

Introduction to AI

Applied AI & Advanced
Machine Learning

Intelligent Apps



Intelligent Things

TREND 1

**AI IS THE
NEW
UI**
Experience
Above All

79%

**OF EXECS SAY
AI WILL
REVOLUTIONIZE
CUSTOMER
INTERACTIONS**

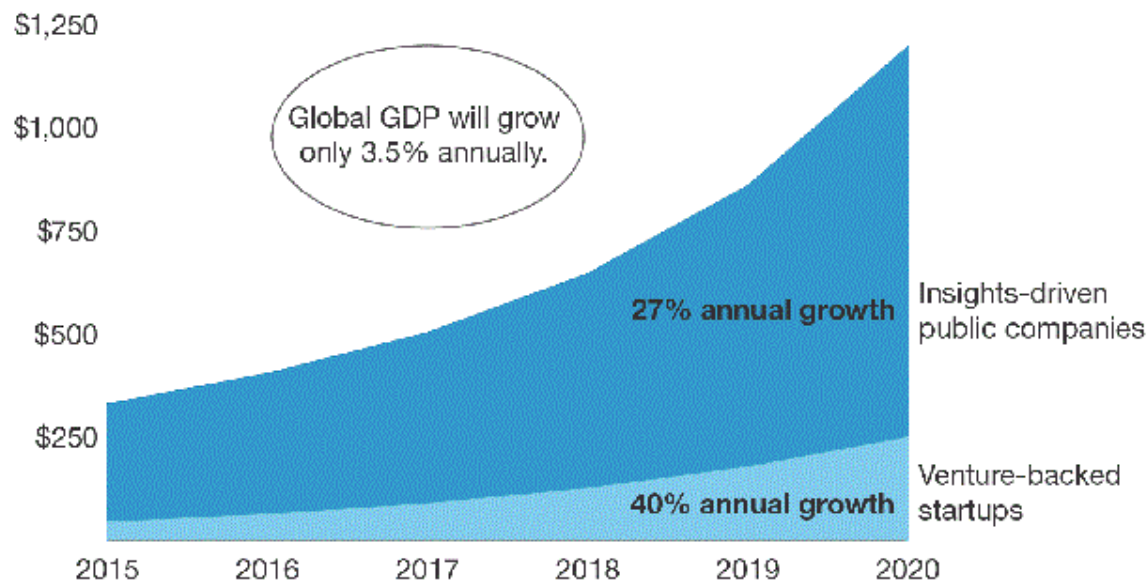
#TECHVISION2017

Insights-Driven Businesses Will Steal \$1.2 Trillion Annually By 2020

Predictions 2017: Artificial Intelligence Will Drive The Insights Revolution

Revenue forecast of insights-driven businesses

(\$ billions)



Note: The data point for public companies in 2015 is actual revenue; all other data points shown are estimates or projected figures.

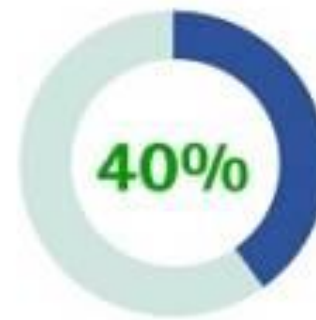
Source: Economic Intelligence Unit, Morningstar, and PitchBook Data

Flexible access to best-of-breed AI solutions: the benefits

The Accenture Artificial Intelligence Engine is already in use and delivering business value to companies worldwide (including Accenture). Examples include:



Helping to reduce incident ticket triaging backlog for a large retailer by 20 percent.



Helping to deliver up to 40 percent automation benefit through lease abstraction for Accenture Credit Services, a full-service provider of residential mortgage transformation services.



Accelerating pharmacovigilance—helping to reduce human effort in one life sciences client pilot by over 25 percent.



Conducting large-scale sentiment analysis and aspect categorization for Accenture's business to analyze employee survey data with unprecedented precision.

<https://www.accenture.com/us-en/insight-artificial-intelligence-intelligent-automation>
<https://www.accenture.com/us-en/insight-artificial-intelligence-software>

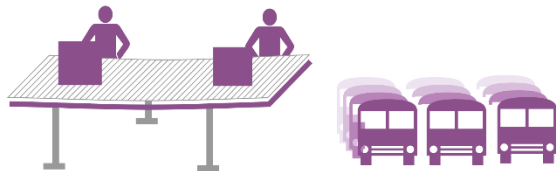


Industrial Revolution 1.0

Steam Power, Mechanisation,
Power Looms



...1760-1830...

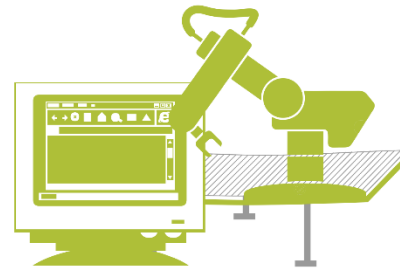


Industrial Revolution 2.0

Assembly Lines, Mass Production
Electricity



...1870-1914...



Industrial Revolution 3.0

Computing, Automation and
Communication Technology



...1970-2010...



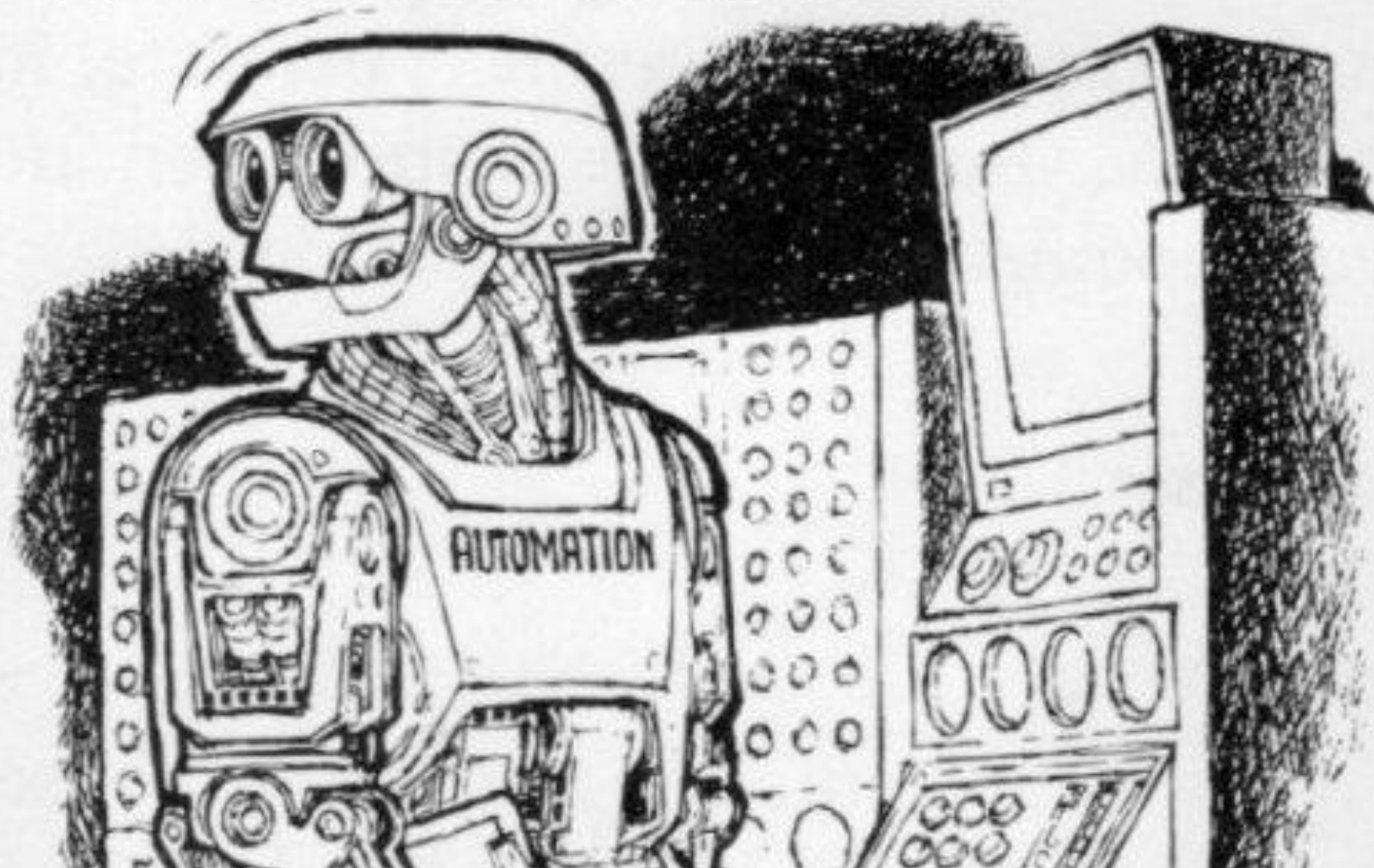
Industrial Revolution 4.0

Internet of Things,
Cyber Physical Systems (CPS)
3D Printing,
Artificial Intelligence / Machine Learning



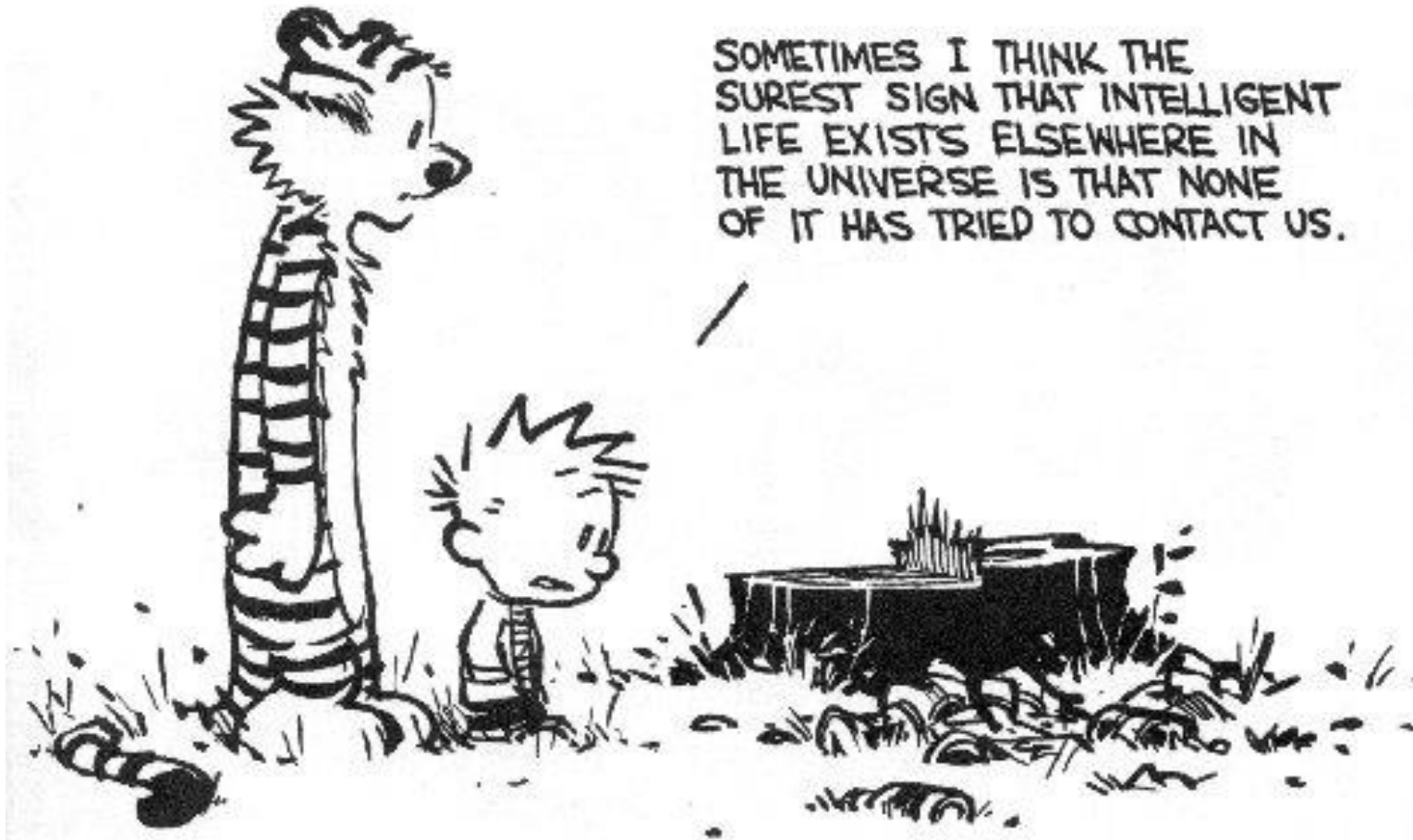
...TODAY...

OH...HAVEN'T YOU HEARD?—
THE INDUSTRIAL REVOLUTION
IS OVER... WE WON....



What is Intelligence?

What is Intelligence?



What is Intelligence?

- Intelligence:
 - “the capacity to learn and solve problems” (Webster's dictionary)
 - in particular,
 - *the ability to solve novel problems*
 - *the ability to act rationally*
 - *the ability to act like humans*
- Varying kinds and degrees of intelligence occur in people, animals and now machines.

What is AI?

What is AI?



What is Artificial Intelligence?

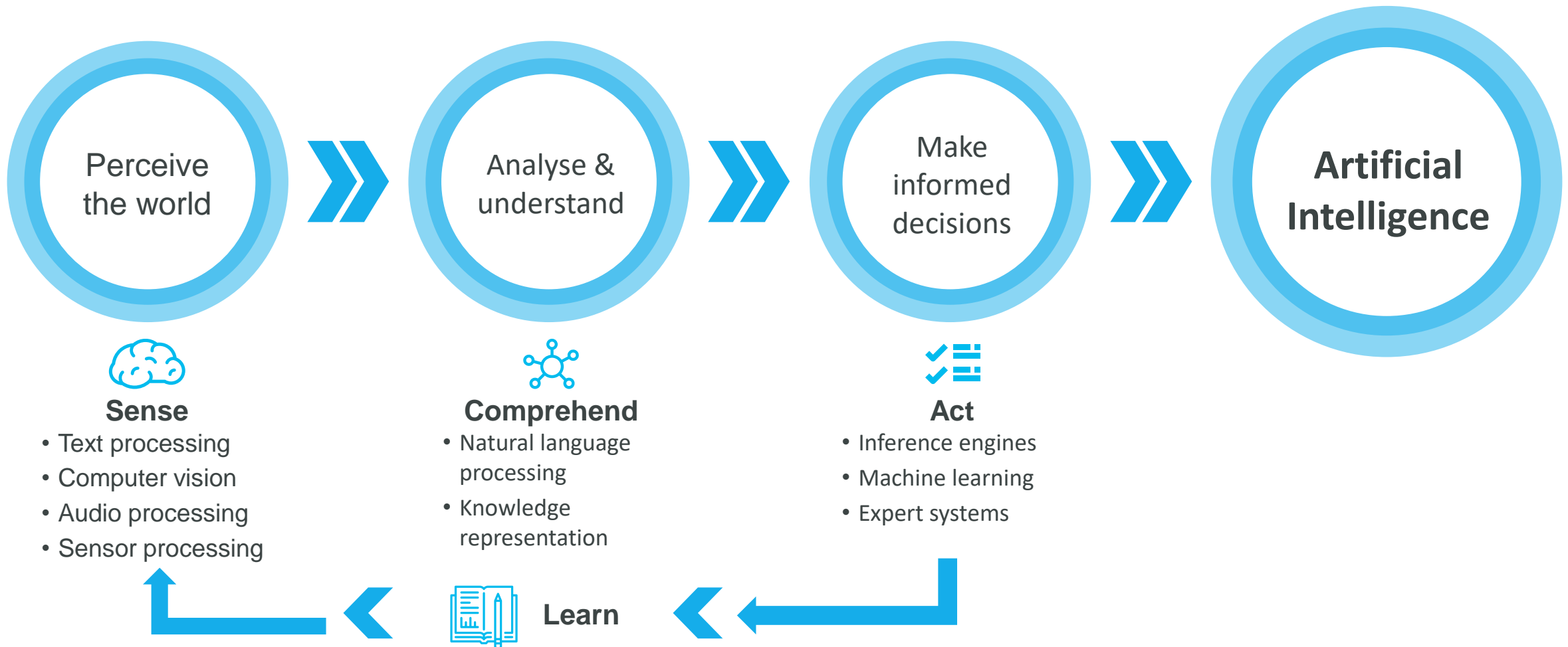
- Artificial Intelligence (AI) is the attempt for computers to perform intelligent actions.
- According to John McCarthy, AI is the science and the engineering of making intelligent machines, especially intelligent computer programs.

AI Introduction Video

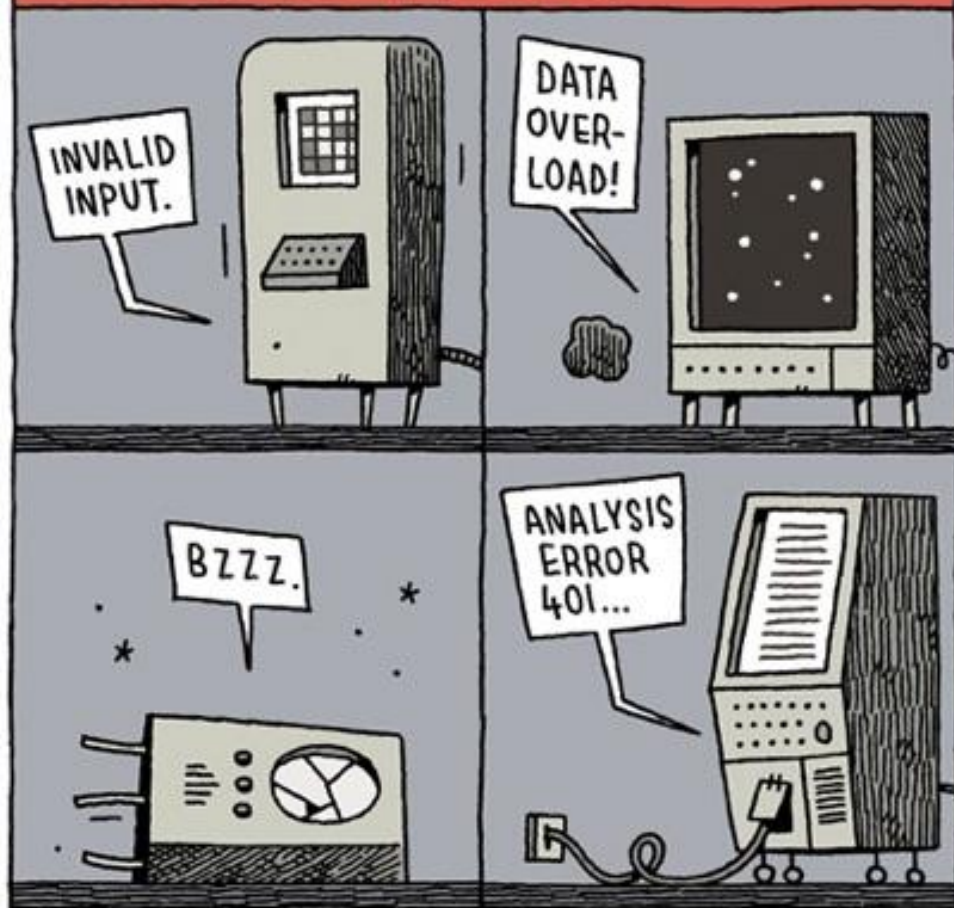
<https://connectedlearning.accenture.com/learningboard/159468-introduction-to-ai>

WHAT IS ARTIFICIAL INTELLIGENCE (Accenture Way)?

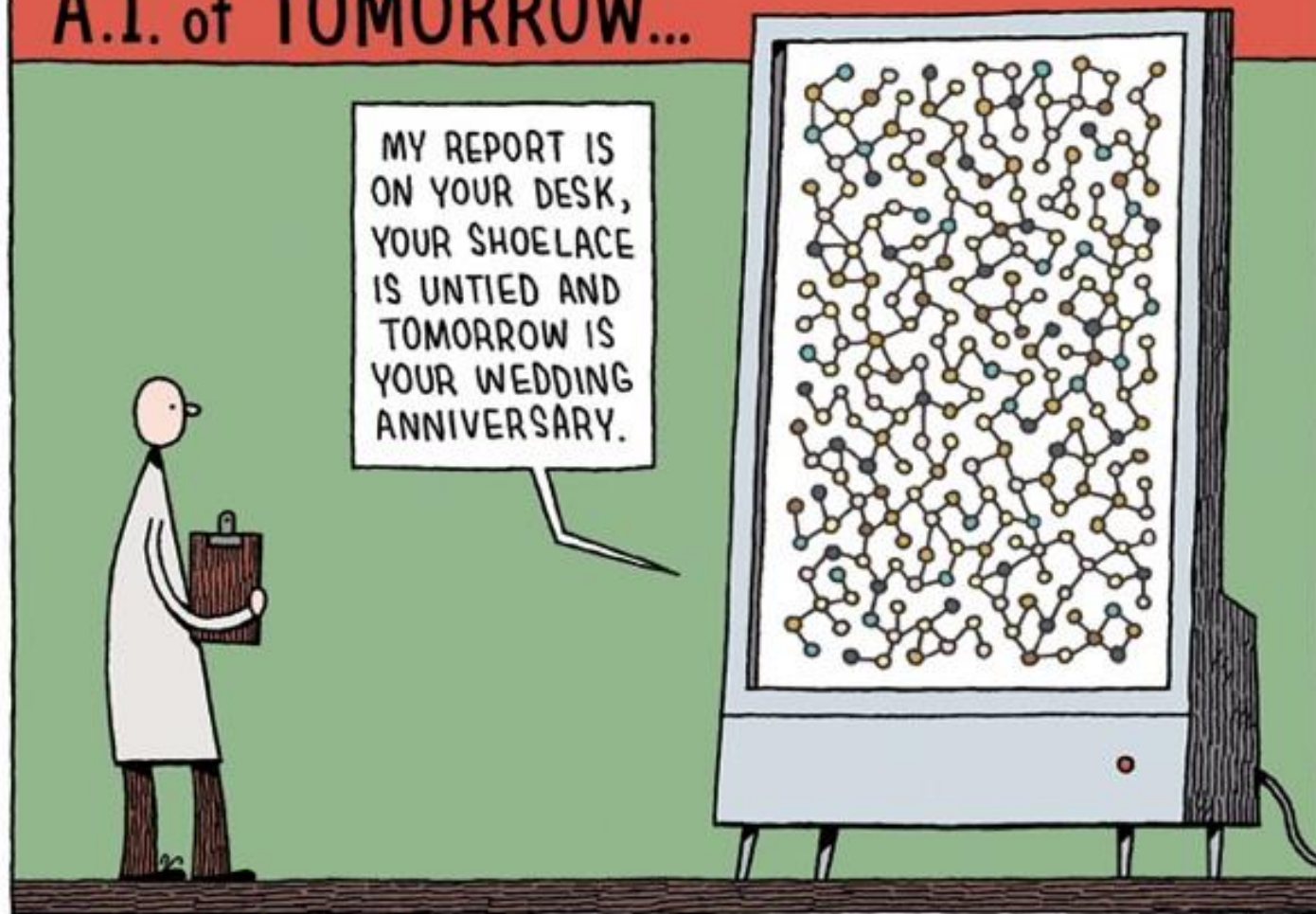
Artificial Intelligence describes a collection of multiple technologies that, together, enable machines to **sense, comprehend, act** and **learn** on their own or with minimal human augmentation.

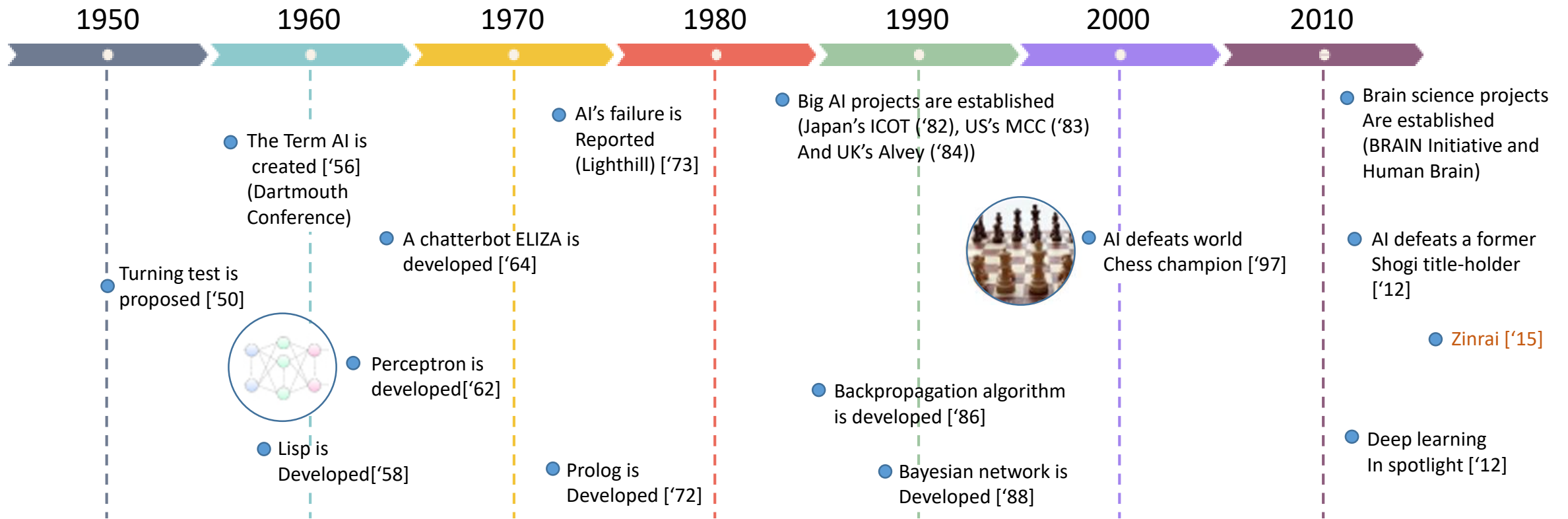


A.I. of the PAST...



A.I. of TOMORROW...





The age of search and deductive reasoning

The first AI boom

AI programs are able to solve only trivial "toy" problems but hardly any practical ones. Into "AI winter"

The age of knowledge acquisition

The second AI boom

Researchers tried to teach machines the knowledge of experts, which turned out to be extremely difficult. Into "AI winter" again

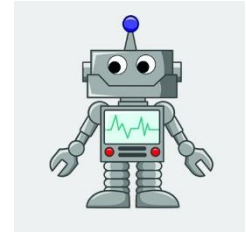
The age of Machine learning

The third AI boom

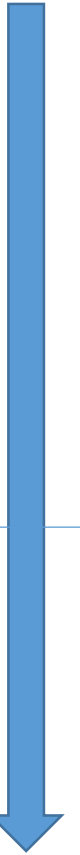
Into the age where computers acquire knowledge from data, not from humans by machine learning

How do we classify AI

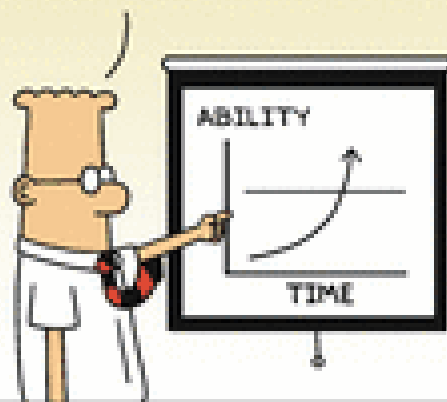
- **Artificial Narrow Intelligence (Weak AI)** - ANI
- **Artificial General Intelligence (Strong AI)** - AGI
- **Artificial Superintelligence** - ASI



Singularity

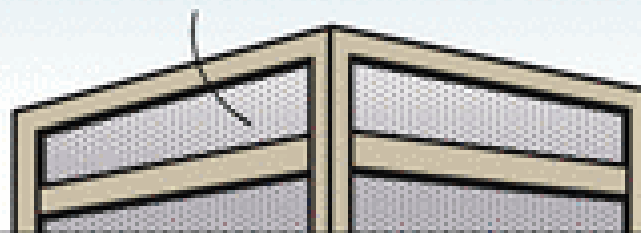


IN A FEW YEARS,
COMPUTERS WILL
PROGRAM THEMSELVES.
THAT'S CALLED THE
SINGULARITY.



Dilbert.com DilbertCartoonist@gmail.com

FROM THAT POINT ON,
MACHINE INTELLIGENCE
WILL INCREASE
EXPONENTIALLY. THE
RESULTING SHOCK
WILL PROBABLY
DESTROY THE FABRIC
OF CIVILIZATION.



1-31-12 ©2012 Scott Adams, Inc. Dist. by Universal Uclick

PLAN "A" IS TO LIVE
AN UNHEALTHY LIFE-
STYLE. PLAN "B" IS
TECHNO-TERRORISM.

I LIKE THE
FIRST ONE.



Realm of possibility

Augmented Intelligence



Some AI Solution Approaches

AI Techniques	Implementation Approach	Example Applications
Knowledge Representation	Logic, Rules, Semantic Nets, XML, Bayesian Networks, etc.	Analyzing clinical (or contract) guidelines to recommend appropriate and permissible treatments (deals).
Search	Tree search, Uniform cost search, A* search, etc.	Personalized Search, Path finding, etc.
Machine Learning	Supervised learning, Unsupervised Learning, Reinforcement Learning	Spam filtering, Product recommendations, Price predictions etc.
Game Theory	Minimax, Alpha-beta pruning, Utilities, Nash Equilibrium	Price Matching, Auctions, etc.
Markov Decision Processes	Policy Evaluation, Monte Carlo, Q-learning	Customer lifetime value modelling
Optimization	Linear programming, Integer programming, Non-linear models	Optimal inventory policies, Optimal routing
Constraint Satisfaction Problem	Factor graphs, Backtracking search, Dynamic ordering, arc consistency	Planning and scheduling, solving puzzles.

Frequently Asked Questions

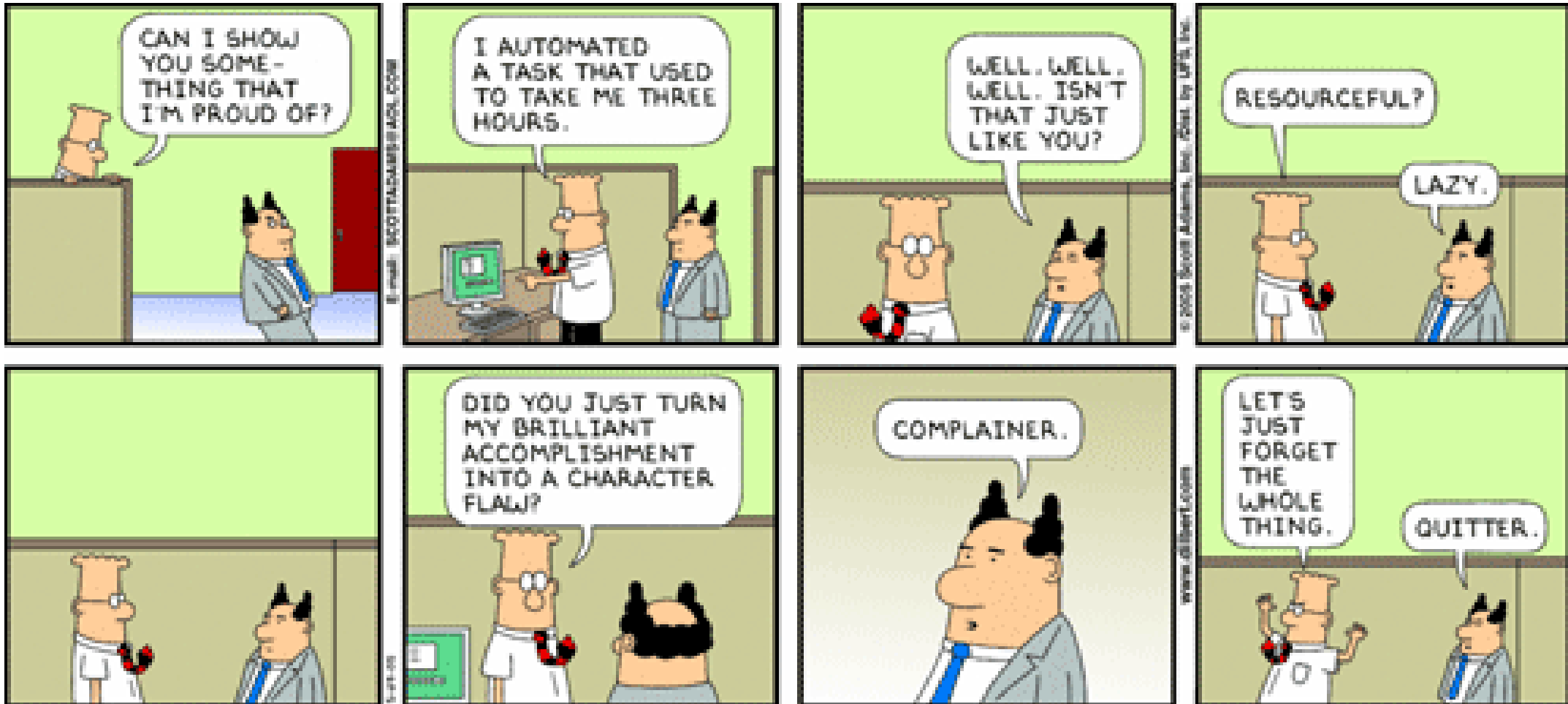
- How is AI different from conventional computing?
- What is the relation between AI and RPA
- What is AI, Machine Learning and Deep Learning?
- What is the relation between AI and Data Science?
- How are IoT and AI related?

What is AI and not AI

Conventional Computing	Artificial Intelligence
Programmer tells the system exactly how to solve the problem	Programmer specifies the problem to the system and not the exact steps to solve the problem
Can solve only a specific problem in a given domain	Can solve a range of problems in a given domain
Need all the input data	Complete input data not needed
Solution is deterministic	Solution can be probabilistic

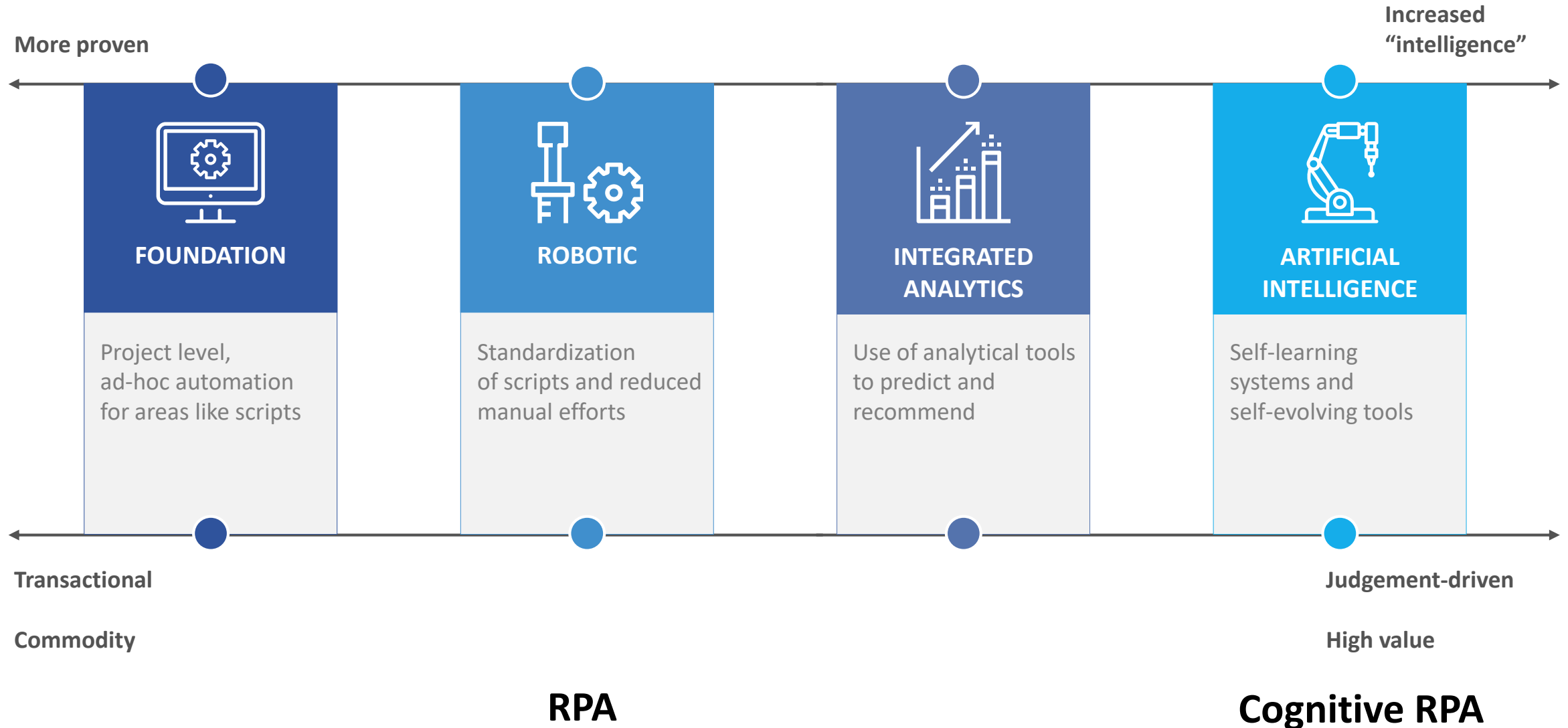
Robotic Process Automation (RPA)

Robotic Process Automation (RPA)

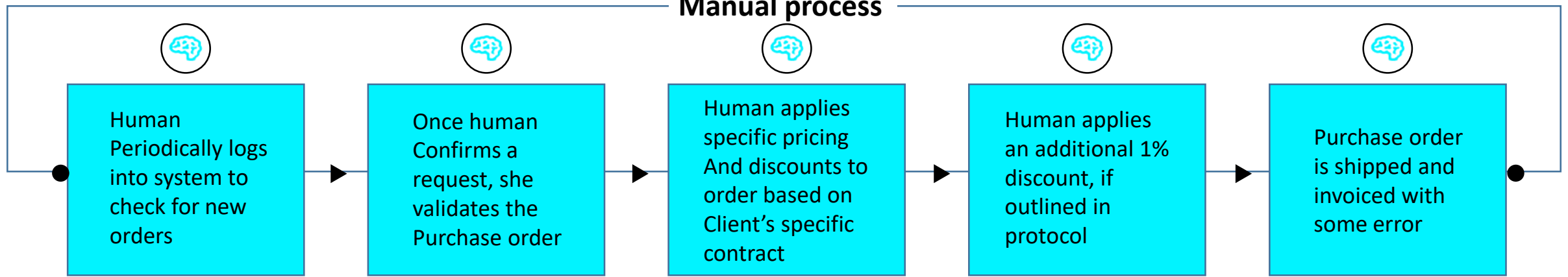


THE INTELLIGENT AUTOMATION CONTINUUM

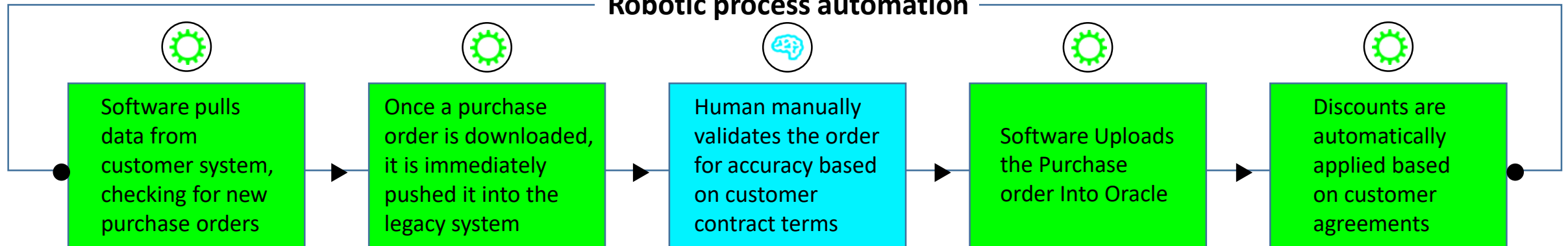
Building blocks for intelligent automation success.



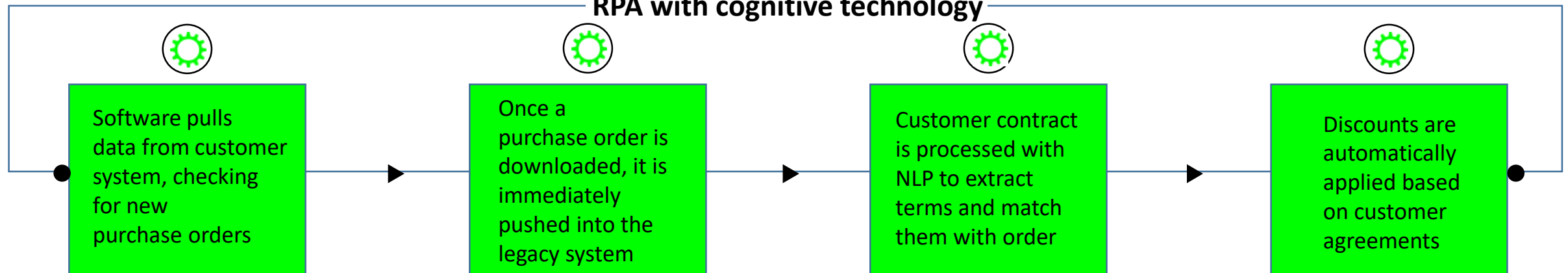
Manual process



Robotic process automation



RPA with cognitive technology

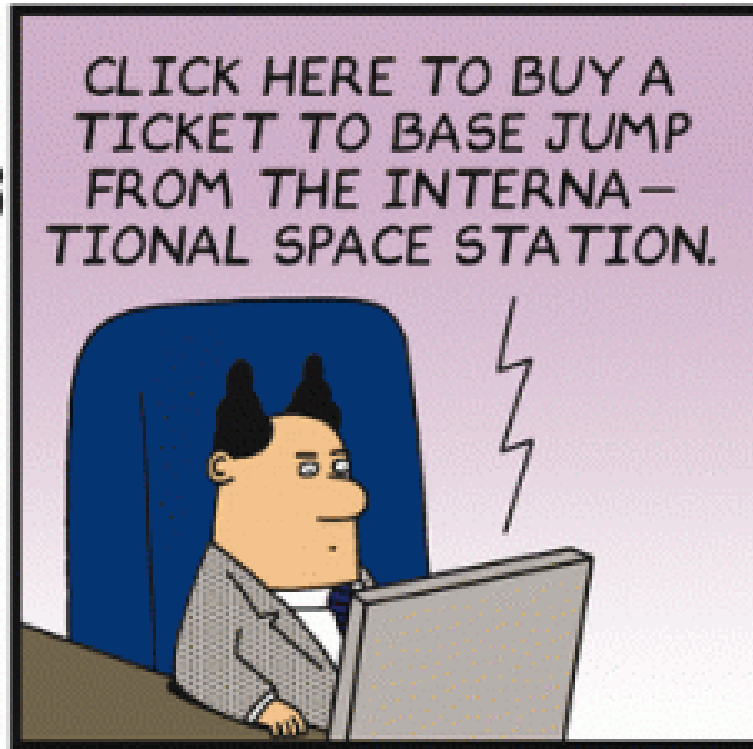


What is Machine Learning?

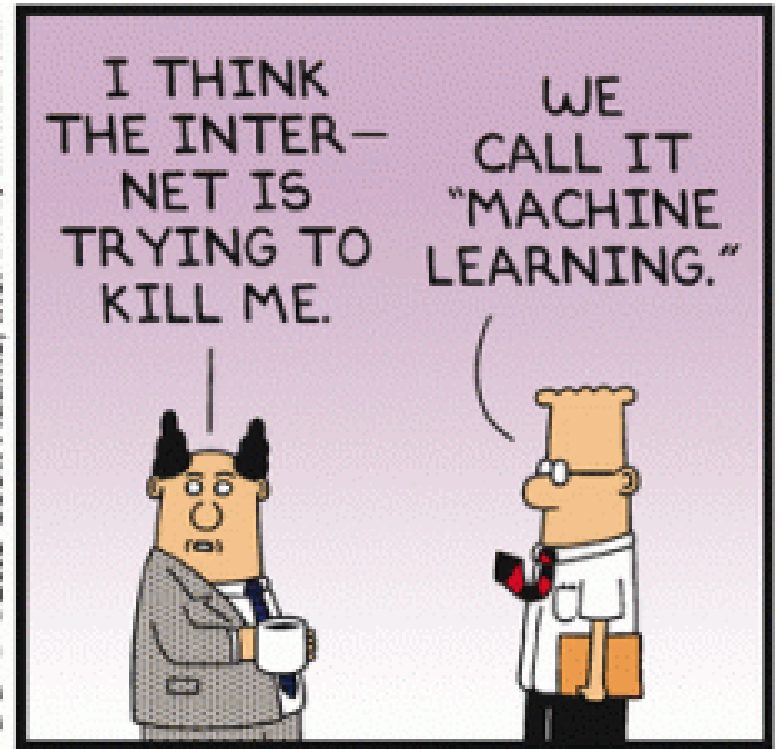
What is Machine Learning?



Dilbert.com DilbertCartoonist@gmail.com

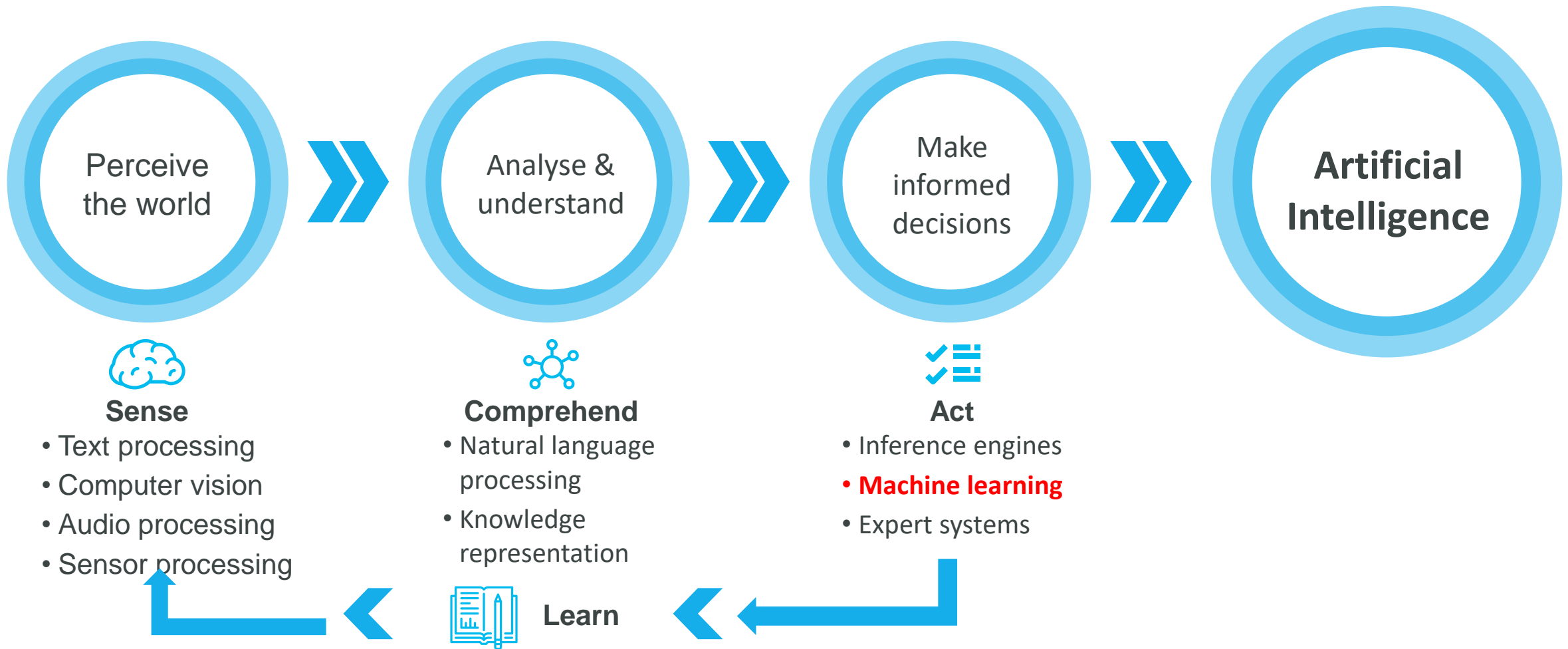


2-2-13 ©2013 Scott Adams, Inc./Dist. by Universal Uclick



WHAT IS ARTIFICIAL INTELLIGENCE (Accenture Way)?

Artificial Intelligence describes a collection of multiple technologies that, together, enable machines to **sense, comprehend, act** and **learn** on their own or with minimal human augmentation.



Machine Learning

Machine learning is a type of artificial intelligence (AI) that

- provides computers with the ability to learn without being explicitly programmed.
- focuses on the development of computer programs that can change when exposed to new data.

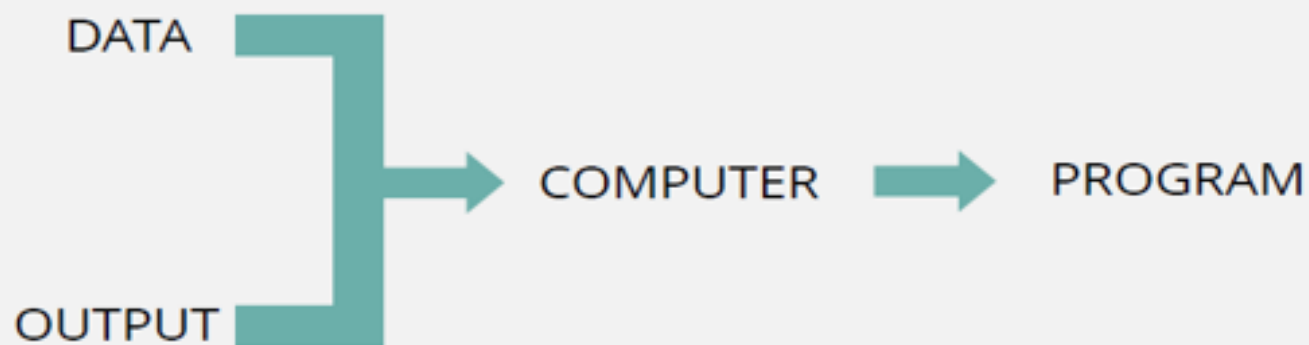
WHAT IS MACHINE LEARNING

A PARADIGM SHIFT

TRADITIONAL PROGRAMMING



MACHINE LEARNING



WHAT IS A MACHINE LEARNING **MODEL**?

A **Machine Learning model** intends to determine **the optimal structure in a dataset** to achieve **an assigned task**.

It results from **learning algorithms** applied on a **training dataset**.



DATA

+



ALGORITHMS

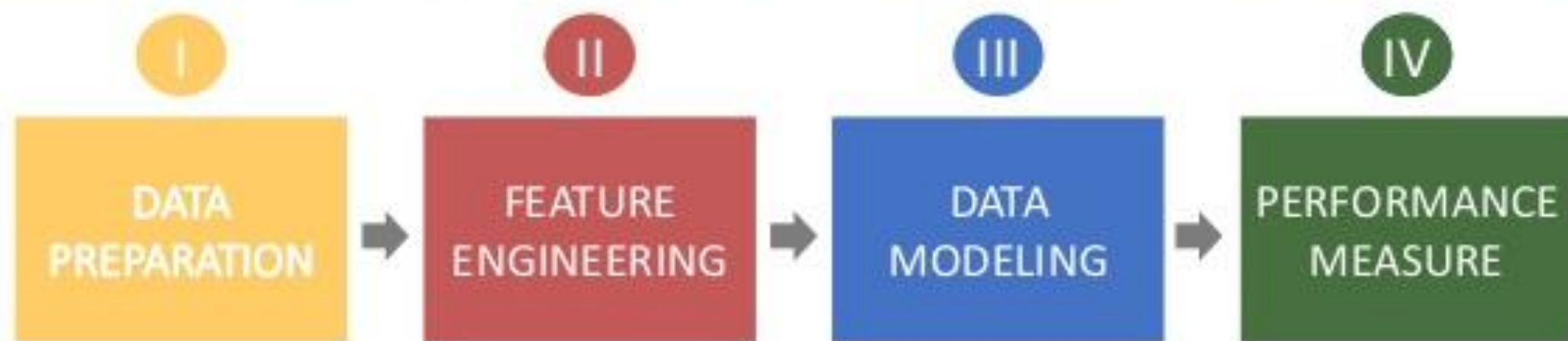
=



MODEL

WHAT IS A MACHINE LEARNING **MODEL**?

There are **4 steps** to build a machine learning model...



DATA

+



ALGORITHMS

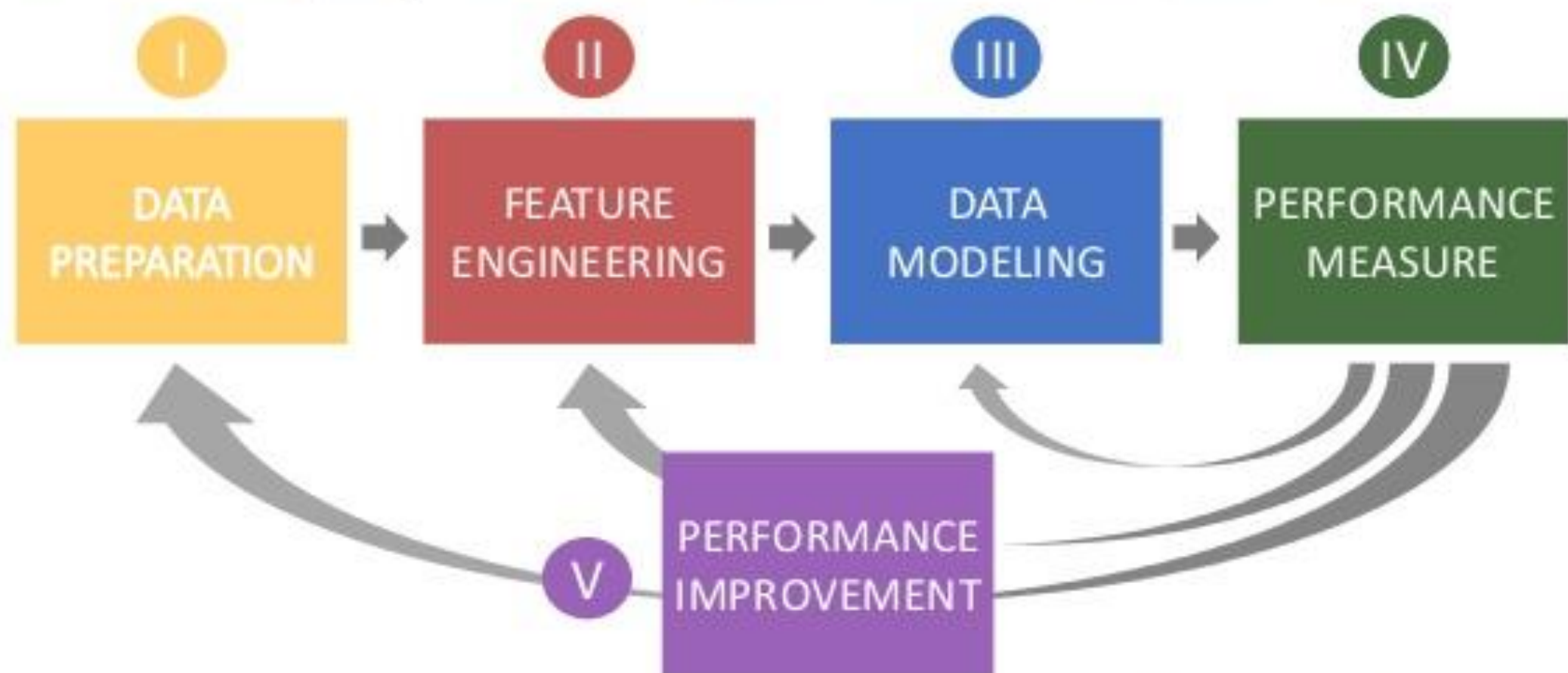
=



MODEL

WHAT IS A MACHINE LEARNING **MODEL**?

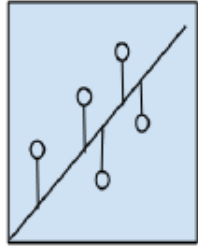
This is a highly iterative process, to repeat...



...until your model reaches a **satisfying performance**!

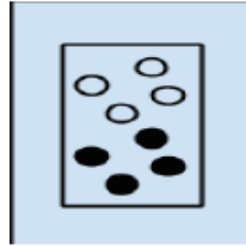
What are Key Problem Solving Algorithms?

Problem Type Paradigm



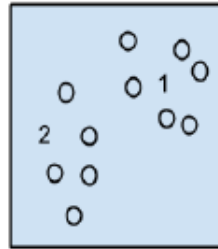
Regression Algorithms

How much/How many it is?



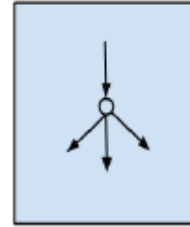
Classification Algorithms

Is this A or B? Is this A or B or C?



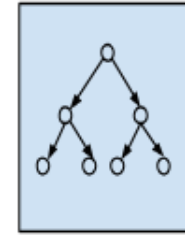
Clustering Algorithms

How is it Organized?



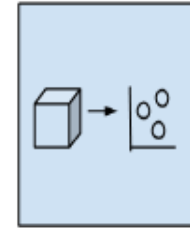
Artificial Neural Network Algorithms

Can we get higher abstraction from it?



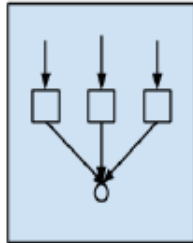
Decision Tree Algorithms

What is its decision flow/reasoning?



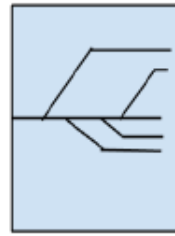
Dimensional Reduction Algorithms

What is common in it?



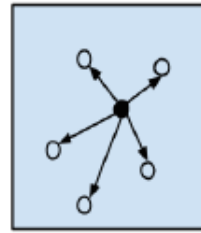
Ensemble Algorithms

Can combining models gives better output?



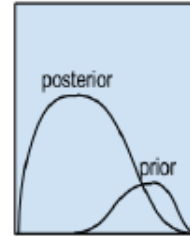
Regularization Algorithms

How can we generalize given model?



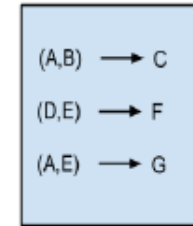
Instance-based Algorithms

What is the similarity in it?



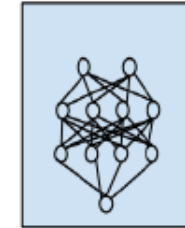
Bayesian Algorithms

What is probable effect of it?



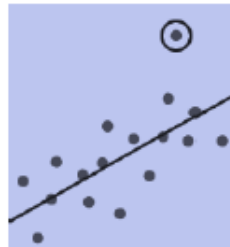
Association Rule Learning Algorithms

Can we draw straight rules from it?



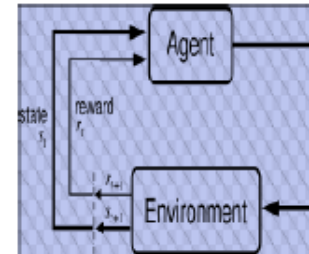
Deep Learning Algorithms

Can it draw finer feature from it?



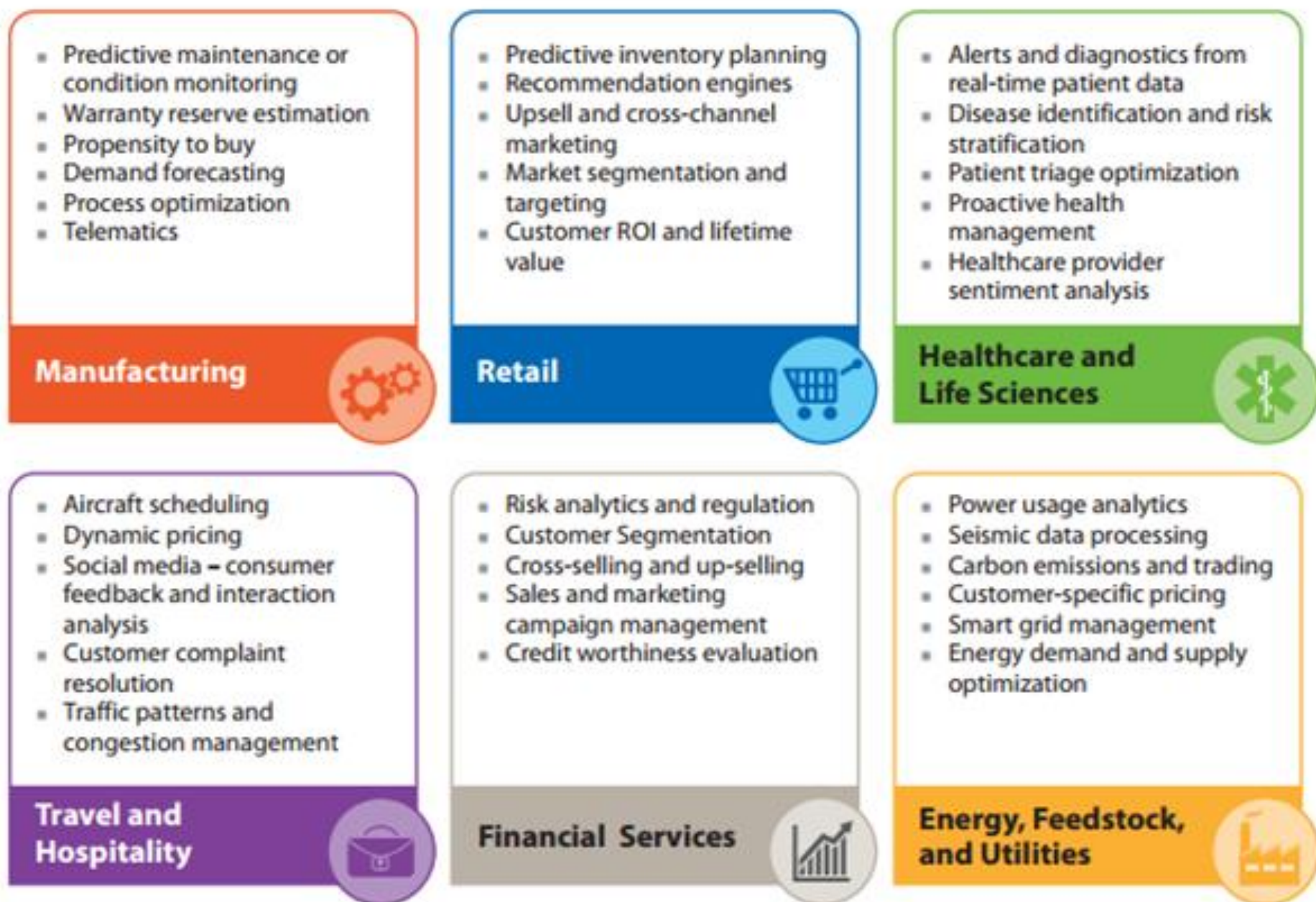
Anomaly Detection

Is it weird?



Reinforcement Learning

What should I do Next?

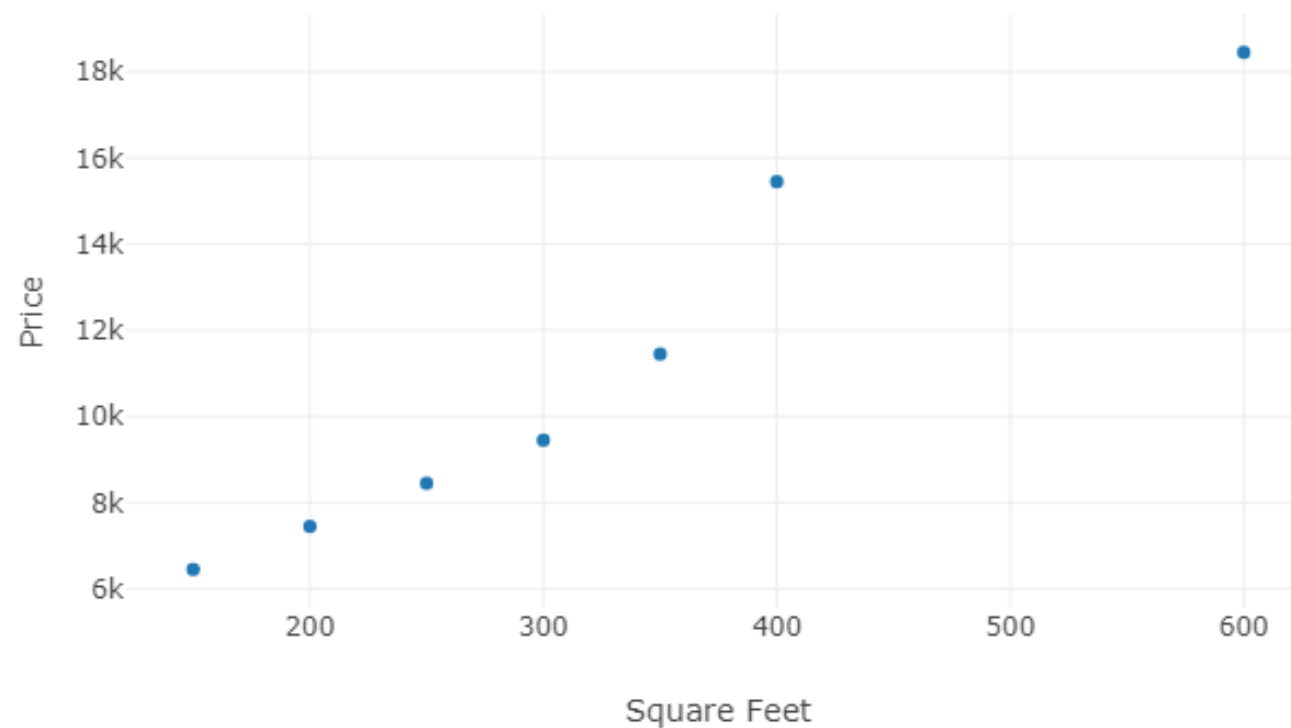


Machine Learning applications across industries

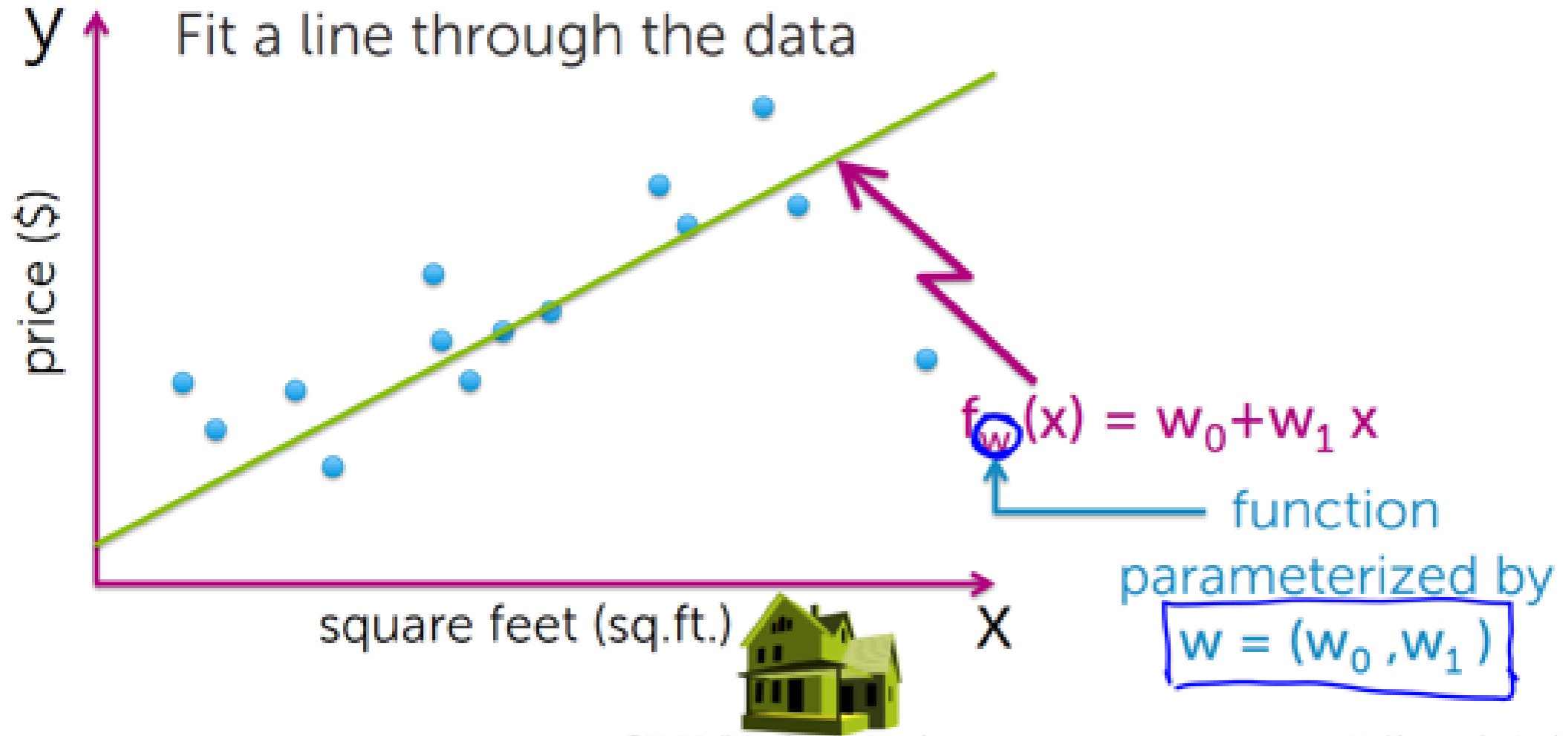
Predicting House Prices



Square_feet Vs Price



Regression Model



WHAT IS A FEATURE?

"A **feature** is an **individual measurable property** of a **phenomenon** being observed."

Example: Predict the price of an apartment



Features

(Individual measurable properties)

Size: 33 sqm

Location: Paris 6th

Floor: 5th

Elevator: No

rooms: 2

...



Label

(Phenomenon observed)

400k€

The number of features you will be using is called the **dimension**.

Supervised Learning - Regression

SUPERVISED
LEARNING

REGRESSION

When the training set contains labels (i.e. outputs/target)

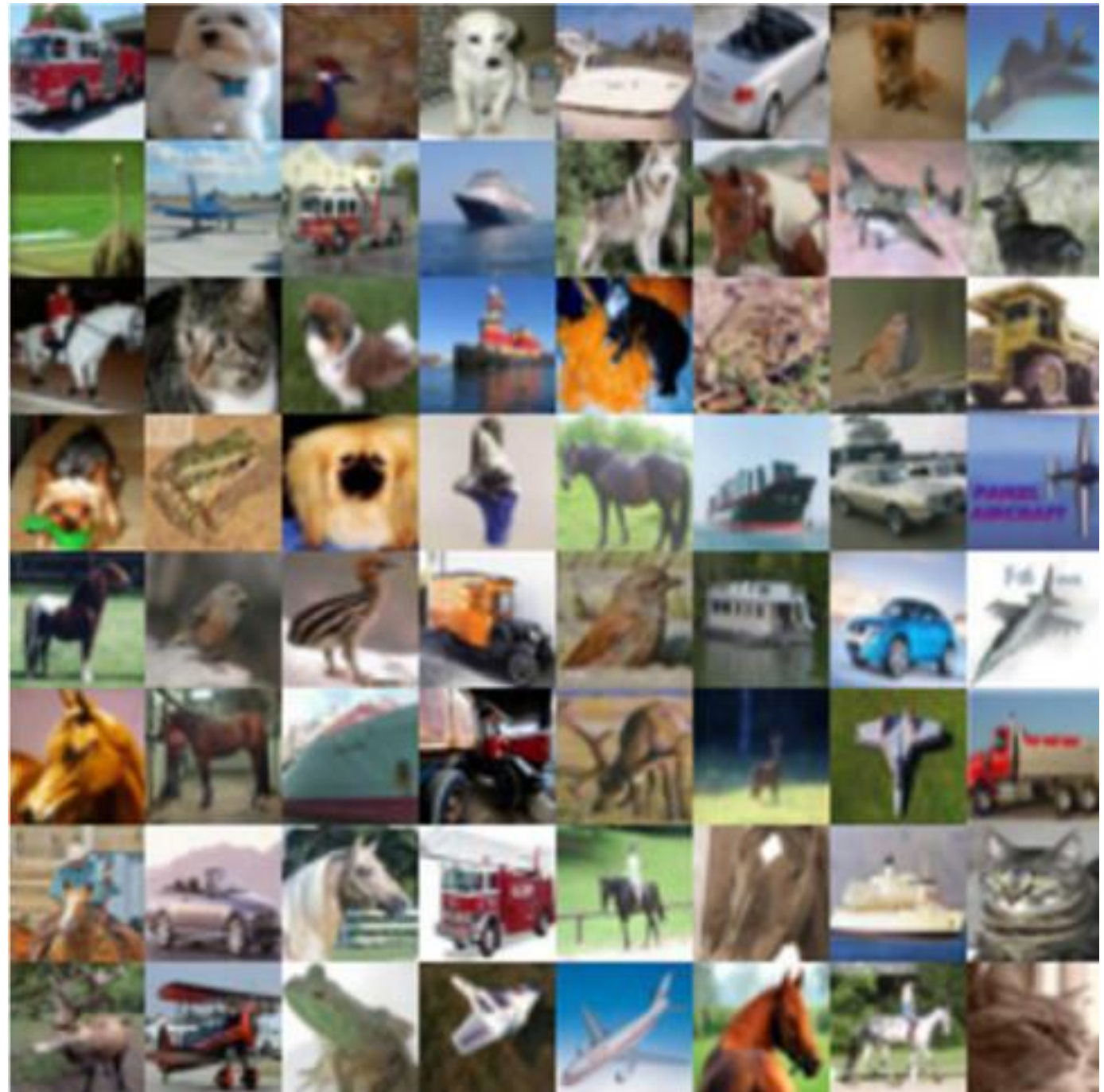
Example: Predict the price of an apartment

FEATURES					LABEL
Size (m ²)	# rooms	Location	Floor	Elevator	Price (k€)
62	3	Paris	3	Yes	500
92	4	Lyon	4	No	400
43	2	Lille	5	Yes	200

What is AI here: The algorithm learns the weights associated with the features to predict the house price

$$Price = w_0 * Size + w_1 * \#rooms + w_2 * Location + w_3 * Floor + w_4 * Floor + w_5 * Elevator$$

Unlabeled Dataset



Labeled Dataset

airplane



automobile



bird



cat



deer



dog



frog



horse



ship

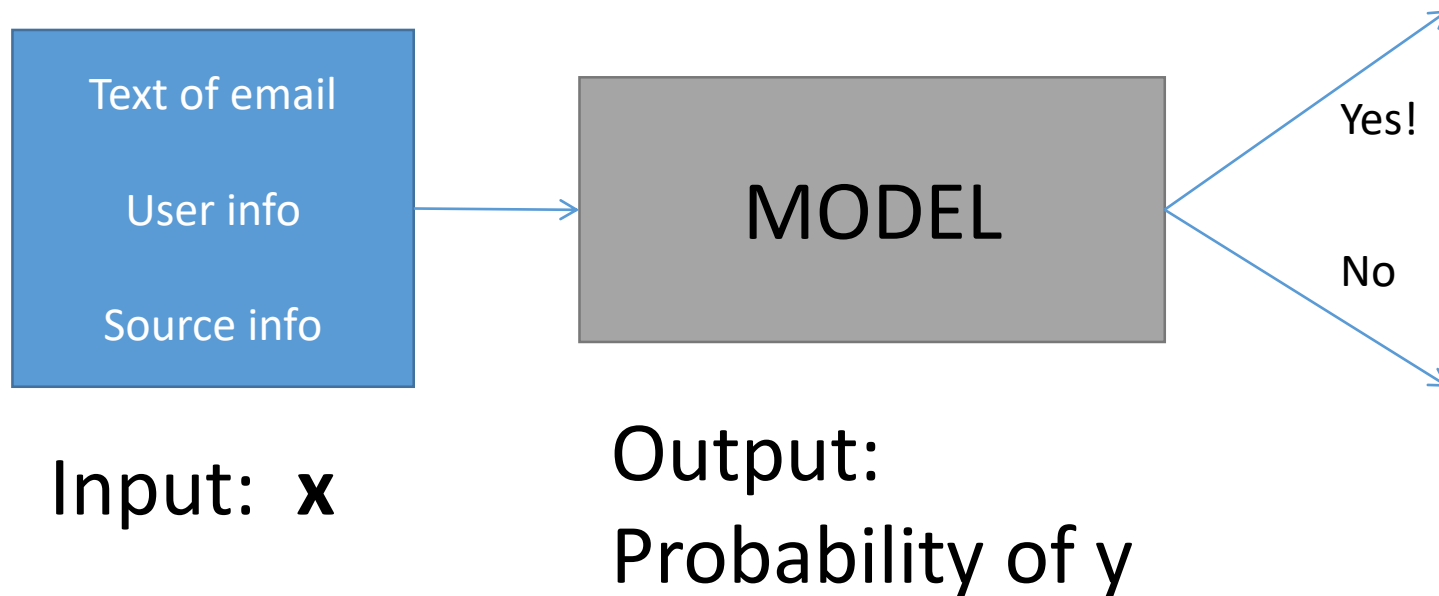


truck



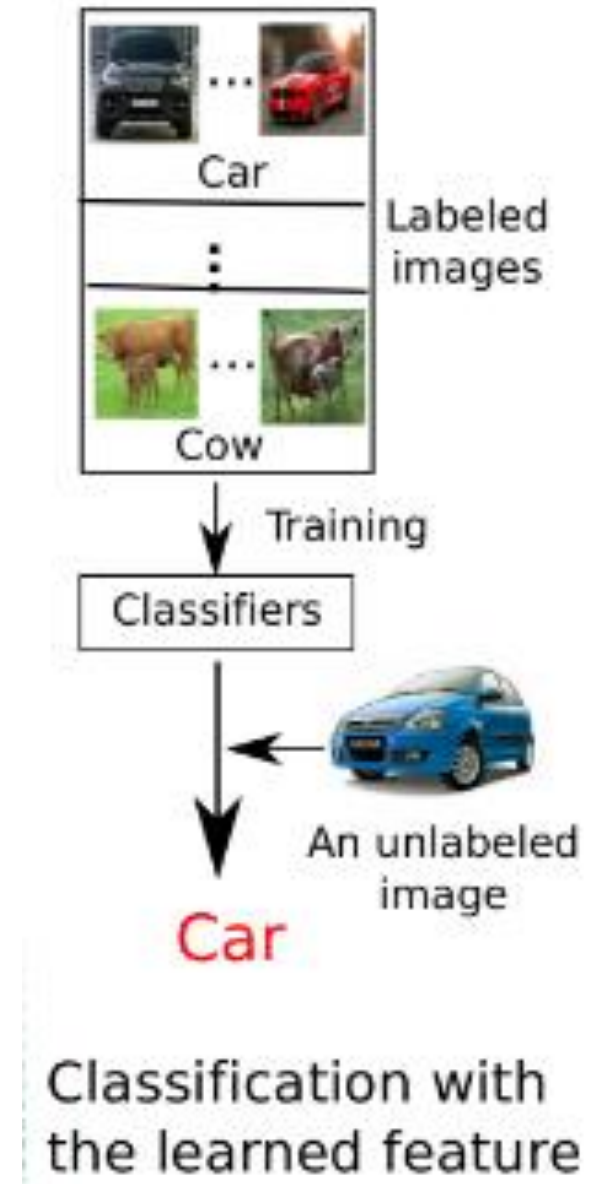
Spam Filtering - Supervised Learning (Classification)

- A user opens an email...
 - Will she thinks its spam?



- What's the probability email is spam?

Supervised Learning - Classification



What is AI here: Learning to classify unseen data into labelled categories

Classification

Scenarios:

- Which emails are spam
- Which transactions are fraudulent
- Which quotes are more likely to become orders
- Recognition of speech, speaker, image, sentiment, etc.

Supervised Algorithms

Supervised algorithms are used to build **two** kind of models

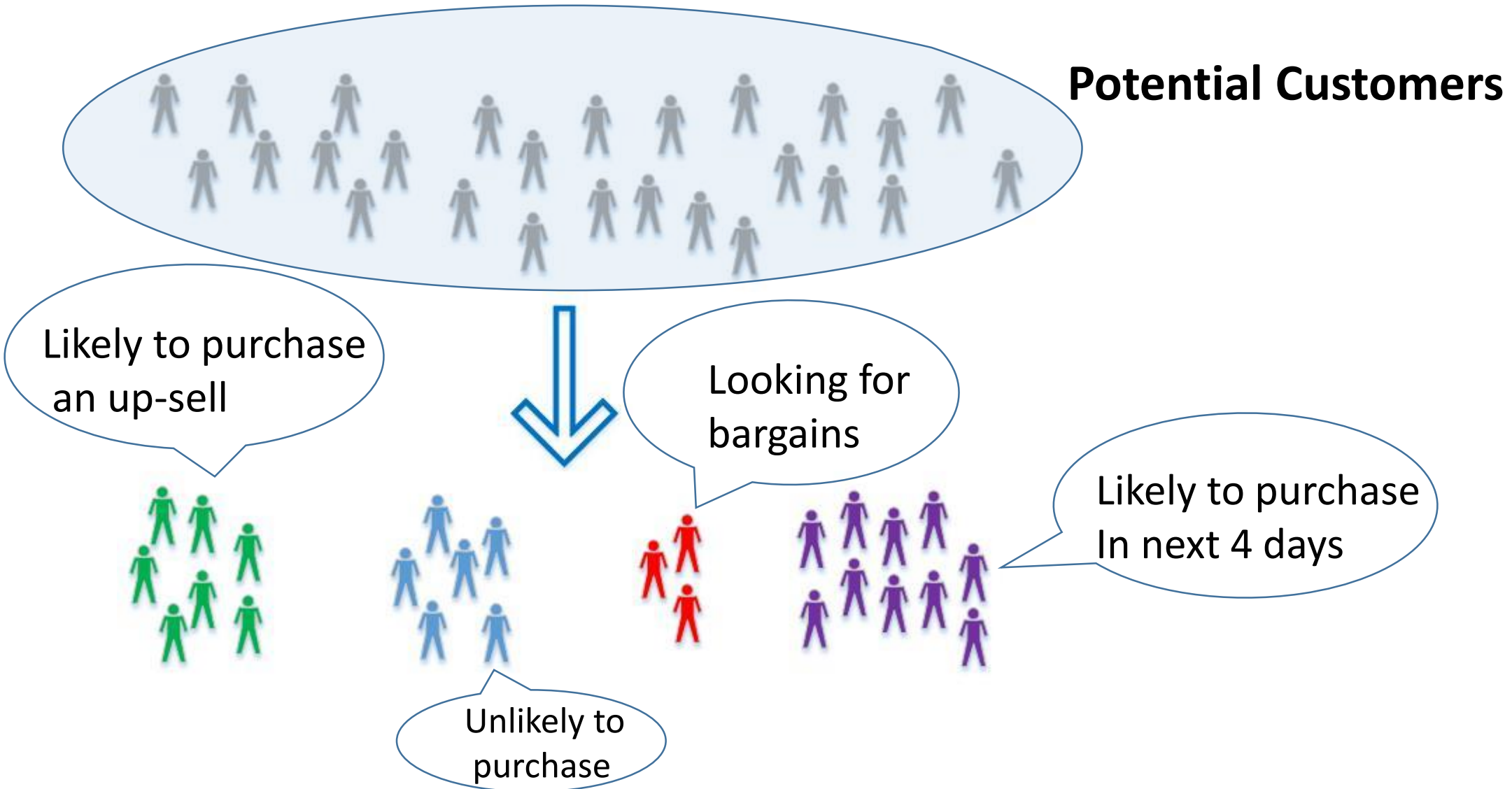
REGRESSION

Label is used to predict a **continuous value**.
e.g. predict the price of an apartment,
support ticket volume prediction

CLASSIFICATION

Label is used to predict a **discrete value**.
e.g. predict whether an email is spam or not,
support ticket classification

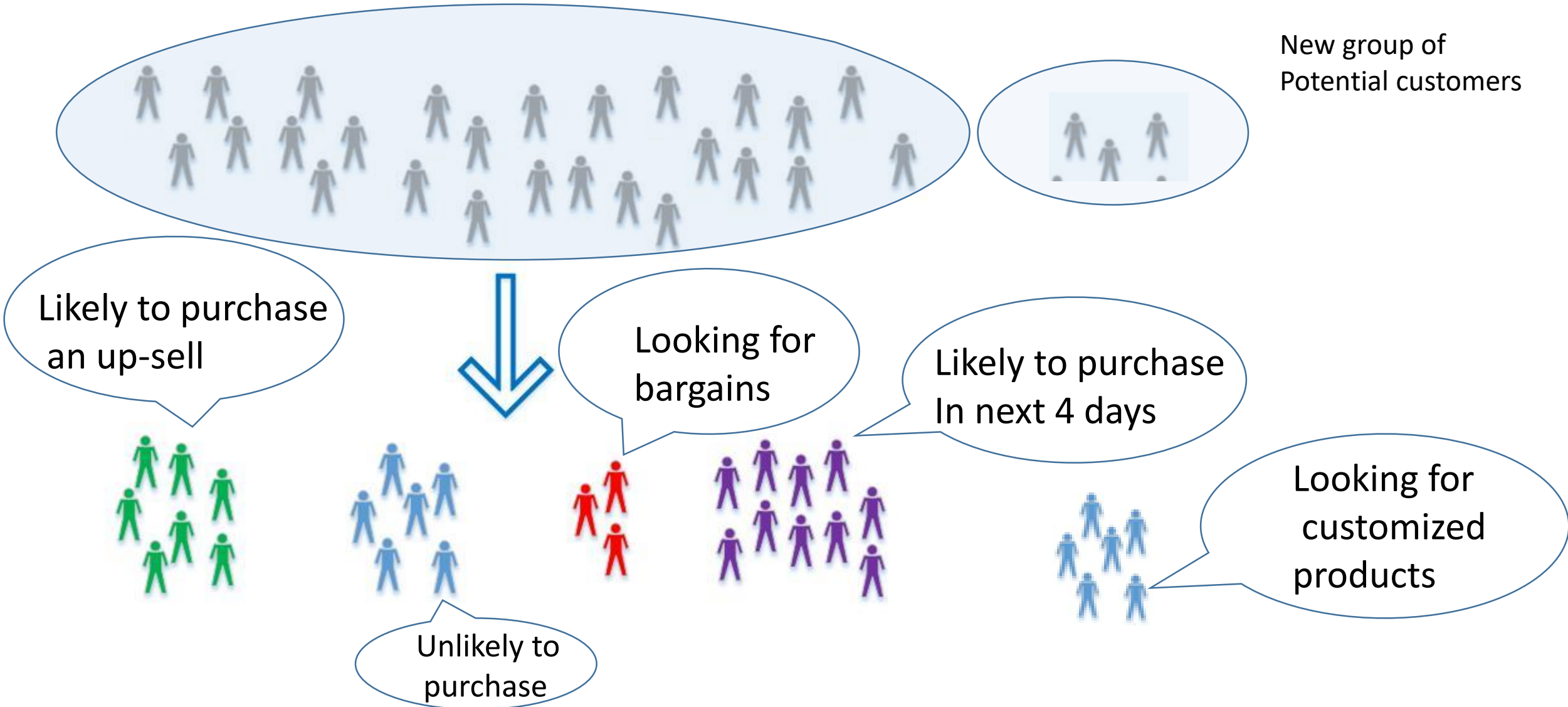
Clustering



Clustering

Potential Customers

New group of
Potential customers



Unsupervised Learning

UNSUPERVISED LEARNING

When the training set contains **no label**, only features

Example: Define client segments within a customer base

FEATURES				
Name	Gender	Age	Location	Married
John	M	46	New-York	Yes
Sarah	F	42	San Francisco	No
Michael	M	18	Los Angeles	Yes
Danielle	F	54	Atlanta	Yes

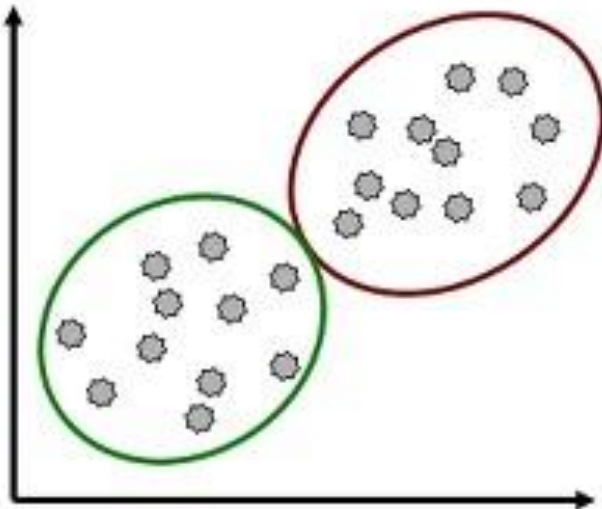
LABEL



Difference between Clustering & Classification

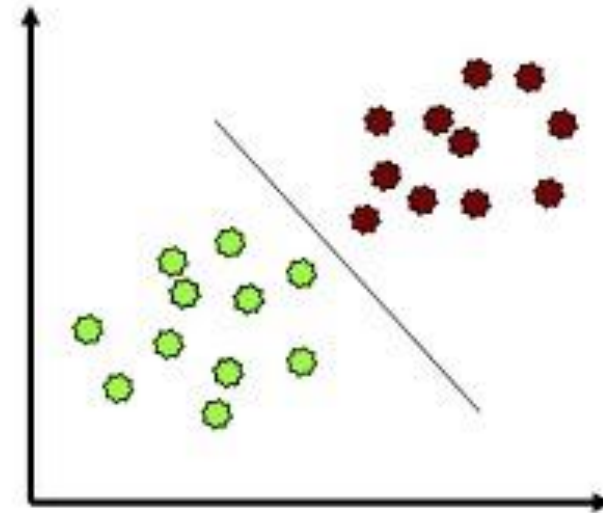
CLUSTERING

- Data is not labeled
- Group points that are "close" to each other
- Identify structure or patterns in data
- Unsupervised learning



CLASSIFICATION

- Labeled data points
- Want a "rule" that assigns labels to new points
- Supervised learning



Unsupervised Learning – Association Analysis

Unlabeled data: quest for hidden structure in the data

— Market Basket/Affinity Analysis

- Pattern in the purchases: what is bought together?
- Amazon 2009 revenue \$24.5B, \$5B from recommended products



What is AI here: Learning the purchasing pattern (behavior) of the buyers

Unsupervised Learning: Dimensionality Reduction

- Most machine learning and data mining techniques may not be effective for high-dimensional data
 - ❑ **Curse of Dimensionality**
 - ❑ Query accuracy and efficiency degrade rapidly as the dimension increases.
- The **intrinsic** dimension may be small.
 - ❑ For example, the number of genes responsible for a certain type of disease may be small.

Supervised Learning:

Predicting values. **Known** targets.

User inputs correct answers to learn from. Machine uses the information to guess new answers.

REGRESSION:

Estimate continuous values
(Real-valued output)

CLASSIFICATION:

Identify a unique class
(Discrete values, Boolean, Categories)

Unsupervised Learning:

Search for structure in data. **Unknown** targets.

User inputs data with undefined answers. Machine finds useful information hidden in data.

Cluster Analysis

Group into sets

Density Estimation

Approximate distributions

Dimension Reduction

Select relevant variables



The first time when a baby tries a lemon.



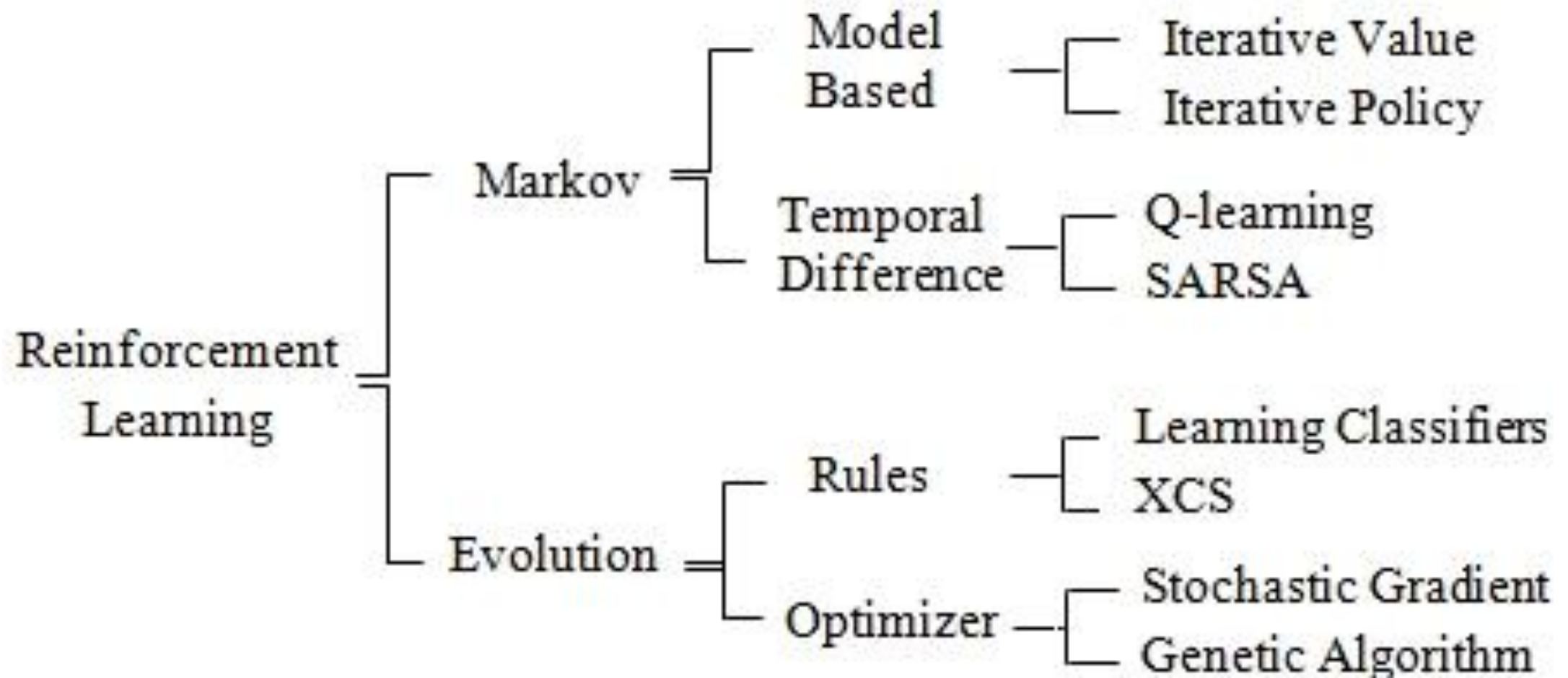
Chocolate is a different experience.

- This is actually **Reinforcement Learning**.
The baby learns from reward (chocolate) or punishment (lemon) experience.
- Reinforcement learning determines the best set of actions in order to
Maximize (Reward – Punishment)

Reinforcement Learning

- Questions that RL answers are about what action (or decision) should be taken:
 - Where to place an ad on the webpage so that the viewer is most likely to click it?
 - Adjust the temperature higher, lower, or leave it where it is?
 - How to adjust the price in response to customer demand?
 - How many shares of this stock to be bought right now?
 - Continue driving at the same speed, brake, or accelerate in response to that yellow light?
- Reinforcement Learning algorithms can start working without any data.
- They gather data as they go, learning from trial and error.

Reinforcement Learning



Machine Learning Approaches



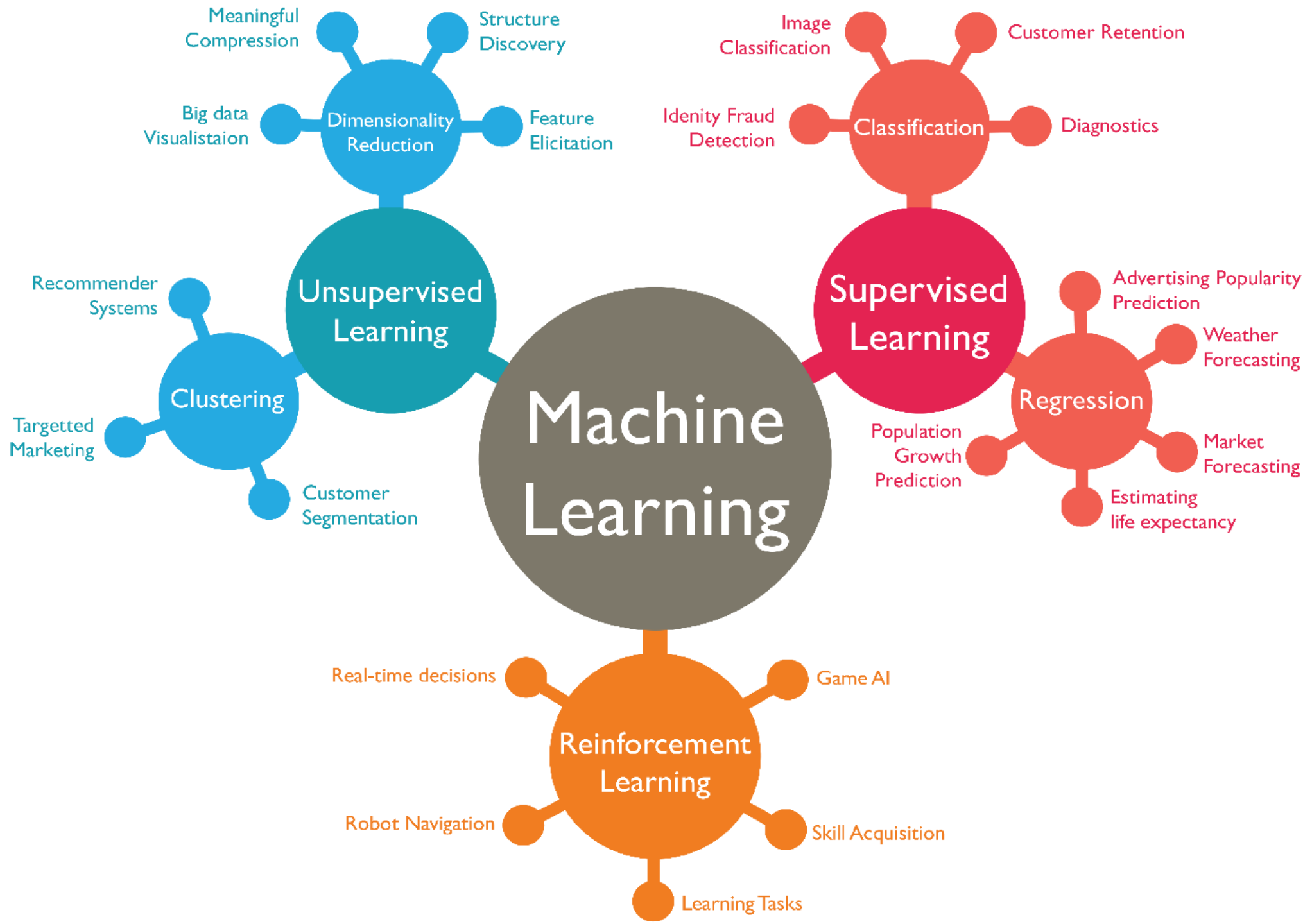
Supervised Learning: Learning with a **labeled training set**
Example: email spam detector with training set of already labeled emails



Unsupervised Learning: **Discovering patterns** in unlabeled data
Example: cluster similar documents based on the text content



Reinforcement Learning: learning based on **feedback** or reward
Example: learn to play chess by winning or losing



Deep Learning

ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



MACHINE LEARNING

Machine learning begins to flourish.



DEEP LEARNING

Deep learning breakthroughs drive AI boom.



1950's

1960's

1970's

1980's

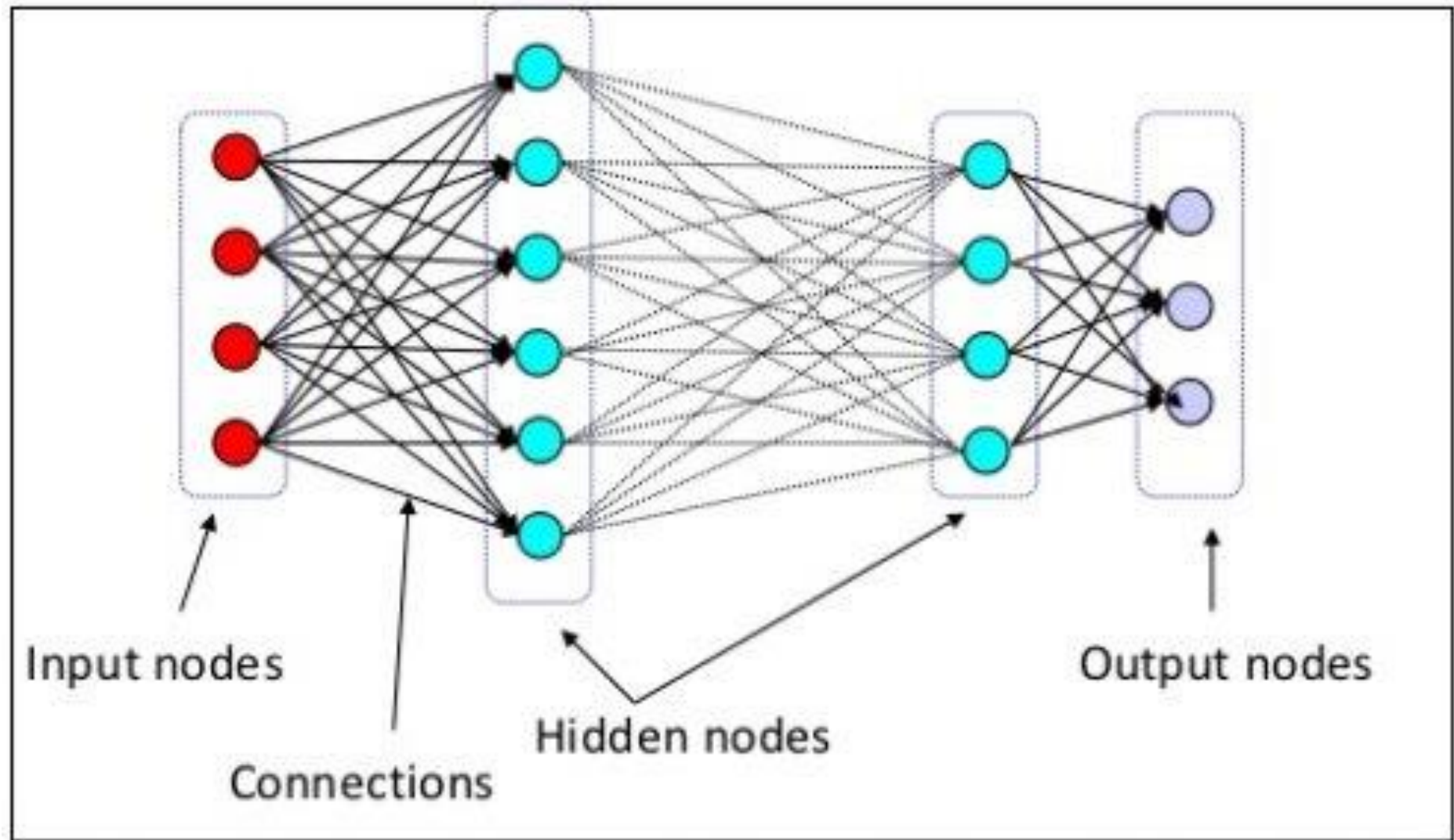
1990's

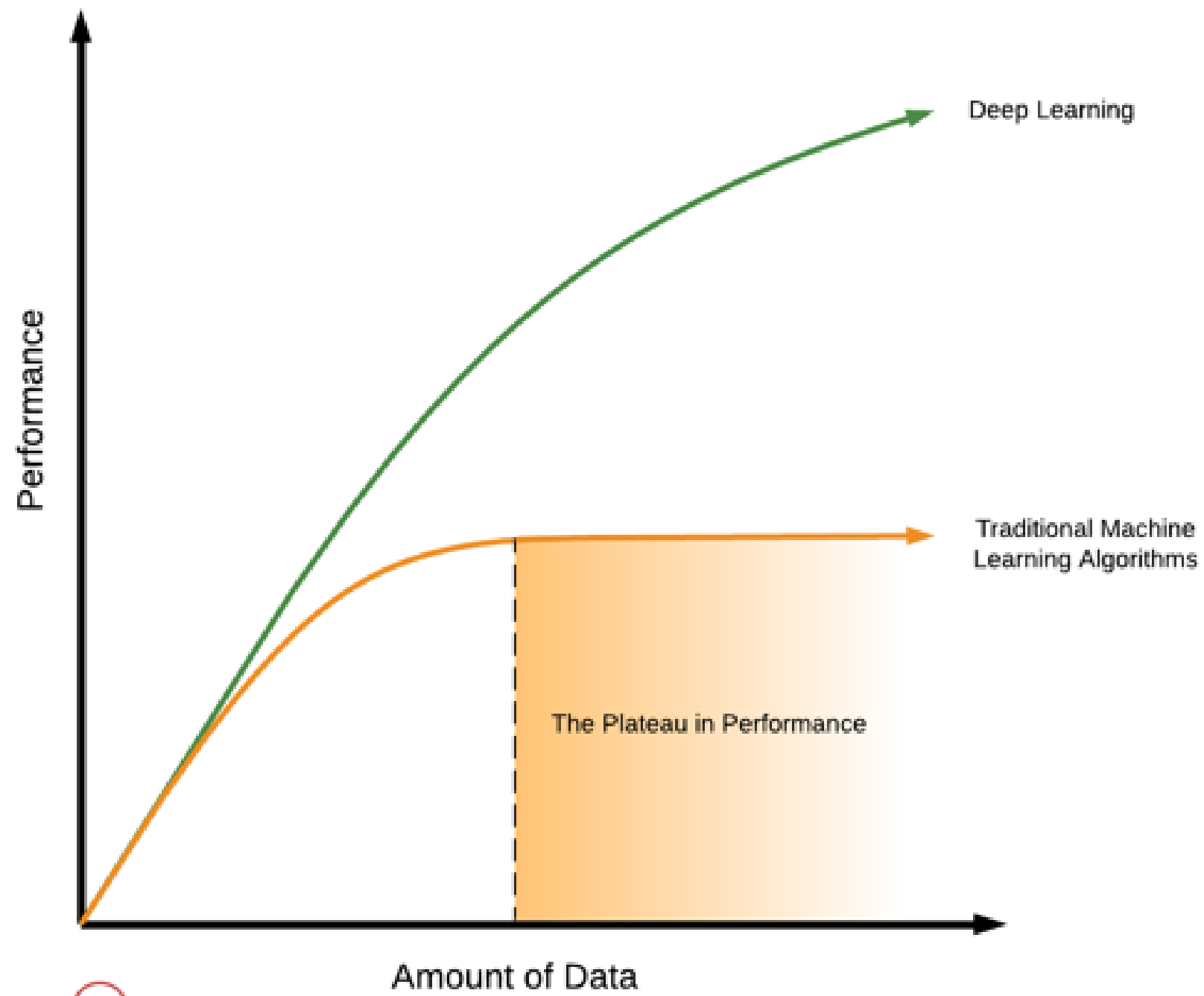
2000's

2010's

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

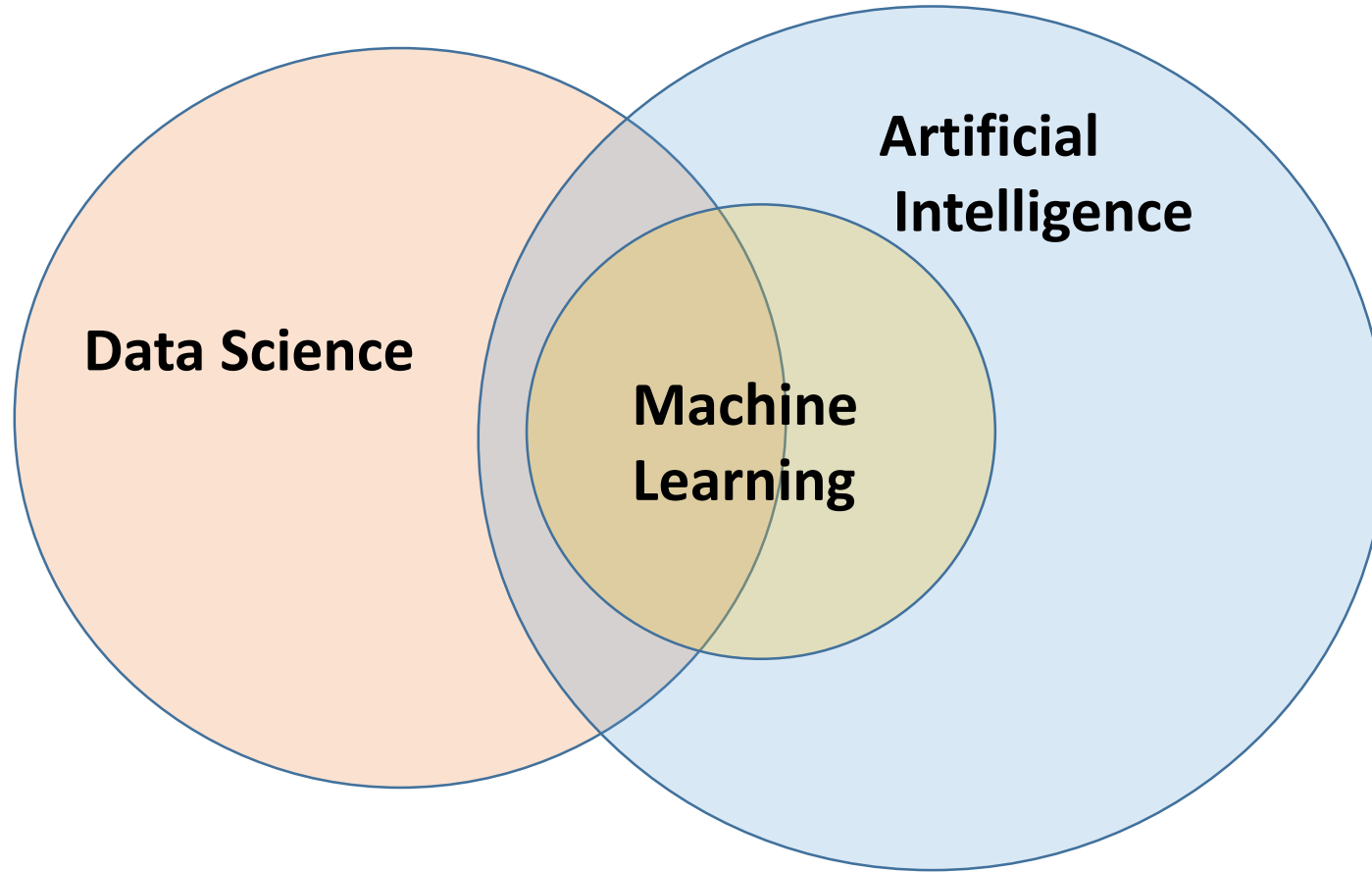
Deep Learning- Deep Neural Networks





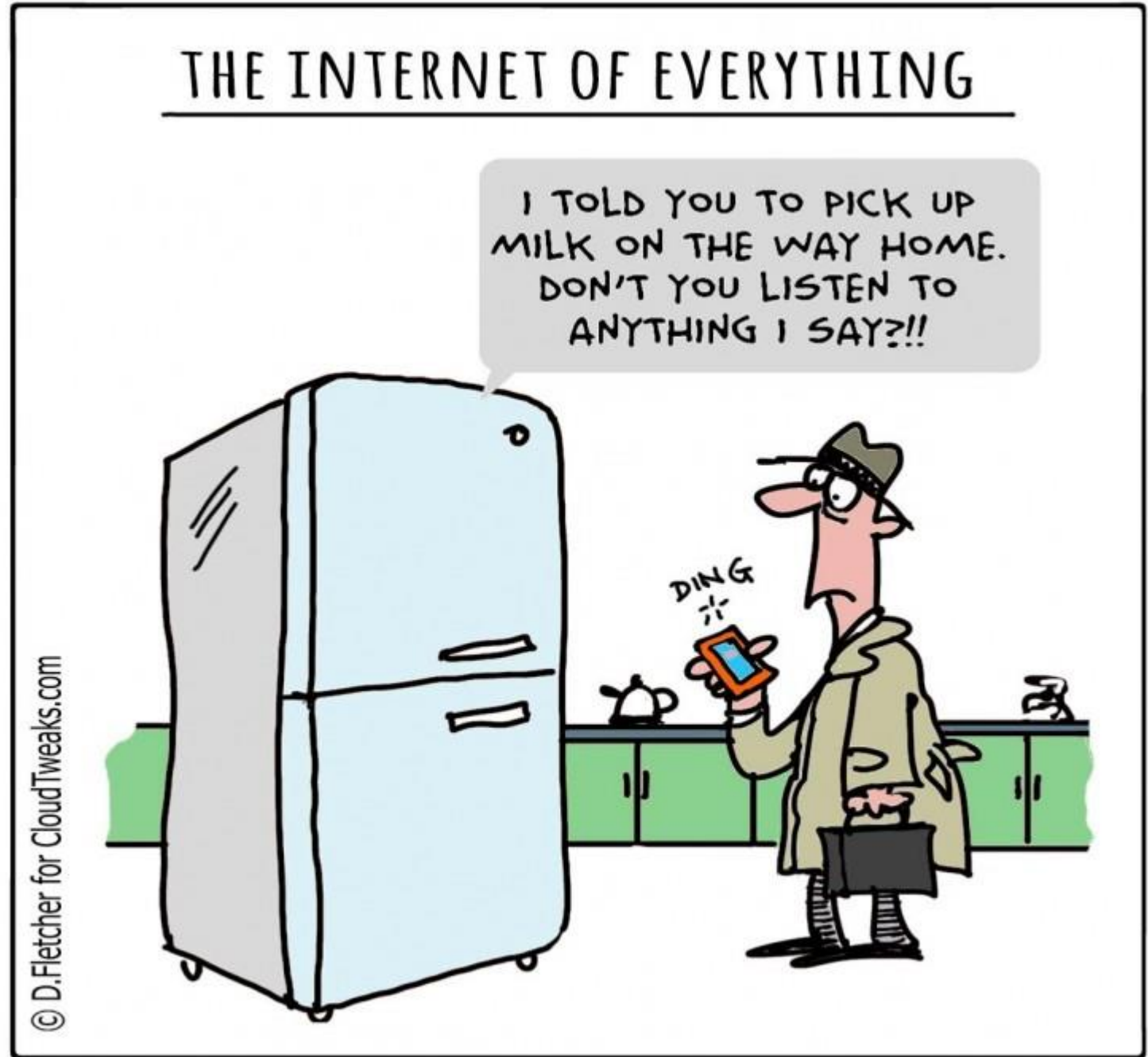
Artificial Intelligence & Data Science

Artificial Intelligence & Data Science



Machine Learning is the main connection between data science and artificial intelligence since machine learning is the process of learning from data.

AI and IoT



“Devices” can mean a lot of “things”



...all becoming connected to the cloud.

EXPLOSION OF AI + IOT

BY 2020...

- GARTNER PREDICTS 21 **BILLION DEVICES** WILL BE CONNECTED
- IDC PREDICTS IOT SPENDING WILL REACH **\$1.5 TRILLION**

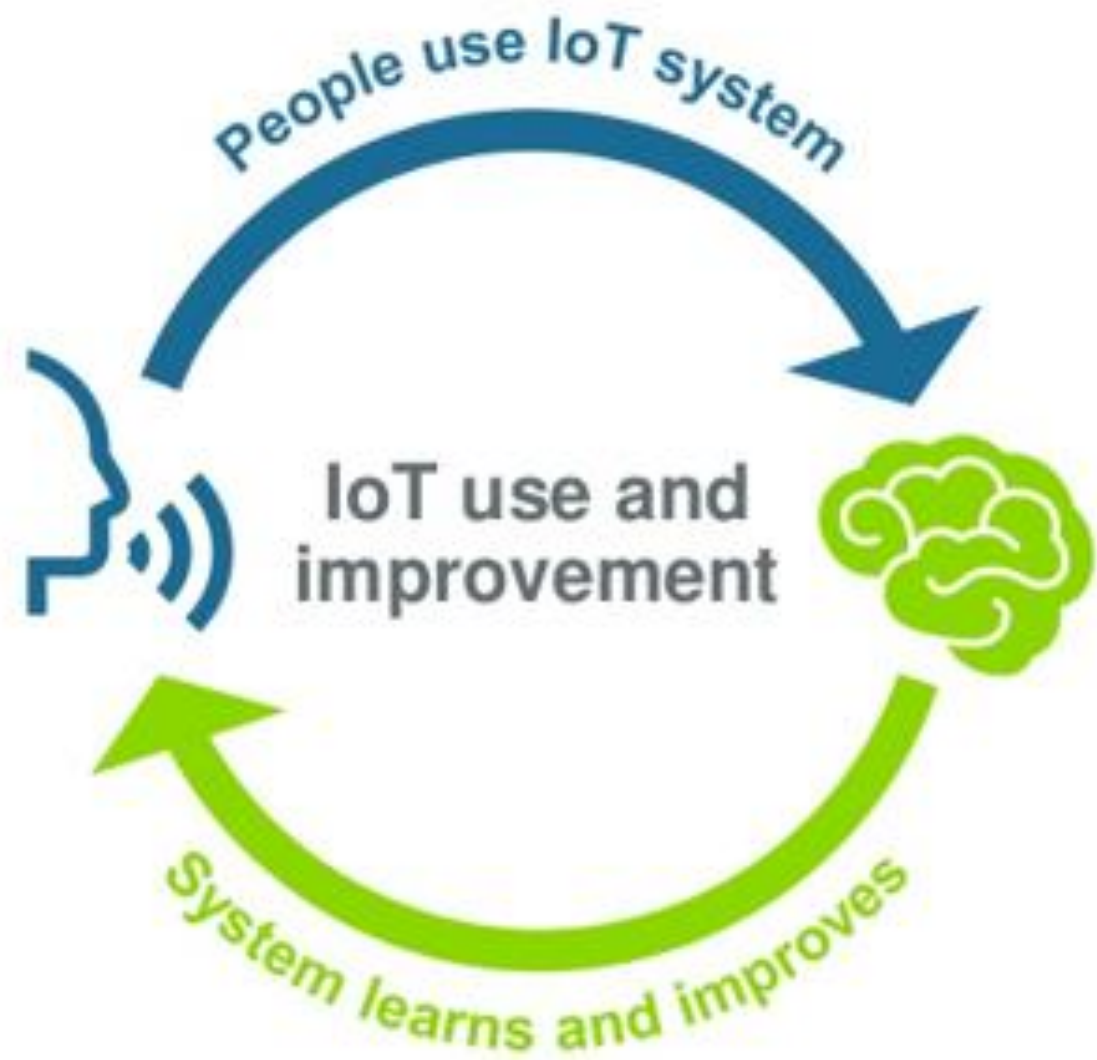
ACCORDING TO CB INSIGHTS,

- AI PATENTS ARE AT AN **ALL TIME HIGH** - 5X 2006
- AI VC INVESTMENT TRIPIED TO **\$2.5 BILLION IN LAST 5 YEARS**



We need an IoT
that is **intelligent
and interoperable**
– meaning, all of
these “things”
need to work
together.

The easier IoT systems are to use, the more we'll use them – and the more we use them – the more intelligent they become.





People drive cars



Cars drive themselves



Siri points you to
airline websites



AI personal assistants book
your flight before you ask



People cook food



Machines learn &
cook from YouTube
videos



Doctors conduct in-
person check-ups



Devices can check
your vitals at home

Sources:

<http://www.sciencelent.com/driverless-cars-could-reduce-traffic-fatalities-by-up-to-90-says-report/>

<http://spectrum.ieee.org/automation/robotics/artificial-intelligence/robots-learning-to-cook-by-watching-youtube-videos>