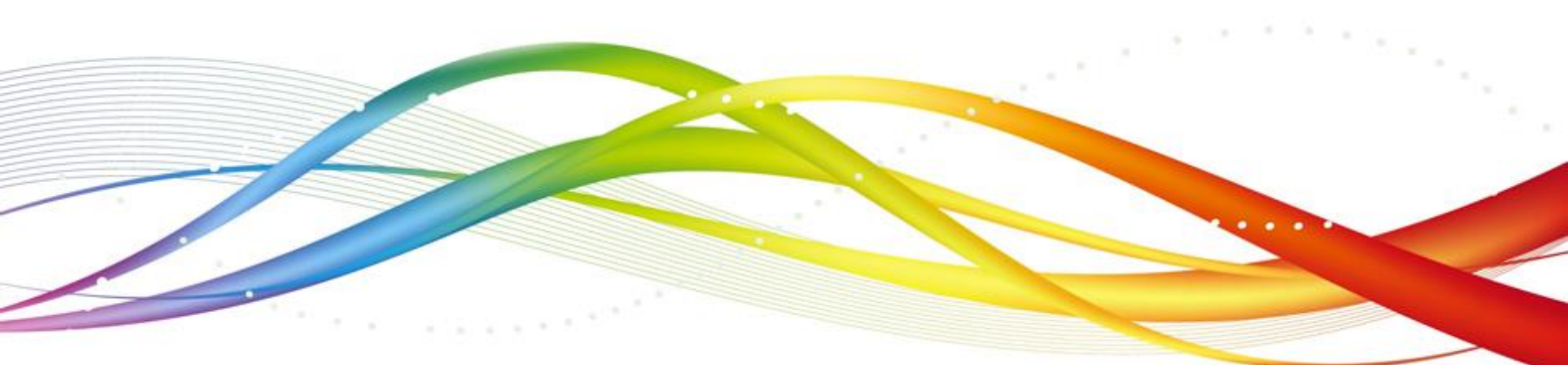# Applied Artificial Intelligence – Machine Learning L1 – An Introduction

Snehalatha N
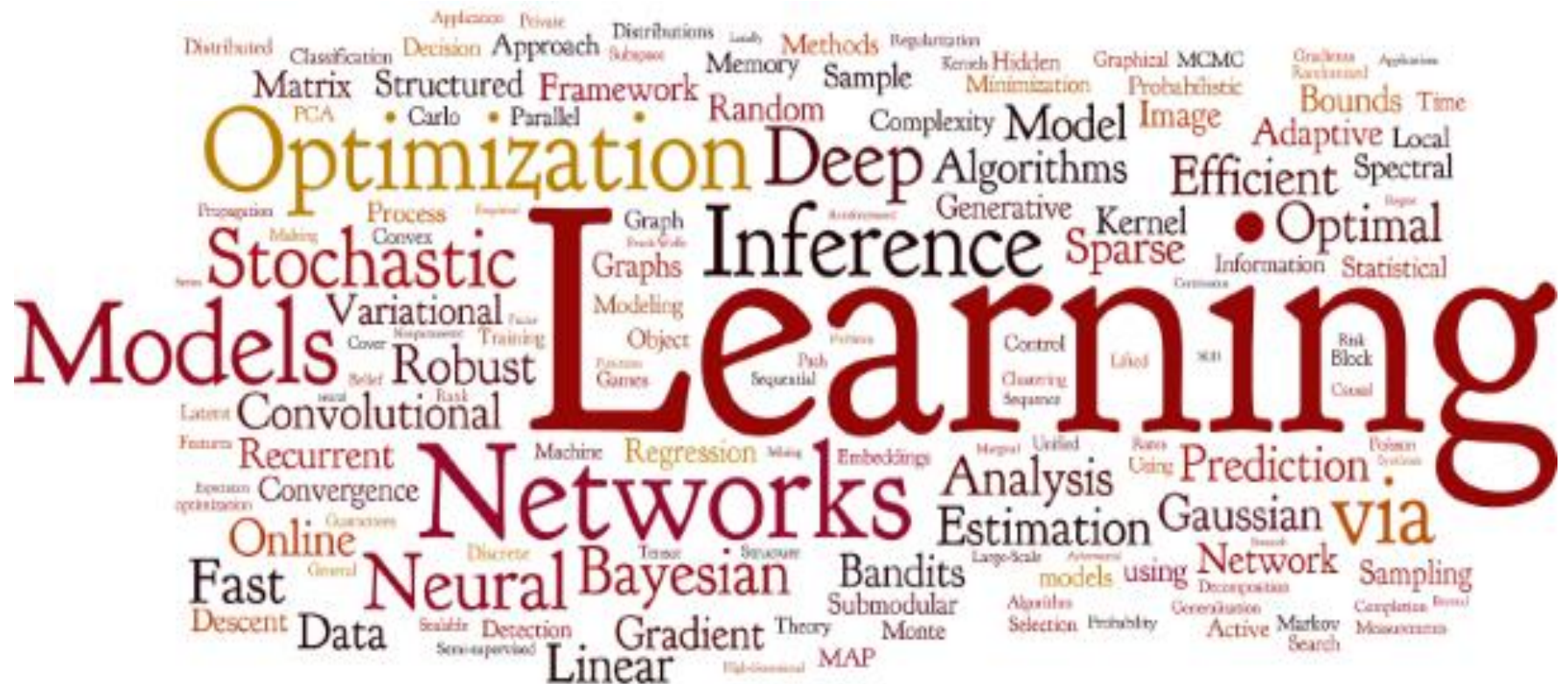
Agenda

1 **What is Artificial Intelligence**

2 **Timeline, Gartner's Hype Cycle, Forrester Research**

3 **Key Players and Focus Areas**

4 **NLP and Machine Learning**

5 **AI Applications and Eco System**

6 **AI Agents**

Artificial Intelligence

Artificial Intelligence

Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans.

Some of the activities computers with artificial intelligence are designed for include:
Speech recognition
Learning
Planning
Problem solving

Artificial Intelligence

Artificial intelligence is a branch of computer science that aims to create intelligent machines

Machines that mimic the cognitive functions that humans associate with other human minds, such as "learning and "problem solving".
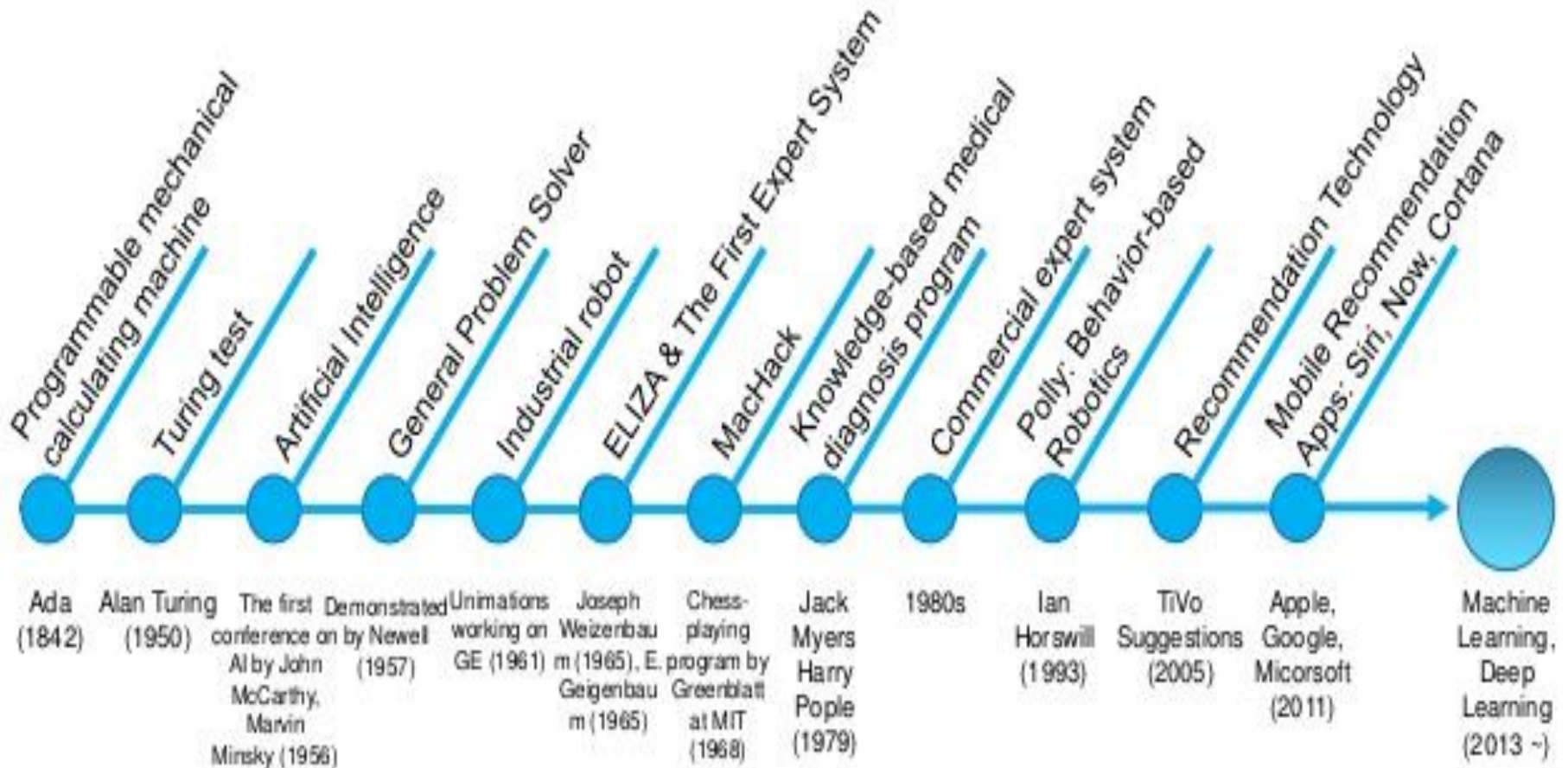
Artificial Intelligence

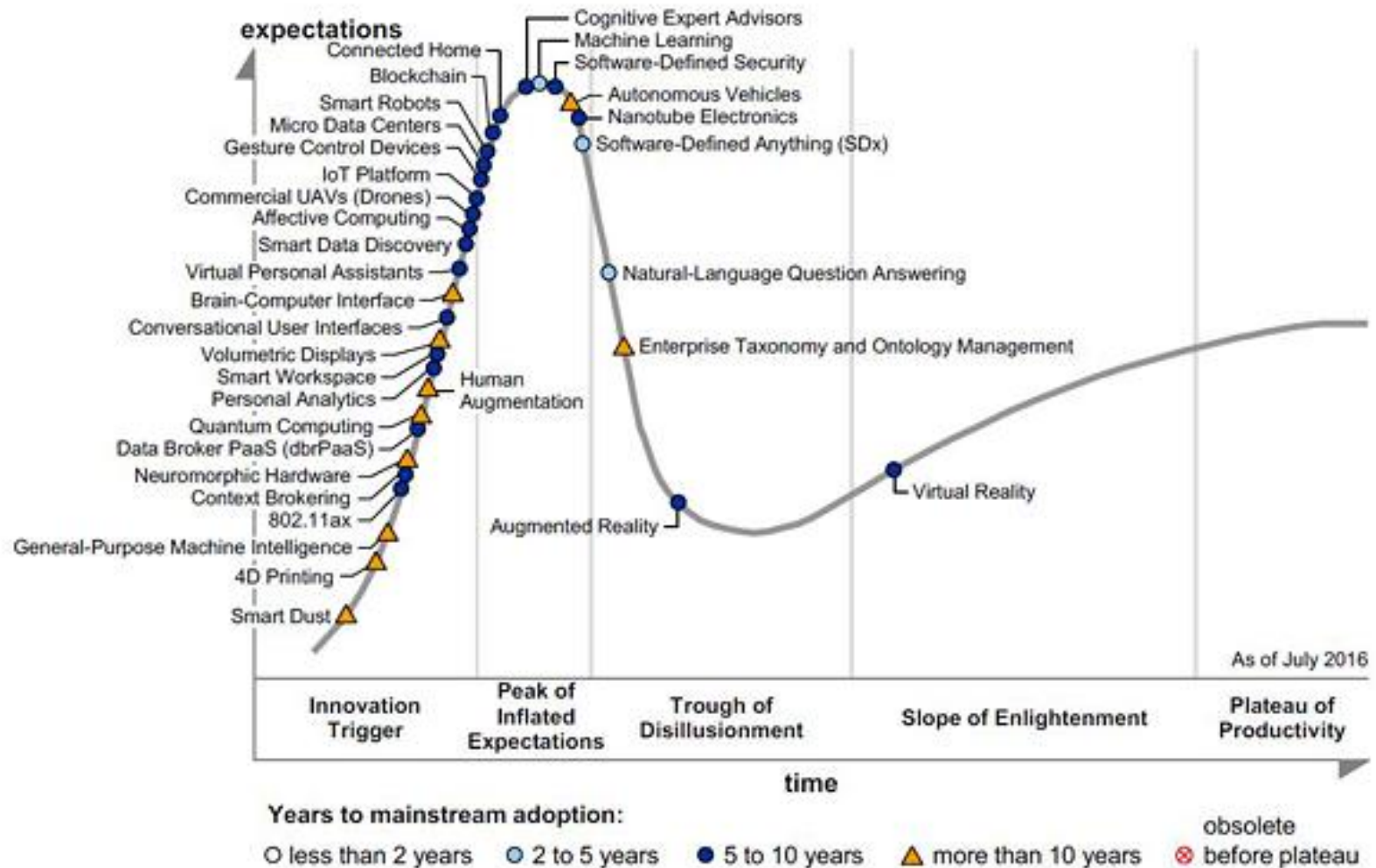"In the next 10 years, the shift will be towards a world that is AI-first"

Sundar Pinchai, CEO, Google

Artificial Intelligence : Time Line

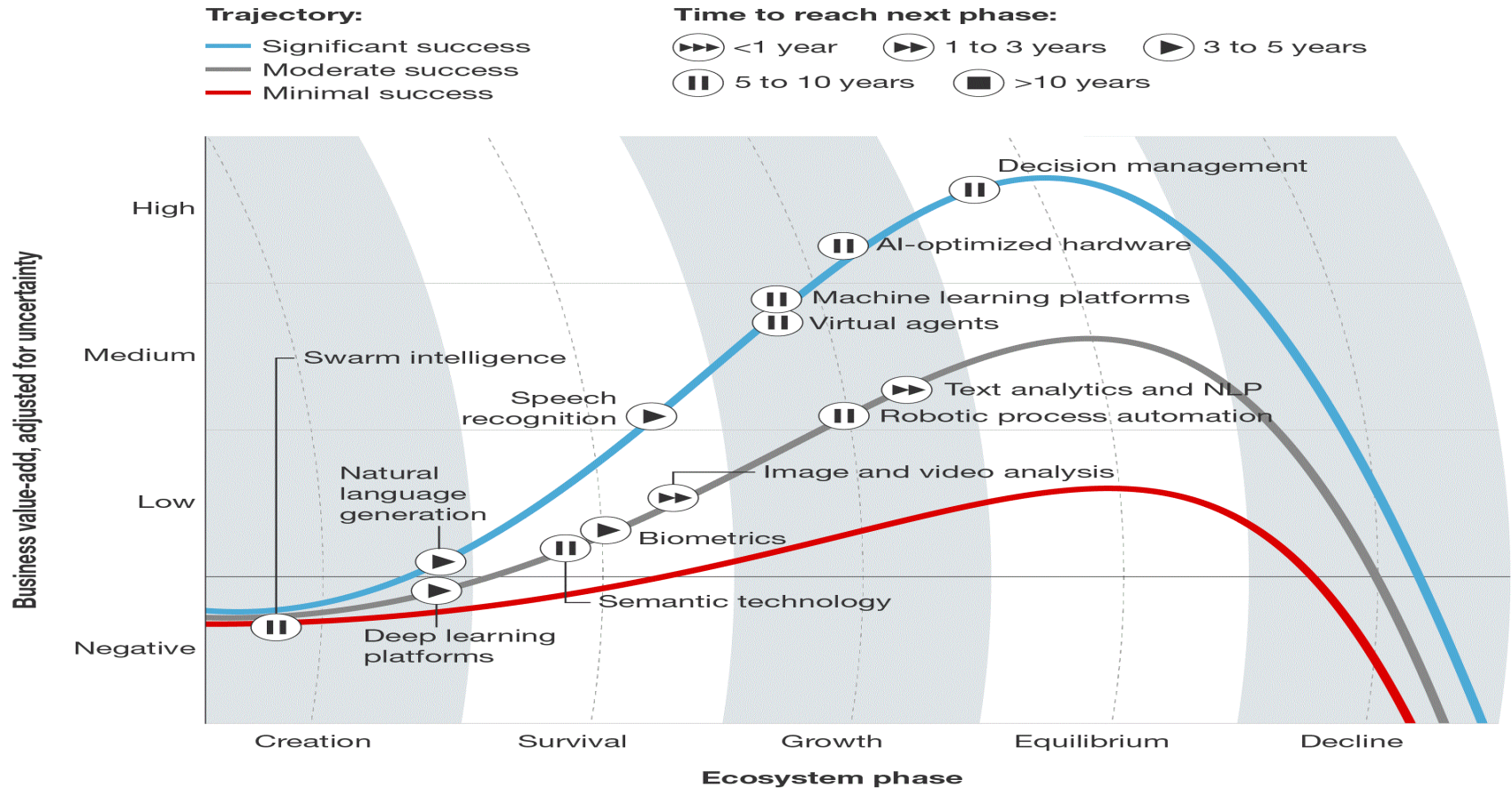# Artificial Intelligence : Hype Cycle

Source: Gartner (July 2016)

Artificial Intelligence : Forrester Research

TechRadar™: Artificial Intelligence Technologies, Q1 '17

TechRadar™: Artificial Intelligence Technologies, Q1 2017
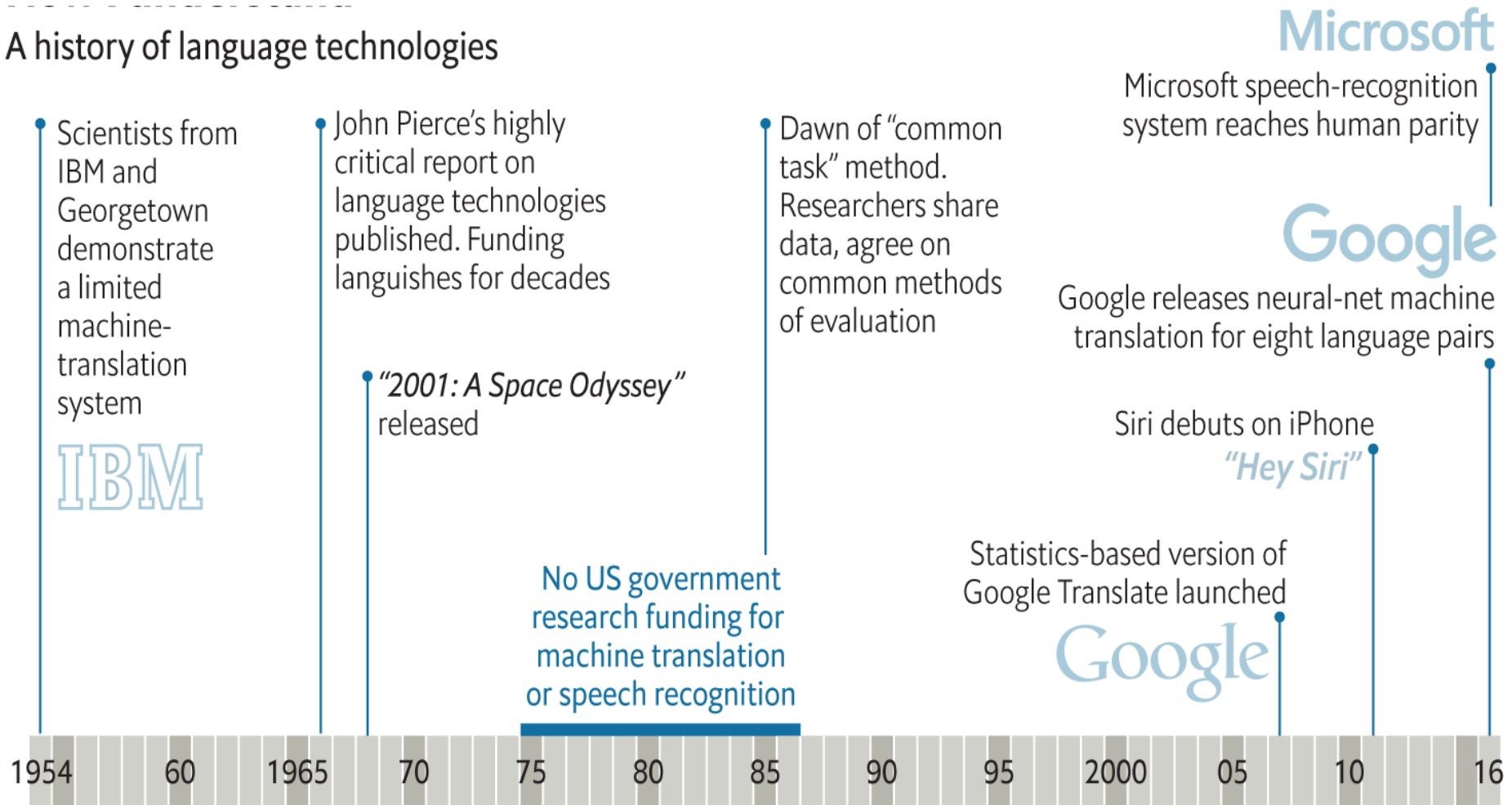

Source: Forrester Research, Inc. Unauthorized reproduction, citation, or distribution prohibited.

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https://www.forbes.com/sites/gilpress/2017/01/23/top-10-hot-artificial-intelligence-ai-technologies/#71c05e6b1928
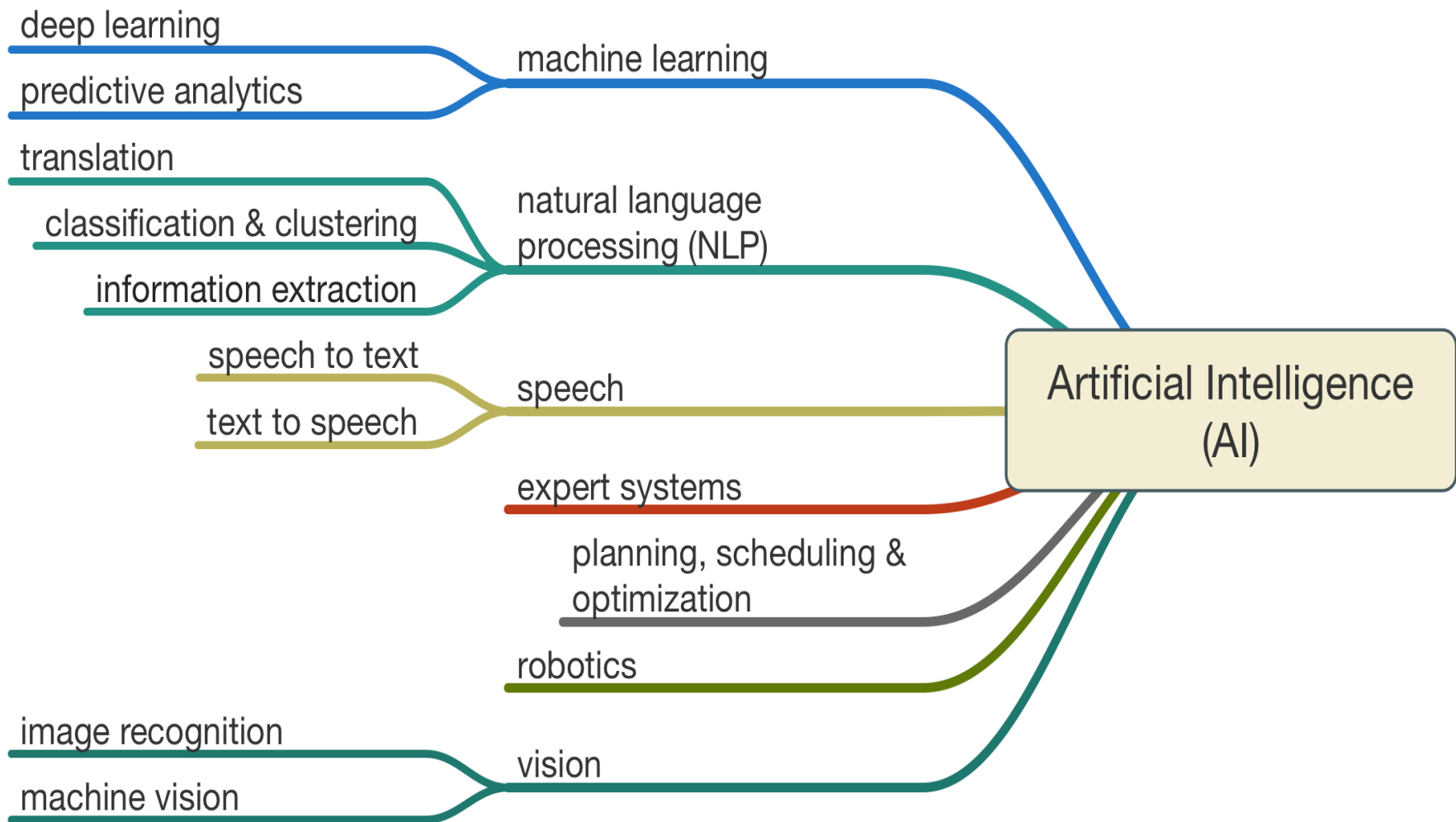
Artificial Intelligence : Key Players
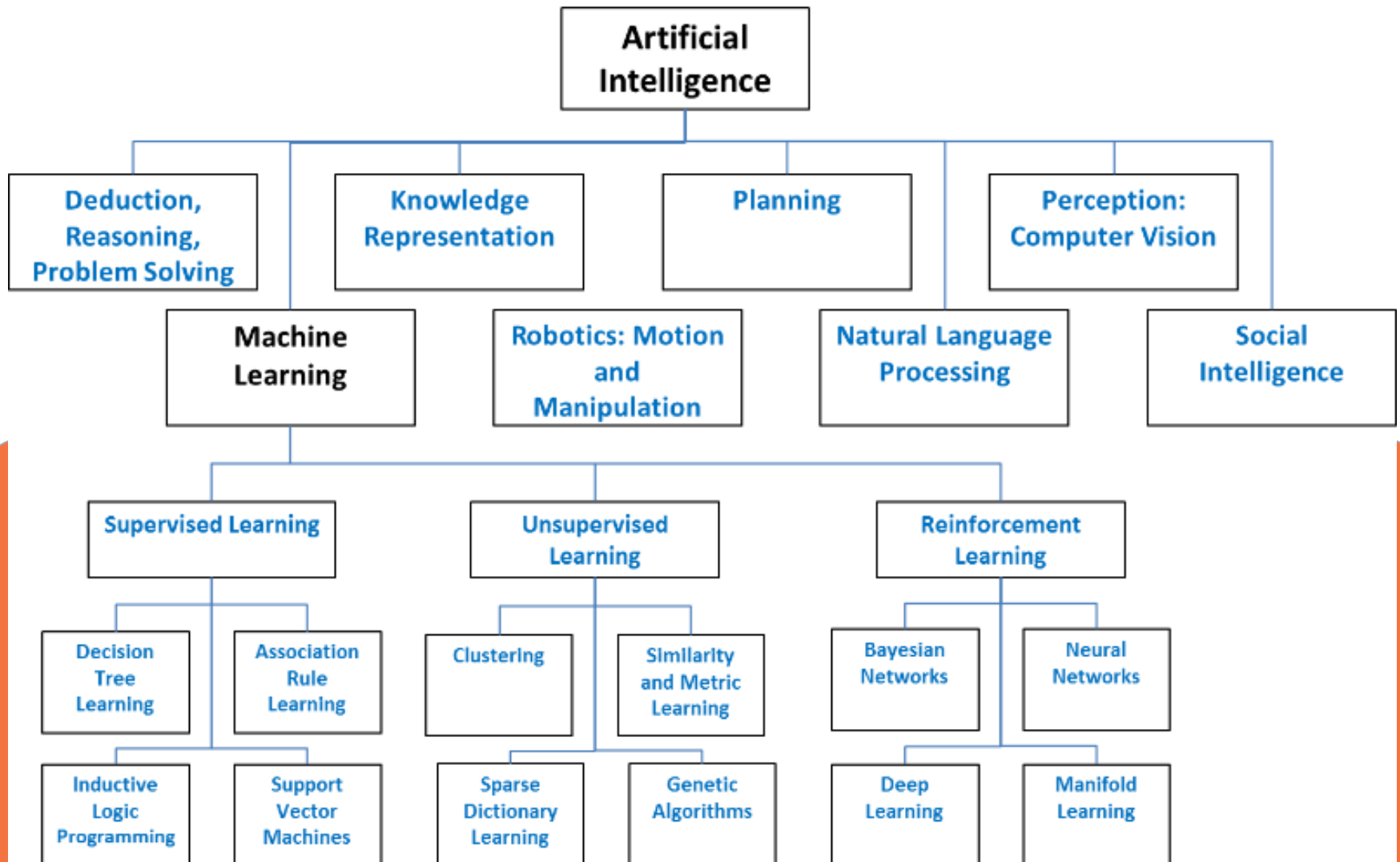
A history of language technologies

Scientists from IBM and Georgetown demonstrate a limited machine-translation system

IBM

John Pierce's highly critical report on language technologies published. Funding languishes for decades

"2001: A Space Odyssey" released

Dawn of "common task" method. Researchers share data, agree on common methods of evaluation

No US government research funding for machine translation or speech recognition

Microsoft

Microsoft speech-recognition system reaches human parity

Google

Google releases neural-net machine translation for eight language pairs

Siri debuts on iPhone
"Hey Siri"

Statistics-based version of Google Translate launched

Google

| 1954 | 60 | 1965 | 70 | 75 | 80 | 85 | 90 | 95 | 2000 | 05 | 10 | 16 |

Source: *The Economist*

Artificial Intelligence : Focus Areas

deep learning
predictive analytics
→ machine learning

translation
classification & clustering
information extraction
→ natural language processing (NLP)

speech to text
text to speech
→ speech

expert systems

planning, scheduling & optimization

robotics

image recognition
machine vision
→ vision

→ Artificial Intelligence (AI)

https://datafloq.com/read/illustrious-big-data-scientist-infographic/424

Artificial Intelligence : NLP and Machine Learning

Artificial Intelligence : Application Areas

Search engines

Driverless cars

Voice recognition

Product recommender systems of webshops

Spam filtering

Handwrite recognition

Machine vision

Face recognition of digital cameras

Artificial Intelligence : State of Art

International grandmaster Arnold Denker studies the pieces on the board in front of him. He realizes there is no hope; he must resign the game. *His opponent, HITECH, becomes the first computer program to defeat a grandmaster in a game of chess (Berliner, 1989)*

An analyst in the Mission Operations room of the Jet Propulsion Laboratory suddenly starts paying attention. A red message has flashed onto the screen indicating an "anomaly" with the Voyager spacecraft, which is somewhere in the vicinity of Neptune. Fortunately, the analyst is able to correct the problem from the ground. *Operations personnel believe the problem might have been overlooked had it not been for MARVEL, a real-time expert system that monitors the massive stream of data transmitted by the spacecraft, handling routine tasks and alerting the analysts to more serious problems (Schwuttke, 1992).*

TODAY, SELF DRIVING CARS?

"I want to go from Boston to San Francisco," the traveller says into the microphone. "What date will you be travelling on?" is the reply. The traveller explains she wants to go October 20th, nonstop, on the cheapest available fare, returning on Sunday.

A speech understanding program named PEGASUS handles the whole transaction, which results in a confirmed reservation that saves the traveller $894 over the regular coach fare. Even though the speech recognizer gets one out of ten words wrong,18 it is able to recover from these errors because of its understanding of how dialogs are put together (Zue et al., 1994)

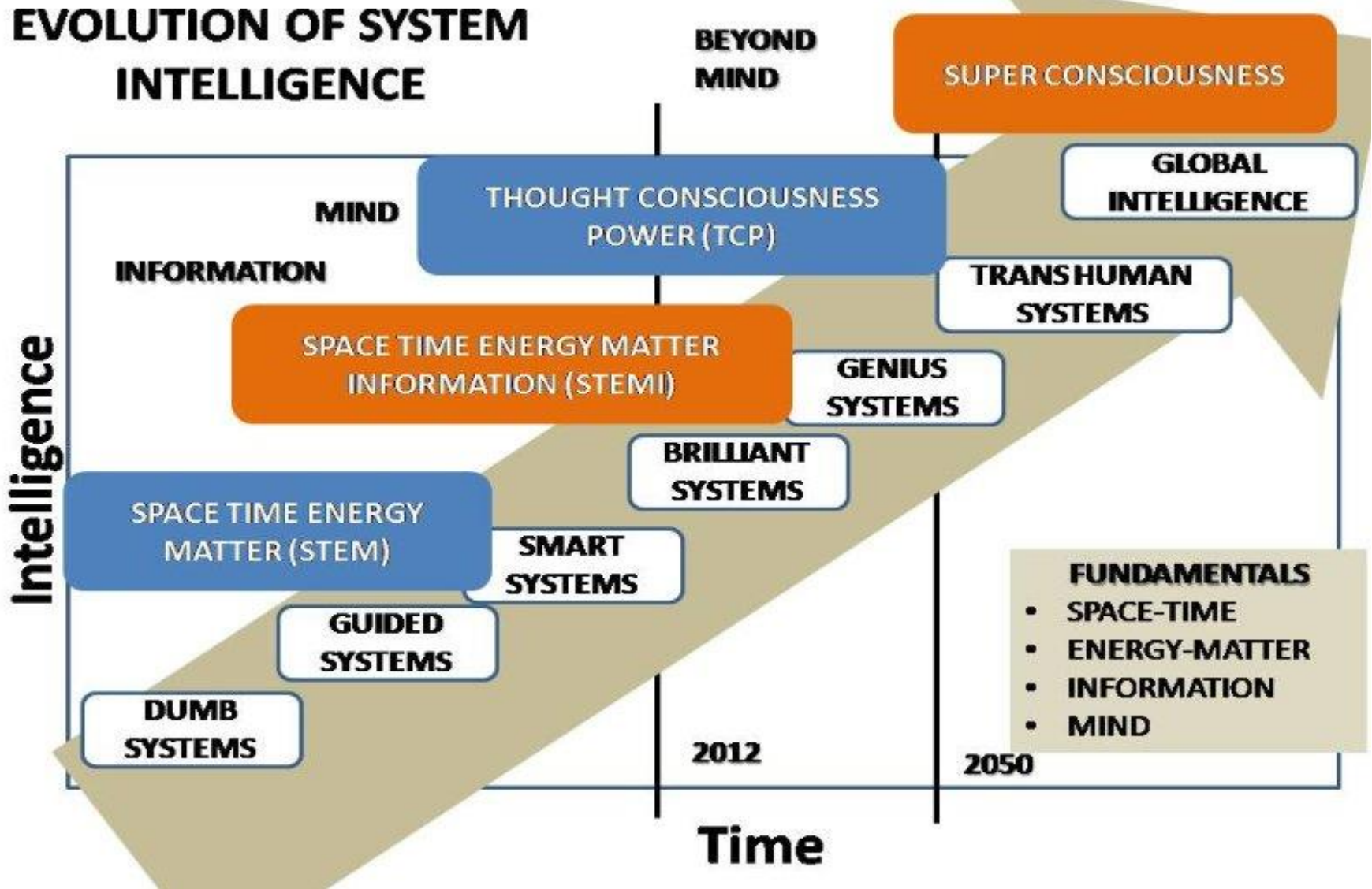|	
"The exciting new effort to make computers think . . . *machines with minds*, in the full and literal sense" (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . ." (Bellman, 1978)	"The study of mental faculties through the use of computational models" (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act" (Winston, 1992)
"The art of creating machines that perform functions that require intelligence when performed by people" (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better" (Rich and Knight, 1991)	"A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes" (Schalkoff, 1990) "The branch of computer science that is concerned with the automation of intelligent behavior" (Luger and Stubblefield, 1993)

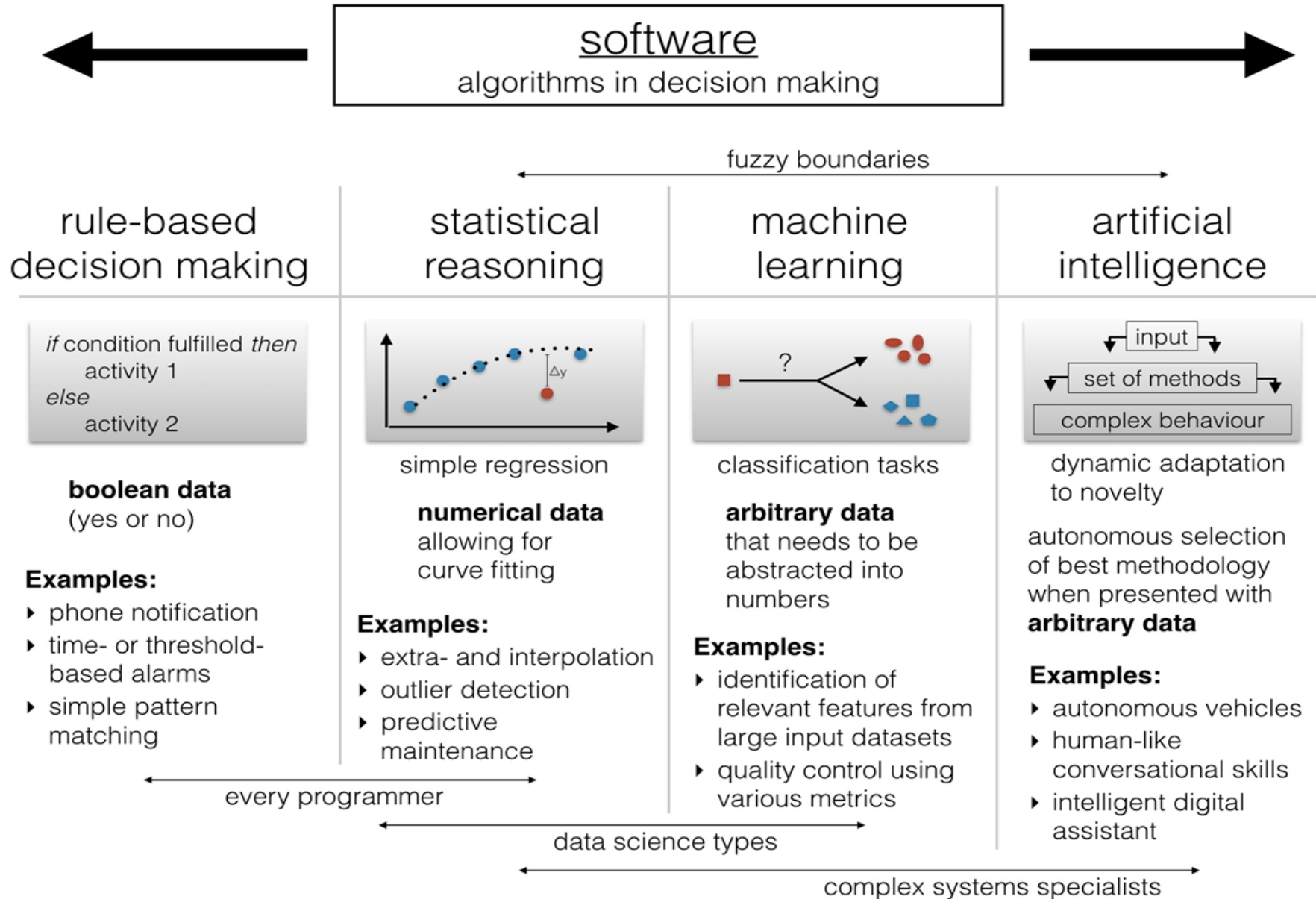|	
Systems That think like humans	**Systems that think rationally**
Systems that act like humans	Systems that act rationally

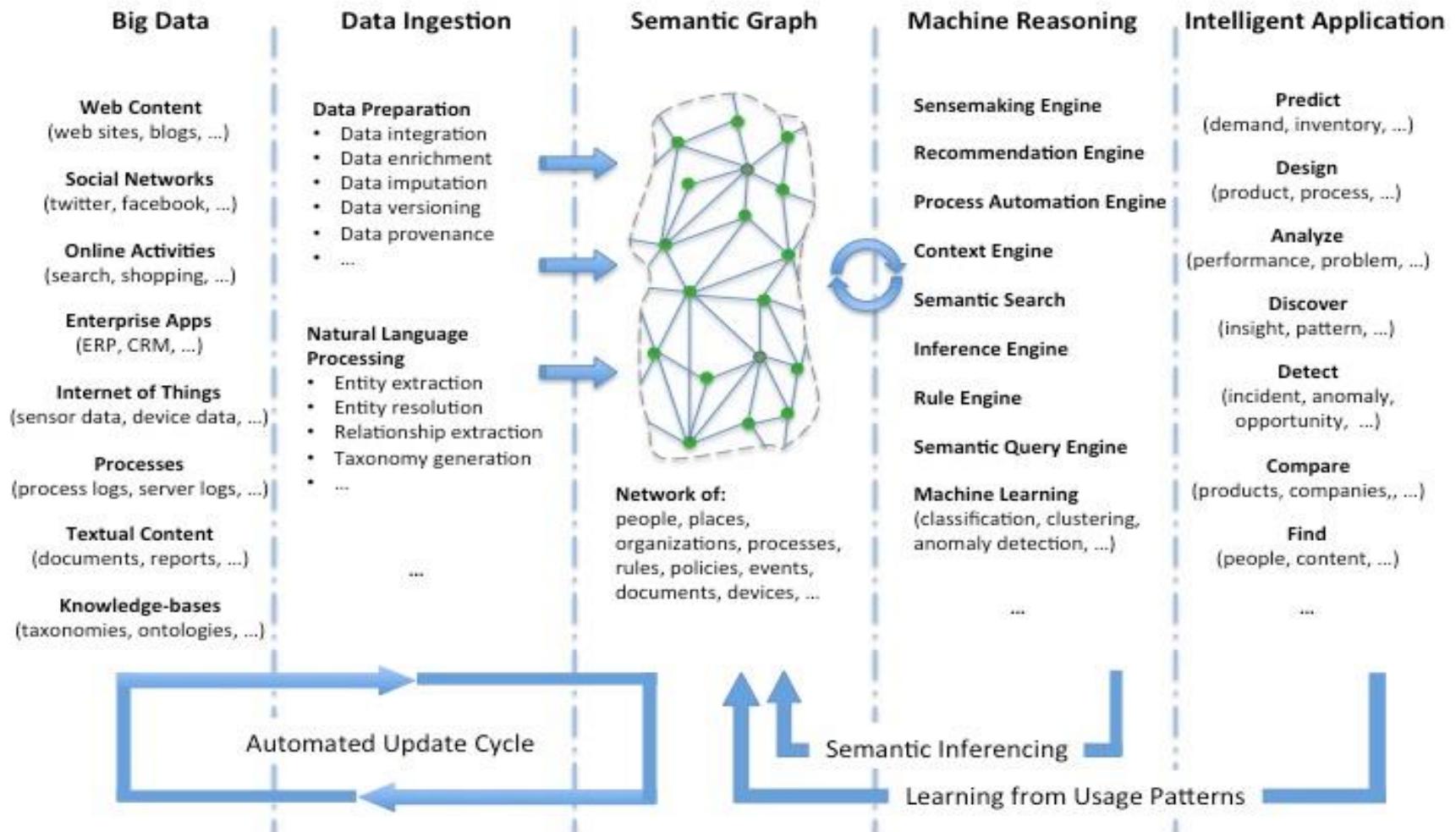# Artificial Intelligence : System Evolution

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Artificial Intelligence

software
algorithms in decision making

fuzzy boundaries

rule-based decision making	statistical reasoning	machine learning	artificial intelligence
if condition fulfilled *then* activity 1 *else* activity 2	simple regression	classification tasks	input set of methods complex behaviour
boolean data (yes or no)	**numerical data** allowing for curve fitting	**arbitrary data** that needs to be abstracted into numbers	dynamic adaptation to novelty autonomous selection of best methodology when presented with **arbitrary data**
Examples: ‣ phone notification ‣ time- or threshold-based alarms ‣ simple pattern matching	**Examples:** ‣ extra- and interpolation ‣ outlier detection ‣ predictive maintenance	**Examples:** ‣ identification of relevant features from large input datasets ‣ quality control using various metrics	**Examples:** ‣ autonomous vehicles ‣ human-like conversational skills ‣ intelligent digital assistant

every programmer

data science types

complex systems specialists

Artificial Intelligence : Eco System

Big Data → Intelligent Applications
(A Lifecycle View)

Big Data

Web Content
(web sites, blogs, ...)

Social Networks
(twitter, facebook, ...)

Online Activities
(search, shopping, ...)

Enterprise Apps
(ERP, CRM, ...)

Internet of Things
(sensor data, device data, ...)

Processes
(process logs, server logs, ...)

Textual Content
(documents, reports, ...)

Knowledge-bases
(taxonomies, ontologies, ...)

Data Ingestion

Data Preparation
• Data integration
• Data enrichment
• Data imputation
• Data versioning
• Data provenance
• ...

Natural Language Processing
• Entity extraction
• Entity resolution
• Relationship extraction
• Taxonomy generation
• ...

Semantic Graph

Network of:
people, places,
organizations, processes,
rules, policies, events,
documents, devices, ...

Machine Reasoning

Sensemaking Engine

Recommendation Engine

Process Automation Engine

Context Engine

Semantic Search

Inference Engine

Rule Engine

Semantic Query Engine

Machine Learning
(classification, clustering,
anomaly detection, ...)

...

Intelligent Application

Predict
(demand, inventory, ...)

Design
(product, process, ...)

Analyze
(performance, problem, ...)

Discover
(insight, pattern, ...)

Detect
(incident, anomaly,
opportunity, ...)

Compare
(products, companies,, ...)

Find
(people, content, ...)

...

Automated Update Cycle

Semantic Inferencing

Learning from Usage Patterns

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Artificial Intelligence : Agents & Environment

Source : https://techcrunch.com/2016/09/06/buddha-was-a-data-scientist/?ncid=rss

Effectors are Actuators

Artificial Intelligence : Goal Based Agent

Source : https://techcrunch.com/2016/09/06/buddha-was-a-data-scientist/?ncid=rss

Artificial Intelligence : Utility Based Agent

Source : https://techcrunch.com/2016/09/06/buddha-was-a-data-scientist/?ncid=rss

Artificial Intelligence : Examples

Agent Type	Percepts	Actions	Goals	Environment
Medical diagnosis system	Symptoms, findings, patient's answers	Questions, tests, treatments	Healthy patient, minimize costs	Patient, hospital
Satellite image analysis system	Pixels of varying intensity, color	Print a categorization of scene	Correct categorization	Images from orbiting satellite
Part-picking robot	Pixels of varying intensity	Pick up parts and sort into bins	Place parts in correct bins	Conveyor belt with parts
Refinery controller	Temperature, pressure readings	Open, close valves; adjust temperature	Maximize purity, yield, safety	Refinery
Interactive English tutor	Typed words	Print exercises, suggestions, corrections	Maximize student's score on test	Set of students

Source : https://techcrunch.com/2016/09/06/buddha-was-a-data-scientist/?ncid=rss

Artificial Intelligence Applications

Trading Agent

STOCK MARKET

Rates

News

BONDS

Trades

COMMO DITIES

Patient

Diagnostic Agent

Vital Signals

Diagnostics

Doctor

Gaming Agent

You

Your moves

Its moves

Crawling AGENT

World Wide Web

Web Pages

DB
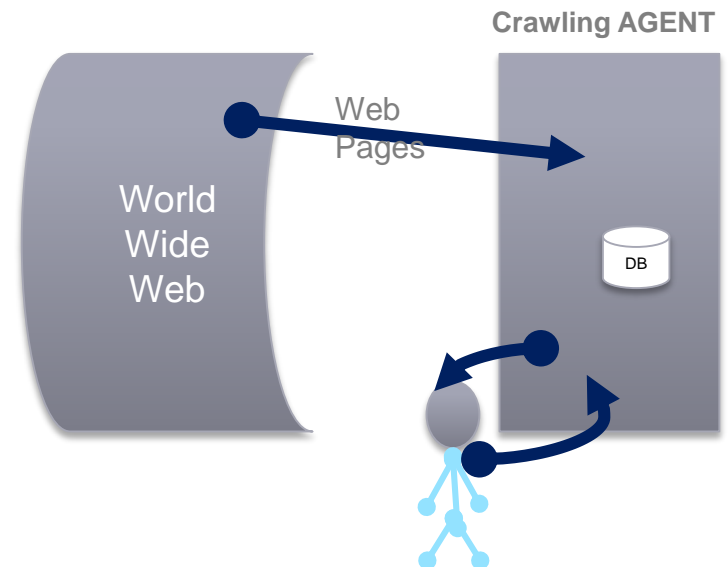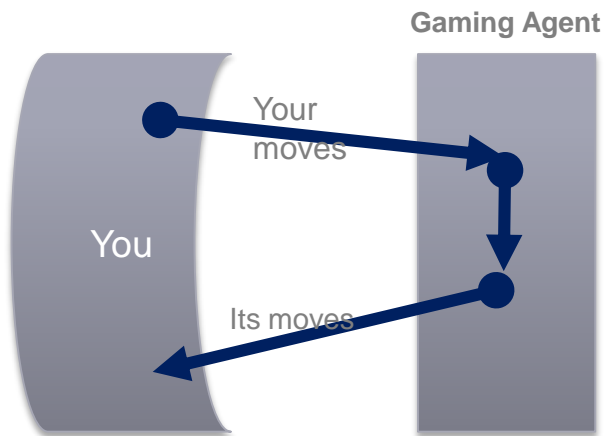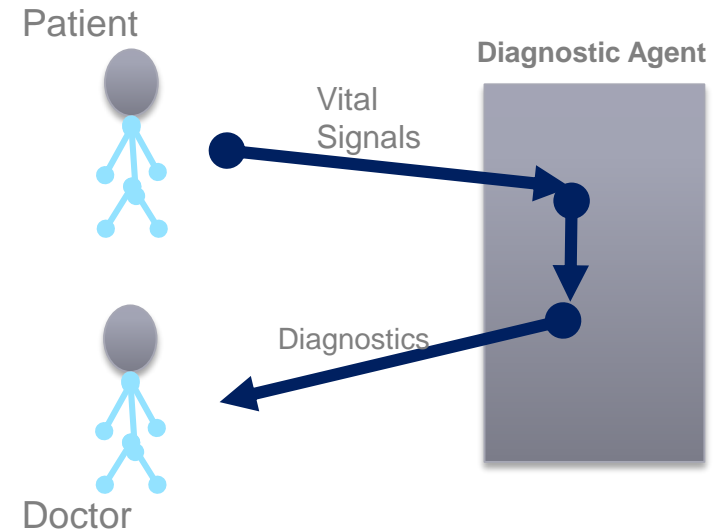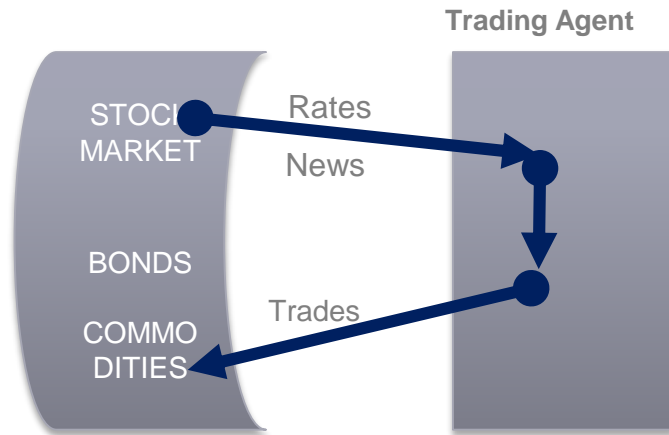
What to do when you don't know what to do?

REASONS FOR UNCERTAINTY

- *SENSOR LIMITS*
- *IGNORANCE*
- *ADVERSARIES*
- *LAZINESS*
- *STOHASTIC ENVIRONMENT*

Bayes Network
Reasons with known models

Machine Learning
Learn models from data

Artificial Intelligence : Machine Learning
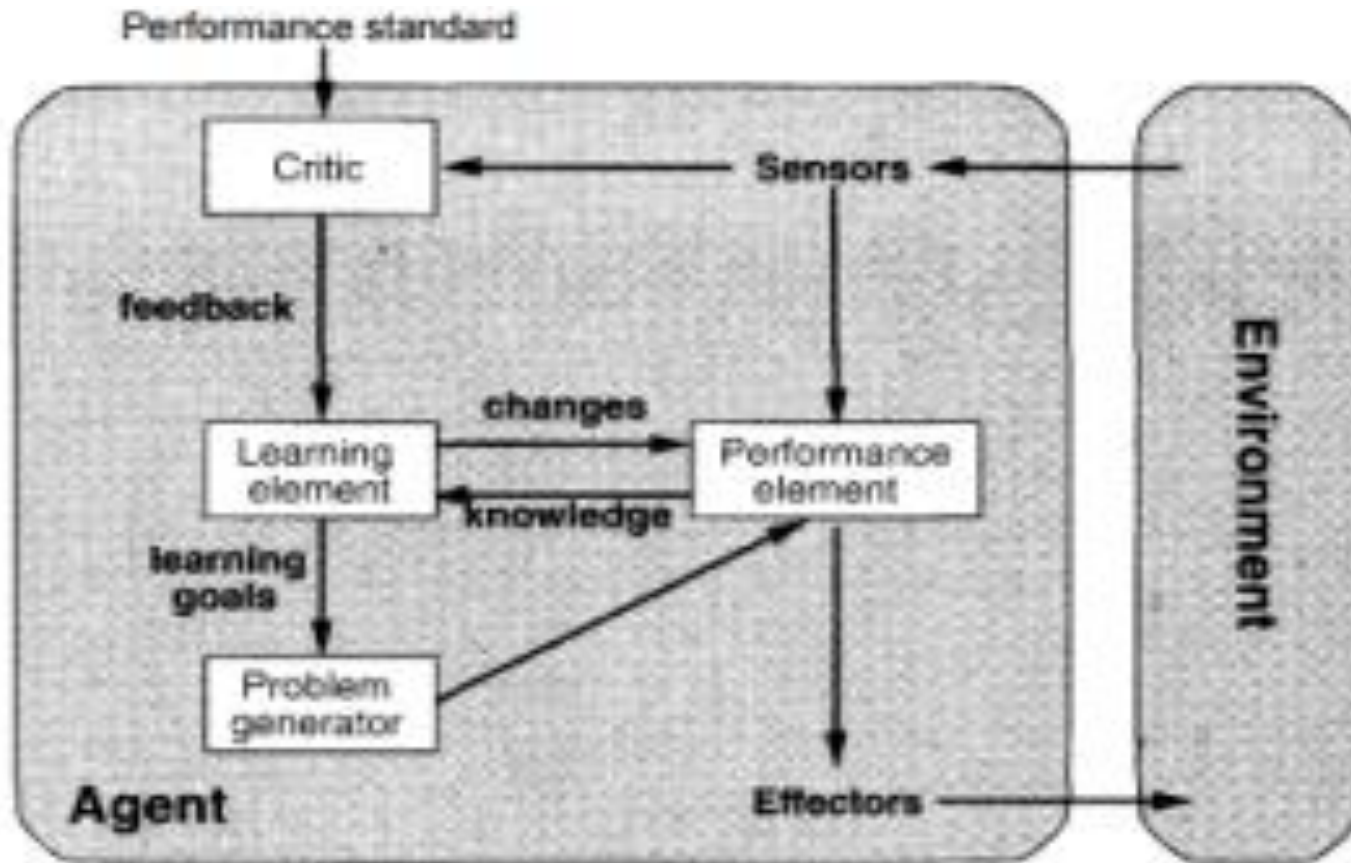
Machine learning algorithms results ***improve with experience***, enable us to ***find patterns in large data sets*** and make ***predictions more effectively***—about people, equipment, systems and processes.

Source : https://techcrunch.com/2016/09/06/buddha-was-a-data-scientist/?ncid=rss

Artificial Intelligence : Open Source ToolKits

- Brain   https://github.com/harthur/brain
- Concurrent Pattern   http://www.cascading.org/projects/pattern/
- Convnetjs   https://github.com/karpathy/convnetjs
- Decider   https://github.com/danielsdeleo/Decider
- etcML   www.etcml.com
- Etsy Conjecture   https://github.com/etsy/Conjecture
- Google Sibyl   https://plus.google.com/+ResearchatGoogle/posts/7CqQbKfYKQf
- GraphX   https://amplab.cs.berkeley.edu/publication/graphx-grades/
- KNIME   http://www.knime.org/
- List   https://github.com/showcases/machine-learning
- ML software   http://www.cs.ubc.ca/~murphyk/Software/index.html
- MLPNeuralNet   https://github.com/nikolaypavlov/MLPNeuralNet

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Artificial Intelligence : Landscape
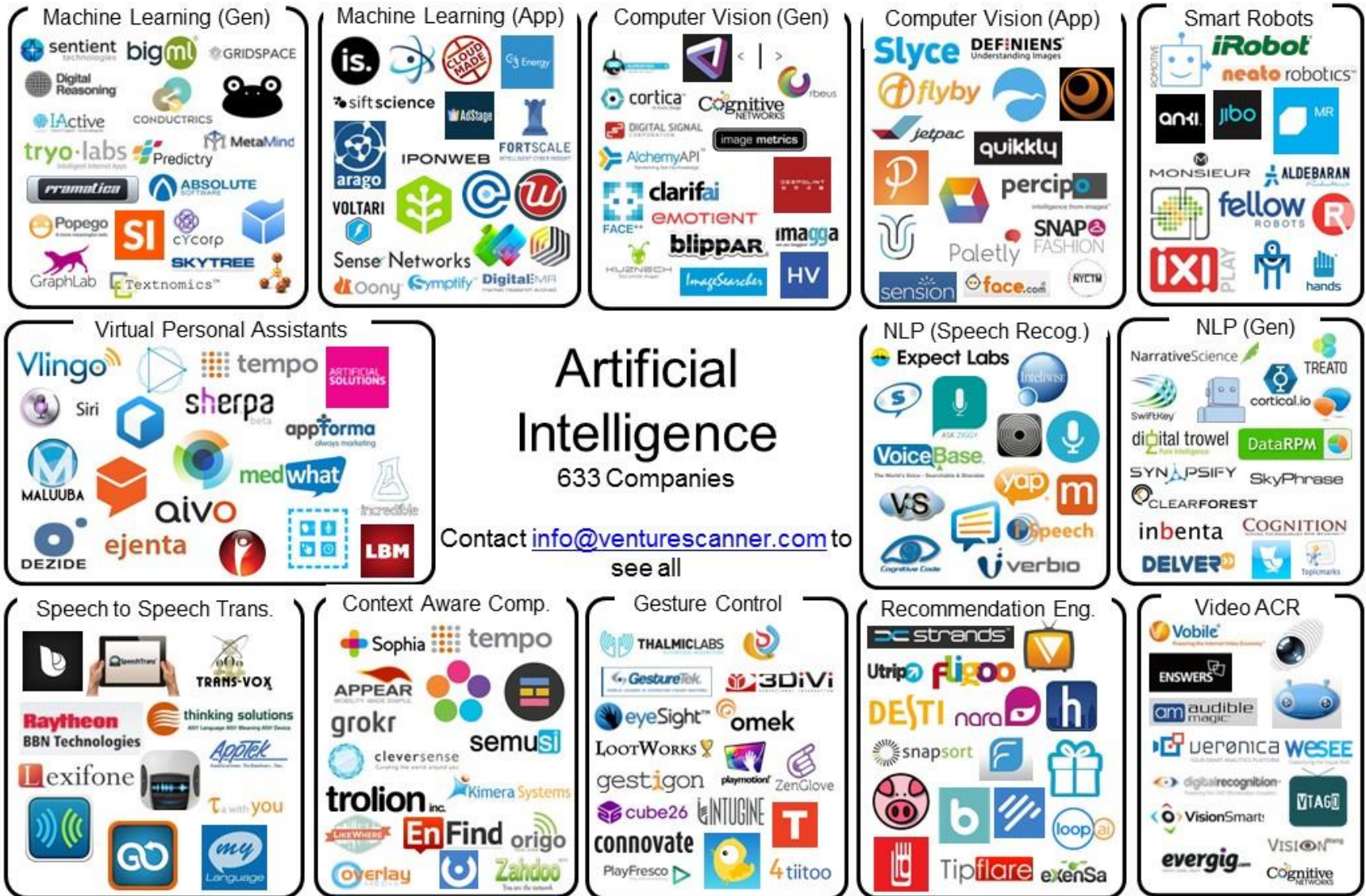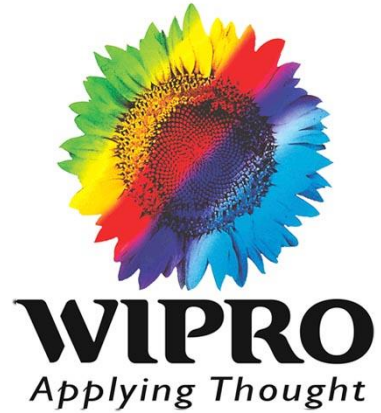
Thank You

Snehalatha N

Snehalatha.Nagamangala@wipro.com

Machine Intelligence LANDSCAPE

Artificial Intelligence: Landscape