REPUBLIC POLYTECHNIC

DISCOVER. TRANSFORM. ACHIEVE

Artificial Intelligence for Law Enforcement

Quick poll

http://bit.ly/2Y8MTi2

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)
	Lunch Break
Section 4:	Use cases sharing (30 mins)
Section 5:	AI Services (30 mins)
Section 6:	Hands-on/Demo anomaly detection (45 hour)
Section 7:	Hands-on/Demo Graphs (45 hour)

Resources

- Goto http://bit.ly/35RvShu
  - Download pdf (this presentation deck)
  - Links to other resources. Save you the typing!

Introduction of trainer

Name

Seow Khee Wei

Telegram

@kwseow

Email

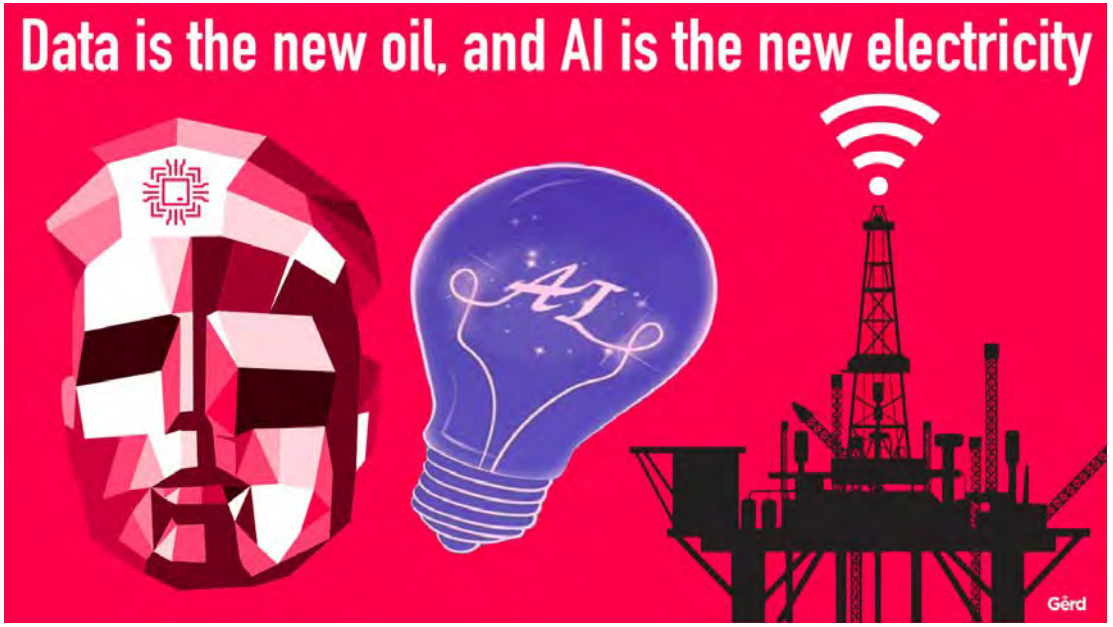
seow_khee_wei@rp.edu.sg

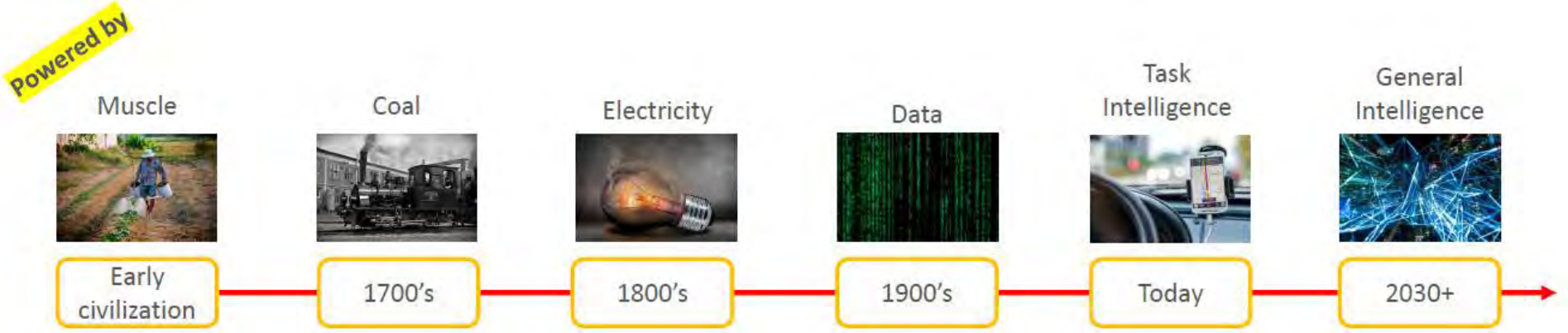
What is Artificial Intelligence?

- The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision making, and translation between languages.” – Google

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





History of AI

A.I. TIMELINE

1950
TURING TEST
Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955
A.I. BORN
Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961
UNIMATE
First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964
ELIZA
Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966
SHAKEY
The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER
Many false starts and dead-ends leave A.I. out in the cold

1997
DEEP BLUE
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998
KISMET
Cynthia Breazeal at MIT introduces KISmet, an emotionally intelligent robot insofar as it detects and responds to people's feelings

1999
AIBO
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time

2002
ROOMBA
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011
SIRI
Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S

2011
WATSON
IBM's question answering computer Watson wins first place on popular $1M prize television quiz show *Jeopardy*

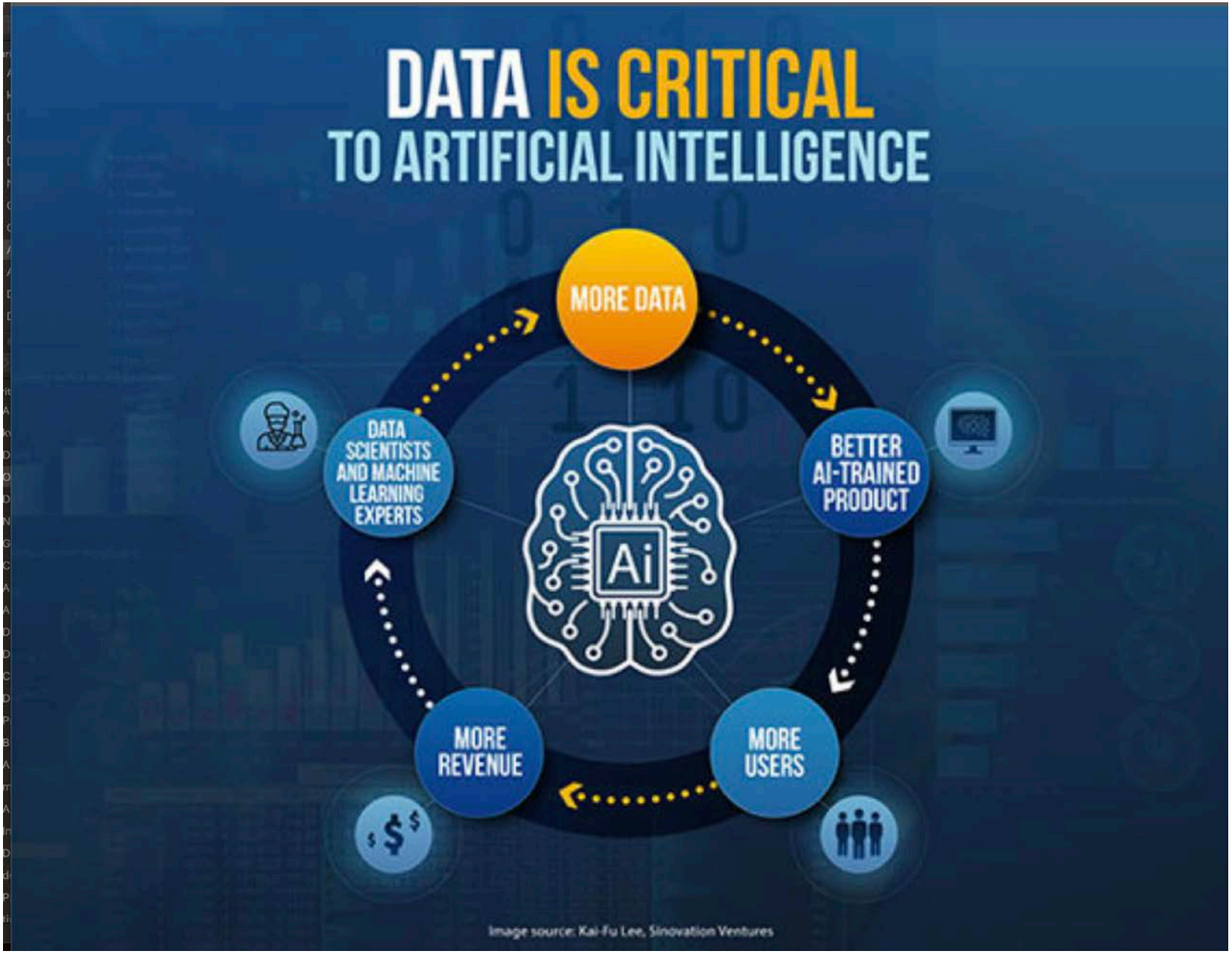
2014
EUGENE
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

2014
ALEXA
Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks

2016
TAY
Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

2017
ALPHAGO
Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

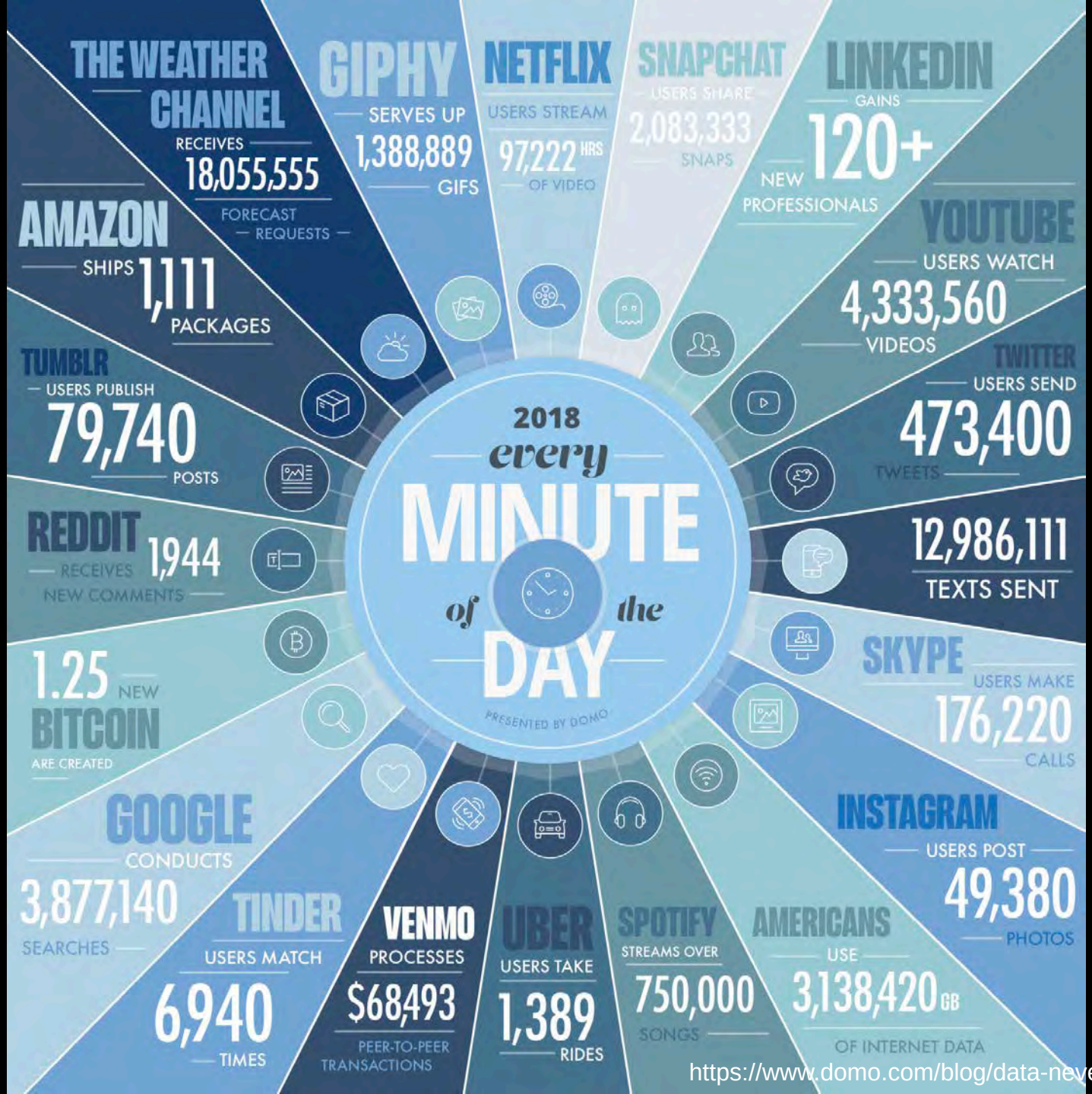
https://digitalwellbeing.org/artificial-intelligence-timeline-infographic-from-eliza-to-tay-and-beyond/


DATA IS CRITICAL
TO ARTIFICIAL INTELLIGENCE
MORE DATA
BETTER AI-TRAINED PRODUCT
MORE USERS
MORE REVENUE
DATA SCIENTISTS AND MACHINE LEARNING EXPERTS
Ai
Image source: Kai-Fu Lee, Sinovation Ventures

Bigger Datasets

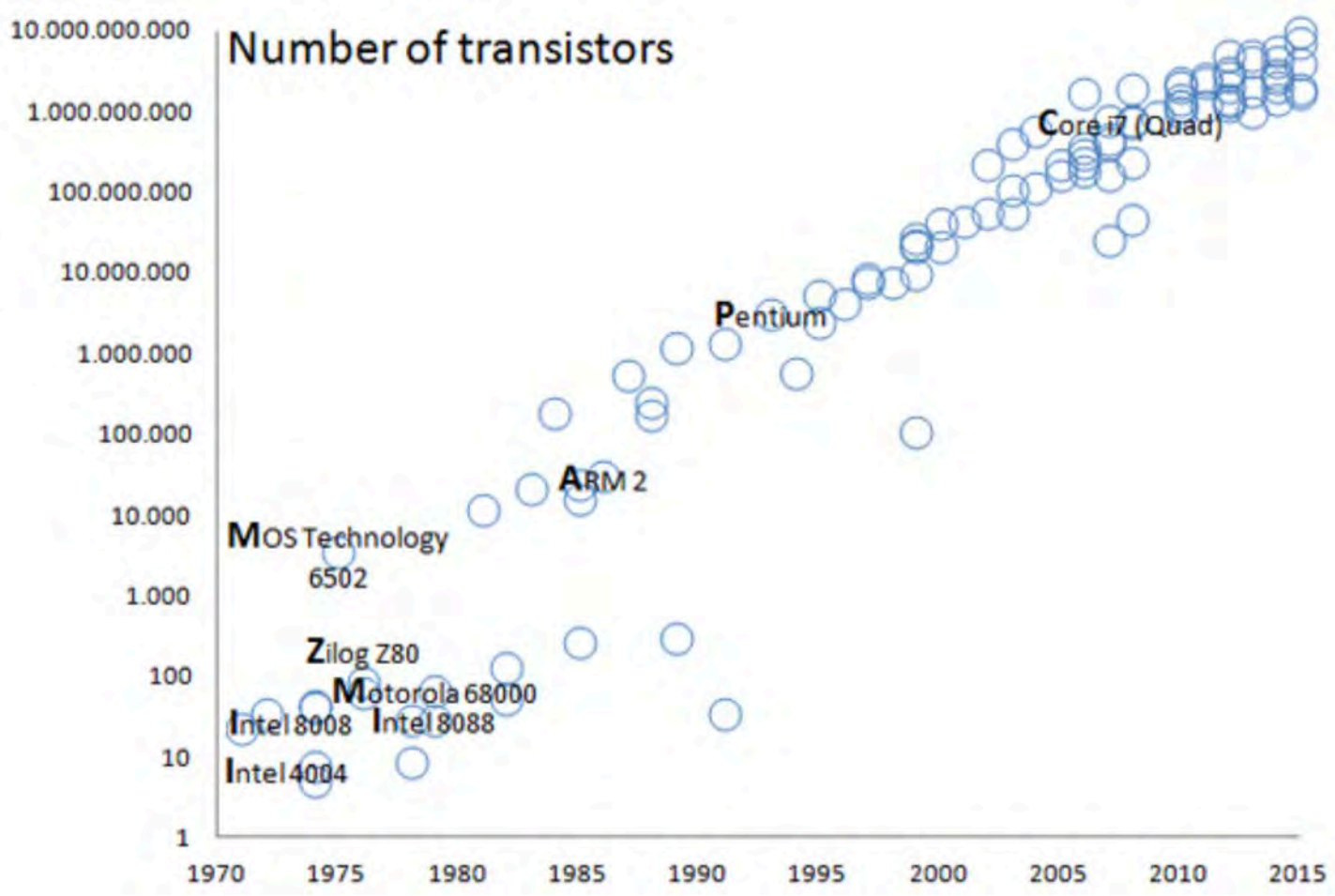
In 2020, it is expected that:

- The average internet user will generate ~1.5 GB of traffic per day.
- A smart hospital will generate 3,000 GB/day.
- Self-driving cars are each generating over 4,000 GB/day.
- Connected planes will generate 40,000 gigabytes per day.
- A connected factory will generate 1 million gigabytes per day.

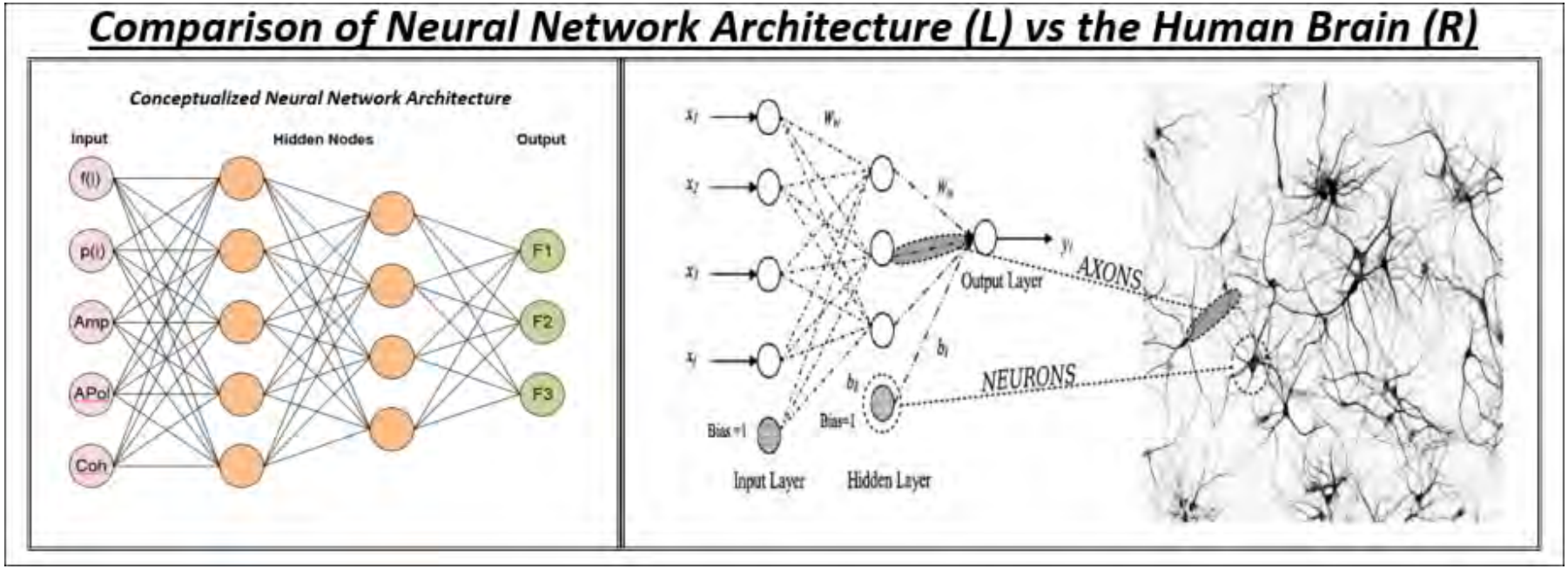


https://www.domo.com/blog/data-never-sleeps-3-0/

Moore’s Law

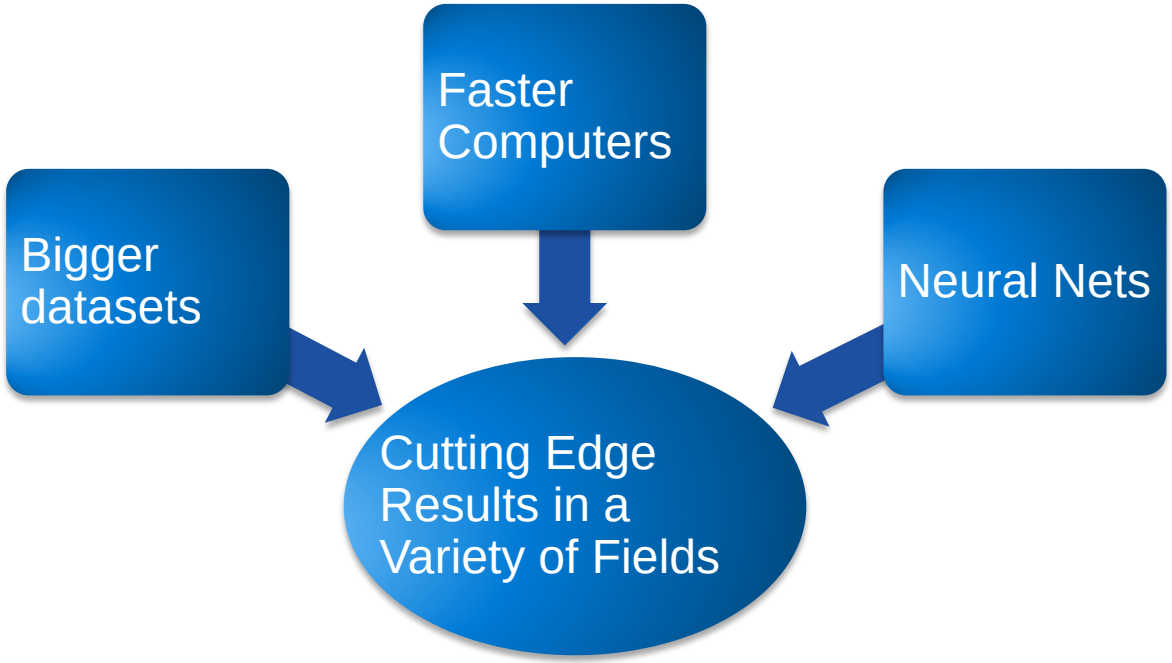

Number of transistors
10.000.000.000
1.000.000.000
100.000.000
10.000.000
1.000.000
100.000
10.000
1.000
100
10
1
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Core i7 (Quad)
Pentium
ARM 2
MOS Technology 6502
Zilog Z80
Motorola 68000
Intel 8008
Intel 8088
Intel 4004

Neural Network

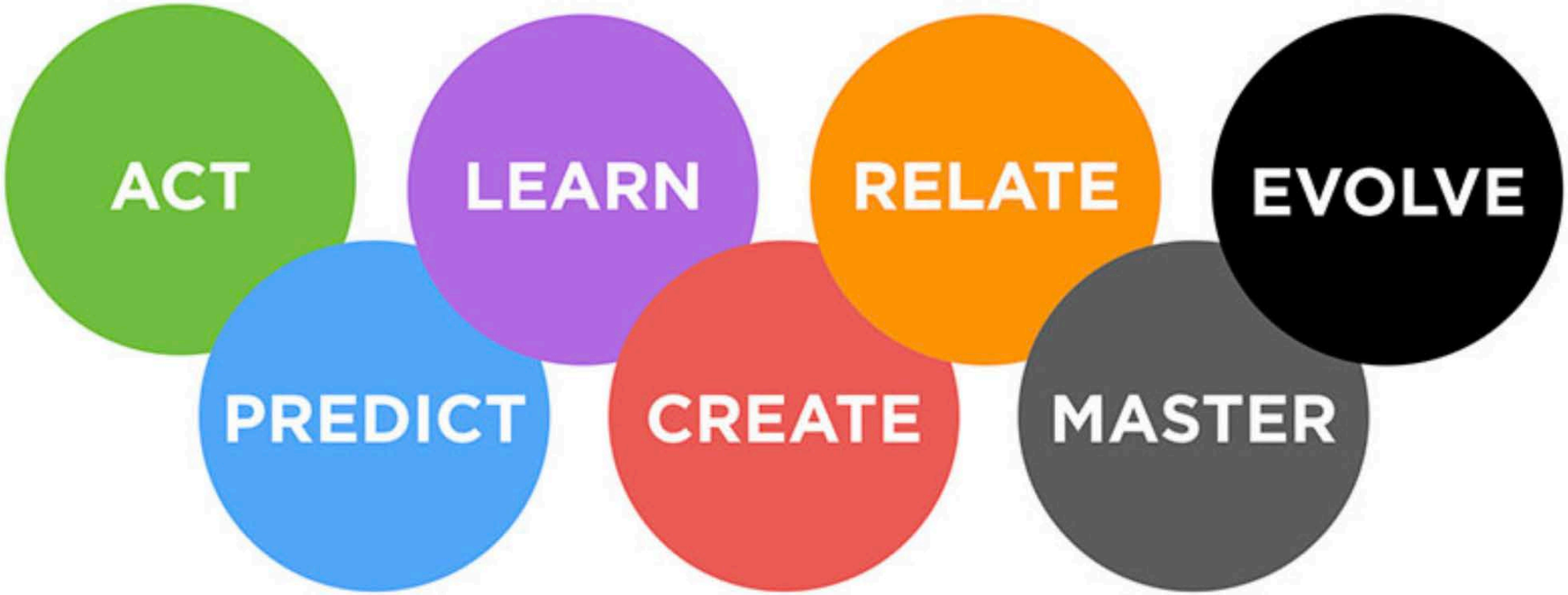


AI Hardware

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

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

Systems that Acts

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

Systems that Predicts

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

Systems that Learns

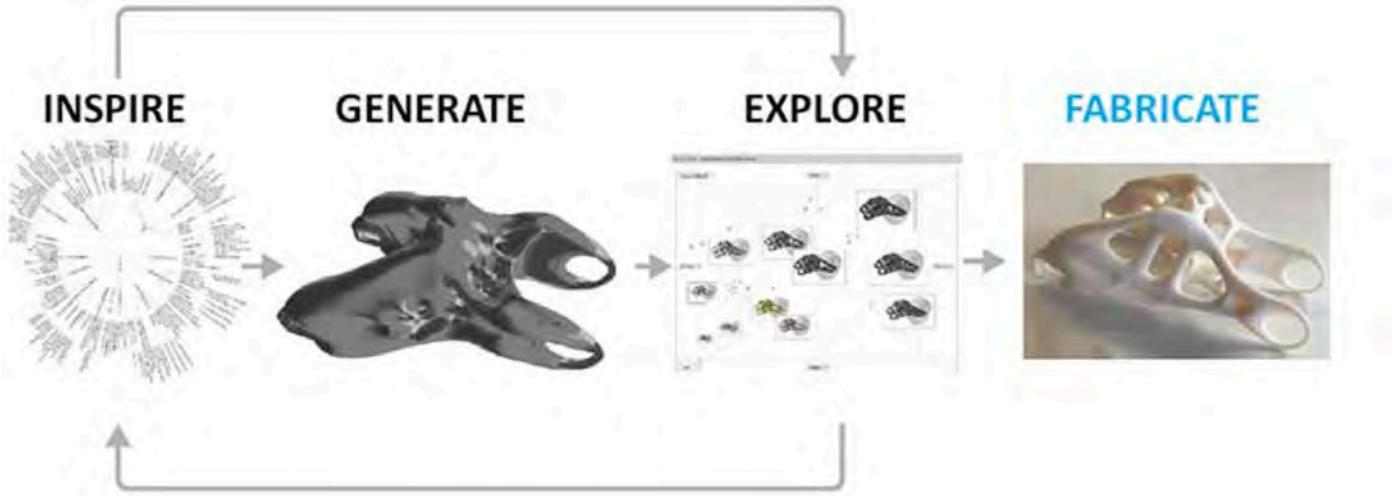
https://www.topbots.com/topbots-ai-machine-intelligence-continuum/?utm_medium=article&utm_source=medium&utm_campaign=AI-Continuum

Systems that Create

Generated story about image
Model: Romantic Novels

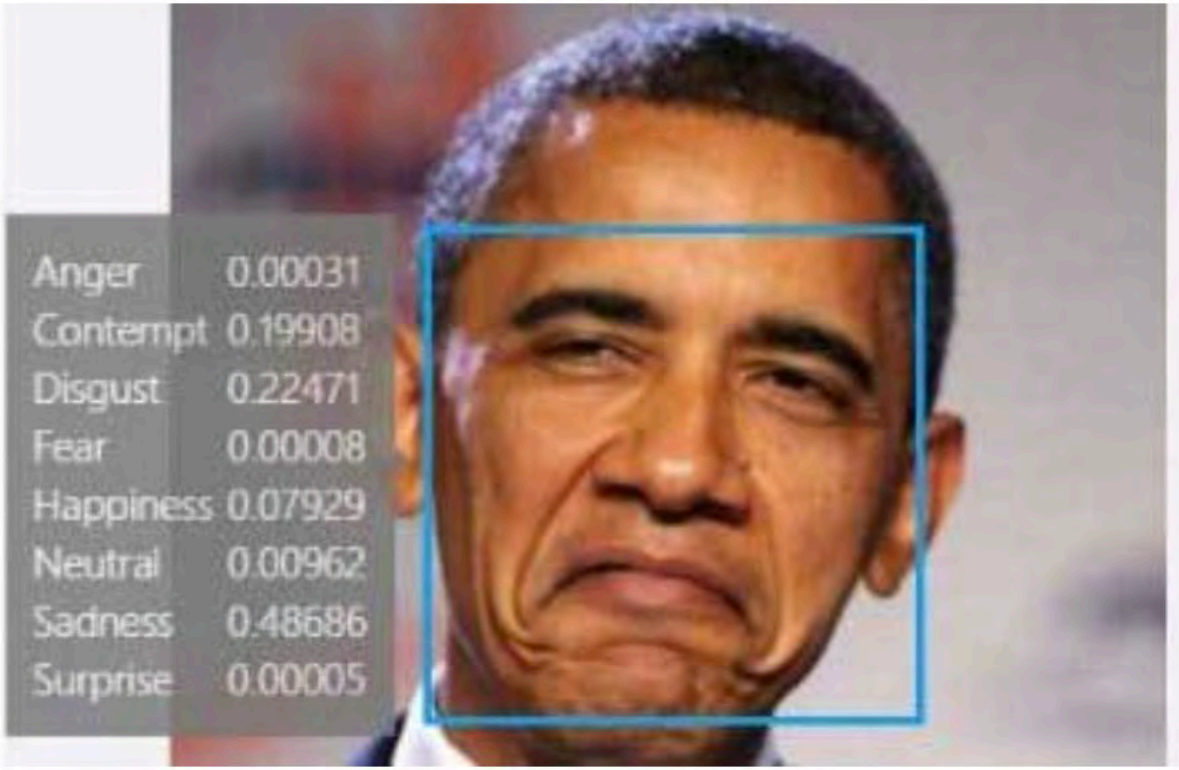
"He was a shirtless man in the back of his mind, and I let out a curse as he leaned over to kiss me on the shoulder.

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



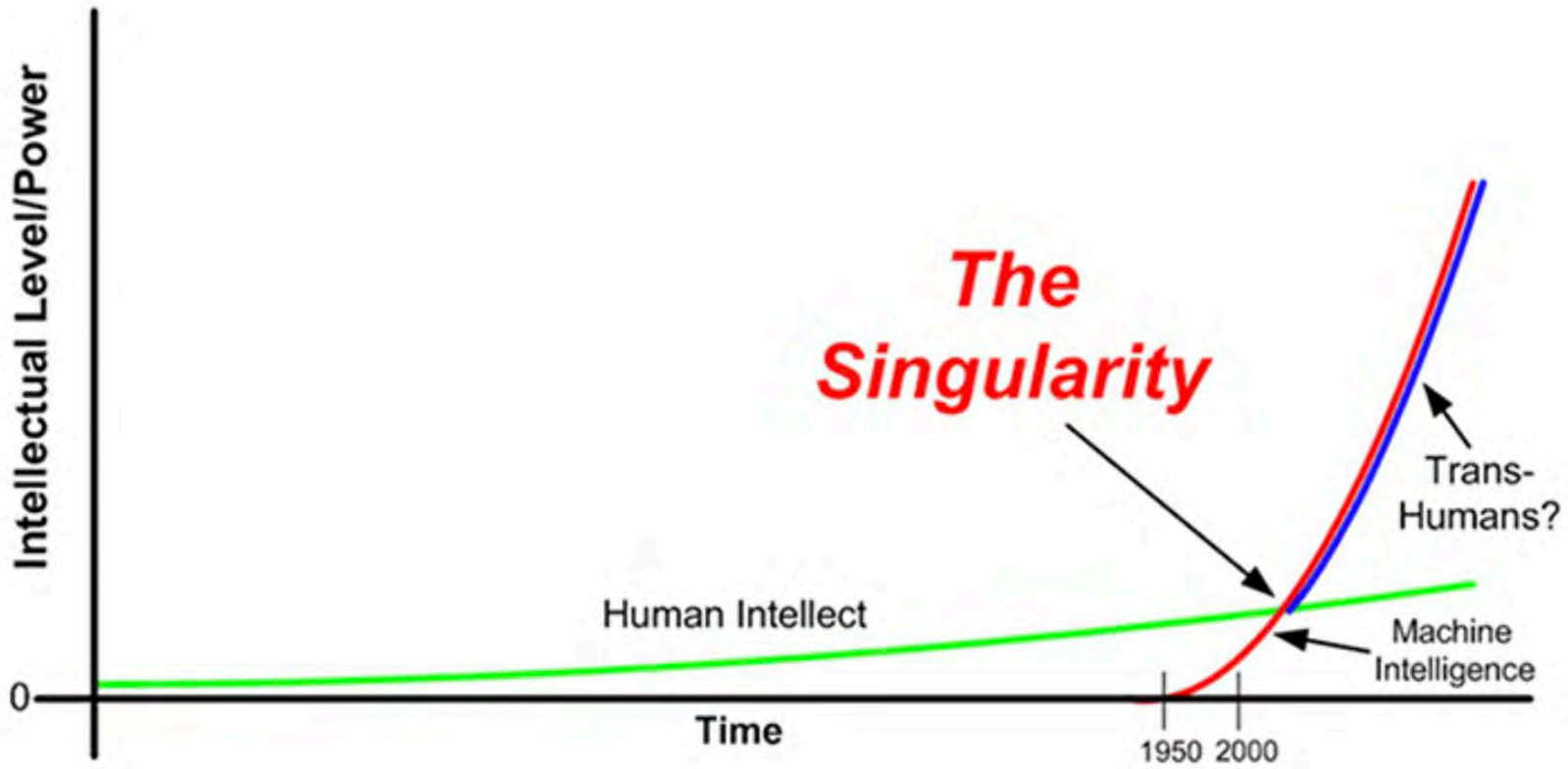
https://www.topbots.com/topbots-ai-machine-intelligence-continuum/?utm_medium=article&utm_source=medium&utm_campaign=AI-Continuum

Systems that Master




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

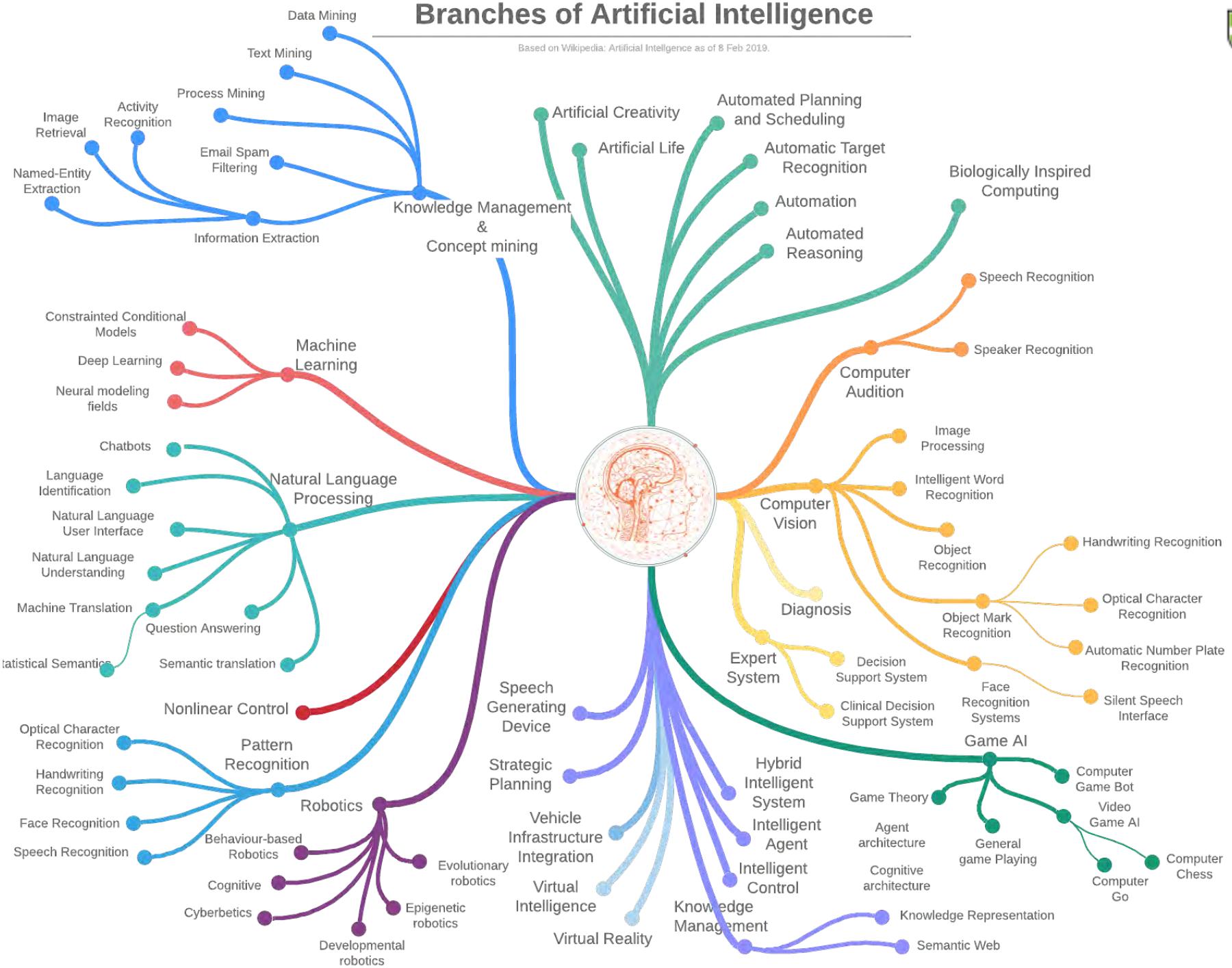
Systems that Evolve



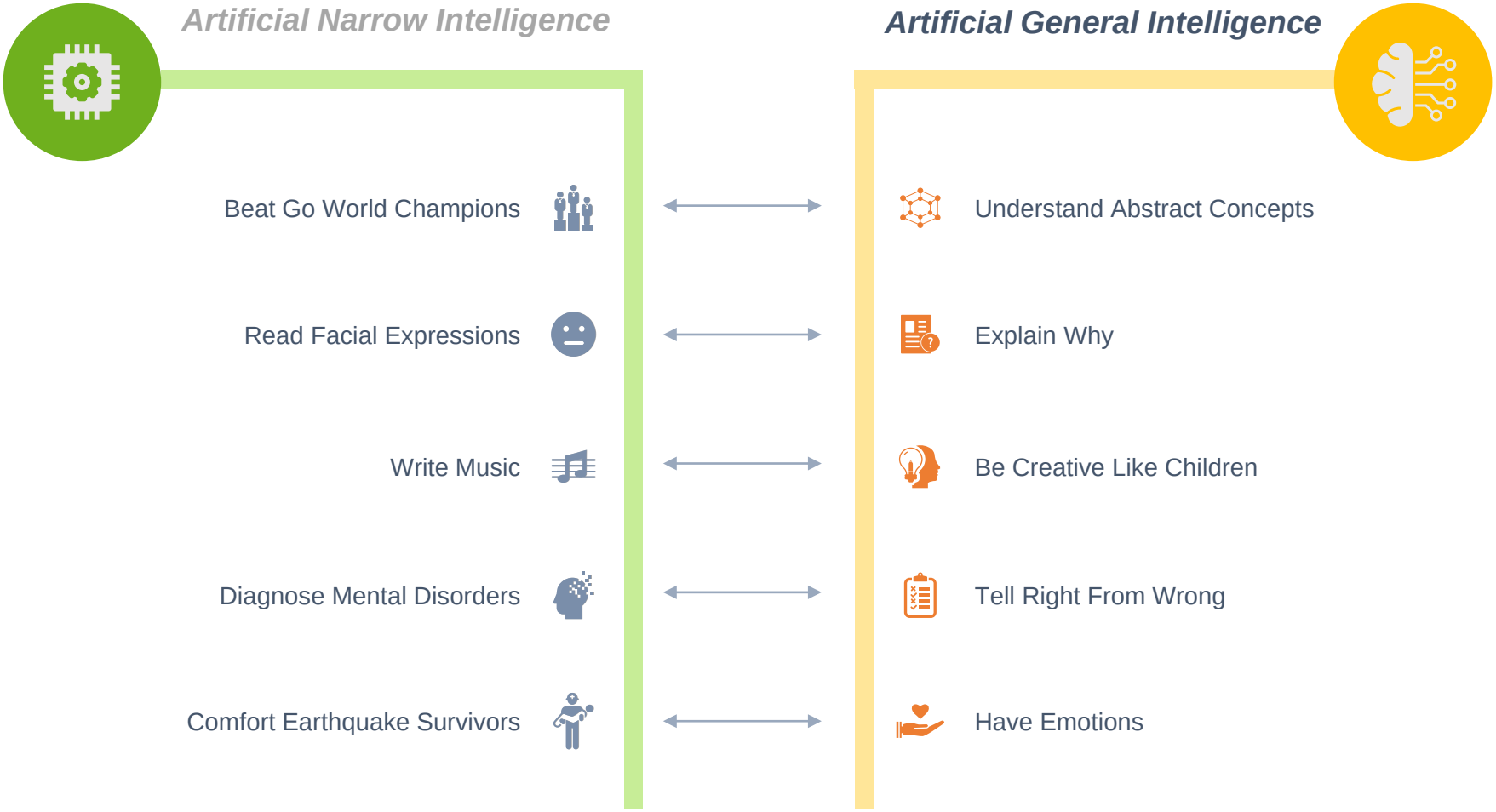
https://www.topbots.com/topbots-ai-machine-intelligence-continuum/?utm_medium=article&utm_source=medium&utm_campaign=AI-Continuum

Branches of Artificial Intelligence

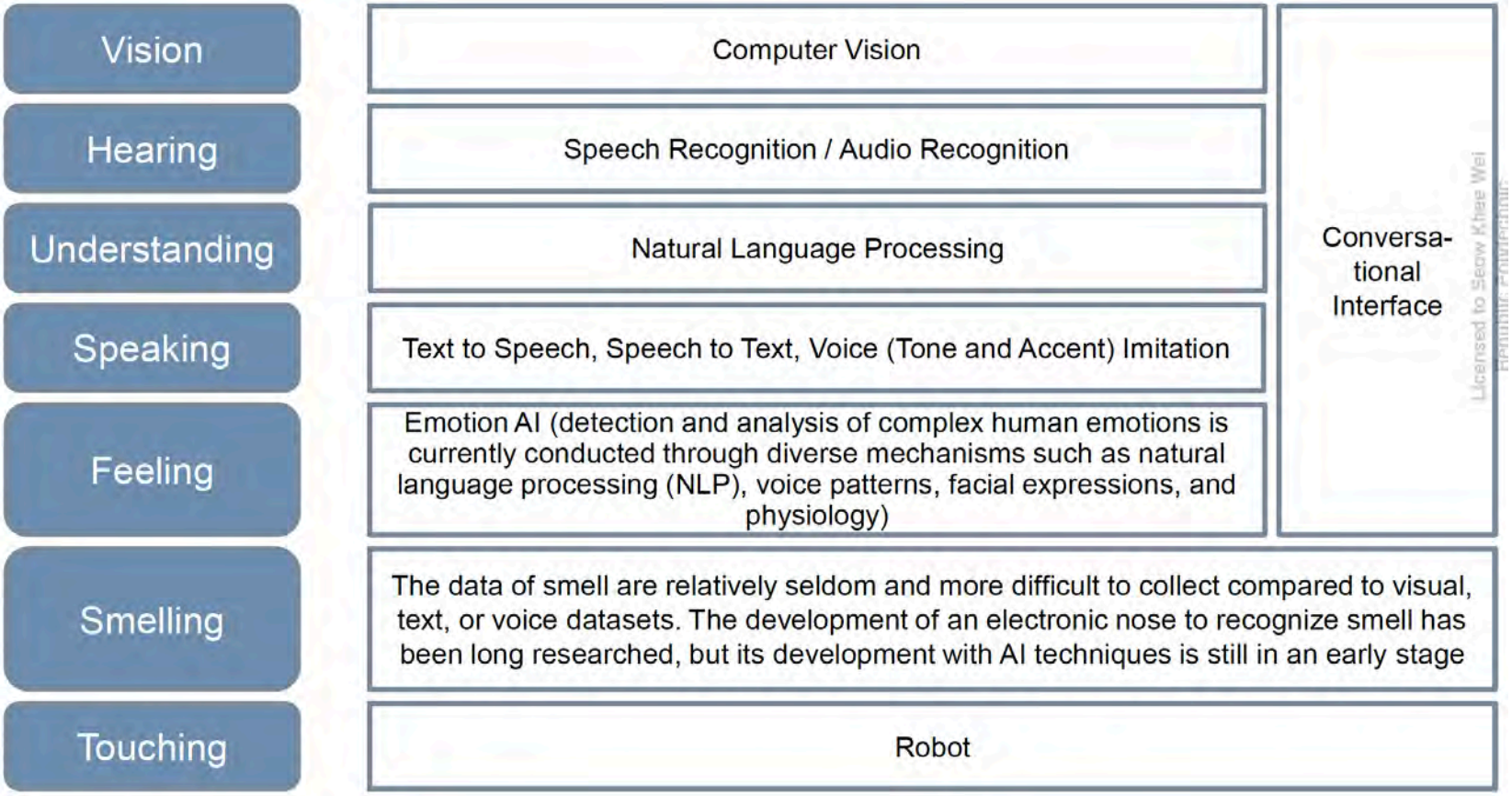
Based on Wikipedia: Artificial Intelligence as of 8 Feb 2019.



Artificial Narrow Intelligence vs Artificial General

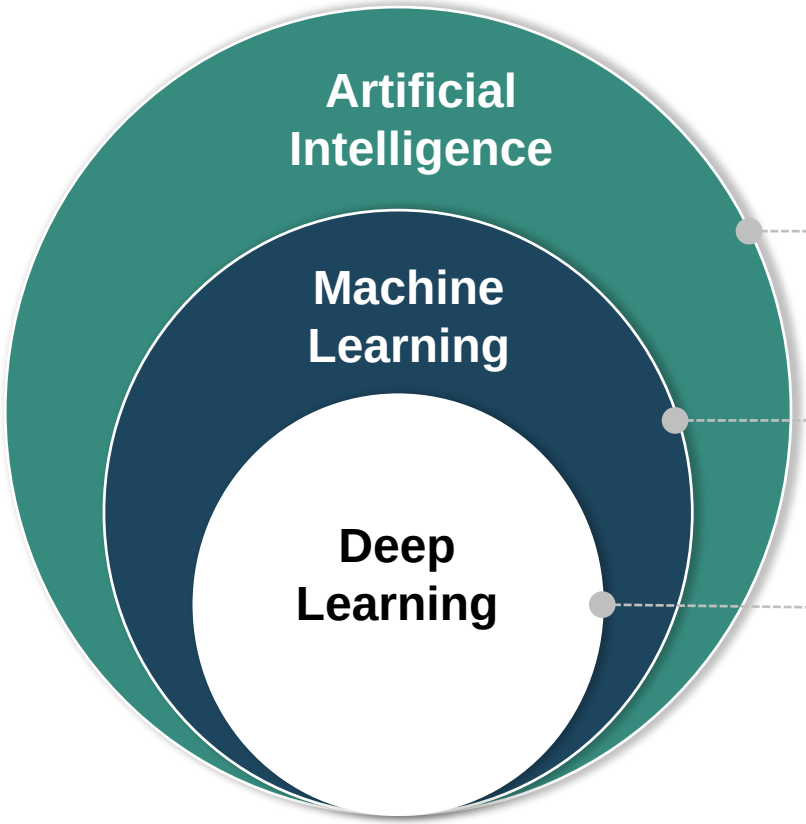


Mapping Human Perceptions to AI-enabled Capabilities



Source: Frost & Sullivan

Definitions

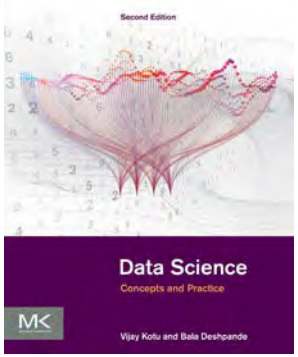


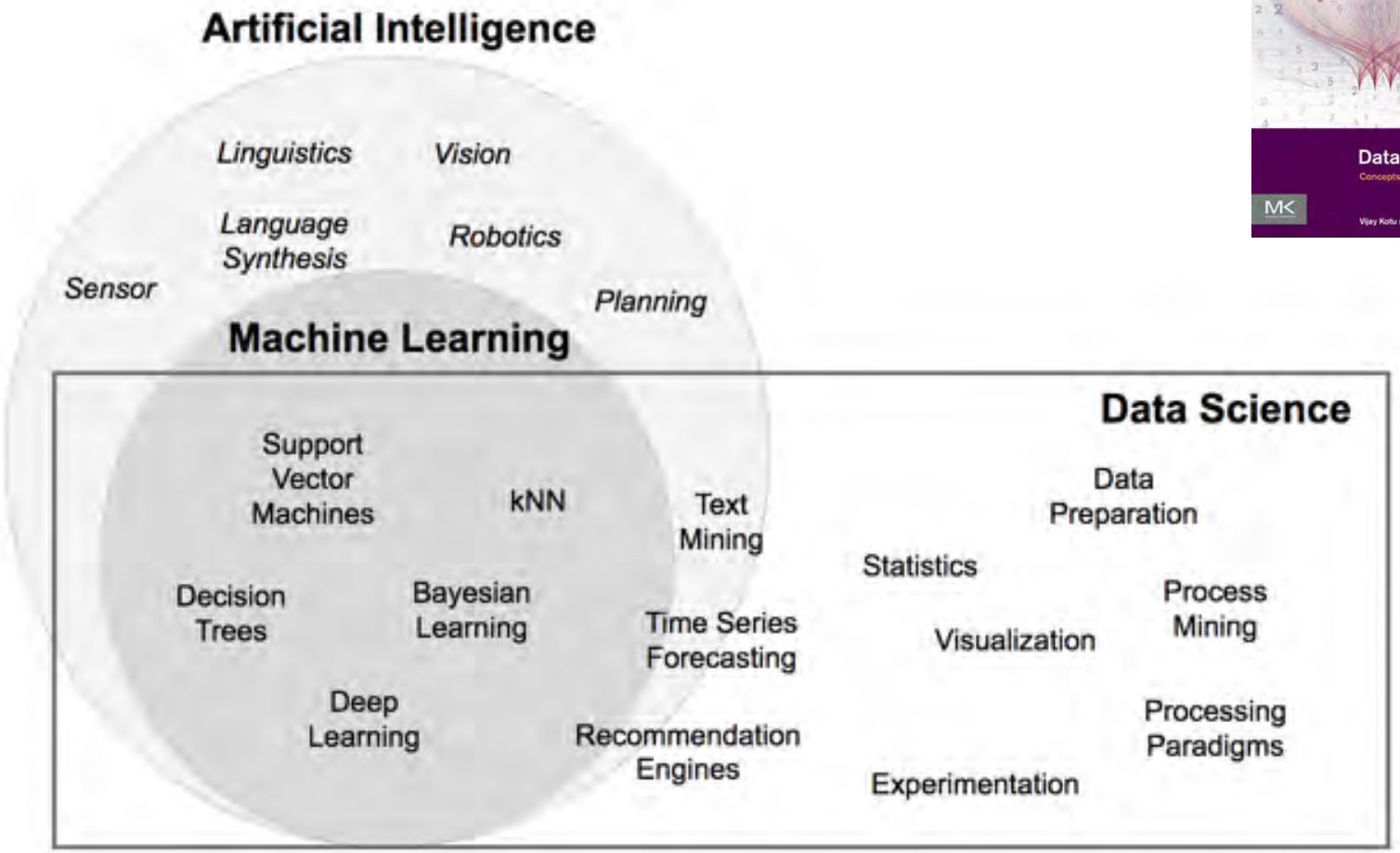
Artificial Intelligence
Any technique which enables computers to sense, reason, act and adapt

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

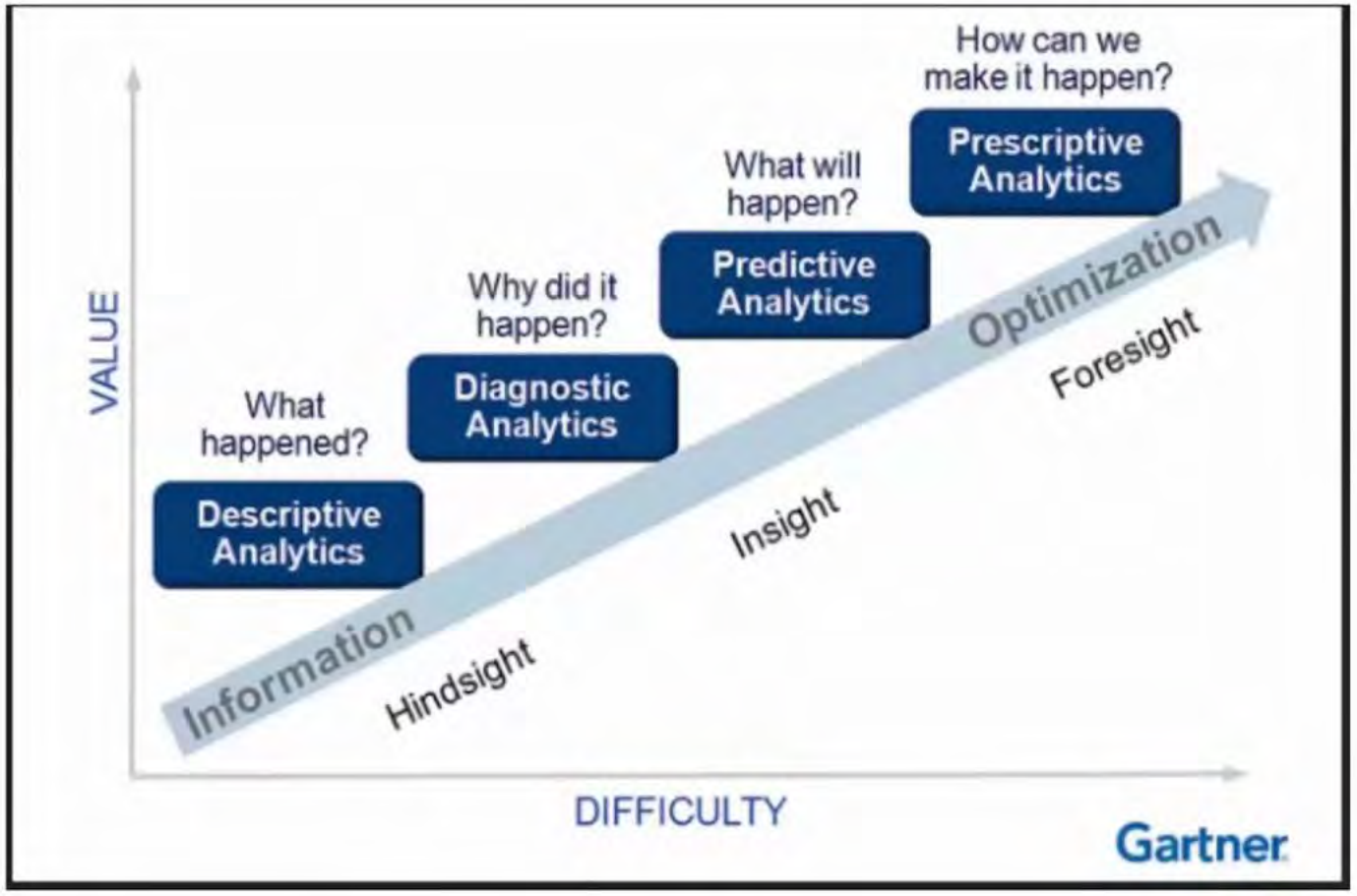
Deep Learning
A subset of machine learning in which multilayered neural networks learn from vast amount of data.

AI vs ML vs DS


Second Edition
Data Science
Concepts and Practice
MK
Vijay Kotu and Bala Deshpande


Artificial Intelligence
Linguistics
Vision
Language Synthesis
Robotics
Sensor
Planning
Machine Learning
Support Vector Machines
kNN
Text Mining
Decision Trees
Bayesian Learning
Time Series Forecasting
Deep Learning
Recommendation Engines
Data Science
Data Preparation
Statistics
Process Mining
Visualization
Processing Paradigms
Experimentation

Gartner Analytic Continuum



5 questions data science answers

Is this weird? (Anomaly detection)

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

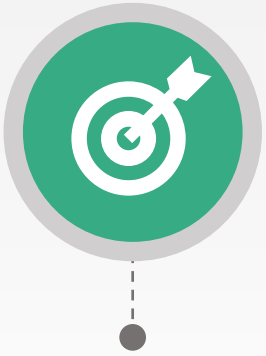
Is this A or B? (Classification)

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?

How many? How Much? (Regression)

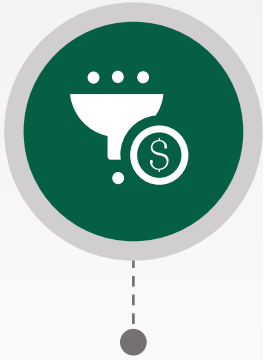
What will the temperature be next Tuesday?
What will my fourth quarter sales be?

How is this organized? (Clustering)



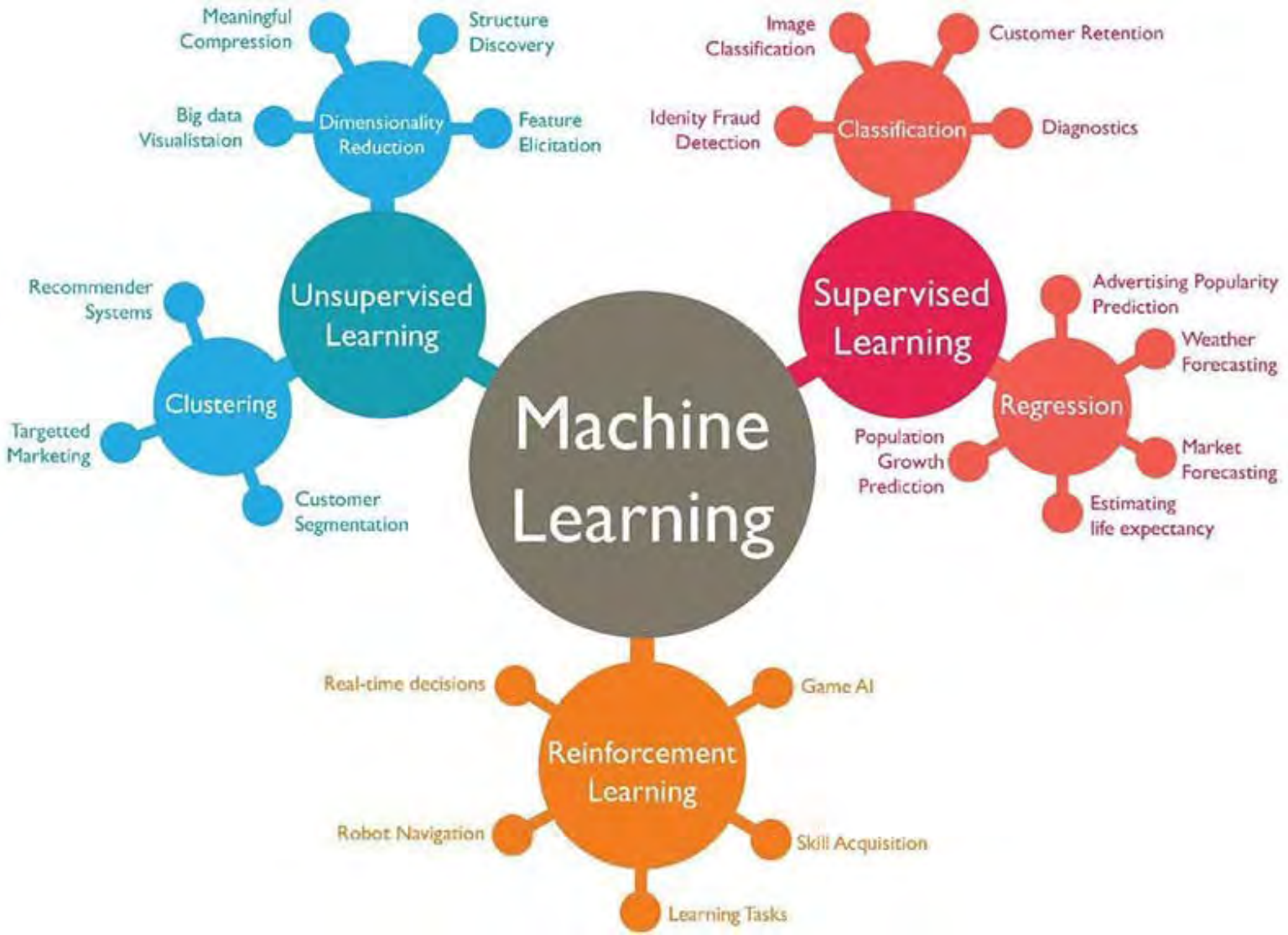
Which viewers like the same types of movies?
Which printer models fail the same way?

What should I do? (Reinforce Learning)

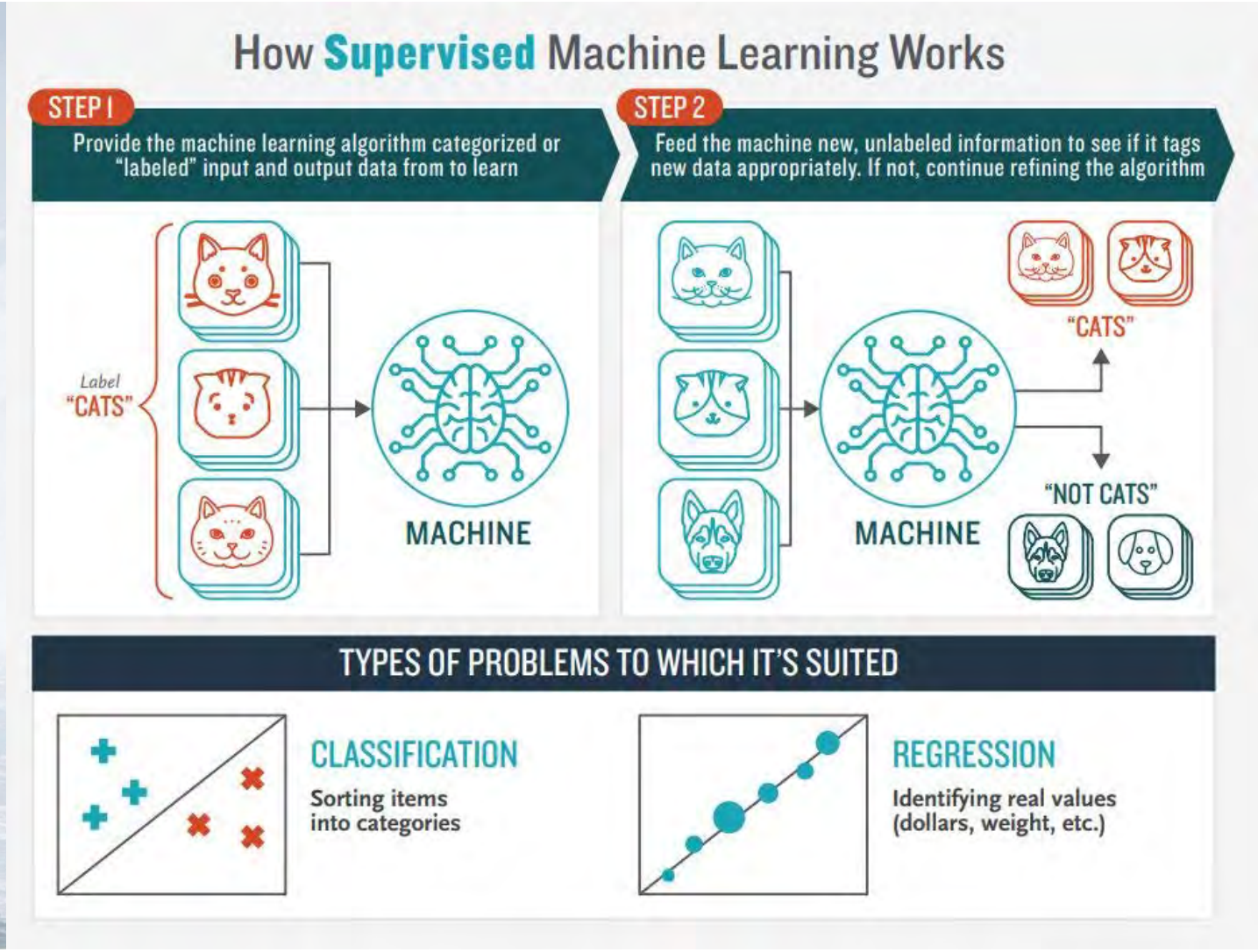


If I'm a self-driving car: At a yellow light, brake or accelerate?
For a robot vacuum: Keep vacuuming, or go back to the charging station?

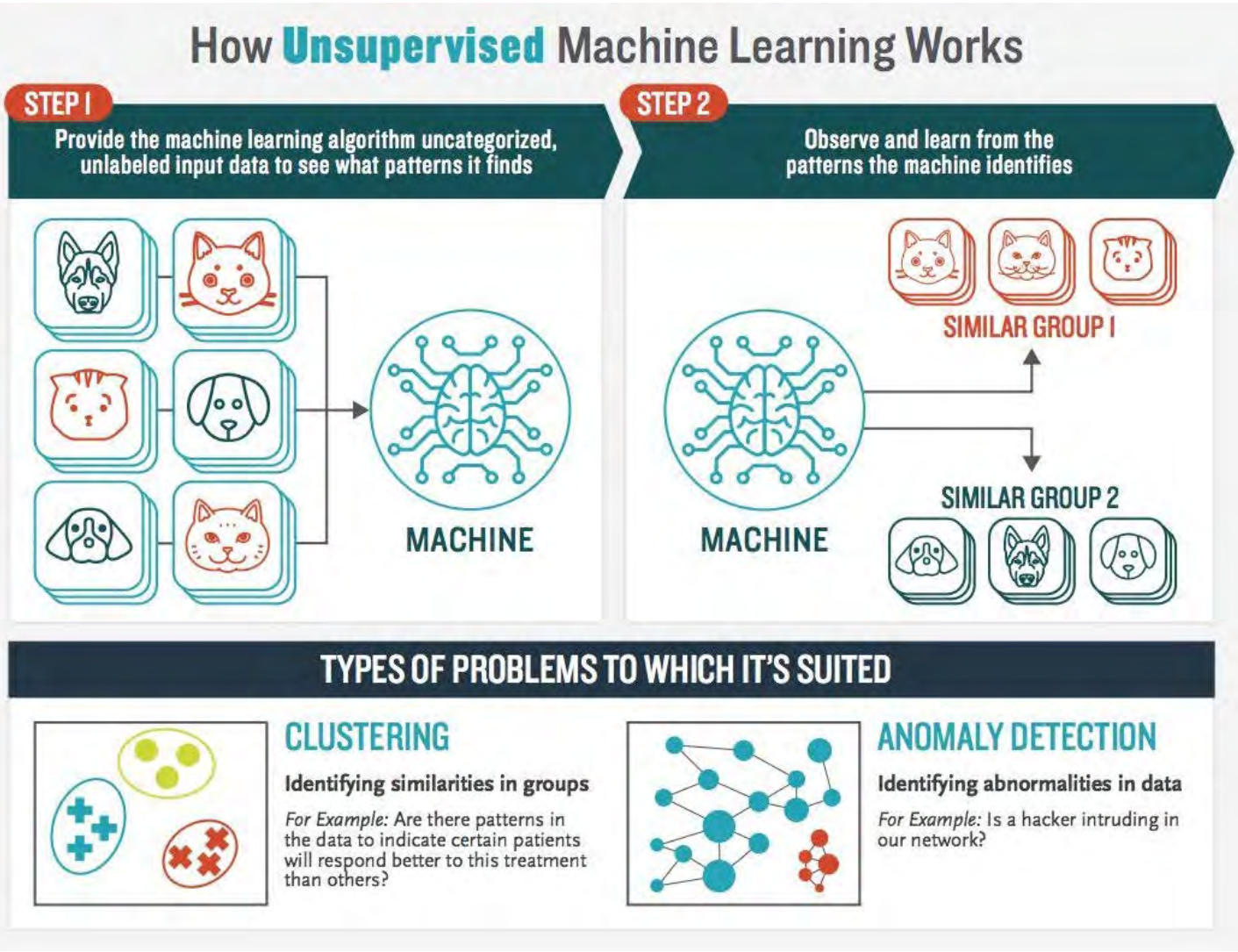
Types of Machine Learning



Supervised Learning



Unsupervised Learning



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.

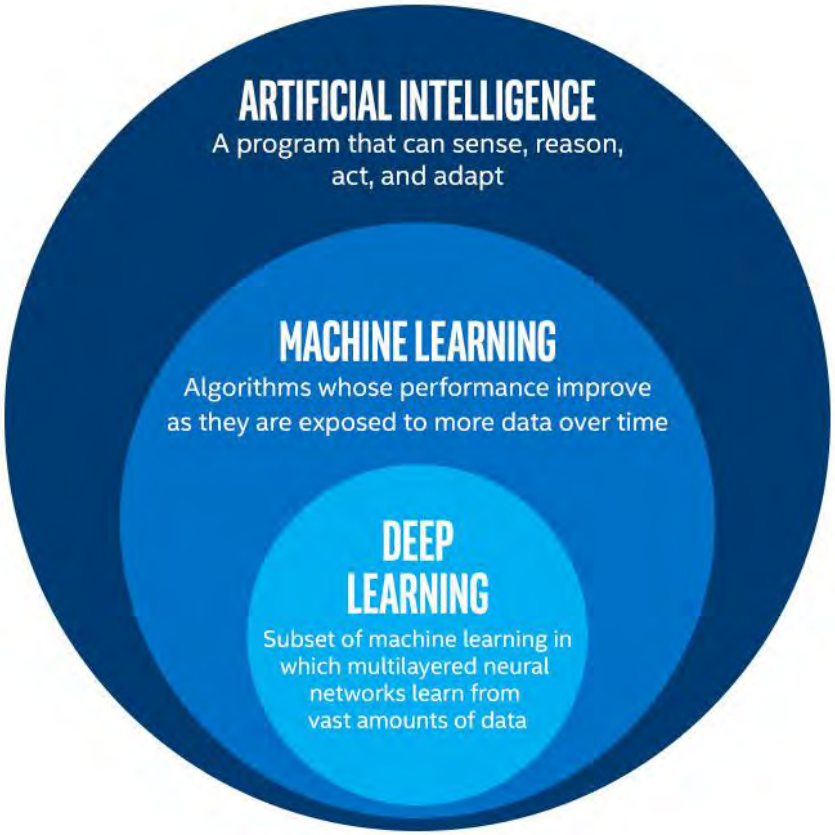
Dog and cat recognition

What is deep learning?

Deep Learning

"Machine learning that involves using very complicated models called "deep neural networks"." (Intel)

Models determine best representation of original data; in classic machine learning, humans must do this.

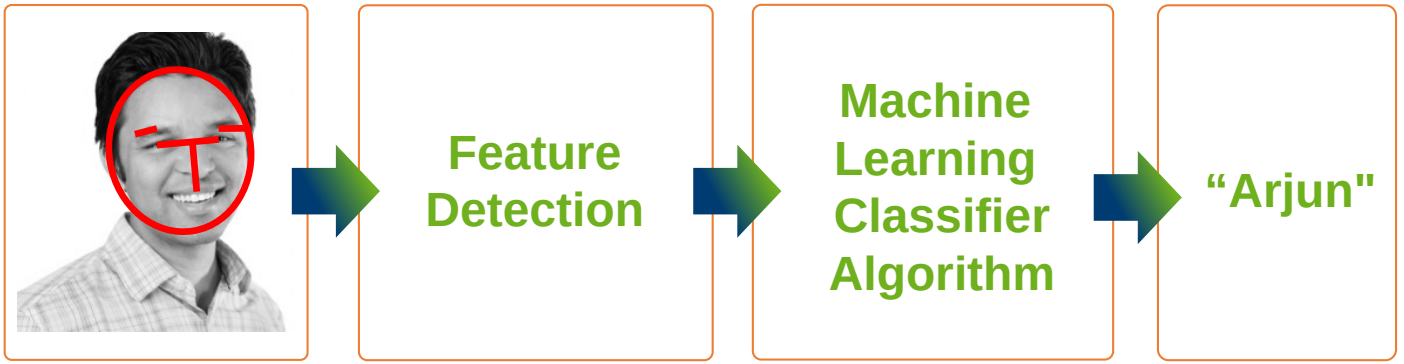


Deep Learning Example

Classic Machine Learning

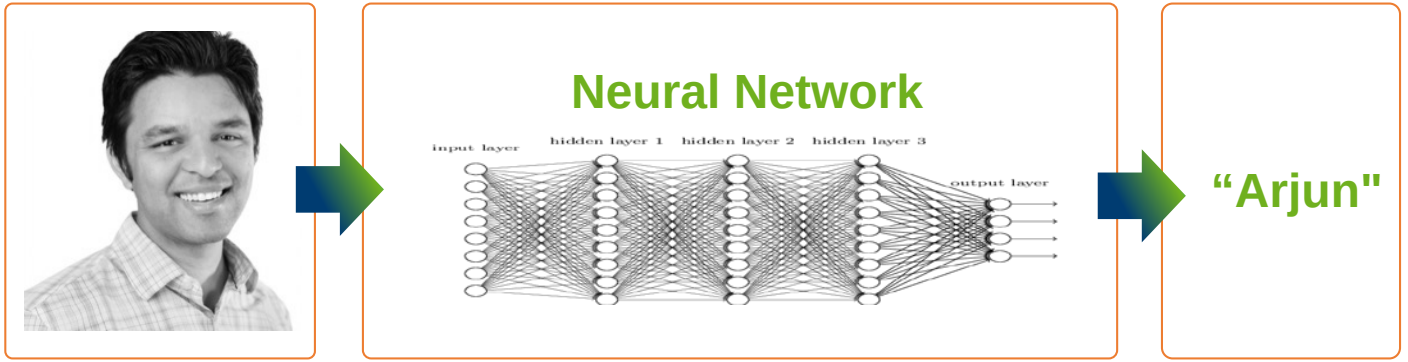
Step 1: Determine features.

Step 2: Feed them through model.



Deep Learning

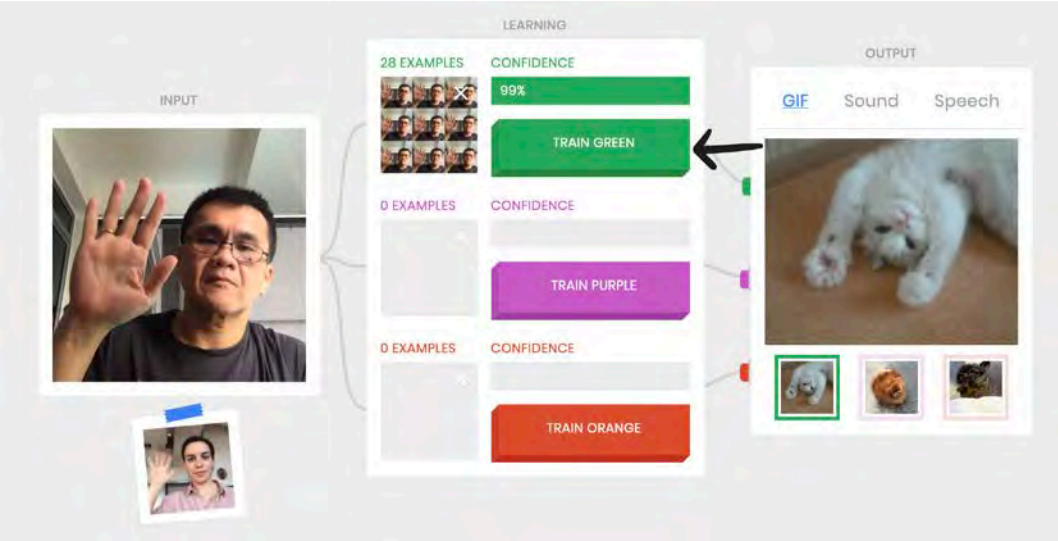
Steps 1 and 2 are combined into 1 step.



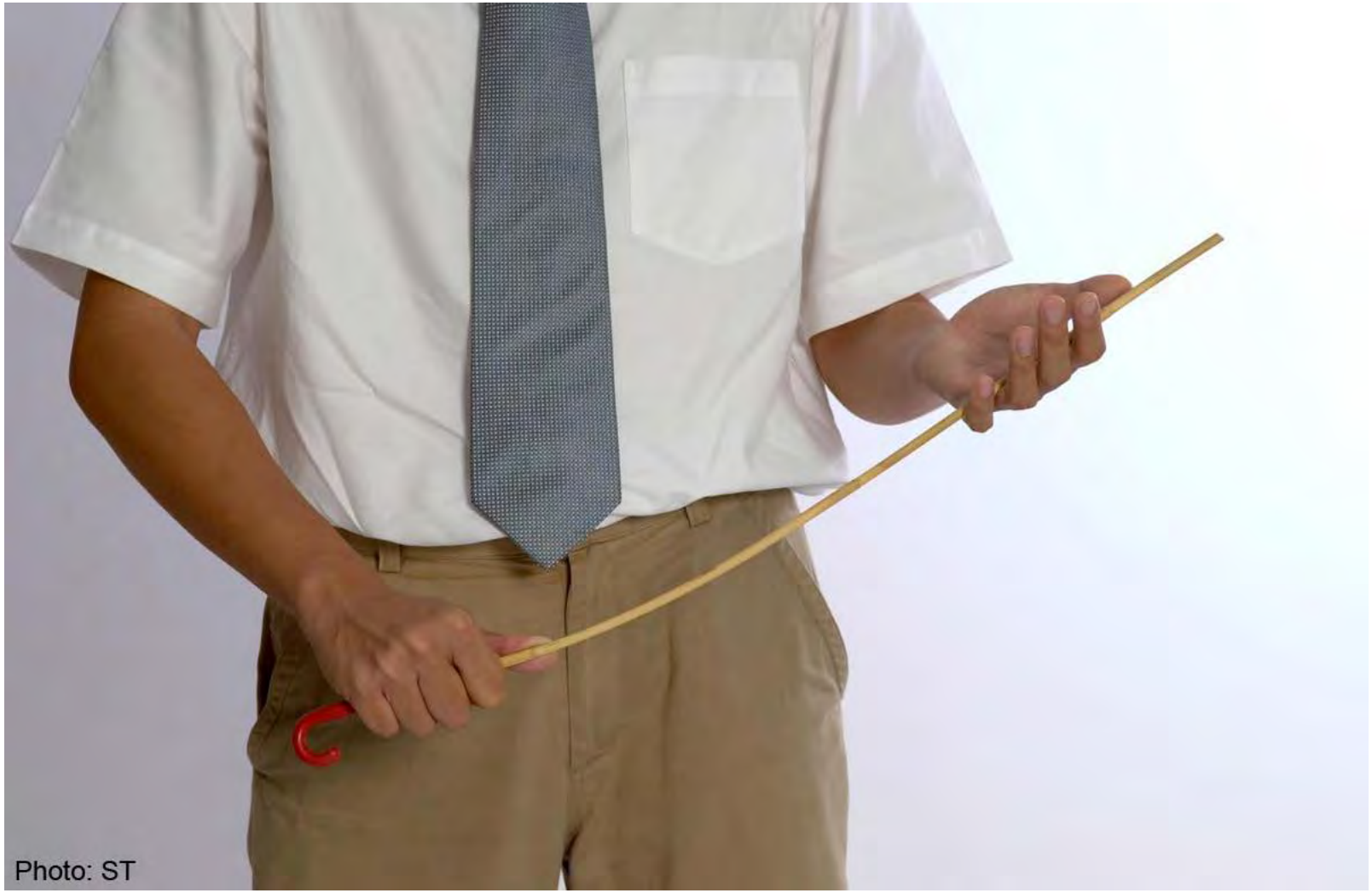
What is neural network?

Deep Learning in Action

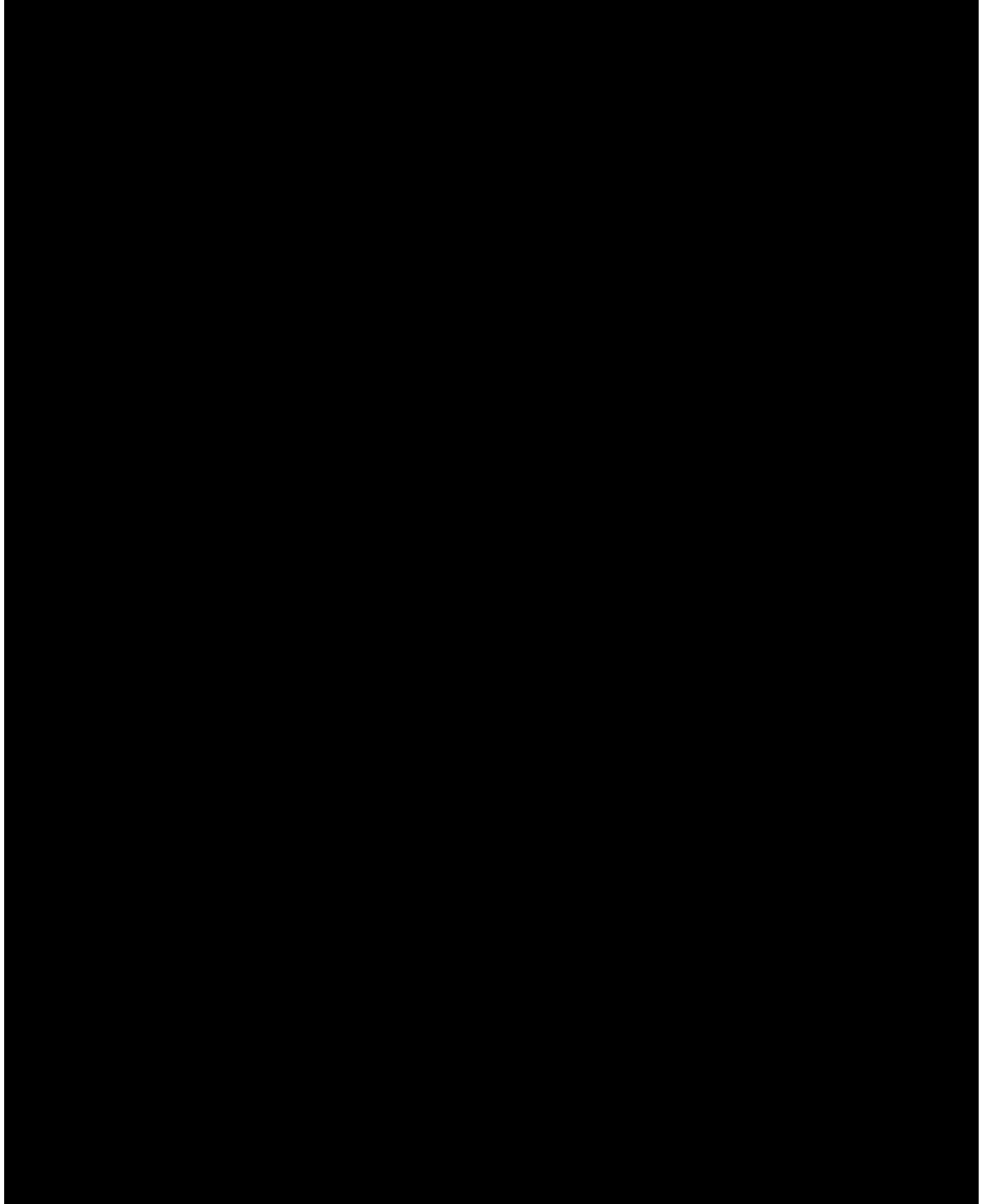
https://teachablemachine.withgoogle.com/



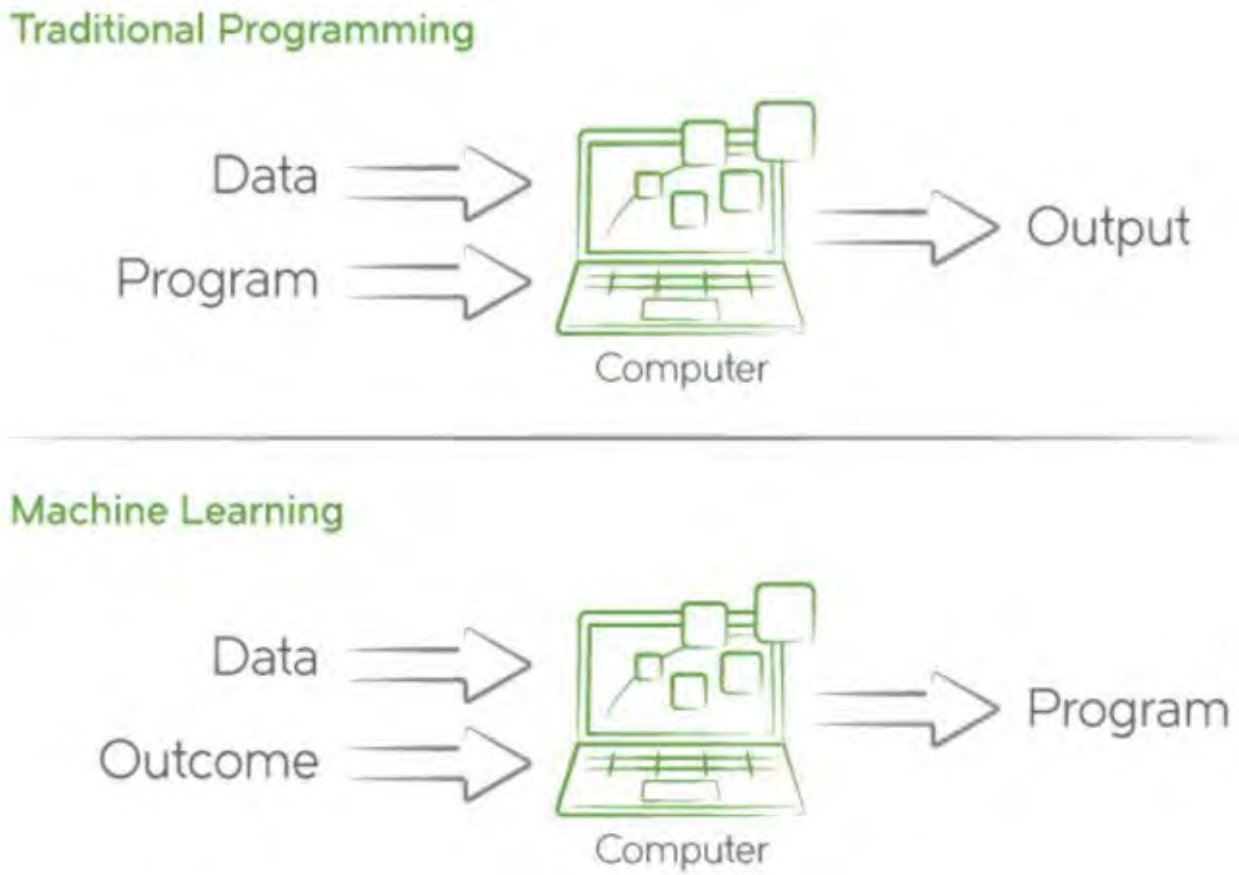
Reinforcement Learning

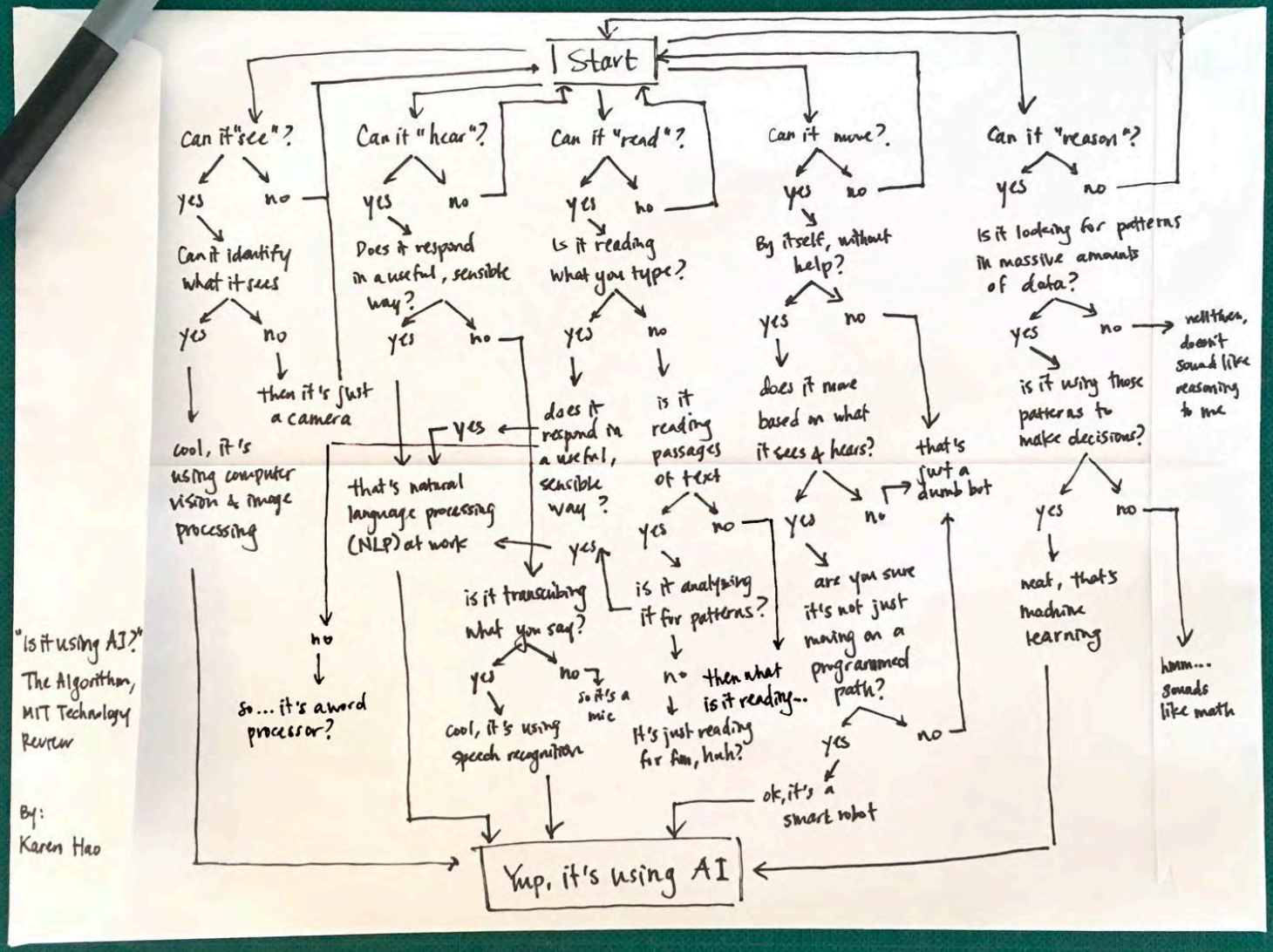


Reinforcement Learning



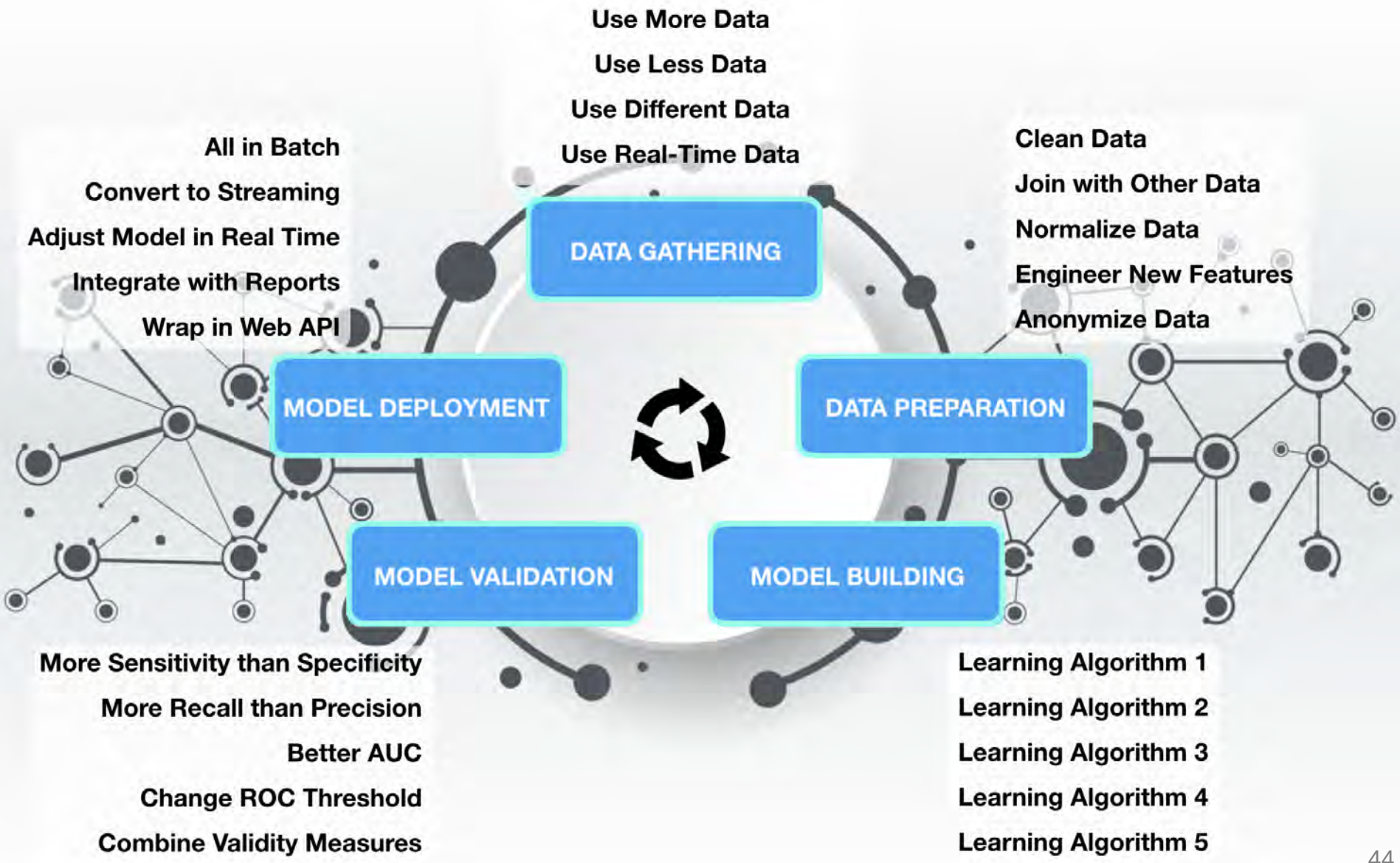
Traditional Programming vs Machine Learning





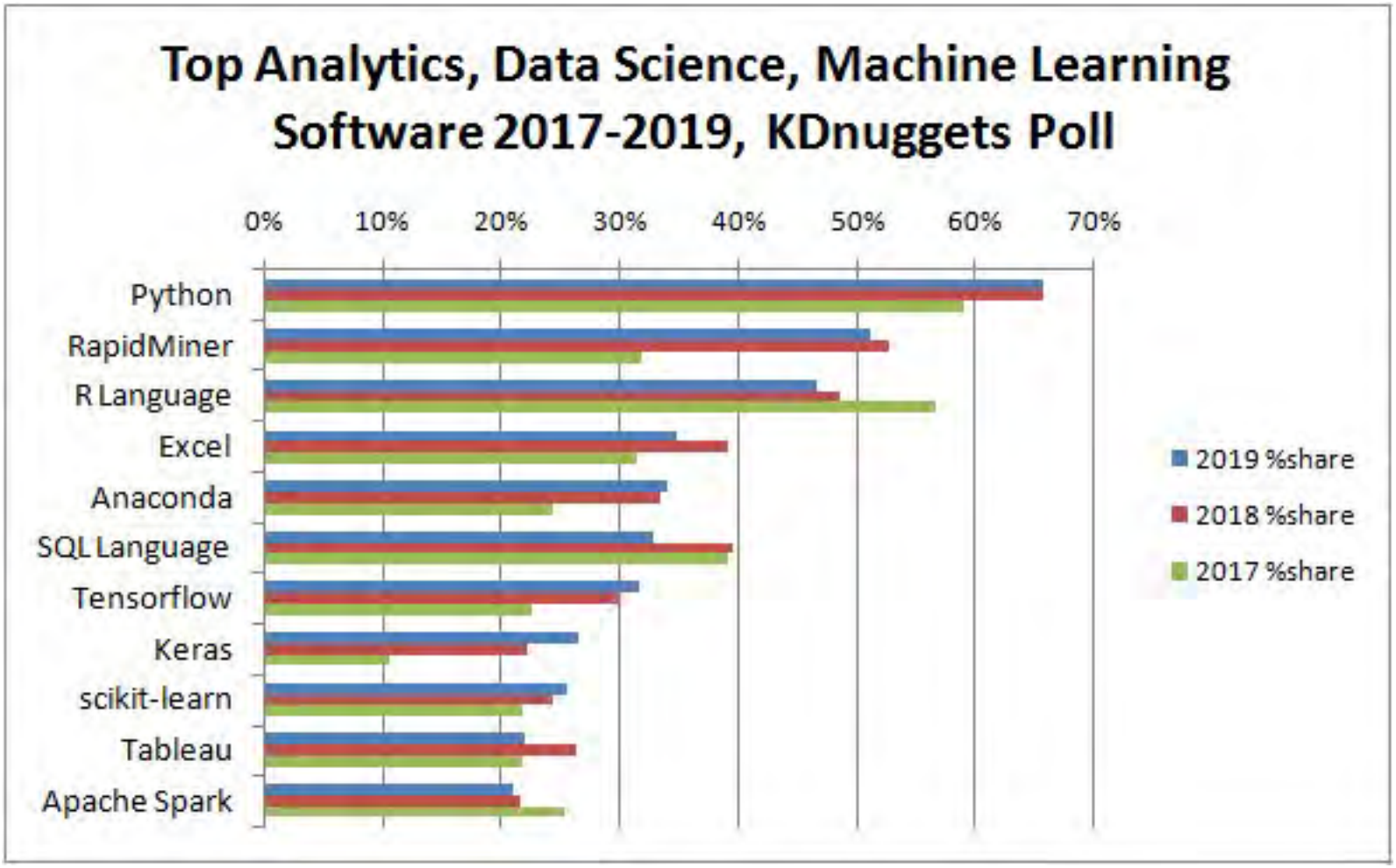
https://www.technologyreview.com/s/612404/is-this-ai-we-drew-you-a-flowchart-to-work-it-out/

AI/ML Workflow



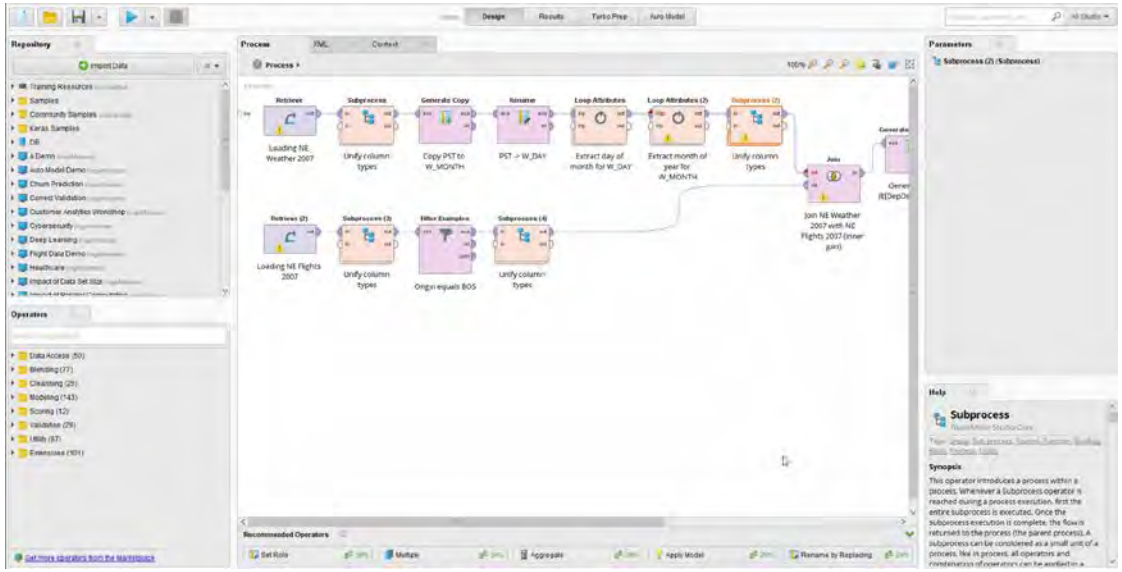
https://towardsdatascience.com/gui-fying-the-machine-learning-workflow-towards-rapid-discovery-of-viable-pipelines-cab2552c909f

What are the popular tools?

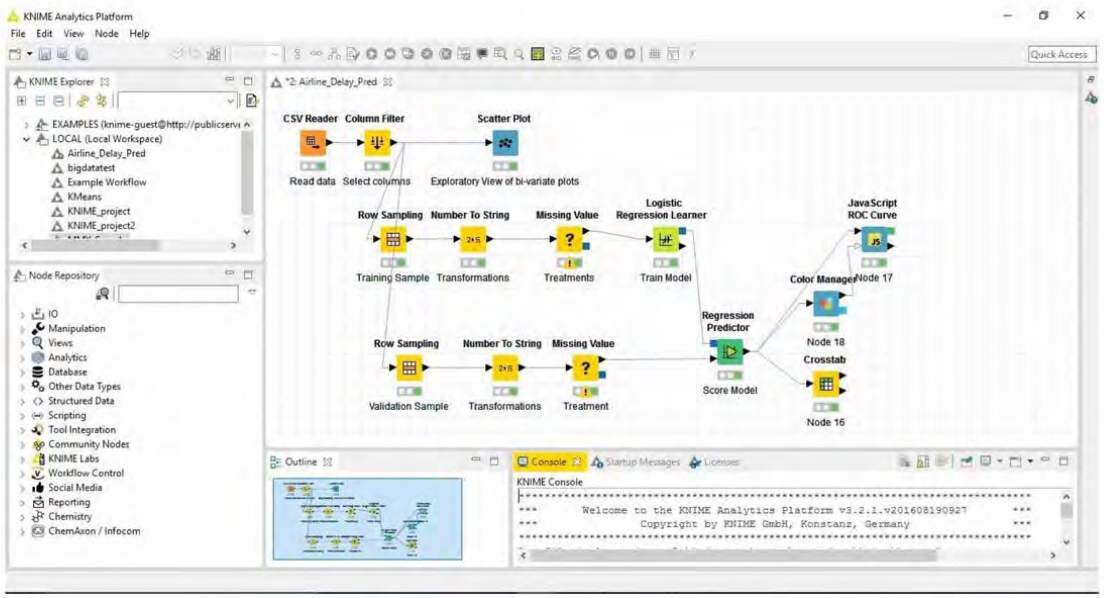


https://www.kdnuggets.com/2019/05/poll-top-data-science-machine-learning-platforms.html

Graphical Tools (ML/DS)

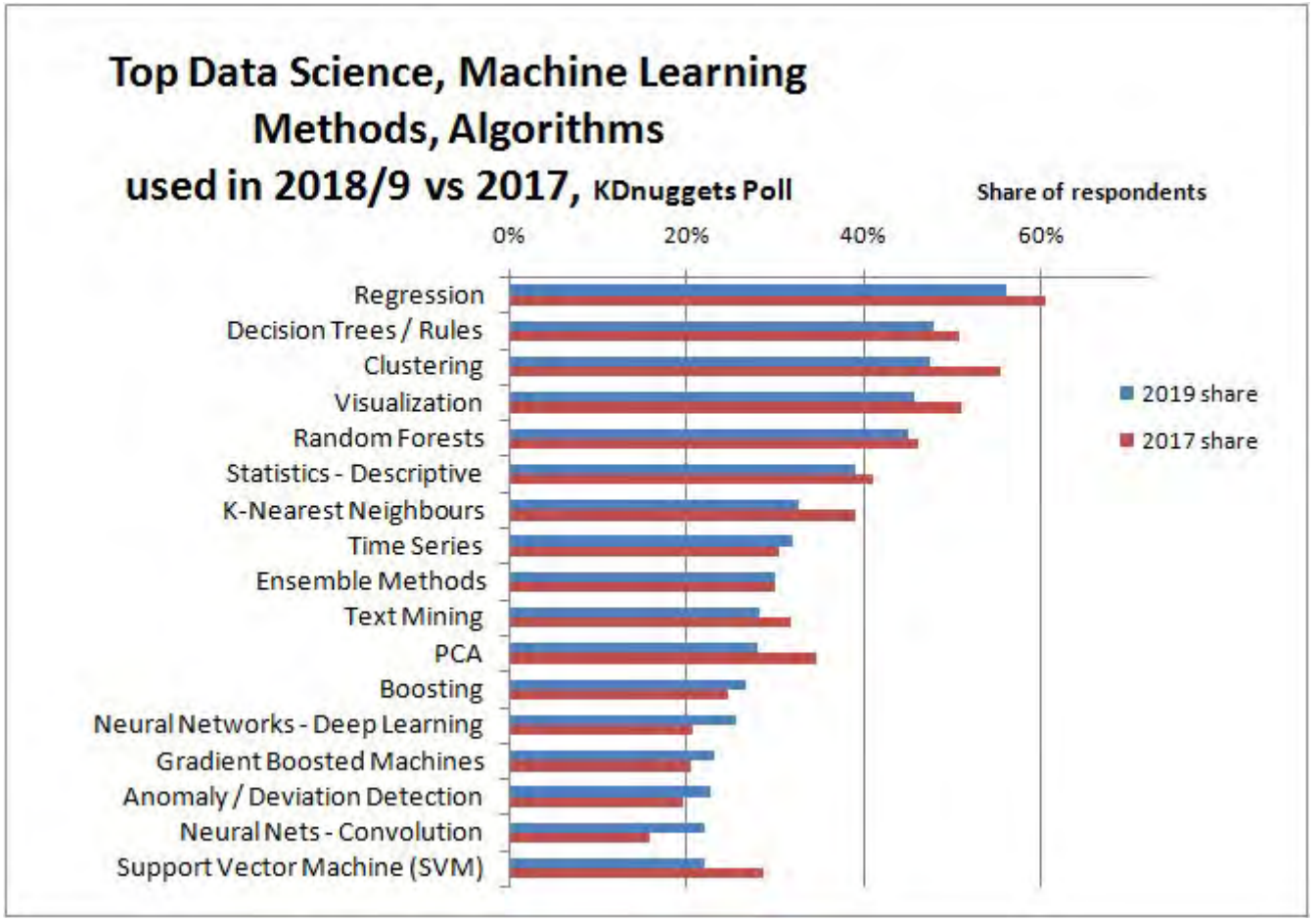


RapidMiner



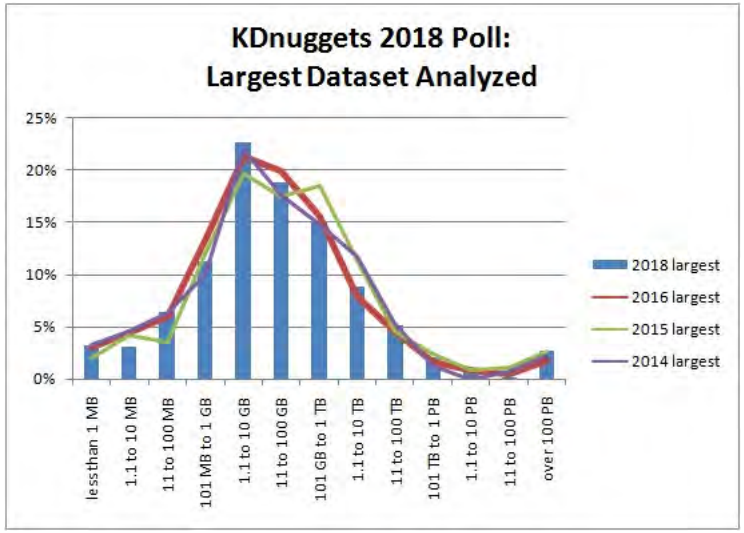
KNIME

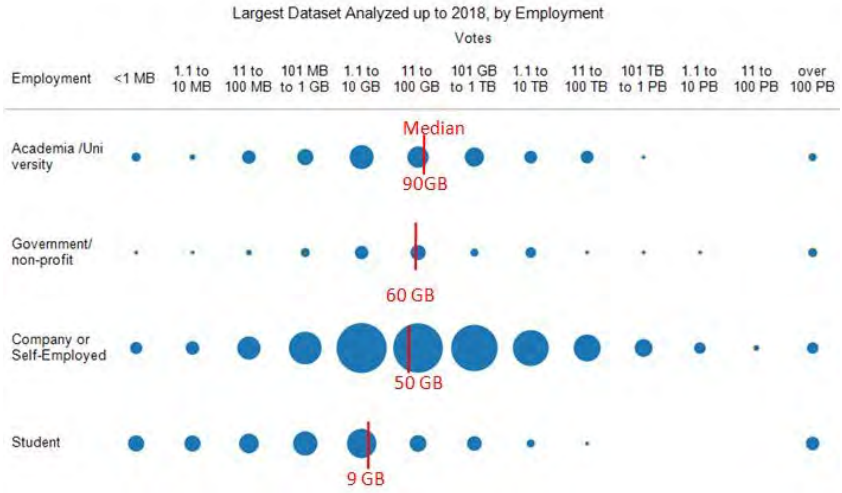
Top Methods/algorithms

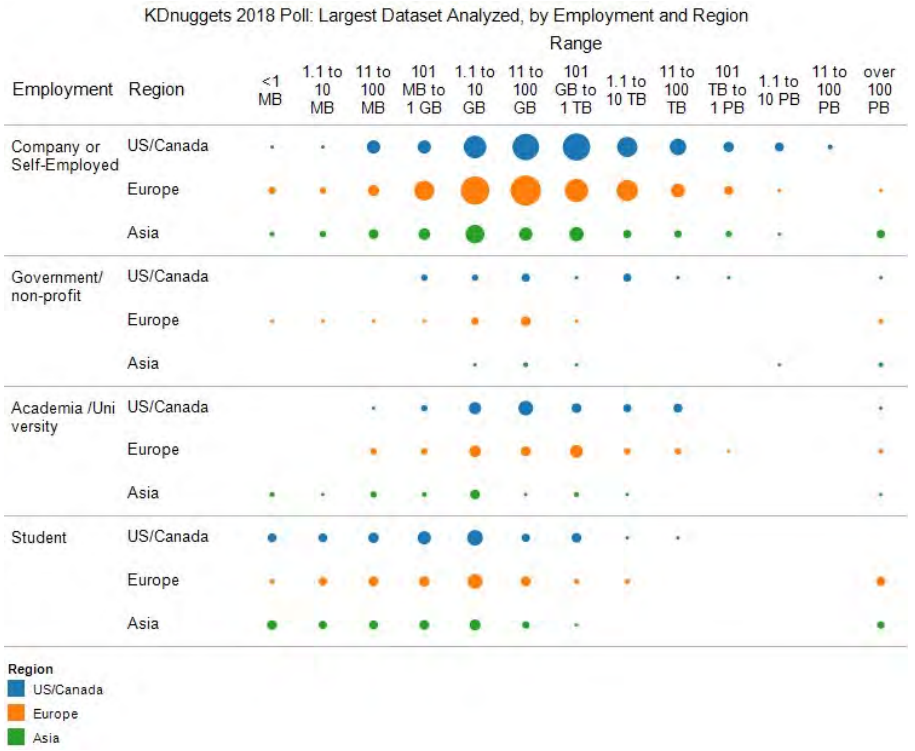


https://www.kdnuggets.com/2019/04/top-data-science-machine-learning-methods-2018-2019.html

Datasets size

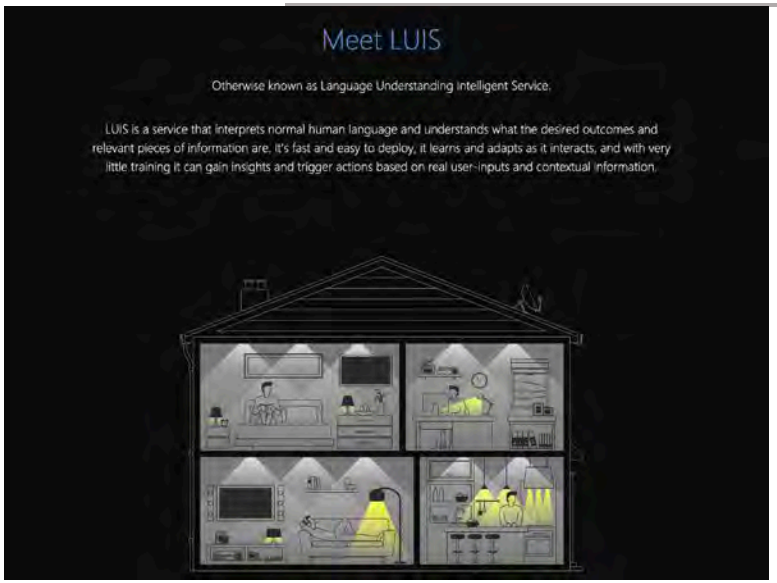


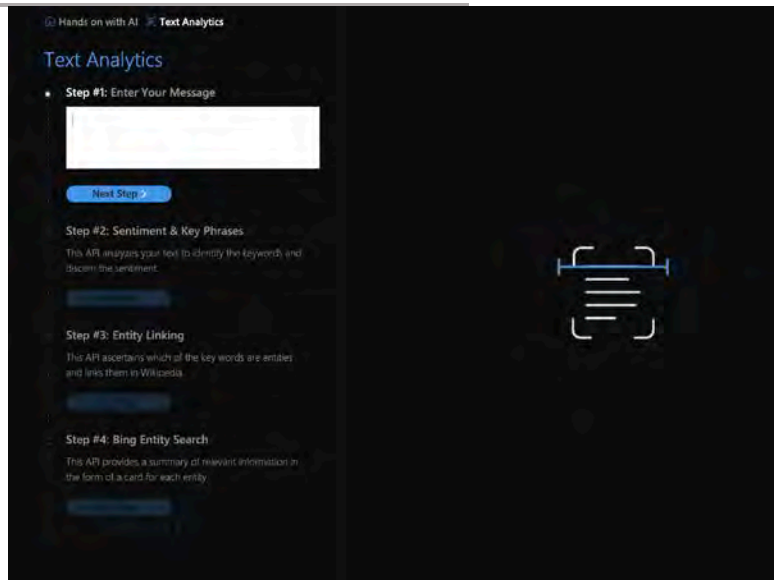


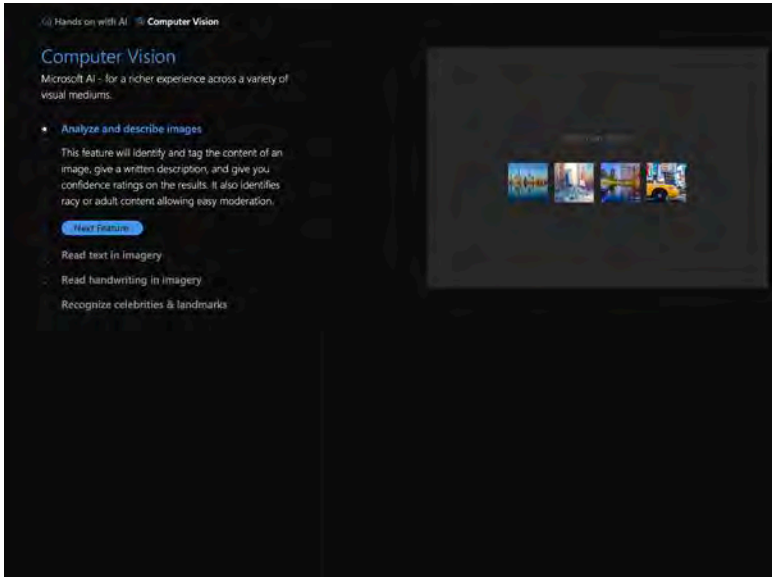


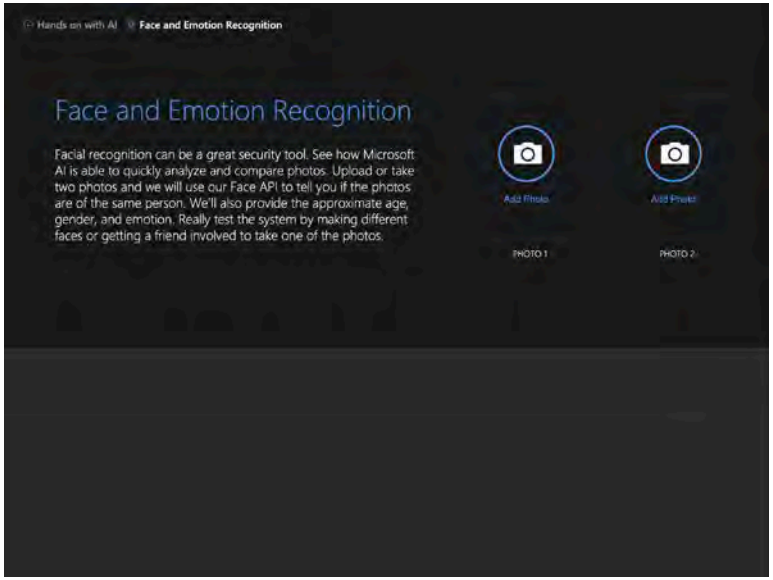
https://www.kdnuggets.com/2018/10/poll-results-largest-dataset-analyzed.html

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.


Hands on with AI
Text Analytics
Text Analytics
Step #1: Enter Your Message
Next Step
Step #2: Sentiment & Key Phrases
Step #3: Entity Linking
Step #4: Bing Entity Search


Hands on with AI
Computer Vision
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


Hands on with AI
Face and Emotion Recognition
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

Microsoft | Microsoft AI Our approach Products & Services Blog Research All Microsoft

Hands on with AI / Language Understanding

Using AI to make video content better.

Otherwise known as Language Understanding Intelligent Service.

A machine learning-based service to build natural language into apps, bots, and IoT devices.
Quickly create enterprise-ready, custom models that continuously improve.

See it in action >

SCAN ME

https://aidemos.microsoft.com/luis

Microsoft | Microsoft AI Our approach Products & Services Blog Research All Microsoft

Hands on with AI / Text Analytics

Text Analytics

Step #1: Enter Your Message

Saturn is the sixth planet from the Sun and the second-largest in the Solar System, after Jupiter. It is a gas giant with an average radius about nine times that of Earth.

Next Step >

Step #2: Sentiment & Key Phrases

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

Next Step

Step #3: Entity Linking

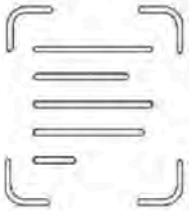
This API ascertains which of the key words are entities and links them in Wikipedia.

Next Step

Step #4: Bing Entity Search

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

Start Over Learn to code



SCAN ME

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

Microsoft | Microsoft AI Our approach Products & Services Blog Research All Microsoft

Hands on with AI / Computer Vision

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 Step

Read text in imagery

Read handwriting in imagery

Recognize celebrities & landmarks

SCAN ME

https://aidemos.microsoft.com/computer-vision

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.

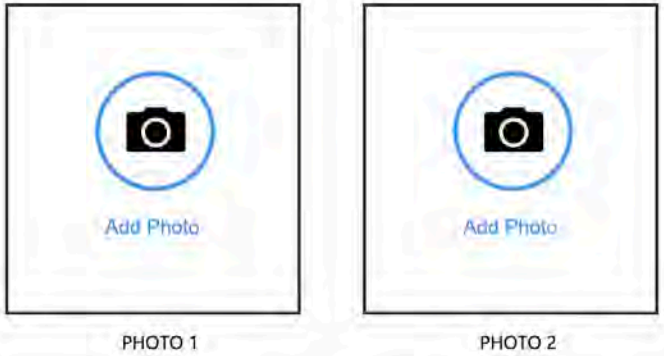


PHOTO 1 PHOTO 2

SCAN ME

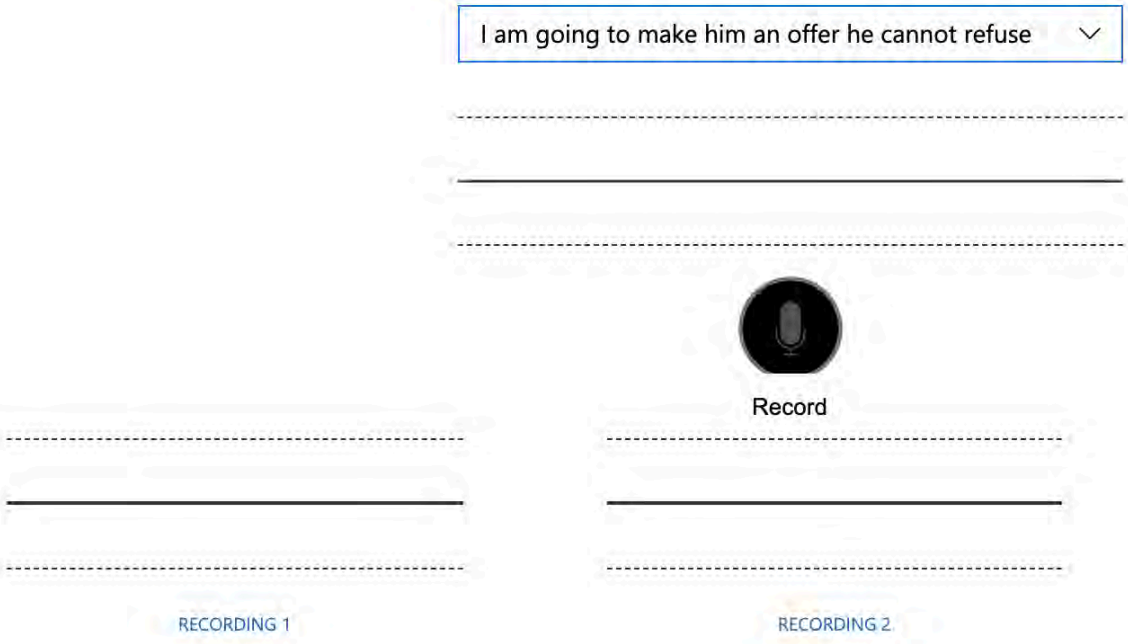
https://aidemos.microsoft.com/face-recognition

Microsoft | Microsoft AI Our approach Products & Services Blog Research All Microsoft

Hands on with AI / Speech Authentication

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. Try mixing it up by having someone else record their voice.



https://aidemos.microsoft.com/speech-authentication

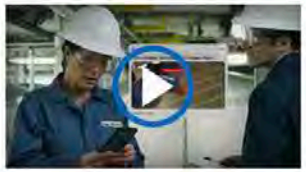
Put it to the test

Microsoft | Microsoft AI Our approach Products & Services Blog Research All Microsoft

Hands on with AI / 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.

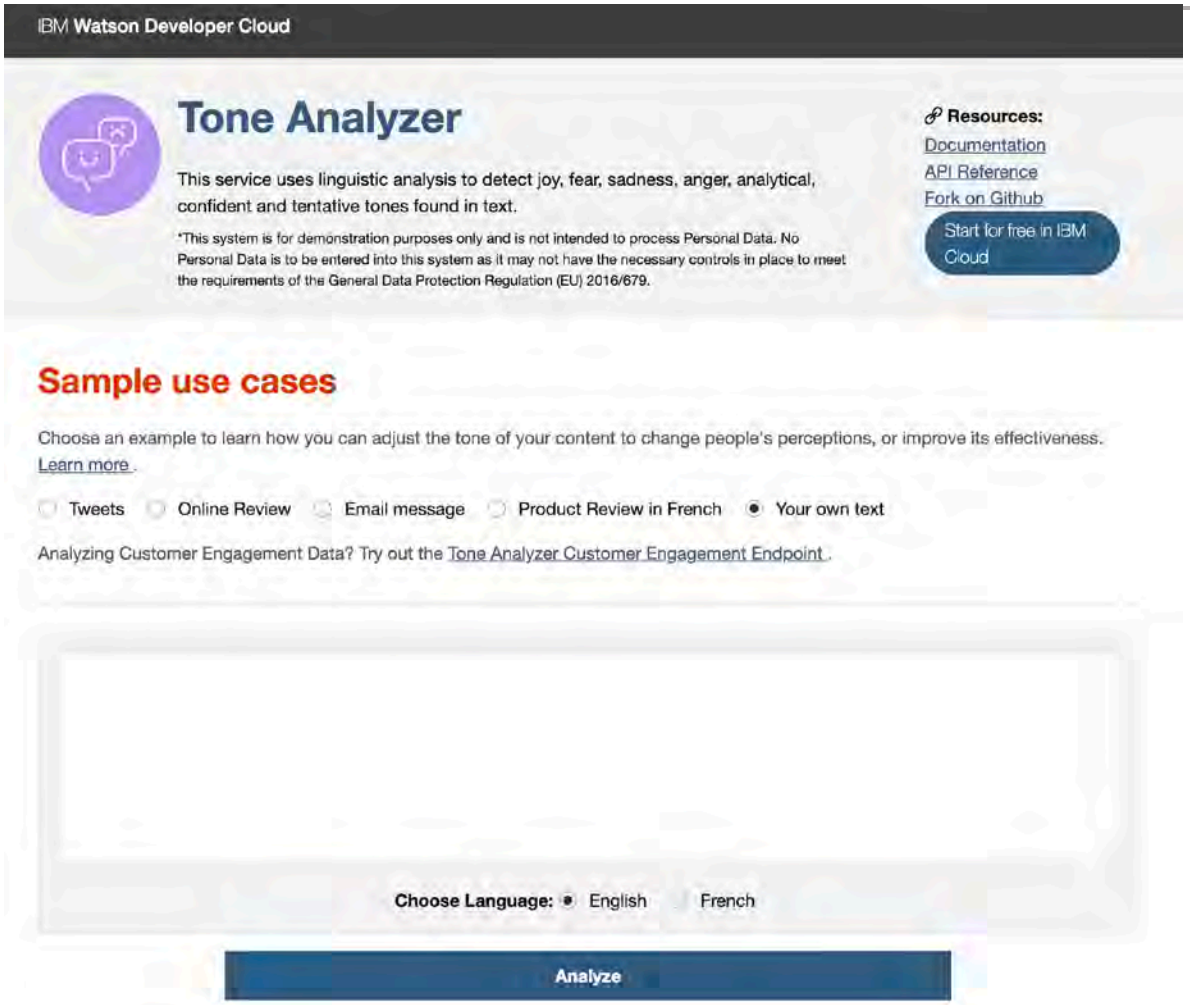



Select one of the videos above to see it in action

SCAN ME

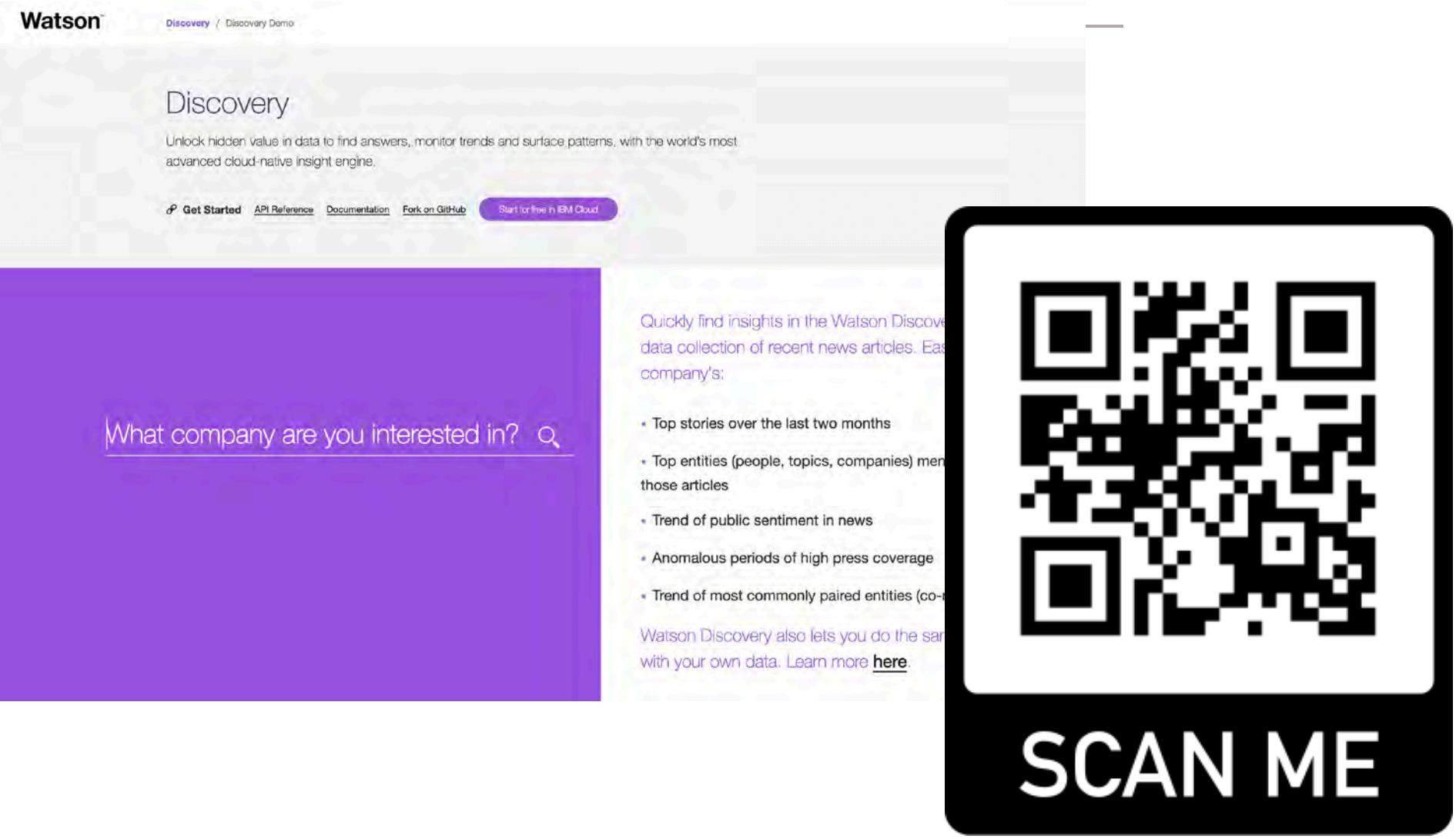
https://aidemos.microsoft.com/video-indexer

Tone Analyzer



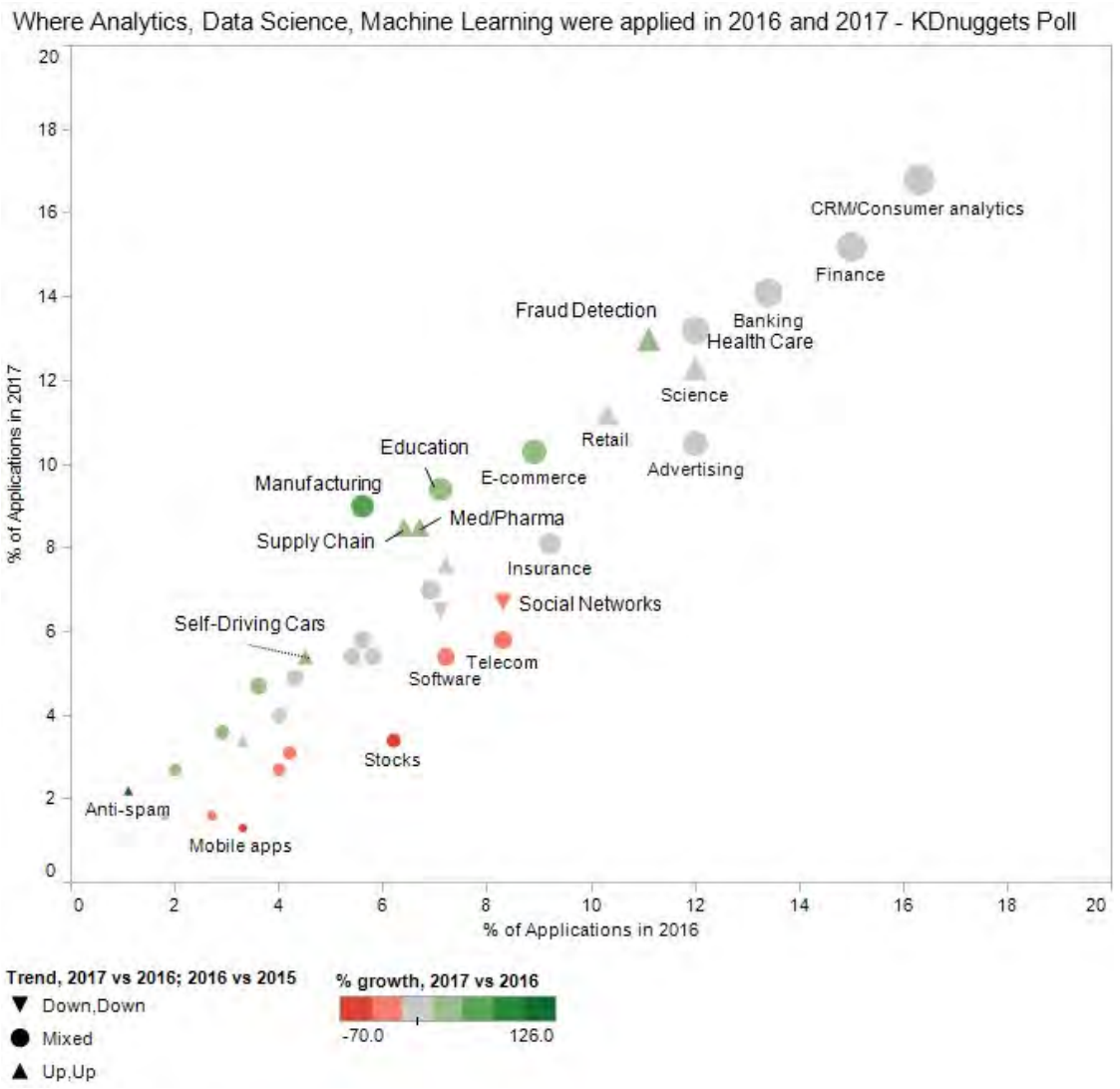
http://bit.ly/2TLD0Vb

Discovery



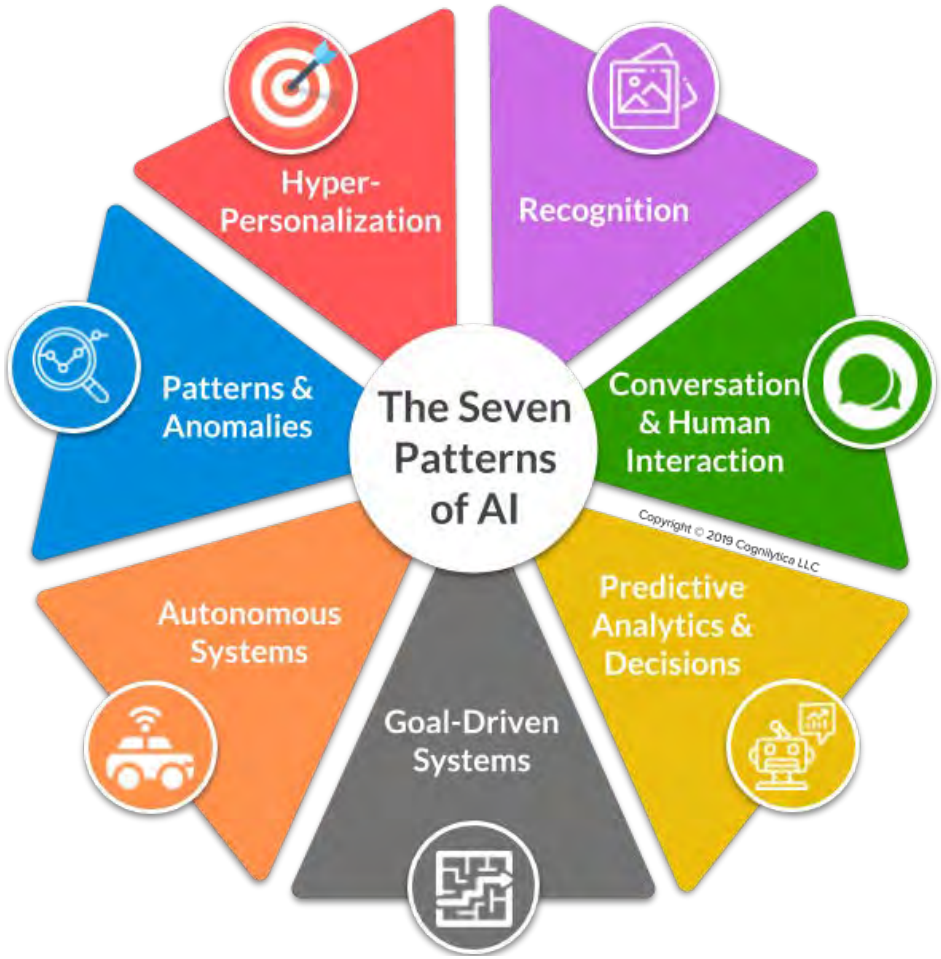
http://bit.ly/2HZ9n0B

Where is AI applied?



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

The Seven Patterns of AI



Any AI project or implementation falls within one or more of these 7 patterns that Cognilytica has identified (in no particular order).

HYPERSONALIZATION

Using ML to learn and build individual profiles for deep personalization.
Example use cases: Personalized content, personalized recommendations, behavior profiling.

AUTONOMOUS SYSTEMS

Systems that are able to accomplish a task, achieve a goal, interact with surroundings with minimal or any human involvement.
Example use cases: Autonomous vehicles, automatic knowledge generation, cobots, self-driving decisions.

PREDICTIVE ANALYTICS & DECISION SUPPORT

Helping humans make better decisions through models that help predict future data and behavior.
Example use cases: Assisted search and retrieval, predicting a value, behavior, or failure, Guided assistance.

CONVERSATIONAL/HUMAN INTERACTION

Machines interacting with humans through natural conversation and interaction including voice, text, images, and written forms.
Example use cases: Chatbots, voice assistants, content generation, sentiment analysis, machine translation.

PATTERNS & ANOMALIES

Using ML to identify patterns in data and learn higher-order connections between information to provide insight and spot outliers.
Example use cases: Fraud & risk detection, discovering patterns among data, surfacing insights in data, automatic error detection / correction, predictive text.

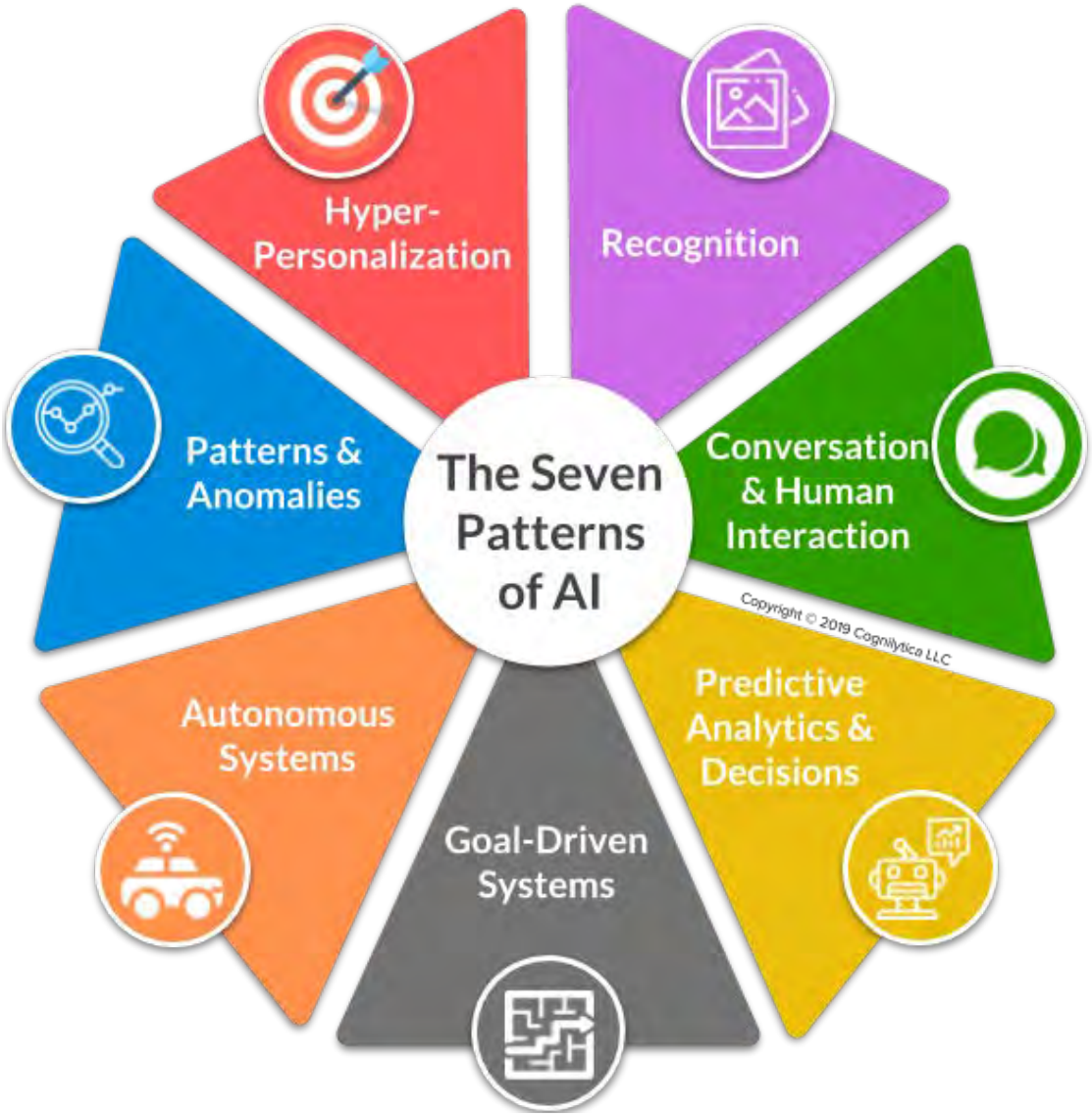
RECOGNITION

Using ML to identify and understand images, sound, items, handwriting, faces, and gestures.
Example use cases: Facial recognition, sound recognition, item detection, handwriting / text recognition.

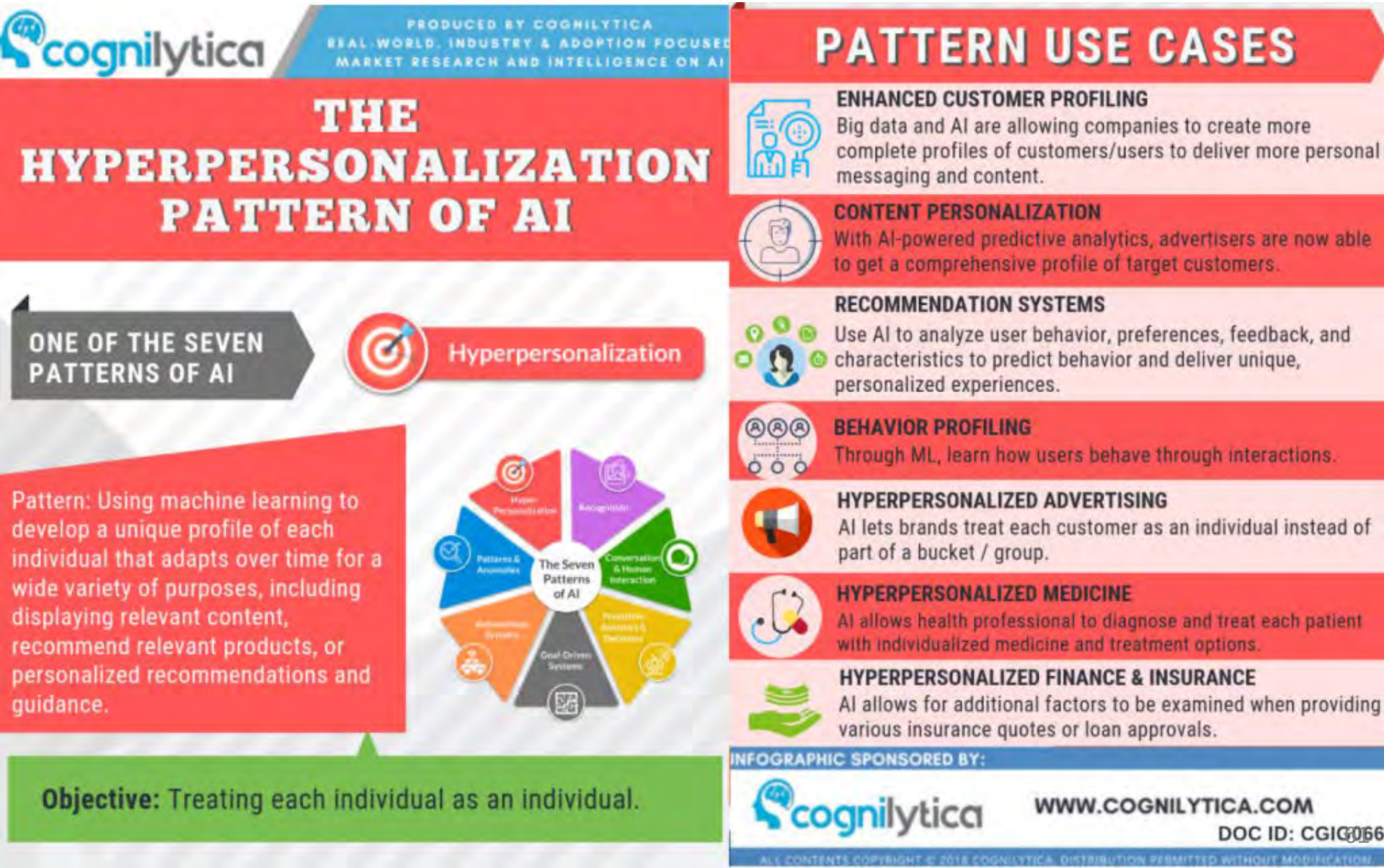
GOAL-DRIVEN SYSTEMS

Find the optimal solution to a problem through trial and error.
Example use cases: scenario simulation, game playing, bidding and real-time auctions

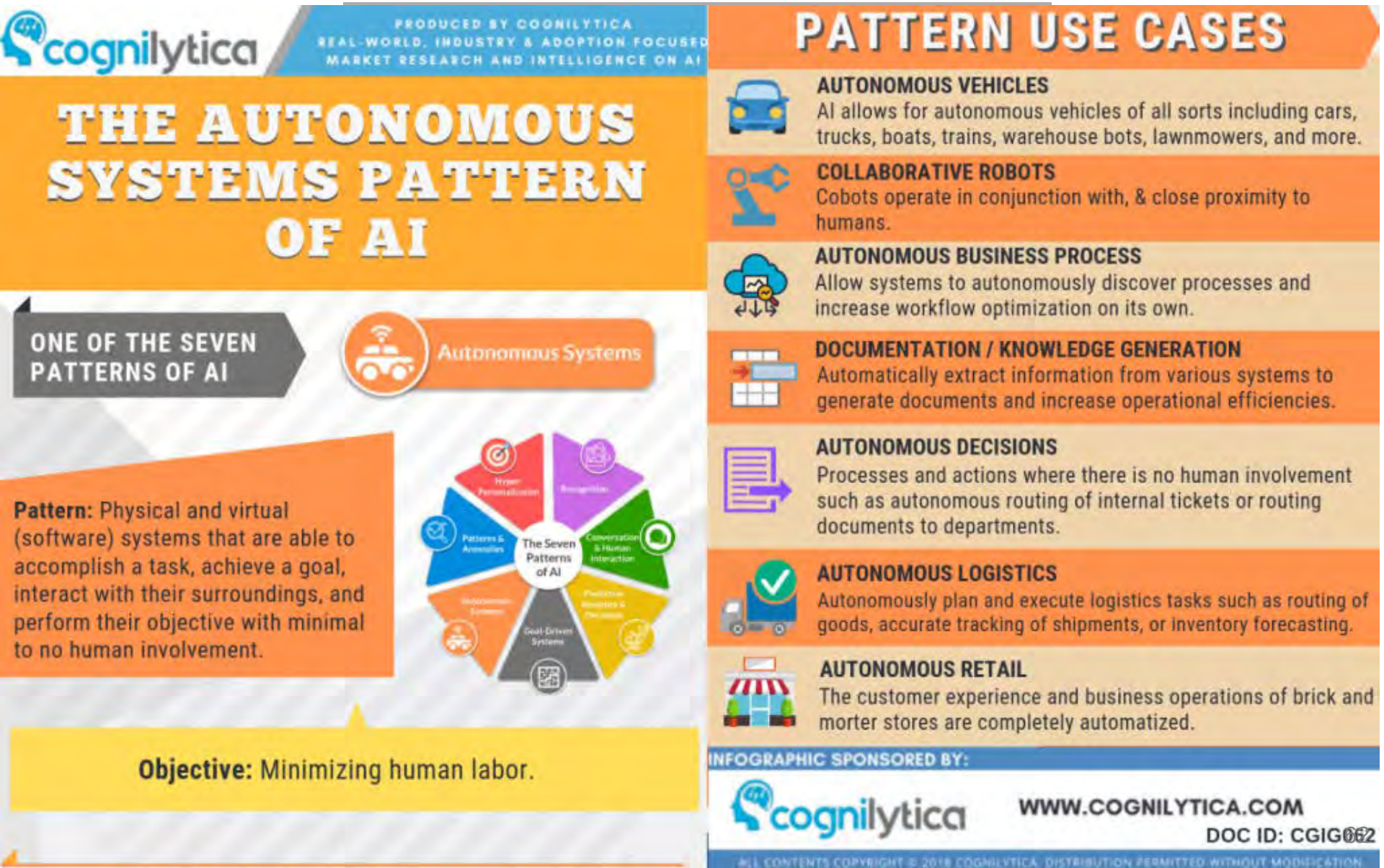
Patterns of AI



Hyperpersonalization

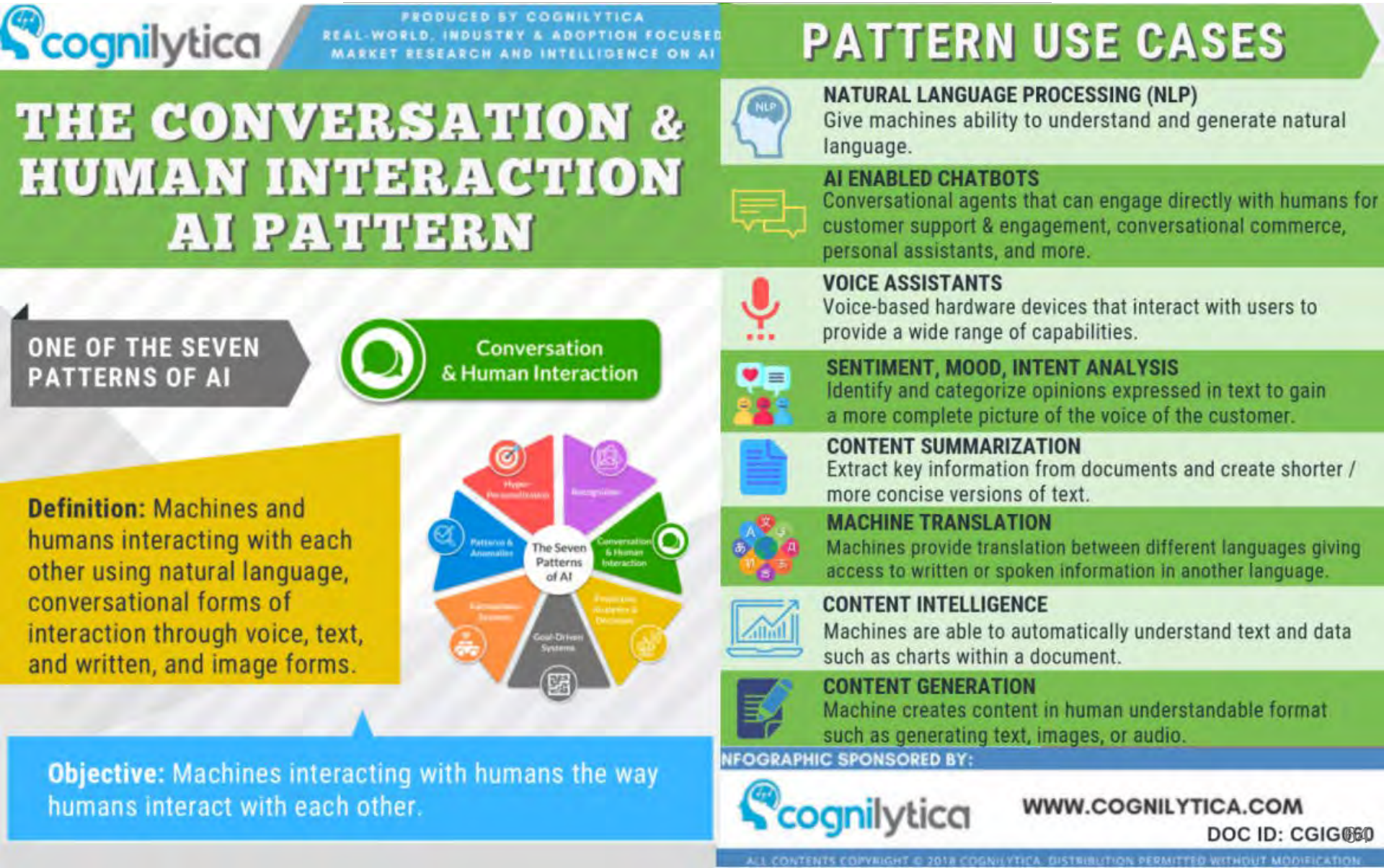


Autonomous System



Predictive Analytics

Conversation & Human interaction



Pattern & Anomaly Detection

cognilytica

PRODUCED BY COGNILYTICA
REAL-WORLD, INDUSTRY & ADOPTION FOCUSED
MARKET RESEARCH AND INTELLIGENCE ON AI

THE PATTERN & ANOMALY PATTERN OF AI

ONE OF THE SEVEN PATTERNS OF AI

Patterns & Anomalies

Pattern: Use ML to identify patterns in data and learn higher-order connections between information to provide insight into whether a given piece of data fits an existing pattern or is an outlier.

Objective: Find which one of these things is like the other and which is not

PATTERN USE CASES

FRAUD & RISK DETECTION
Use ML to find which one of these things is like the other and which is not. Used heavily for financial transactions such as credit card purchases.

UNCOVERING INSIGHTS IN DATA
Machines look at data to find insights, patterns, and groupings in the data.

AUTOMATIC ERROR DETECTION & CORRECTION
AI systems can learn what's "normal" behavior and spot mistakes or errors and make adjustments as needed.

INTELLIGENT MONITORING
AI can monitor of various systems (hardware and software) to determine when errors or breakdowns will occur to help predict maintenance cycles of machinery, formulate predictions regarding asset malfunction, and allow for reductions in unplanned downtime.

DATA AUGMENTATION & DISCOVERY
Using unstructured learning to find and group information that might be relevant from data.

PREDICTIVE TYPING / PREDICTIVE TEXT
AI can provide text suggestions that learn over time allowing the software to build custom dictionaries.

CYBERSECURITY APPLICATIONS
AI can help with cybersecurity by learning and adapting to changing threats, identify and spot malware, phishing attacks, and more.

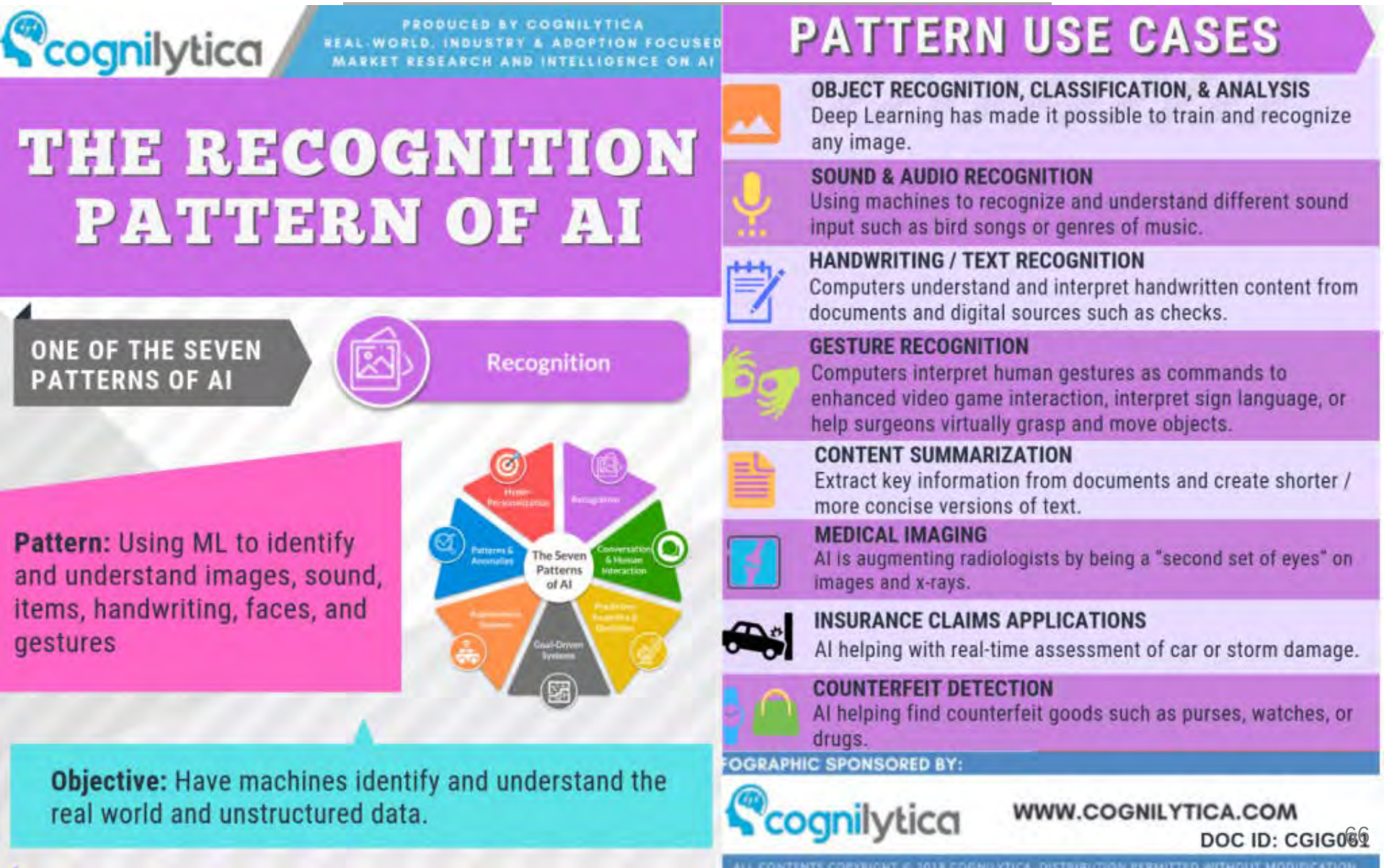
CANDIDATE MATCHING
AI can sort through thousands of potential candidates to find best matches, screen candidates, and help suggest best candidates for position.

INFOGRAPHIC SPONSORED BY:

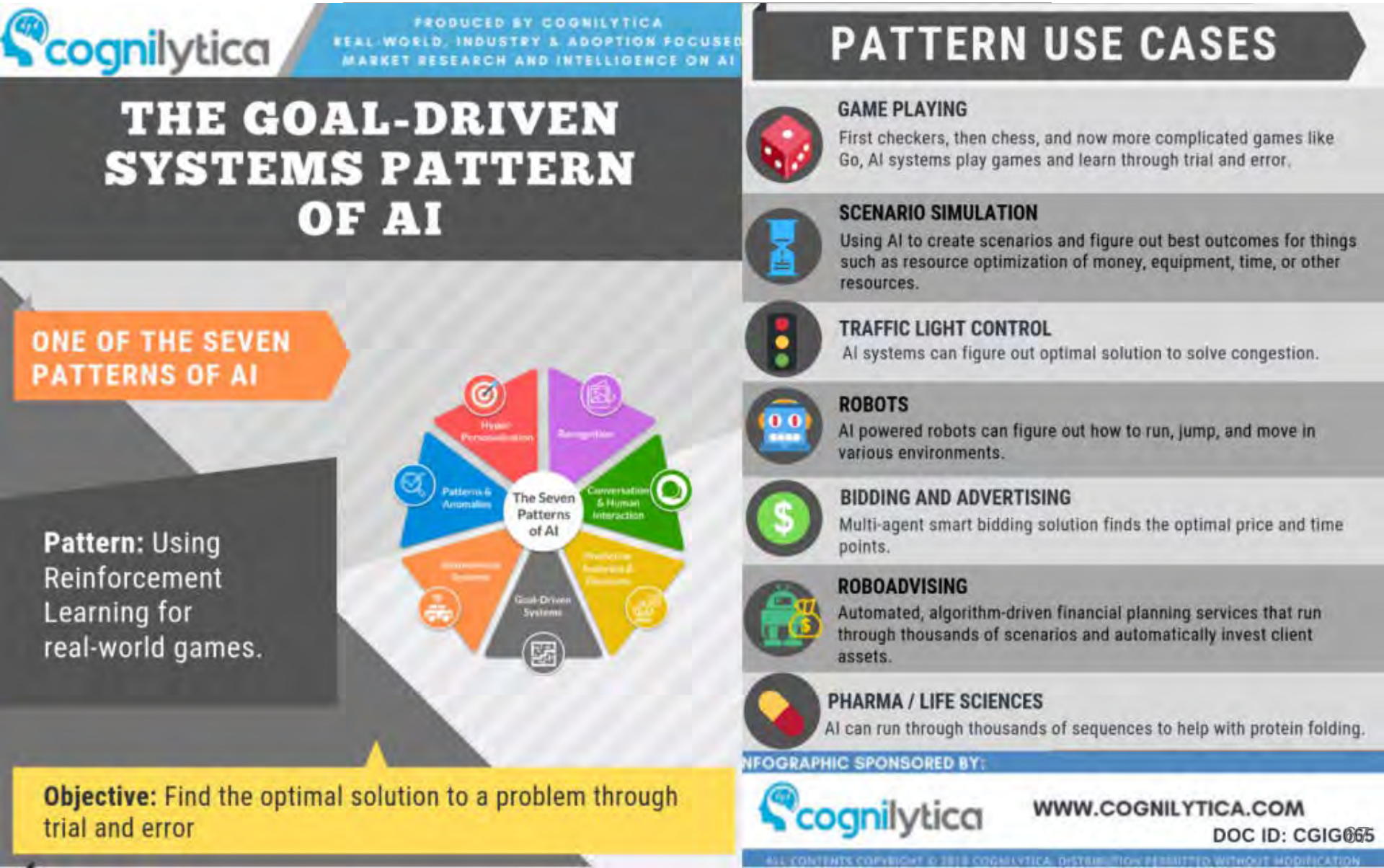
cognilytica

WWW.COGNILYTICA.COM
DOC ID: CGIG063

Recognition Pattern



Goal-Driven System



AI IN LAW ENFORCEMENT

Ways AI is impacting the capabilities of law enforcement around the world

ROBOTS

Robotic devices have been used by law enforcement since 2010, most notably used in detecting and deactivating explosive devices. In India, they've gone as far as developing a real-life robot police officer!

CROWD CONTROL

AI has helped improve large-scale surveillance through monitoring data, images, and the use of drones and other devices. Chinese law enforcement is dramatically increasing use of AI-enabled cameras at major events.

PREDICTIVE POLICING

Through the use of tools such as the Harm Assessment Risk Tool (HART), AI has helped improve predictive policing to better stop crimes before they are committed.

MONITORING SOCIAL MEDIA

AI improves scanning of social media for illicit activities such as drug dealing and radicalized individuals such as ISIS recruiters.

IMAGE RECOGNITION AND FACIAL DETECTION

AI helps scan video footage for people/objects, transcrie audio, and increases accuracy in redacting footage. The Netherlands has recently developed interview 'bots' to improve lie detection.

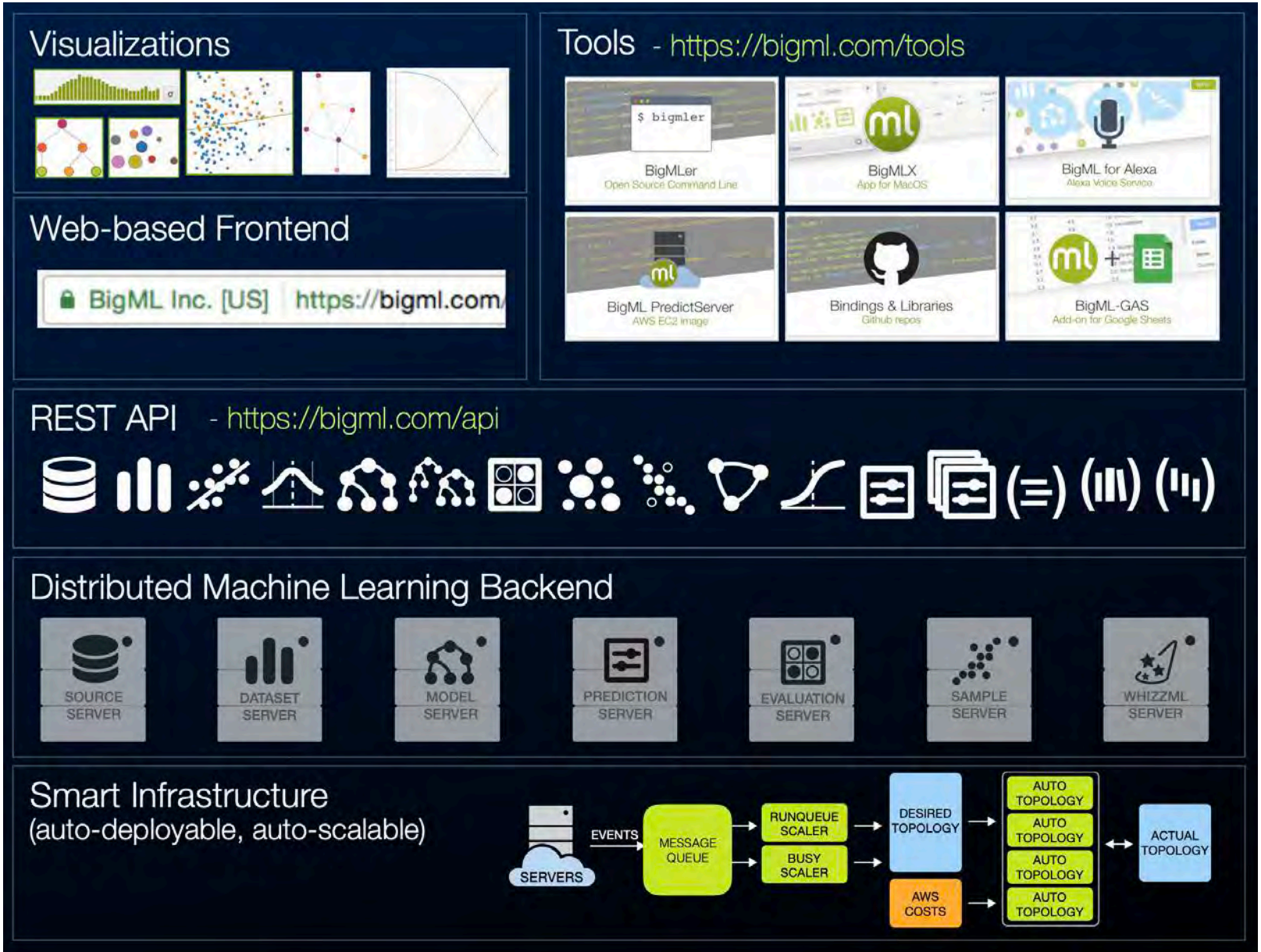
DATA DISCOVERY

Law enforcement uses AI systems to identify patterns and anomalies and uncover important information in piles of data.

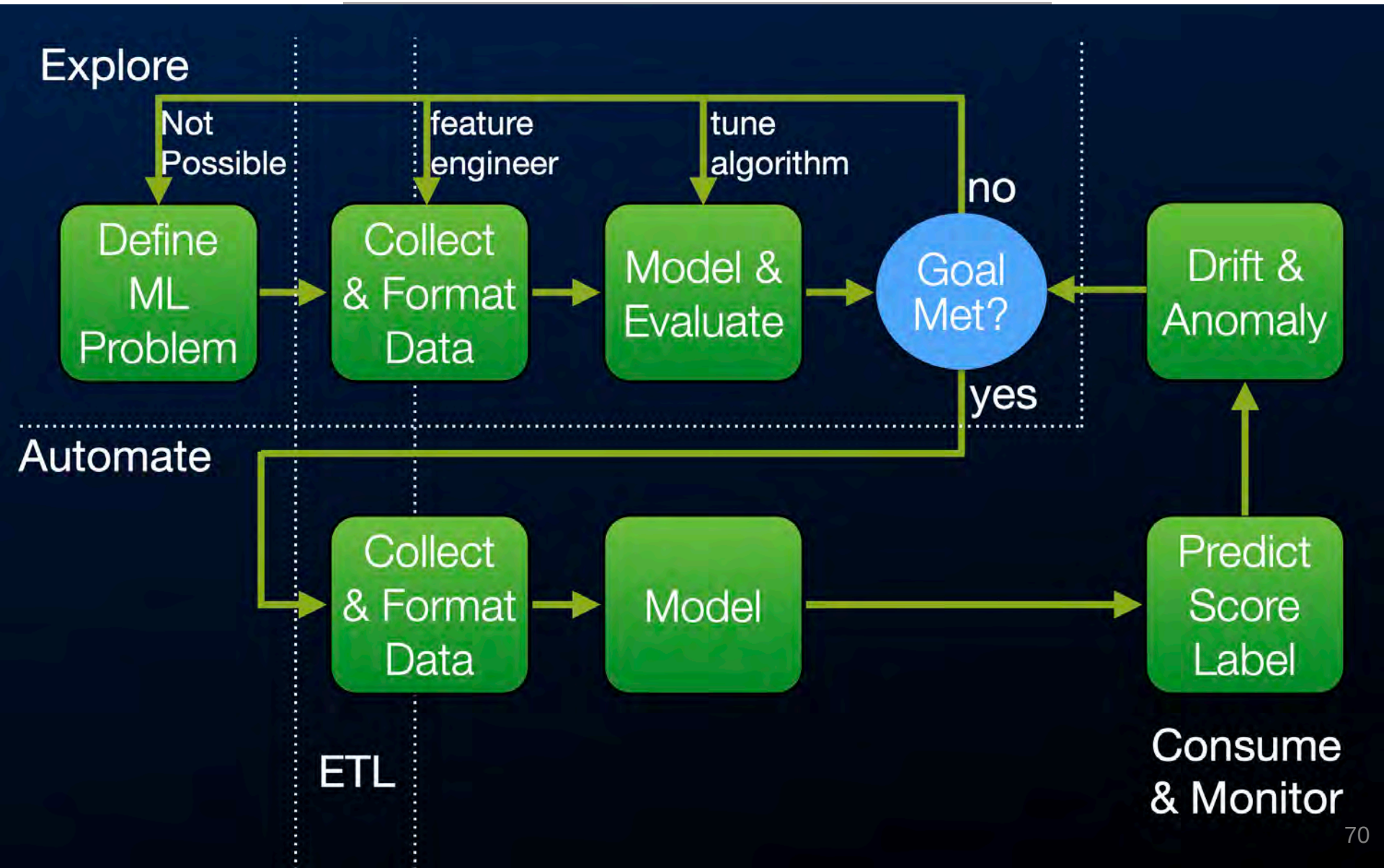
MISSING PERSONS

Companies are developing AI technology for law enforcement to improve the tracking of missing persons.

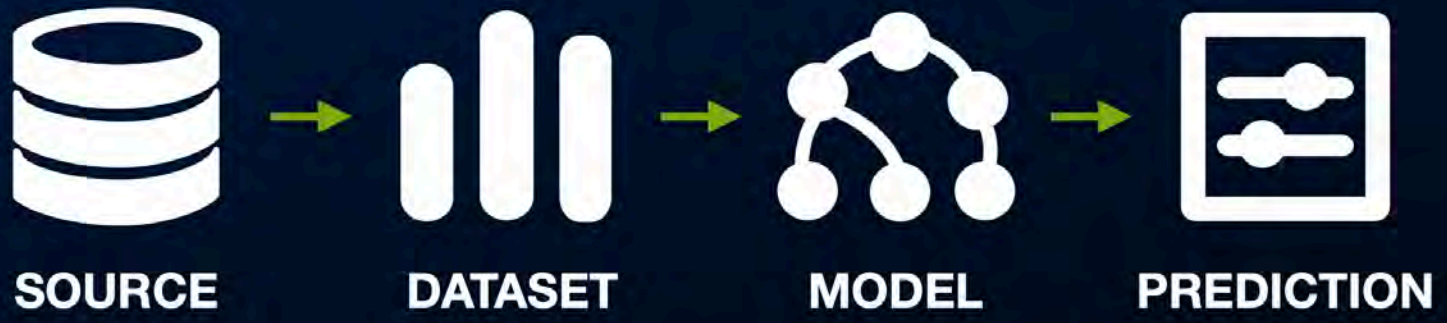
Hands on – Anomaly detection



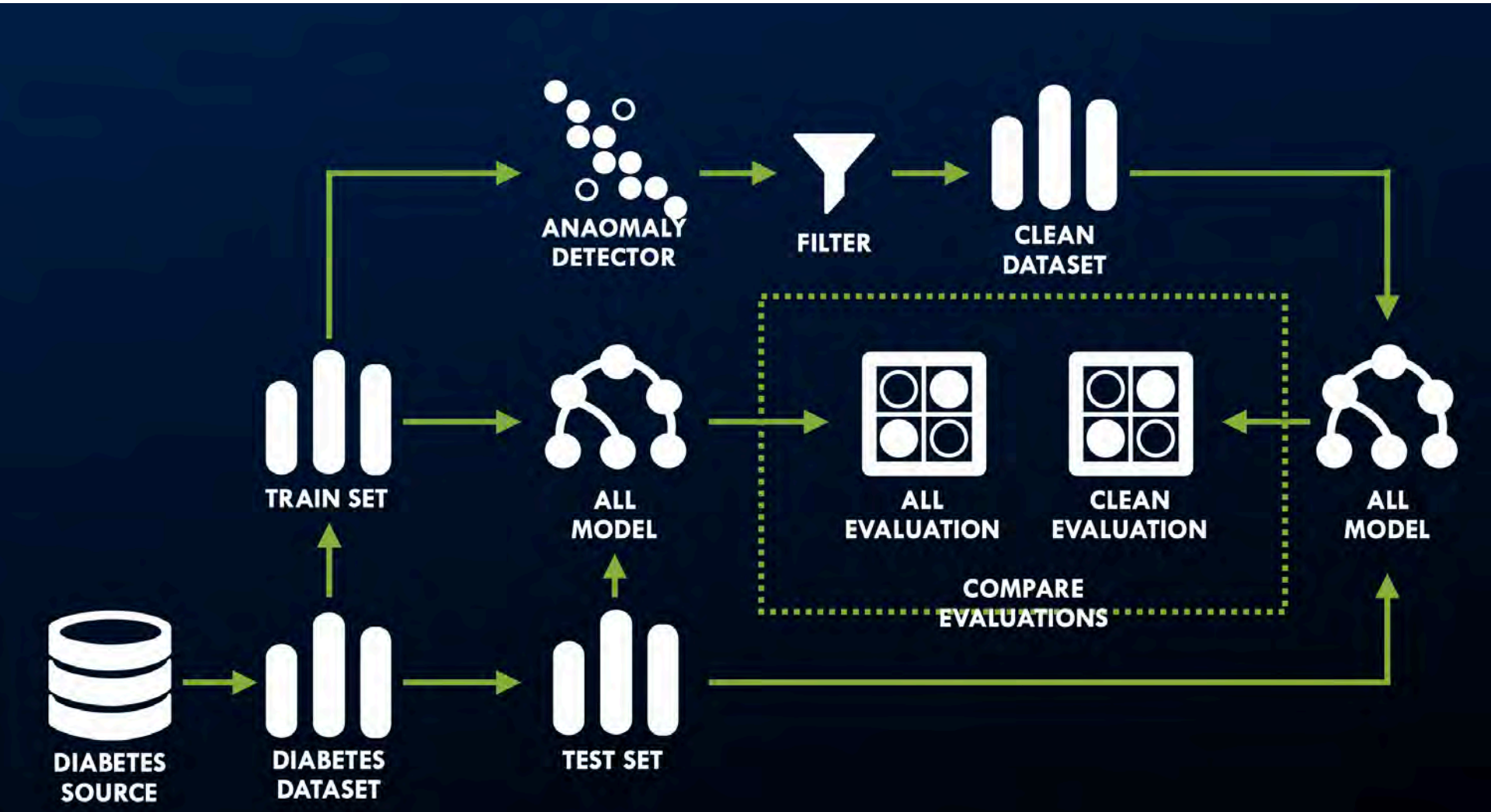
Predictive Application



Simple Workflow



Credit Transaction Anomalies



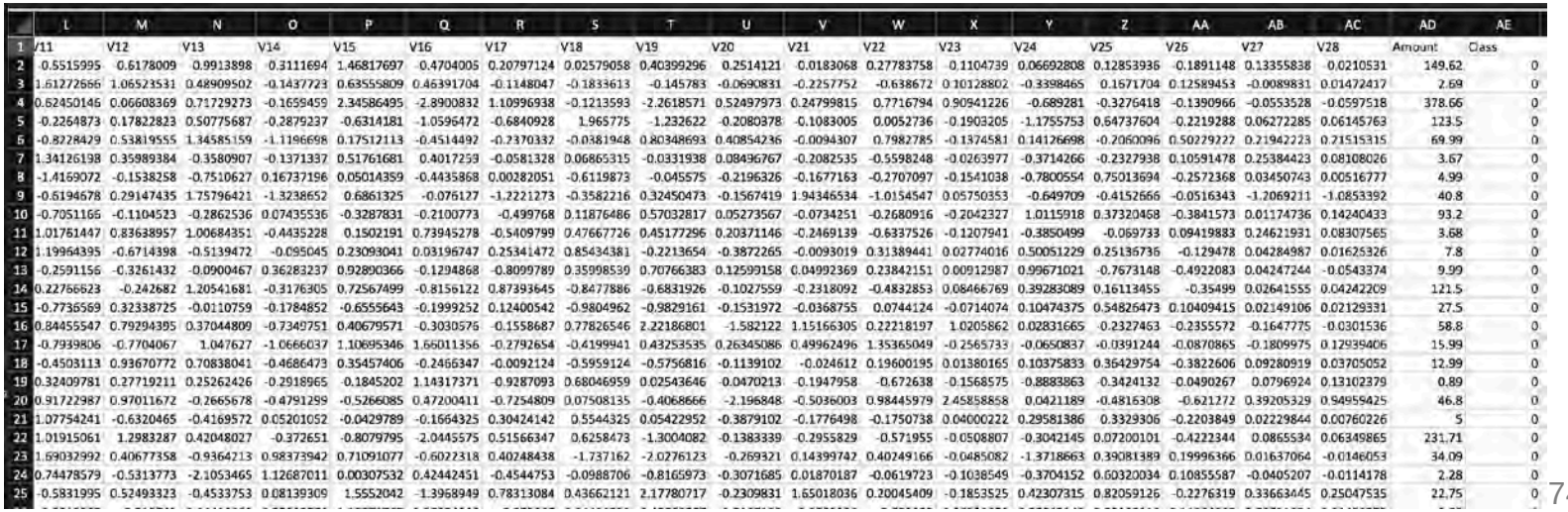
The dataset

- It is important that credit card companies are able to recognize fraudulent credit card transactions so that customers are not charged for items that they did not purchase.

- The datasets contains transactions made by credit cards in September 2013 by european cardholders. This dataset presents transactions that occurred in two days, where we have 492 frauds out of 284,807 transactions. The dataset is highly unbalanced, the positive class (frauds) account for 0.172% of all transactions.

The dataset

- It contains only numerical input variables which are the result of a transformation. Unfortunately, due to confidentiality issues, we cannot provide the original features and more background information about the data. Features V1, V2, ... V28 are the principal components obtained with PCA, the only features which have not been transformed with PCA are 'Time' and 'Amount'.
- Feature 'Time' contains the seconds elapsed between each transaction and the first transaction in the dataset. The feature 'Amount' is the transaction Amount, this feature can be used for example-dependant cost-sensitive learning. Feature 'Class' is the response variable and it takes value 1 in case of fraud and 0 otherwise.

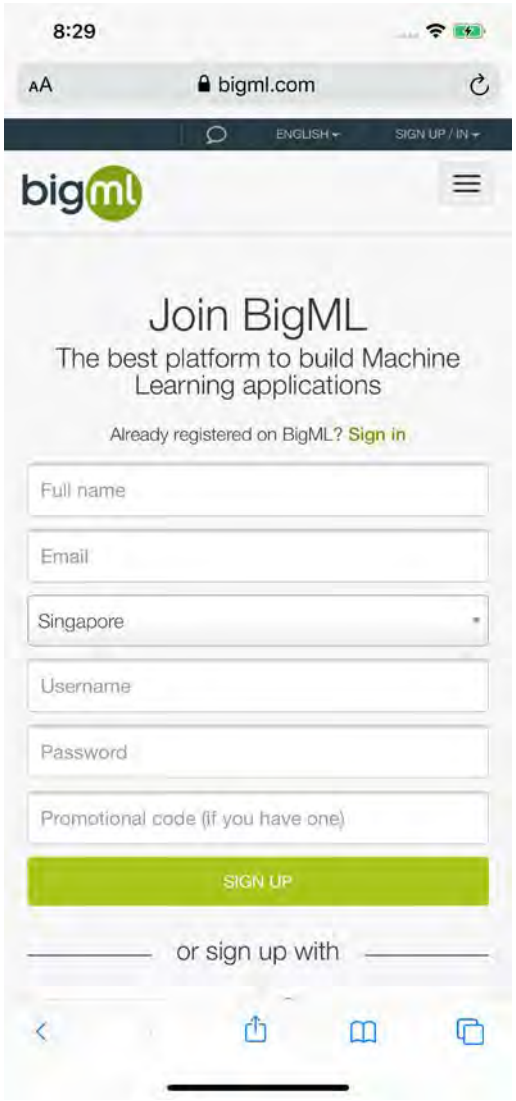


	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	Amount	Class
2	0.5515995	0.6178009	0.9913898	0.3111694	1.46817697	-0.4704005	0.20797124	0.02579058	0.40399296	0.2514121	0.0183068	0.27783758	-0.1104739	0.06692808	0.12853936	-0.1891148	0.13355838	-0.0210531	149.62	0
3	1.61272666	1.06523531	0.48909502	-0.1437723	0.63555809	0.46391704	-0.1148047	-0.1833613	-0.145783	-0.0690831	-0.2257752	-0.638672	0.10128802	-0.3398465	0.1671704	0.12589453	-0.0089831	0.01472417	2.69	0
4	0.62450146	0.06608369	0.71729273	-0.1659459	2.34586495	-2.8900832	1.10996938	-0.1213593	-2.2618571	0.52497973	0.24799815	0.7716794	0.90941226	-0.689281	-0.3276418	-0.1390966	-0.0553528	-0.0597518	378.66	0
5	-0.2254873	0.17822823	0.50775687	-0.2879237	-0.6314181	-1.0596472	-0.6840928	1.965775	-1.232622	-0.2080378	-0.1083005	0.0052736	-0.1903205	-1.1755753	0.64737604	-0.2219288	0.06272285	0.06145763	123.5	0
6	-0.8228429	0.53819555	1.34585159	-1.1196698	0.17512113	-0.4514492	-0.2370332	-0.0381948	0.80348693	0.40854236	-0.0094307	0.7982785	-0.1374581	0.14126698	-0.2060096	0.50229222	0.21942223	0.21515315	69.99	0
7	1.34126198	0.35989384	-0.3580907	-0.1371337	0.51761681	0.4017259	-0.0581328	0.06865315	-0.0331938	0.08496767	-0.2082535	-0.5598248	-0.0263977	-0.3714266	-0.2327938	0.10591478	0.25384423	0.08108026	3.67	0
8	-1.4169072	-0.1538258	-0.7510627	0.16737196	0.05014359	-0.4435868	0.00282051	-0.6119873	-0.045575	-0.2196326	-0.1677163	-0.2707097	-0.1541038	-0.7800554	0.75013694	-0.2572368	0.03450743	0.00516777	4.99	0
9	-0.6194678	0.29147435	1.75796421	-1.3238652	0.6861325	-0.076127	-1.2221273	-0.3582216	0.32450473	-0.1567419	1.94346534	-1.0154547	0.05750353	-0.649709	-0.4152666	-0.0516343	-1.2069211	-1.0853392	40.8	0
10	-0.7051166	-0.1104523	-0.2862536	0.07435536	-0.3287831	-0.2100773	-0.499768	0.11876486	0.57032817	0.05273567	-0.0734251	-0.2680916	-0.2042327	1.0115918	0.37320458	-0.3841573	0.01174736	0.14240433	93.2	0
11	1.01761447	0.83638957	1.00684351	-0.4435228	0.1502191	0.73945278	-0.5409799	0.47667726	0.45177296	0.20371146	-0.2469139	-0.6337526	-0.1207941	-0.3850499	-0.069733	0.09419883	0.24621931	0.08307565	3.68	0
12	1.19964395	-0.6714398	-0.5139472	-0.095045	0.23093041	0.03196747	0.25341472	0.85434381	-0.2213654	-0.3872265	-0.0093019	0.31389441	0.02774016	0.50051229	0.25136736	-0.129478	0.04284987	0.01625326	7.8	0
13	-0.2591156	-0.3261432	-0.0900467	0.36283237	0.92890366	-0.1294868	-0.8099789	0.35998539	0.70766383	0.12599158	0.04992369	0.23842151	0.00912987	0.99671021	-0.7673148	-0.4922083	0.04247244	-0.0543374	9.99	0
14	0.22766623	-0.242682	1.20541681	-0.3176305	0.72567499	-0.8156122	0.87393645	-0.8477886	-0.6831926	-0.1027559	-0.2318092	-0.4832853	0.08466769	0.39283089	0.16113455	-0.35499	0.02641555	0.04242209	121.5	0
15	-0.7736569	0.32338725	-0.0110759	-0.1784852	-0.6555643	-0.1999252	0.12400542	-0.9804962	-0.9829161	-0.1531972	-0.0368755	0.0744124	-0.0714074	0.10474375	0.54826473	0.10409415	0.02149106	0.02129331	27.5	0
16	0.84455547	0.79294395	0.37044809	-0.7349751	0.40679571	-0.3030576	-0.1558687	0.77826546	2.22186801	-1.582122	1.15166305	0.22218197	1.0205862	0.02831665	-0.2327463	-0.2355572	-0.1647775	-0.0301536	58.8	0
17	-0.7939806	-0.7704067	1.047627	-1.0666037	1.10695346	1.66011356	-0.2792654	-0.4199941	0.43253535	0.26345086	0.49962496	1.35365049	-0.2565733	-0.0650837	-0.0391244	-0.0870865	-0.1809975	0.12939406	15.99	0
18	-0.4503113	0.93670772	0.70838041	-0.4686473	0.35457406	-0.2466347	-0.0092124	-0.5959124	-0.5756816	-0.1139102	-0.024612	0.19600195	0.01380165	0.10375833	0.36429754	-0.3822606	0.09280919	0.03705052	12.99	0
19	0.32409781	0.27719211	0.25262426	-0.2918965	-0.1845202	1.14317371	-0.9287093	0.68046959	0.02543646	-0.0470213	-0.1947958	-0.672638	-0.1568575	-0.8883863	-0.3424132	-0.0490267	0.0796924	0.13102379	0.89	0
20	0.91722987	0.97011672	-0.2665678	-0.4791299	-0.5266085	0.47200411	-0.7254809	0.07508135	-0.4068666	-2.196848	-0.5036003	0.98445979	2.45858858	0.0421189	-0.4816308	-0.621272	0.39205329	0.94959425	46.8	0
21	1.07754241	-0.6320465	-0.4169572	0.05201052	-0.0429789	-0.1664325	0.30424142	0.5544325	0.05422952	-0.3879102	-0.1776498	-0.1750738	0.04000222	0.29581386	0.3329306	-0.2203849	0.02229844	0.00760226	5	0
22	1.01915061	1.2983287	0.42048027	-0.372651	-0.8079795	-2.0445575	0.51566347	0.6258473	-1.3004082	-0.1383339	-0.2955829	-0.571955	-0.0508807	-0.3042145	0.07200101	-0.4222344	0.0865534	0.06349865	231.71	0
23	1.69032992	0.40677358	-0.9364213	0.98373942	0.71091077	-0.6022318	0.40248438	-1.737162	-2.0276123	-0.269321	0.14399742	0.40249166	-0.0485082	-1.3718663	0.39081389	0.19996366	0.01637064	-0.0146053	34.09	0
24	0.74478579	-0.5313773	-2.1053465	1.12687011	0.00307532	0.42442451	-0.4544753	-0.0988706	-0.8165973	-0.3071685	0.01870187	-0.0619723	-0.1038549	-0.3704152	0.60320034	0.10855587	-0.0405207	-0.0114178	2.28	0
25	-0.5831995	0.52493323	-0.4533753	0.08139309	1.5552042	-1.3968949	0.78313084	0.43662121	2.17780717	-0.2309831	1.65018036	0.20045409	-0.1853525	0.42307315	0.82059126	-0.2276319	0.33663445	0.25047535	22.75	0

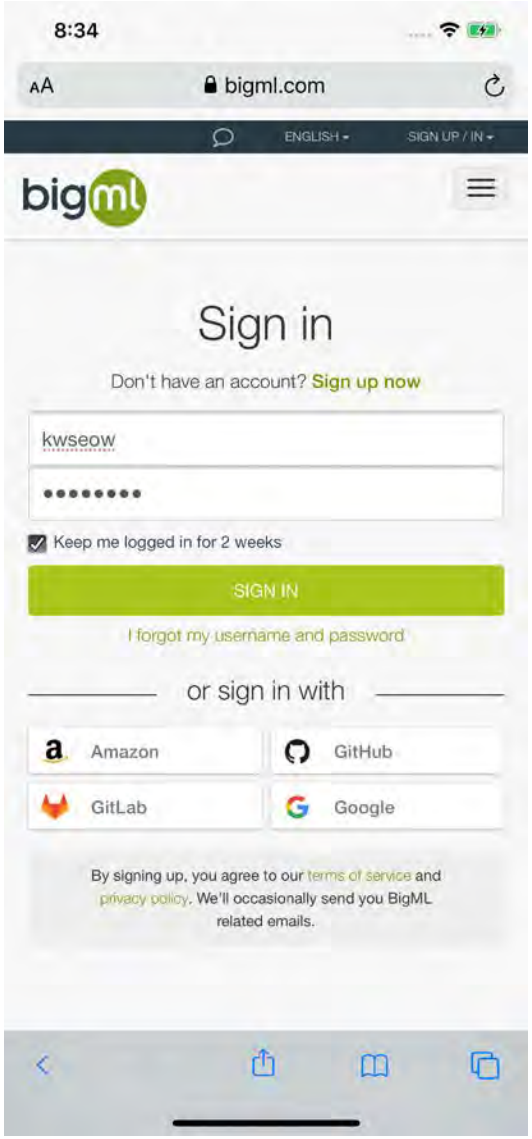
(1) Sign up for free account

SCAN ME

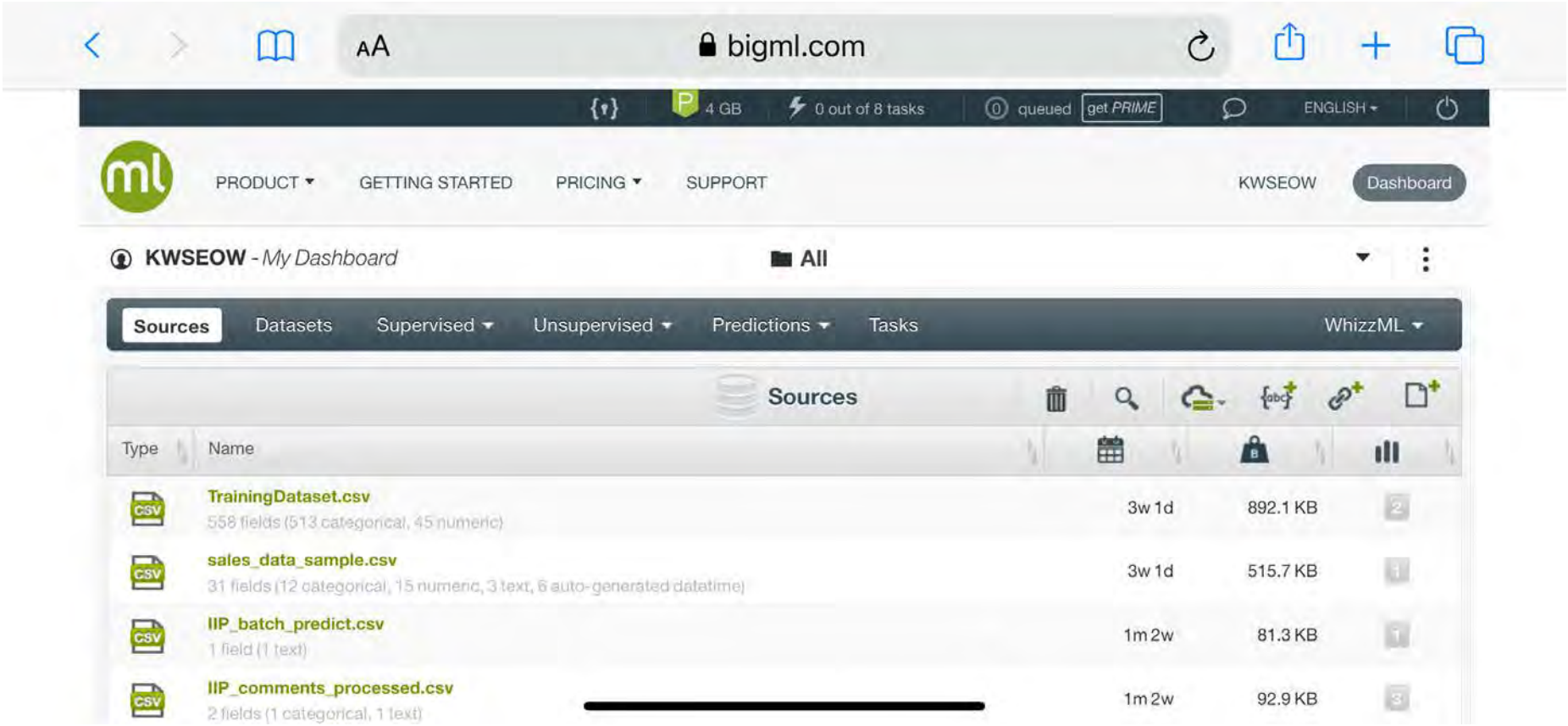
http://bit.ly/2OTSeJ4



(2) Sign in

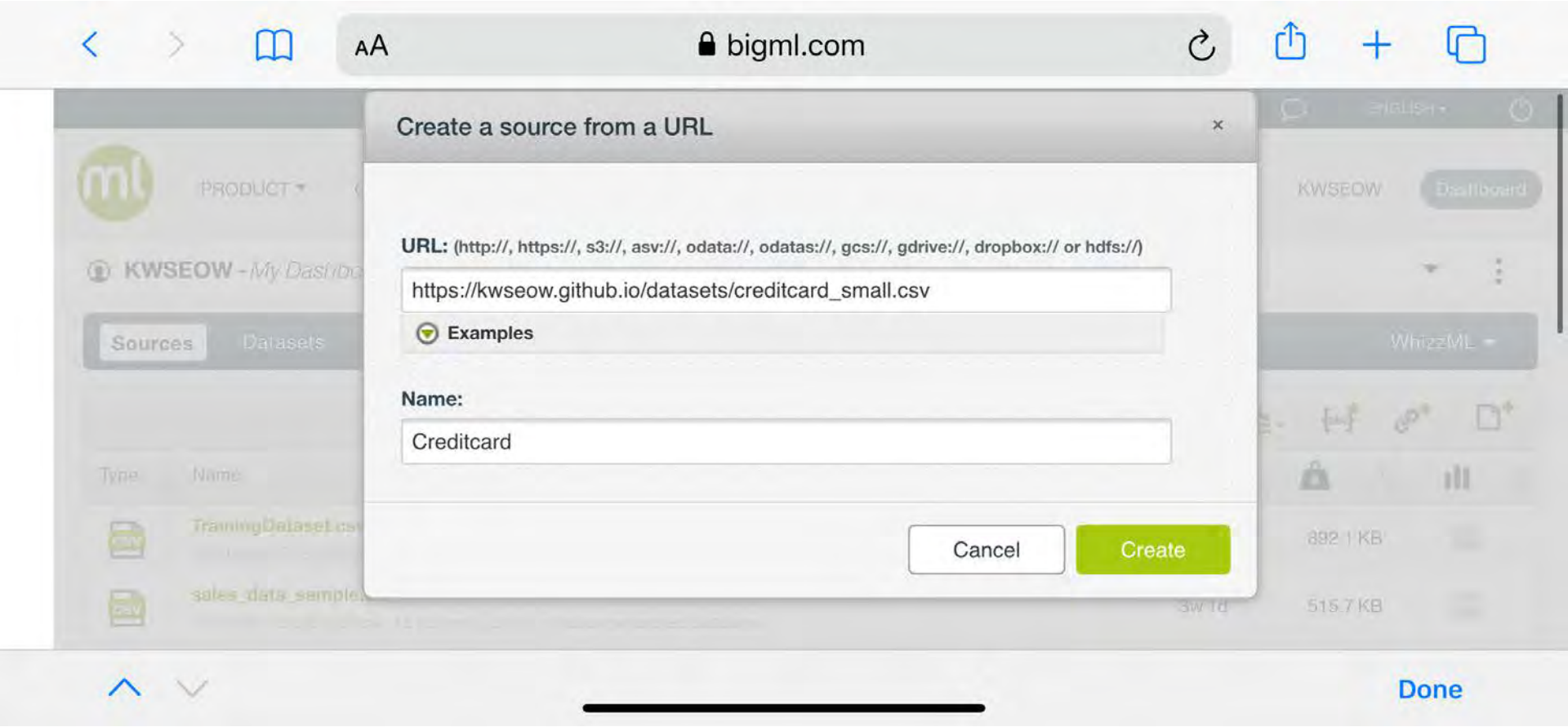

8:34
AA
bigml.com
ENGLISH
SIGN UP / IN
bigml
Sign in
Don't have an account? Sign up now
kwseow
Keep me logged in for 2 weeks
SIGN IN
I forgot my username and password
or sign in with
Amazon
GitHub
GitLab
Google
By signing up, you agree to our terms of service and privacy policy. We'll occasionally send you BigML related emails.

(3) Create Source



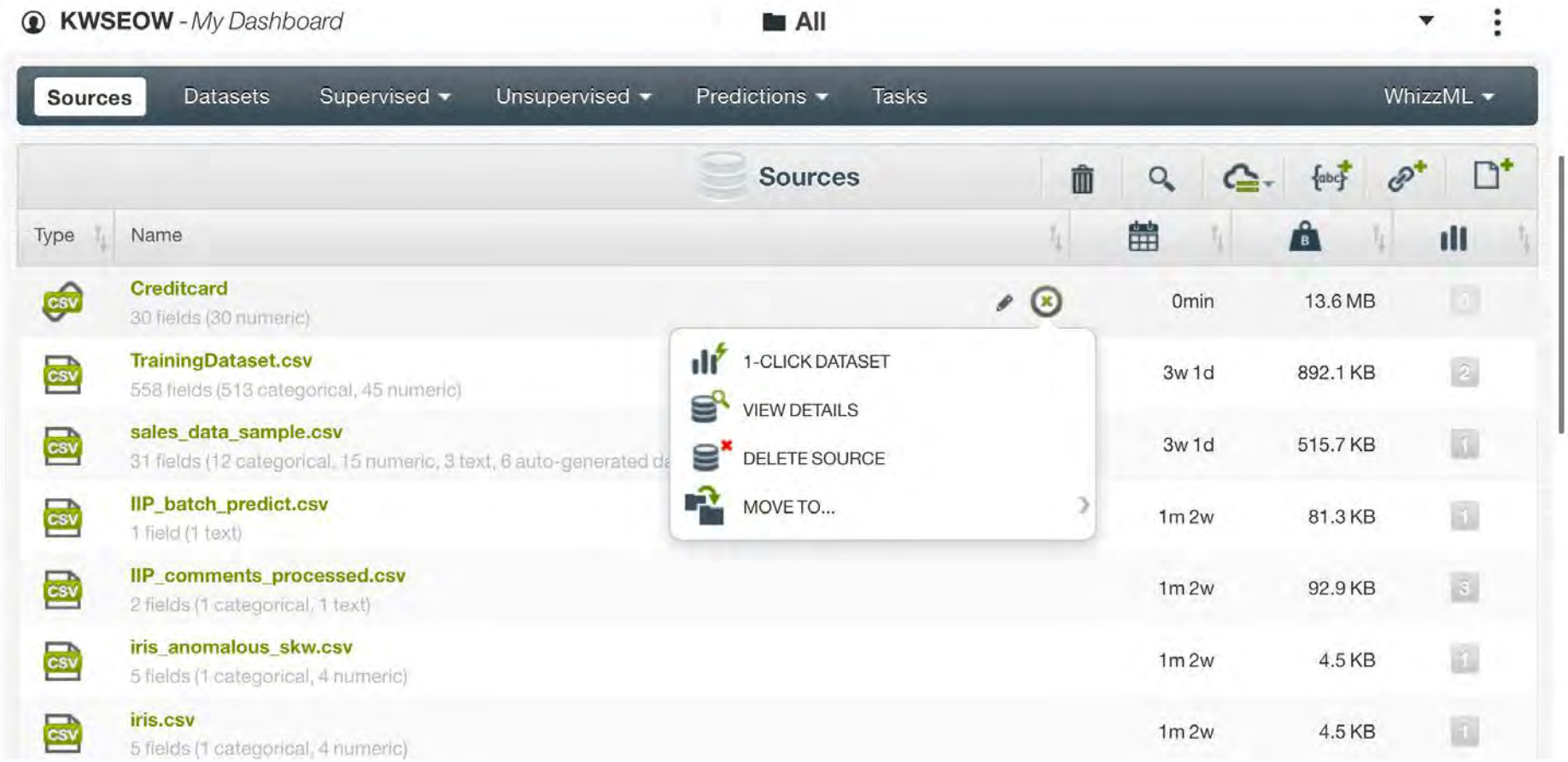
https://kwseow.github.io/datasets/creditcard_small.csv

(3) Create Source



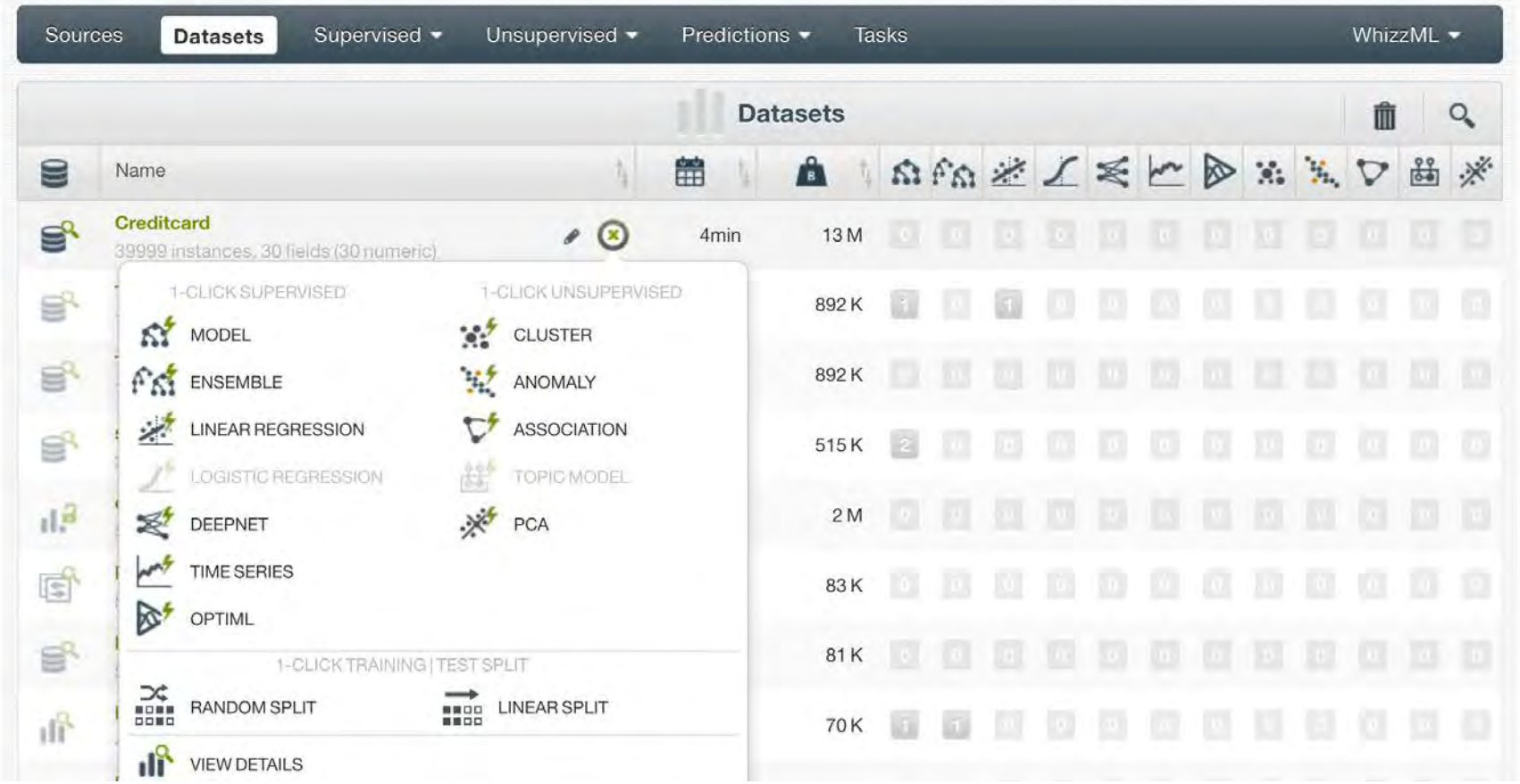
https://kwseow.github.io/datasets/creditcard_small.csv

(4) Create Dataset



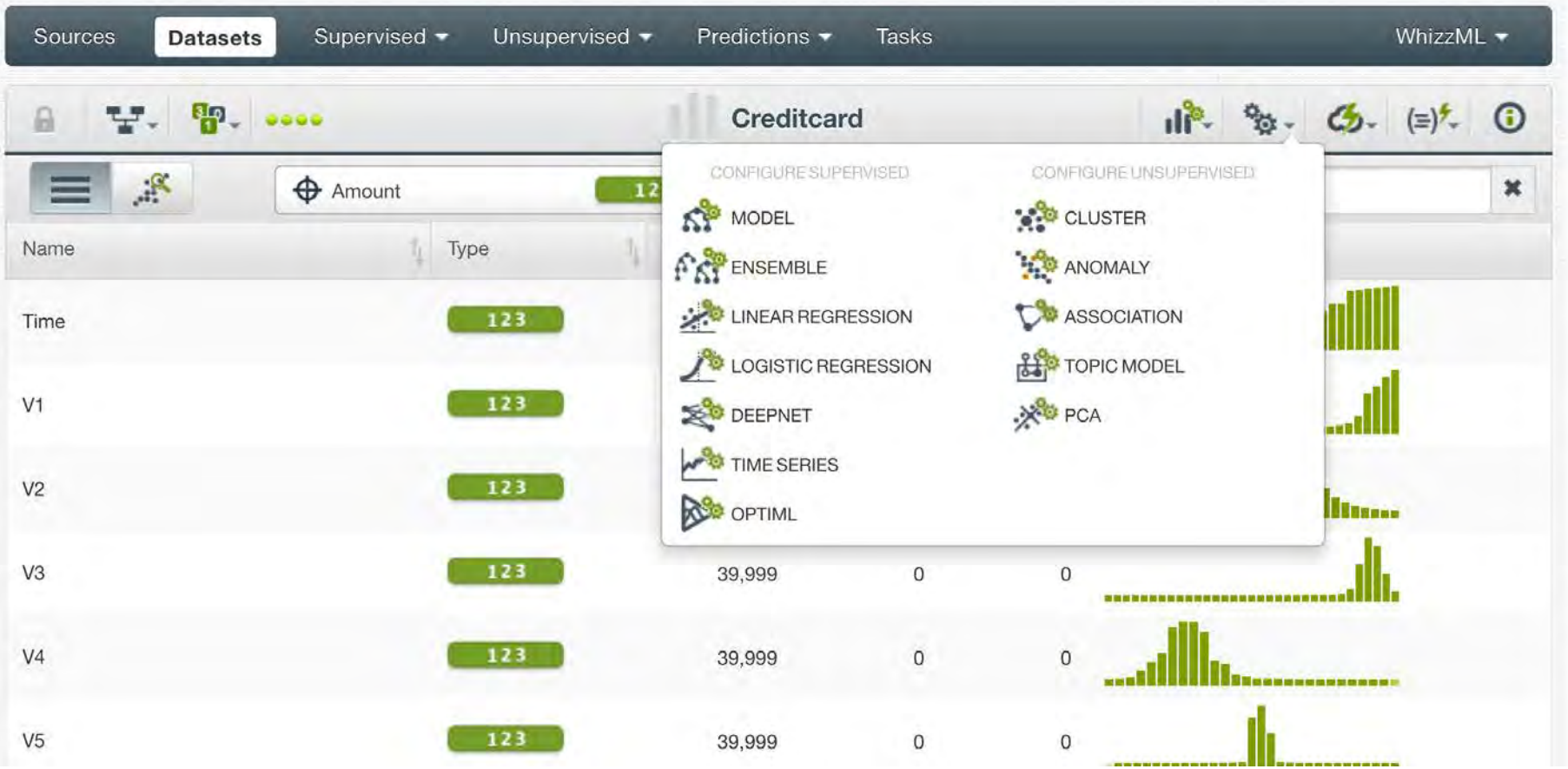
(5) Create Anomaly Detector

- One click detector

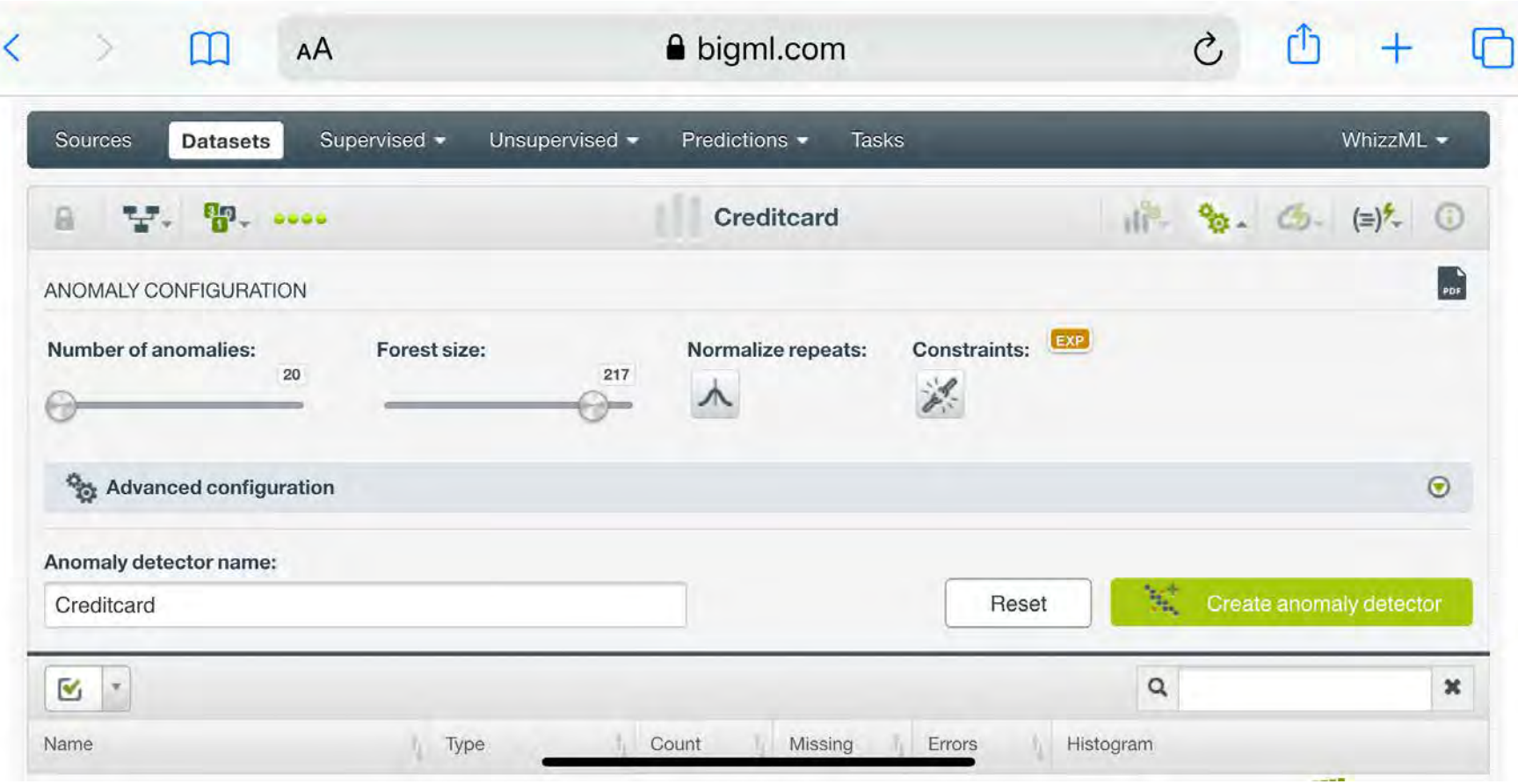


(5) Create Anomaly Detector

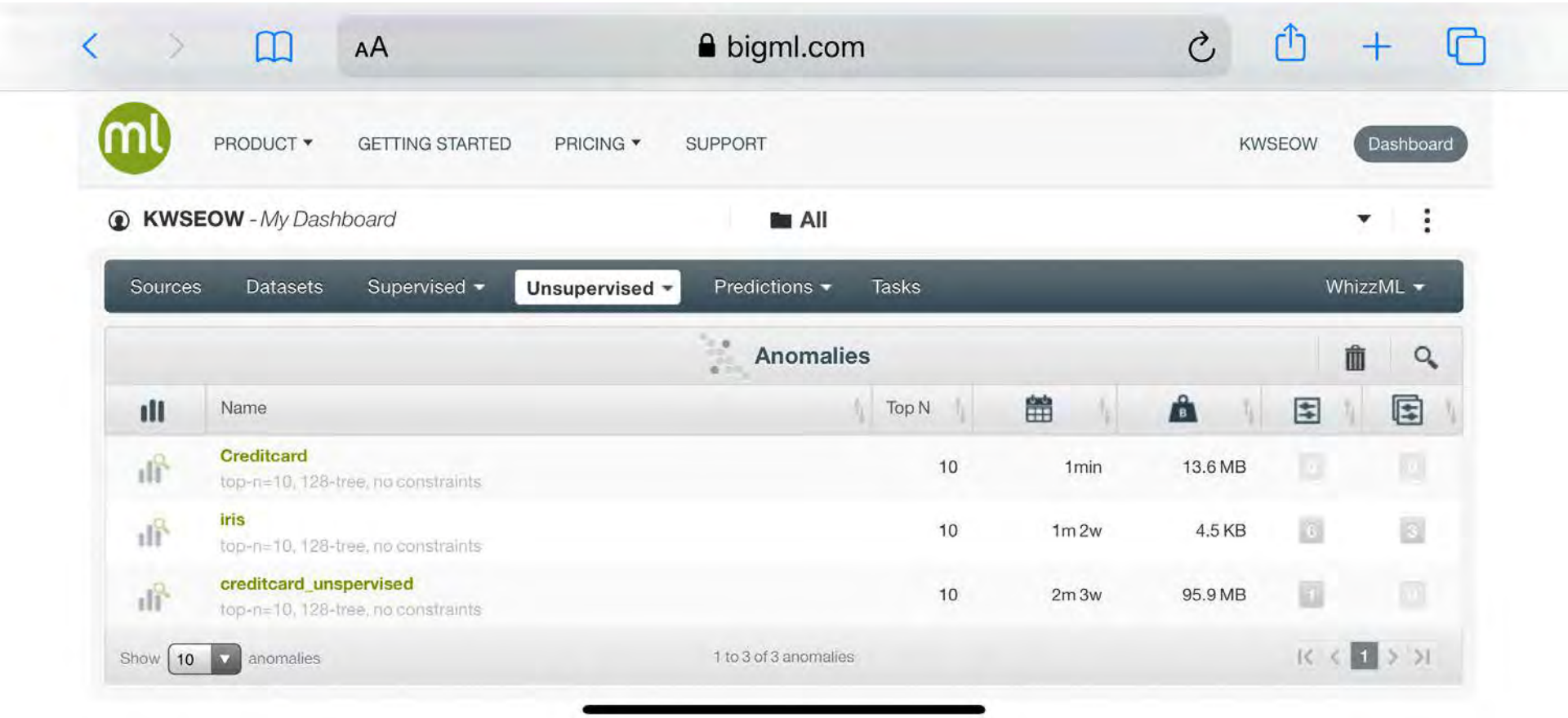
- Custom Anomaly Detector



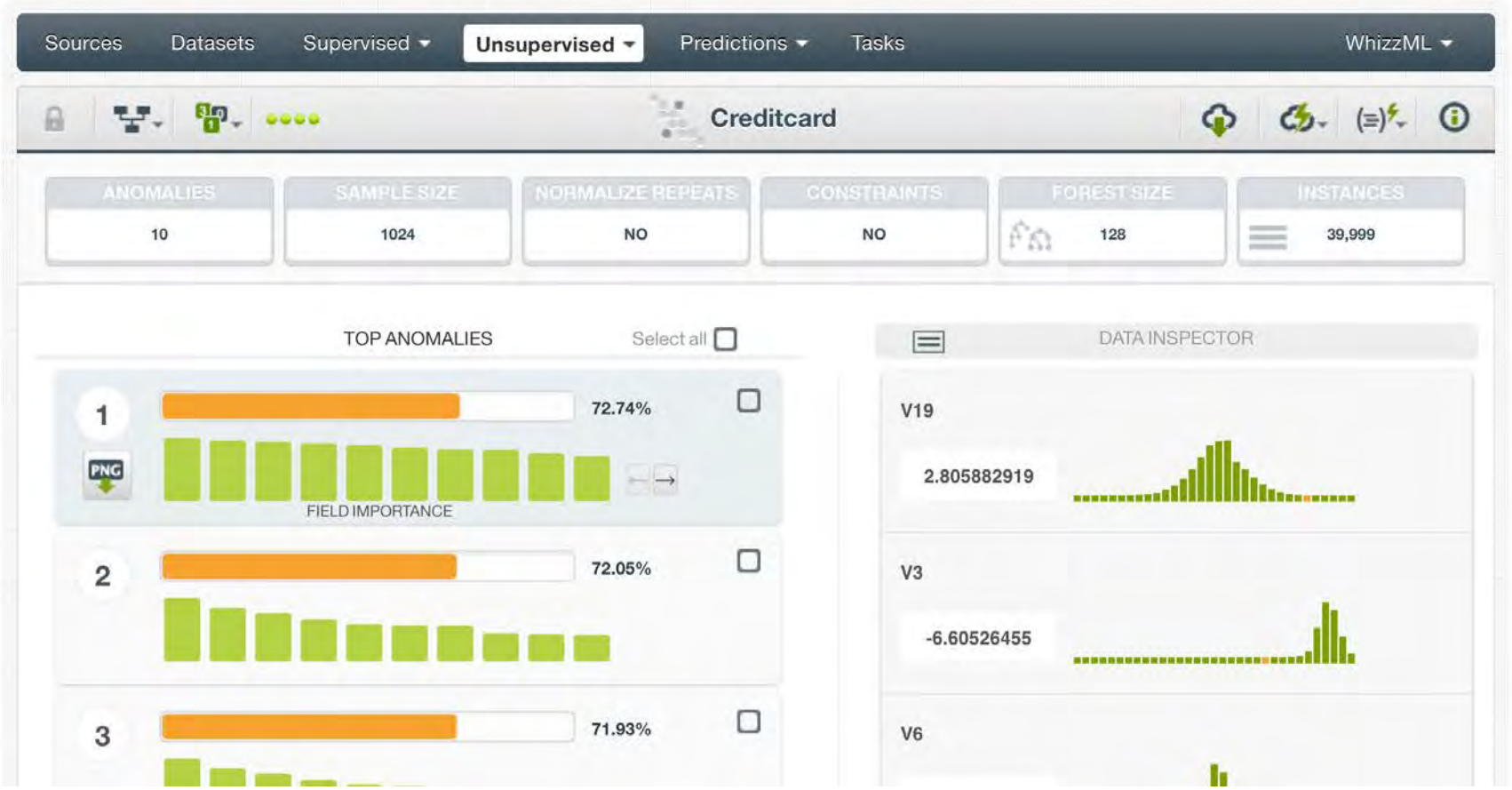
(5) Create Anomaly Detector



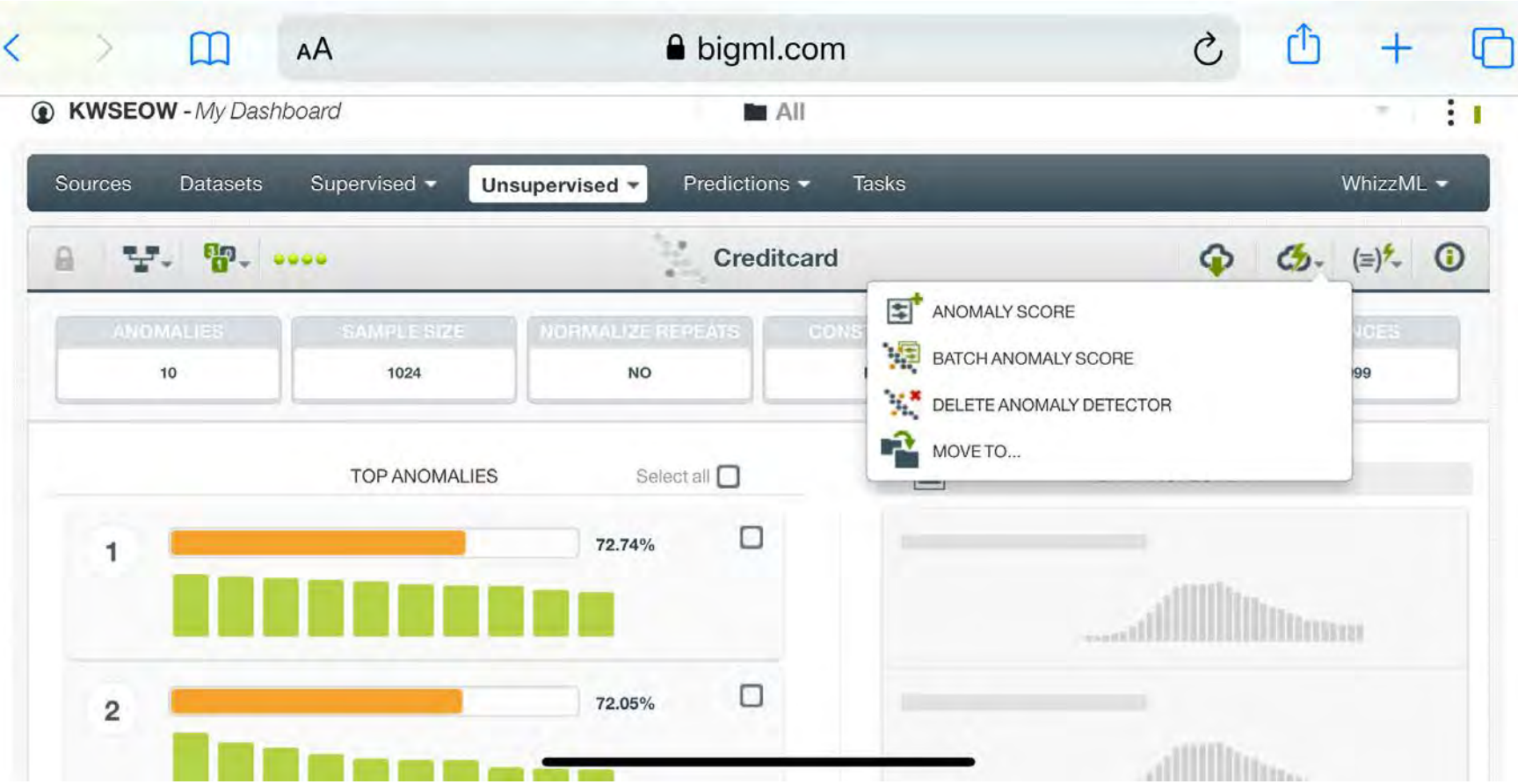
(6) Check for anomalies



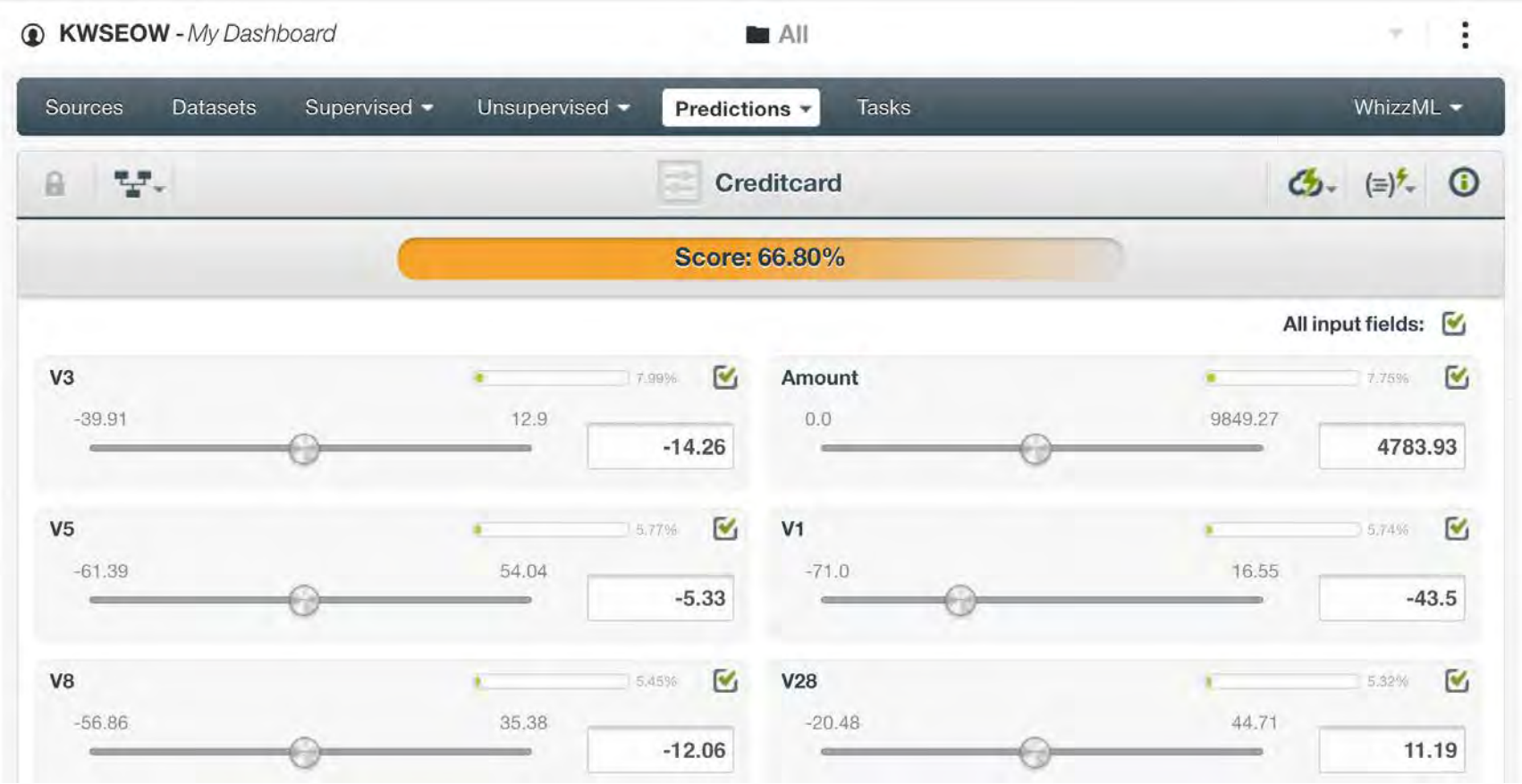
(6) Check for anomalies



(7) Make prediction



(7) Make prediction

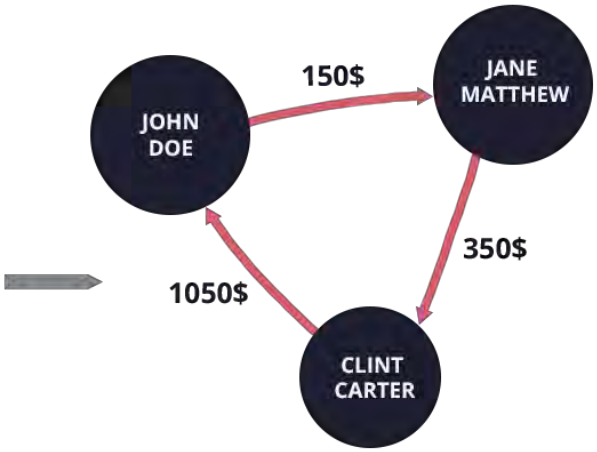


What is a graph?

What is a graph?

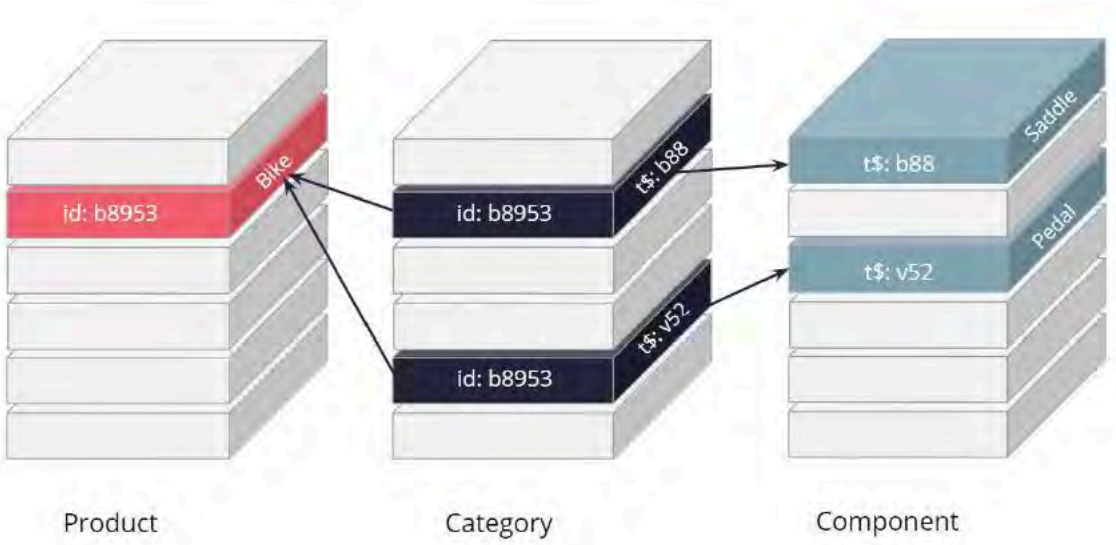
- A graph is a data structure that consists of a set of nodes, and edges (or relationships).
  - Each node represents an entity, such as a person, a bank account or any piece of data.
  - Each edge represents how two nodes are linked to each other, for example person «a» owns bank account «b».
  - Nodes and edges can have properties, additional information associated with them. For instance, the name of the person «a» is «John».

ID	Date	Sender	Amount	Receiver
#1	05/12/18	John Doe	150$	Jane Matthew
#2	06/24/18	Jane Matthew	350$	Clint Carter
#3	04/28/18	Clint Carter	1050$	John Doe



From relational to graph

- The graph approach emerged to address some of the shortcomings of the relational databases management systems (RDBMS)



A tabular data model requieres complex sets of joins accross tables to model relationships.

From relational to graph

- They are very good for instance for routine analysis of data, or fast operations at scale such as verifying that a transaction belongs to a valid customer. But they also have their drawbacks:
  - poor performances for querying relationships: retrieving the relationships of a row requires going from table to table via “joins”. These joins have an exponential computational cost. As a result, queries that require going through a high number of joins are oftentimes unpractical for performance reasons;
  - low flexibility: tables are hard to evolve and relationships across tables are complex to manage. As a result RDBMS tend to struggle to adapt to domains with complex connected data.

From relational to graph

- Popular graph (or RDF) database vendors:
  - AllegroGraph
  - Cosmos DB
  - Datastax Enterprise Graph
  - JanusGraph
  - Neo4j
  - Stardog

When it’s relevant

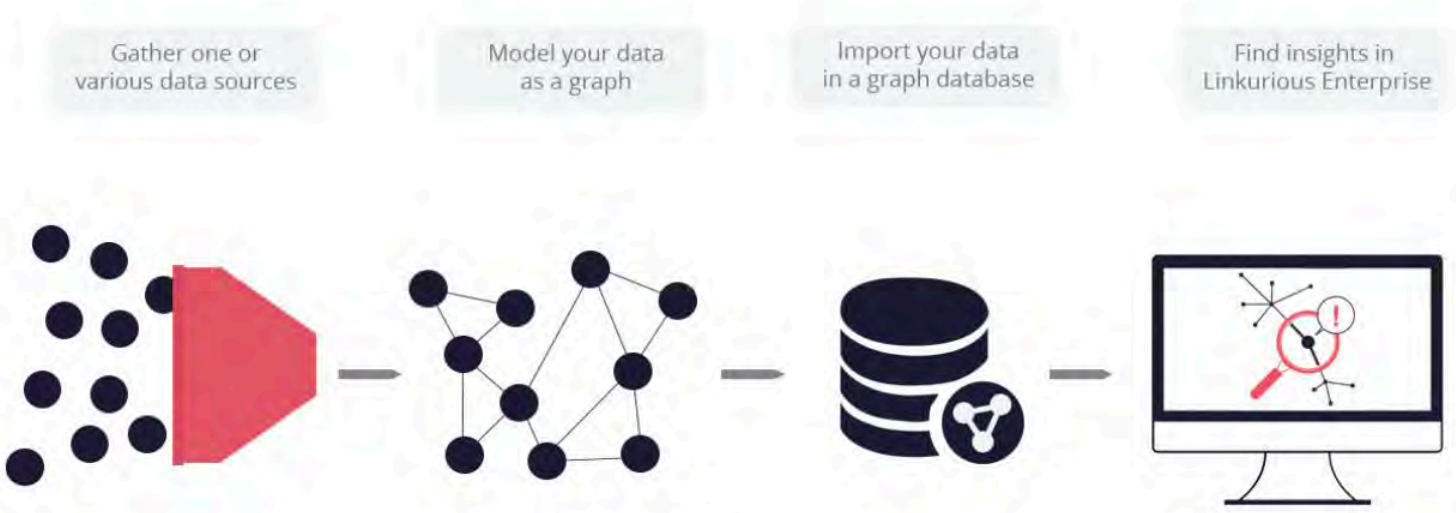
- Using a graph approach makes sense when your data and your questions involve connections.
- E.g. In a money laundering investigation for example, it is crucial to capture how money flows between individuals and companies.
- Similarly, some questions are particularly well suited for graphs:
  - “how X and Y are connected”,
  - “what is X connected to”,
  - “what’s the role of X in the network”.
- The world biggest companies have been relying on graphs for years now with systems such as the Google’s “Knowledge Graph” or Linkedin’s “Enterprise Graph”.

When it’s relevant

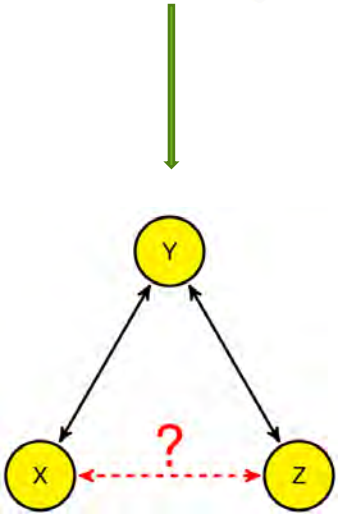
- Among the use cases in which the graph approach is the most popular are cybersecurity, anti-financial crime or intelligence analysis. In these domains, the organisations switching from tables to graph benefit from:
  - a unified view of their data instead of blindspots and silos;
  - the ability to run complex queries without hitting performance bottlenecks.

- A more complete data picture and the ability to detect complex patterns are invaluable assets to identify cases of fraud or other threats in large volumes of data.
  - For the banks, government agencies and other organisation turning to a graph approach, it leads to the discovery of new threats and faster investigations.

Workflow



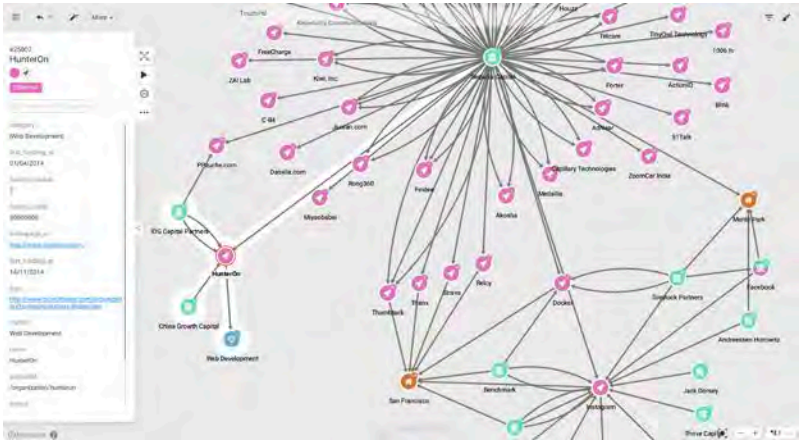
The graph journey



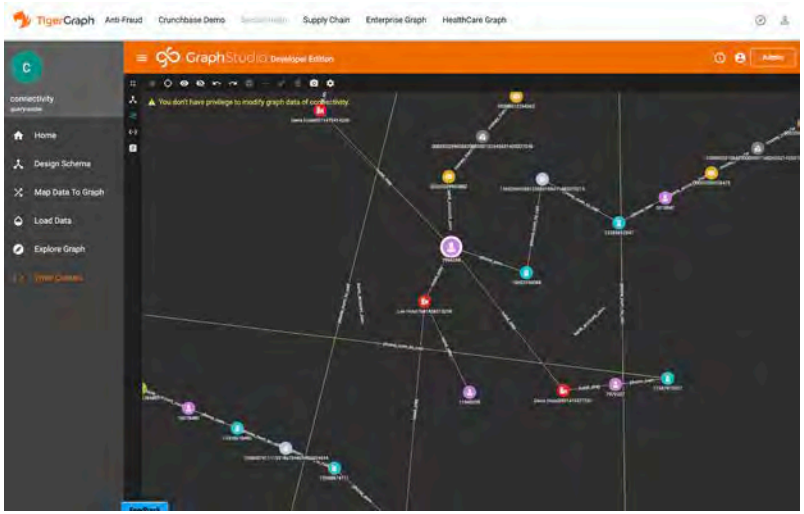
Make Prediction

Graph service provider

- lets you visualize and analyse graph data. It connects to a graph database and provides a real-time access to the data.
- Help you:
  - detect sophisticated threats: the unified graph view of your data reveals suspicious connections and patterns otherwise hidden in silos;
  - accelerate investigations: graph visualization removes the difficulty of tracking information scattered across tools and tables, letting you find hidden insights faster.



linkurio.us

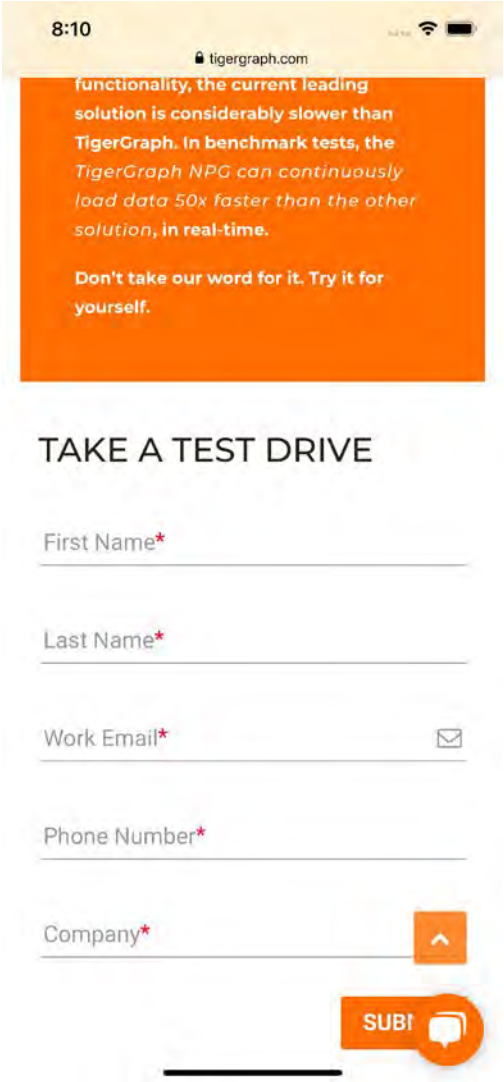


tigergraph.com

(1) Sign up for test drive

SCAN ME

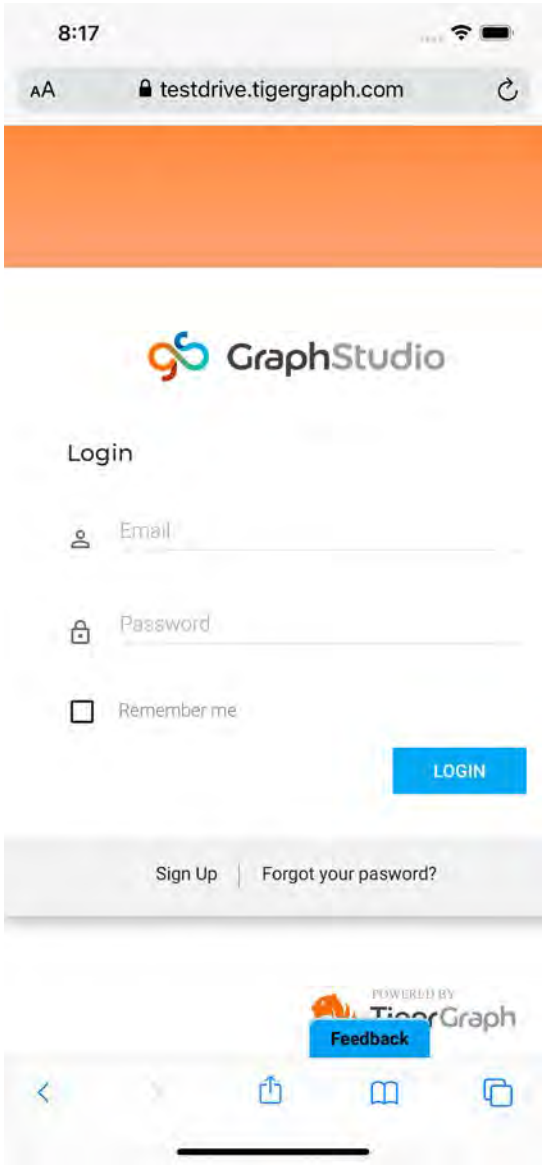
http://bit.ly/31sm8ad



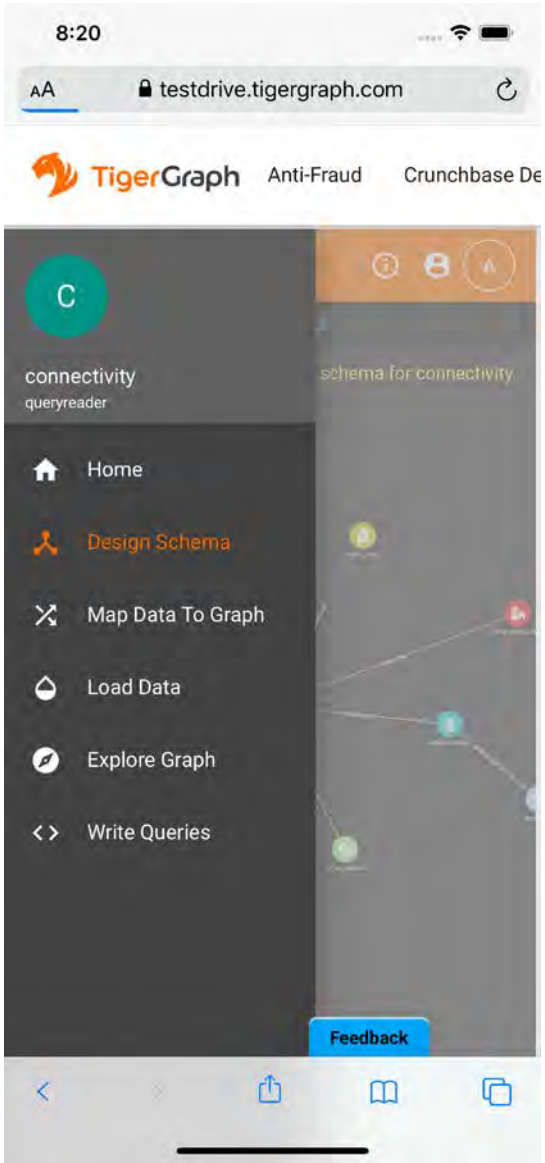
(2) Login to testdrive

SCAN ME

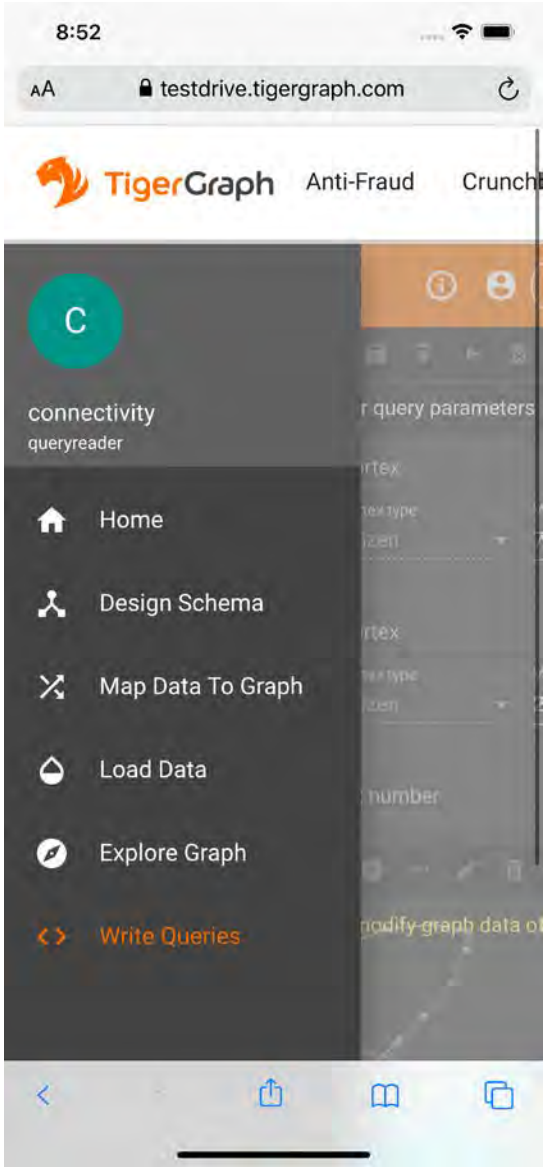
https://testdrive.tigergraph.com

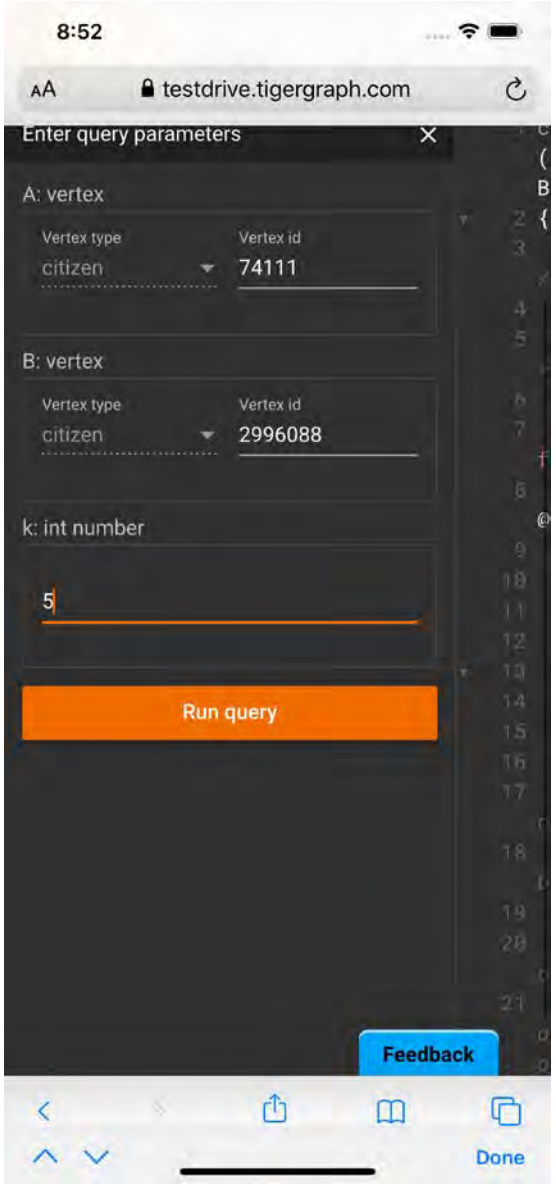


(2) Social graph demo



(2) Social graph demo





Investigations

Investigation 01

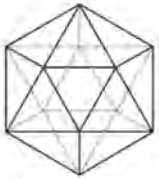
Find top 10 people that relates both Citizen 8497253 and 13546088.

Investigation 02

How are Citizen 9627525 & 9742157 connected?

Investigation 03

Who are the Citizens that link Citizen 8672114 &10144141?



STELLAR

GRAPH

StellarGraph is a Python library for machine learning on graph-structured (or equivalently, network-structured) data.

- implements several state-of-the-art algorithms for applying machine learning methods to discover patterns and answer questions using graph-structured data.

- The StellarGraph library can be used to solve tasks using graph-structured data, such as:
  - Representation learning for nodes and edges, to be used for visualisation and various downstream machine learning tasks;
  - Classification and attribute inference of nodes or edges;
  - Link prediction;
  - Interpretation of node classification through calculated importance of edges and neighbours for selected nodes

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

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

Readying 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.

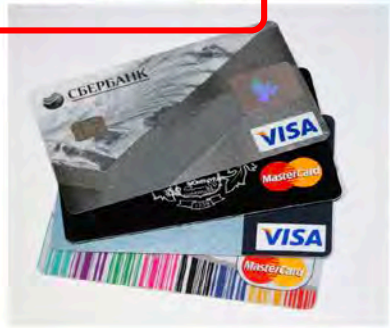
JP Morgan

https://www.youtube.com/watch?v=n94Uw5L_CZo

Fraud Detection

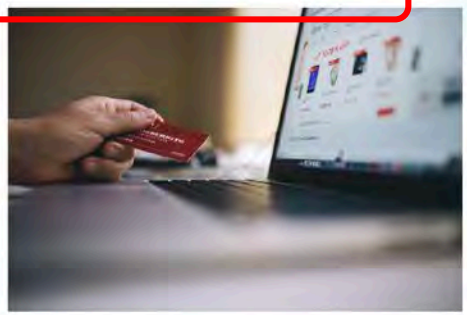
Traditionally **:** Fraud is on the rise, but fraud detection is a challenging problem to solve correctly.

- 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

Sift Science

https://www.youtube.com/watch?v=db0Ysjk4ZI0

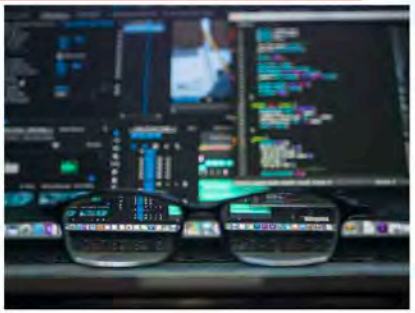
Risk Management

Traditionally : New regulations force tighter control on financial institutions.

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

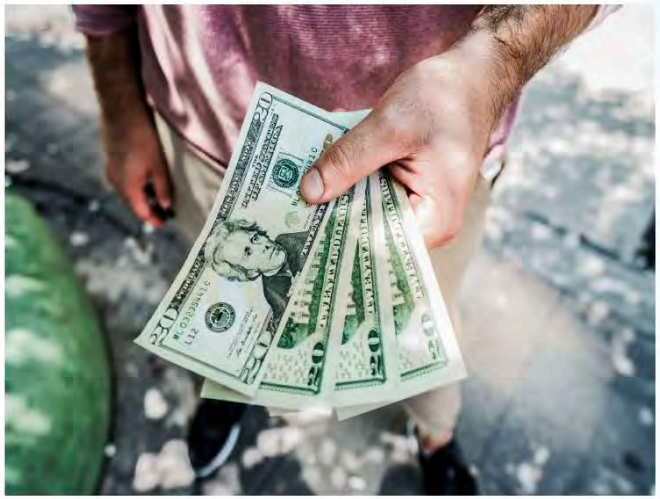
Now with AI : ML can help discern the credit worthiness of potential customers

- 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.



Zest Finance

https://www.youtube.com/watch?v=fMR10zPM0Sw

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 trends 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.

Cognizant

https://www.youtube.com/watch?v=6Kk1HTzSBvY

Travel

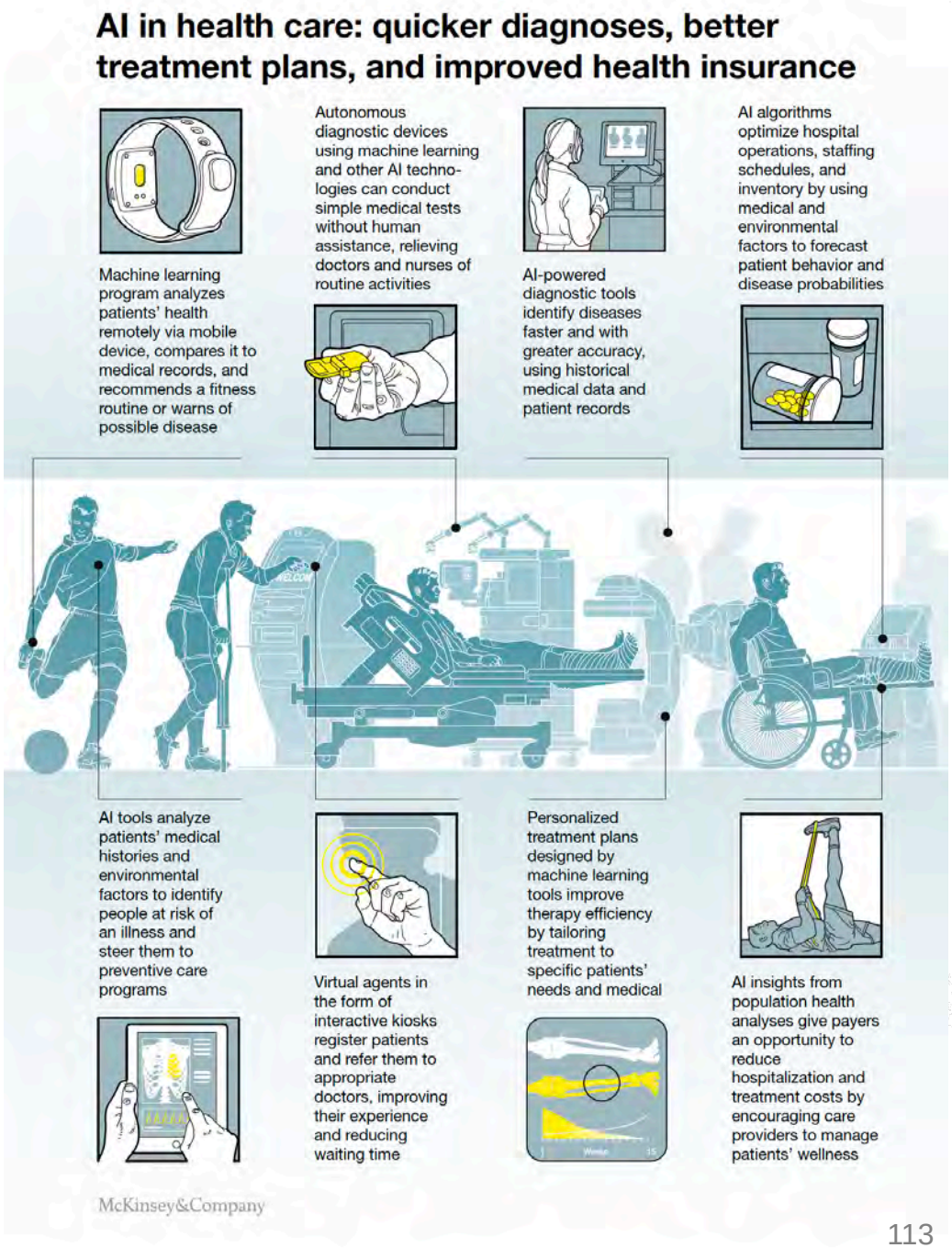
- Hotel Bookings by Voice Command
- AI Concierge Services
  - https://techcrunch.com/2018/06/19/amazon-launches-an-alexa-system-for-hotels/
- Travel Service Chatbots
- Check-in Through Facial Recognition
- Self-Driving Cars and Mobility as a Service
  - https://www.economist.com/international/2016/09/29/it-starts-with-a-single-app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



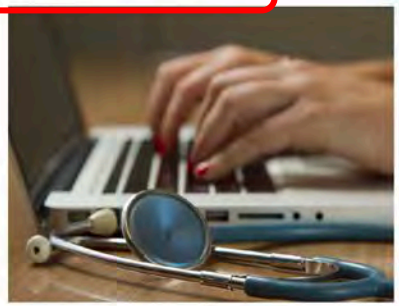
Healthcare – Medical Diagnosis

Traditionally : Medical Diagnosis was a challenging process.

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

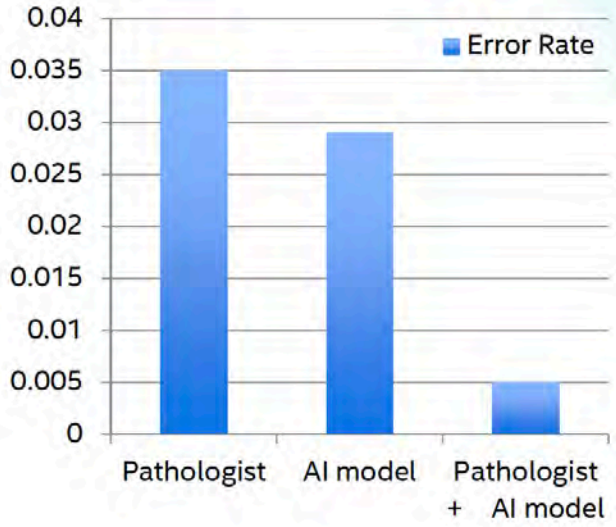
***Now* with AI :** Doctors can provide diagnoses more efficiently and accurately, with the availability of:

- 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.

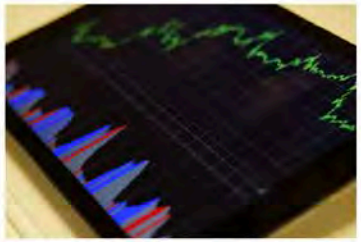
Healthcare – Drug Discovery

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



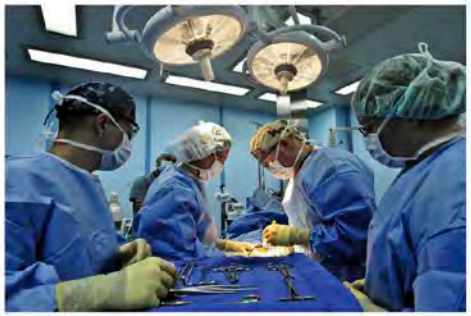
Example: HetioNet drug discovery model, 2016, UCSF, Himmelstein and Baranzini.

- 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.

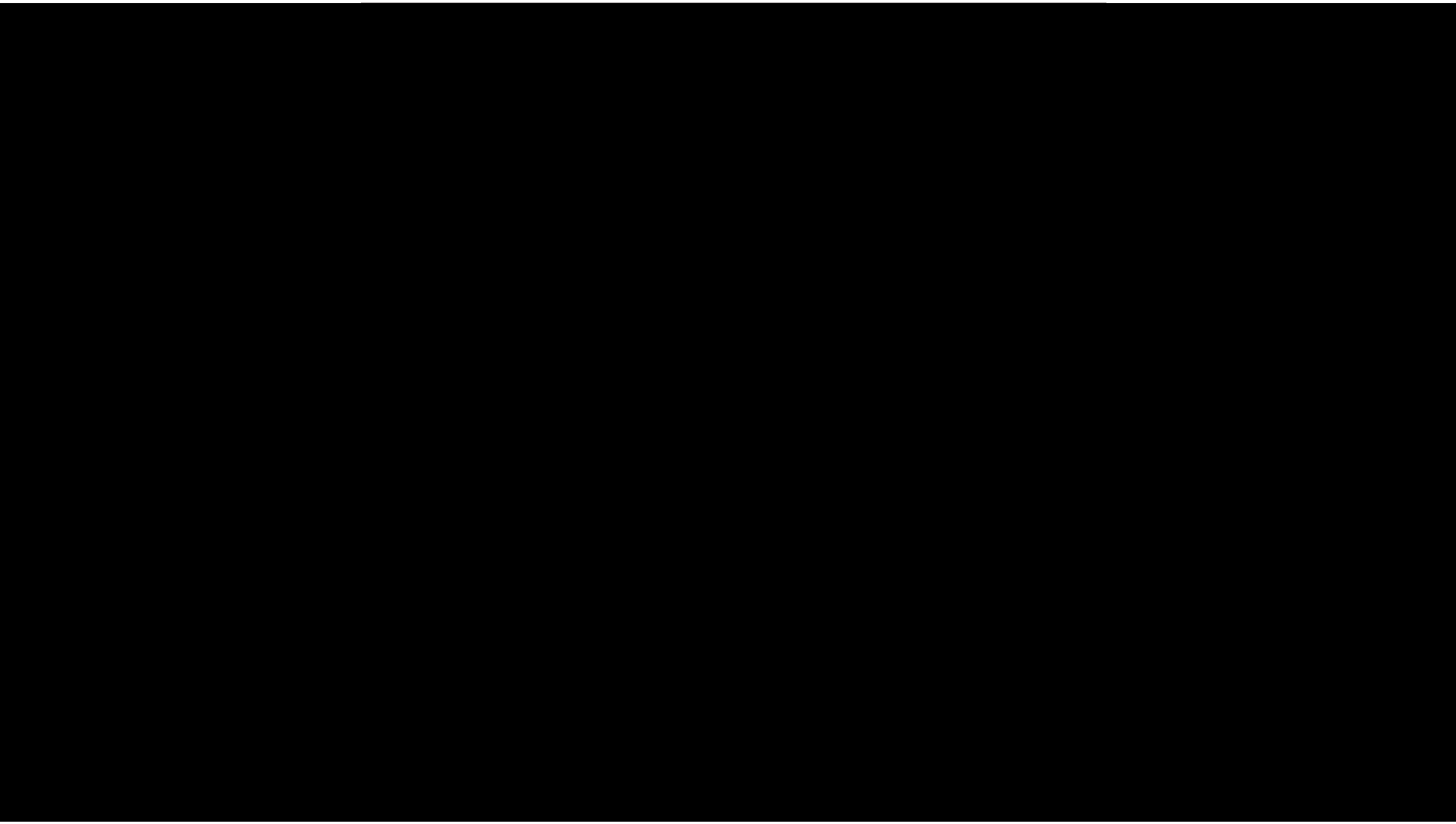
- Adverse anesthesia effects
- Operational complications



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.

Robot Surgery

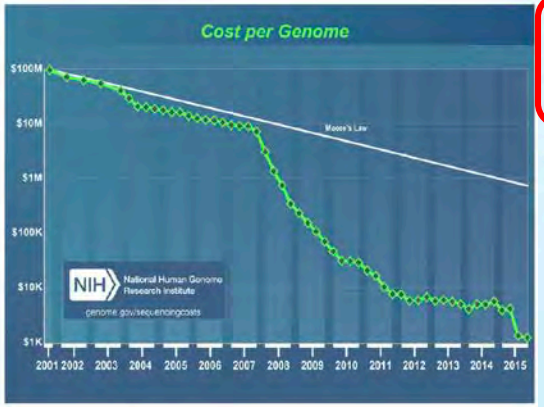


https://www.youtube.com/watch?v=H-sOLL9cz_g

Healthcare – Genome Sequencing

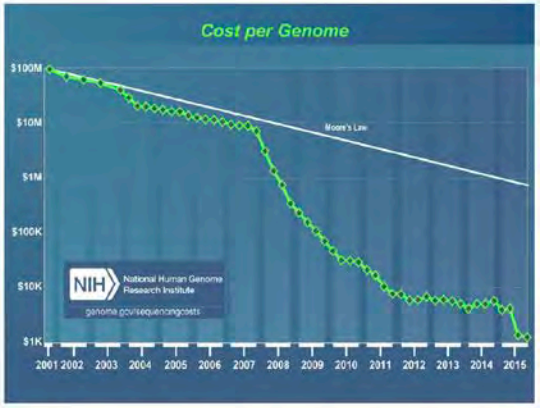
In 2001: Full human sequencing cost $100 million.

- 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

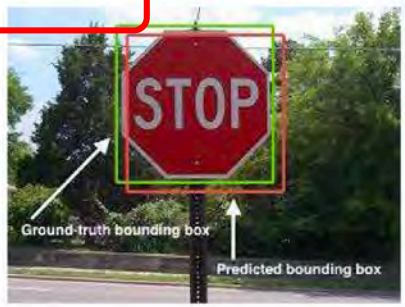
Autonomous Car

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.

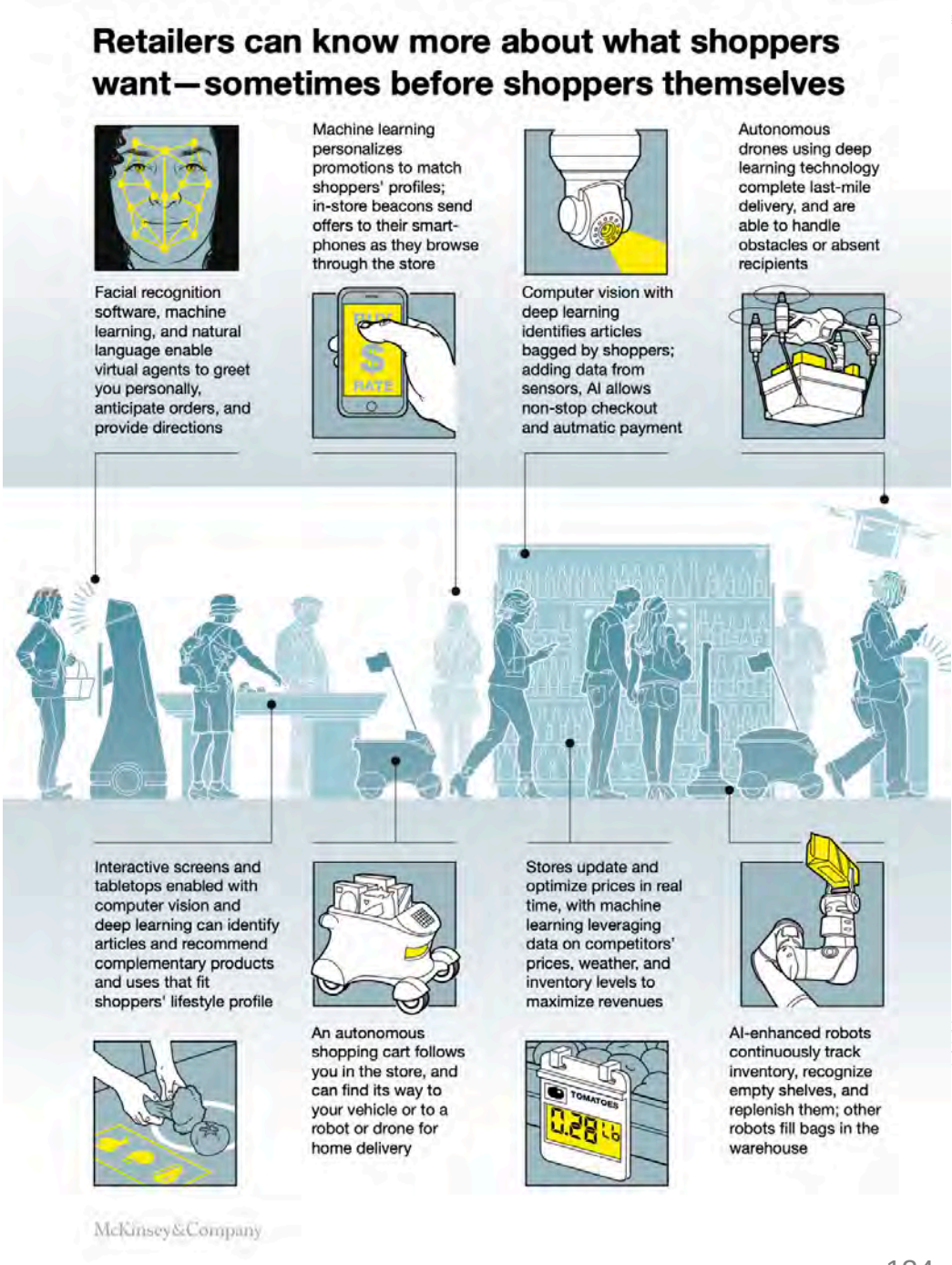
- Save on fuel, and reduce wind-drag and the chance of a collision
- Video, LIDAR, and accelerometers are used to collect detailed data about the truck's surroundings
- Guidance algorithms provide feedback for braking, steering, and throttling commands, based on incoming and historical data

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.



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

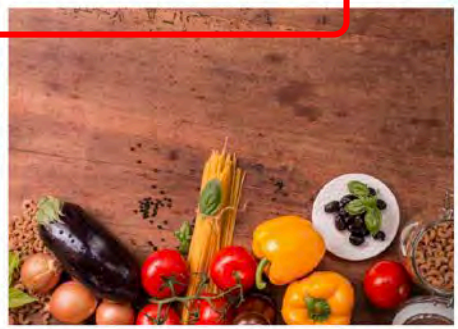
Food Supply Chain

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

- This can result in excessive waste or food unavailability

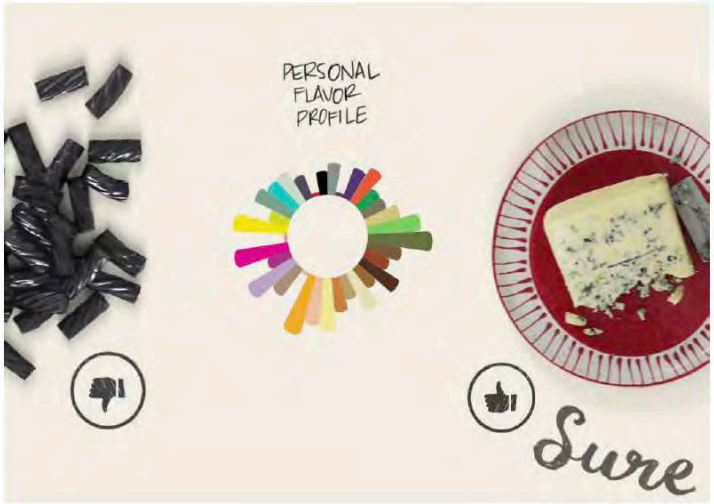
Now with AI : Many companies have started to leverage sophisticated algorithms to forecast demand.

- 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.

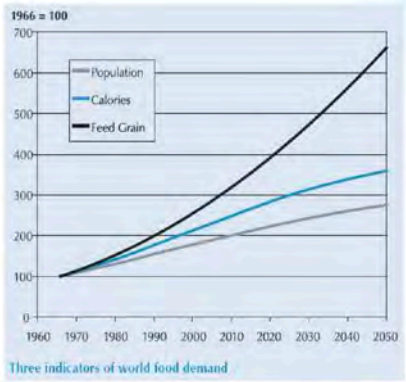
Agriculture Industry

- 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.

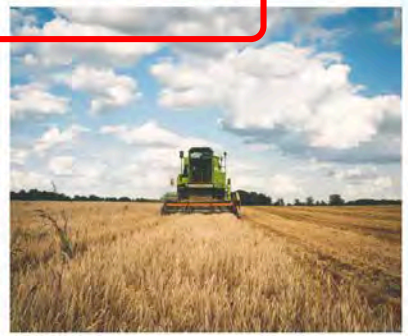


source: www.card.iastate.edu

Three indicators of world food demand

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

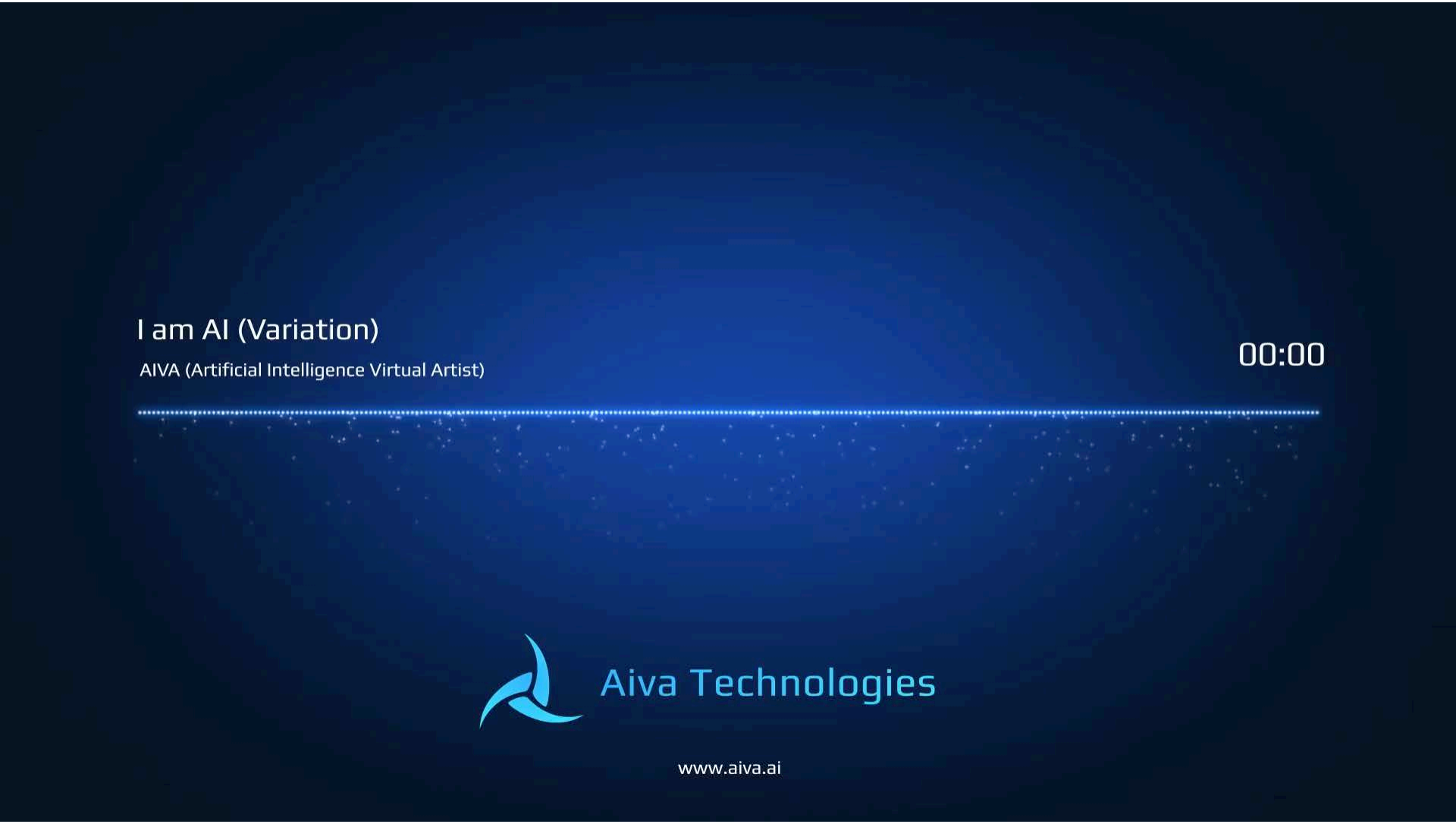
- DL-enabled robots are being used to identify and kill weeds.
- Companies have shown 90% herbicide reduction due to "targeted" spray application.
- AI-driven genome sequencing advancements enables crop "genome" editing.



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.

I AM AI



https://www.youtube.com/watch?v=gzGkC_o9hXI

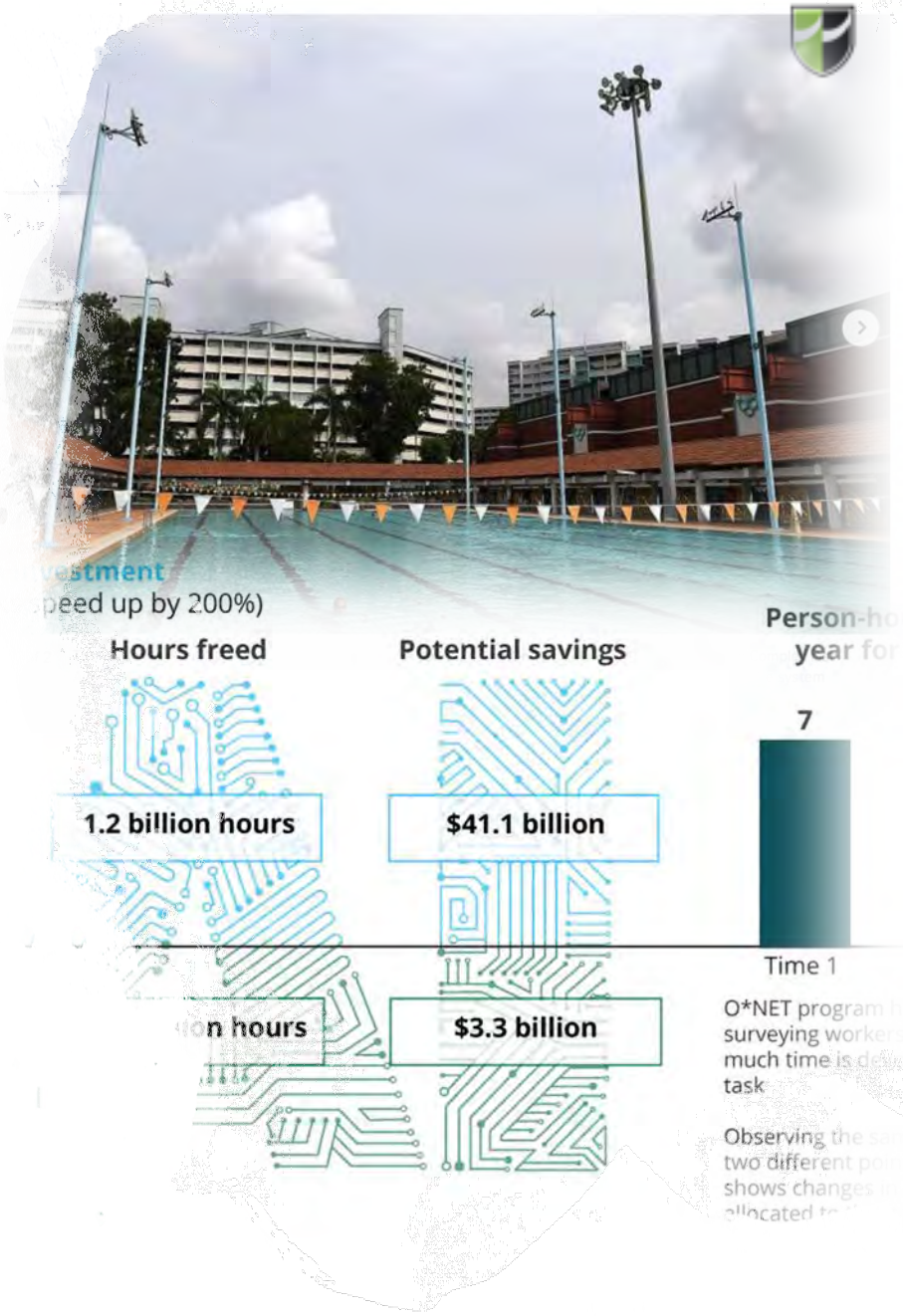
AI for Music Generation

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.

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

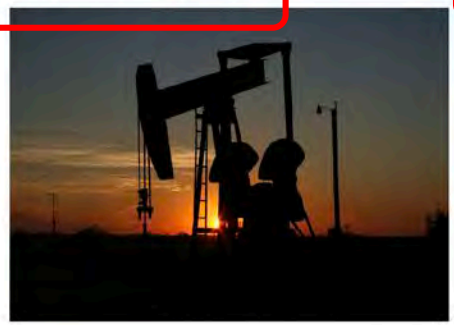
Example: Deep Instinct

- 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

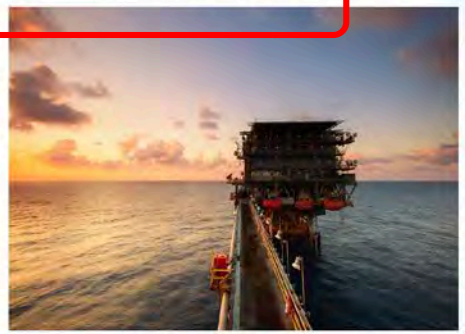
Traditionally : Shrinking oil reserves force companies to operate in remote and possibly hostile areas.

- 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.



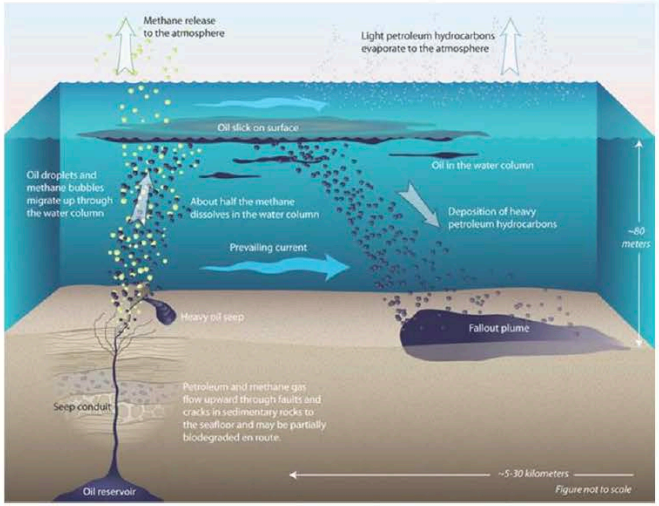
Now with AI : AI uses economic, political and weather data to forecast optimum production locations.

- 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.

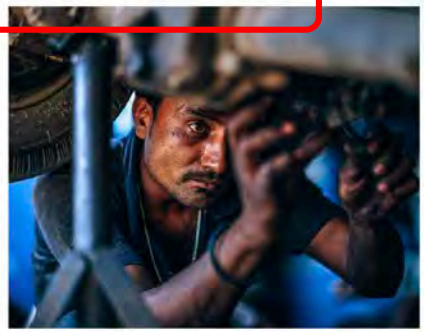
- AI robots are used in ocean exploration to detect "natural seep".
- Robots are trained via DL techniques and learn from their mistakes.
- Simultaneously protect the ecosystem and detect new energy resources.



Preventive Maintenance

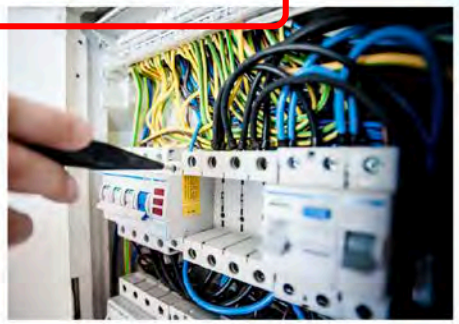
Traditionally **:** Relied on historical data to provide basis for preventative maintenance schedule.

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



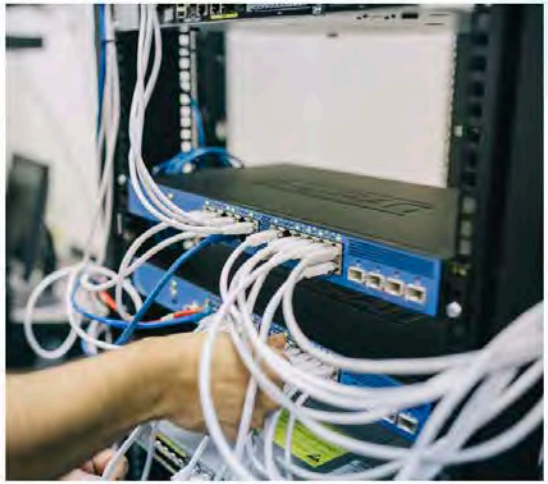
Now with AI **:** Internet of Things (IoT) sensors help to optimize maintenance scheduling.

- 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

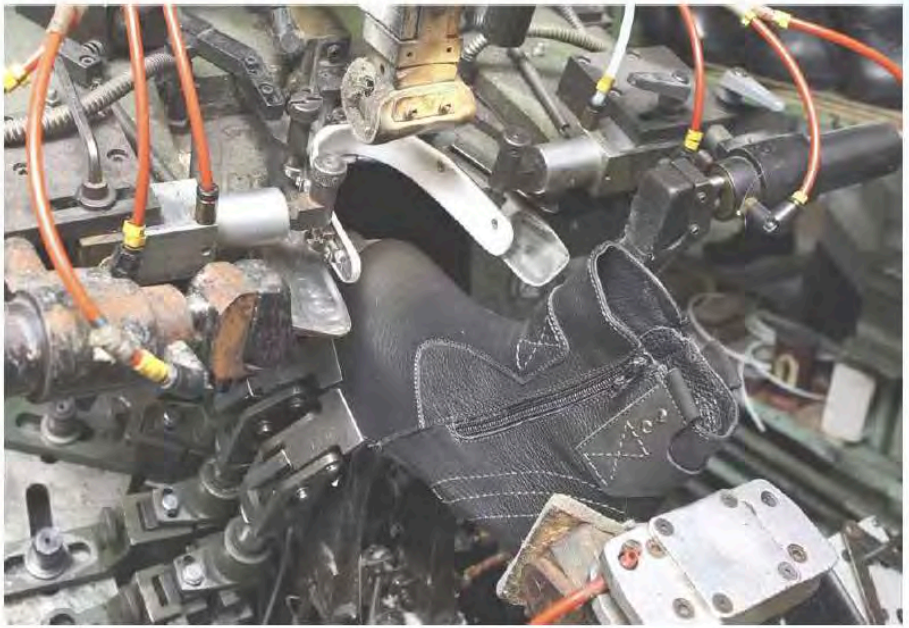
Example: Computer vision for fault detection on solar panels.

- 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

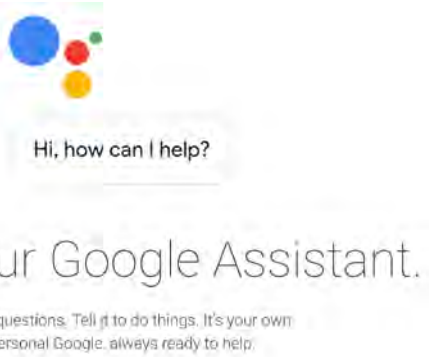
- AI Augmented messaging.
- AI for sorting and routing inquiries.
- AI enhanced customer phone calls.
- Some companies have used AI to fully automate customer service.

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.

AI Services



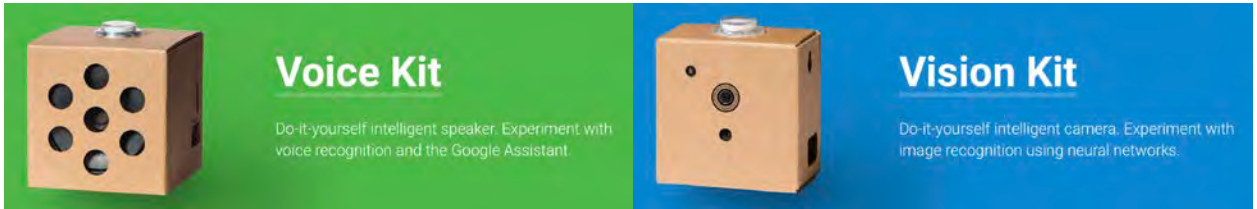
- Google Search
- Google Assistant (hands on)
- Google Photo (image recognition)
- Speech Recognition

- Google's AI Services for Companies
  - https://experiments.withgoogle.com/collection/ai

- Google's cloud-based AI Tools
  - https://ai.google

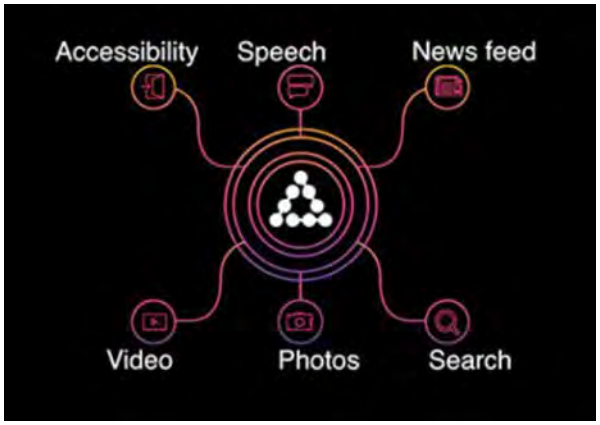
- Google's AI Experiments:
  - https://experiments.withgoogle.com/ai

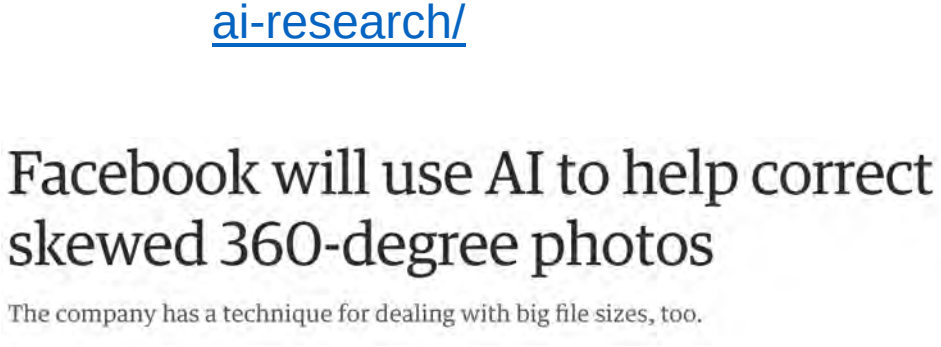
- Do-it-Yourself AI:
  - https://aiyprojects.withgoogle.com/voice/



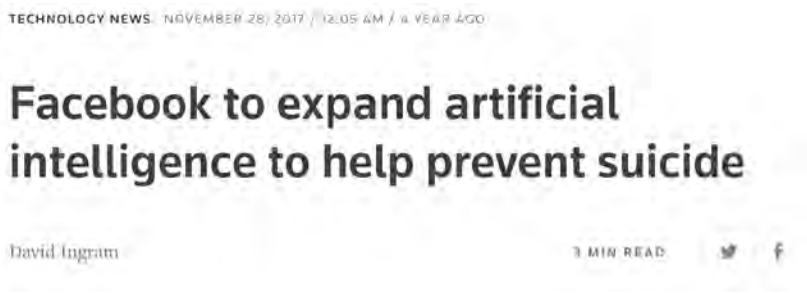
AI Services

- Facebook Photo search
- FBLearner 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

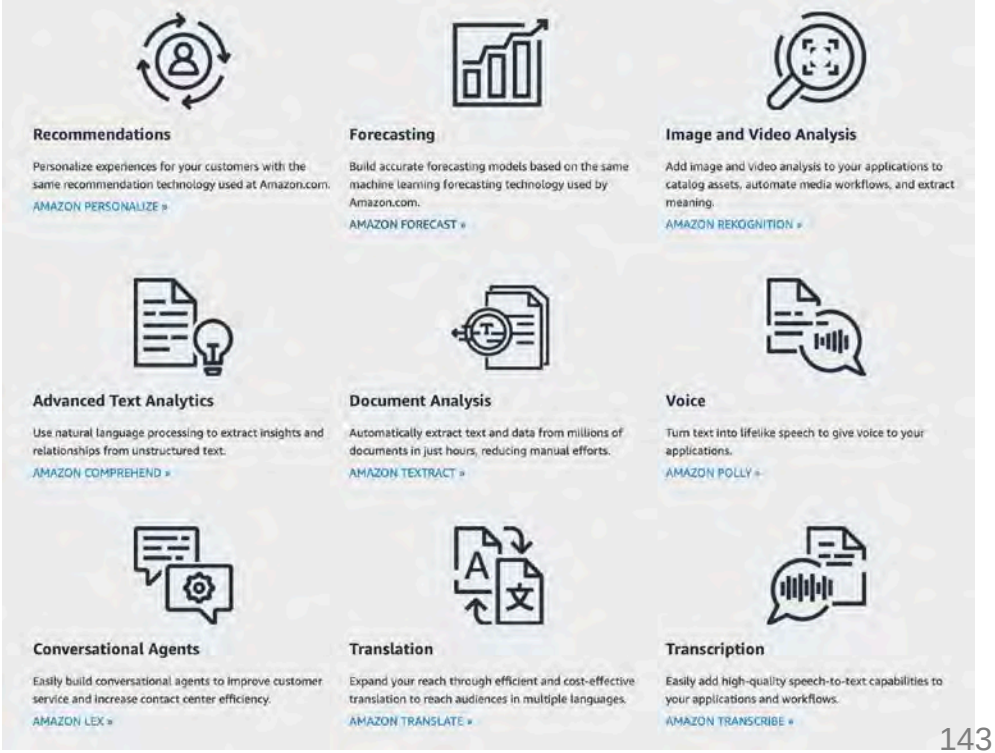
David Ingram

3 MIN READ

AI Services

- Amazon Recommended Products
- Alexa Personal Assistant
- Cloud Storage

- Amazon's AI platform:
  - Amazon Lex
  - Amazon Polly
  - Amazon Recognition

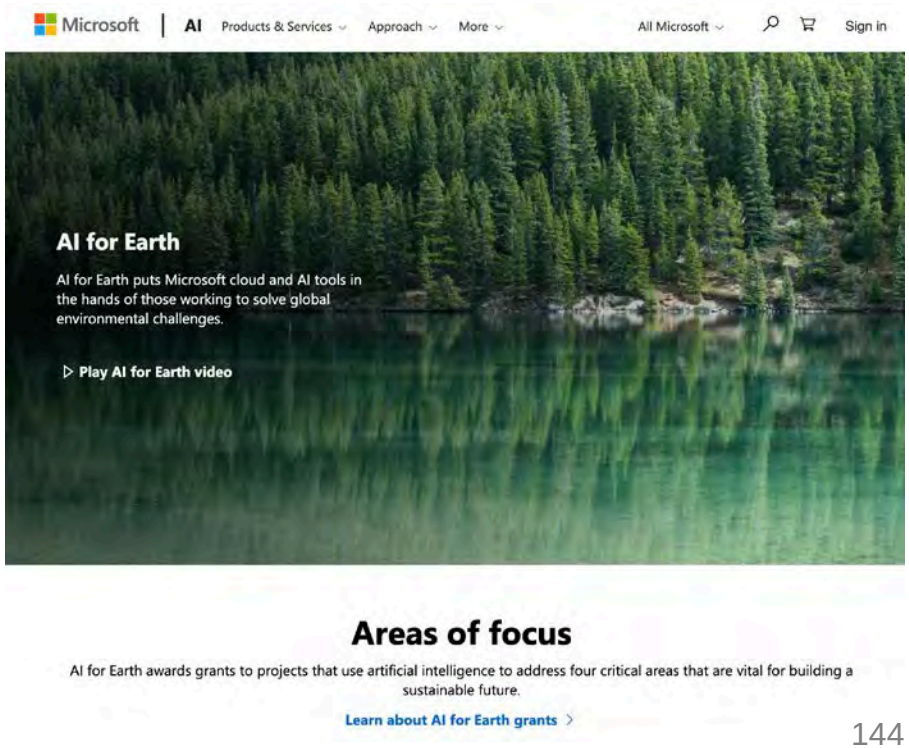


https://aws.amazon.com/machine-learning/

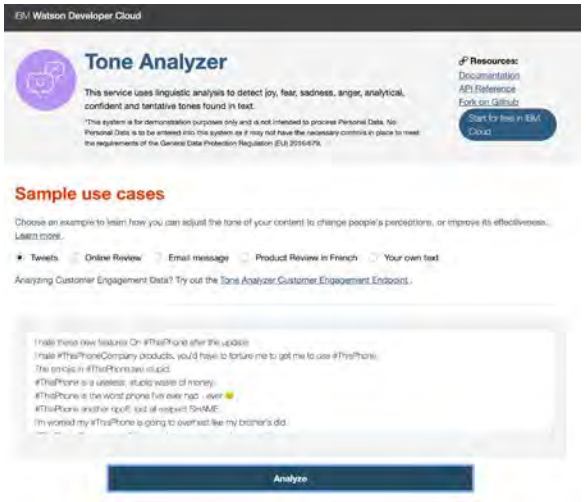
AI Services

- 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



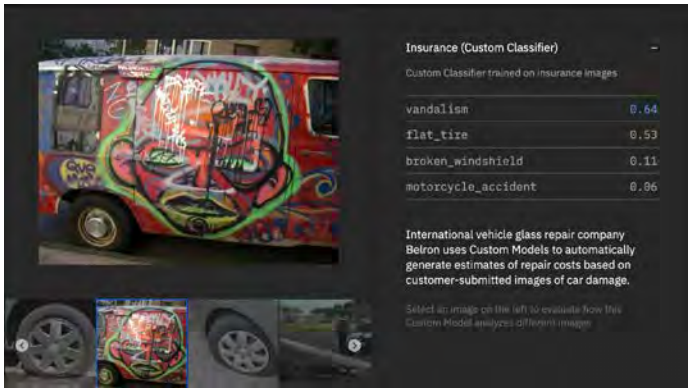
AI Services



- Cognos Analytice - https://www.ibm.com/sg-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)

AI Services

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

Apple acquires AI tech that seeks to understand your photos

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

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

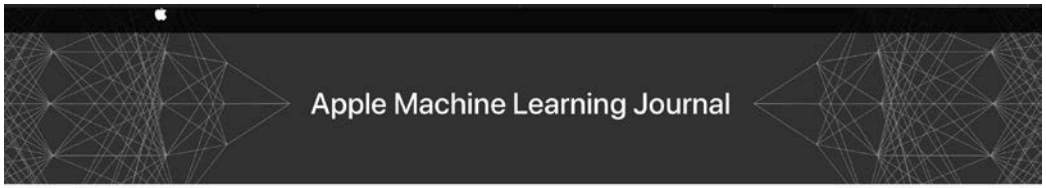
Kif Leswing, Business Insider US

October 18, 2017

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)

Alibaba Group

Innovation

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

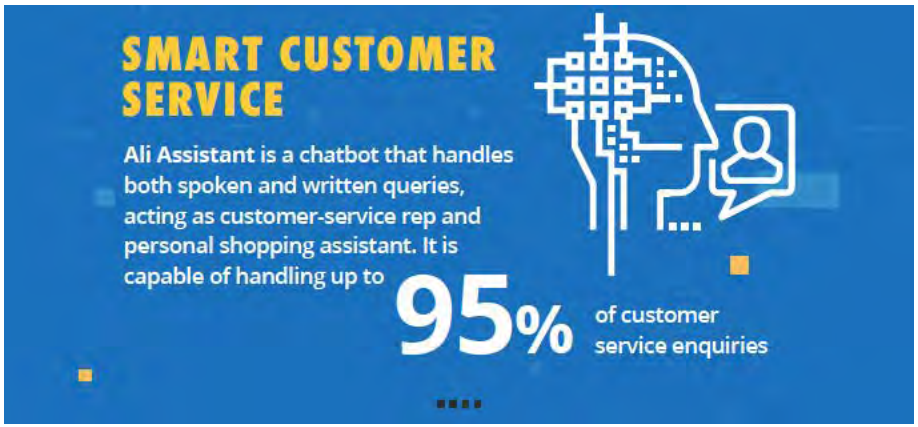
This year's November 11 shopping ritual will engage a recommendation algorithm, robots, and chatbots capable of understanding human emotion

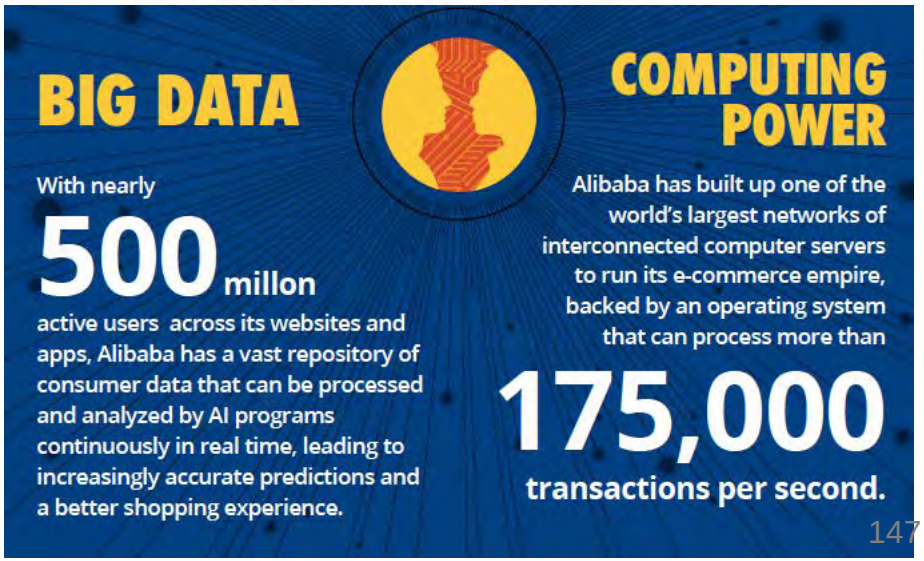
Topic | Singles' Day (11.11)

Intelligent Machines

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

AI will blur the line between online and offline retail.

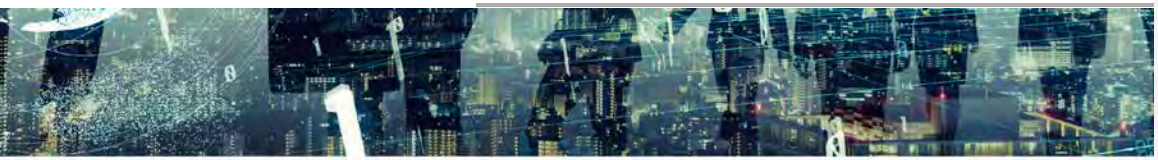




Function specific AI services

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://capio.ai/index.html
Hiring	https://hiringsolved.com/product
Programming	https://www.codota.com/enterprise https://kite.com/

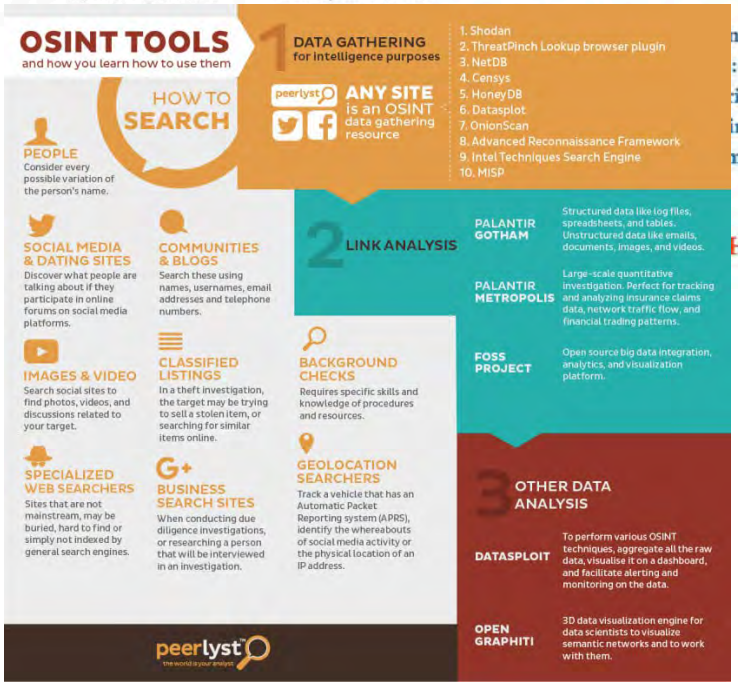
OSINT



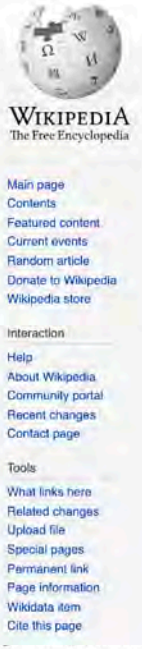
A Guide to Open Source Intelligence (OSINT)

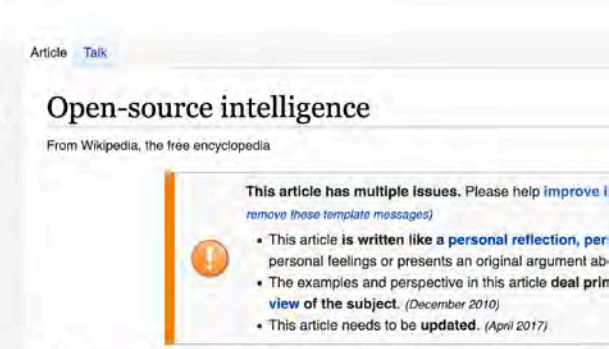
By Michael Edison

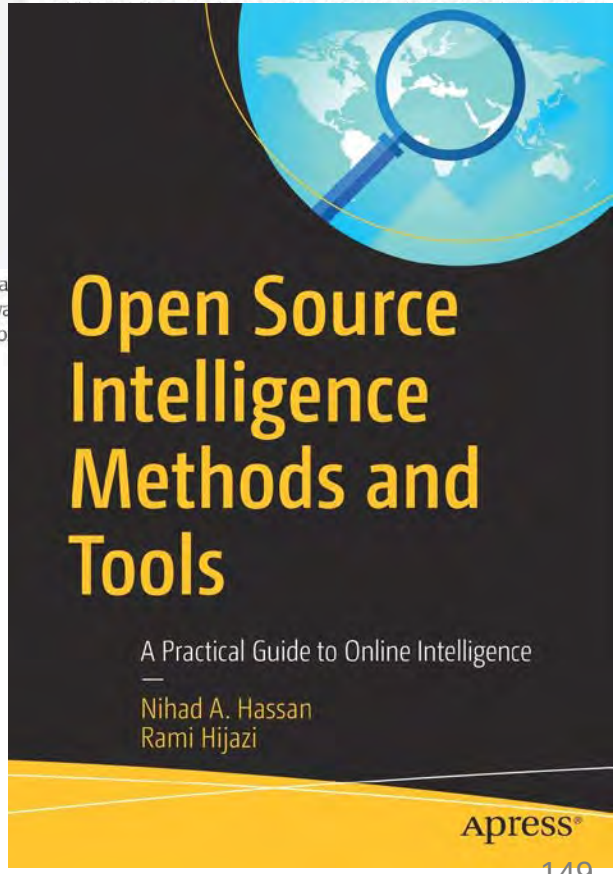
Photo/Adobe Stock



https://www.peerlyst.com/posts/resource-osint-tools-and-how-you-learn-how-to-use-them-guurhart





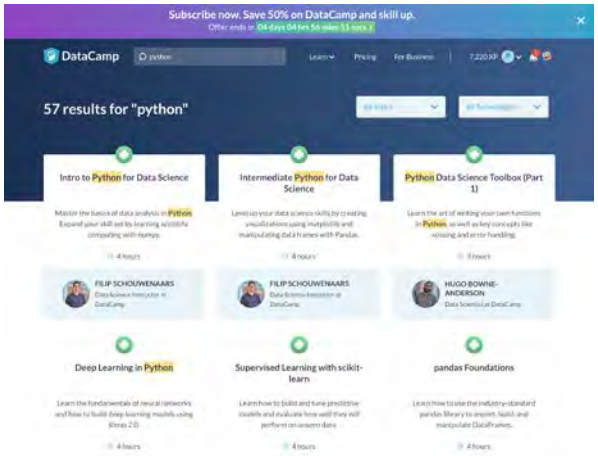


https://www.amazon.com/Open-Source-Intelligence-Methods-Tools/dp/1484232127

Where to go from here?

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

Edx
https://www.edx.org/



Lifelong Learning

Scan me

- https://www.rp.edu.sg/soi/lifelong-learning

Short Courses

SOI offers an extensive variety of short, industry-relevant courses for ICT skills upgrading and skills acquisition. Our courses are categorized under different areas, ranging from Artificial Intelligence (AI), Business Intelligence/ Business Analytics (BI/BA), Business Processes (BP), Unmanned Aerial Vehicle (UAV), IT Security, New/ Digital Media, Software Development to the Internet of Things (IoT). To view our short course offerings, click on the relevant tab below.

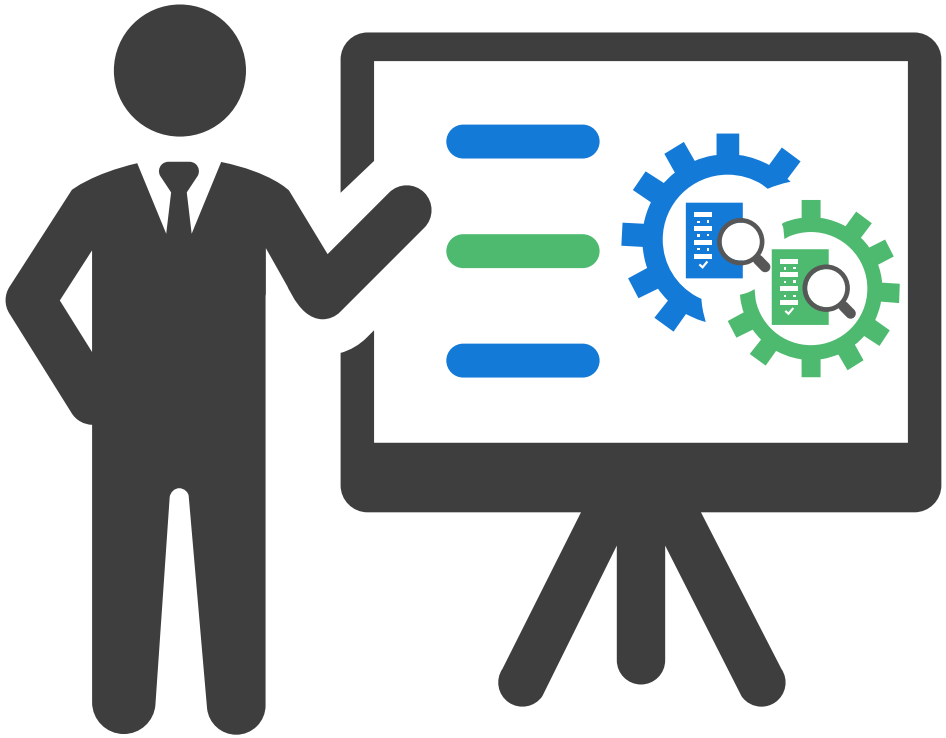
AI | Data Analytics | IT Security | DevOps | Software Development | New/ Digital Media | UAV | RPA

+ Artificial Intelligence for Everyone - A Practical Experience (1 day Beginner)

+ Artificial Intelligence for Techies - A Hands-On Approach (1 day Beginner)

+ An Introduction to Code-Free Machine Learning (1 day Beginner)

Summary



Email
seow_khee_wei@rp.edu.sg

Telegram
@kwseow

Source code:

Thank you