



The ABCs and Applications of Artificial Intelligence, Machine Learning, and Data Science

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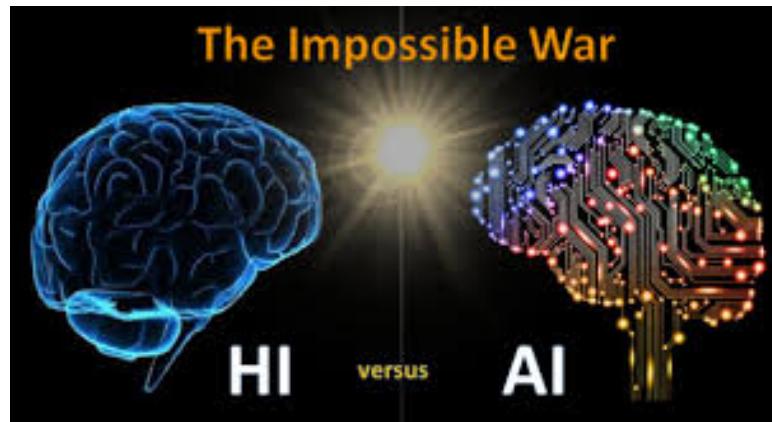
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<http://dampa.cdm.depaul.edu/>



Artificial Intelligence (AI)



What is Artificial Intelligence (AI)?

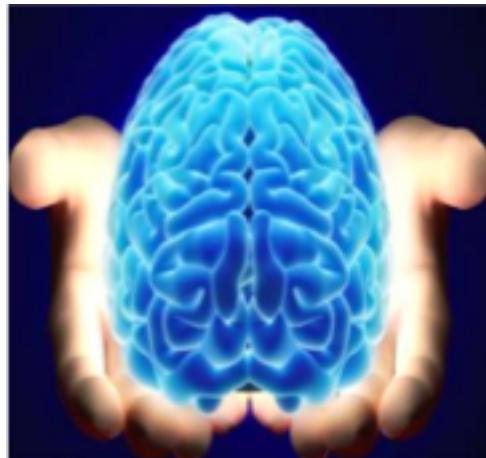
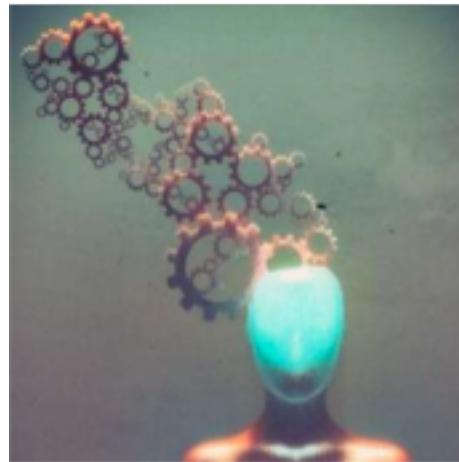
Artificial

+

Intelligence

=

Artificial Intelligence



- ❖ **Intelligence:** The capacity to learn and solve problems
- ❖ **Artificial Intelligence:** Artificial intelligence (AI) is the simulation of human intelligence by machines
 - The ability to solve problems
 - The ability to act rationally
 - The ability to act like humans

Latest AI Products across Industries



InnerEye:
AI to help
treat cancer



Artificial intelligence to help treat cancer

Dr R. Jena, Neuro-oncologist at University of Cambridge Cancer Centre, UK
Dr A. Criminisi, Principal Researcher at Microsoft Cambridge, UK



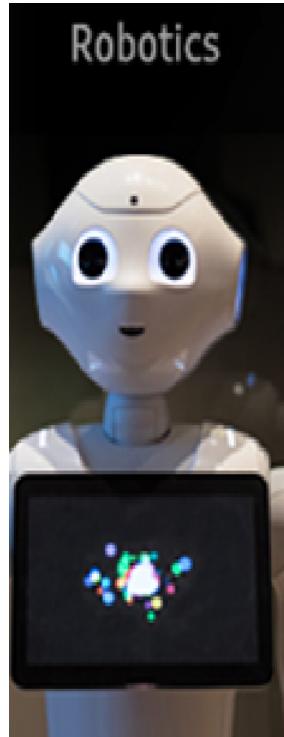
Latest AI Products across Industries

Self-Driving:

How Does
Google's
Driverless
Car Work?



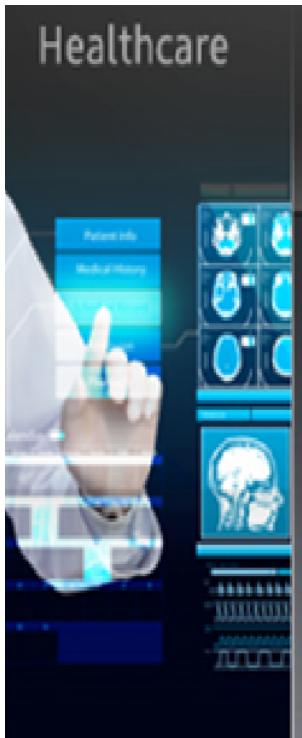
Latest AI Products across Industries



**Meet Pepper,
Humanoid
Robot**
**How human a
robot can be?**



Latest AI Products across Industries



InnerEye:
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Self-Driving:
How Does
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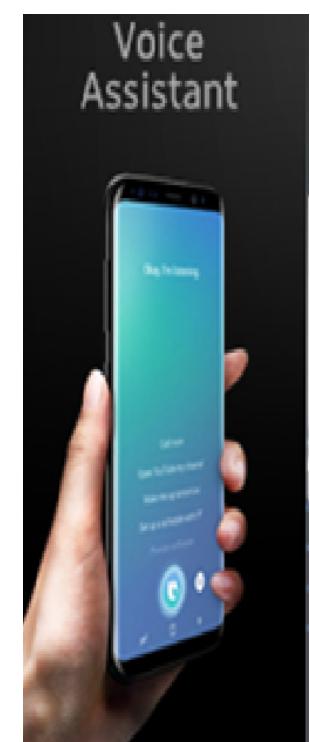


Meet Pepper,
Humanoid
Robot
How human a
robot can be?

Context-personalized openness:
How to connect the users and
their phones across text, voice,
image, video, and sensors



**Consumer
Electronics**



**Voice
Assistant**

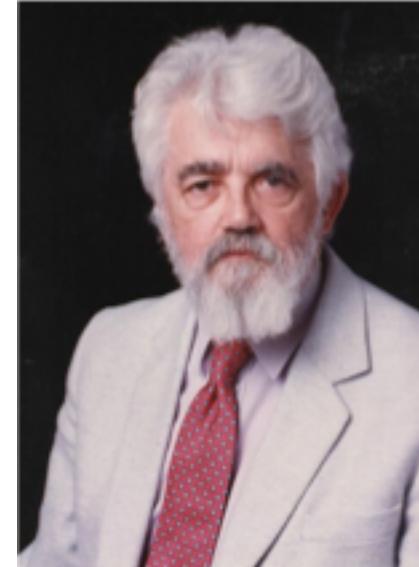
The Early History of AI



1950

Alan Turing wrote a landmark paper titled “Computing Machinery and Intelligence” that asked the question:

“Can machines think?”



1956

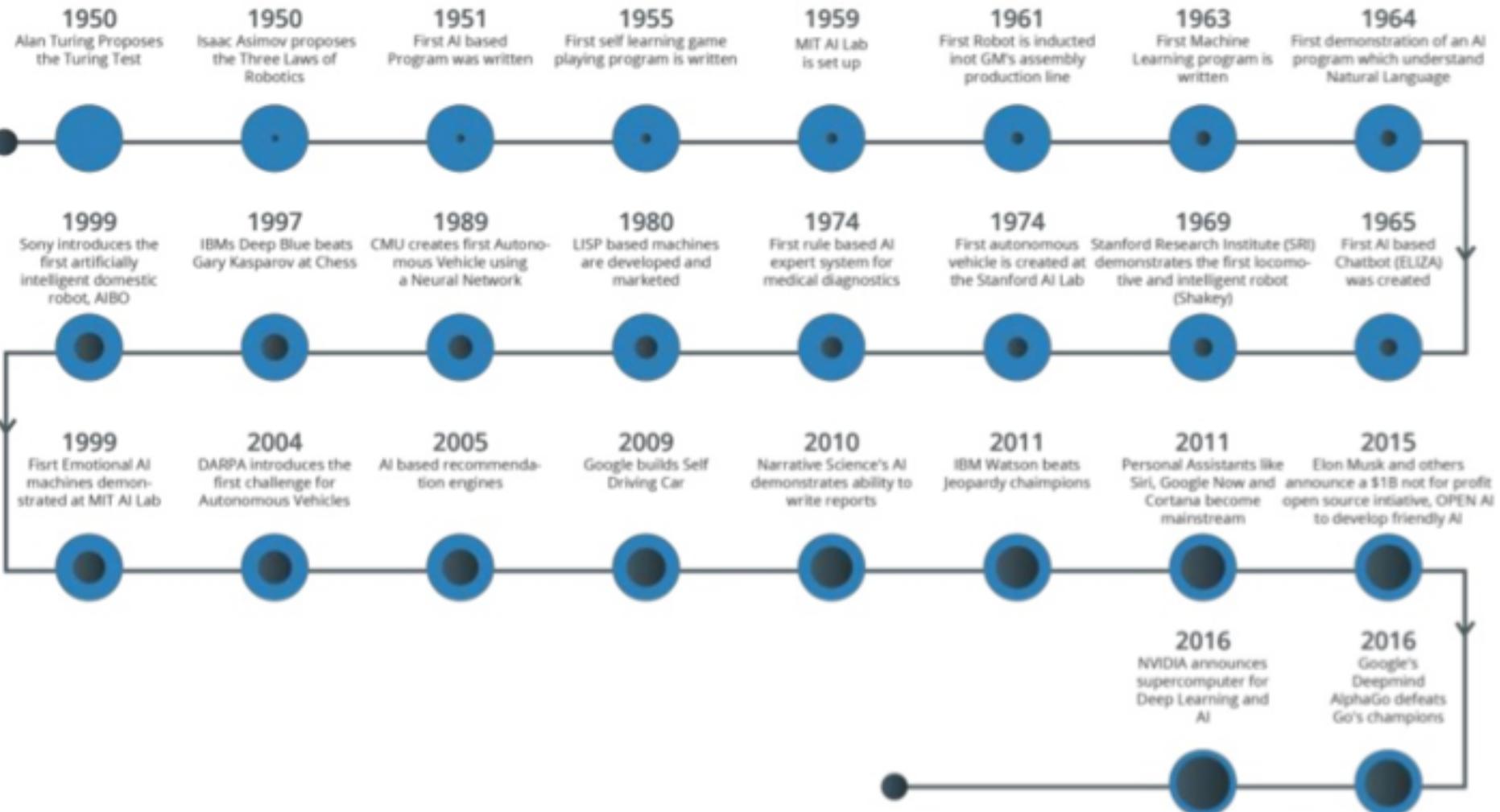
John McCarthy at a workshop at Dartmouth coined the phrase a

“Study of Artificial Intelligence”



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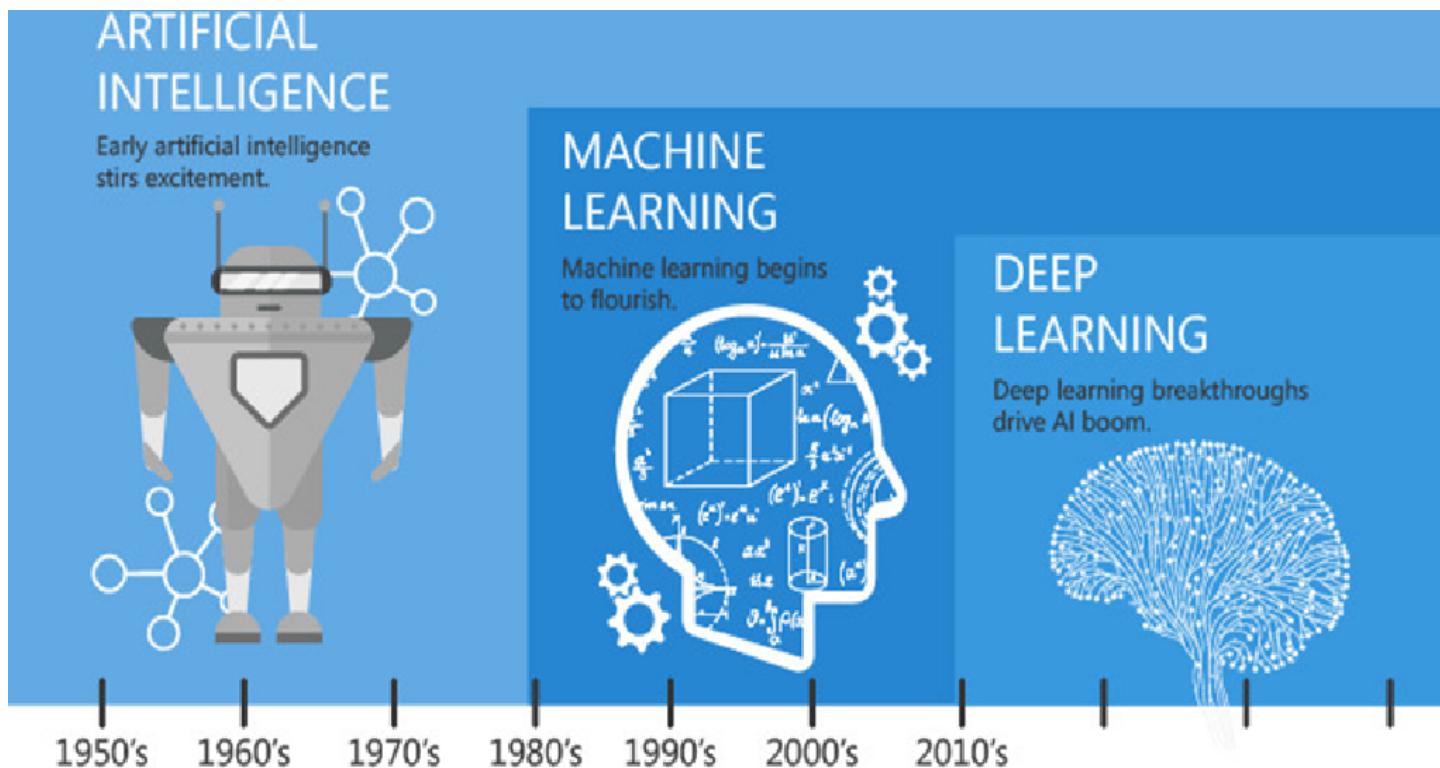
The Milestones of AI



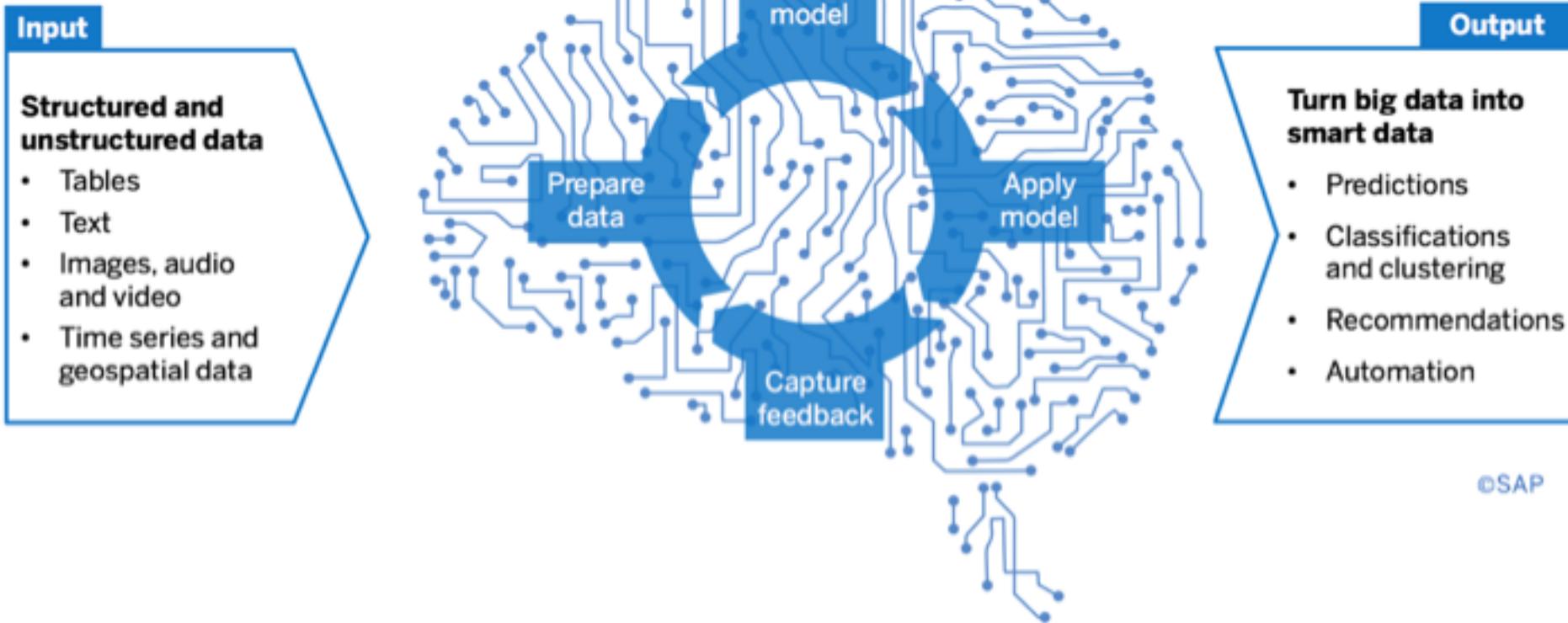
Machine Learning (ML)

“Machine Learning is the science of getting computers to learn and act like humans do, and improve their learning over time in autonomous fashion, by feeding them data and information in the form of observations and real-world interactions.”

TechEmerge 2017



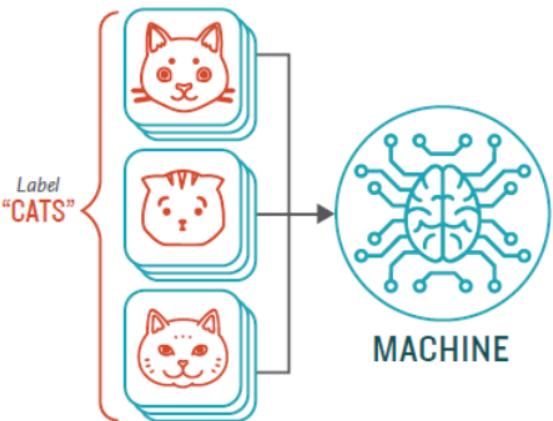
ML as a Process



ML: Supervised learning vs Unsupervised learning

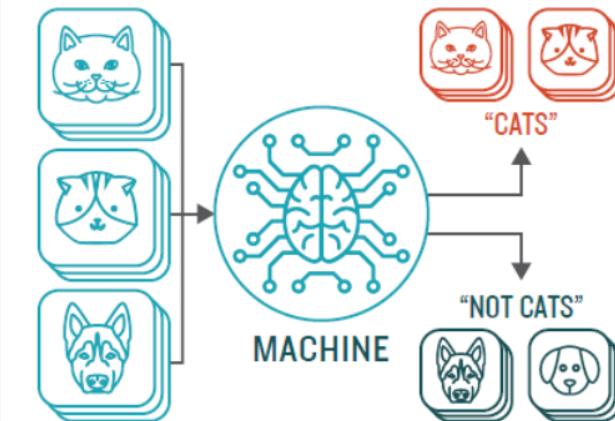
STEP 1

Provide the machine learning algorithm categorized or "labeled" input and output data from to learn



STEP 2

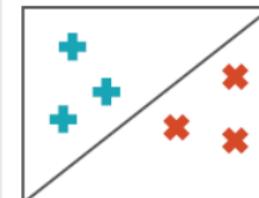
Feed the machine new, unlabeled information to see if it tags new data appropriately. If not, continue refining the algorithm



TYPES OF PROBLEMS TO WHICH IT'S SUITED

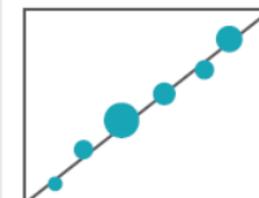
CLASSIFICATION

Sorting items into categories



REGRESSION

Identifying real values (dollars, weight, etc.)



Supervised Learning

Continuous Labels

Prediction

Algorithms includes:
Decision Tree/Regression/....

Discrete Labels

Classification

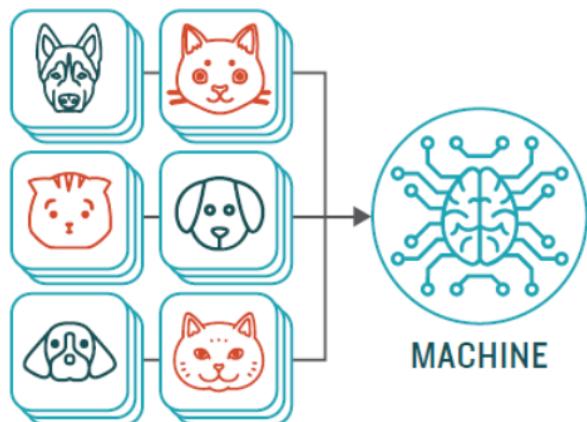
Algorithms includes:
Naïve Bayes/K nearest neighbor..



ML: Supervised learning vs Unsupervised learning

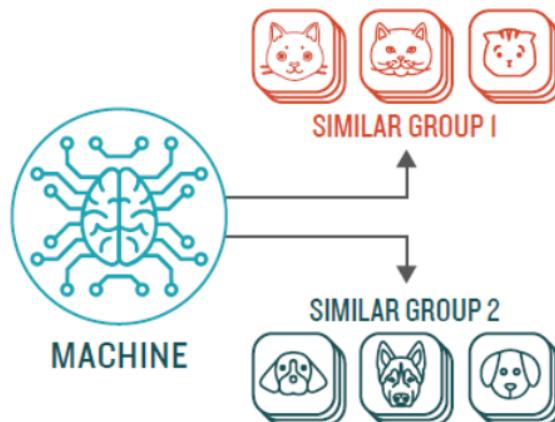
STEP 1

Provide the machine learning algorithm uncategorized, unlabeled input data to see what patterns it finds



STEP 2

Observe and learn from the patterns the machine identifies

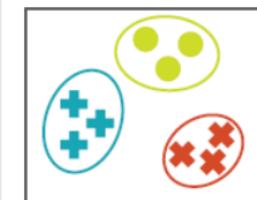


TYPES OF PROBLEMS TO WHICH IT'S SUITED

CLUSTERING

Identifying similarities in groups

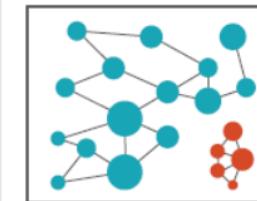
For Example: Are there patterns in the data to indicate certain patients will respond better to this treatment than others?



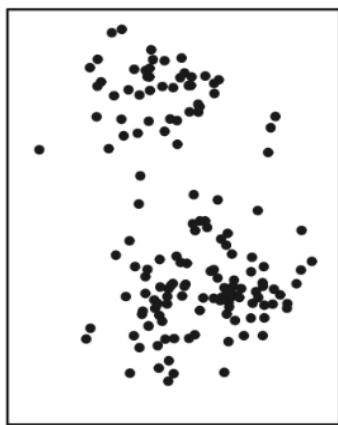
ANOMALY DETECTION

Identifying abnormalities in data

For Example: Is a hacker intruding in our network?

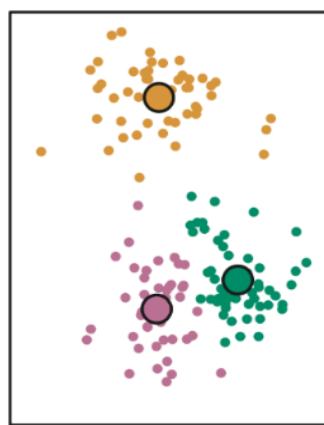


Data



K-means Clustering

Final Results

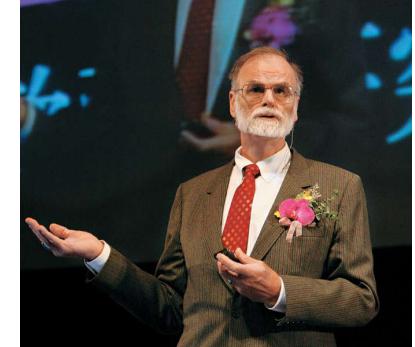


Learning from data structure
without using explicitly provided
labels, but using similarity.



Data Science (DS)

*Data science can be imaged as a "fourth paradigm" of science: empirical, theoretical, computational and now **data-driven**...*

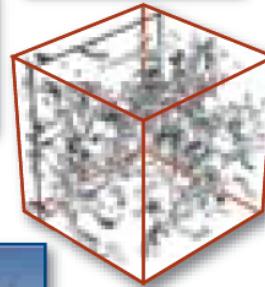


-- Jim Gray (*Turing Award Winner*)

Science Paradigms

- Thousand years ago:
science was **empirical**
describing natural phenomena
- Last few hundred years:
theoretical branch
using models, generalizations
- Last few decades:
a computational branch
simulating complex phenomena
- Today: **data exploration** (eScience)
unify theory, experiment, and simulation
 - Data captured by instruments or generated by simulator
 - Processed by software
 - Information/knowledge stored in computer
 - Scientist analyzes database/files using data management and statistics

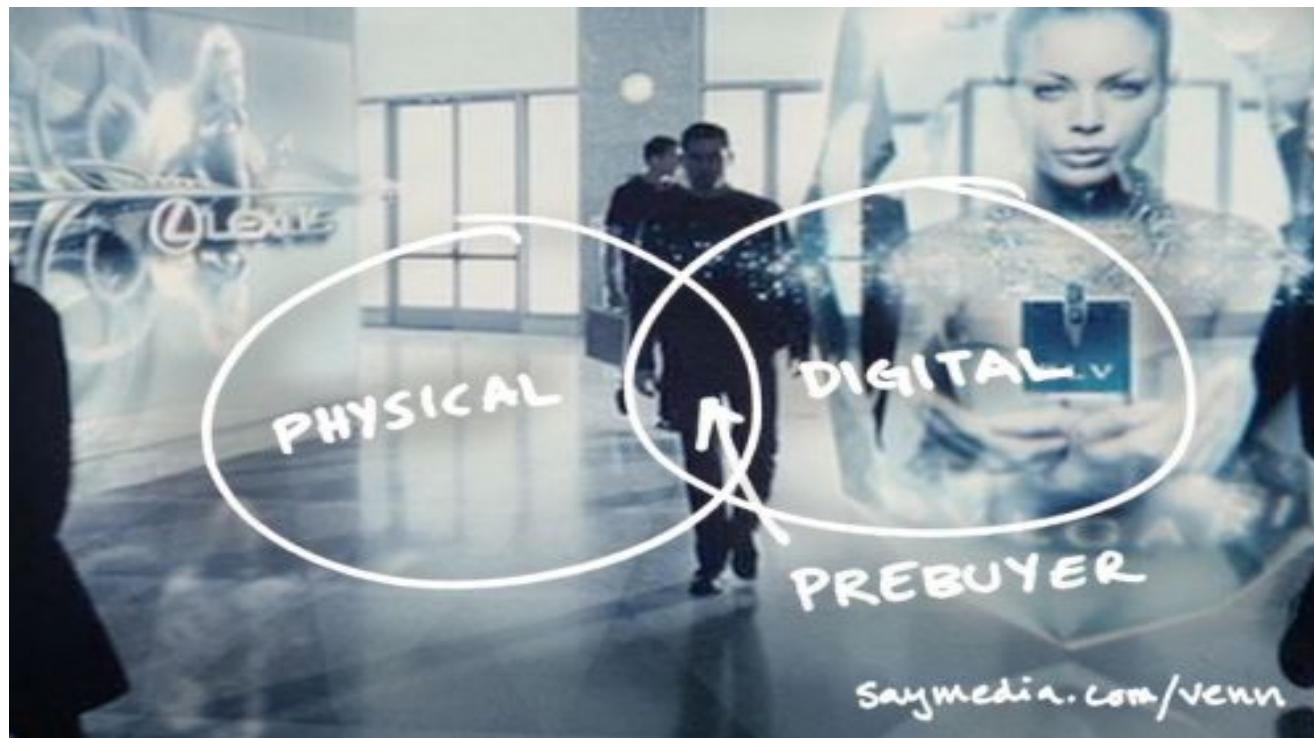
$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{4\pi G p}{3} - K \frac{c^2}{a^2}$$



DS Applications

Digital Advertisements!

- *Predict product needs and prices live as you walk into the store*
 - *Personal Advertising in movie “Minority Report”*



PERFECTION

PURSUIT



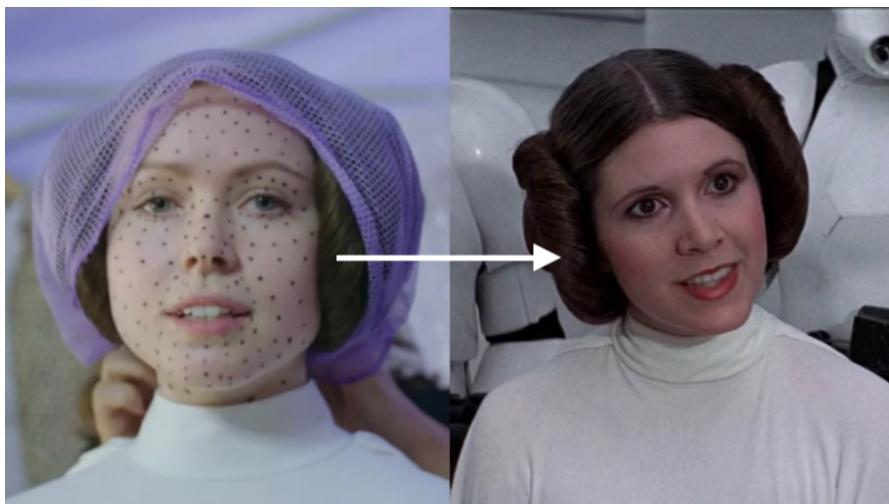
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DS Applications

The new breakthrough is that, using **deep learning techniques**, anybody with a powerful GPU, and training data, can create believable fake videos.

Image Recognition: Exploring DeepFakes!

- DeepFakes offers the ability to swap one face for another in an image or a video. Face swapping has been done in films for years, but it required skilled video editors and CGI experts to spend many hours to achieve decent results.

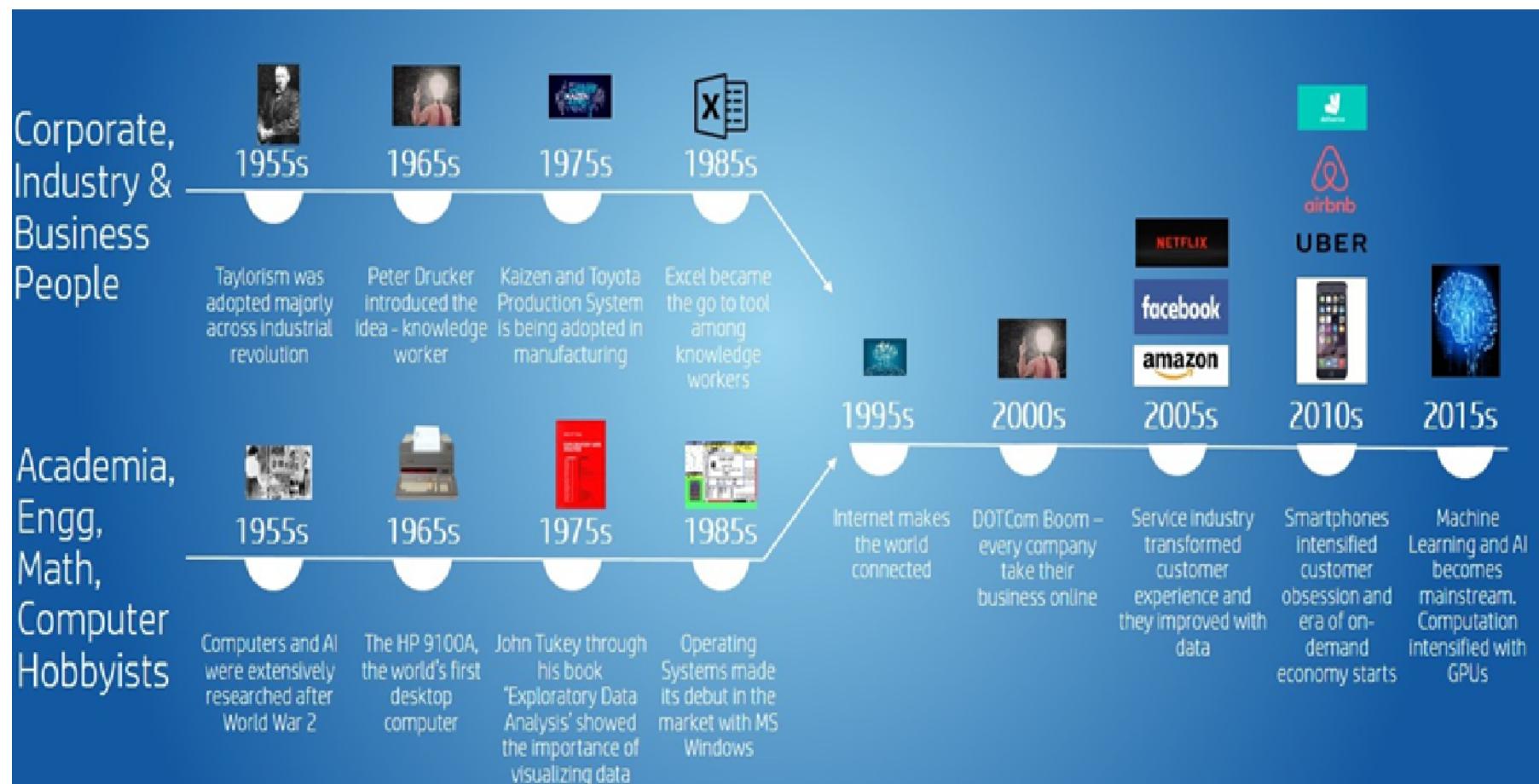


Star Wars Rogue One, an actress, along with some CGI magic was used to recreate a young Carrie Fisher.



Two popular late night TV hosts, Jimmy Fallon and John Oliver, have their faces swapped.

Summary



Interesting Readings

- J. Gray. *The Fourth Paradigm: Data-Intensive Scientific Discovery*
https://www.microsoft.com/en-us/research/wp-content/uploads/2009/10/Fourth_Paradigm.pdf
- Free machine learning and data science books to kick off your summer learning season



<https://www.kdnuggets.com/2018/05/10-more-free-must-read-books-for-machine-learning-and-data-science.html>