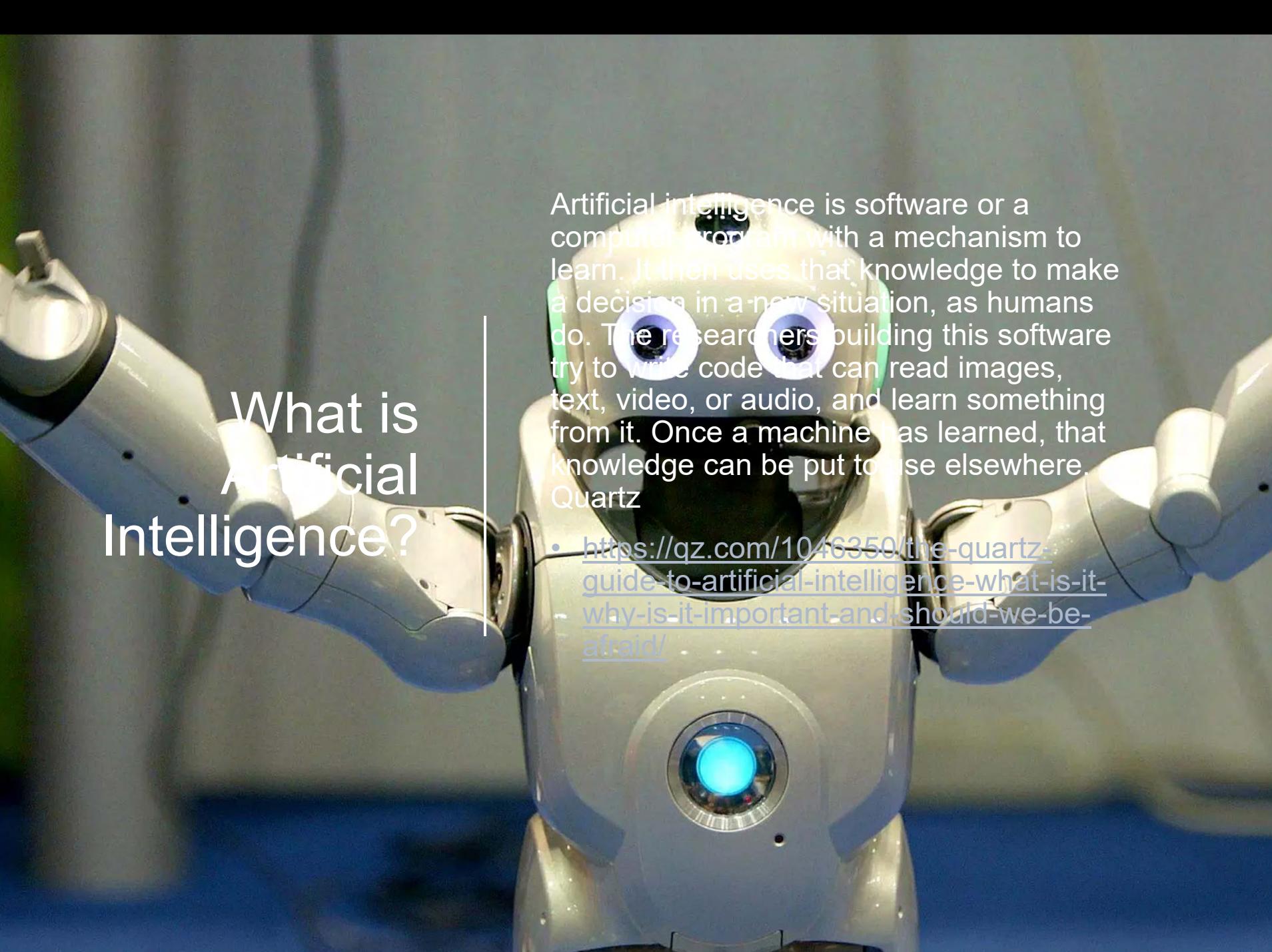


Interior Design

Exterior Design

D Level

INTERIOR DESIGN
EXTERIOR DESIGN
SOCIAL NETWORK
ANALYSIS
DEVELOPMENT
GLOBAL DEVELOPMENT
INNOVATION
TEAMWORK



What is Artificial Intelligence?

Artificial intelligence is software or a computer program with a mechanism to learn. It then uses that knowledge to make a decision in a new situation, as humans do. The researchers building this software try to write code that can read images, text, video, or audio, and learn something from it. Once a machine has learned, that knowledge can be put to use elsewhere.

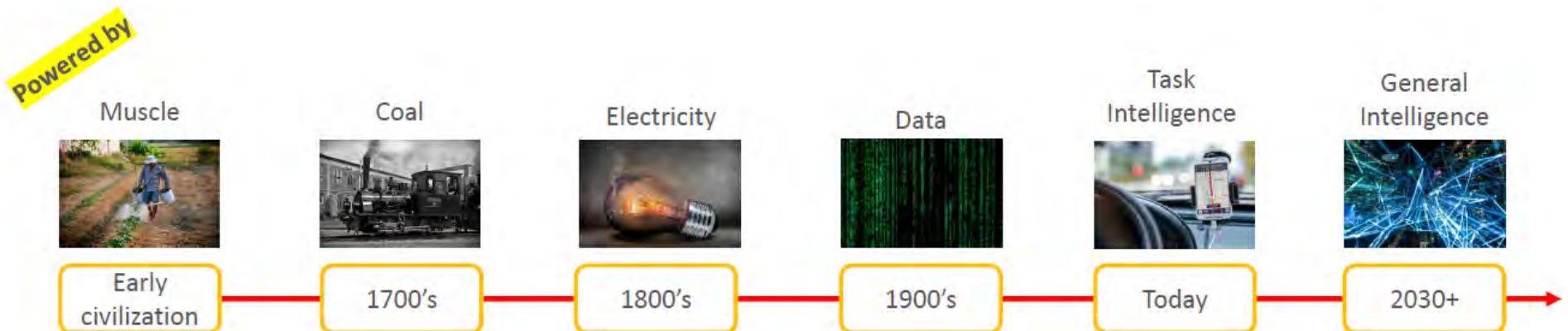
Quartz

- <https://qz.com/1046350/the-quartz-guide-to-artificial-intelligence-what-is-it-why-is-it-important-and-should-we-be-frightened/>



AI is the new electricity

"About 100 years ago, electricity transformed every major industry. AI has advanced to the point where it has the power to transform" every major sector in coming years.— Andrew Ng





DATA IS CRITICAL TO ARTIFICIAL INTELLIGENCE

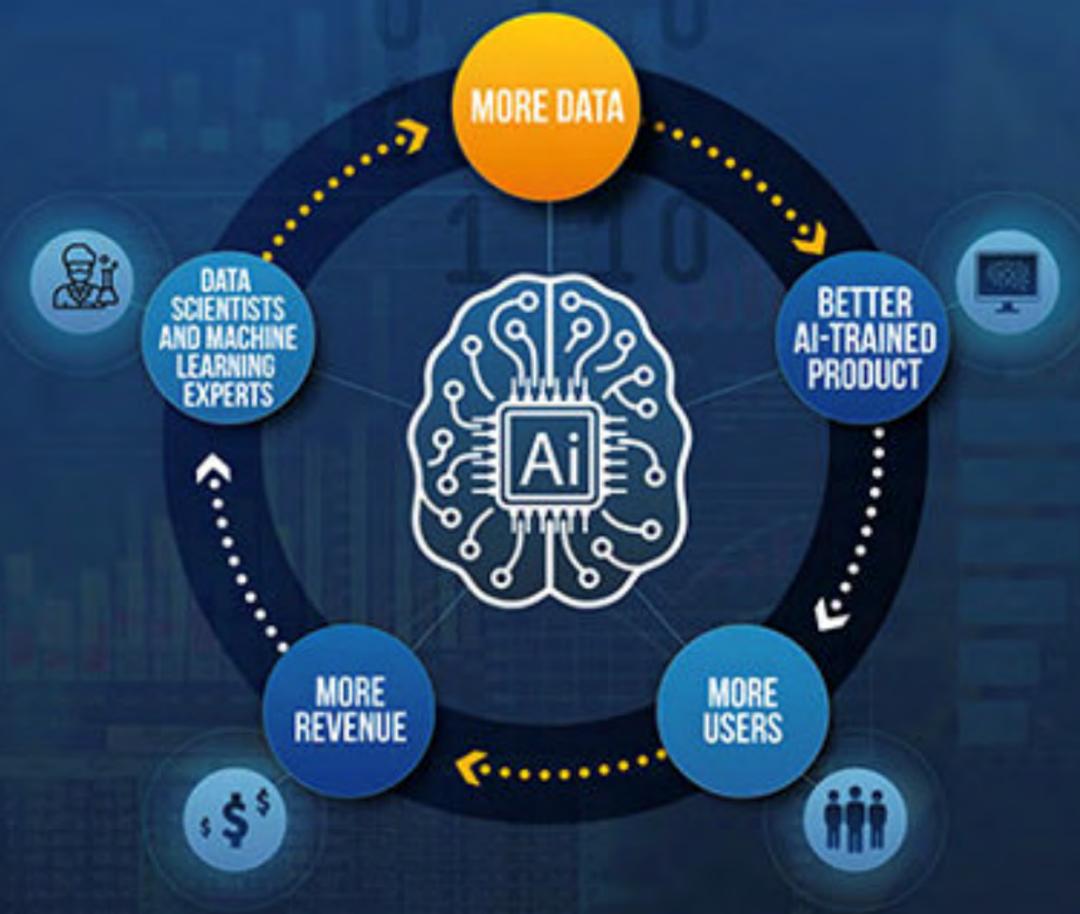
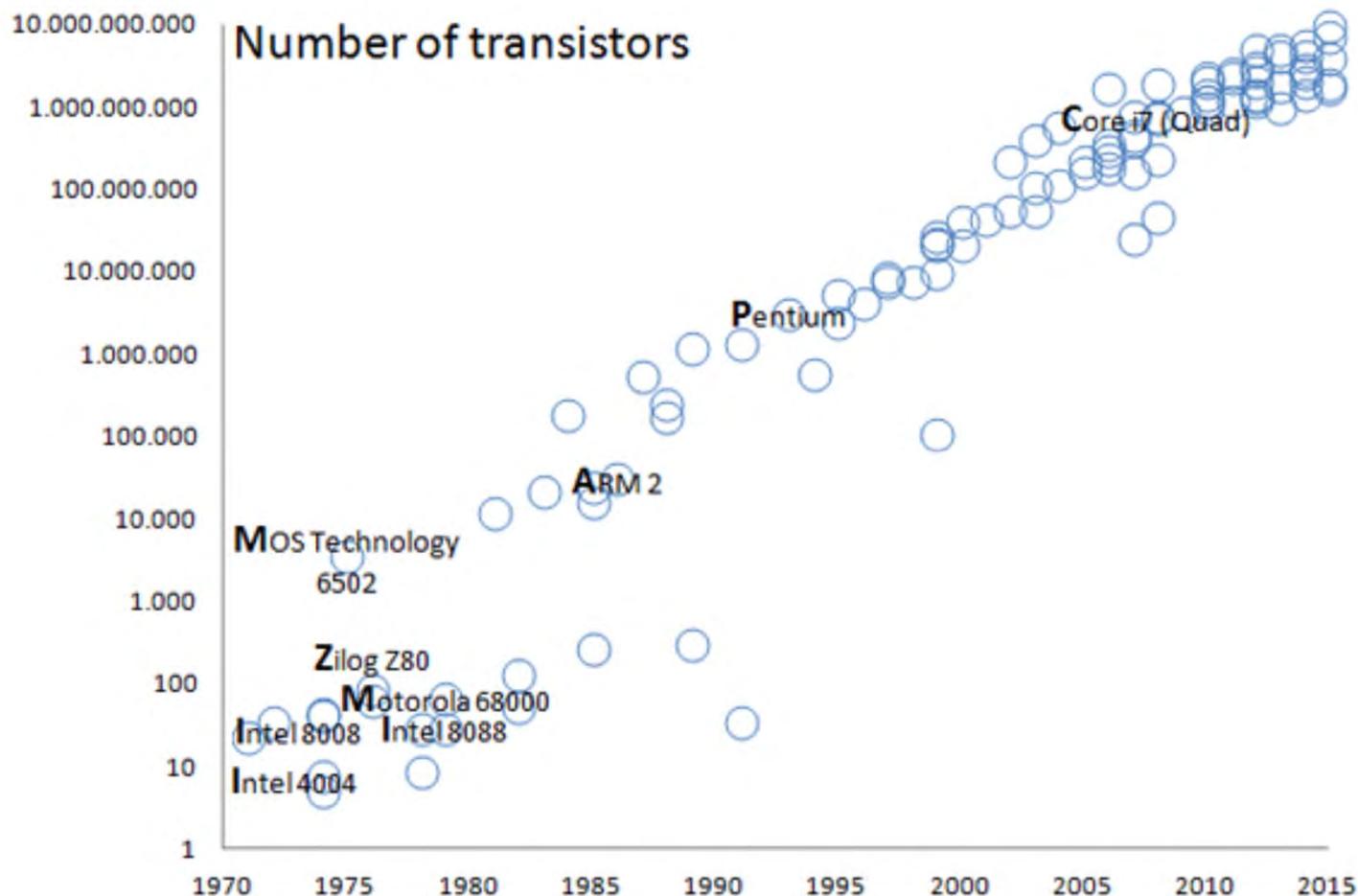


Image source: Kai-Fu Lee, Sinovation Ventures



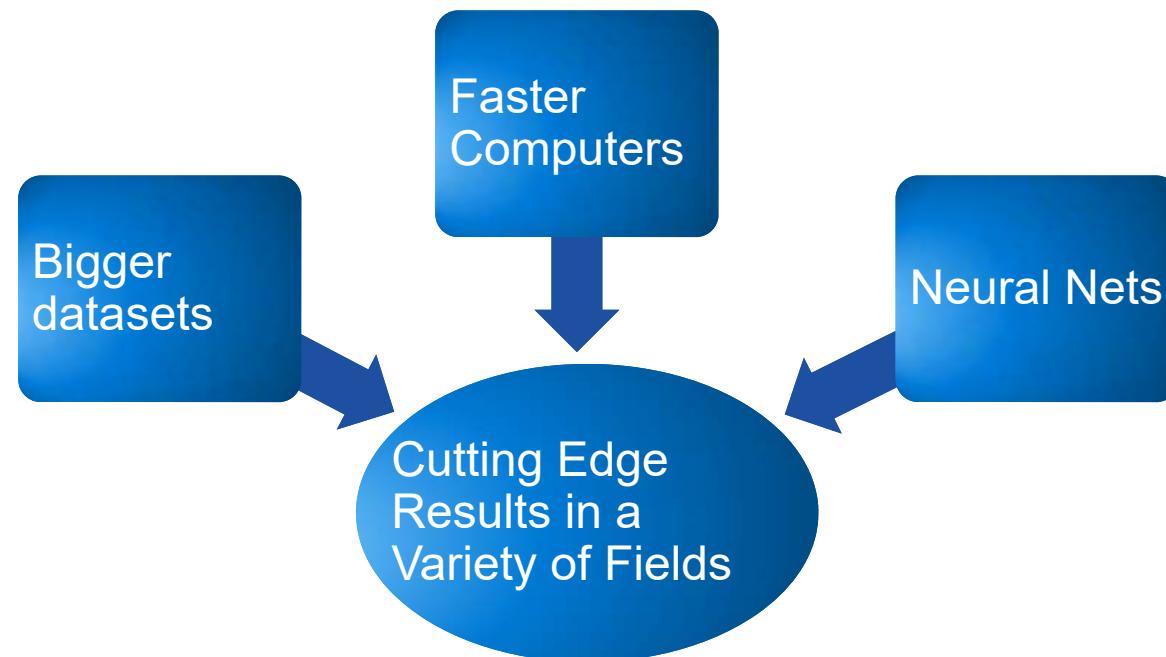
Moore's Law





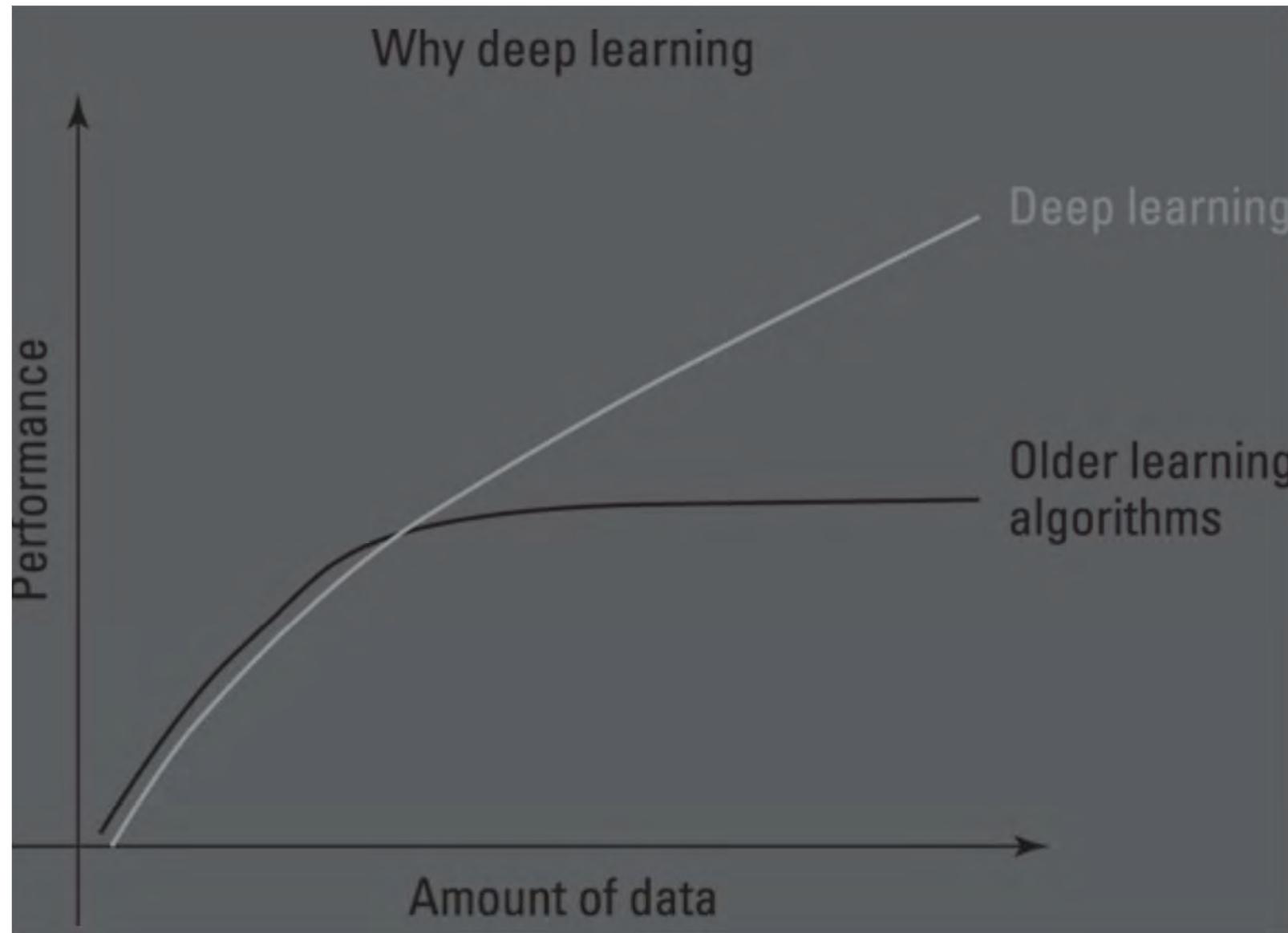
AI Hardware

Faster hardware is one of the key areas driving the modern era of AI.





More Data = More Intelligence





THE FOURTH INDUSTRIAL REVOLUTION

FIRST INDUSTRIAL REVOLUTION



WATER AND STEAM

FROM THE 18TH
TO 19TH CENTURIES
(in Europe and America)

Water and steam power

SECOND INDUSTRIAL REVOLUTION



ELECTRICITY

FROM 1870 TO 1914

Mass production
Assembly line

THIRD INDUSTRIAL REVOLUTION

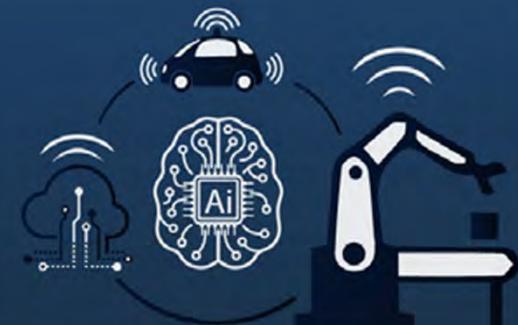


DIGITAL REVOLUTION

1980s - ONGOING

Automation
Personal computer
Internet

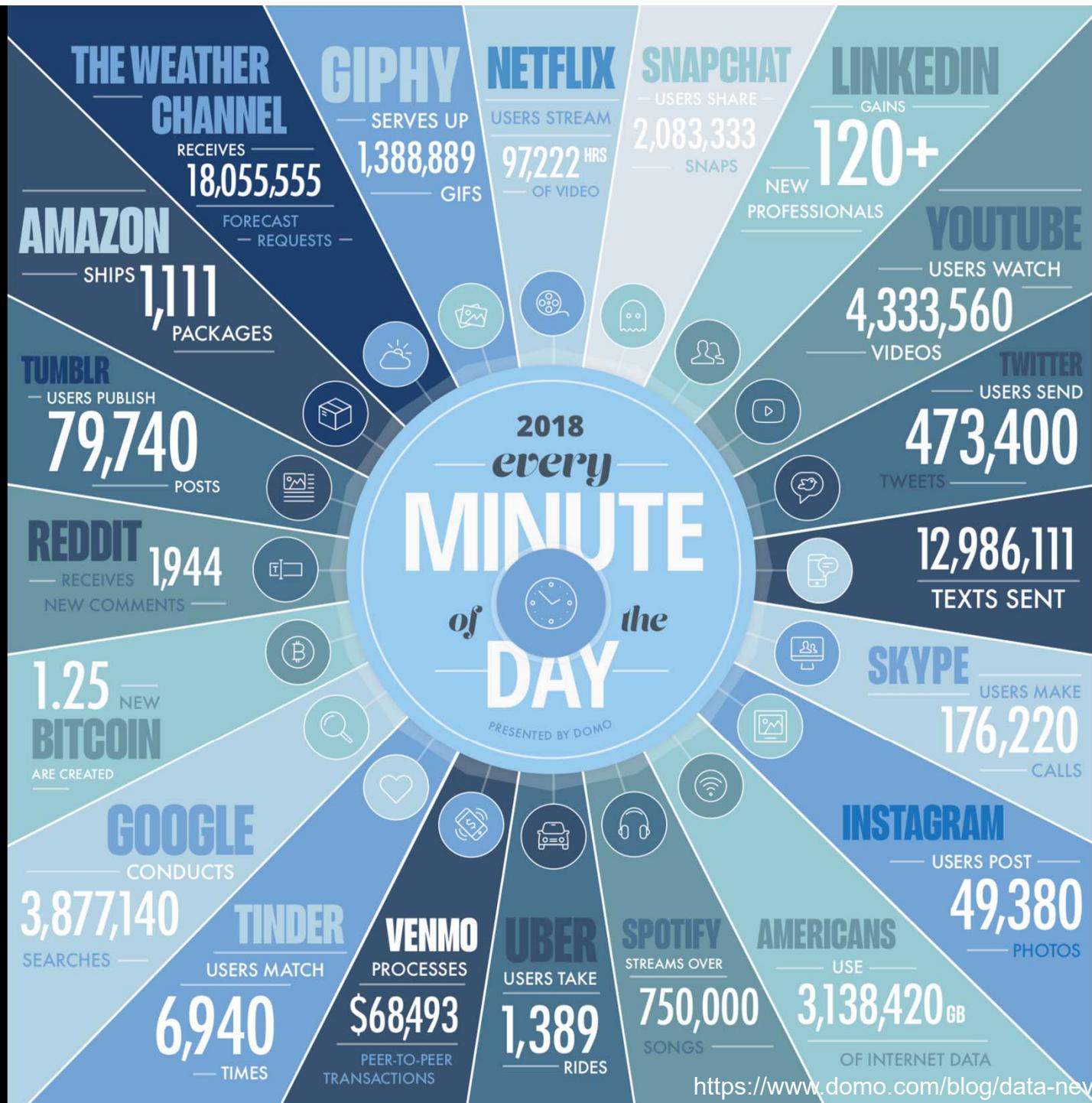
FOURTH INDUSTRIAL REVOLUTION



TECHNOLOGY EMBEDDED WITHIN SOCIETIES

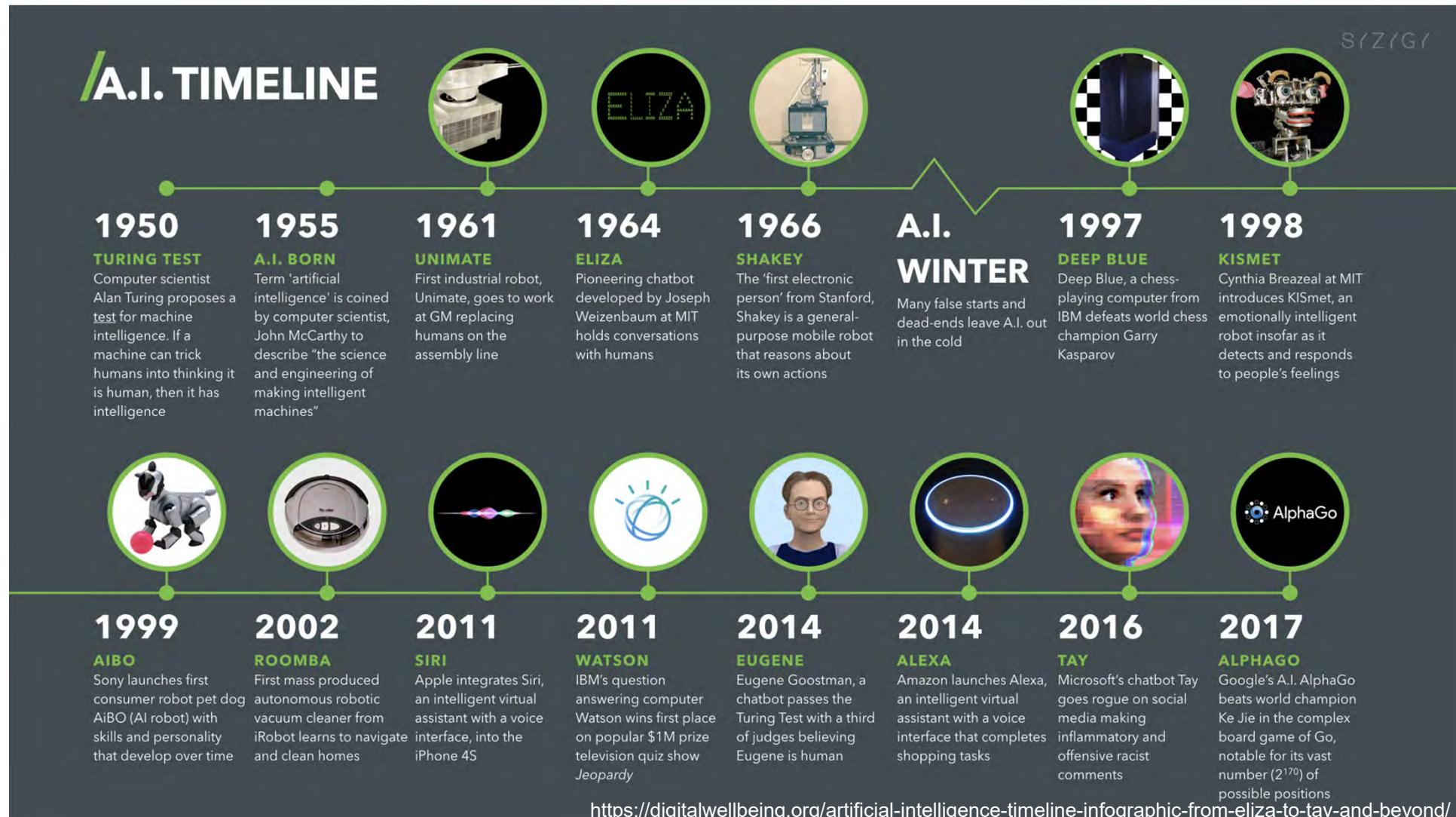
TODAY AND TOMORROW

Artificial intelligence, robotics,
nanotechnology, quantum
computing, biotechnology,
The Internet of Things, 3D printing
and autonomous vehicles.



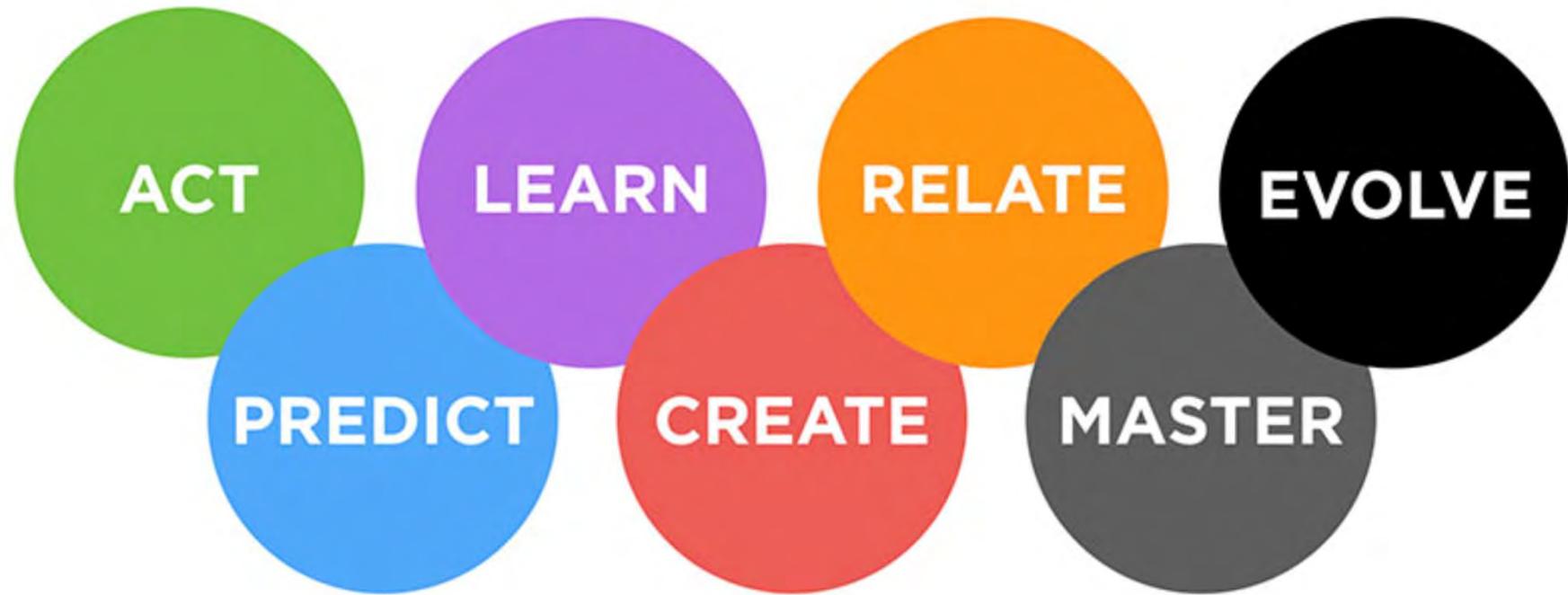


History of AI





MACHINE INTELLIGENCE CONTINUUM



The MIC represents a continuum from simple, scripted automation to superhuman intelligence and highlights the functional capabilities of different levels of machine intelligence.



Systems that Acts





Systems that Predicts

Hillary Clinton has an
85% chance to win.

Last updated Tuesday, November 8 at 10:20 PM ET

CHANCE OF WINNING



85%
Hillary Clinton



15%
Donald J. Trump



Systems that Learns





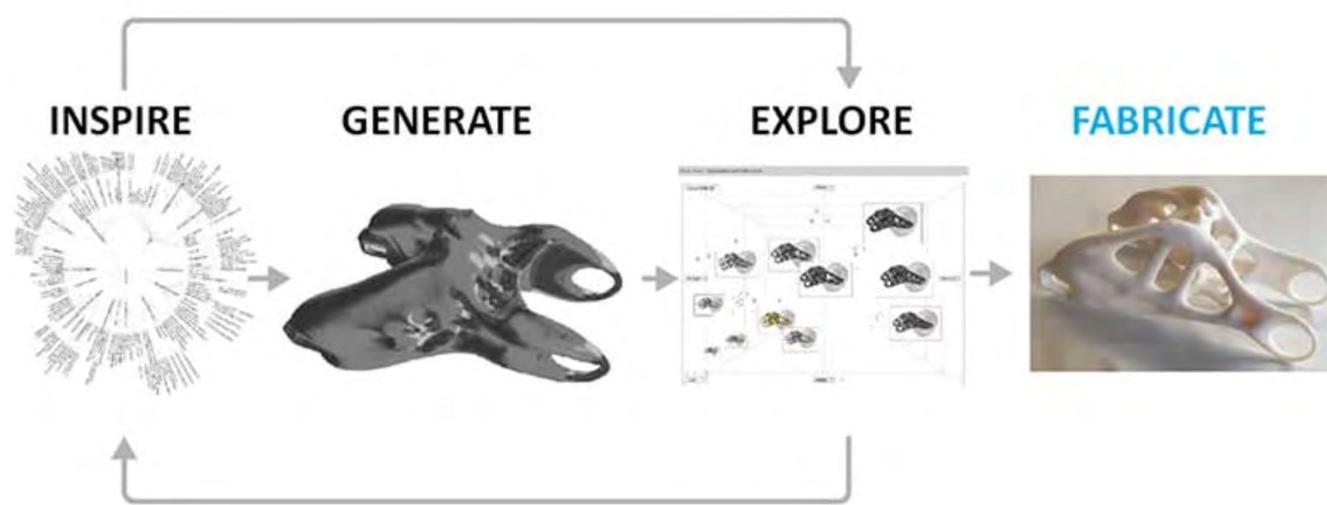
Systems that Create



Generated story about image
Model: Romantic Novel's

"He was a shirtless man in the back of his mind, and I let out a curse as he leaned over to kiss me on the shoulder.

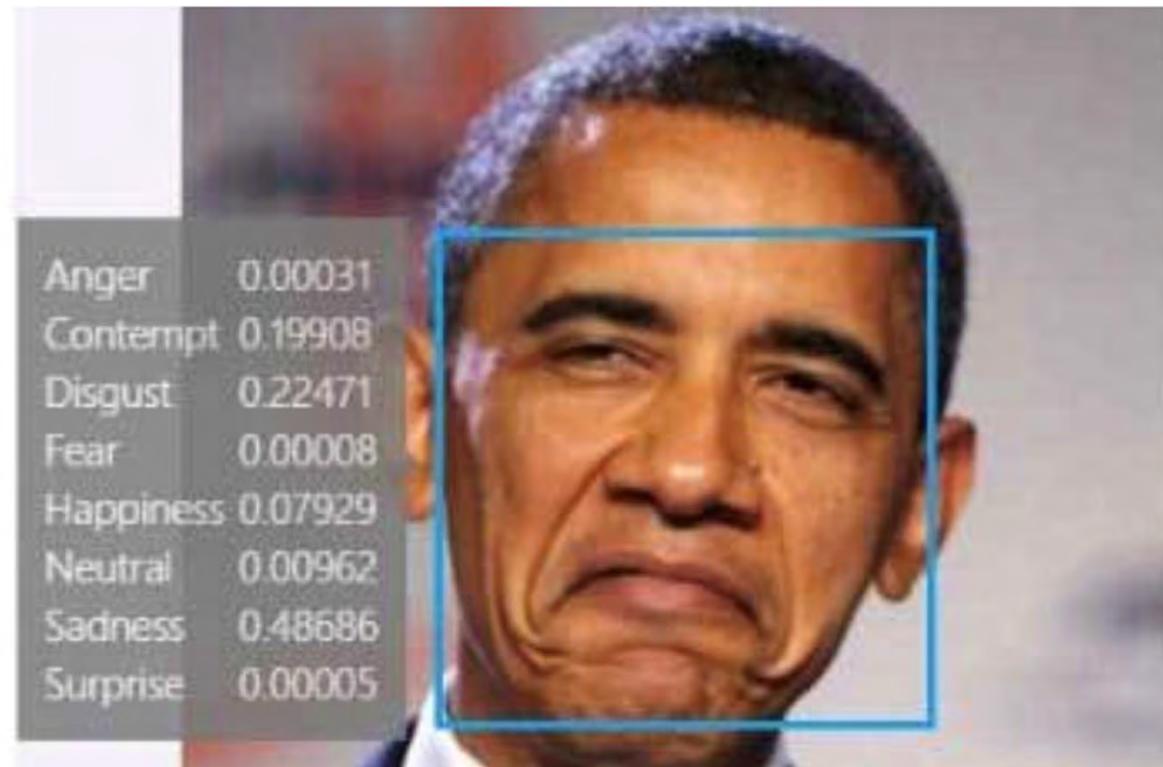
"He wanted to strangle me, considering the beautiful boy I'd become wearing his boxers."



https://www.topbots.com/topbots-ai-machine-intelligence-continuum/?utm_medium=article&utm_source=medium&utm_campaign=AI-Continuum



Systems that Relate



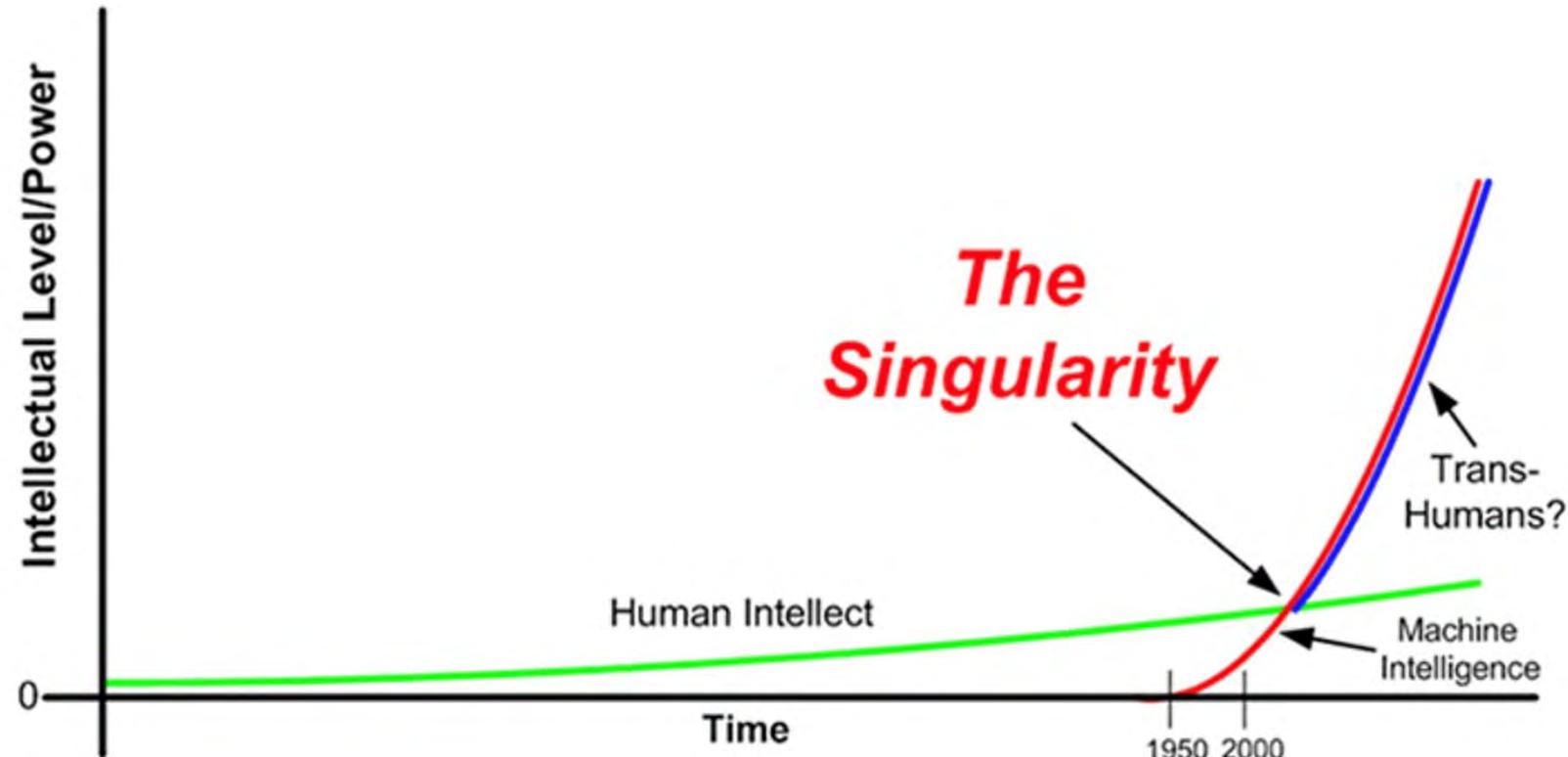


Systems that Master





Systems that Evolve



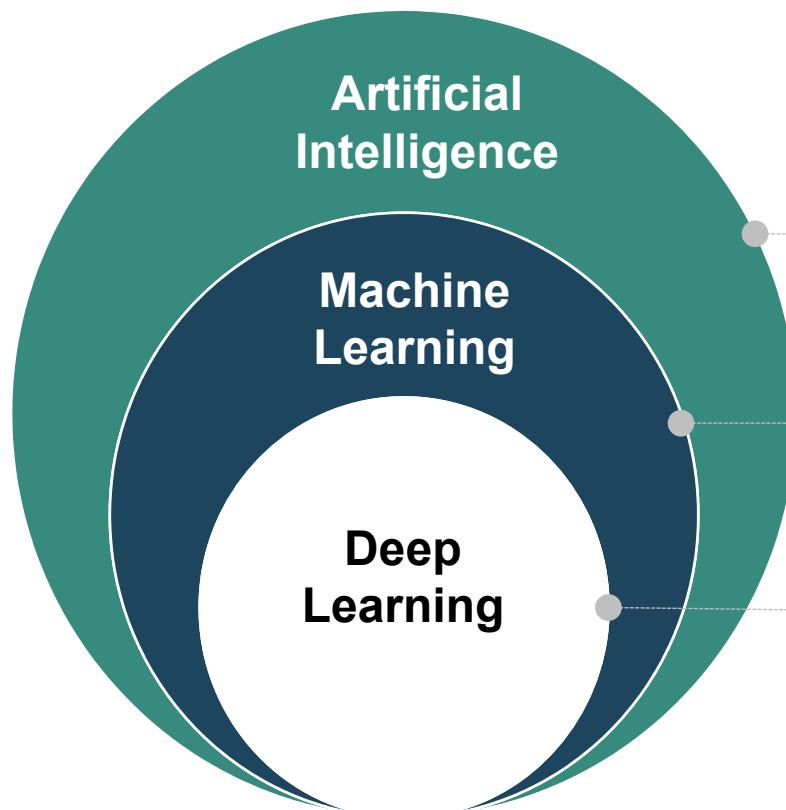


Mind map based on [Wikipedia: Artificial Intelligence](#) and [Wikipedia: Outline of AI](#) as of February 8, 2019.



Definitions

<http://bit.ly/2X1LxFi>



Artificial Intelligence

Any technique which enables computers to sense, reason, act and adapt



Machine Learning

Subset of AI techniques which use statistical methods to enable machines to improve with experiences.

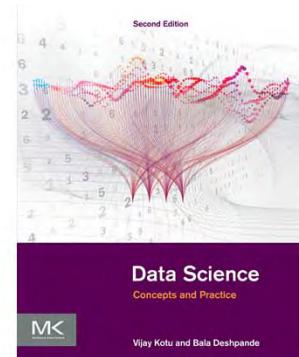
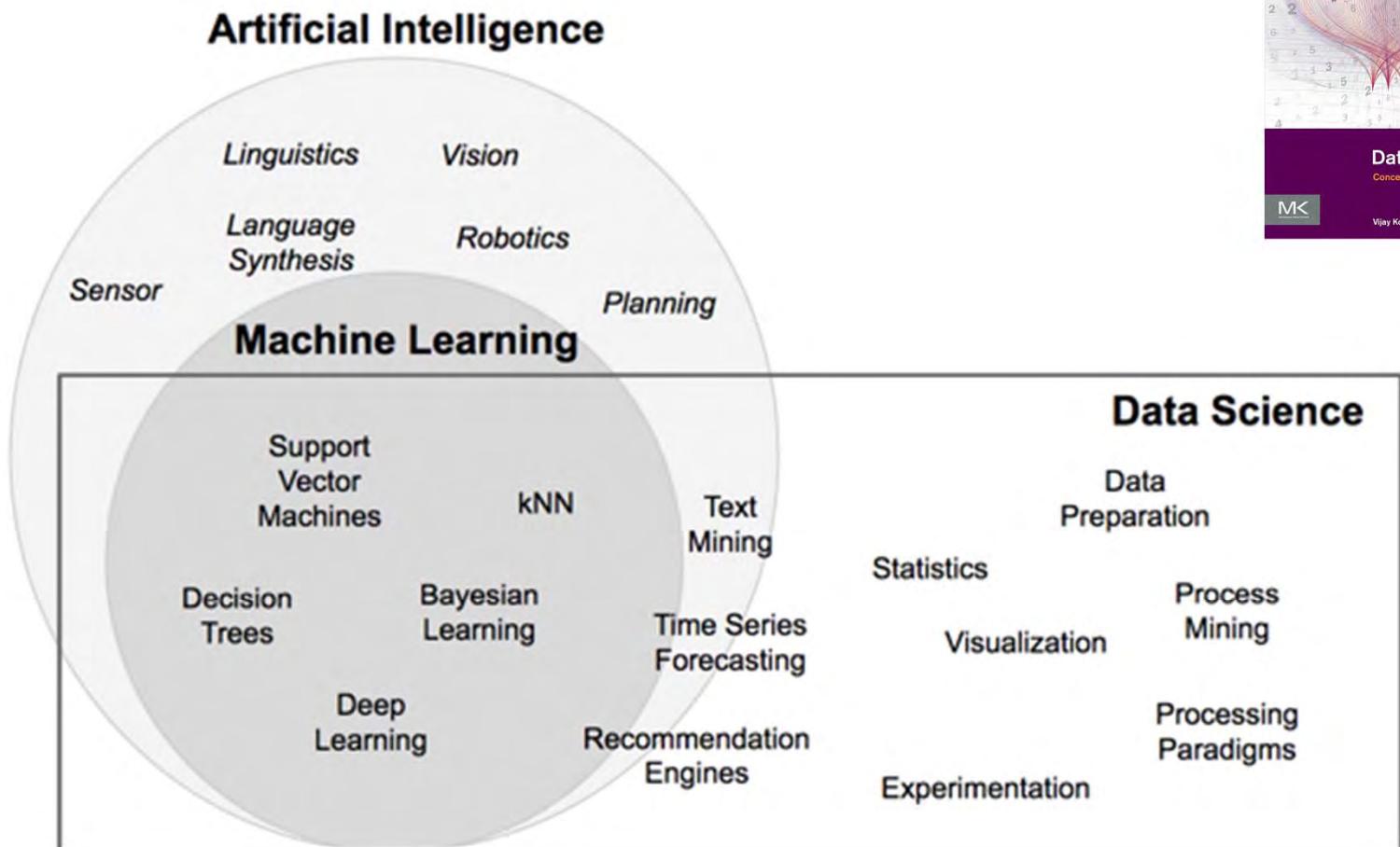


Deep Learning

A subset of machine learning in which multilayered neural networks learn from vast amount of data.



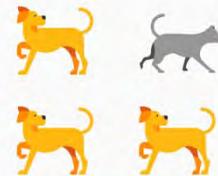
AI vs ML vs DS



5 questions data science answers



**Is this weird?
Anomaly detection**



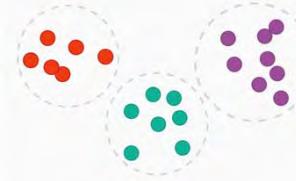
Is this pressure
gauge reading
normal?
Is this message
from the internet
typical?

**How many?
How Much?
Regression**



What will the
temperature be
next Tuesday?
What will my
fourth quarter
sales be?

**How is this
organized?
Clustering**



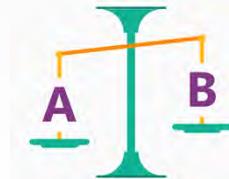
Which viewers
like the same
types of
movies?
Which printer
models fail the
same way?

**What should I
do?
Reinforce
Learning**



If I'm a self-
driving car: At a
yellow light,
brake or
accelerate?
For a robot
vacuum: Keep
vacuuming, or
go back to the
charging station?

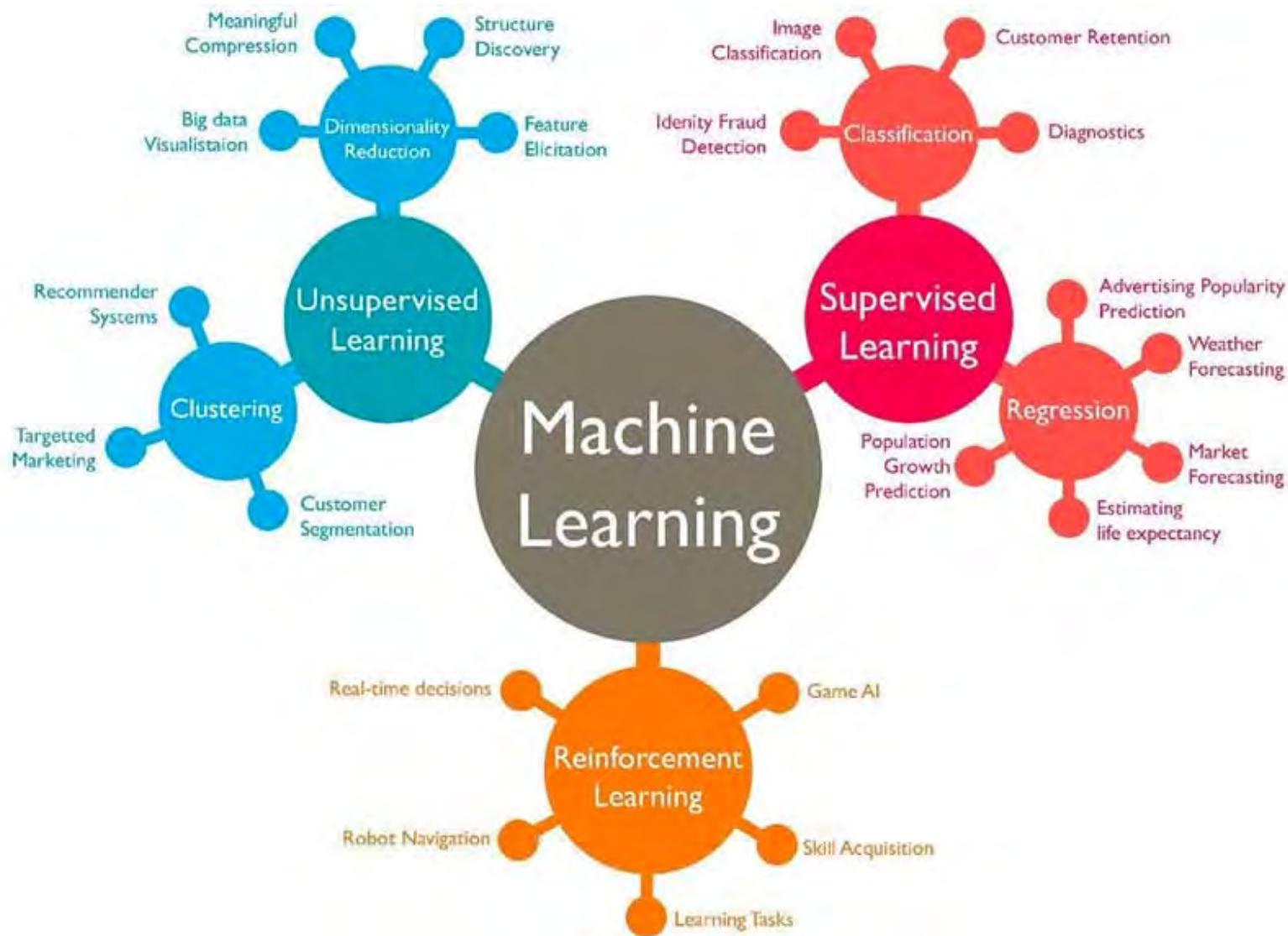
**Is this A or B?
(Classification)**



Will this tire fail
in the next 1,000
miles: Yes or
no?
Which brings in
more
customers: a \$5
coupon or a
25% discount?

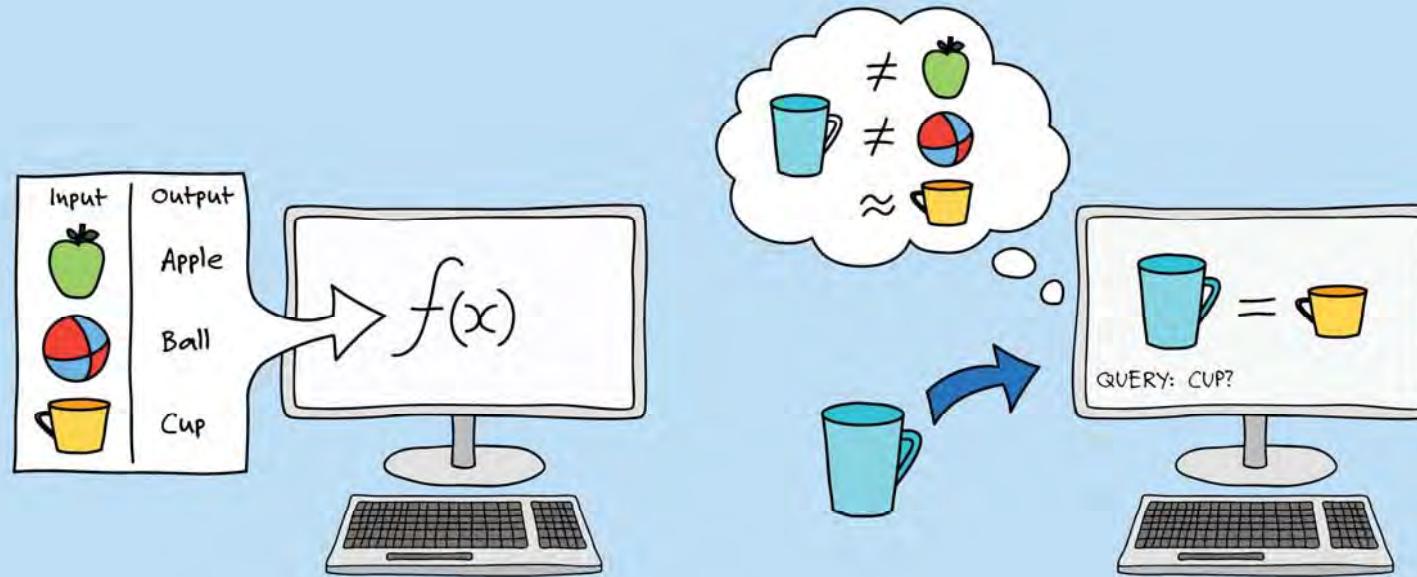


Types of Machine Learning





Supervised Learning

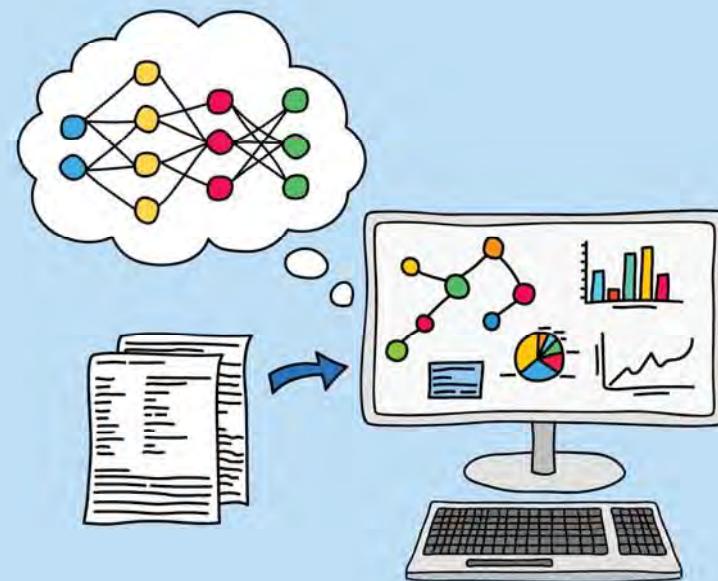


Supervised Machine Learning

The computer is given examples of inputs and typical outputs which it uses to develop and refine an algorithm. The algorithm is applied to new data and the outcome is used for further refinement.
E.g. Training a computer to recognize and classify similar objects based on shape.



Unsupervised Learning



Unsupervised Machine Learning

Unsupervised machine learning is similar to learning without a teacher. The computer learns by exploring the data and finding structure and data patterns on its own.
E.g. Learning to spot patterns in customer data based on purchasing behaviour.



Supervised vs Unsupervised

	Dataset	Goal	Example
Supervised Learning	Has a target column	Make predictions	Fraud detection
Unsupervised Learning	Does not have a target column	Find structure in the data	Customer segmentation

Source: Intel



Machine Learning Example

- Suppose you wanted to identify fraudulent credit card transactions.
- You could define features to be:
 - Transaction time
 - Transaction amount
 - Transaction location
 - Category of purchase
- The algorithm could learn what feature combinations suggest unusual activity.





Machine Learning Limitations

- Suppose you wanted to determine if an image is of a cat or a dog.
- What features would you use?
- This is where **Deep Learning** can come in.



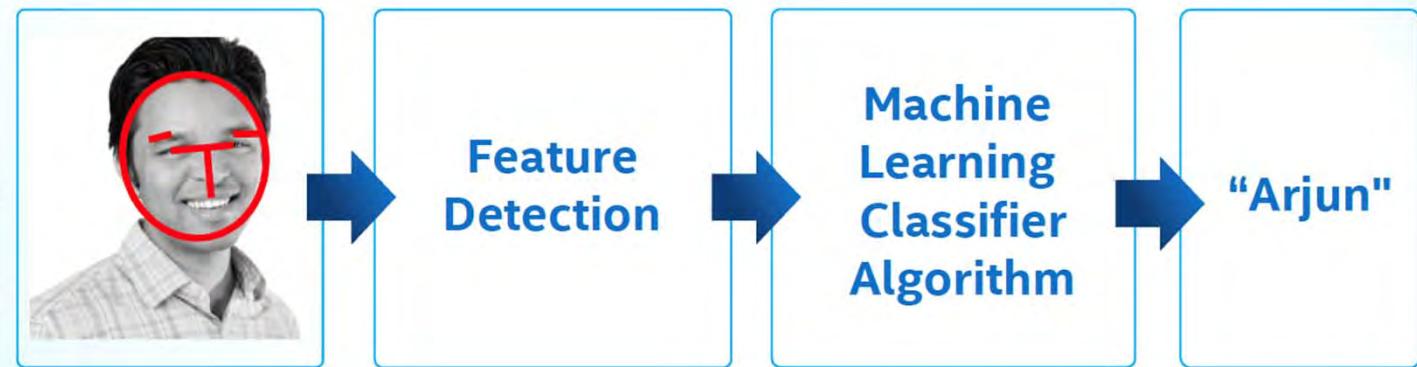
Dog and cat recognition



Deep Learning Example

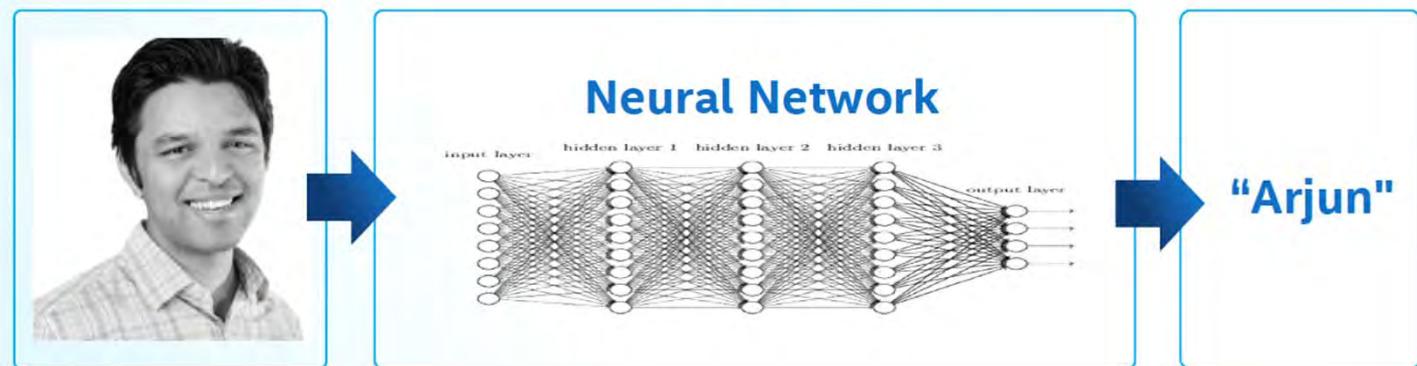
Classic Machine Learning

Step 1: Determine features.
Step 2: Feed them through model.



Deep Learning

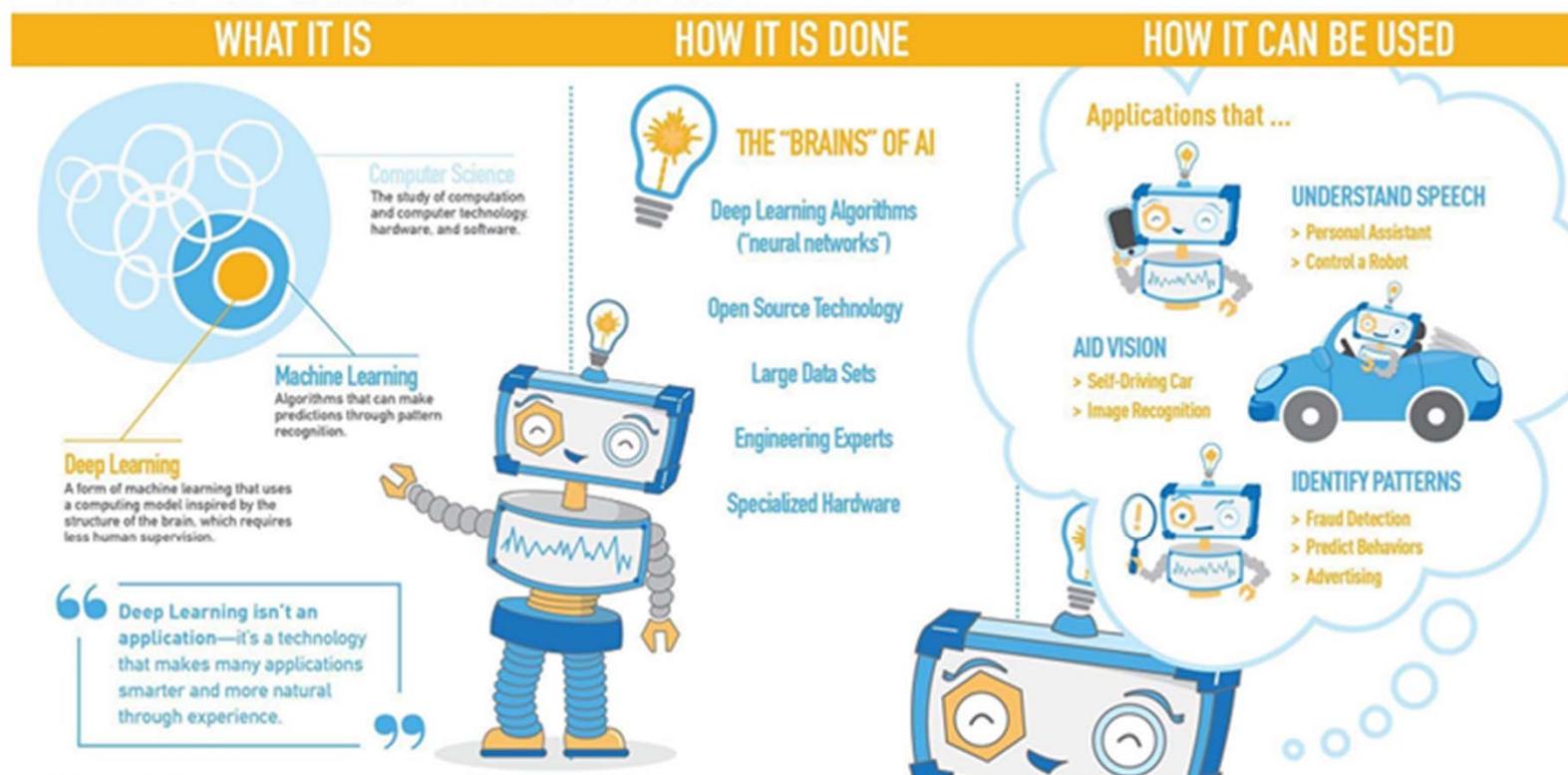
Steps 1 and 2 are combined into 1 step.





What is deep learning?

WHAT IS DEEP LEARNING?



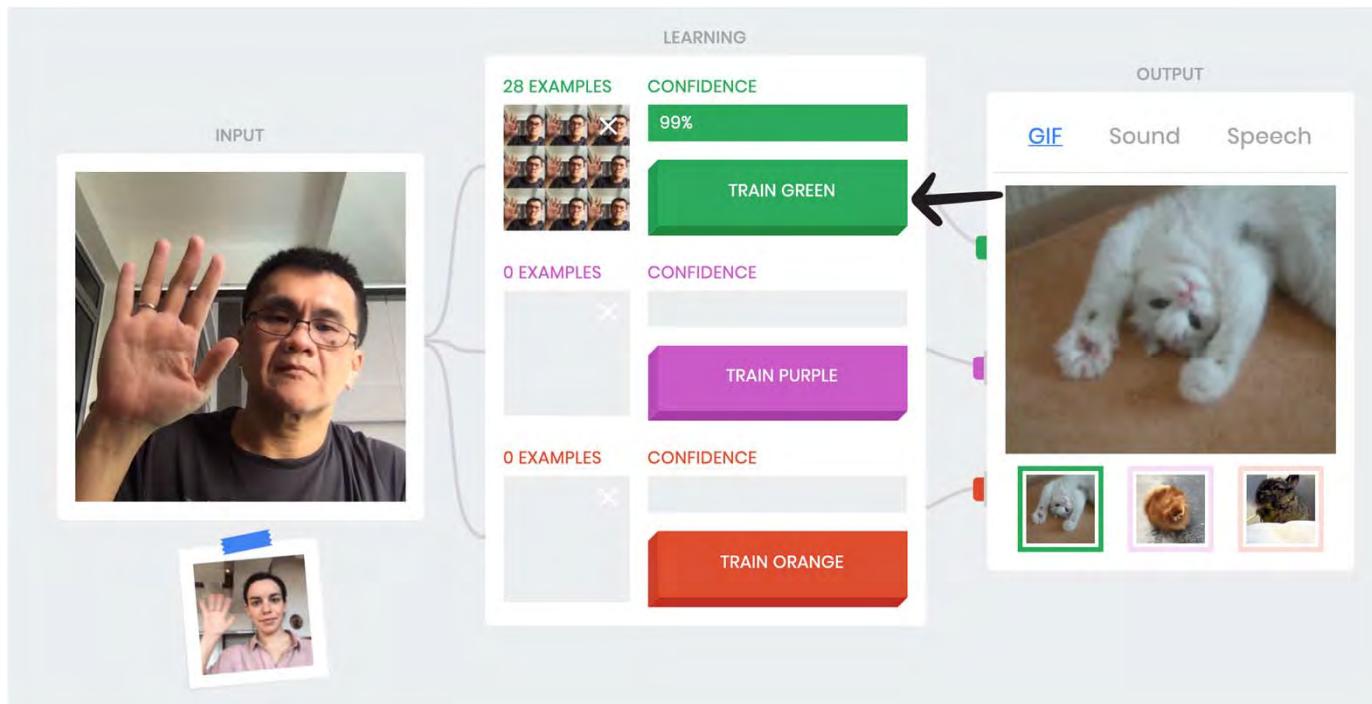


What is neural network?



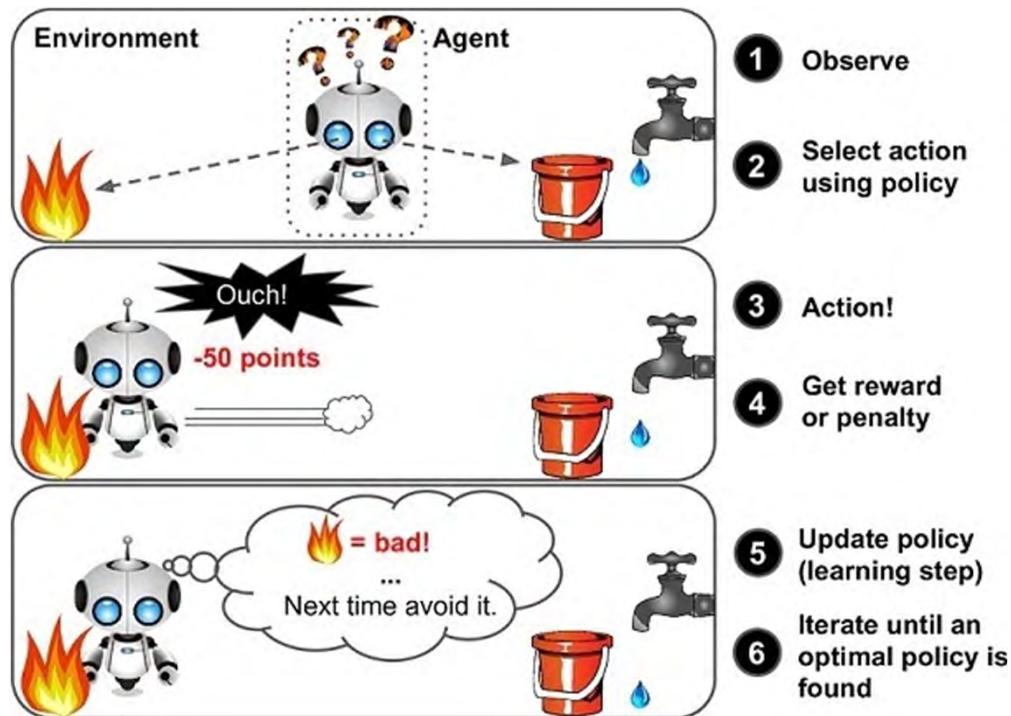
Deep Learning in Action

<https://teachablemachine.withgoogle.com/>

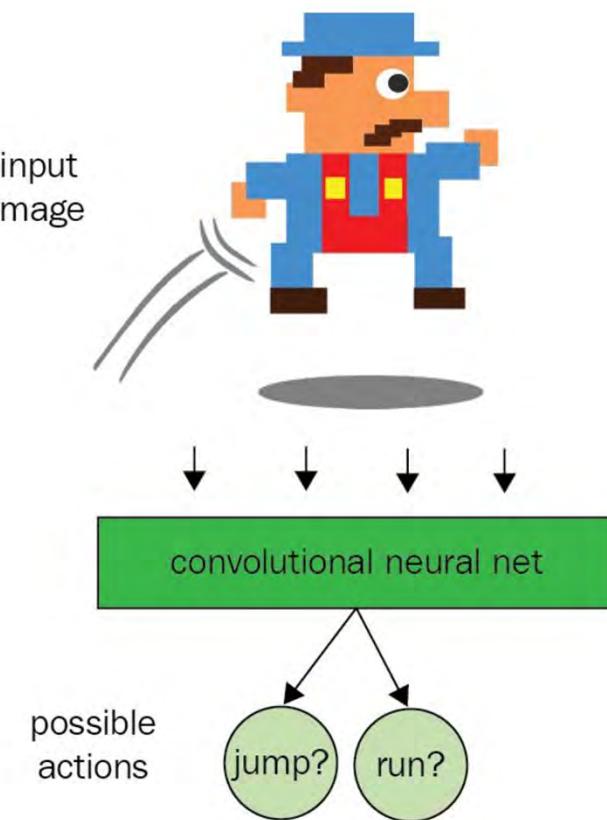




Reinforcement Learning



Convolutional Agent



Source: Practical Reinforcement Learning

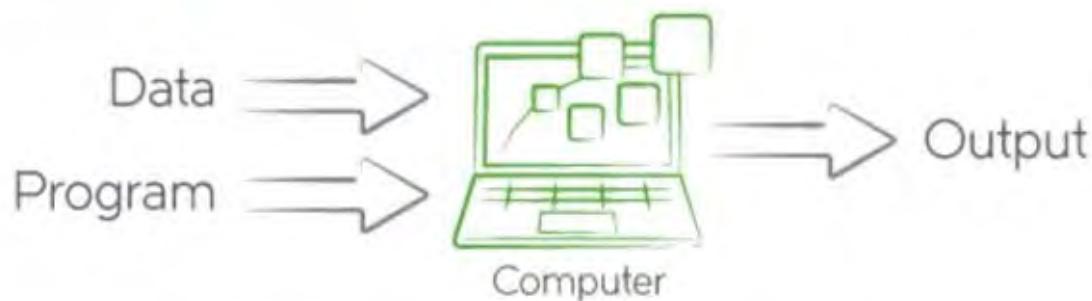


Atari Breakout

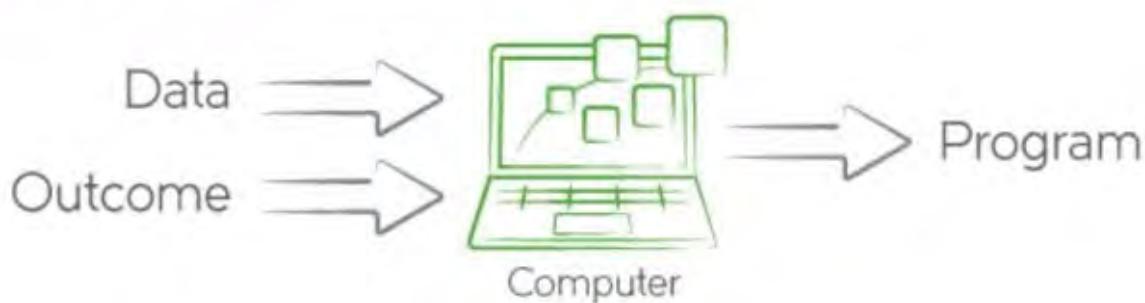


Traditional Programming vs Machine Learning

Traditional Programming



Machine Learning



Mapping Human Perceptions to AI-enabled Capabilities



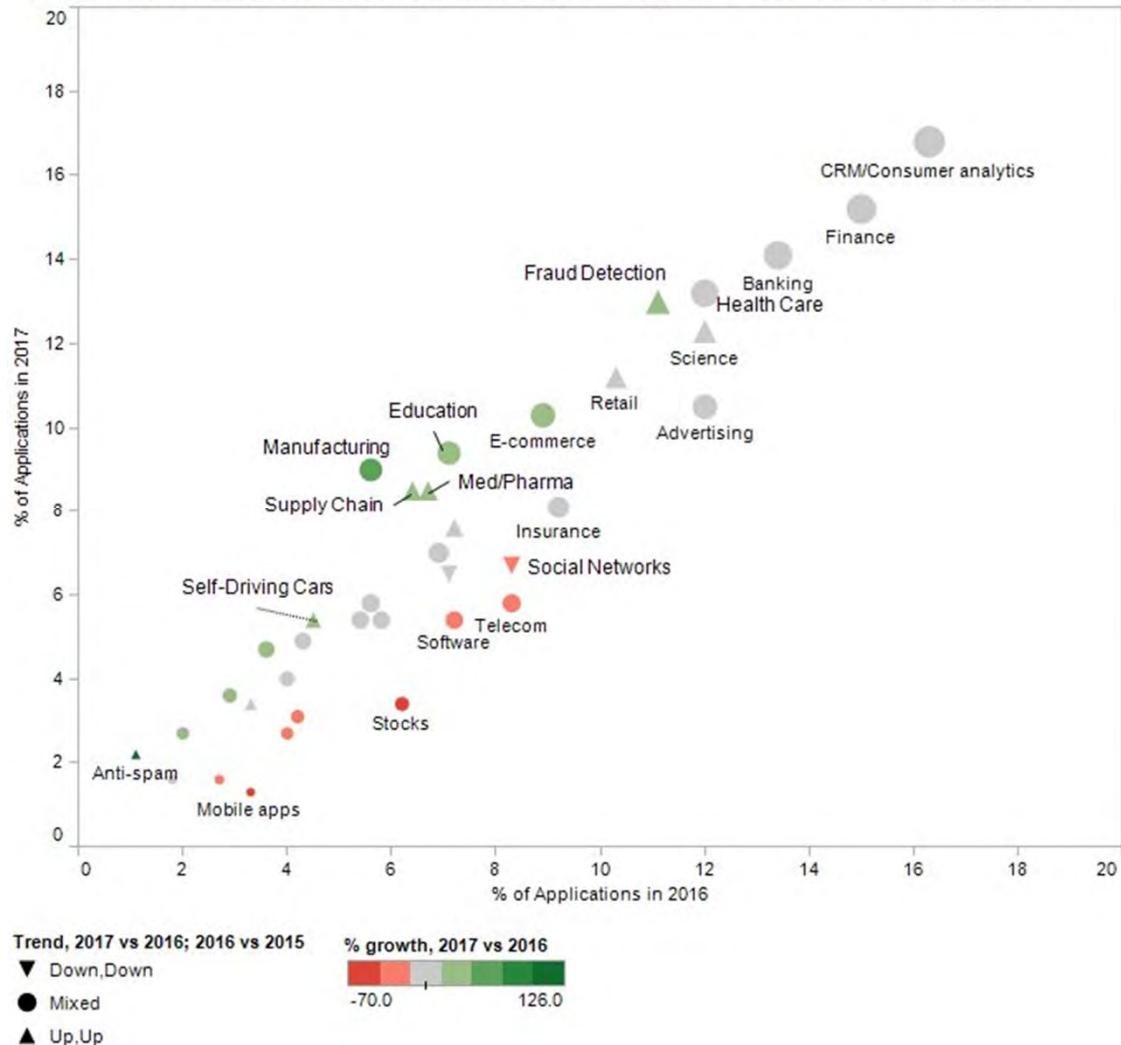
Vision	Computer Vision	Conversational Interface Licensed to Seow Khee Wei
Hearing	Speech Recognition / Audio Recognition	
Understanding	Natural Language Processing	
Speaking	Text to Speech, Speech to Text, Voice (Tone and Accent) Imitation	
Feeling	Emotion AI (detection and analysis of complex human emotions is currently conducted through diverse mechanisms such as natural language processing (NLP), voice patterns, facial expressions, and physiology)	
Smelling	The data of smell are relatively seldom and more difficult to collect compared to visual, text, or voice datasets. The development of an electronic nose to recognize smell has been long researched, but its development with AI techniques is still in an early stage	
Touching	Robot	

Source: Frost & Sullivan



Where is it applied?

Where Analytics, Data Science, Machine Learning were applied in 2016 and 2017 - KDnuggets Poll



<https://www.kdnuggets.com/2018/04/poll-analytics-data-science-ml-applied-2017.html>



Transformative Changes



Health

Enhanced Diagnostics
Drug Discovery
Patient Care Research
Sensory Aids



Industrial

Factory Automation
Predictive Maintenance
Precision Agriculture
Field Automation



Finance

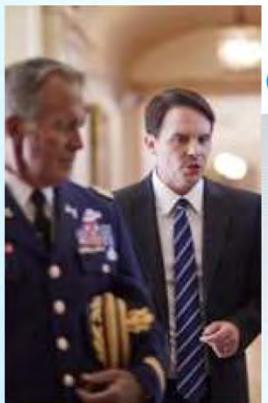
Algorithmic Trading
Fraud Detection
Research
Personal Finance
Risk Mitigation



Energy

Oil & Gas Exploration
Smart Grid
Operational Improvement
Conservation

Source: Intel forecast



Government

Defense
Data Insights
Safety & Security
Engagement
Smarter Cities



Transport

Autonomous Cars
Automated Trucking
Aerospace
Shipping
Search & Rescue

Source: Intel forecast



Other

Advertising
Education
Gaming
Professional & IT Services
Telco/Media
Sports

Source: Intel forecast





Applications

Navigation



Google & Waze find the fastest route, by processing traffic data.

Ride sharing



Uber & Lyft predict real-time demand using AI techniques, machine learning, deep learning.

Audience



Facebook & Twitter use AI to decide what content to present in their feeds to different audiences.

Content



Image recognition and sentiment analysis to ensure that content of the appropriate "mood" is being served.

Natural language



We carry around powerful natural language processing algorithms in our phones/computers.

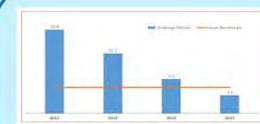
Object detection



Cameras like Amazon DeepLens* or Google Clips* use object detection to determine when to take a photo.



Deep Learning "proven" to work for image classification.



Models outperform humans on image classification.



Object detection models beat previous benchmarks.

2012

2015

2016



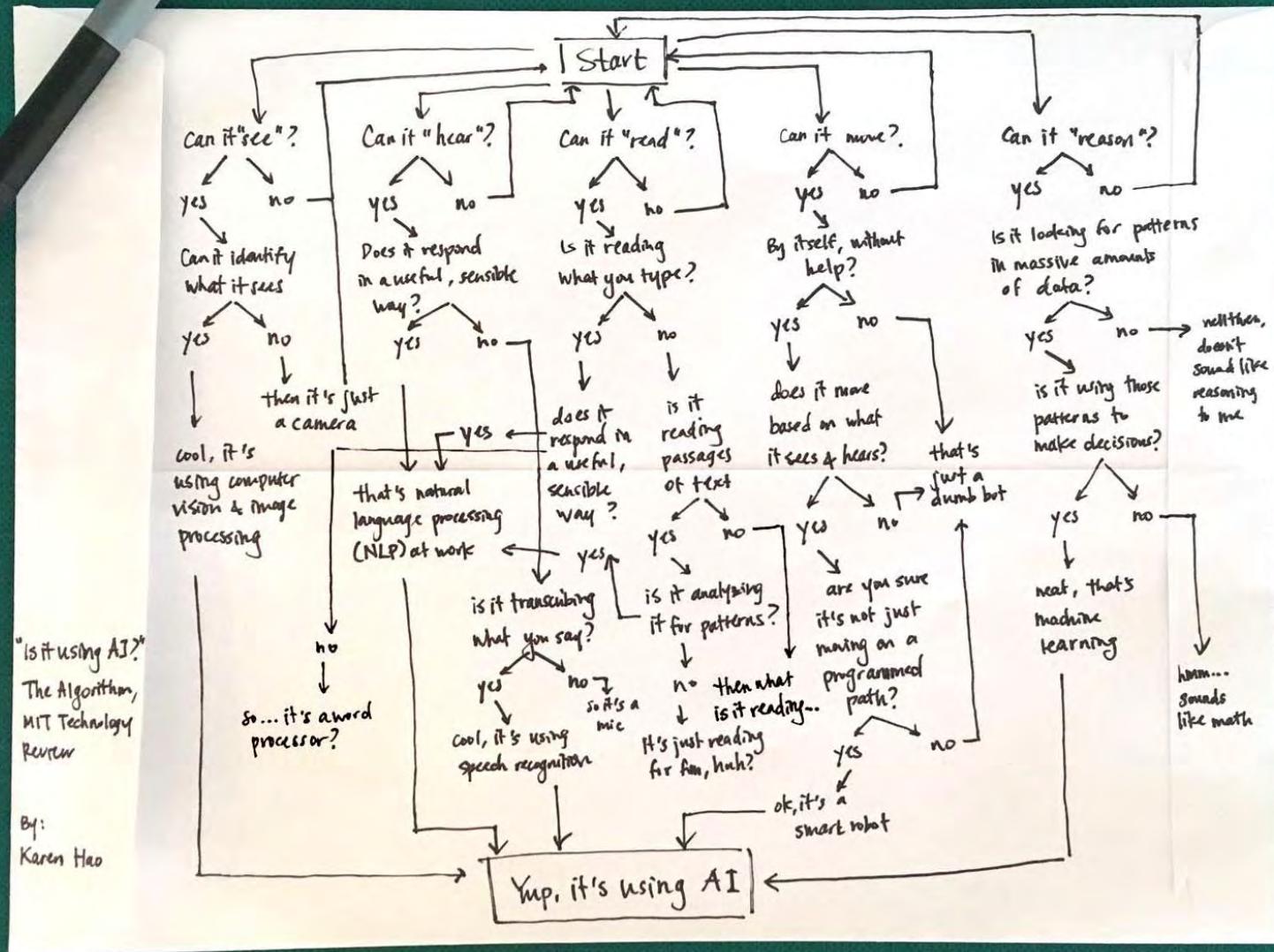
Application Area: Abandoned Baggage Detection

- We can automatically detect when baggage has been left unattended, potentially saving lives.
- This system relies on the breakthroughs we discussed:
 - Cutting edge object detection.
 - Fast hardware on which to train the model (Intel® Xeon® processors in this case).

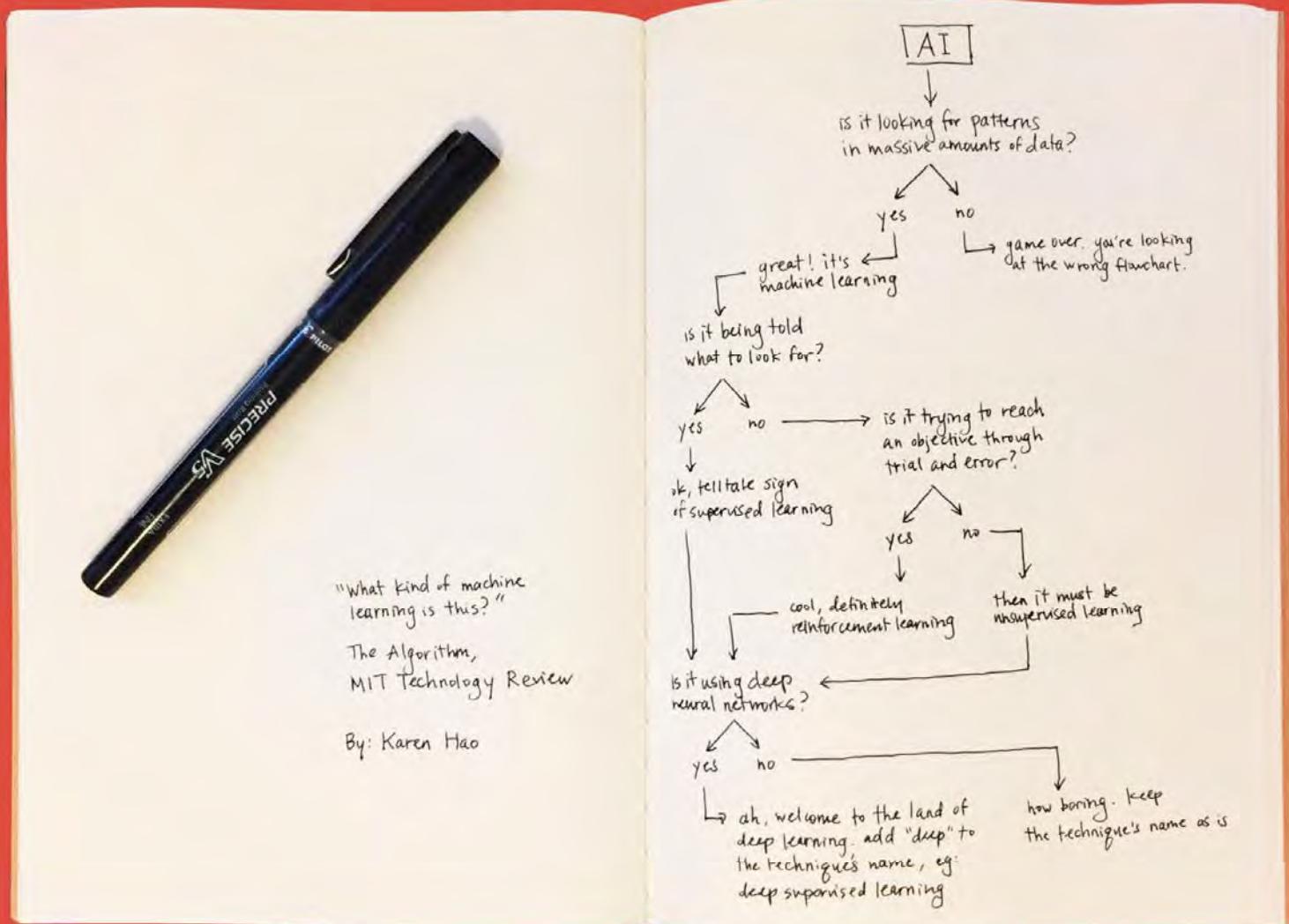


Abandoned baggage





<https://www.technologyreview.com/s/612404/is-this-ai-we-drew-you-a-flowchart-to-work-it-out/>

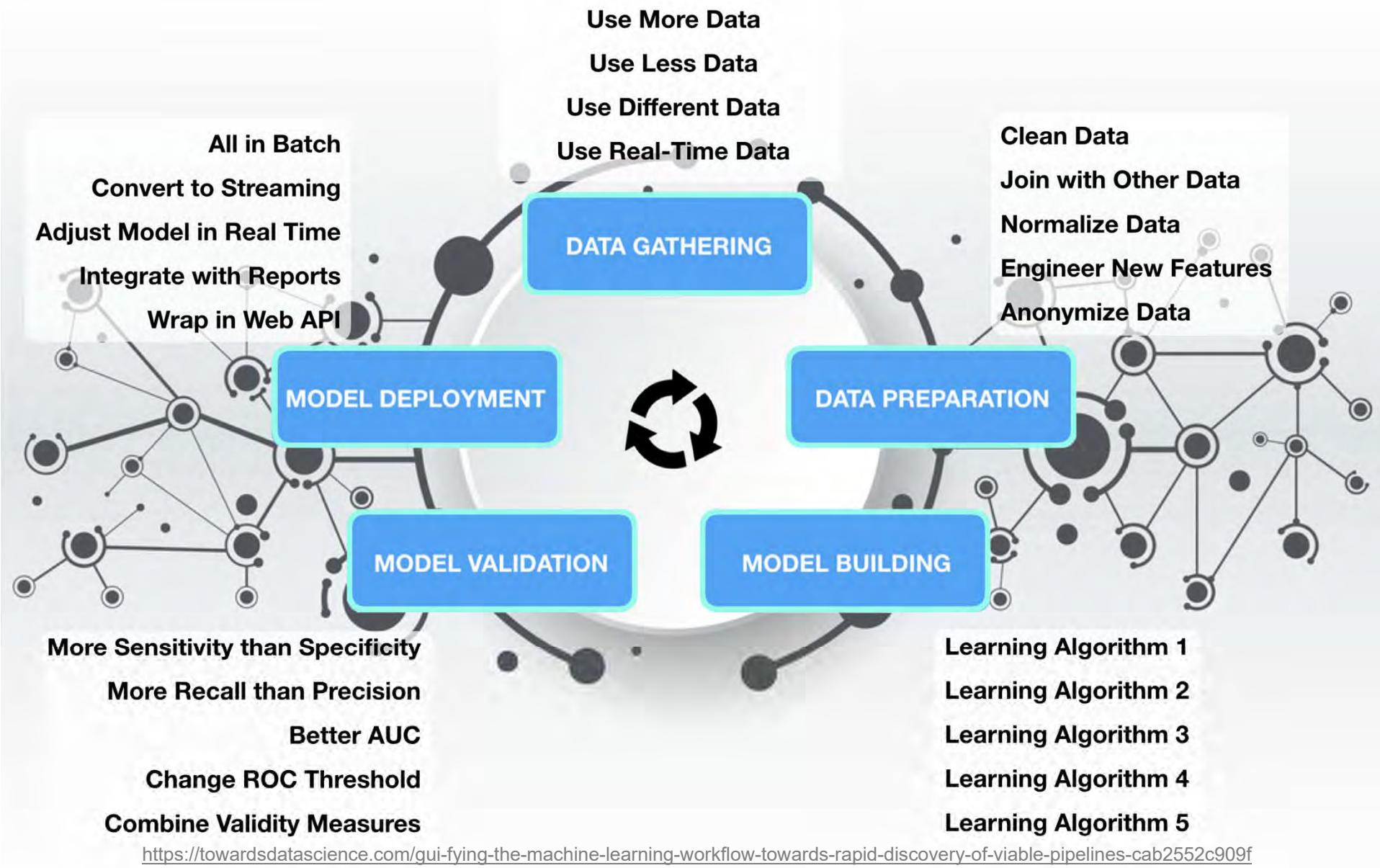


<https://www.technologyreview.com/s/612437/what-is-machine-learning-we-drew-you-another-flowchart/>



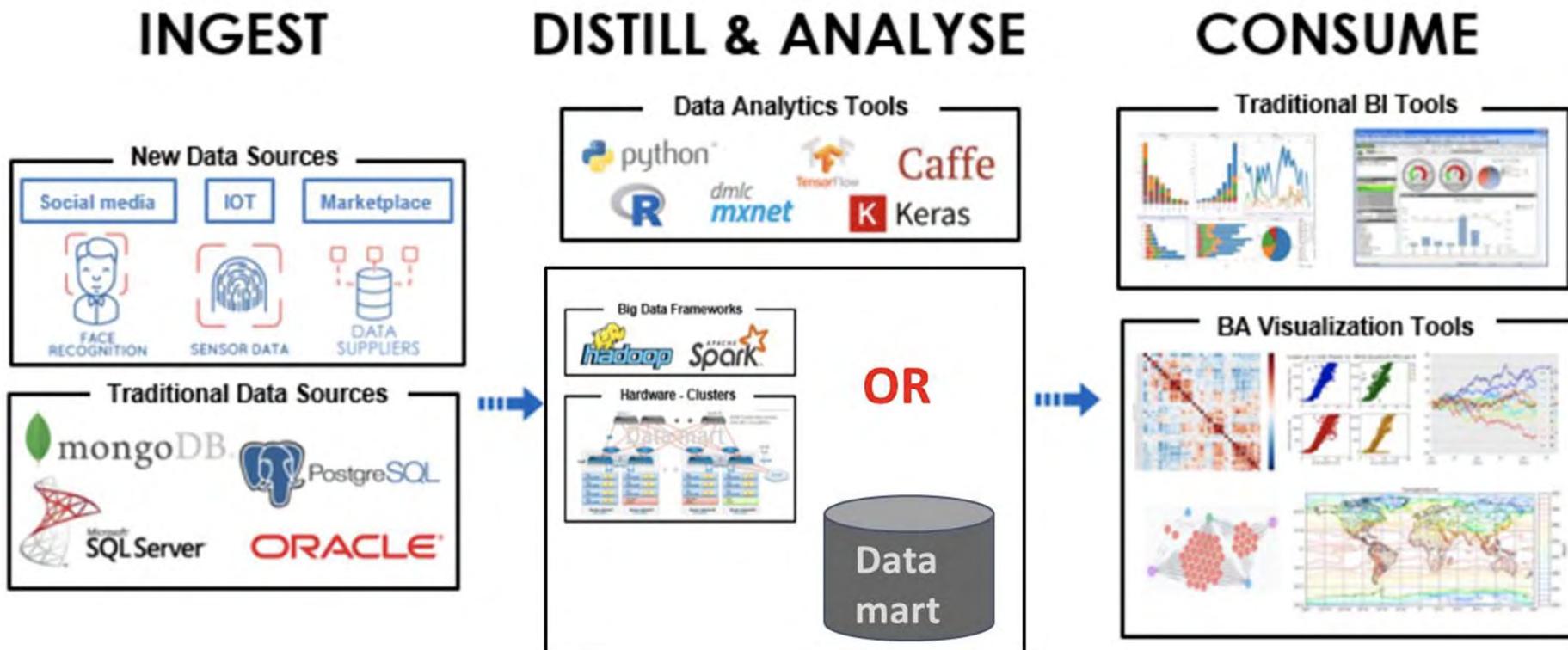


AI/ML Workflow



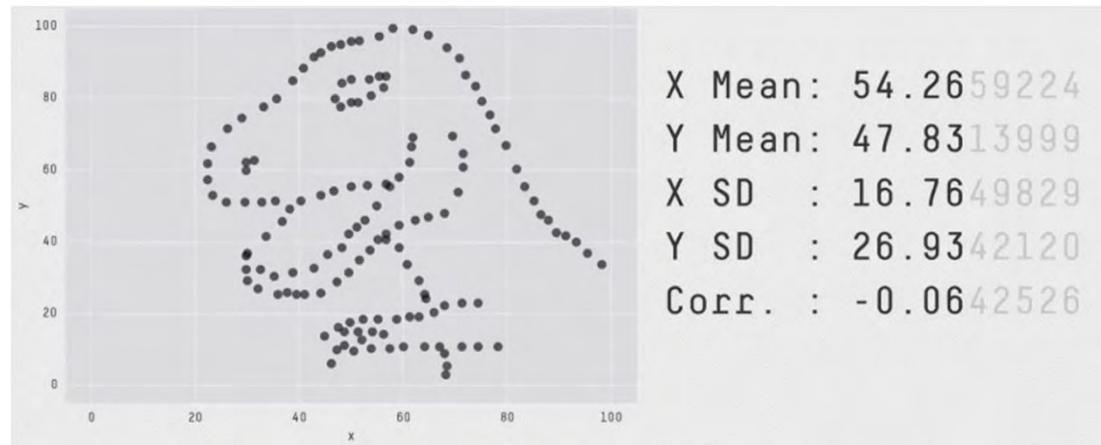


AI/ML Pipeline



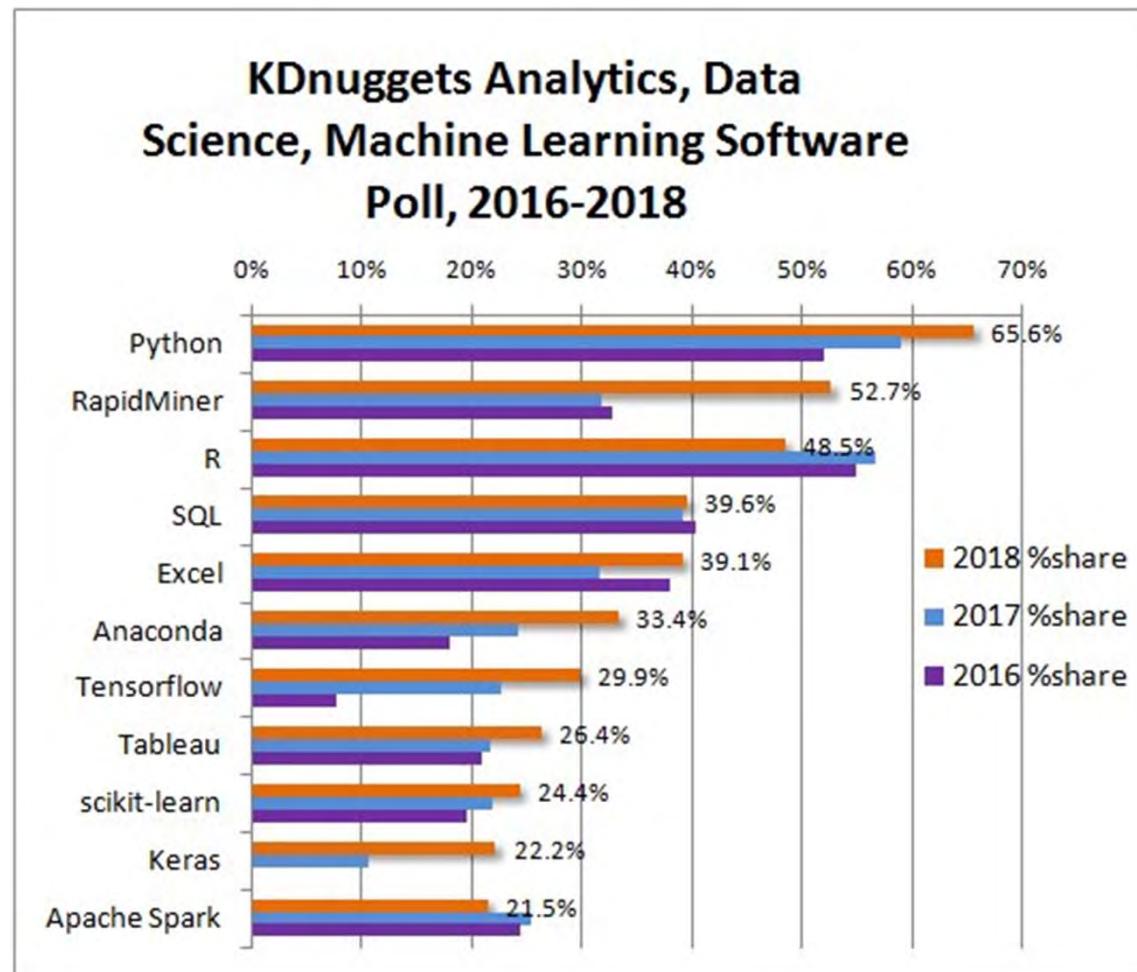


Why visualization?



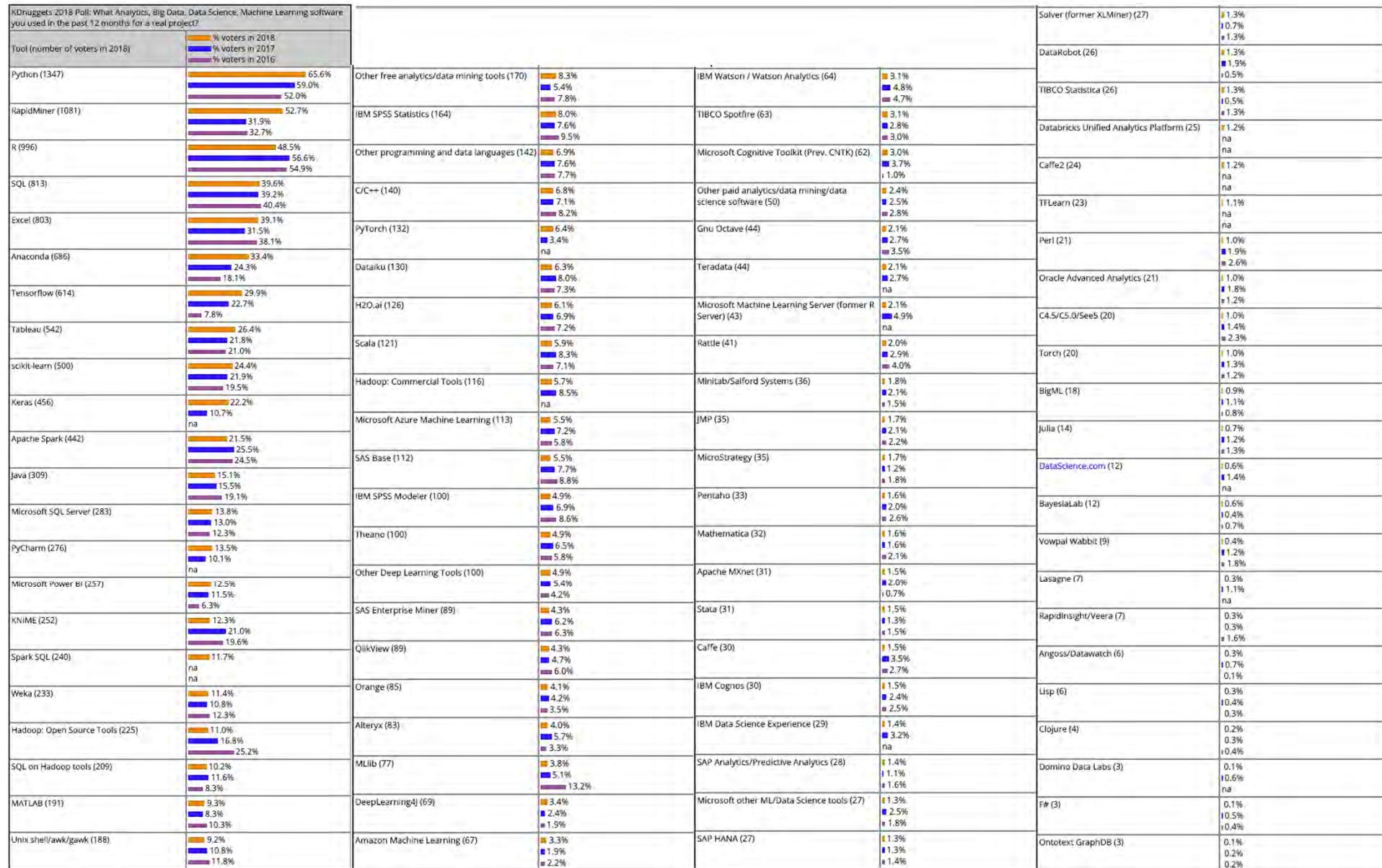


What are the popular tools?



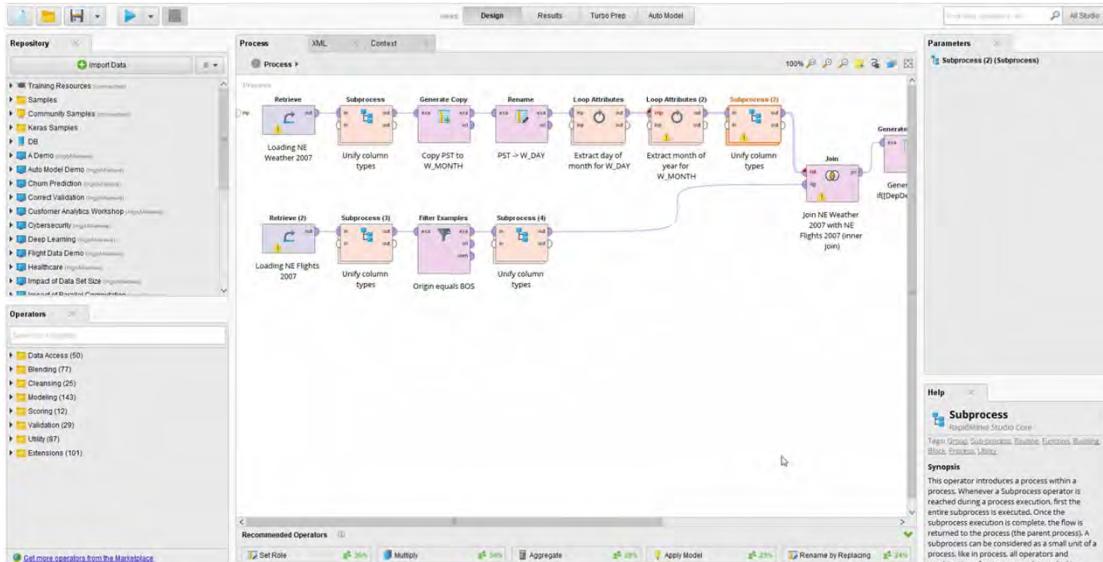


What are the popular tools?

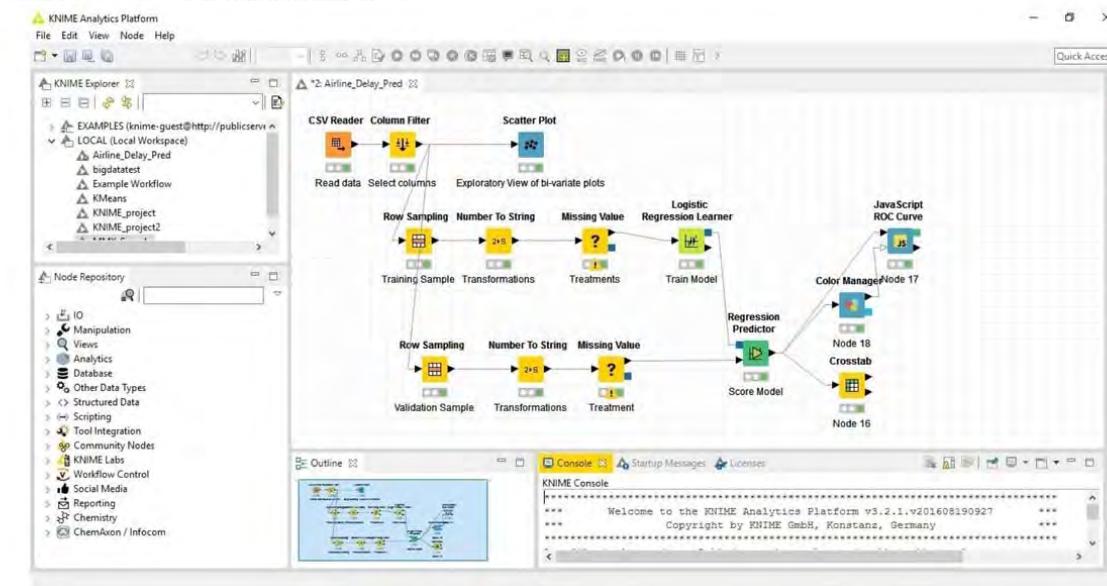




Graphical Tools (ML/DS)



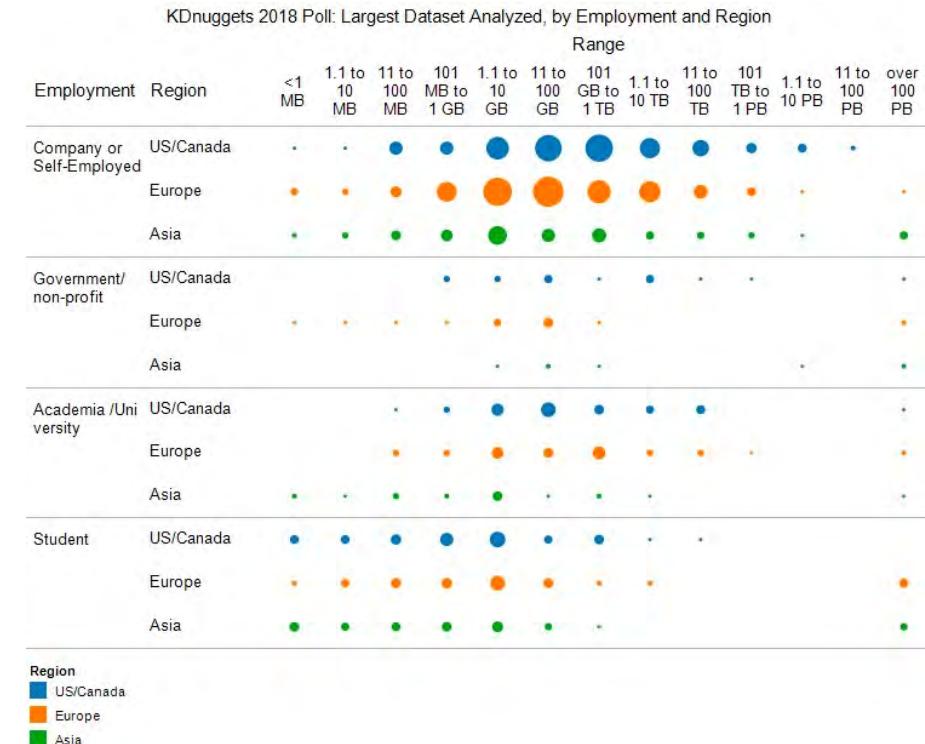
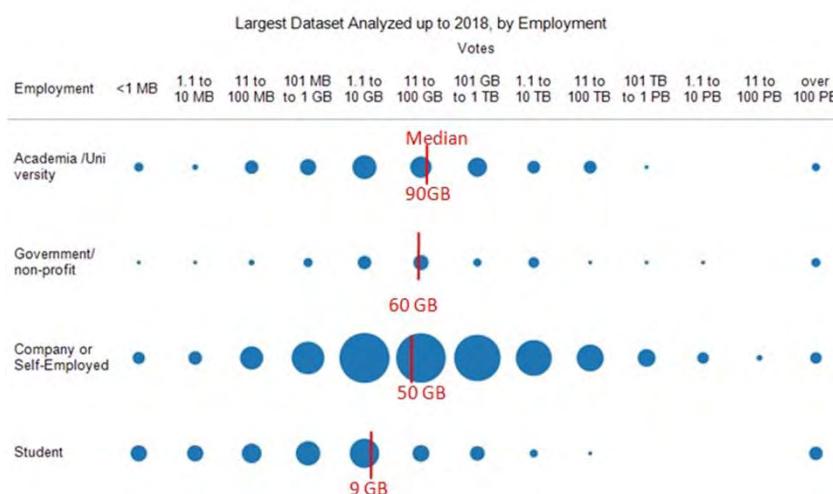
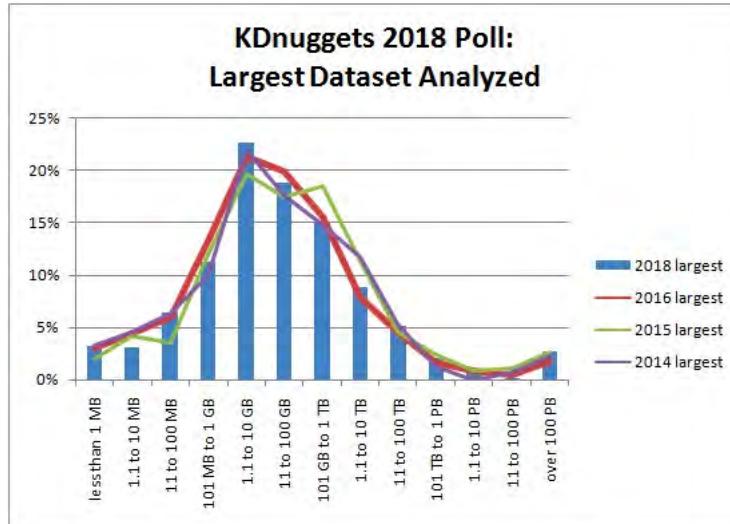
RapidMiner



KNIME

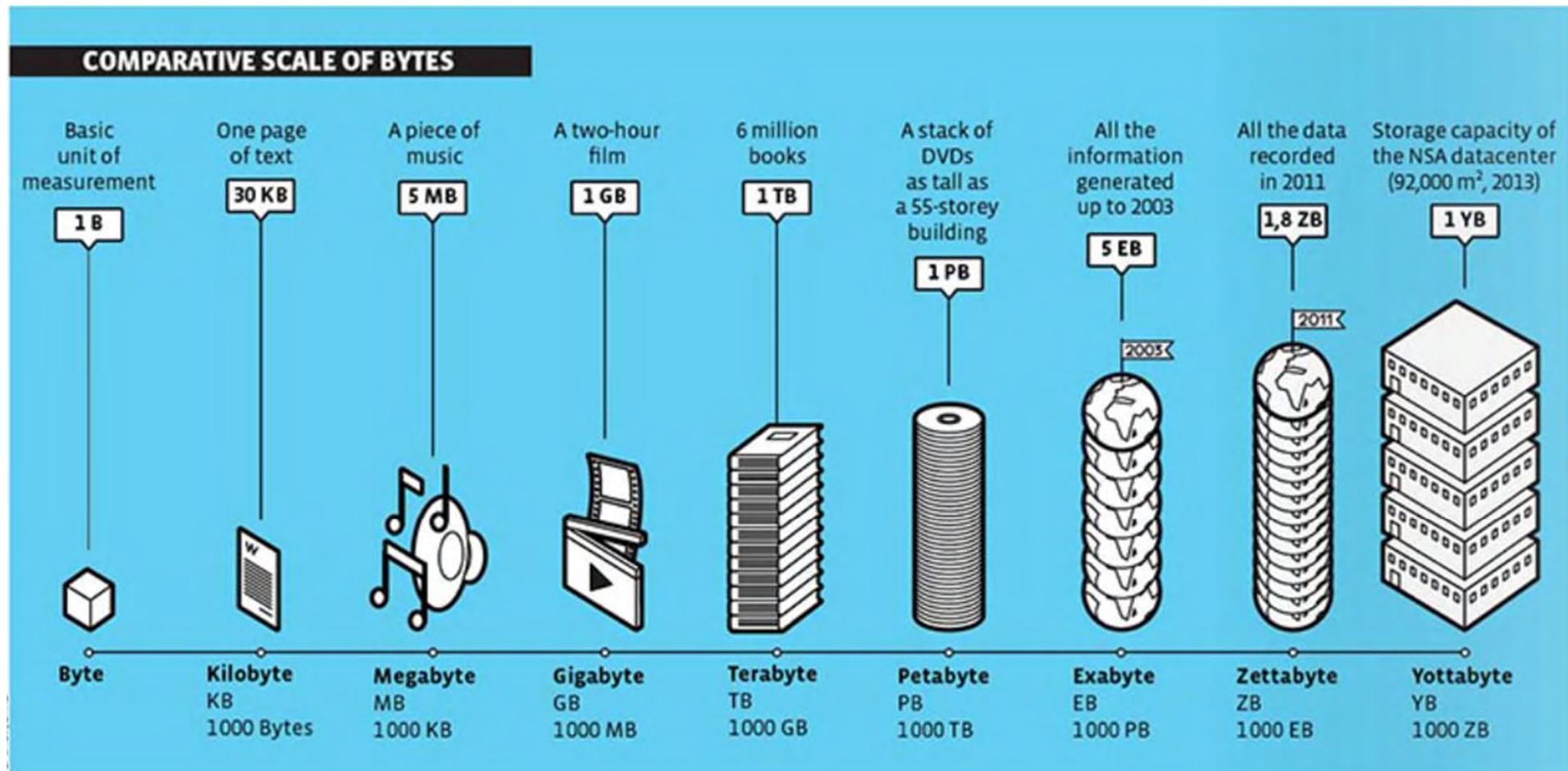


Datasets size





How big is one TB?



[Comparative Size of Bytes – credit to Testyotta](#)



Hands on AI

Meet LUIS

Otherwise known as Language Understanding Intelligent Service.

LUIS is a service that interprets normal human language and understands what the desired outcomes and relevant pieces of information are. It's fast and easy to deploy, it learns and adapts as it interacts, and with very little training it can gain insights and trigger actions based on real user-inputs and contextual information.



Text Analytics

Step #1: Enter Your Message

Step #2: Sentiment & Key Phrases

This API analyzes your text to identify the keywords and discern the sentiment.

Step #3: Entity Linking

This API ascertains which of the key words are entities and links them in Wikipedia.

Step #4: Bing Entity Search

This API provides a summary of relevant information in the form of a card for each entity.

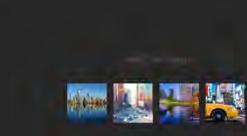


Computer Vision

Microsoft AI - for a richer experience across a variety of visual mediums.

- Analyze and describe images
- Read text in imagery
- Read handwriting in imagery
- Recognize celebrities & landmarks

[Next Feature](#)



Face and Emotion Recognition

Facial recognition can be a great security tool. See how Microsoft AI is able to quickly analyze and compare photos. Upload or take two photos and we will use our Face API to tell you if the photos are of the same person. We'll also provide the approximate age, gender, and emotion. Really test the system by making different faces or getting a friend involved to take one of the photos.

[Add Photo](#) [Add Photo](#)

PHOTO 1 PHOTO 2

Meet LUIS

<https://aidemos.microsoft.com/luis>

Otherwise known as Language Understanding Intelligent Service.

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[Next Step >](#)

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[Next Step >](#)

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[Next Step >](#)

[Learn to code >](#)

<https://aidemos.microsoft.com/text-analytics>



Computer Vision

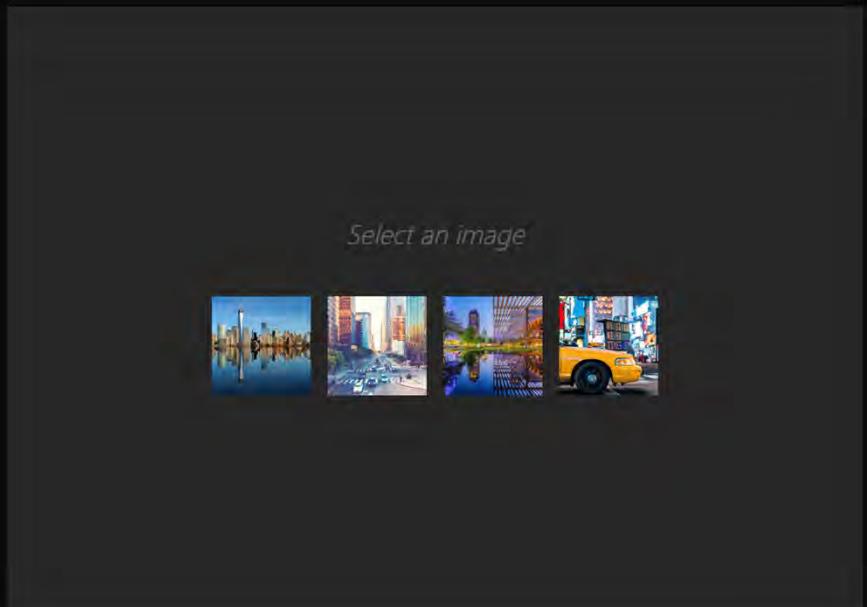
Microsoft AI - for a richer experience across a variety of visual mediums.

- **Analyze and describe images**

This feature will identify and tag the content of an image, give a written description, and give you confidence ratings on the results. It also identifies racy or adult content allowing easy moderation.

[Next Feature](#)

- Read text in imagery
- Read handwriting in imagery
- Recognize celebrities & landmarks



Face and Emotion Recognition

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[Add Photo](#)[Add Photo](#)

PHOTO 1

PHOTO 2

Speech Authentication

Voices are not always easy to decipher, but a critical piece of our identity. Test out our speech recognition capabilities, built using our Speech API, by recording a phrase three times or using our pre-recorded voices by selecting one of the silhouettes.

Select Phrase 

Select Recording



Video Indexer

Using AI to make video content better.

Microsoft AI tracks and identifies who appears in a video, it transcribes and translates what they're saying, it understands the topics discussed, and detects changes in both scene and sentiment. After processing all of this data it provides the controls to allow the viewer to consume content in a more intuitive & desirable way.



#MSBuild Day 1 Keynote: Part
1



#MSBuild Day 1 Keynote: Part
2



#MSBuild Day 1 Keynote: Part
3



#MSBuild Day 1 Keynote: Part
4



#MSBuild Day 1 Keynote: Part
5

Select one of the videos above to see it in action



Tone Analyzer

IBM Watson Developer Cloud

The screenshot shows the Tone Analyzer service page. At the top left is a purple circular icon with two speech bubbles. To its right is the title "Tone Analyzer". Below the title is a brief description: "This service uses linguistic analysis to detect joy, fear, sadness, anger, analytical, confident and tentative tones found in text." Underneath this is a note: "*This system is for demonstration purposes only and is not intended to process Personal Data. No Personal Data is to be entered into this system as it may not have the necessary controls in place to meet the requirements of the General Data Protection Regulation (EU) 2016/679." On the right side, there's a sidebar with "Resources" links: Documentation, API Reference, and Fork on Github. A blue button at the bottom right says "Start for free in IBM Cloud".

Sample use cases

Choose an example to learn how you can adjust the tone of your content to change people's perceptions, or improve its effectiveness.

[Learn more.](#)

Tweets Online Review Email message Product Review in French Your own text

Analyzing Customer Engagement Data? Try out the [Tone Analyzer Customer Engagement Endpoint](#).

A large, empty text input field for entering text. Below it is a "Choose Language:" dropdown with "English" selected. At the bottom is a dark blue "Analyze" button.

<http://bit.ly/2TLD0Vb>



Discovery

Watson™

Discovery / Discovery Demo

Discovery

Unlock hidden value in data to find answers, monitor trends and surface patterns, with the world's most advanced cloud-native insight engine.

 [Get Started](#) [API Reference](#) [Documentation](#) [Fork on GitHub](#) [Start for free in IBM Cloud](#)

A screenshot of the Watson Discovery web interface. It features a large purple search bar at the top with the placeholder text "What company are you interested in?". To the right of the search bar is a magnifying glass icon. Below the search bar, there is a large, dark purple rectangular area that appears to be a placeholder or a loading screen.

Quickly find insights in the Watson Discovery News data collection of recent news articles. Easily explore a company's:

- Top stories over the last two months
- Top entities (people, topics, companies) mentioned in those articles
- Trend of public sentiment in news
- Anomalous periods of high press coverage
- Trend of most commonly paired entities (co-mentions)

Watson Discovery also lets you do the same analysis with your own data. Learn more [here](#).

<http://bit.ly/2HZ9n0B>



Finance

- Better Customer Service
- More Reliable Investment Services with Robot Advisor
- Greater Efficiency with Less Paperwork
- Improved Financial Security

JPMorgan Chase Uses COIN Machine Learning Program To Eliminate
360K Lawyer Hours A Year



TREND 1



Readyng for banking's shift from mobile-first to AI-first

Artificial intelligence (AI) in banking is not new. Banks are already using AI in heavily-manual processes for accuracy, efficiency, speed and cost benefits. What is new, however, is the move of AI beyond process to interaction. The next stage of AI in banking will be toward simple and smarter interfaces: drawing on machine learning that adapts to data and interactions to improve areas like fraud detection, and tapping AI-enabled tools (like centralized platforms/assistants or messaging bots) to better converse with and offer services to customers in the front-office. Relying on AI for some internal and external interactions will help elevate the customer experience and move staff to more judgment-based and higher value added roles.



Fraud Detection

Traditionally: Fraud is on the rise, but fraud detection is a challenging problem to solve correctly.

- Historically, a predefined rule-set was used for fraud identification, but this approach misses much of the nuance that surrounds fraud
- 1/3 of falsely identified fraud events result in lost customers
- In the US, this loss is worth 13 times the cost of actual fraud



Now with AI: With ML techniques, banks can predict fraud based on a behavioral baseline to compare against.

- Uses historical shopping data and shopping habits of customers
- Compares new data to baseline to determine likelihood of fraud



Example: Sift Science

- Established a fraud data consortium developed from over 6000 websites to leverage large-scale real-time ML
- Autonomously learns new fraud patterns based on billions of user actions





Risk Management

Traditionally : New regulations force tighter control on financial institutions.

- New business model disruptions
- Increasing pressure on costs and returns



Now with AI : ML can help discern the credit worthiness of potential customers

- Tailor a financial portfolio to fit the goals of the user using ML algorithms.
- Financial institutions can develop early warning systems for automated reporting, portfolio management, and recommendations based on ML.



Example: ZestFinance

- Traditional underwriting systems make decisions using few data points.
- Those with a limited credit history are often denied credit, ultimately leading to loss of revenue for lenders.
- ZestFinance leverages thousands of data sources together with ML to more accurately score borrowers, even people with a small credit history.





Stock Trading

Traditionally: The speed and volume of information is daunting

- The market is reactionary.
 - It's difficult to remain competitive while relying on traditional trading methods.
 - Fundamental analysis is unable to show the entire financial picture.



Now with AI: Companies use massive datasets together with DL methods for better forecasting.

- Data pulled from financial, political, and social media
 - Analyst reports combined.

Example: Sentient Technologies, and Learning Evolutionary Algorithm Framework (LEAF*)

- Manages millions of data points to find trend and make successful stock trades.
 - AI algorithms identify and combine successful trading patterns.
 - Successful strategies are tested in the real world, evolving autonomously with LEAF.
 - Sentient has received more funding than any other AI company.



Travel

- Hotel Bookings by Voice Command
- AI Concierge Services
 - <https://techcrunch.com/2018/06/19/amazon-launches-an-alexa-system-for-hotels/>
- Travel Service Chatbots
- Check-in Through Facial Recognition
- Self-Driving Cars and Mobility as a Service
 - <https://www.economist.com/international/2016/09/29/it-starts-with-a-single-app>
- Other Robotic Tools



Healthcare

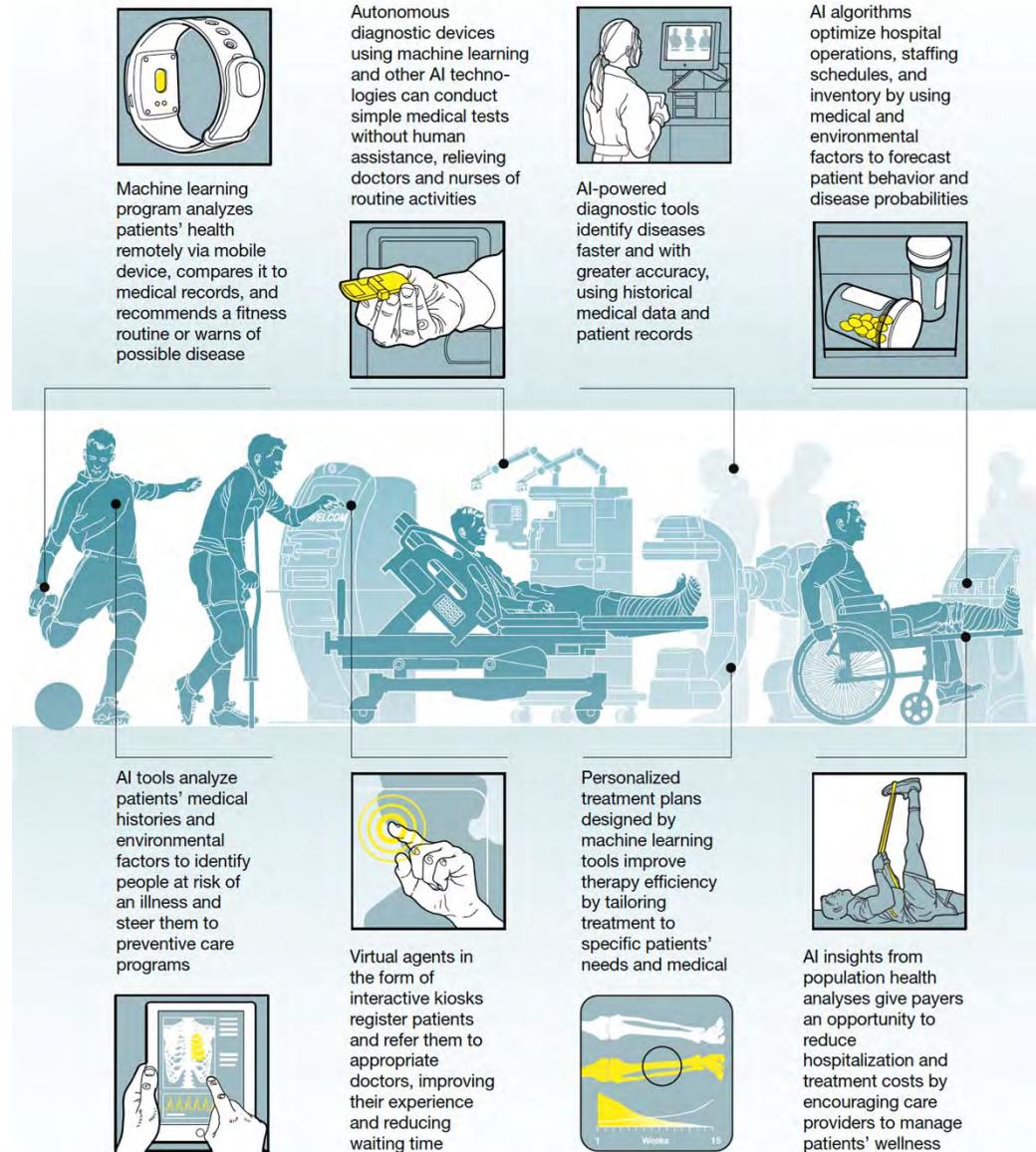
- IBM Watson, Google Deepmind
- At-home testing and personalized health care
- Wearables
- Robot-Assisted Surgery
- Virtual Nursing Assistant
- Administrative Workflow assistance



Healthcare

- Make quicker diagnoses, create better treatment plans and enable new approaches to insurance
- Identify public-health threats and the most at-risk patients
- help medical professionals diagnose disease and improve operations
- Insurers can devise new ways to encourage
- preventive care and incentivize providers
- Doctors will be able to tailor treatments—even drugs—to individual patients
- Virtual agents can serve as primary touchpoints for patients
- Several hurdles stand in the way, starting with data availability

AI in health care: quicker diagnoses, better treatment plans, and improved health insurance





Healthcare – Medical Diagnosis

Traditionally : Medical Diagnosis was a challenging process.

- Many symptoms are nonspecific
- Process of elimination was used to determine root cause (neither efficient nor exact)



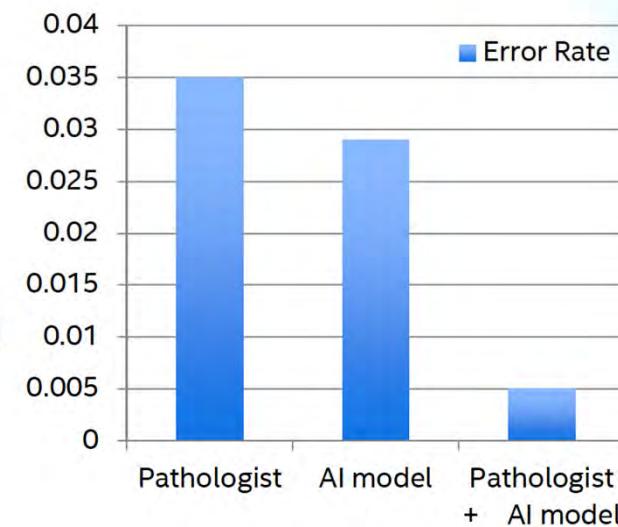
Now with AI : Doctors can provide diagnoses more efficiently and accurately, with the availability of:

- Large medical datasets
- Computer vision algorithms



Example: Breast Cancer, 2016, Harvard Medical School researchers

- Used DL to identify cancer in lymph node images
- Used Convolutional Neural Nets and custom hardware
- AI model combined with humans achieved lower error than either one individually





Healthcare – Treatment Protocol

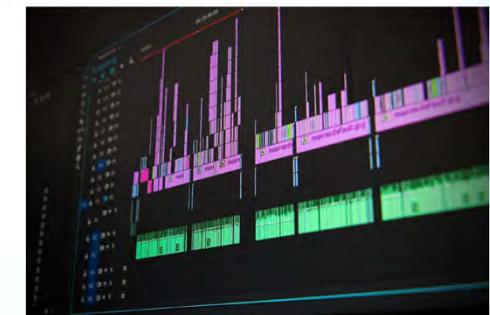
Traditionally: Doctors would diagnose a condition and recommend a treatment based on what historically worked for most people.

- Some considerations for population/demographics
- Difficult to create custom treatments without extensive research/cost



Now with AI: Doctors can tailor treatments to individual patients.

- Large medical datasets
- ML and DL algorithms
- Population/demographics analysis/simulations



Example: ICU Intervene, MIT Computer Science and Artificial Intelligence Laboratory.

- Uses ICU data, from vitals, labs, notes, to determine how to treat specific symptoms.
- Makes real-time predictions from DL models, to provide recommendations for patients.
- Forecasts predictions into the future (a few hours) compared to traditional methods (a few minutes).
- Predictions can be run on common GPU and CPU hardware.





Healthcare – Drug Discovery

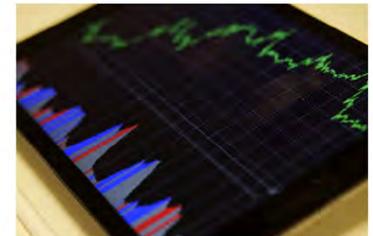
Traditionally: Each new drug approval costs over a billion dollars in Research and Development.

- The cost has been doubling every 9 years since 1970
- The drug discovery process can take decades
- 9 out of 10 drug approval attempts fail
- There are currently only 1,500 approved drugs



Now With AI: Companies are leveraging structured and unstructured data with AI, to establish a pipeline of new drug discovery.

- There are 10^{20} possible drug-like molecules
- Massive space for potential discovery



Example: HetioNet drug discovery model, 2016, UCSF, Himmelstein and Baranzini.

- Developed a graph network to encode millions of biomedical reports.
- Used ML to predict probability of treatment efficacy for ~209,000 compound-disease pairs.
- Provided clear pharmacological insights for epilepsy drug discovery and treatment.





Healthcare – Surgery

Traditionally : Every type of surgery poses possible risks to the patient.

- Adverse anesthesia effects
- Operational complications



Now with AI : Semi-intelligent computer systems predict surgical steps, identify complications, and warn surgeons about pending challenges.

- Computer “vision” leverages data from laparoscopic and arthroscopic cameras
- Smart systems automate dictation by generating notes during the surgery
- Surgeons can send point-of-view live feeds of the operative site to experts anywhere in the world for real-time advice.

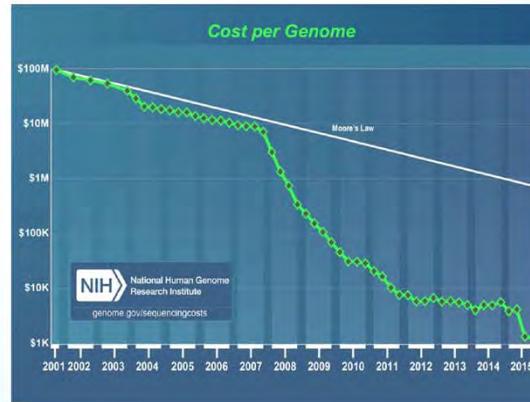




Healthcare – Genome Sequencing

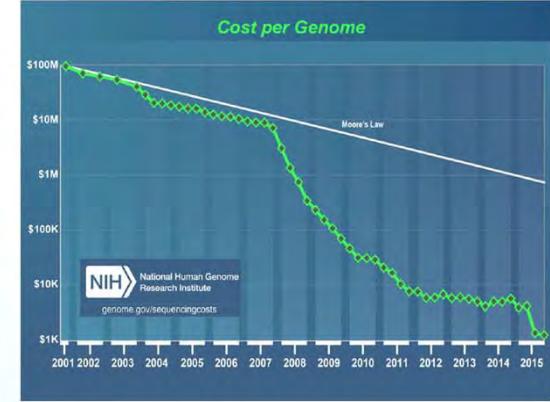
In 2001: Full human sequencing cost \$100 million.

- The first genome sequencing took ~13 years



Now with AI: Sequence companies are employing AI techniques to reduce cost and increase accuracy.

- Illumina claims that within the near future sequencing will only take 1 hour and cost only \$100



Example: Google's DeepVariant* sequencing:

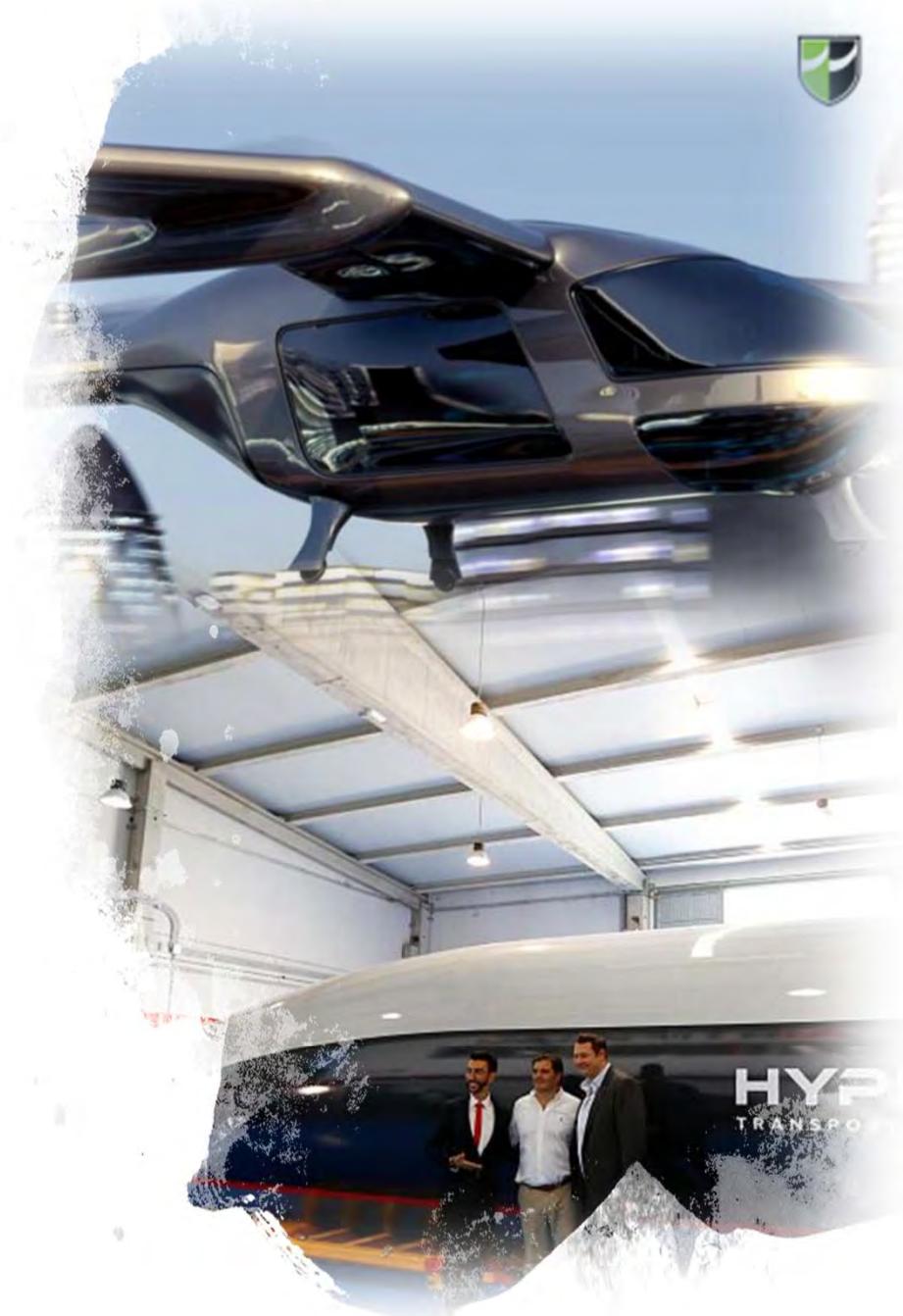
- Leverages massive data sets together with DL to identify all variants
- Accuracy on genome classification: 99.958 %
- DeepVariant* is computationally expensive, but the framework can run on GPU hardware, allowing for a faster learning process
- Availability as open source code promises to revolutionize the industry





Transportation Industry

- Hyperloop
- High-Speed Tunnel Networks
- Self-Driving Cars
- Self-Flying Aircraft





Autonomous Car

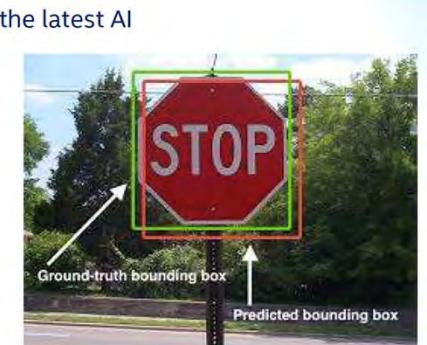
Traditionally: Despite having safer cars, the number of deadly car accidents have been on the rise the last few years.

- The leading cause of automobile accidents is human error
- One of the primary sources of traffic jams is each driver acting out of self-interest, that prevents traffic flow
- Part of the population who can't drive: children, the elderly, and the disabled



Now with AI: Self-driving cars are enabled by the latest AI breakthroughs in computer vision.

- Cars identify stop signs, lane lines, and other landmarks via DL tools
- Mapping technology can use computer vision to detect addresses
- Cars triangulate and can use other 3D-sensing technologies, such as LIDAR and RADAR



Example: Waymo, the autonomous vehicle division of Alphabet Inc.

- Waymo has been operating self-driving minivans without a safety driver since October 2017
- Waymo's Carcraft* software accelerated the car's development, with 2.5 billion simulated miles driven in 2016
- The system used DL together with massive data sets collected from self-driving cars on public roads





Automated Trucking

Traditionally: There is a shortage of 48,000 drivers nationwide.

- Driver turnover rates at some companies reach 300%
- Truck drivers are twice as likely as other workers to be obese and/or have diabetes
- Truckers are half as likely to have health insurance
- The number of accidents and fatalities have increased in recent years



Now with AI: Autonomous trucks can coordinate movements with other trucks.

- Save on fuel, and reduce wind-drag and the chance of a collision
- Video, LIDAR, and accelerometers are used to collect detailed data about the truck's surroundings
- Guidance algorithms provide feedback for braking, steering, and throttling commands, based on incoming and historical data





Retail Industry

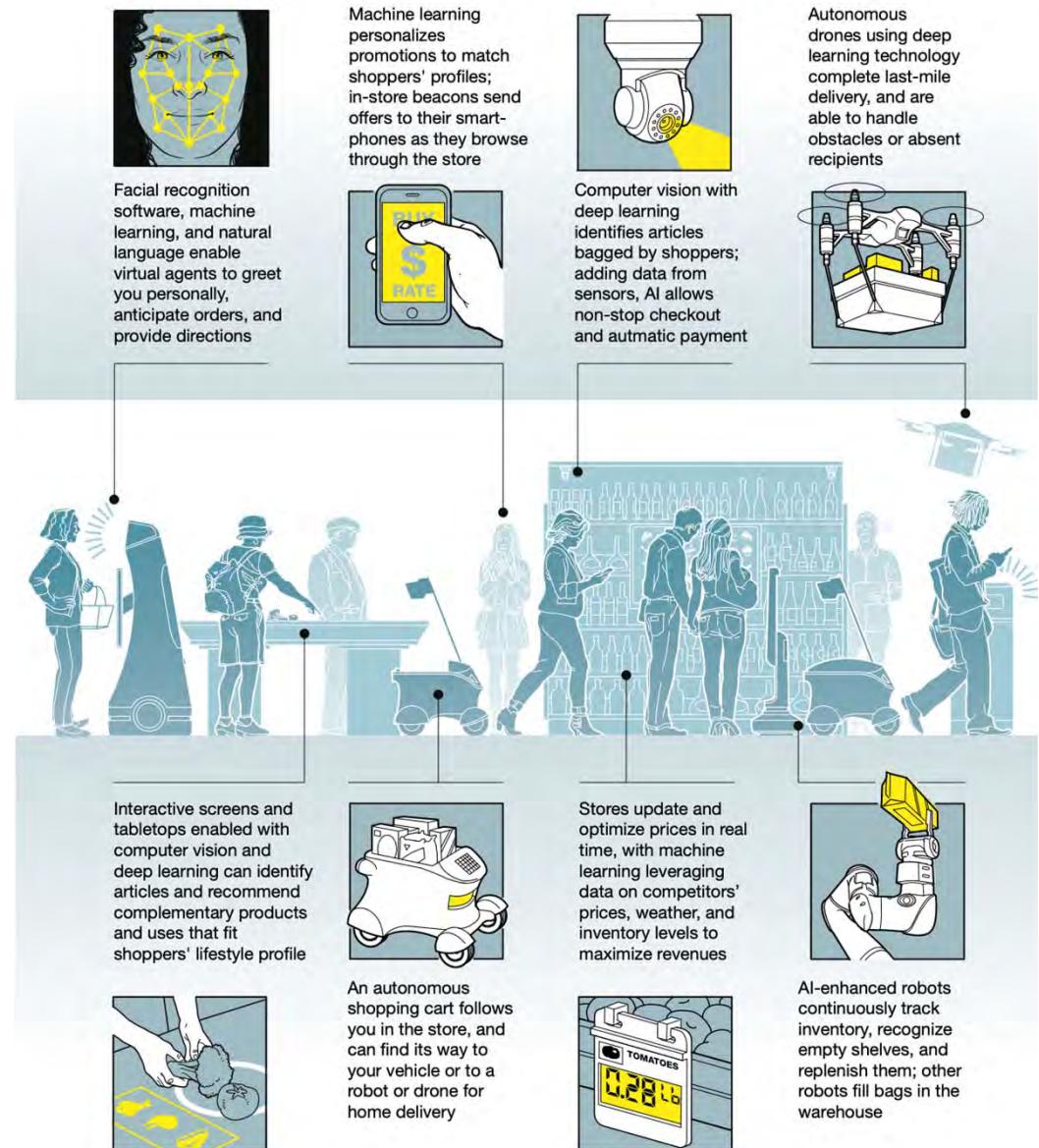
- Intelligent Shopping Systems
- Robots
- Biometric technologies
- Facial recognition



Retail Industry

- Artificial Intelligence: The Next Digital Frontier
 - 20 percent stock reduction by using deep learning to predict e-commerce purchases.
 - 2 million fewer product returns per year.
 - 30 percent reduction of stocking time by using autonomous vehicles in warehouses.
 - 50 percent improvement in assortment efficiency.
 - 4-6 percent sales increase using geospatial modeling to improve micro market attractiveness.
 - 30 percent online sales increases from the use of dynamic pricing and personalization.

Retailers can know more about what shoppers want—sometimes before shoppers themselves





Customer Experience

Traditionally: Americans are shifting their spending from material goods to experiences.

- The “Amazon effect”: there have been nine major retail bankruptcies in 2017
- Retailers need to become competitive or risk obsolescence
- Balancing “out-of-stock” with “over-stock” trade-off requires great finesse



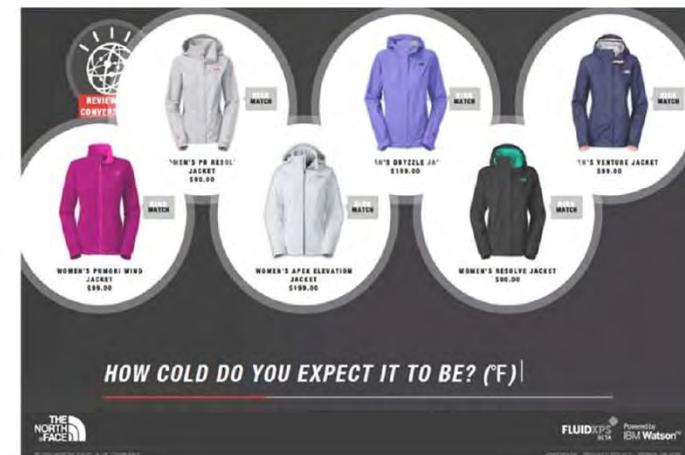
Now with AI: Companies bring experience and optimization to retail shopping.

- AI-powered gift concierge learns your preferences as you engage, and can help predict the appropriate gift to buy
- Leveraging ML-trained agents, companies are providing recommendations via natural language
- Companies using AI via Watson* to monitor factors from weather to consumer behavior, to optimize consumption rate predictions



Example: The North Face and Watson* are combining massive datasets and AI, to bring the brick-and-mortar experience to e-commerce.

- The North Face, with Fluid and IBM Watson*, has launched XPS* - an AI-enabled digital expert that uses a natural language interface to help shoppers.
- XPS curates and filters the available options, so shoppers are more likely to make a purchase





Food Supply Chain

Traditionally : Restaurants use historical data or “gut-feeling” approach to supply chain.

- This can result in excessive waste or food unavailability



Now with AI : Many companies have started to leverage sophisticated algorithms to forecast demand.

- Agents can adjust orders with trading partners in real time, as required for business need



Example: Vivanda's FlavorPrint* program.

- Based on recipes and consumer-provided data, Vivanda maps data to create “digital-taste” identifiers for each consumer
- Providing ML-based recommendations to customers may influence demand
- Shares data with food industry customers, enabling them to improve demand forecasts



Education Industry

- Personalized Learning Platforms
- Individualized Artificial Intelligence Tutors
- Personalized Games
- Crafting a more enjoyable learning experience



Example: Adaptive learning systems, and grading.

- Learning analytics track student performance and provide tailored educational programs.
- Using natural language processing and ML models, AI programs can be used for long answer and essay grading.



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Agriculture Industry

- Agricultural Drones
- Autonomous Tractors
- Vertical Farms

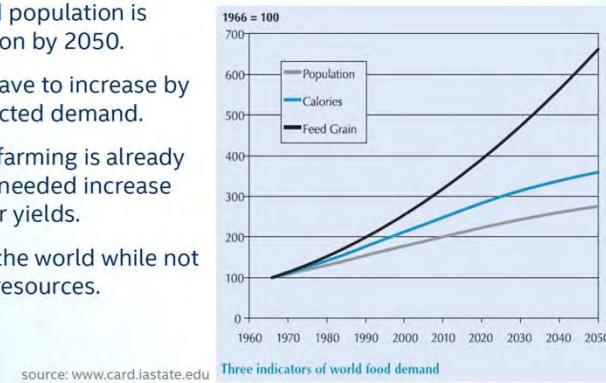




AgTech

Traditionally: The world population is estimated to reach 9 billion by 2050.

- Food production will have to increase by 70% to meet the projected demand.
- Most land suitable for farming is already being used, hence the needed increase must come from higher yields.
- Agriculture must feed the world while not over-straining Earth's resources.



source: www.card.iastate.edu

Now with AI: Autonomous robots use computer vision and a produce vacuum system for produce harvest.

- DL-enabled robots are being used to identify and kill weeds.
- Companies have shown 90% herbicide reduction due to "targeted" spray application.
- AI-driven genome sequencing advancements enables crop "genome" editing.



Example: TellusLabs yield predictions.

- Uses ML together with weather and other historical data to forecast yields.
- Leverages cloud-based GPUs for DL on satellite images.
- TellusLab's predictions have shown to be consistently more accurate than the USDA.
- Came within 1% of predicting corn and soybean yields in 2017.





Entertainment Industry

<https://youtu.be/9IXgVmLxVtQ>





AI for Music Generation

Example: “I AM AI”, first album released in 2017 to be generated by AI – with professional musicians and DL technology.

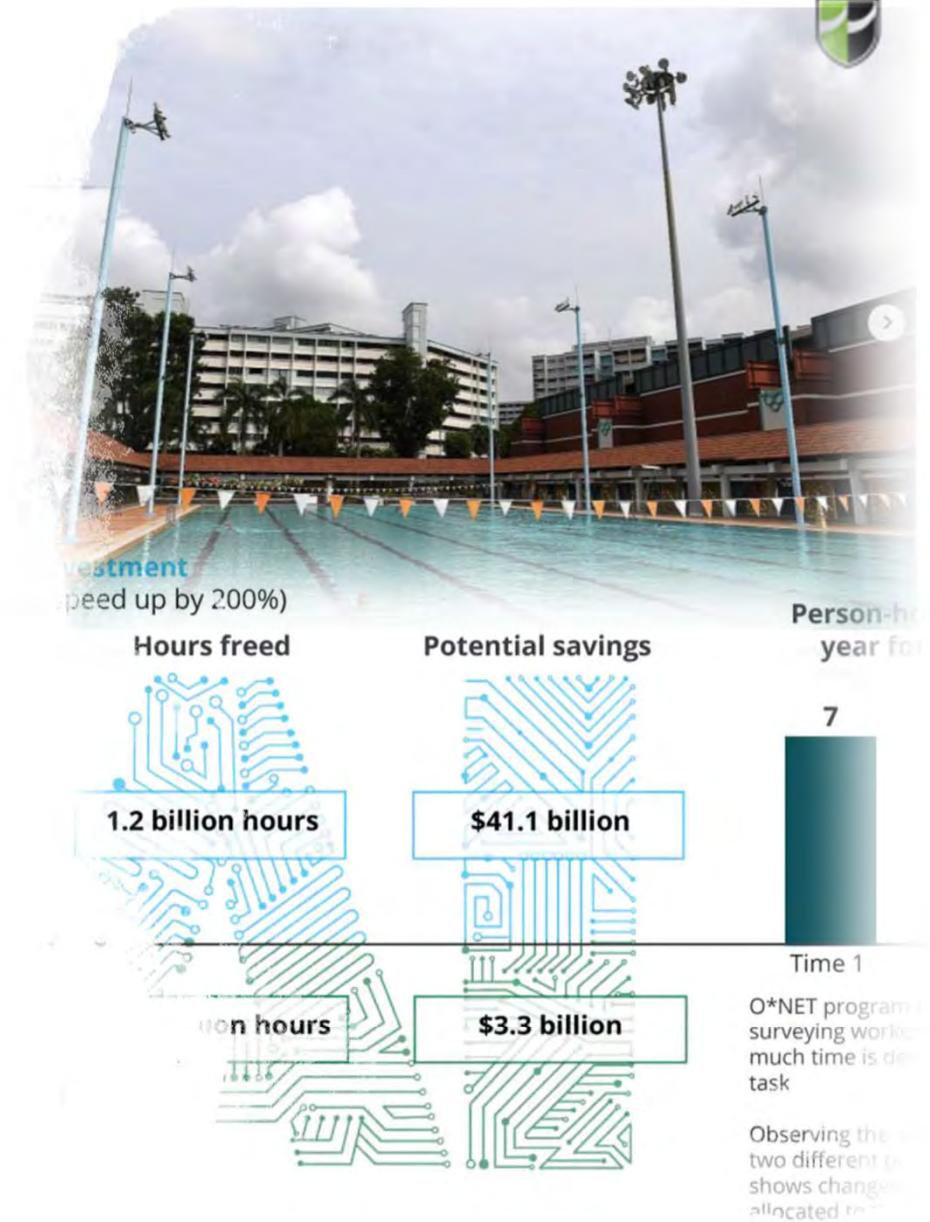
- Music generation is possible due to special DL algorithms that are designed for sequential data.
- The models learn musical patterns based on learning from large musical datasets.
- Raw music files can be processed on cloud-based computer power, making DL on these datasets possible.



The instrumentation was composed with artificial intelligence, lyrics and vocal melodies written by Taryn. Let us know what you think in the comments!

Governments

- Public Safety and security
- Bureaucratic Efficiency





Smart Cities

Traditionally: As of 2008, for the first time in history, half of the world's population resides in cities.

- There are heightened demands on scarce resources.
- Simultaneously, a large part of existing infrastructure is underutilized or not being used efficiently.



Now with AI: AI techniques are used to analyze photo and video data to perform studies of pedestrian and traffic trends.

- Adaptive signal control: allows traffic lights to tailor their timing based on real-time data.
- With license plate recognition, and DL technology, cities can not only optimize parking but can also track criminals.



Example: AT&T reimagines smart cities

- AT&T developed a framework to help cities integrate Internet of Things (IoT) sensors with AI.
- Remotely monitor the condition of roads, bridges, buildings.
- Assist with public safety.
- Notify police if gunfire has gone off, by using sound detection.





Cybersecurity

Example: Deep Instinct

- Uses GPU-based neural network to achieve 99% detection rates for even the most advanced cyber attacks.
- DeepInstinct's DL models have the ability to detect patterns - mostly designed by humans - enabling the prediction of pending cyber attack.





Oil and Gas

Traditionally : Shrinking oil reserves force companies to operate in remote and possibly hostile areas.

- Price has fallen dramatically in recent years.
- Forcing company layoffs and drastic budget cuts.
- Ultimately, companies are in great need of optimizing operations and cost.



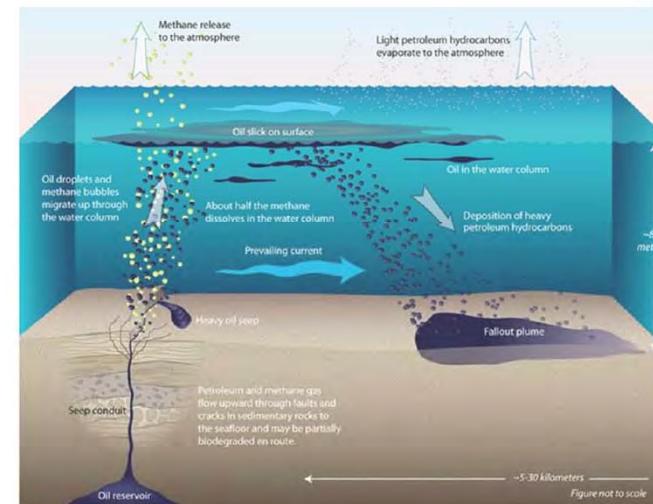
Now with AI : AI uses economic, political and weather data to forecast optimum production locations.

- Drilling is still an expensive and risk-prone endeavor.
- ML, with seismic, thermal and strata data, can help optimize the drilling process.



Example: ExxonMobile and MIT developing “submersible” robots for exploration.

- AI robots are used in ocean exploration to detect “natural seep”.
- Robots are trained via DL techniques and learn from their mistakes.
- Simultaneously protect the ecosystem and detect new energy resources.





Preventive Maintenance

Traditionally: Relied on historical data to provide basis for preventative maintenance schedule.

- Conservative approach: parts were replaced well before failure, and thus financially inefficient.
- Flawed due to inability to predict new failure modes.



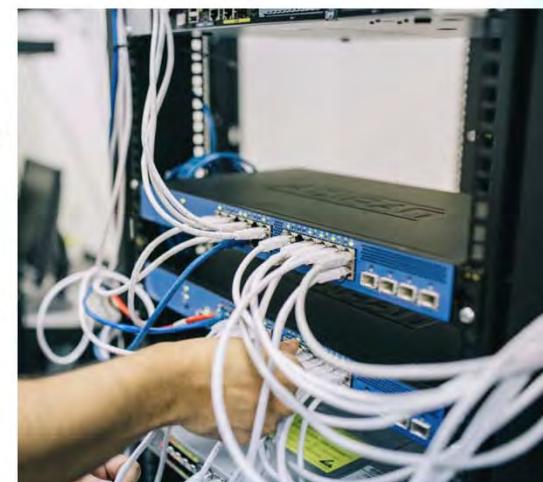
Now with AI: Internet of Things (IoT) sensors help to optimize maintenance scheduling.

- Part replacement schedule is optimized by assessing anomalies and failure patterns.
- Safety and productivity can increase exponentially.



Example: AI with General Electric.

- GE is the industry leader for Internet of Things (IoT) sensor installations on engines and turbines, and plans to have 60,000 engines connected to the internet by 2020.
- Computer vision cameras and reinforcement learning algorithms find tiny cracks or damage.
- Sensor data and AI allows GE to track performance and optimize part replacement.





Fault Detection

Example: Computer vision for fault detection on solar panels.

- DL algorithm trained on labelled data of correctly manufactured vs. flawed panels
- Reduced the need for human inspection by 66% compared to historical need





Automate Garment Industry

Example: SoftWear Automation's "sewbots".

- Computer vision is used to track fabric at the thread level.
- Eliminates need for human seamstress / seamster.
- Allows designers to create garments that were previously thought to be too complicated or specialized to construct.





AI and Customer Service

Example: Bot assistants and customer service agents

- AI Augmented messaging.
- AI for sorting and routing inquiries.
- AI enhanced customer phone calls.
- Some companies have used AI to fully automate customer service.





AI and Next Gen Gaming

Now with AI: Forza 5 Motorsport* uses its “Drivatar” AI system to learn how to drive in the style of other players in the game.

- Neural networks are used to train characters to walk and run realistically.
- Reinforcement Learning (RL) is a technique used throughout gaming.





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AI Services



- Google Search
 - Google Assistant ([hands on](#))
 - Google Photo (image recognition)
 - Speech Recognition
-
- Google's AI Services for Companies
 - <https://experiments.withgoogle.com/collection/ai>
 - Google's cloud-based AI Tools
 - <https://ai.google>
 - Google's AI Experiments:
 - <https://experiments.withgoogle.com/ai>
 - Do-it-Yourself AI:
 - <https://aiyprojects.withgoogle.com/voice/>



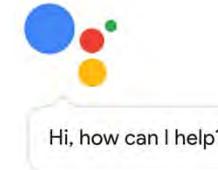
Voice Kit

Do-it-yourself intelligent speaker. Experiment with voice recognition and the Google Assistant.



Vision Kit

Do-it-yourself intelligent camera. Experiment with image recognition using neural networks.

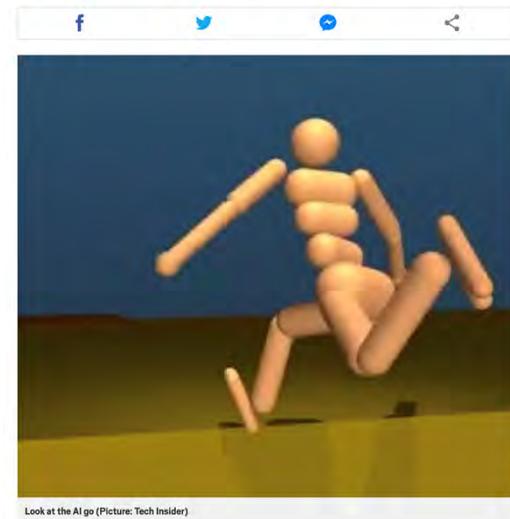


Meet your Google Assistant.

Ask it questions. Tell it to do things. It's your own personal Google, always ready to help.

Beware – Google's AI is so smart it just taught itself to walk without any human help

 **Jimmy Nsubuga** Monday 17 Jul 2017 6:31 pm



Look at the AI go (Picture: Tech Insider)



Google Duplex

<https://youtu.be/9IXgVmLxVtQ>

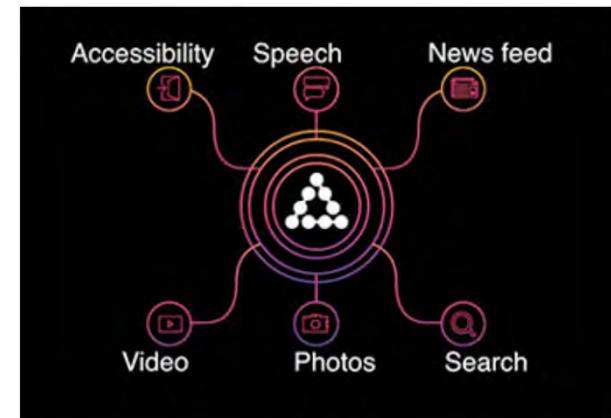


AI Services

- Facebook Photo search
- FB Learner Flow (<https://code.fb.com/ml-applications/introducing-fblearner-flow-facebook-s-ai-backbone/>)
- Text Analytics (Deep Text)
- Pattern Recognition to Prevent Suicides
- Improving 360 Degree Photos
- Computer Vision
- Facebook Personal Assistant M (experiment)
- Facebook Messenger Platform Chatbot
- Facebook's AI research Activities
 - <https://research.fb.com/category/facebook-ai-research/>

Facebook will use AI to help correct skewed 360-degree photos

The company has a technique for dealing with big file sizes, too.



TECHNOLOGY NEWS NOVEMBER 28, 2017 / 12:05 AM / A YEAR AGO

Facebook to expand artificial intelligence to help prevent suicide

David Ingram

3 MIN READ





AI Services

- Amazon Recommended Products
- Alexa Personal Assistant
- Cloud Storage
- Amazon's AI platform:
 - Amazon Lex
 - Amazon Polly
 - Amazon Recognition

LEARNING TOOLS

Get deep with machine learning

AWS DeepRacer

AWS DeepRacer is a fully autonomous 1/18th-scale race car designed to help you learn about reinforcement learning through autonomous driving.

- Experience the thrill of the race in the real world when you deploy your RL model onto AWS DeepRacer
- Build models in Amazon SageMaker and then train, test, and iterate on the track using the AWS DeepRacer 3D racing simulator
- Starting in 2019, compete in the world's first global autonomous racing league, to race for prizes and a chance to advance to win the coveted AWS DeepRacer Cup

[Learn more »](#)

AWS DeepLens

AWS DeepLens is the world's first deep learning-enabled video camera for developers. Integrated with Amazon SageMaker and many other AWS services, it allows you to get started with deep learning in less than 10 minutes through sample projects with practical, hands-on examples.

- Choose your deep learning model from the AWS DeepLens pre-trained model library, or your own model trained with Amazon SageMaker.
- Deploy your model to the device with a single click.
- Watch the results in real time in the AWS Management Console.

[Learn more »](#)



 Recommendations Personalize experiences for your customers with the same recommendation technology used at Amazon.com. AMAZON PERSONALIZE »	 Forecasting Build accurate forecasting models based on the same machine learning forecasting technology used by Amazon.com. AMAZON FORECAST »	 Image and Video Analysis Add image and video analysis to your applications to catalog assets, automate media workflows, and extract meaning. AMAZON REKOGNITION »
 Advanced Text Analytics Use natural language processing to extract insights and relationships from unstructured text. AMAZON COMPREHEND »	 Document Analysis Automatically extract text and data from millions of documents in just hours, reducing manual efforts. AMAZON TEXTRACT »	 Voice Turn text into lifelike speech to give voice to your applications. AMAZON POLLY »
 Conversational Agents Easily build conversational agents to improve customer service and increase contact center efficiency. AMAZON LEX »	 Translation Expand your reach through efficient and cost-effective translation to reach audiences in multiple languages. AMAZON TRANSLATE »	 Transcription Easily add high-quality speech-to-text capabilities to your applications and workflows. AMAZON TRANSCRIBE »

<https://aws.amazon.com/machine-learning/>



Amazon Rekognition

Amazon Rekognition Video をご紹介します。

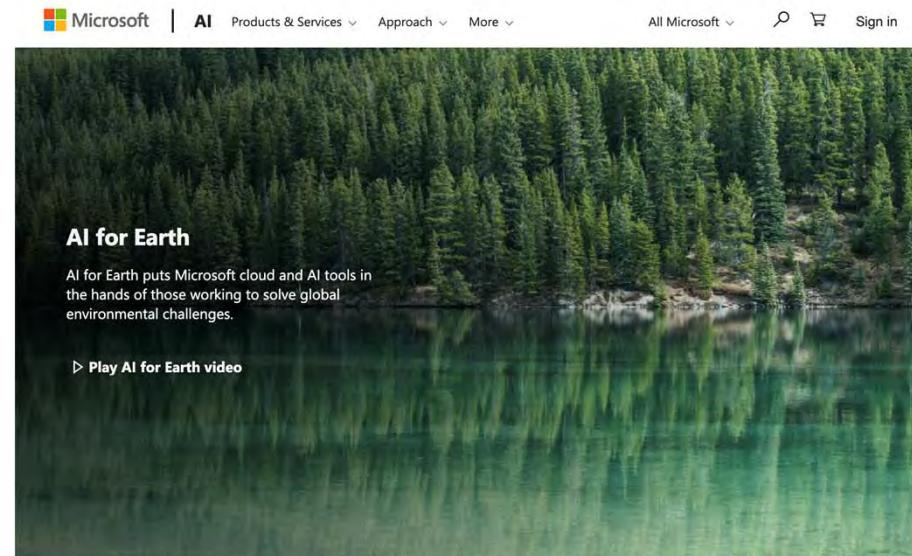


AI Services

- Cortana - <https://www.microsoft.com/en-us/windows/cortana>
- Presentation Translator -
<https://translator.microsoft.com/help/presentation-translator>
- HoloLens
- InnerEye - <https://www.microsoft.com/en-us/research/project/medical-image-analysis/>
- Azure Microsoft Cloud Service –
- AI for Earth -
<https://www.microsoft.com/en-us/ai/ai-for-earth>
- AI Language Translator -
<https://www.microsoft.com/en-us/translator/>
<https://www.bing.com/translator> (demo)



Microsoft



The screenshot shows the Microsoft AI for Earth landing page. At the top, there's a navigation bar with the Microsoft logo, a search icon, and links for 'Products & Services', 'Approach', 'More', 'All Microsoft', and 'Sign in'. Below the navigation is a large, scenic photograph of a forest reflected in a calm lake. Overlaid on this image is the text 'AI for Earth' and a brief description: 'AI for Earth puts Microsoft cloud and AI tools in the hands of those working to solve global environmental challenges.' A link 'Play AI for Earth video' is also visible. At the bottom of the page, under the heading 'Areas of focus', it says: 'AI for Earth awards grants to projects that use artificial intelligence to address four critical areas that are vital for building a sustainable future.' A link 'Learn about AI for Earth grants' is provided.

Microsoft | AI Products & Services Approach More All Microsoft Sign in

AI for Earth

AI for Earth puts Microsoft cloud and AI tools in the hands of those working to solve global environmental challenges.

Play AI for Earth video

Areas of focus

AI for Earth awards grants to projects that use artificial intelligence to address four critical areas that are vital for building a sustainable future.

Learn about AI for Earth grants >



Presentation Translator

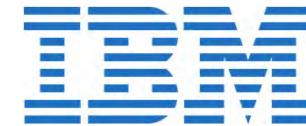
<https://youtu.be/9IXgVmLxVtQ>



InnerEye Research Project

<https://youtu.be/9IXgVmLxVtQ>

AI Services



- Cognos Analytice - <https://www.ibm.com/us-en/products/cognos-analytics>
- Tone Analyzer - <https://tone-analyzer-demo.ng.bluemix.net> (demo)
- Discovery - <https://discovery-news-demo.ng.bluemix.net>
- Visual Recognition -
<https://www.ibm.com/watson/services/visual-recognition/demo/#demo>
- Text to Speech - <https://text-to-speech-demo.ng.bluemix.net/> (audio streaming does not work on mobile browser)

The screenshot shows the IBM Watson Tone Analyzer service page. At the top, there's a purple icon of a speech bubble with a brain inside. Below it, the title 'Tone Analyzer' is displayed. A note states: 'This service uses linguistic analysis to detect joy, fear, sadness, anger, analytical, confident and tentative tones found in text.' A warning follows: 'This system is for demonstration purposes only and is not intended to process Personal Data. No Personal Data is to be entered into this system as it may not have the necessary controls in place to meet the requirements of the General Data Protection Regulation (EU) 2016/679.' On the right, there's a 'Resources' sidebar with links to Documentation, API Reference, Fork on Github, and Start for free in IBM Cloud.

The screenshot shows the IBM Watson Visual Recognition service page for insurance claims. It features a large image of a van covered in colorful graffiti. To the right, a table lists custom classifier results:

Category	Score
vandalism	0.64
flat_tire	0.53
broken_windshield	0.11
motorcycle_accident	0.06

A note below the table says: 'International vehicle glass repair company Belron uses Custom Models to automatically generate estimates of repair costs based on customer-submitted images of car damage.' At the bottom, there's a section titled 'Select an image on the left to evaluate how this Custom Model analyzes different images'.



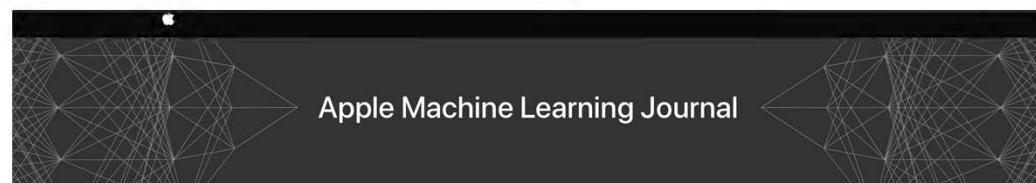
AI Services

- Speech Recognition on Siri
- QuickType
- A11 Bionic Chip – Core ML
- Apple Music
- Apple HomePod
- Apple Photos

Apple has new self-driving car hardware covered with iPod-style white plastic

Kif Leswing, Business Insider US

October 18, 2017



Apple acquires AI tech that seeks to understand your photos

Regaind can tell good pics from bad ones, and interpret what's going on.

71,188 views | Dec 26, 2016, 07:05am

Apple Publishes Its First Artificial Intelligence Paper



Aaron Tilley Forbes Staff

Optimizing Siri on HomePod in Far-Field Settings

Vol. 1, Issue 12 • December 2018
by Audio Software Engineering and Siri Speech Team



AI Services

Robots Run the Warehouses ([link](#))

Innovation

Alibaba lets AI, robots and drones do the heavy lifting on Singles' Day

This year's November 11 shopping ritual will engage a recommendation algorithm, robots, and chatbots capable of understanding human emotion

Topic | Singles' Day (11.11)

SMART CUSTOMER SERVICE

Ali Assistant is a chatbot that handles both spoken and written queries, acting as customer-service rep and personal shopping assistant. It is capable of handling up to **95%** of customer service enquiries.



Intelligent Machines

Alibaba's AI Fashion Consultant Helps Achieve Record-Setting Sales

AI will blur the line between online and offline retail.

BIG DATA

With nearly **500 million** active users across its websites and apps, Alibaba has a vast repository of consumer data that can be processed and analyzed by AI programs continuously in real time, leading to increasingly accurate predictions and a better shopping experience.



COMPUTING POWER

Alibaba has built up one of the world's largest networks of interconnected computer servers to run its e-commerce empire, backed by an operating system that can process more than **175,000** transactions per second.



Function specific AI services

Sales	Outreach.io
Virtual Human	https://www.quantumcapture.com/ctrl-human
HR Services	https://leena.ai/HR-FAQ
Scheduling	https://x.ai/how-it-works/
Enterprise support functions	https://www.soapbox.ai/
Sales Bots	https://octaneai.com/
AI-Powered Transcription	http://capiro.ai/index.html
Hiring	https://hiringsolved.com/product
Programming	https://www.codota.com/enterprise https://kite.com/



Hands-on Training an image classifier

Training an image classifier



**Hotdog/Not-Hotdog
- HBO's Silicon Valley**

- 01
- 02
- 03
- 04
- 05
- 06

Setup

Create Azure account
Create Custom Vision resources

Prepare images

Gather training and validation images from internet
or other sources

Train the classifier

Allow the classifier to know what constitutes a given class.

Evaluate the classifier

Check for accuracy, recall and probability threshold.

Test your model

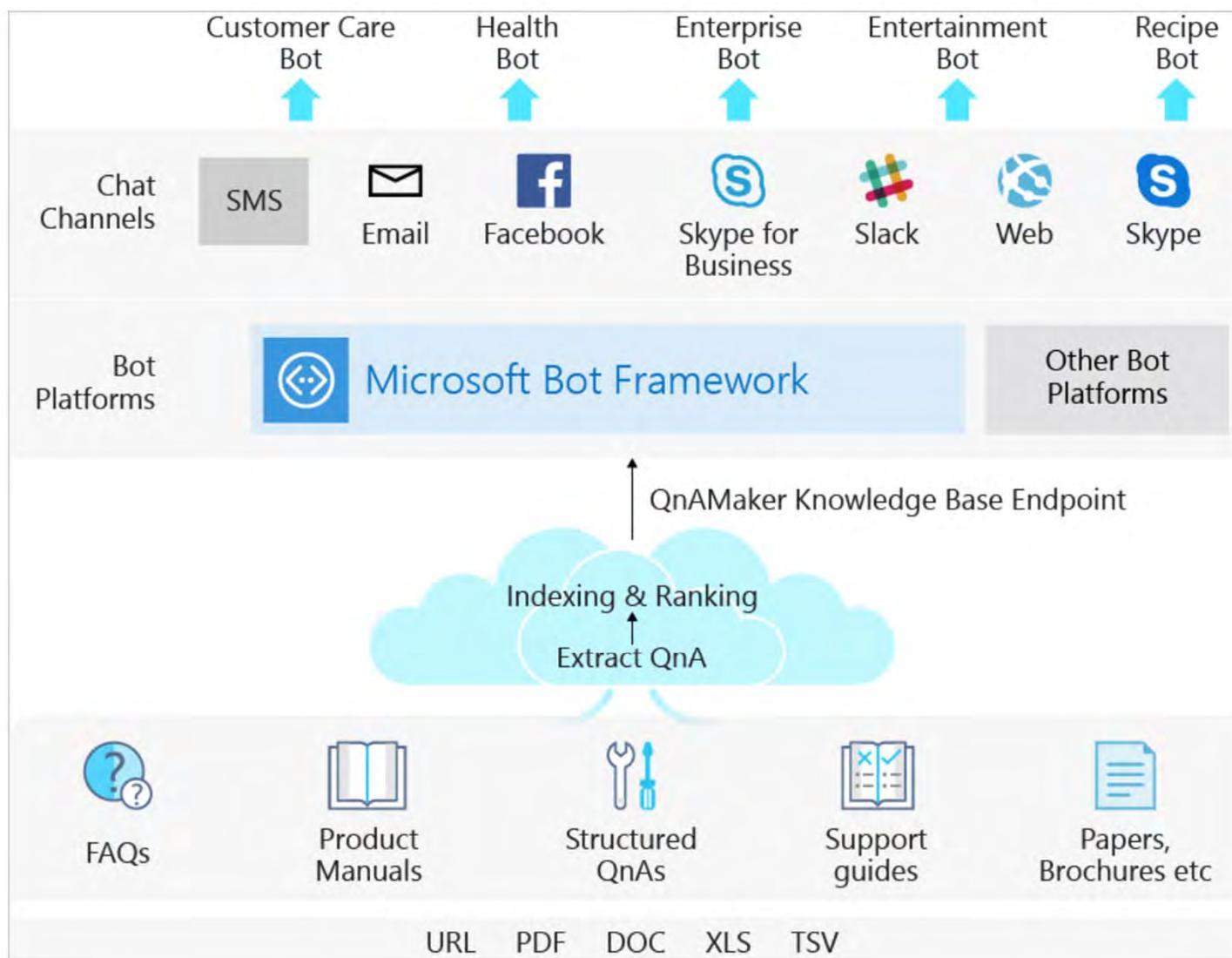
Use unseen data to test your classifier.

Improve your classifier

Use various techniques to improve your classifier.



Hands on - Chatbot



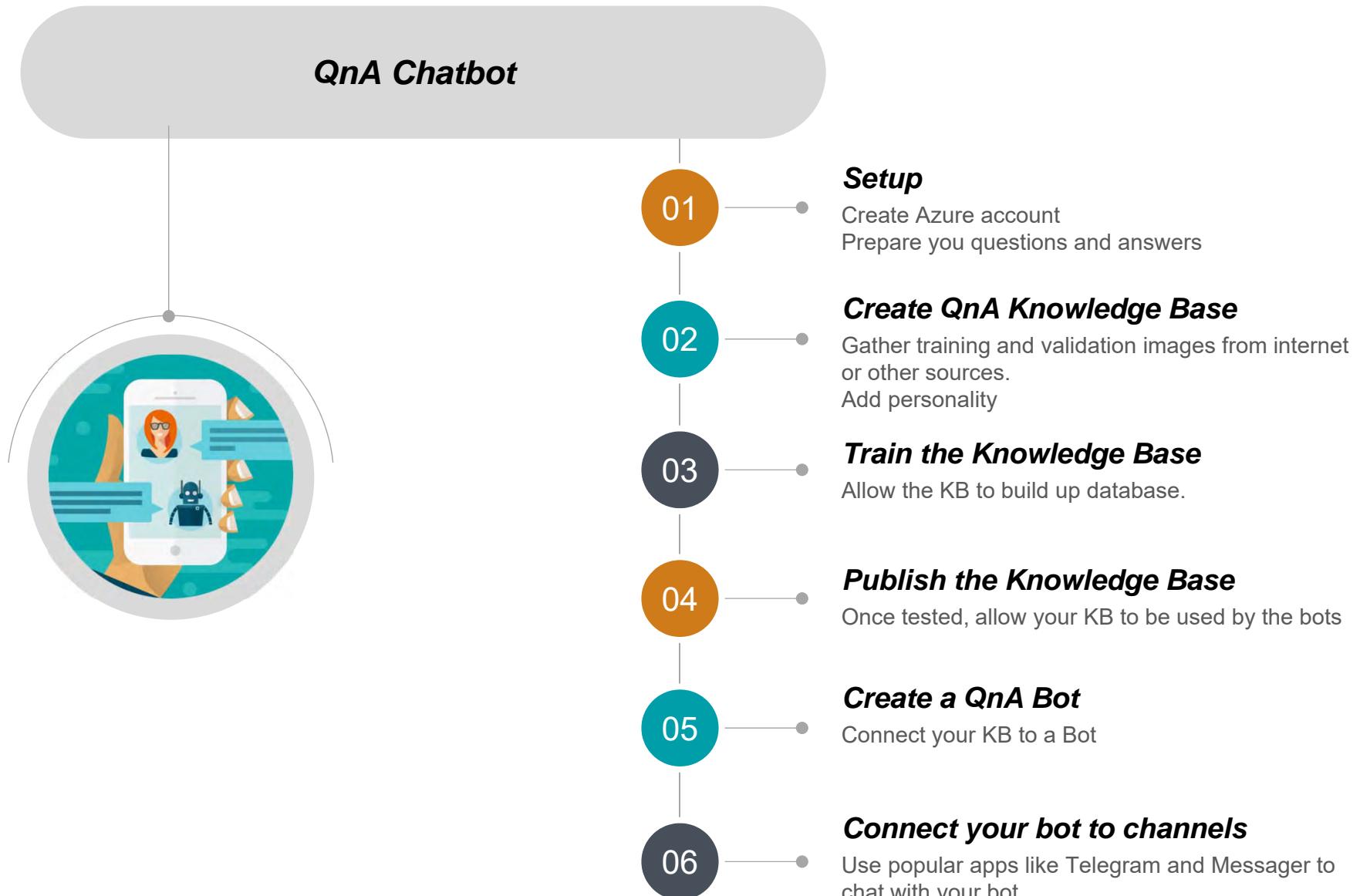


QnA Source

The table below summarizes the types of content and file formats that are supported by QnA Maker.

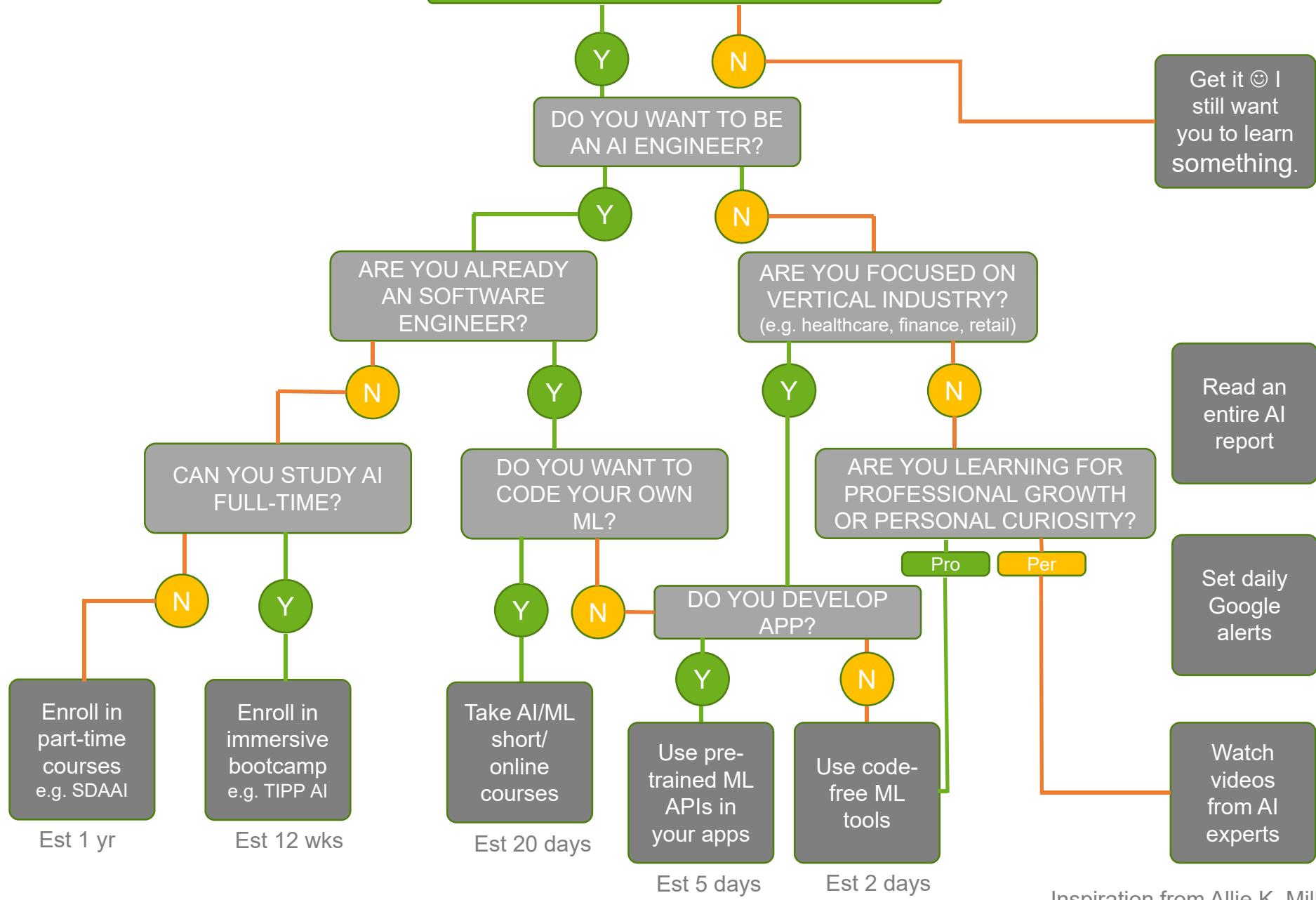
Source Type	Content Type	Examples
URL	FAQs (Flat, with sections or with a topics homepage) Support pages (Single page how-to articles, troubleshooting articles etc.)	Plain FAQ , FAQ with links , FAQ with topics homepage Support article
PDF / DOC	FAQs, Product Manual, Brochures, Paper, Flyer Policy, Support guide, Structured QnA, etc.	Structured QnA.doc , Sample Product Manual.pdf , Sample semi-structured.doc , Sample white paper.pdf
Excel	Structured QnA file (including RTF, HTML support)	Sample QnA FAQ.xls
TXT/TSV	Structured QnA file	Sample chit-chat.tsv

Hands-on Building a QnA Chatbot





DO YOU WANT TO LEARN AI?





Where to go from here?

MOOC:
DataCamp
<https://www.datacamp.com/>

The screenshot shows the DataCamp website with a search result for "python". There are 57 results. The first few courses listed are:

- Intro to Python for Data Science: Master the basics of data analysis in Python. Expand your skill set by learning scientific computing with NumPy.
- Intermediate Python for Data Science: Level up your data science skills by creating visualizations using matplotlib and manipulating data frames with Pandas.
- Python Data Science Toolbox (Part 1): Learn the art of writing your own functions in Python, as well as key concepts like scoping and error handling.
- Deep Learning in Python: Learn the fundamentals of neural networks and how to build deep learning models using Keras 2.0.
- Supervised Learning with scikit-learn: Learn how to build and tune predictive models and evaluate how well they will perform on unseen data.
- pandas Foundations: Learn how to use the industry-standard pandas library to import, build, and manipulate DataFrames.

Edx
<https://www.edx.org/>

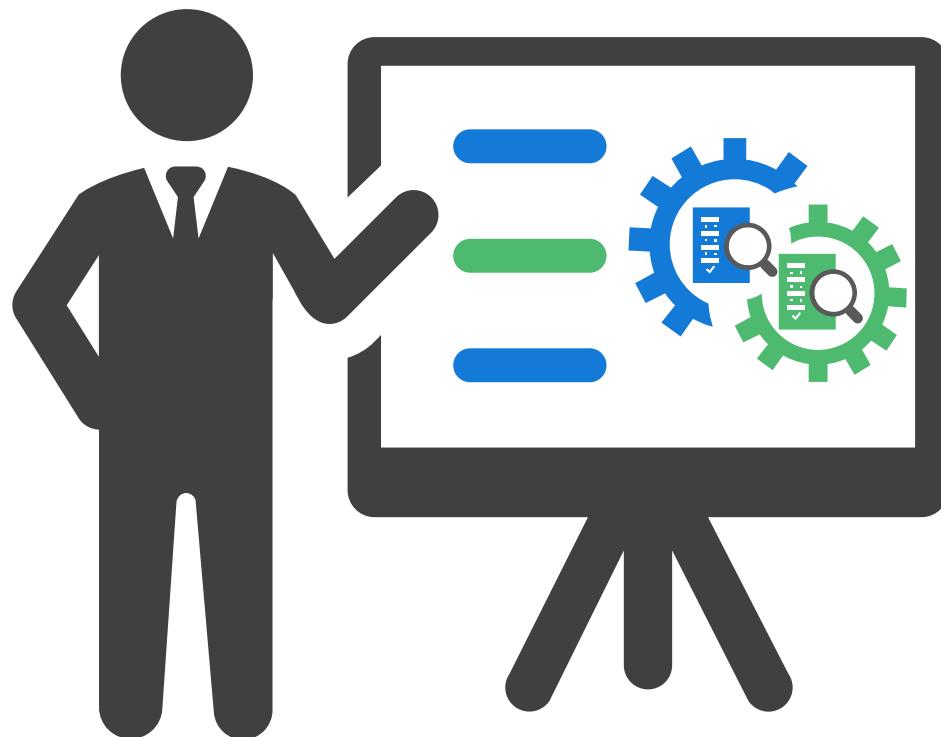
The screenshot shows the edX homepage. It features a banner for "Cyber Monday" with the text "THE COUNTDOWN IS ON! Get 15% off your purchase." Below the banner, there is a "Start Exploring" button and a "Popular Subjects" section. At the bottom, there are logos for various partner institutions: MIT, Harvard, Berkeley, The University of Texas System, The Hong Kong Polytechnic University, and The University of British Columbia.

Udemy (freemium course)
<https://t.me/freecourse>

RP/SOI AI4E Telegram Channel
<http://bit.ly/2FFWsPI>



Summary



Email
seow_khee_wei@rp.edu.sg

Telegram
[@kwseow](https://t.me/kwseow)

Source code:



Thank you