ARTIFICIAL INTELLIGENCE FOR BUSINESS

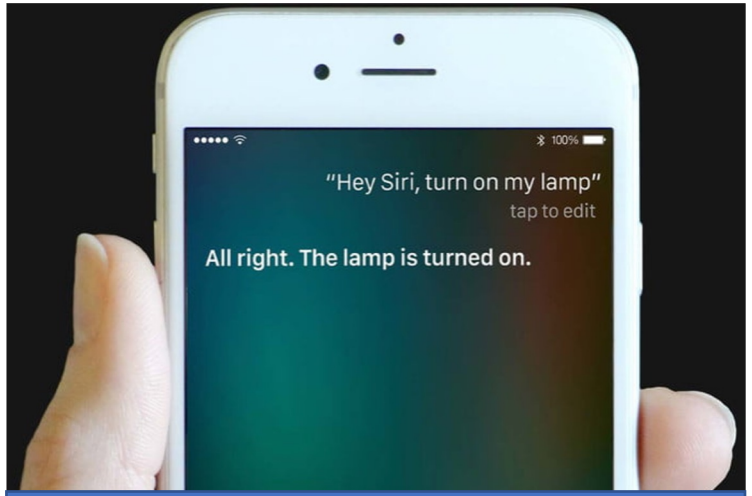
Professor Sameer Maskey
Columbia University

Understanding the Terminology

Self Driving Car

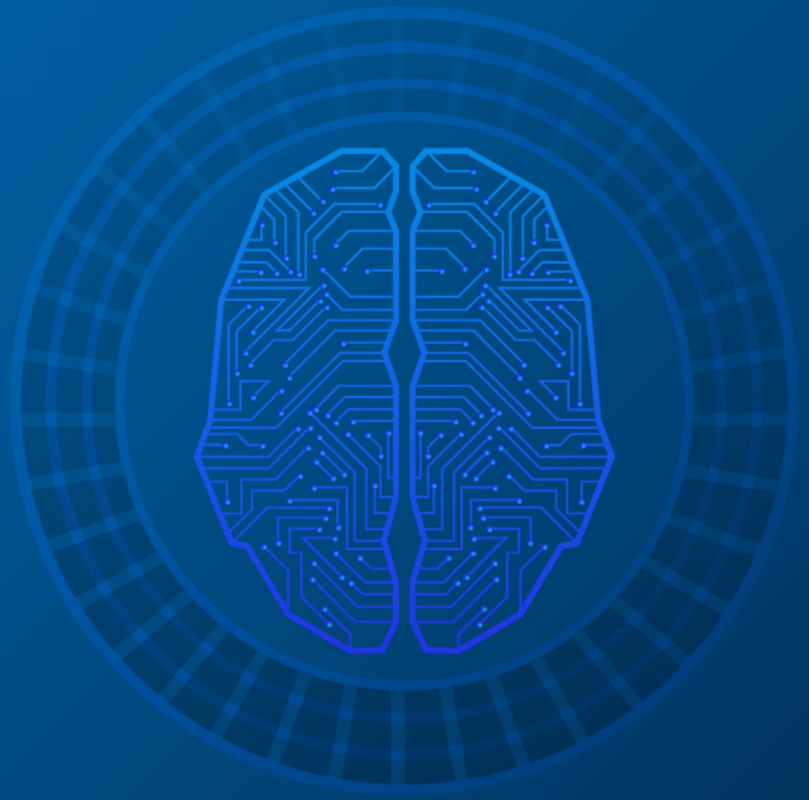
Crop Inspection Drones

Robotic Arm Packing Boxes



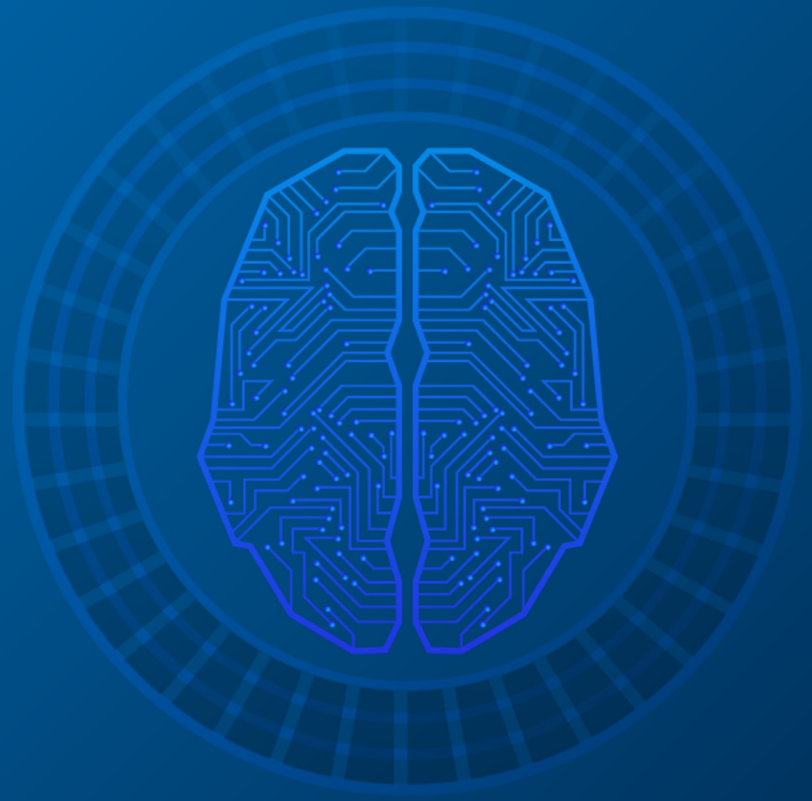
Asking Machine to Turn on Lamp

source: picture from the web



What is **Artificial Intelligence?**

source: picture from the web

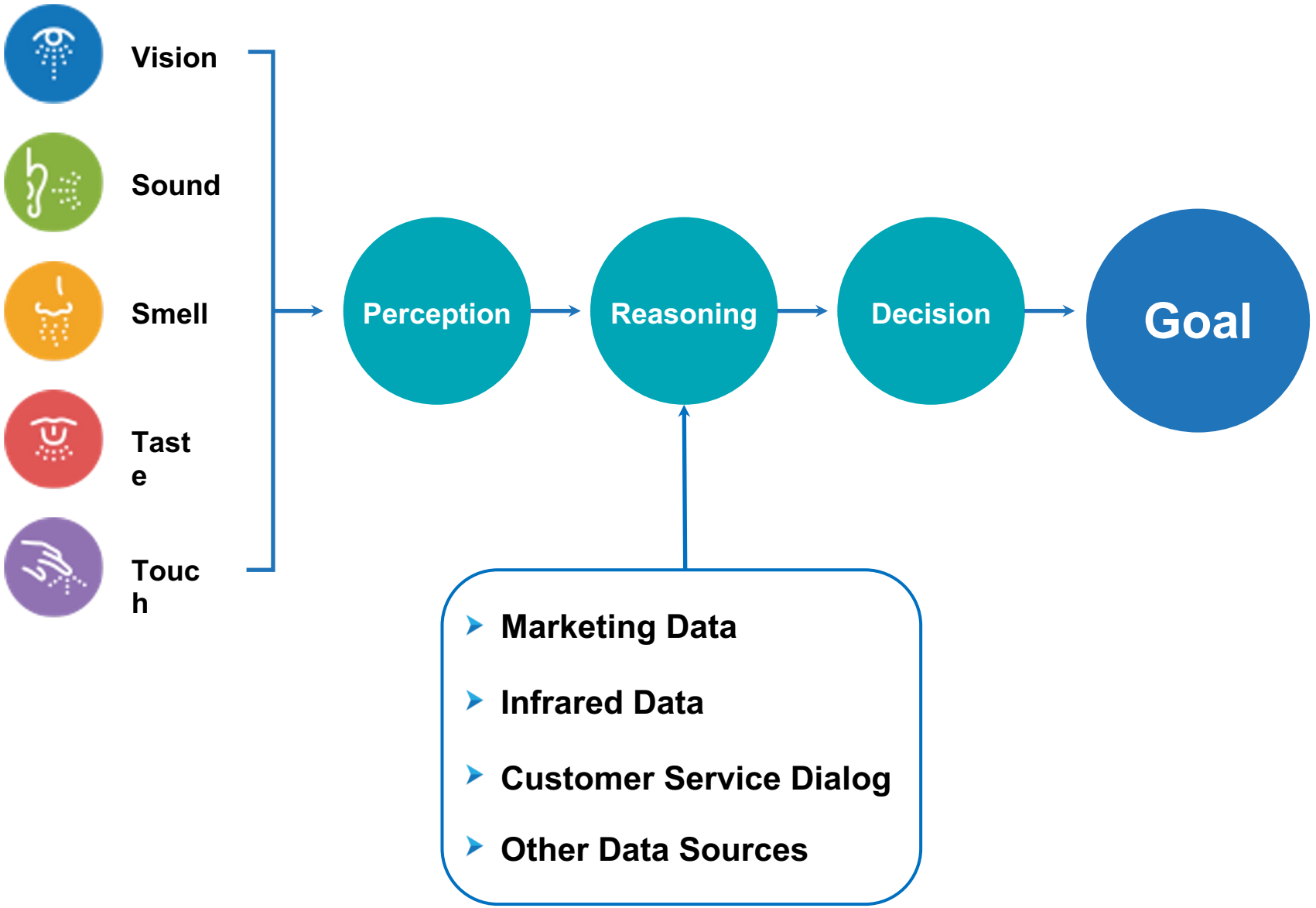


What is **Artificial Intelligence?**

Artificial Intelligence is about building intelligent machines that can perceive, reason and react like humans.

source: picture from the web

Artificial Intelligence



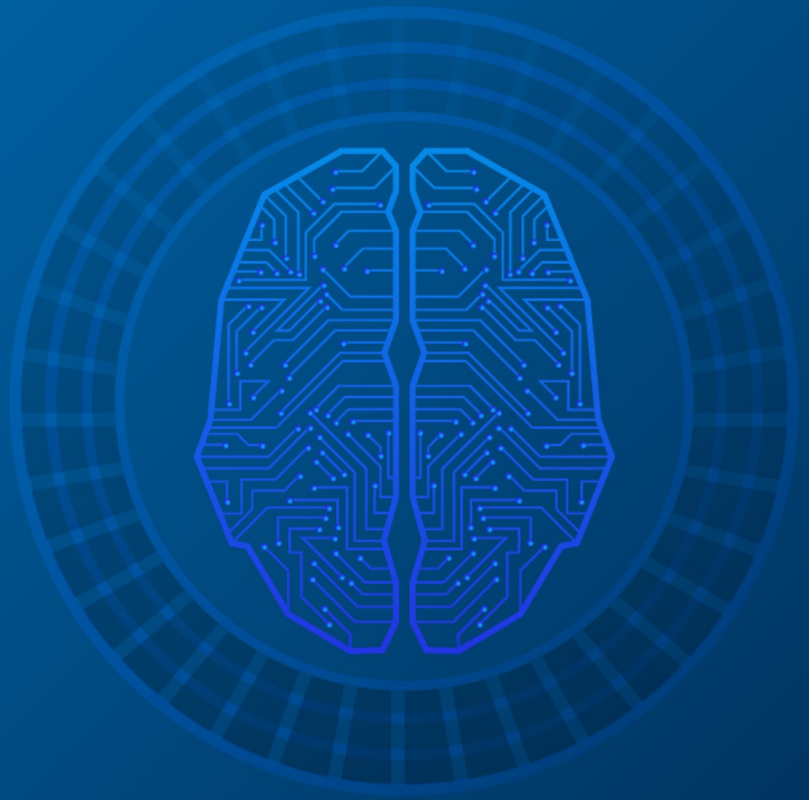
What is **Machine Learning?**

source: picture from the web

What is **Machine Learning?**

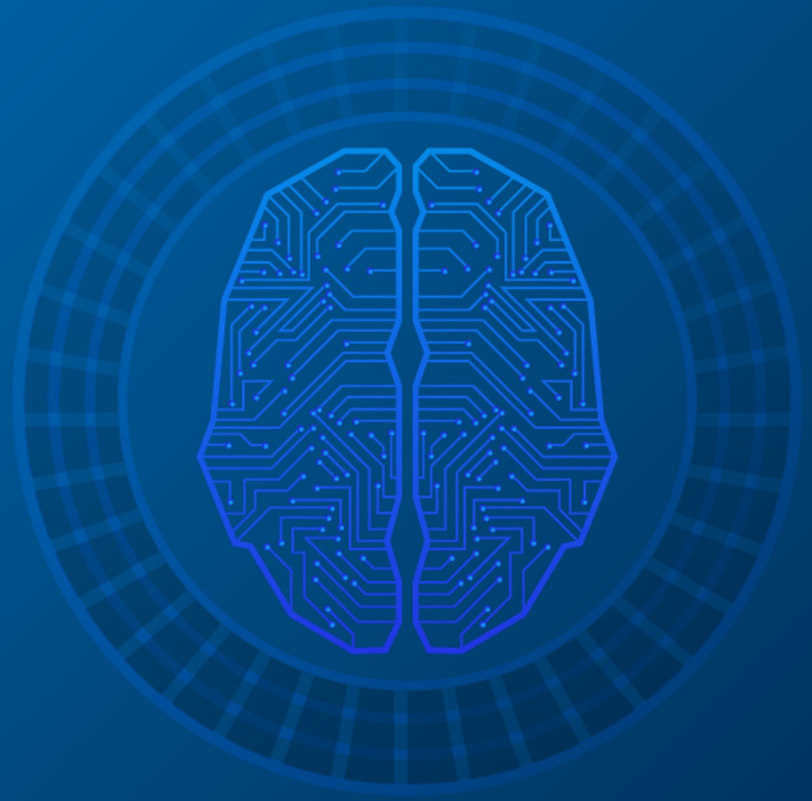
Machine Learning is about building statistical algorithms that allows machines to execute a task without relying on explicit instructions but using patterns on data.

source: picture from the web



What is **Deep Learning?**

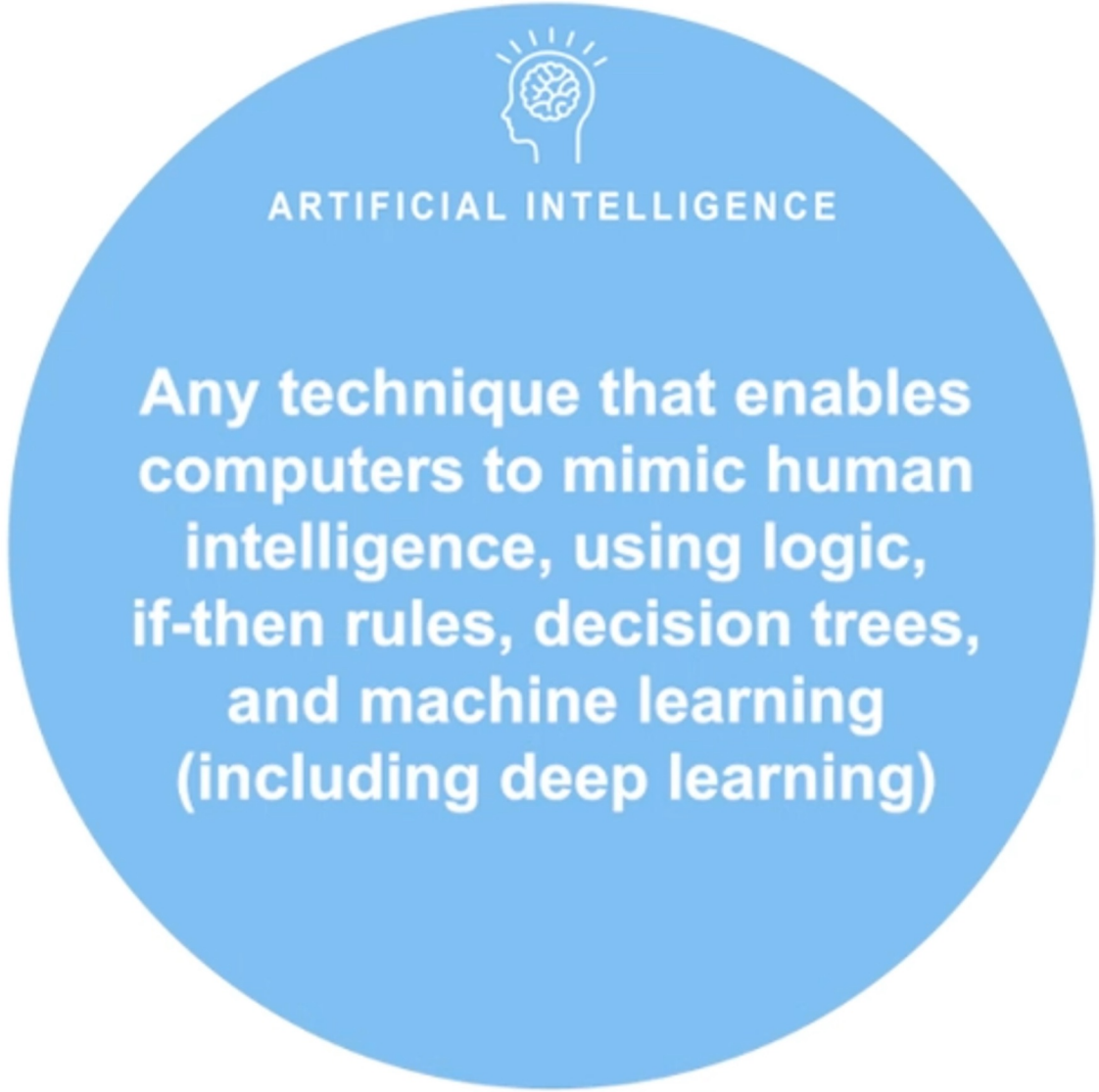
source: picture from the web

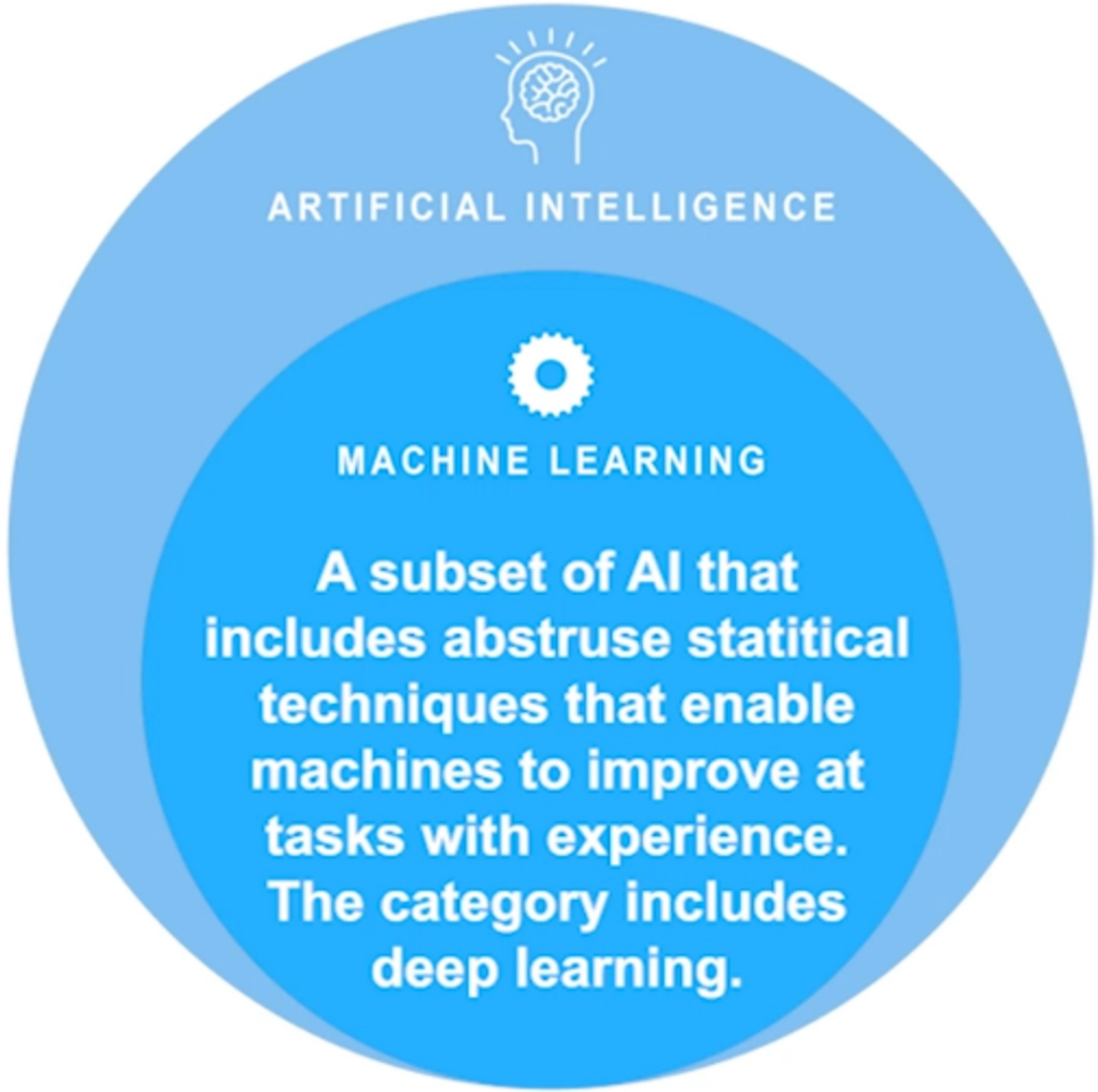


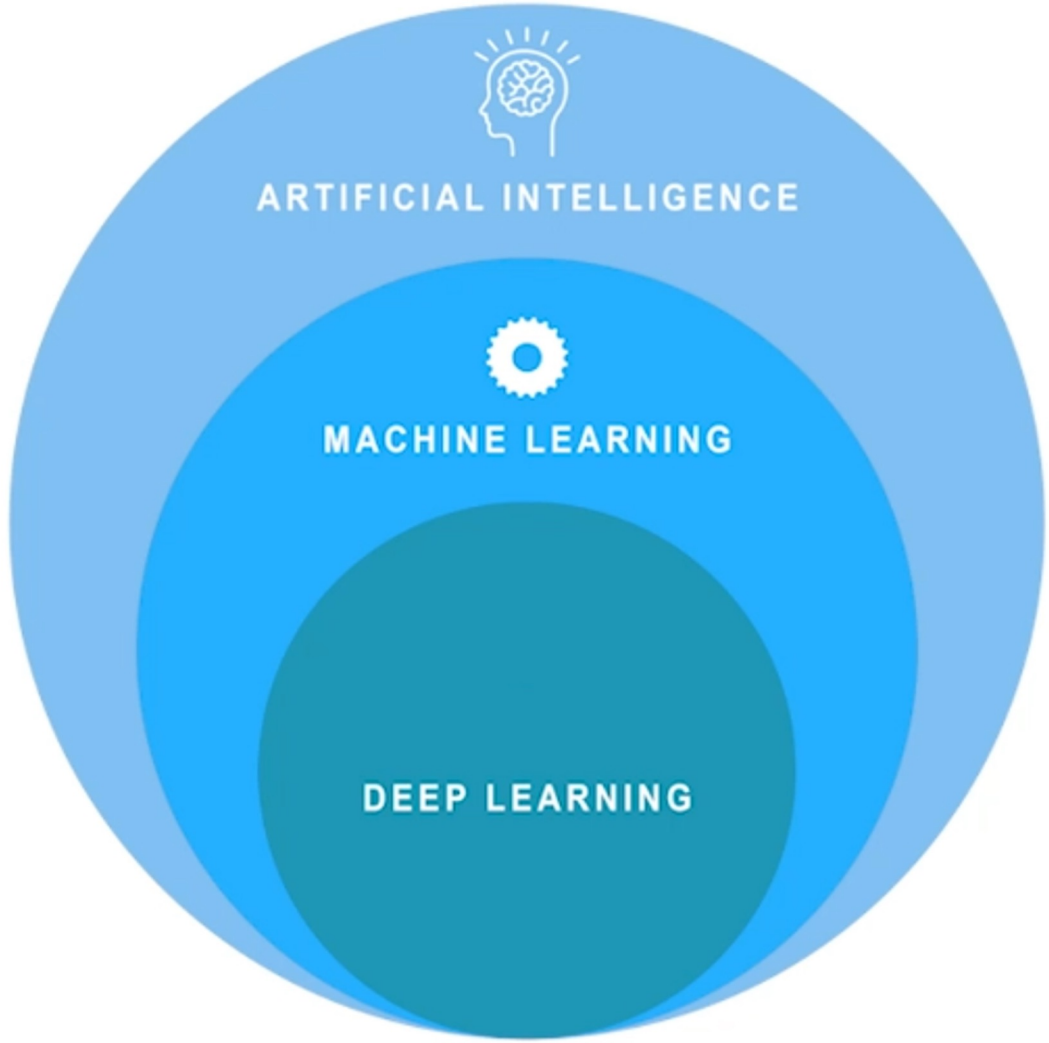
What is **Deep Learning?**

Deep Learning a type of Machine Learning Algorithm that uses layers of neural networks. (Neural Networks are loosely inspired by human brain's network of neurons)

source: picture from the web


ARTIFICIAL INTELLIGENCE
Any technique that enables computers to mimic human intelligence, using logic, if-then rules, decision trees, and machine learning (including deep learning)


ARTIFICIAL INTELLIGENCE
MACHINE LEARNING
A subset of AI that includes abstruse statitical techniques that enable machines to improve at tasks with experience. The category includes deep learning.



The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural networks to vast amount of datas.

Key Takeaway

Machine Learning is the core foundation/tool of most AI and Data Science systems

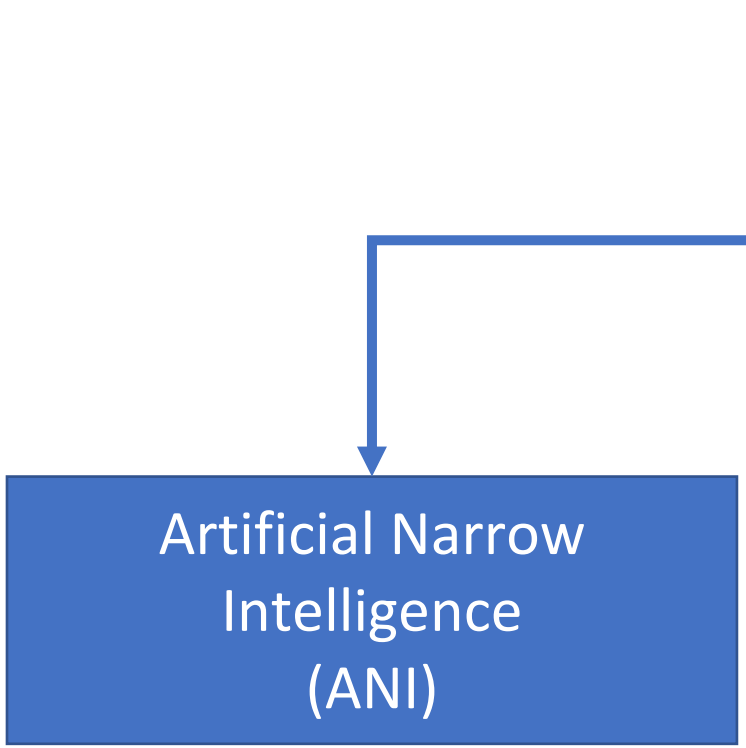
Key Takeaway

Deep Learning is just one type of Machine Learning (ML) Algorithm out of many ML algorithms

Artificial General Intelligence

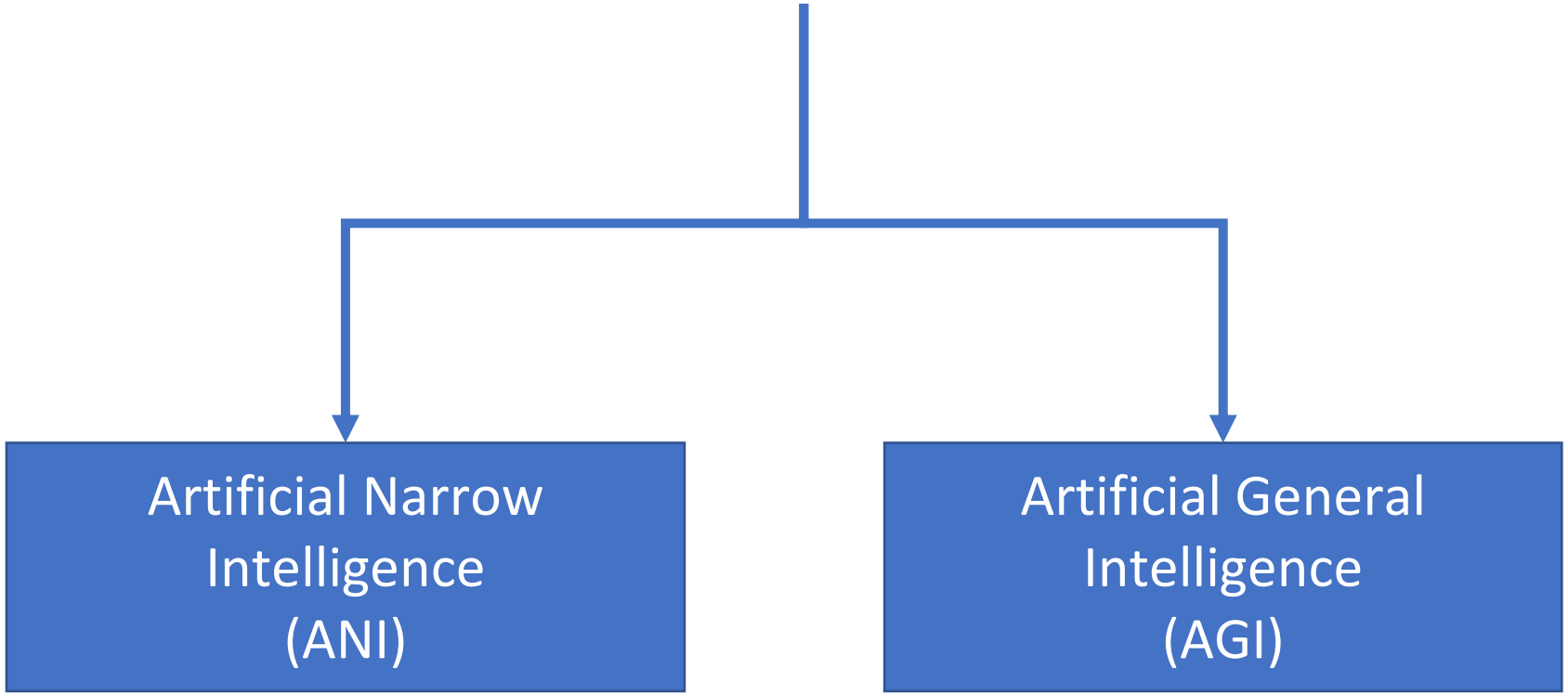
- Machines that can do any cognitive task humans can
- Many tests proposed
  - Turing Test
  - Coffee Test
  - Robot College Student Test
- With this definition of AGI, some distinguish the current form of AI as “narrow AI” or ”Applied AI”

Artificial Intelligence



(Present Day)

Artificial Intelligence

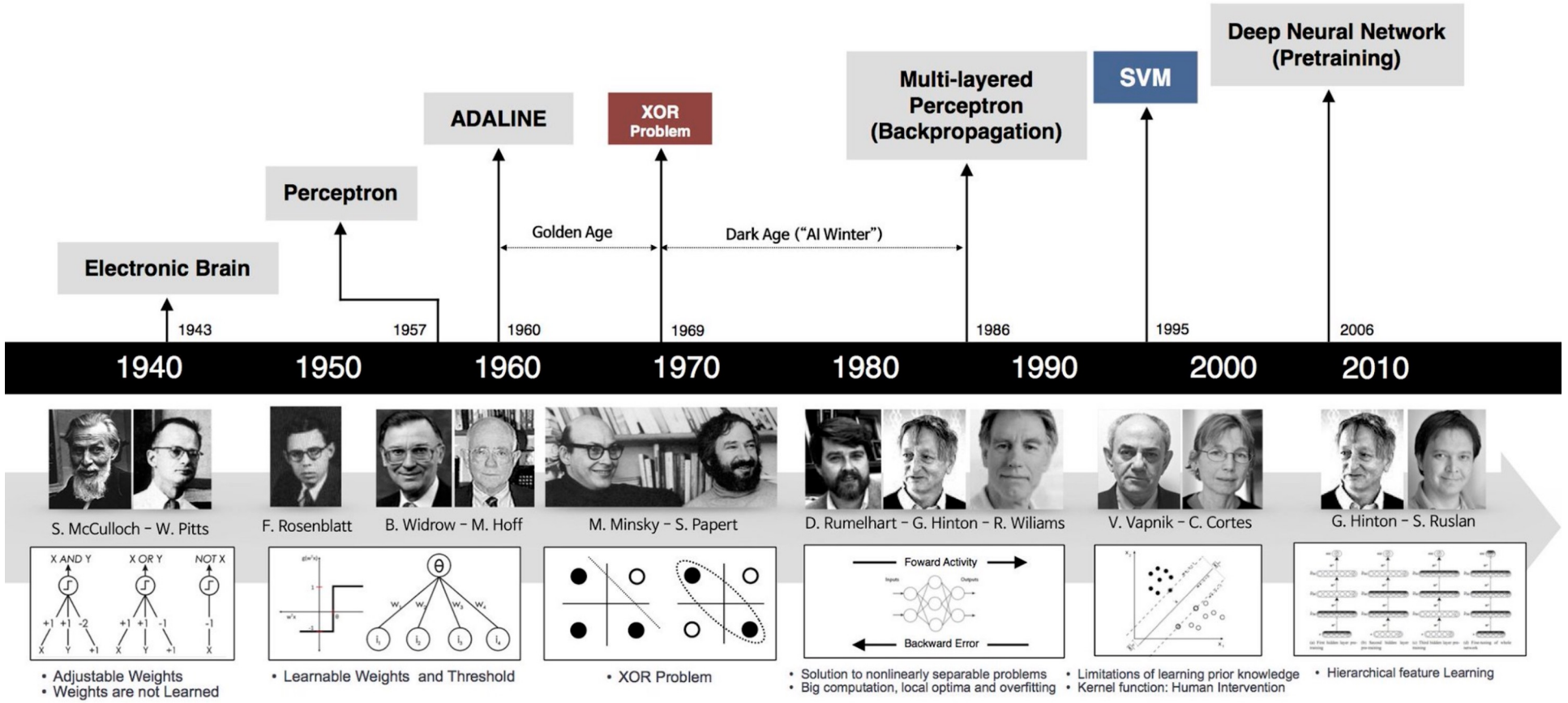


(Present Day)

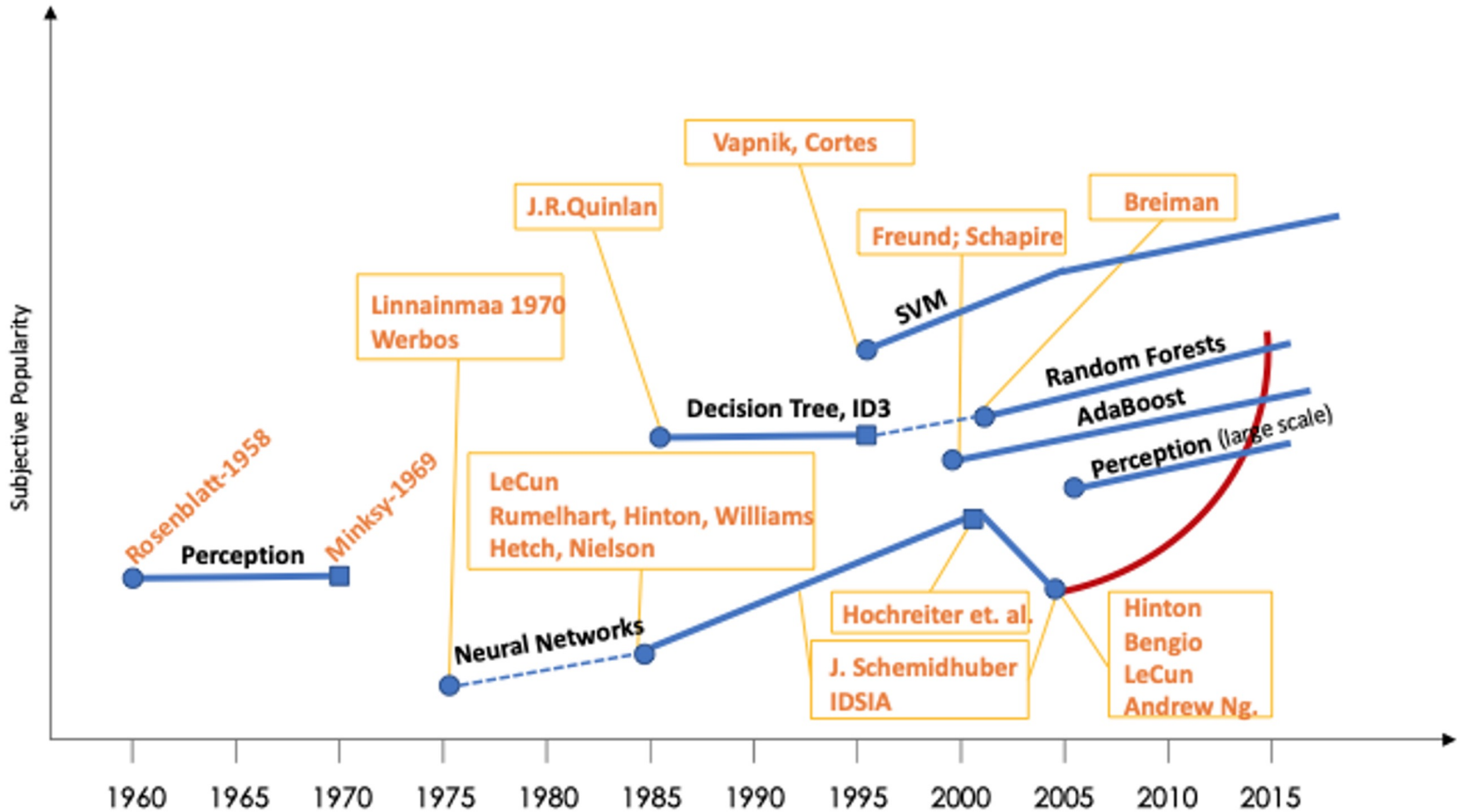
Short History of AI

http://raysolomonoff.com/dartmouth/

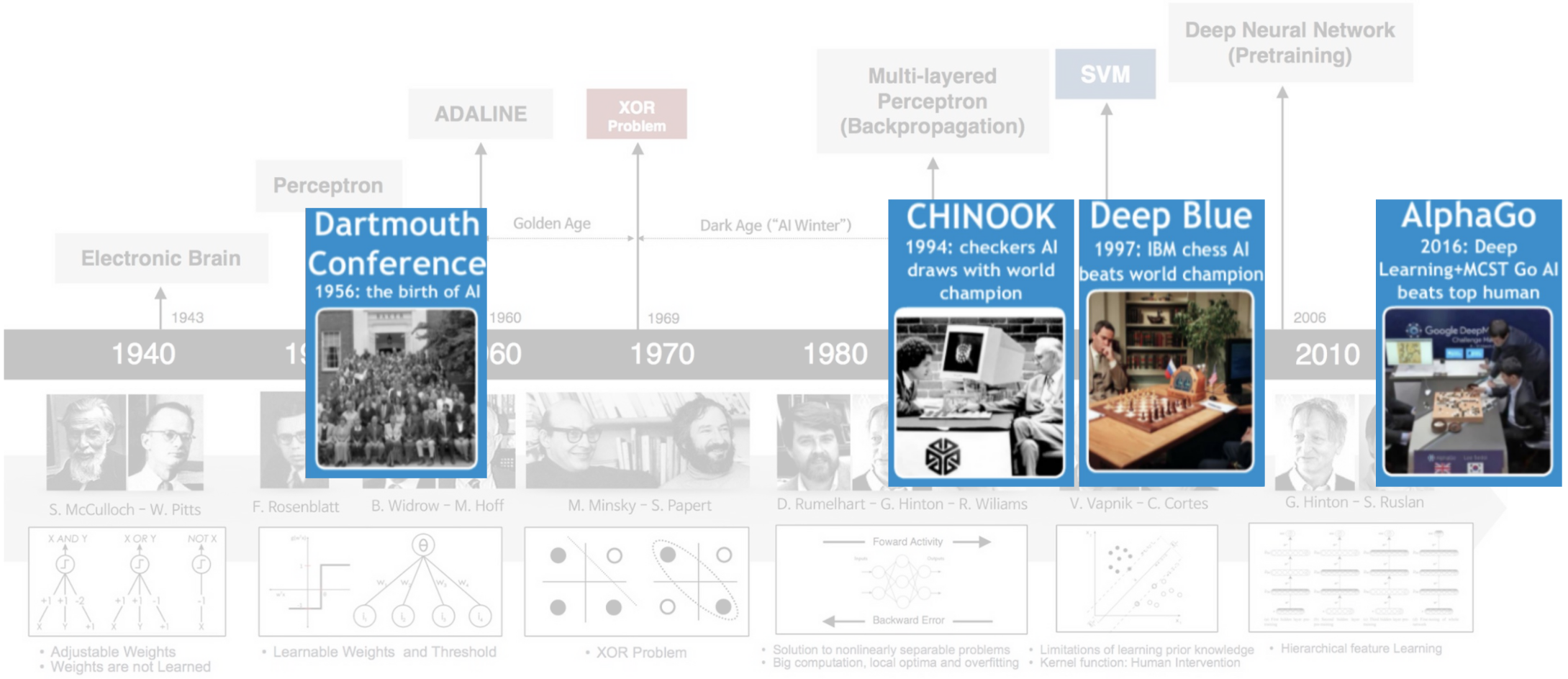
Short AI History



source: picture from the web

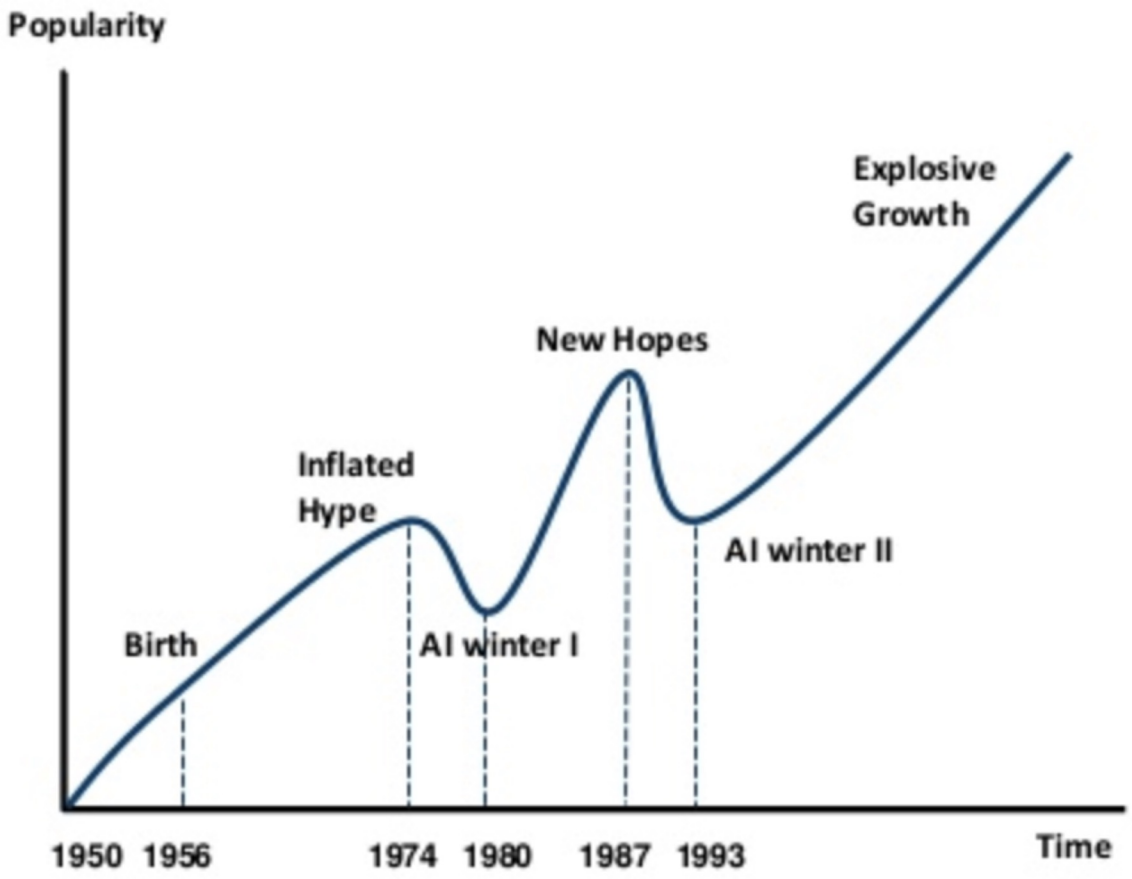

Subjective Popularity
Vapnik, Cortes
J.R.Quinlan
Breiman
Freund; Schapire
Linnainmaa 1970
Werbos
SVM
Random Forests
AdaBoost
Decision Tree, ID3
Perception (large scale)
Rosenblatt-1958
Minksy-1969
Perception
LeCun
Rumelhart, Hinton, Williams
Hetch, Nielson
Neural Networks
Hochreiter et. al.
J. Schemidhuber
IDSIA
Hinton
Bengio
LeCun
Andrew Ng.
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

Short AI History



source: picture from the web

AI Winters



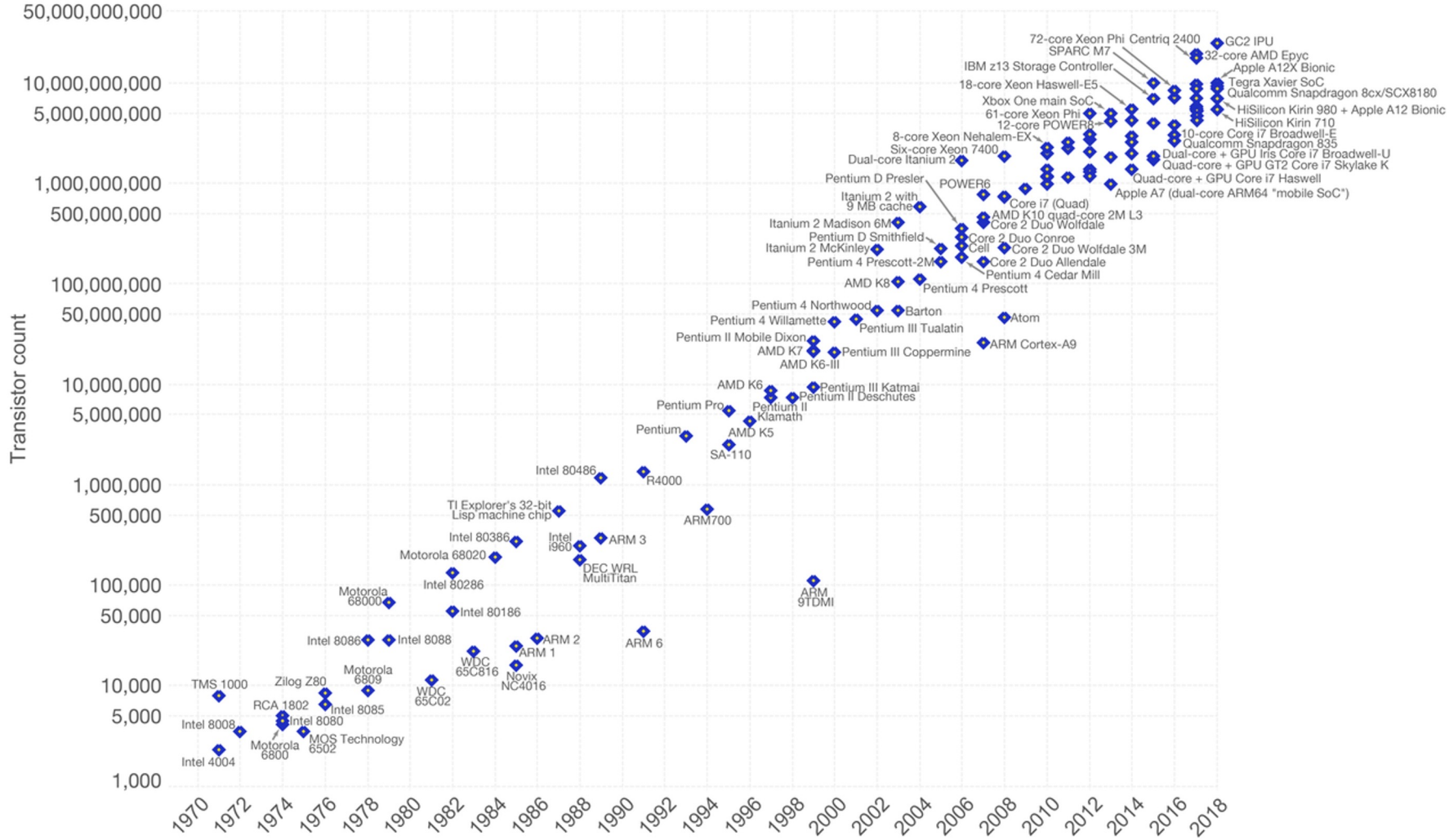
Timeline of AI Development

- **1950s-1960s**: First AI boom - the age of reasoning, prototype AI developed
- **1970s**: AI winter I
- **1980s-1990s**: Second AI boom: the age of Knowledge representation (appearance of expert systems capable of reproducing human decision-making)
- **1990s**: AI winter II
- **1997**: Deep Blue beats Gary Kasparov
- **2006**: University of Toronto develops Deep Learning
- **2011**: IBM's Watson won Jeopardy
- **2016**: Go software based on Deep Learning beats world's champions

Moore's Law – The number of transistors on integrated circuit chips (1971-2018)

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are linked to Moore's law.

Our World in Data

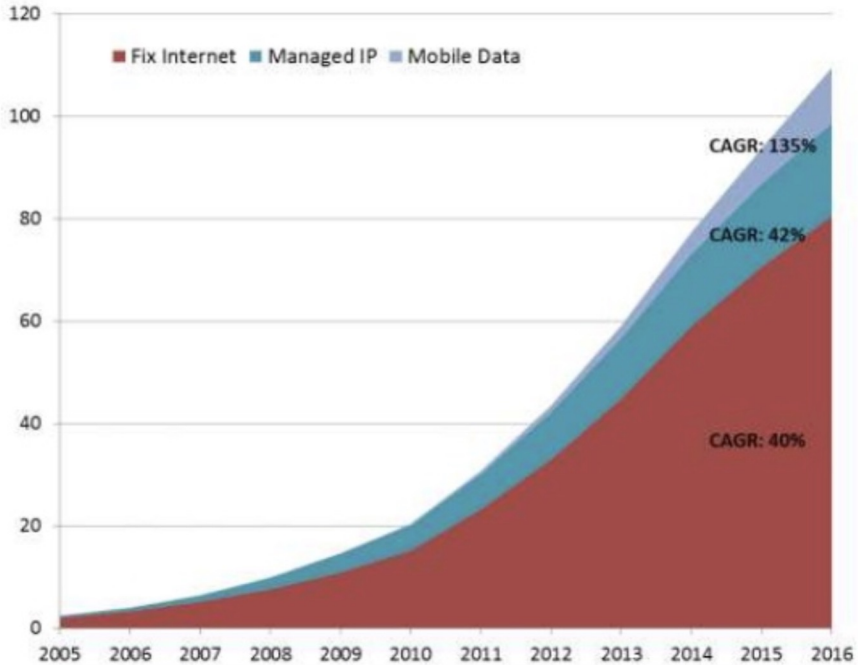


Data source: Wikipedia (https://en.wikipedia.org/wiki/Transistor_count)
The data visualization is available at OurWorldinData.org. There you find more visualizations and research on this topic.

source: picture from the web

Monthly global IP traffic, 2005-16

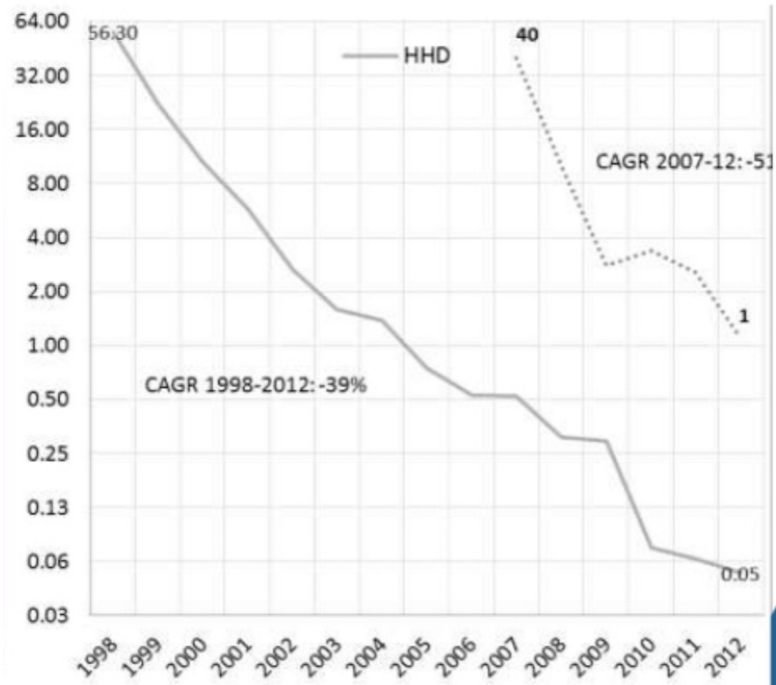
In exabytes (billions of gigabytes)



Source: OECD based on Cisco (2012)

Average data storage cost, 1998-2012

In USD per gigabyte (log scale)



Source: OECD based on Pingdom (2011)

What’s real?

AI Application

Self-Driving Car (Close to reality)

AI Application

Chatbot (Not close to reality)

Close to reality

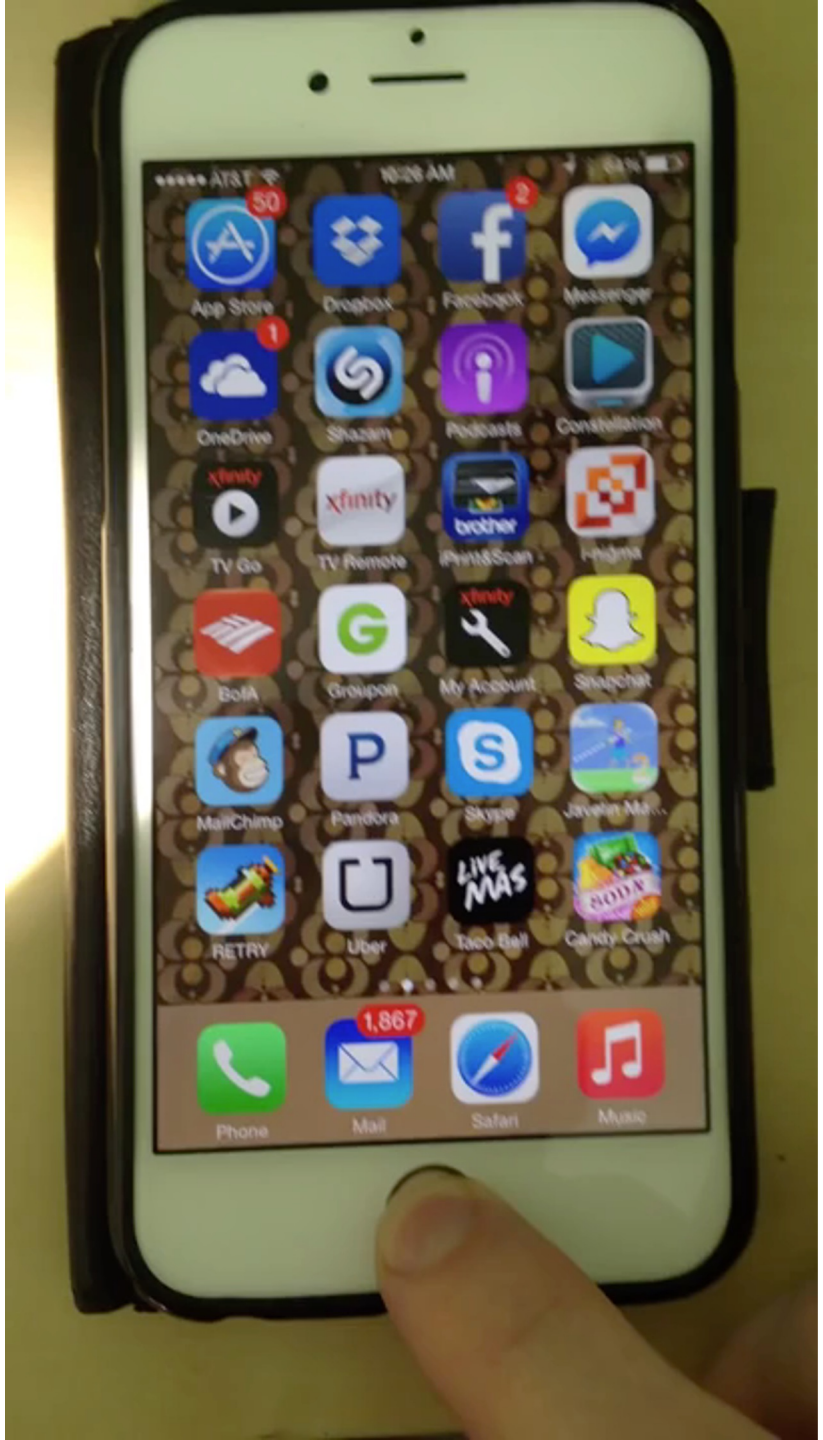
Not close to reality

Auto Driving Tesla

Driver Asleep in Auto Driving Tesla

Easy for humans to learn language
Difficult for machines to learn language

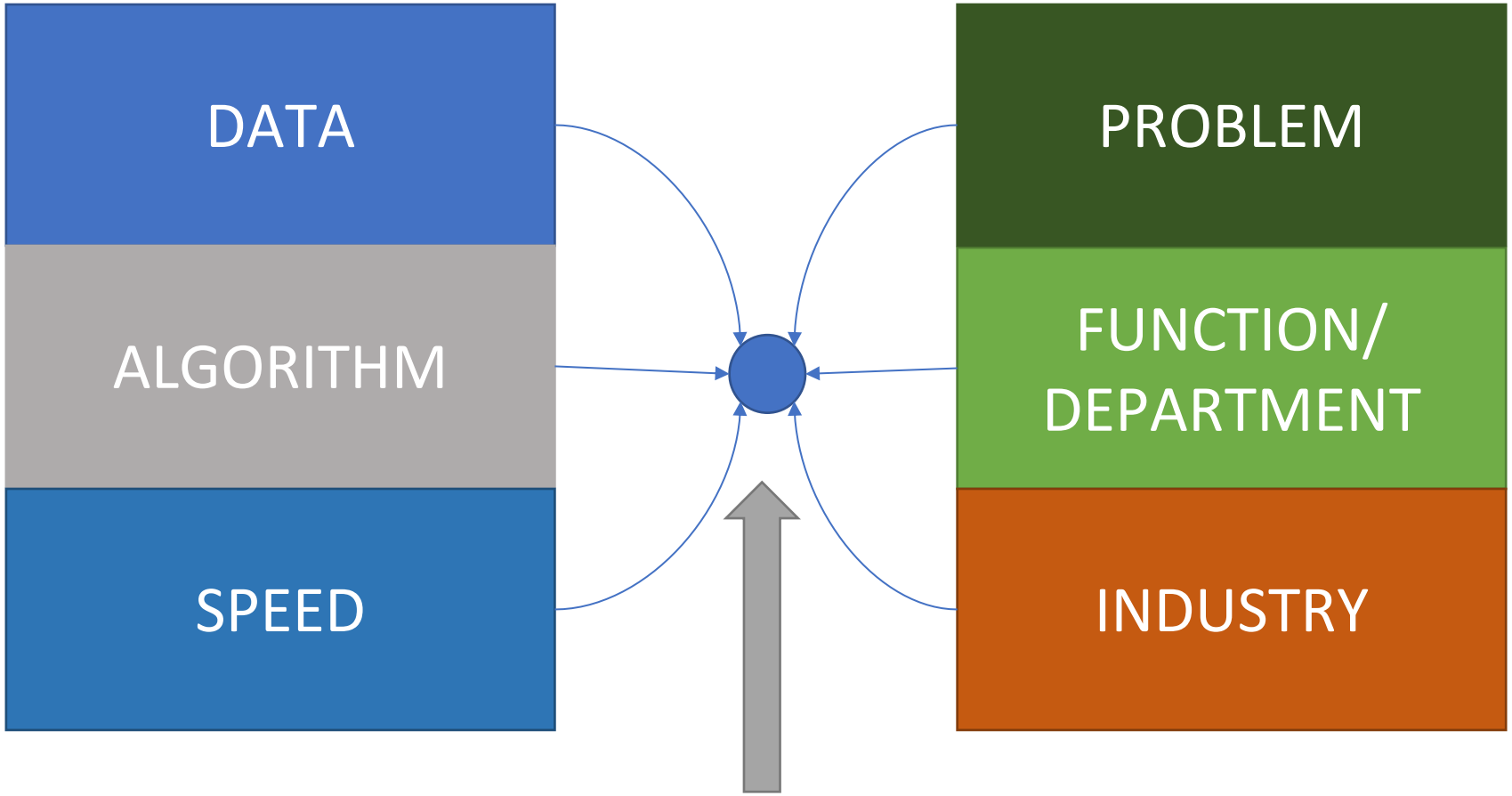
Frustration with Siri



Key Takeaway

Some AI Algorithms have different accuracies across different problems in different industries

AI Solution Factors



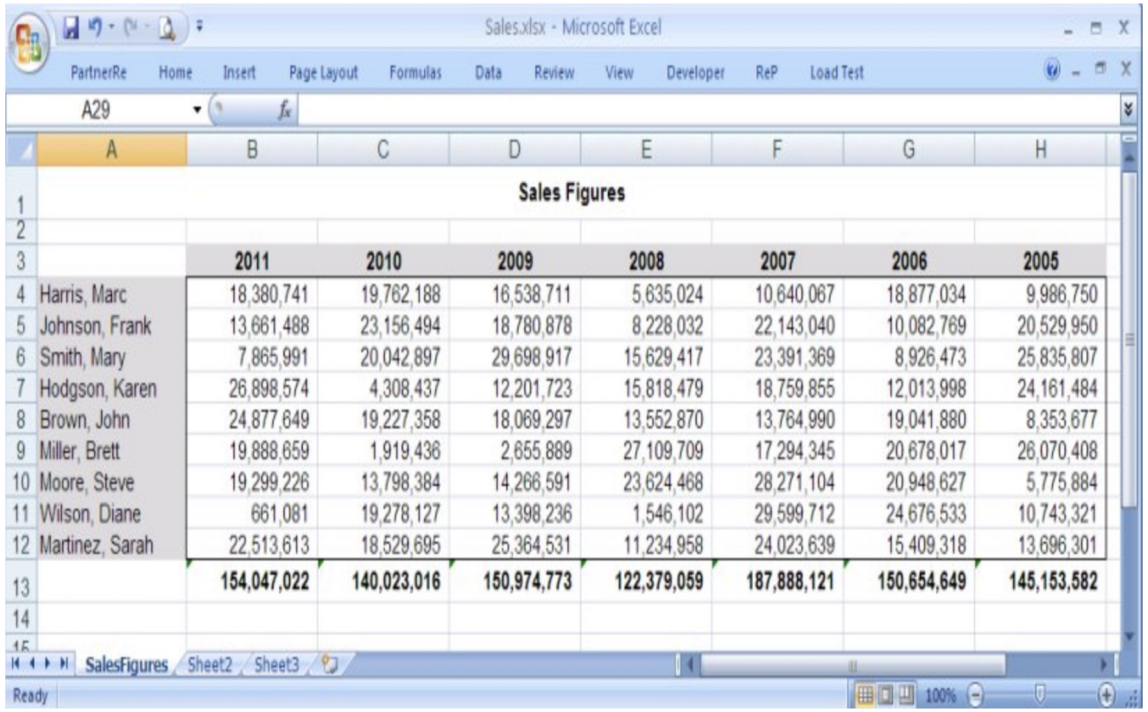
AI SOLUTION
dependent on a combination
of various factors

AI SOLUTION FACTORS

DATA

STRUCTURED

UNSTRUCTURED



Sales.xlsx - Microsoft Excel

PartnerRe Home Insert Page Layout Formulas Data Review View Developer ReP Load Test

A29

	A	B	C	D	E	F	G	H
1	Sales Figures							
2								
3		2011	2010	2009	2008	2007	2006	2005
4	Harris, Marc	18,380,741	19,762,188	16,538,711	5,635,024	10,640,067	18,877,034	9,986,750
5	Johnson, Frank	13,661,488	23,156,494	18,780,878	8,228,032	22,143,040	10,082,769	20,529,950
6	Smith, Mary	7,865,991	20,042,897	29,698,917	15,629,417	23,391,369	8,926,473	25,835,807
7	Hodgson, Karen	26,898,574	4,308,437	12,201,723	15,818,479	18,759,855	12,013,998	24,161,484
8	Brown, John	24,877,649	19,227,358	18,069,297	13,552,870	13,764,990	19,041,880	8,353,677
9	Miller, Brett	19,888,659	1,919,436	2,655,889	27,109,709	17,294,345	20,678,017	26,070,408
10	Moore, Steve	19,299,226	13,798,384	14,266,591	23,624,468	28,271,104	20,948,627	5,775,884
11	Wilson, Diane	661,081	19,278,127	13,398,236	1,546,102	29,599,712	24,676,533	10,743,321
12	Martinez, Sarah	22,513,613	18,529,695	25,364,531	11,234,958	24,023,639	15,409,318	13,696,301
13		154,047,022	140,023,016	150,974,773	122,379,059	187,888,121	150,654,649	145,153,582
14								

SalesFigures Sheet2 Sheet3

Ready 100%

```
weblogic.application.utils.StateMachineDriver.nextState(StateMachineDriver.java:26)
>
####<Dec 29, 2006 2:14:24 PM IST> <Notice> <Log Management> <svaidyan02> <xbusServer>
<[ACTIVE] ExecuteThread: '0' for queue: 'weblogic.kernel.Default (self-tuning)'> <<WLS
Kernel>> <> <> <1167381864275> <BEA-170027> <The server initialized the domain log
broadcaster successfully. Log messages will now be broadcasted to the domain log.>
####<Dec 29, 2006 2:14:24 PM IST> <Notice> <WebLogicServer> <svaidyan02> <xbusServer> <Main
Thread> <<WLS Kernel>> <> <> <1167381864976> <BEA-000365> <Server state changed to ADMIN>
####<Dec 29, 2006 2:14:24 PM IST> <Notice> <WebLogicServer> <svaidyan02> <xbusServer> <Main
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<1167381868541> <BEA-090171> <Loading the identity certificate and private key stored under
the alias DemoIdentity from the jks keystore file
C:\bea2613a\WEBLOG~1\server\lib\DemoIdentity.jks.>
####<Dec 29, 2006 2:14:29 PM IST> <Notice> <Security> <svaidyan02> <xbusServer> <[STANDBY]
ExecuteThread: '5' for queue: 'weblogic.kernel.Default (self-tuning)'> <<WLS Kernel>> <> <>
<1167381869643> <BEA-090169> <Loading trusted certificates from the jks keystore file
C:\bea2613a\WEBLOG~1\server\lib\DemoTrust.jks.>
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<1167381869713> <BEA-090169> <Loading trusted certificates from the jks keystore file
C:\bea2613a\JROCKI~1\jre\lib\security\cacerts.>
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<DynamicSSLListenThread[DefaultSecure[1]]> <<WLS Kernel>> <> <> <1167381932743> <BEA-002611>
<Hostname "svaidyan02.apac.bea.com", maps to multiple IP addresses: 192.168.1.5,
172.22.56.120>
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ExecuteThread: '5' for queue: 'weblogic.kernel.Default (self-tuning)'> <<WLS Kernel>> <> <>
<1167381932753> <BEA-002613> <Channel "Default[2]" is now listening on 127.0.0.1:7021 for
```
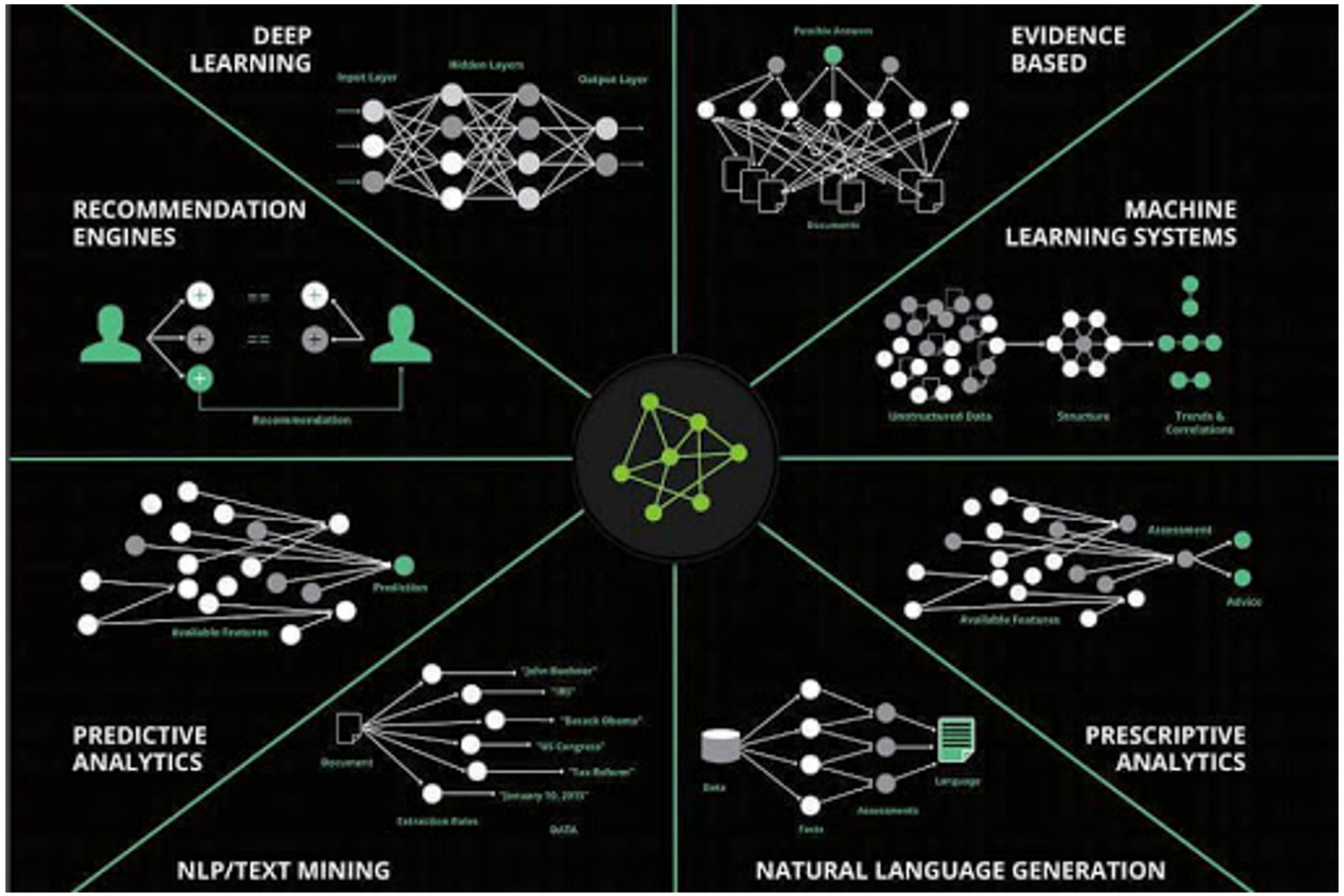
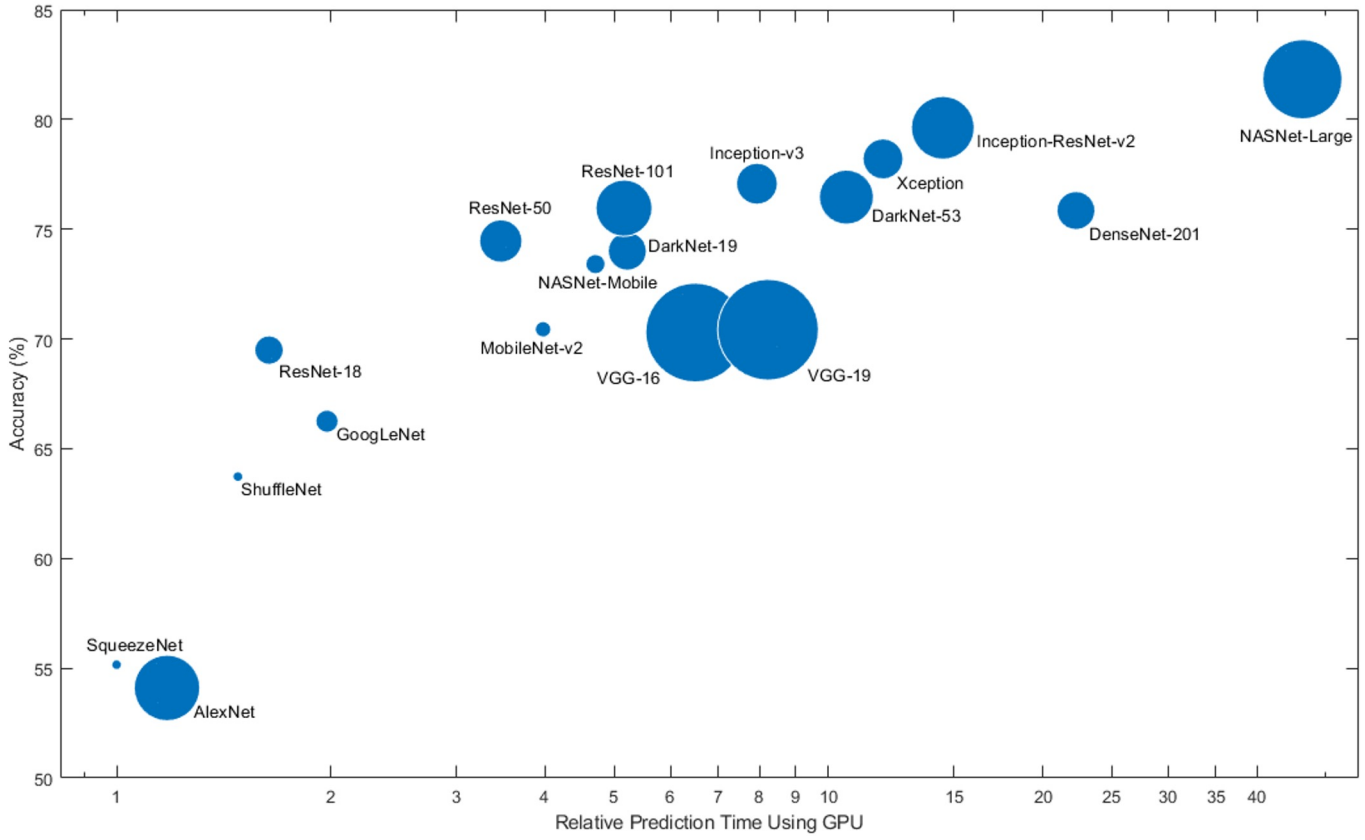

AI SOLUTION FACTORS

ALGORITHM

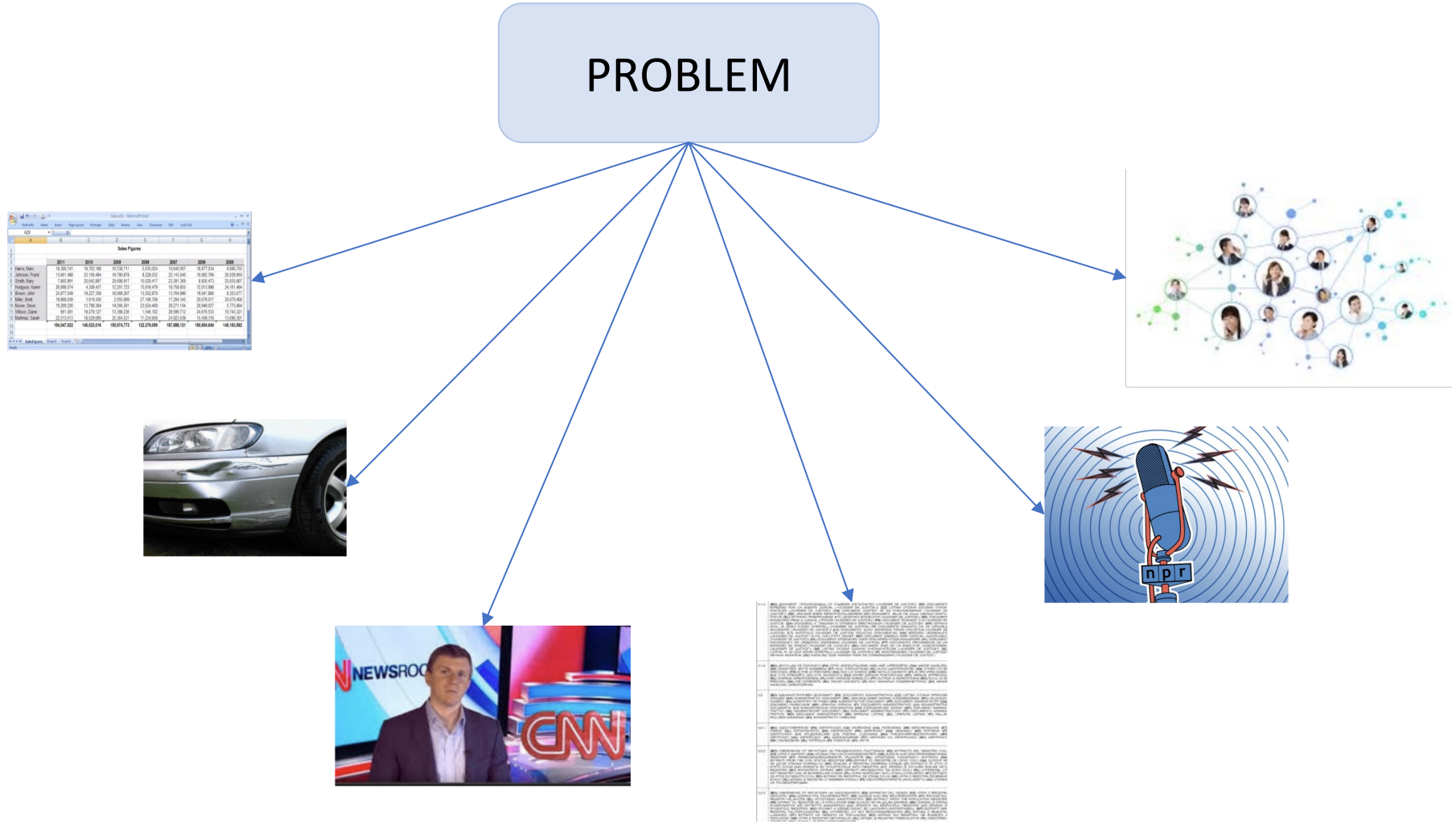


AI SOLUTION FACTORS

SPEED

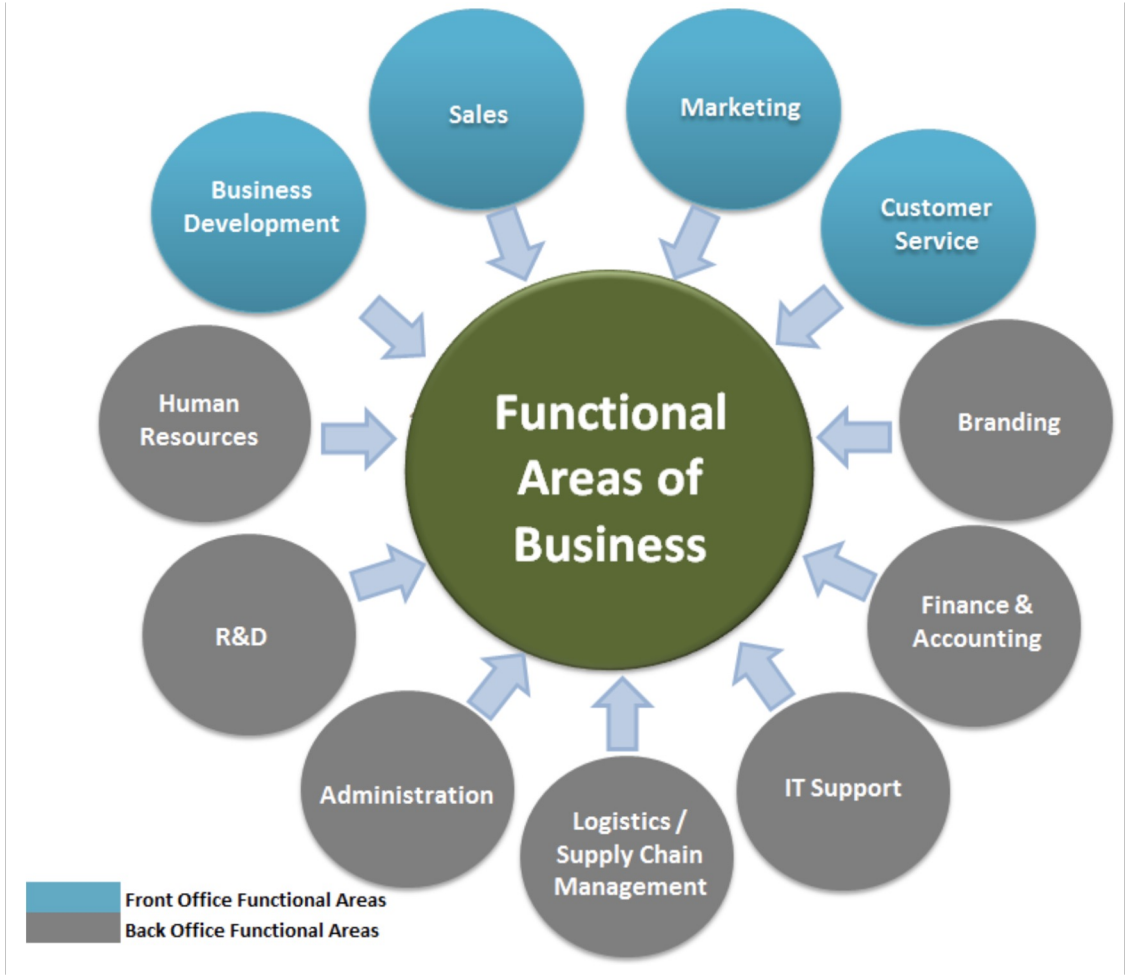


AI SOLUTION FACTORS



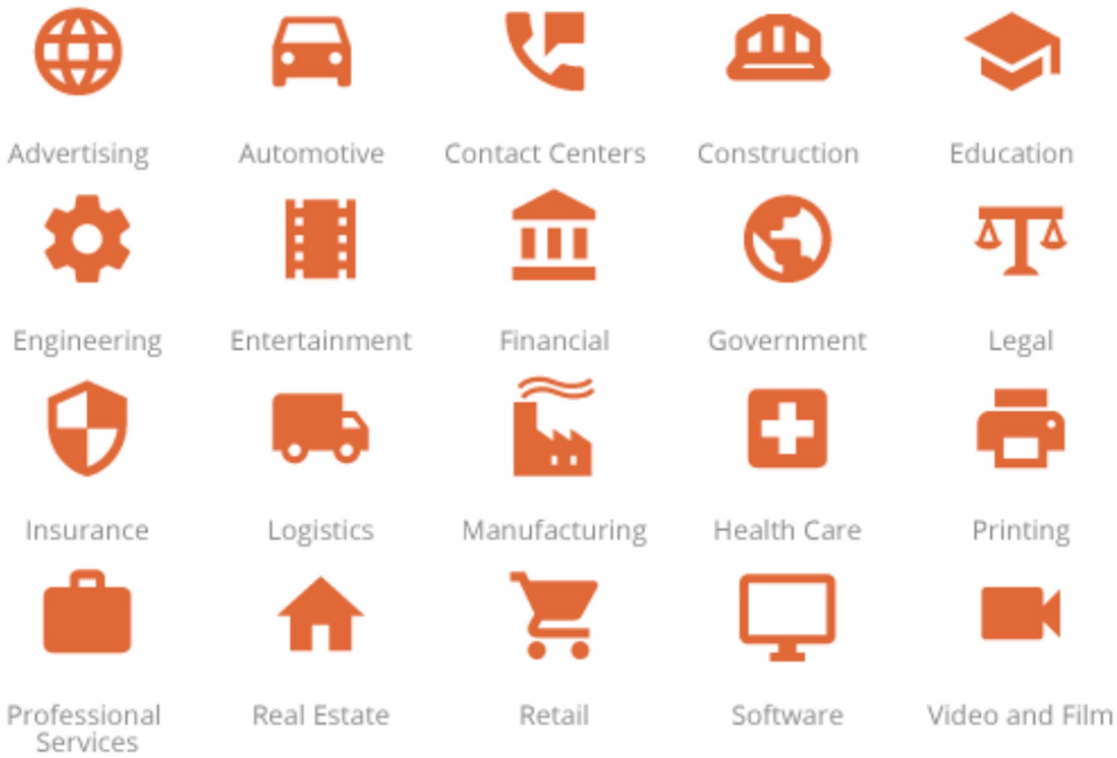
AI SOLUTION FACTORS

FUNCTION /DEPARTMENT

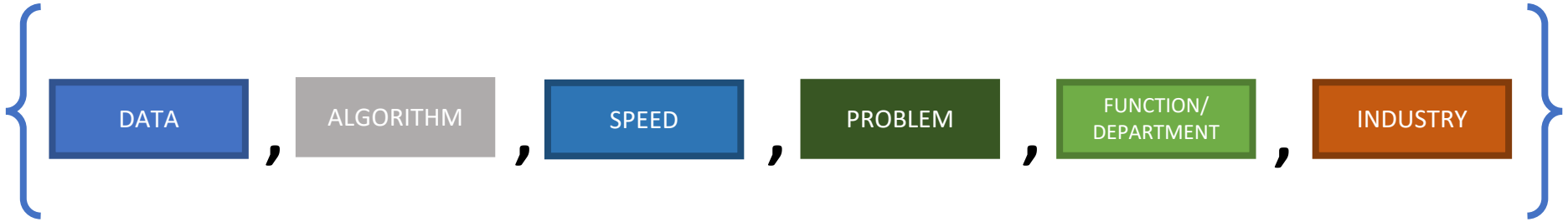


AI SOLUTION FACTORS

INDUSTRY

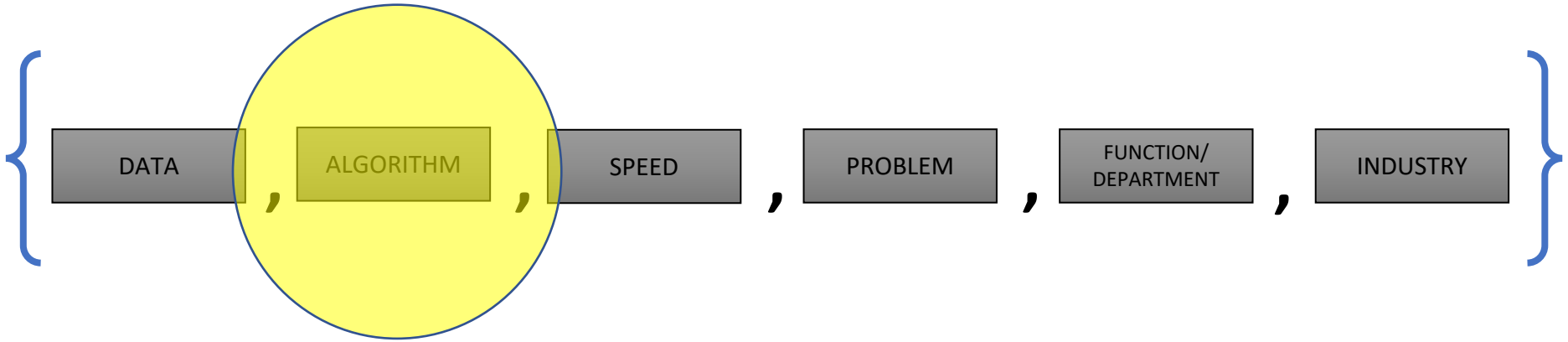


Combination of Various Factors Make AI Solutions Unique



AI Solution is unique for the given combination of factors.

Combination of Various Factors Make AI Solutions Unique



AI Solution is unique for the given combination of factors.