ARTIFICIAL INTELLIGENCE

A Workshop for Business Domains of Marketing, Finance and Human Resources

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Chief Manager (Business Information System)
GAIL (India) Limited

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January 10, 2020

AGENDA

- Analytics
- Analytics Use Cases
- Artificial Intelligence
- AI Use Cases

Foundation

- Machine Learning: Customer Churn Analysis
- Machine Learning: Anomaly Detection
- Deep Learning: Microsoft Stock Price Prediction
- AI: Twitter Sentiment Analysis using NLP

Practical

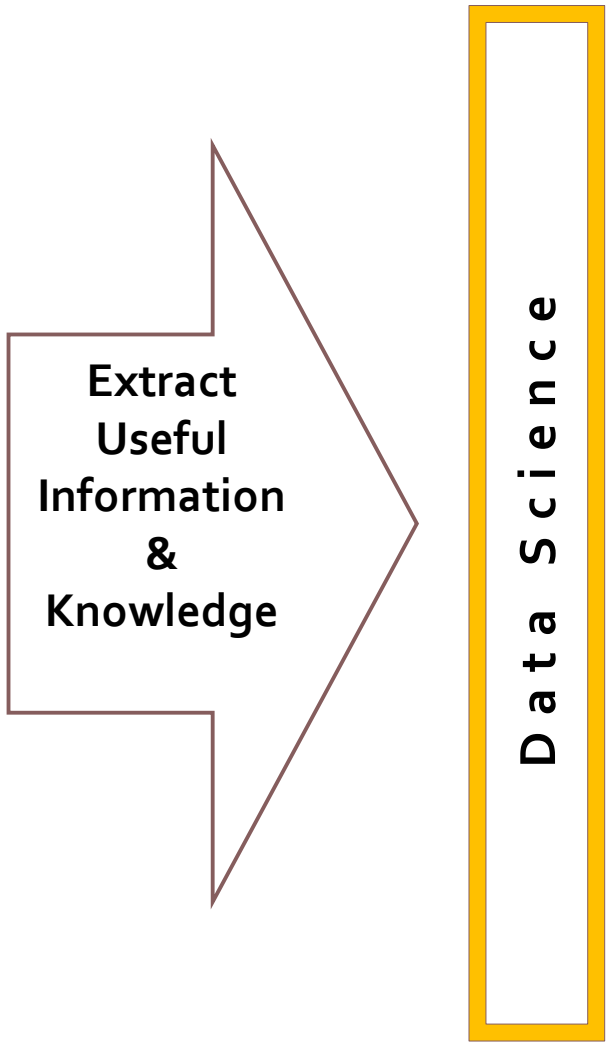
- Next Steps in the Journey of AI

Analytics

A Primer for Professionals

WHY DATA SCIENCE?

- Every aspect of business is open to data collection:
  - Operations
  - Manufacturing
  - Supply chain
  - Customer behavior
  - Marketing campaign
  - Performance
  - Workflow
- Information widely available on external events:
  - Market trends
  - Industry news
  - Competitors' movements



Data opportunity is everywhere

PARADIGM SHIFT

Statisticians

Modelers

Analysts

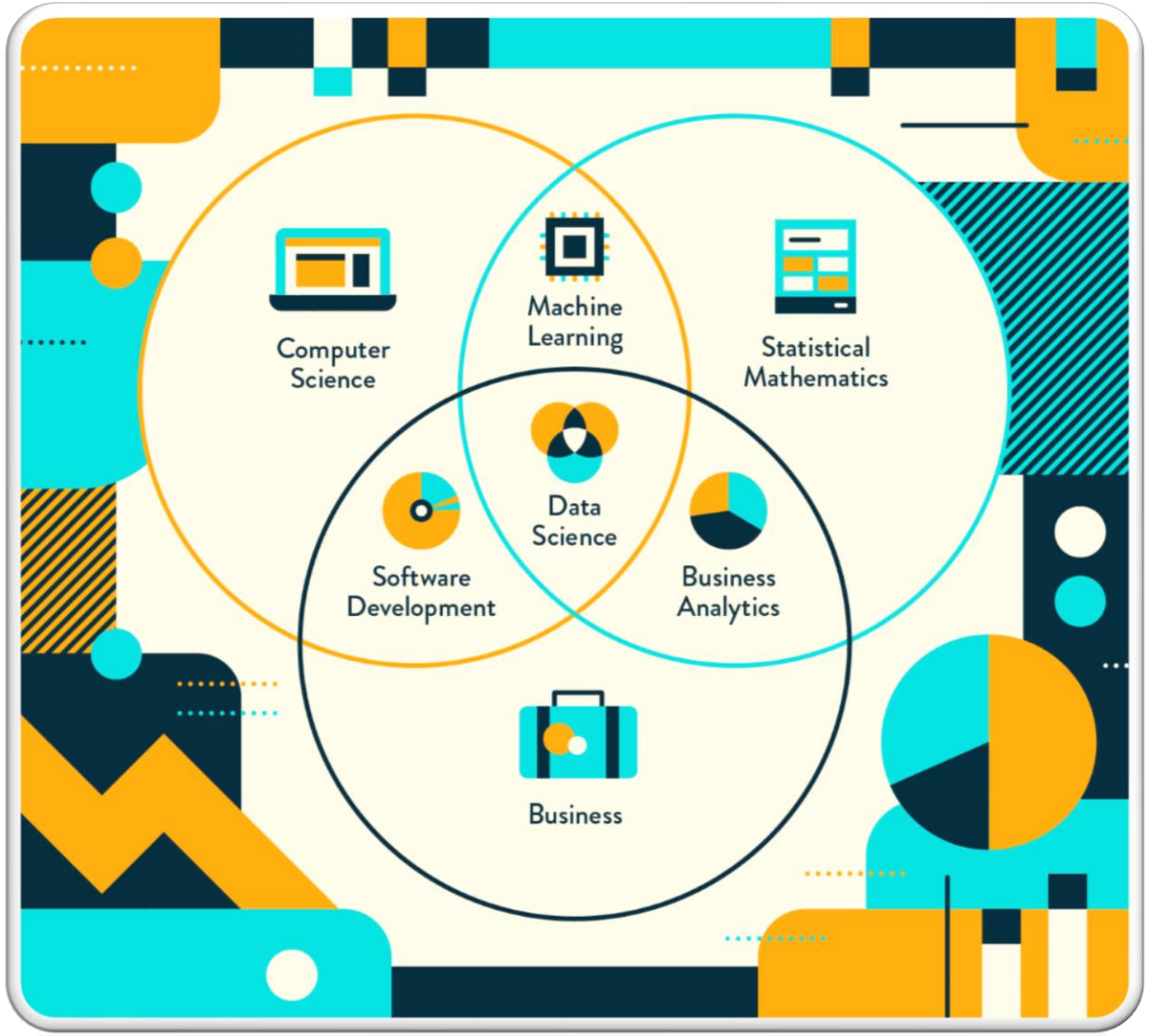
- Volume
- Variety
- Velocity

Data

No more manual analysis

Modern Data Analytics or Big Data Systems

DATA SCIENCE

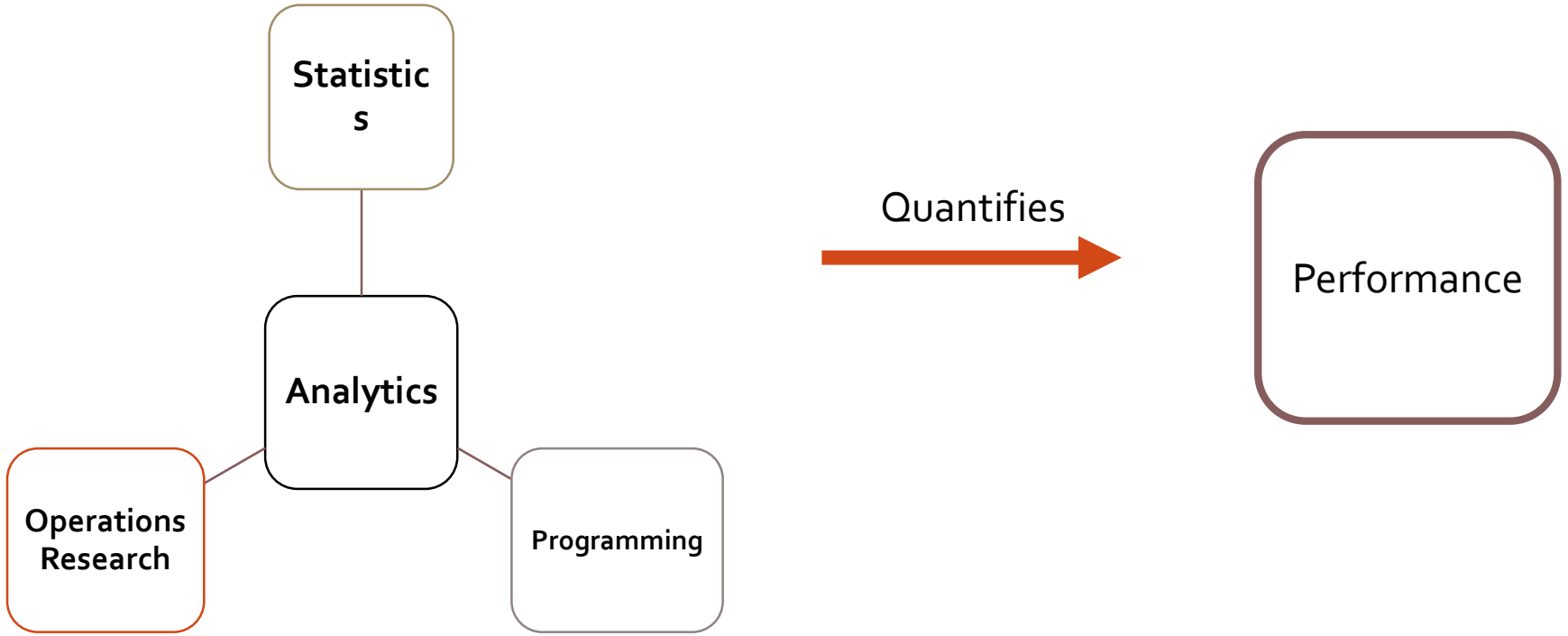


ANALYTICS

- **Analytics** is the discovery, interpretation, and communication of meaningful patterns in **data**; and the process of applying those patterns or insights towards effective **decision-making**.

ANALYTICS

- **Analytics** relies on the simultaneous application of **statistics**, **computer programming** and **operations research** to quantify **performance.**



DATA ANALYTICS

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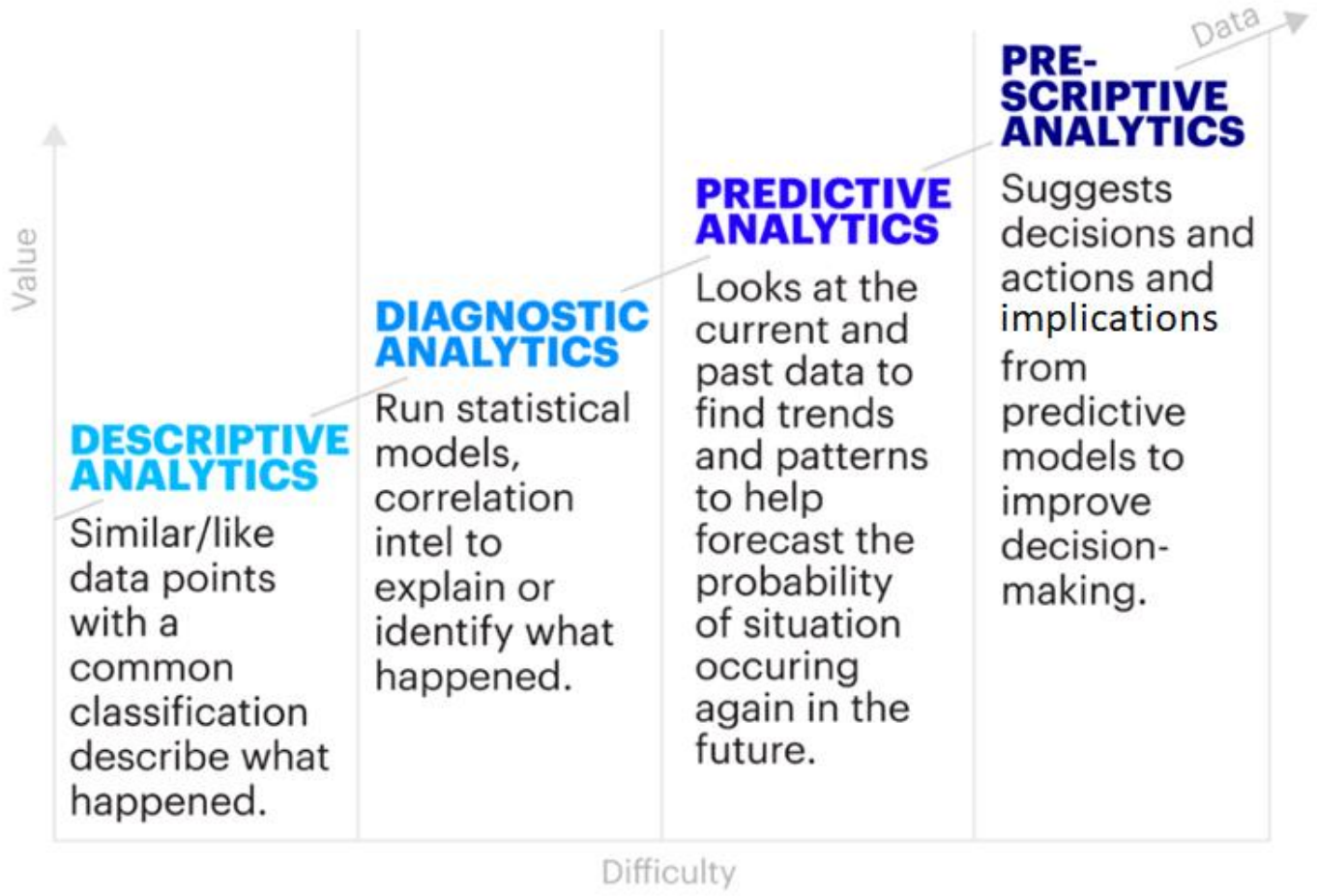
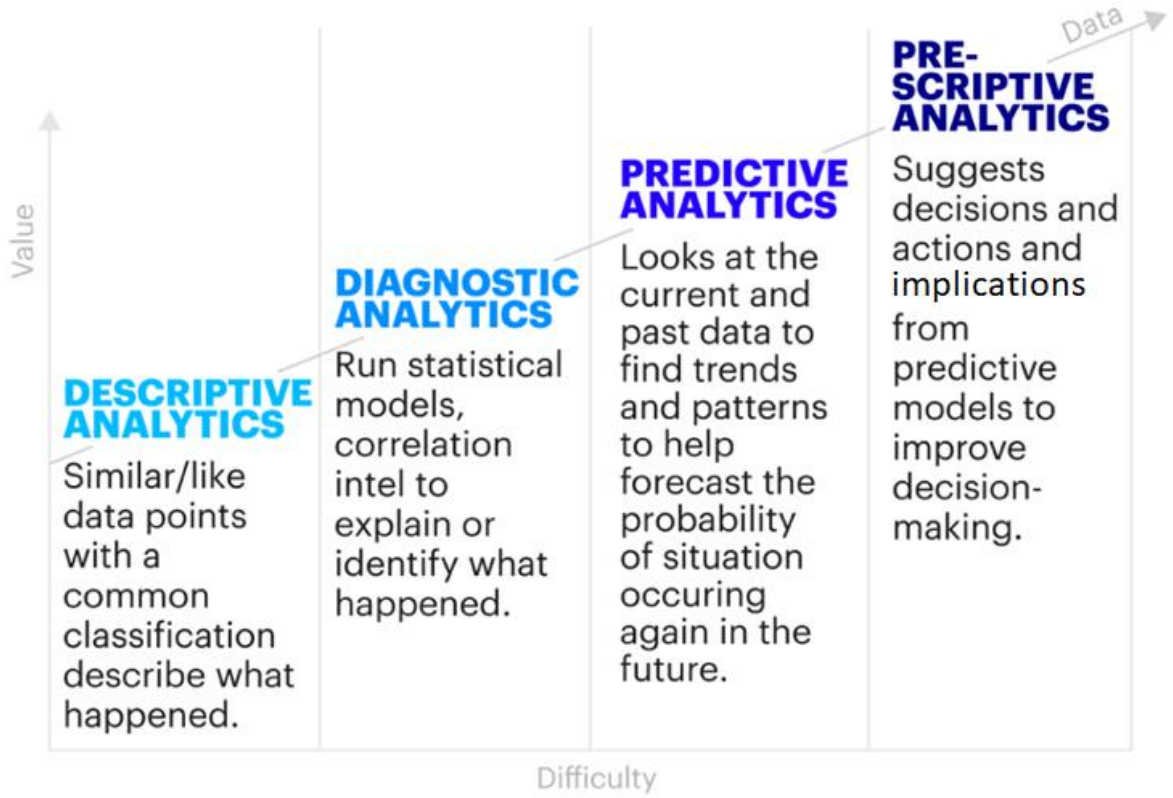
ANALYTICS JOURNEY - TRADITIONAL



Source: Accenture

ANALYTICS JOURNEY - MODERN



DECISION AUTOMATION

Artificial Intelligence

- ❑ Machine Learning
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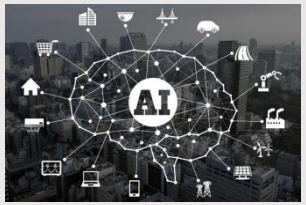
- ❑ Evolutionary Algorithms



BUILDING DEPARTMENT TECHNOLOGY STRATEGY

Take ownership of Digital technology

Align technology strategy with key function and business goals

Think beyond efficiency and effectiveness

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Business must take the lead

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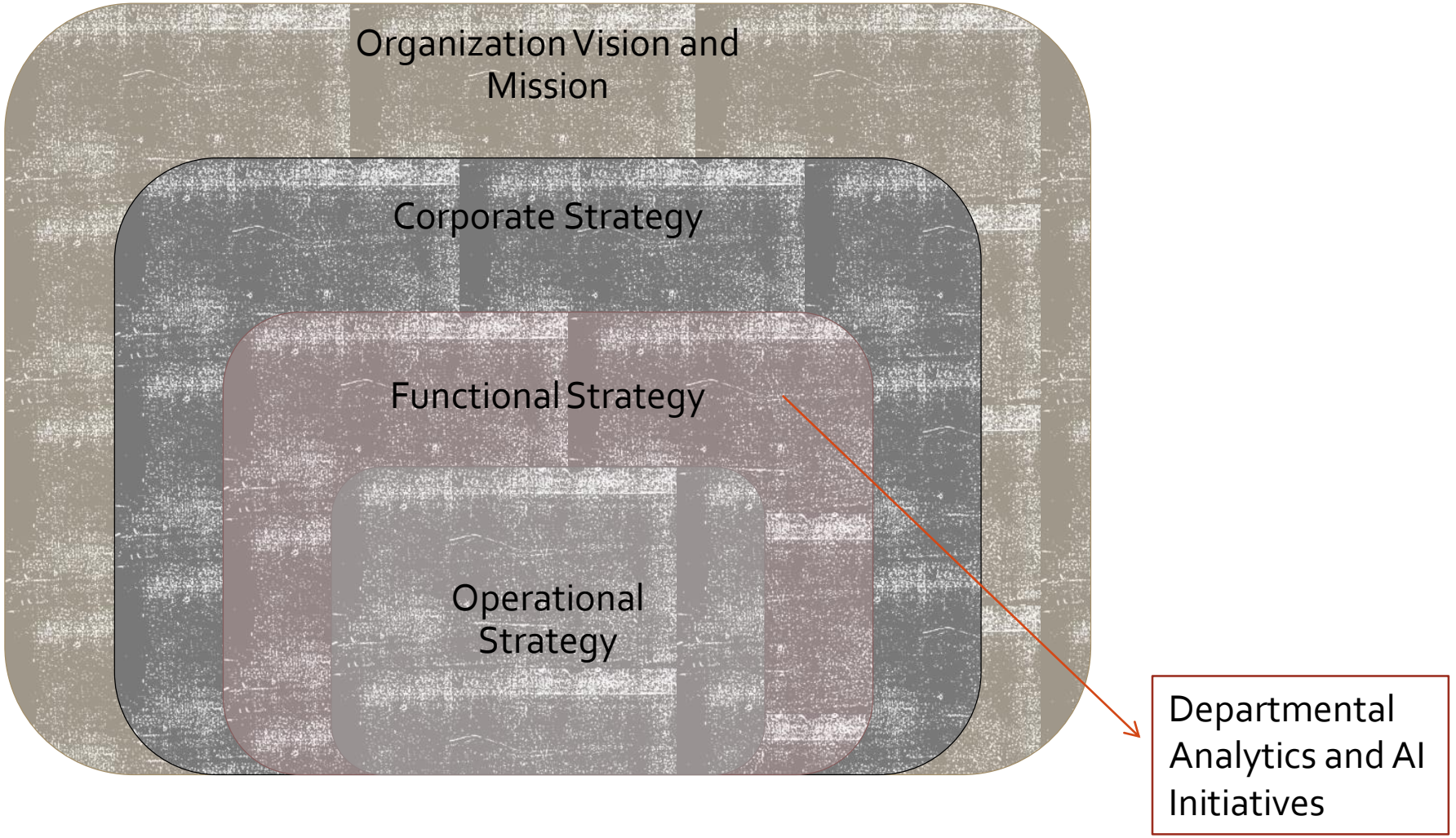

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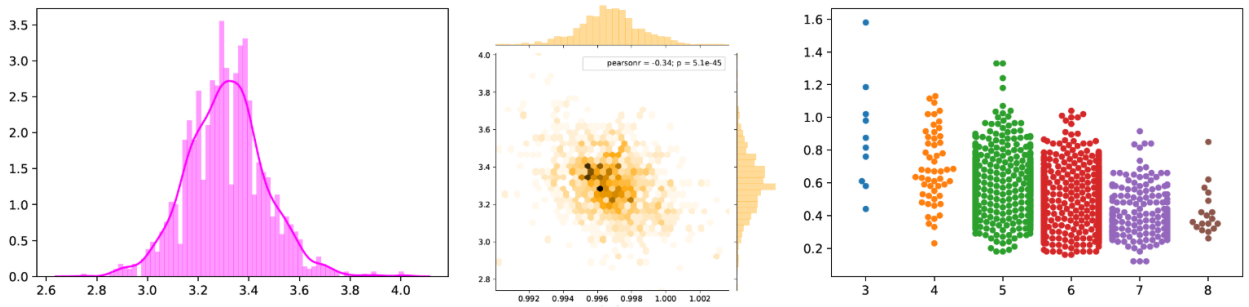
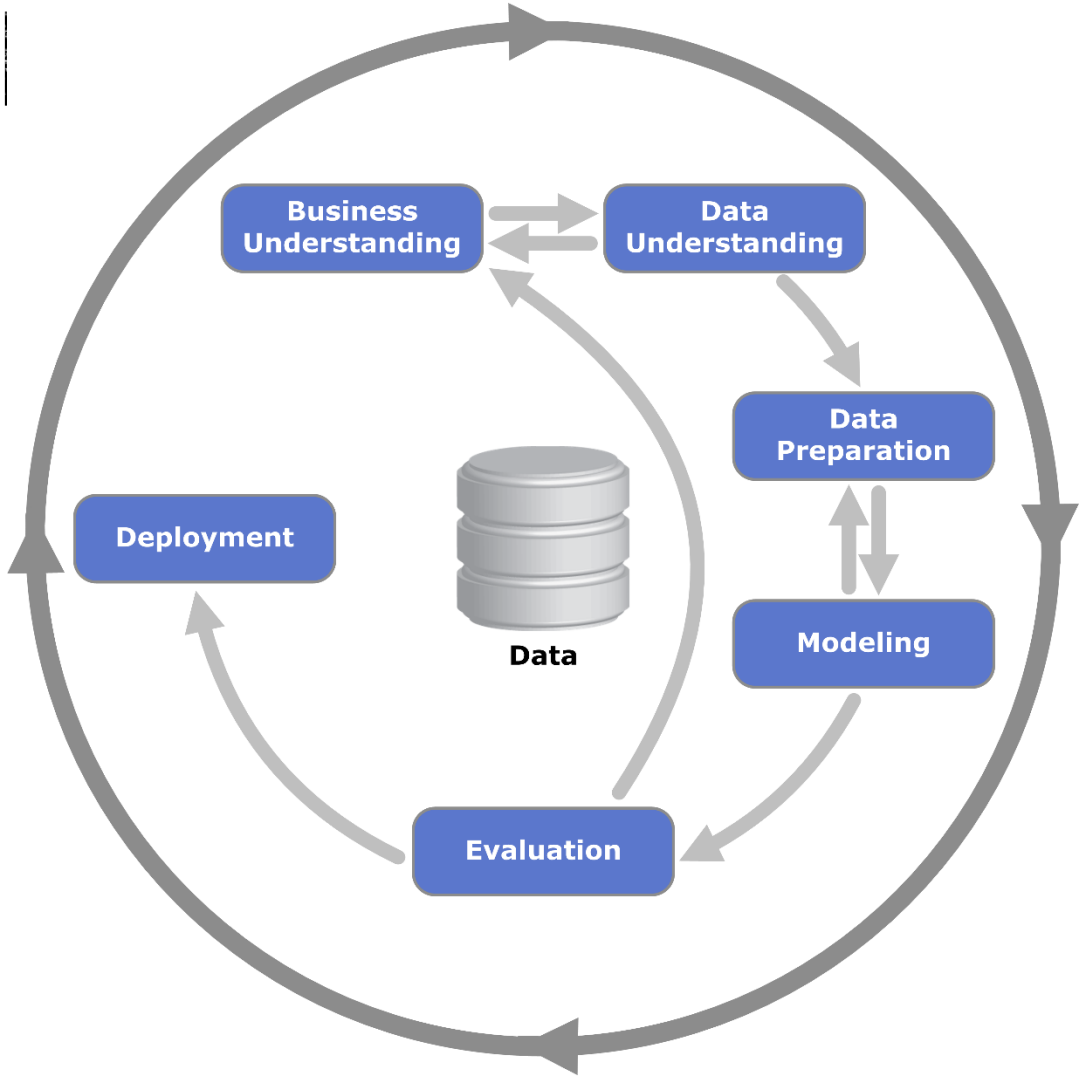


STANDARD PROCESS FOR DATA MIN



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ANALYTICS WALL

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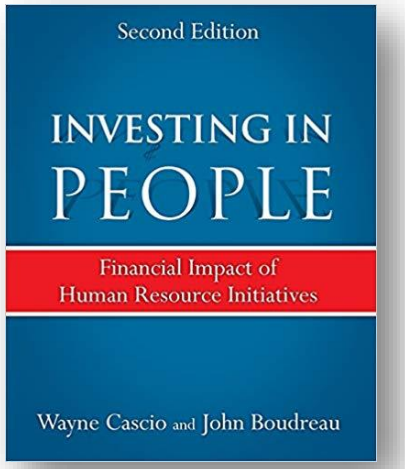

IDENTIFY AND BREAK THROUGH THE WALL

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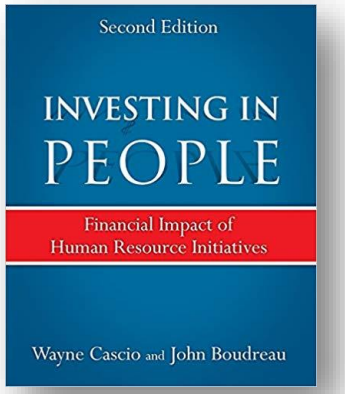
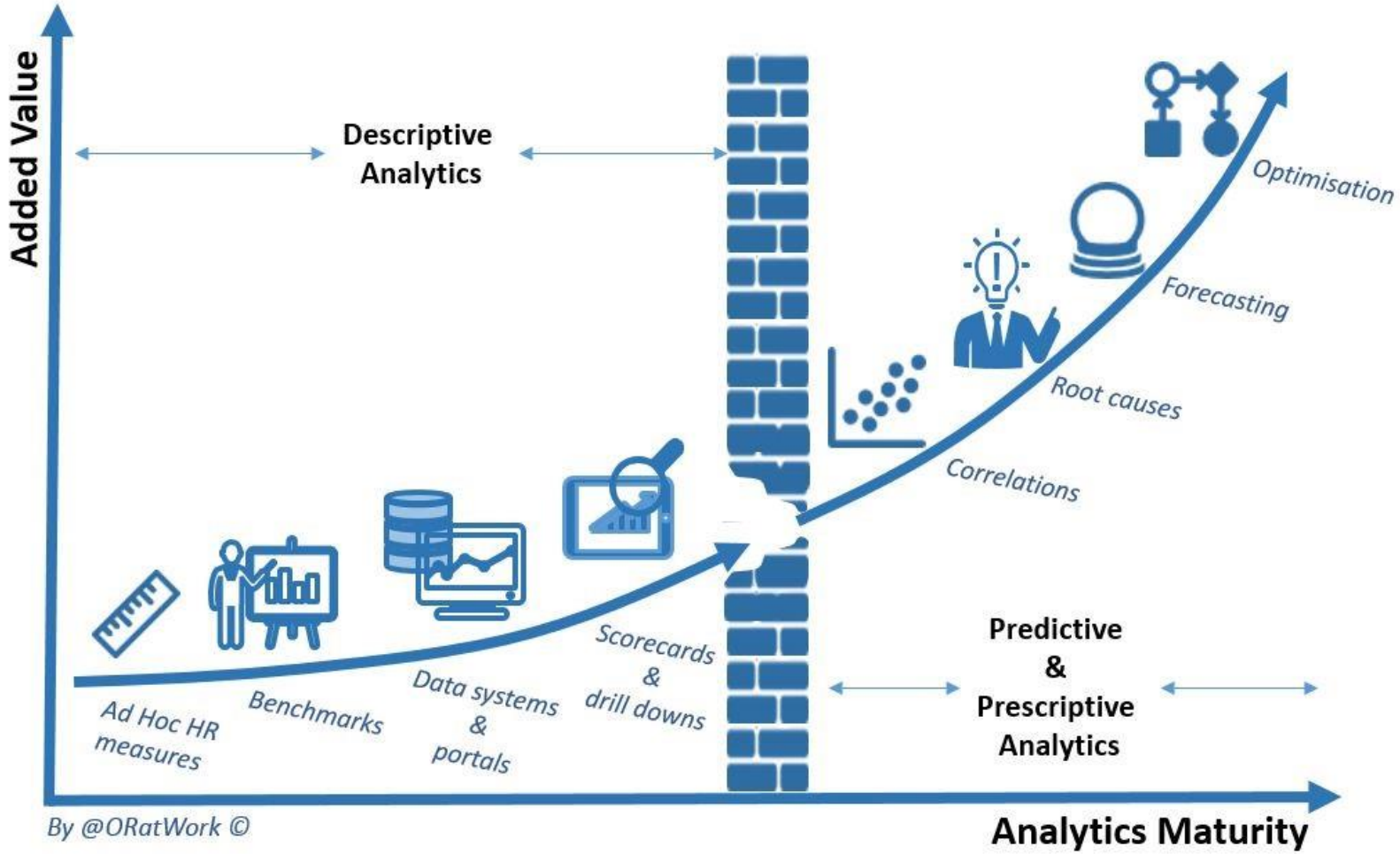


WALL IN ANALYTICS



KEY SKILLS FOR ANALYTICS

- Sense of intellectual curiosity
- Big picture vision
- Business Acumen: Talk data and numbers
- Insisting for details
- Critical thinking: Ability to differentiate between Tools and Methods
- Data interpretation skills: Statistics and Programming
- Data visualization and story-telling
- Desire to learn new things: Tools, EDA, ML, AI, Cloud
- Great communicator and presenter
- Team work

SOME FAMOUS ANALYTICS TOOLS

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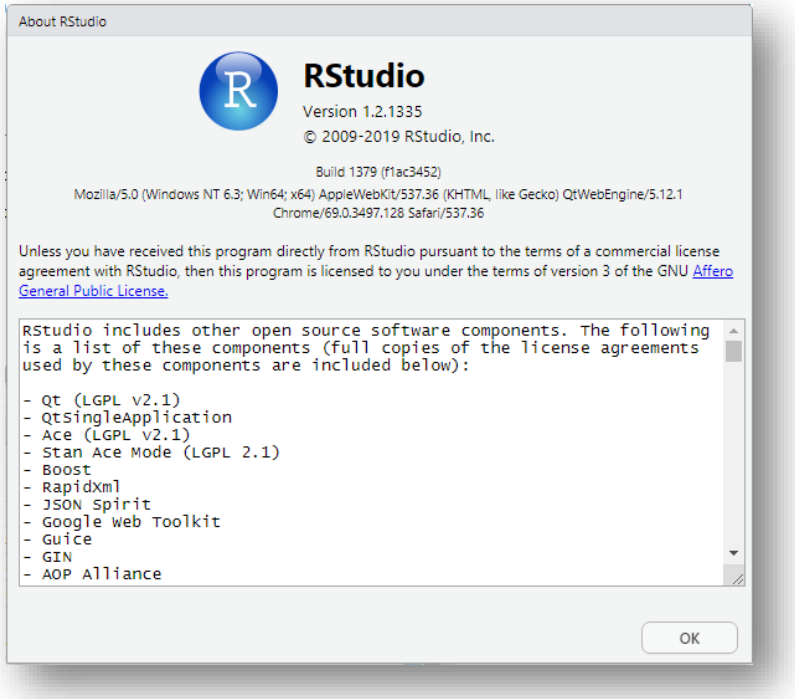
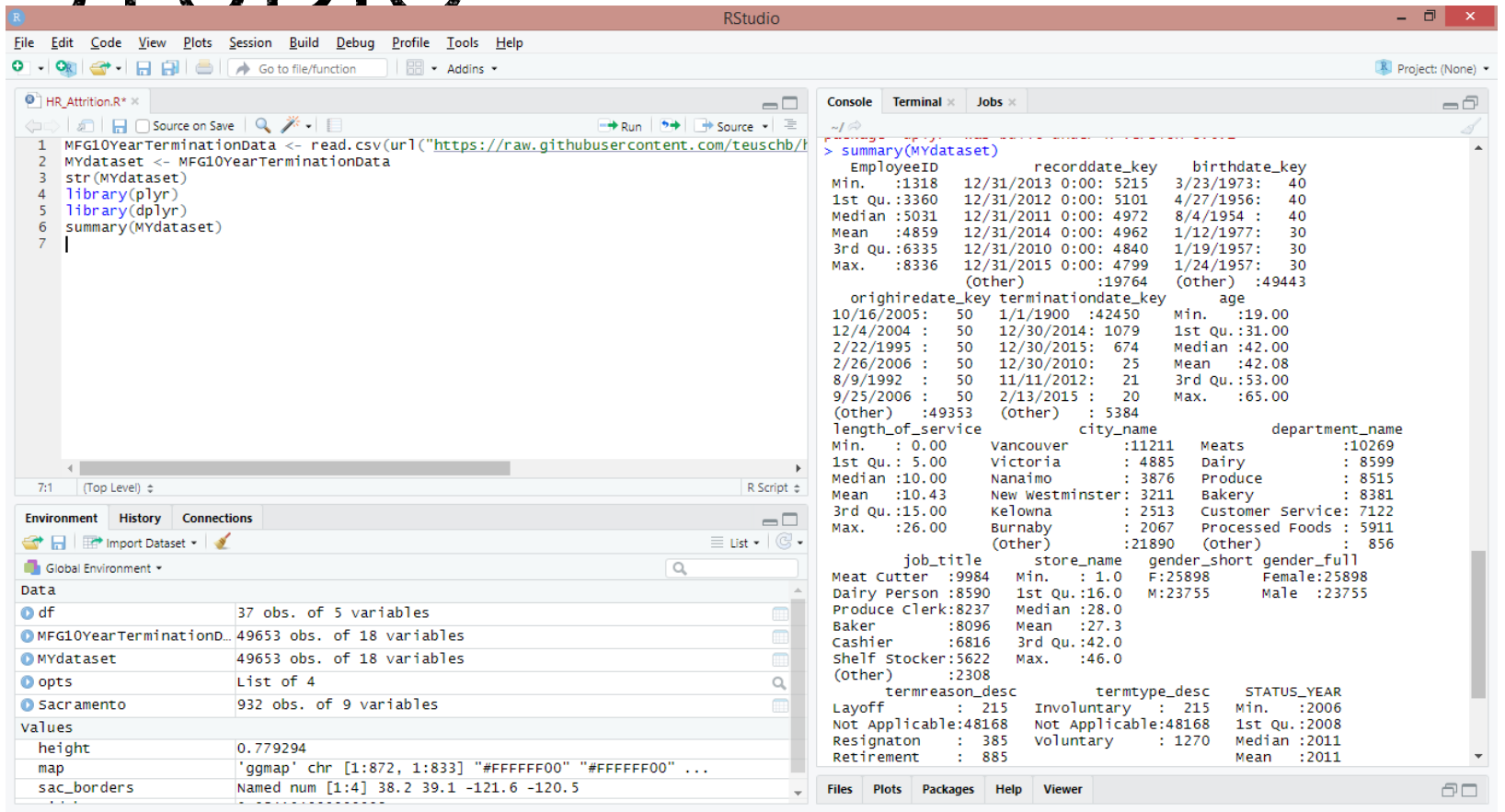


EMPLOYEE ATTRITION ANALYSIS IN R STUDIO



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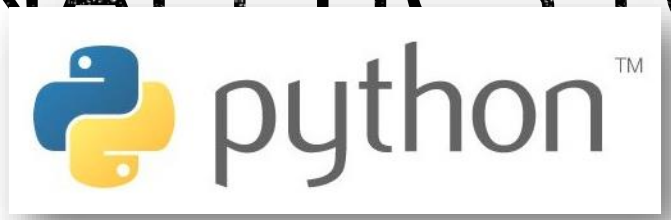

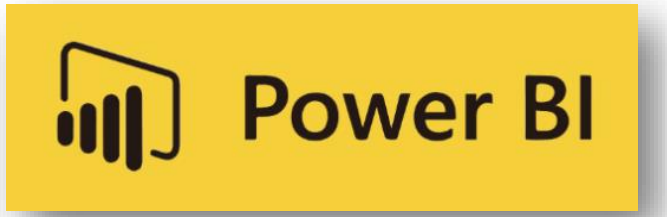

Analytics

Analytics Use-Cases

BUSINESS PROBLEMS TO DATA MINING TASKS

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EXAMPLES OF KNOWLEDGE DISCOVERY & DATA MINING QUESTIONS

- Who are the most profitable customers?
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EXAMPLES OF ANALYTICS

- Text Analytics
- Image Analytics
- Audio and Video Analytics
- Social Media Analytics
- Web Analytics
- Structured Data Analytics
- Unstructured Data Analytics
- People Analytics
- Customer Analytics
- Supplier Analytics
- Business Process Analytics

EXAMPLE: ANALYTICS IN HR

People Analytics

HR Analytics

PEOPLE ANALYTICS DEFINITION

- People analytics is defined as the use of **data** about **human behavior**, **relationships** and **traits** to make **business decisions** — helps to replace decision making based on anecdotal **experience**, **hierarchy** and **risk avoidance** with higher-quality decisions based on **data analysis**, **prediction**, and **experimental research**.

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PEOPLE ANALYTICS

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- **People analytics** has changed the game, with engines that can generate **quantitative** behavioral data on what people do at work, how a transformation will affect their work, and how changes in behavior can improve financial performance.

EXAMPLE: LEADERSHIP TEAM DIVERSITY SCORE

- Effective leadership teams are diverse leadership teams.
- In a recent study conducted by BCG and the Technical University of Munich, companies with diversity scores above the median generated, on average, 38% more of their revenues from new innovative products and services than companies with scores below the median.
- We can use analytics to highlight the importance of diversity in Gender, ethnicity, experience, and nation/state in team performance.

ANALYTICS BASED ON LAGGING VS LEADING-INDICATORS

- A leading indicator refers to future developments and causes. These indicators precede an event. For example, productivity is a leading KPI for labor cost.

- A lagging indicator refers to past developments and effects. This reflects the past outcomes of KPIs.

- Example: If productivity is a leading KPI for labor cost, sickness rate would be a lagging KPI.

ANALYTICS BASED ON LAGGING VS LEADING-INDICATORS

- HR has long been seen as the custodian of "hard" data, such as cost of employment, cost of turnover, absenteeism, labor costs and the like.
- They are critical indicators but they are all lagging indicator of performance and productivity.
- By the time the numbers and analytics are presented, it is often too late to change the strategy.
- HR can be -- and should be -- a more intentional translator of leading-indicator workforce data.
- To do that, HR leaders must drive core people-analytics harder, particularly concerning strategic performance and talent management.

Artificial Intelligence

A Primer for Business Professionals

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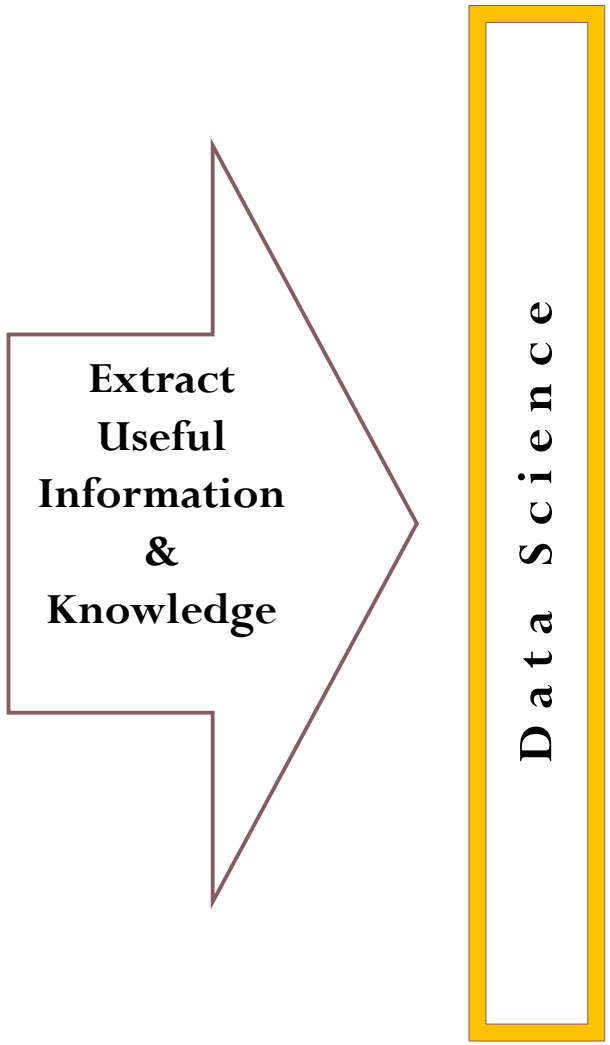
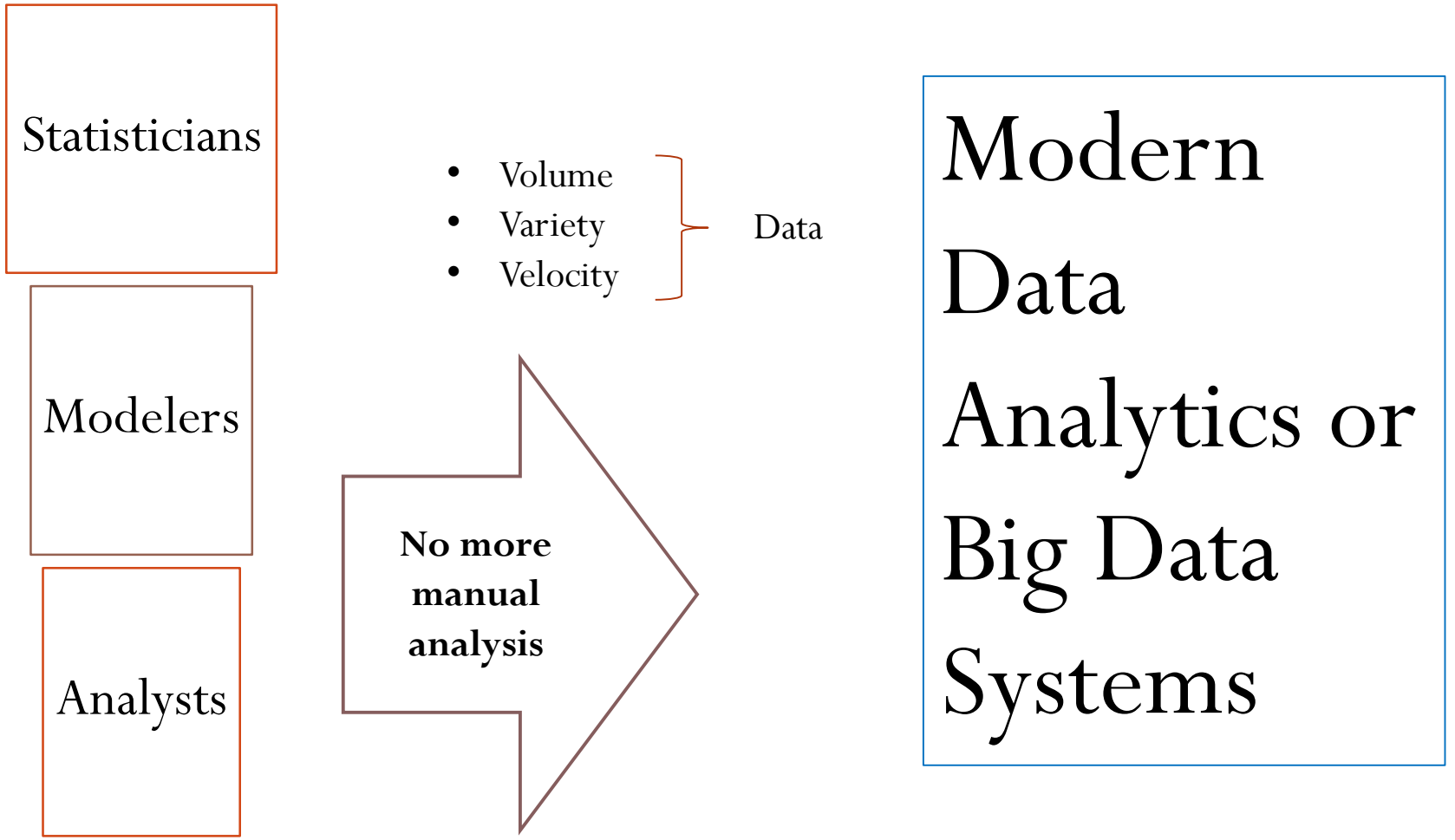
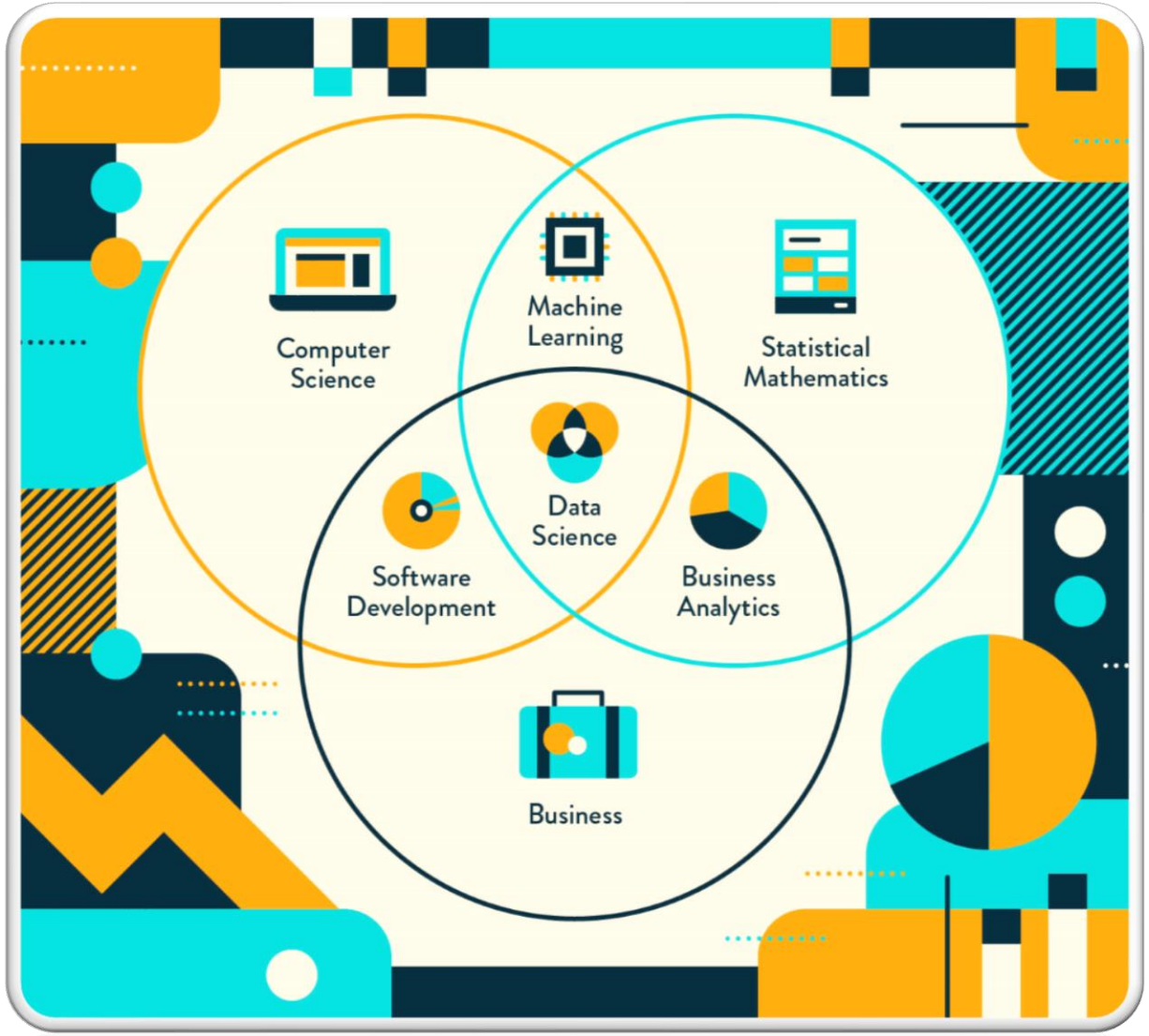


Data opportunity is everywhere

Paradigm Shift



Data Science



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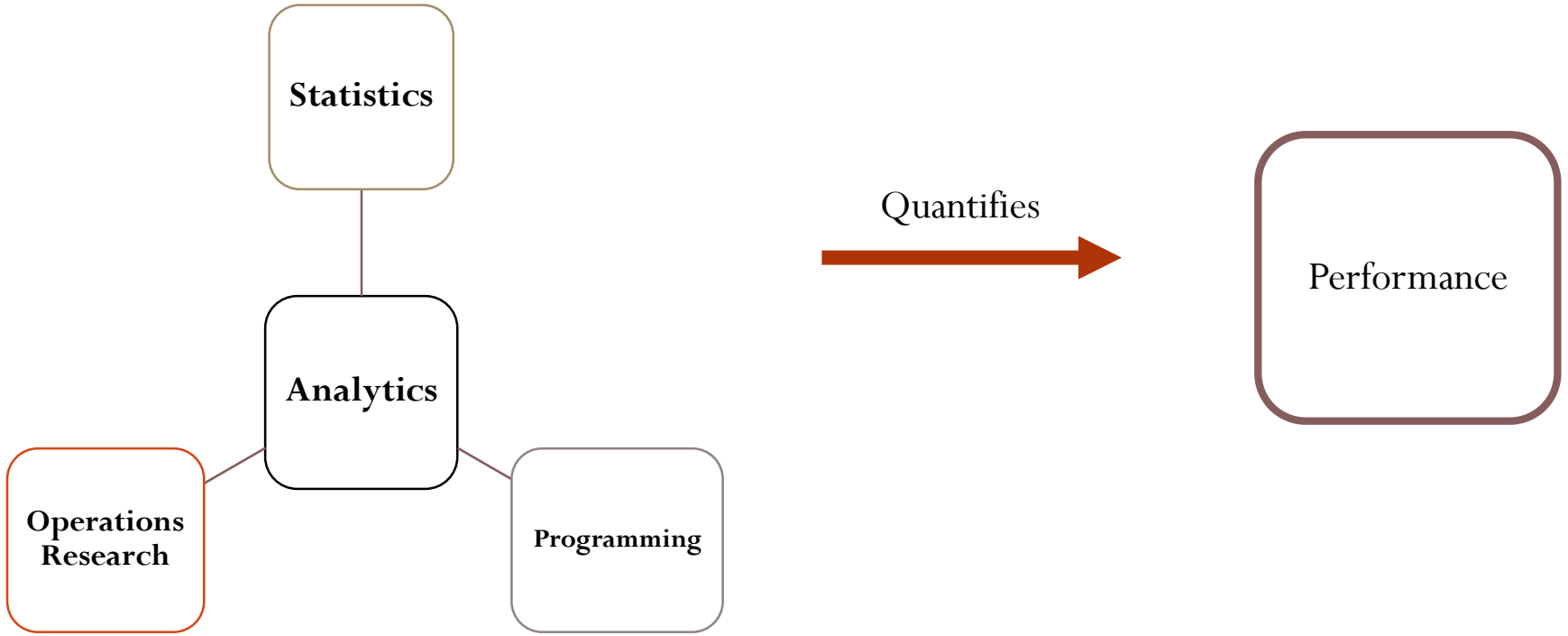

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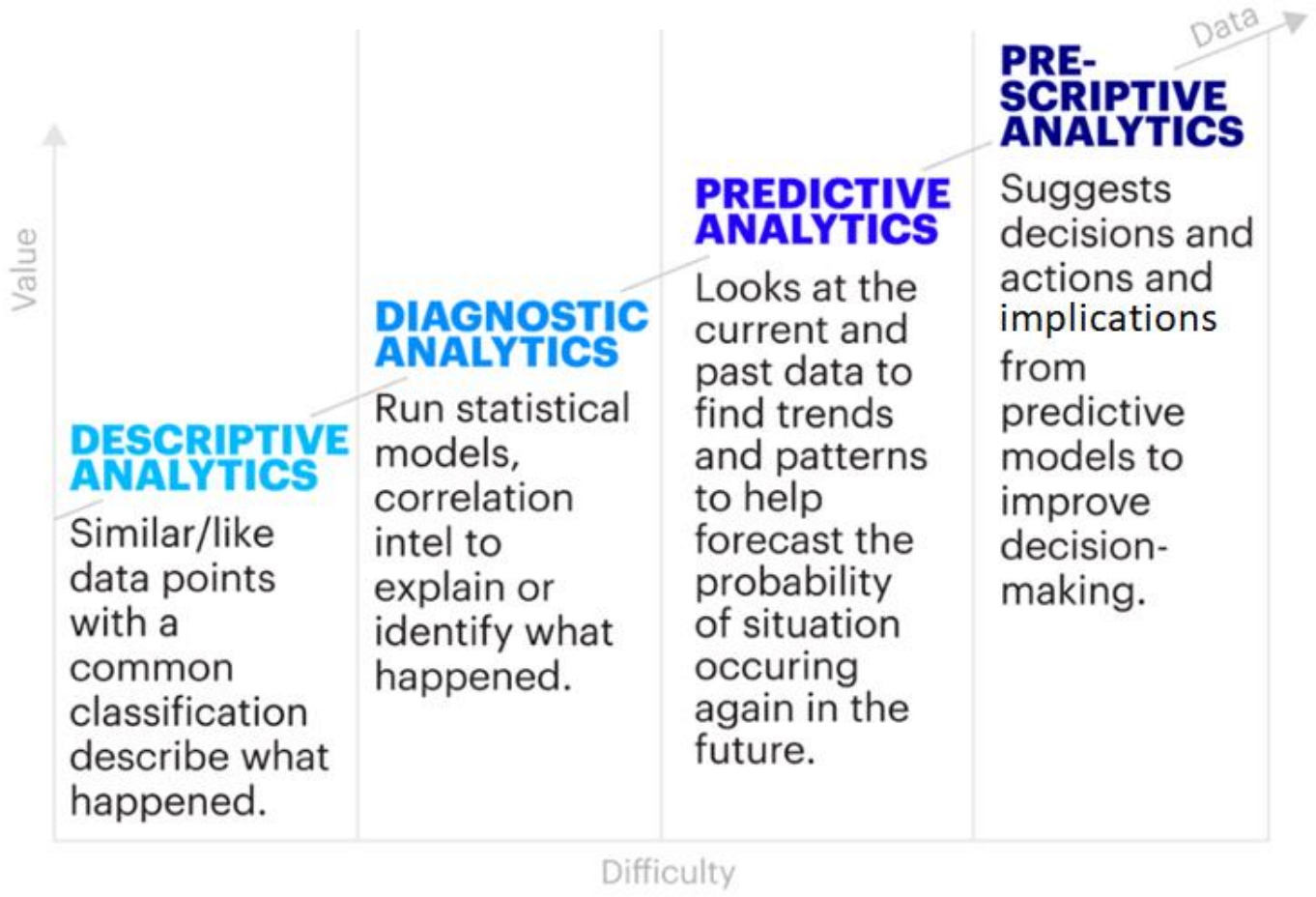

Source: Accenture

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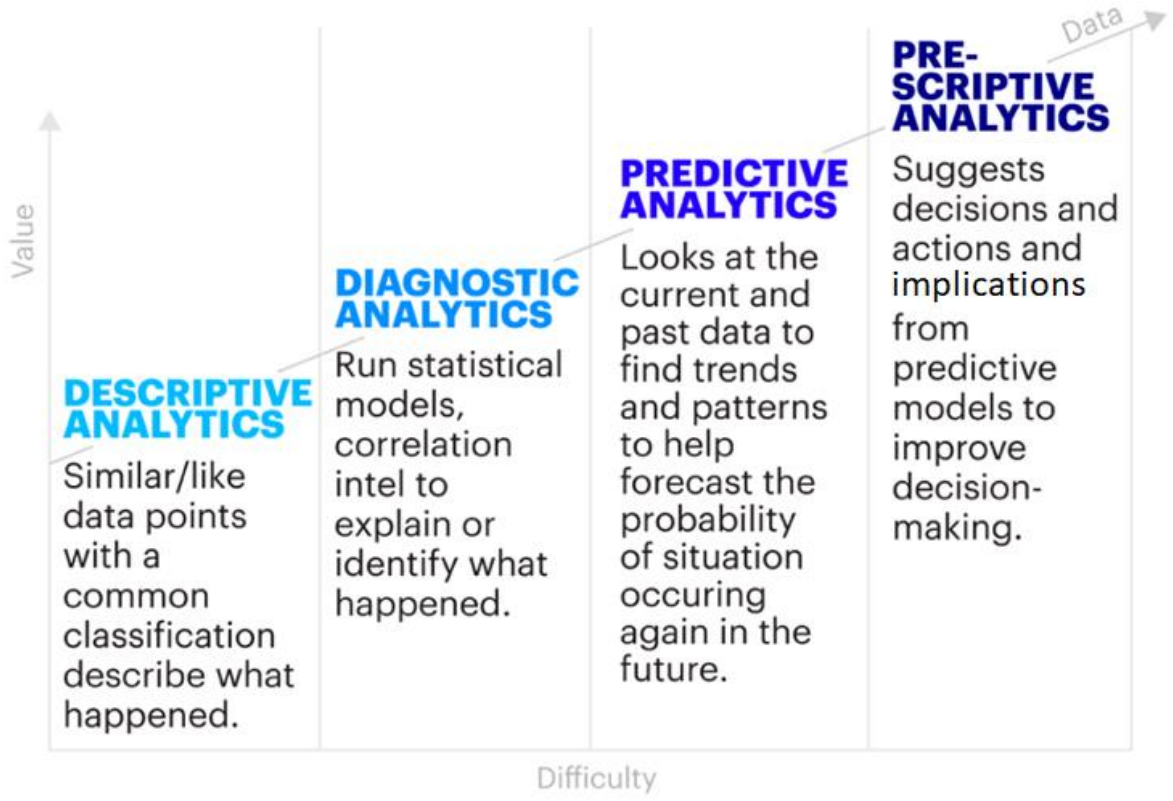

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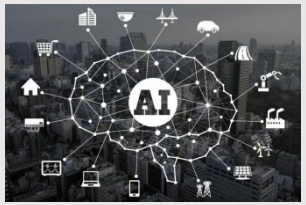

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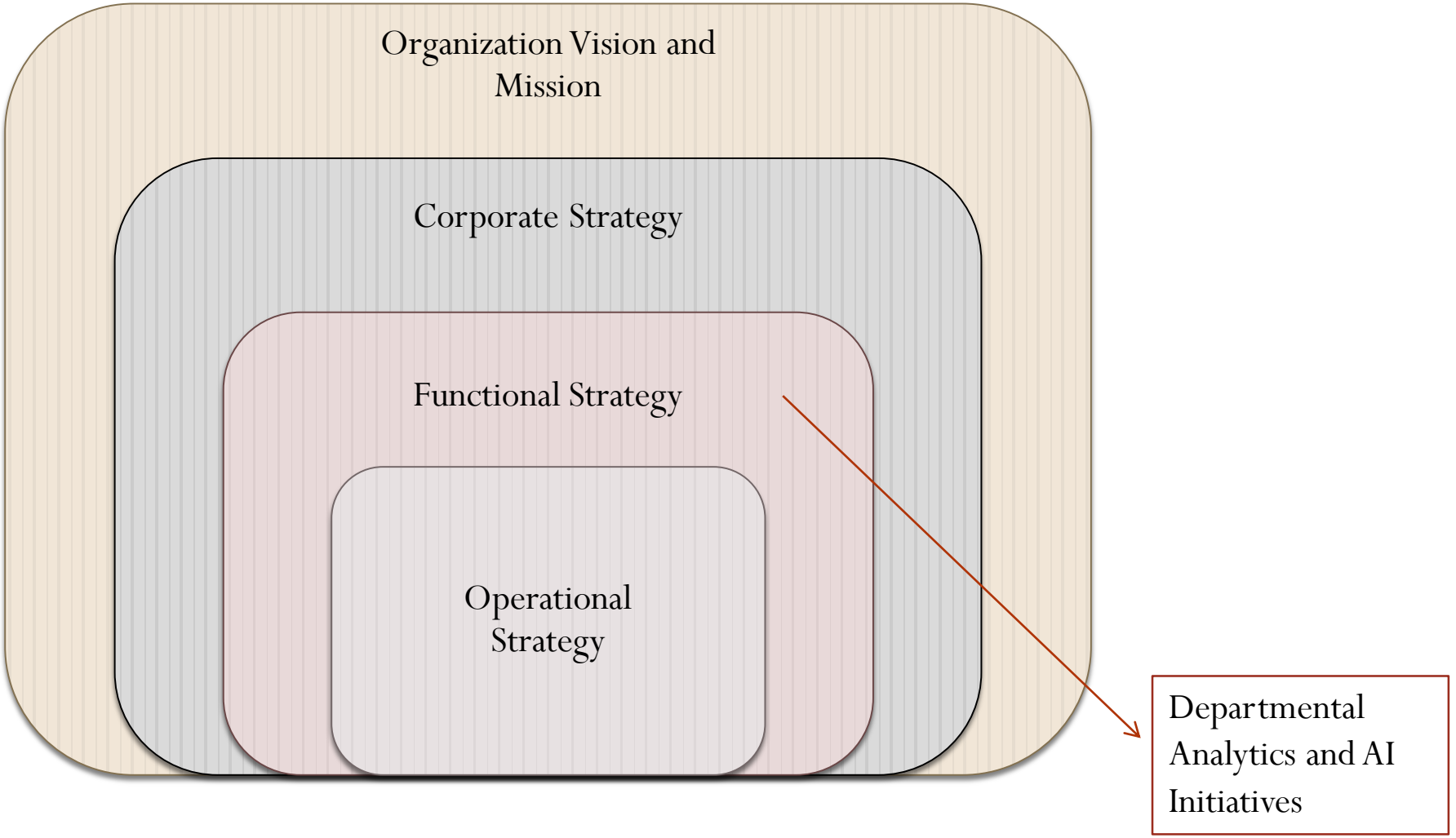

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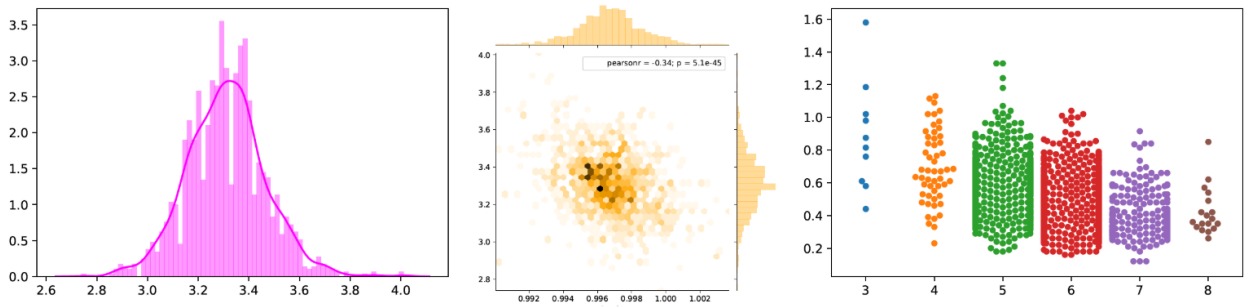
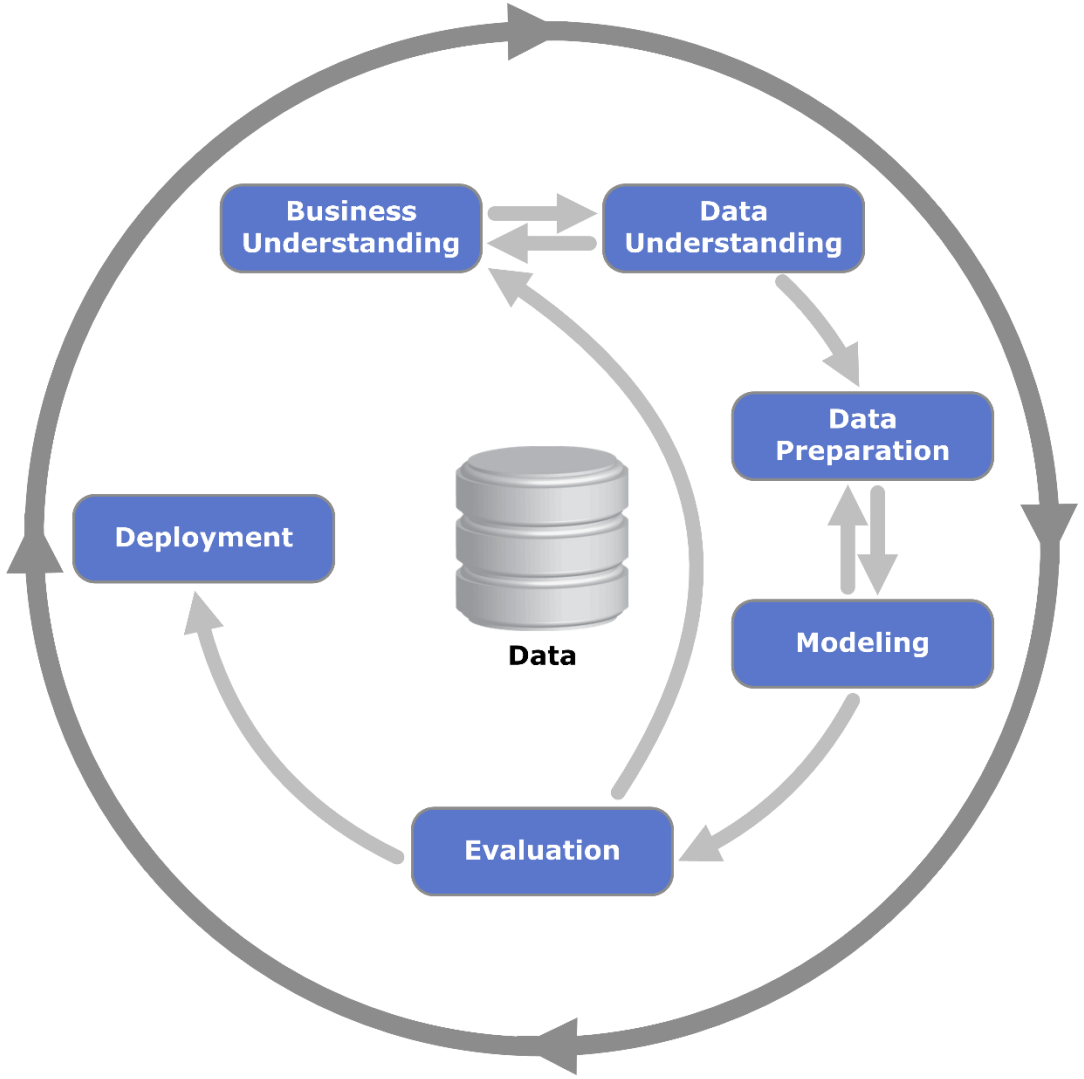


Standard Process for Data Mining



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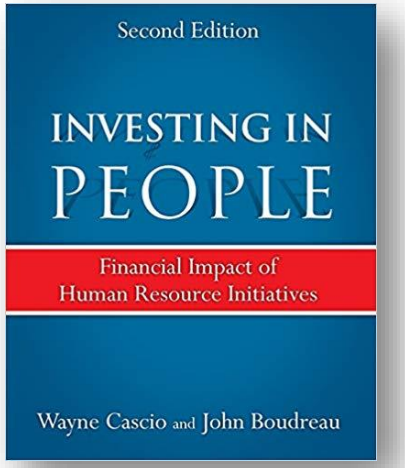

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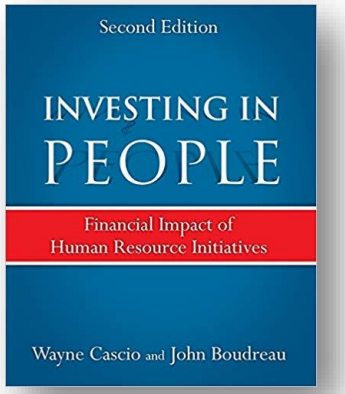
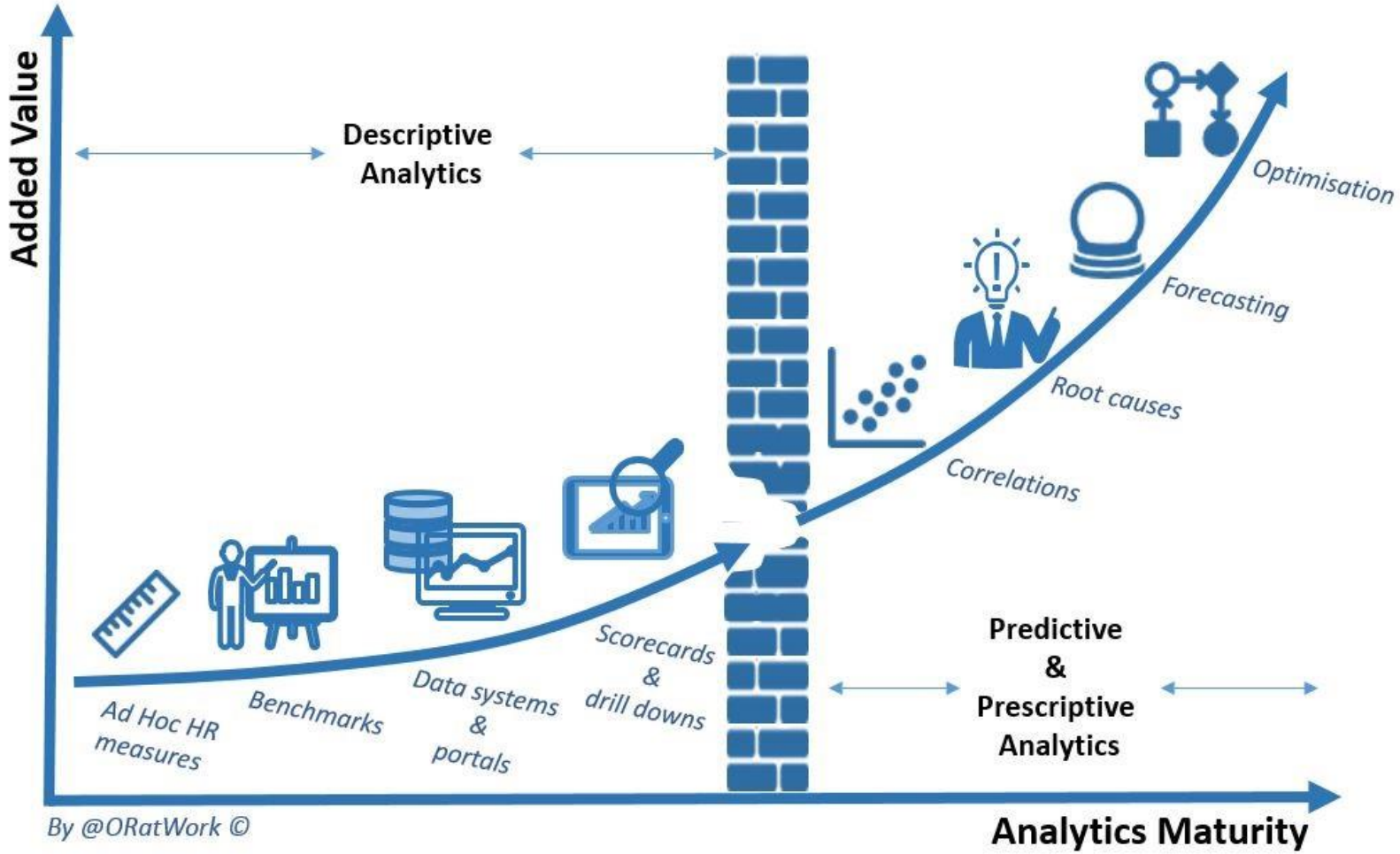


Wall in Analytics



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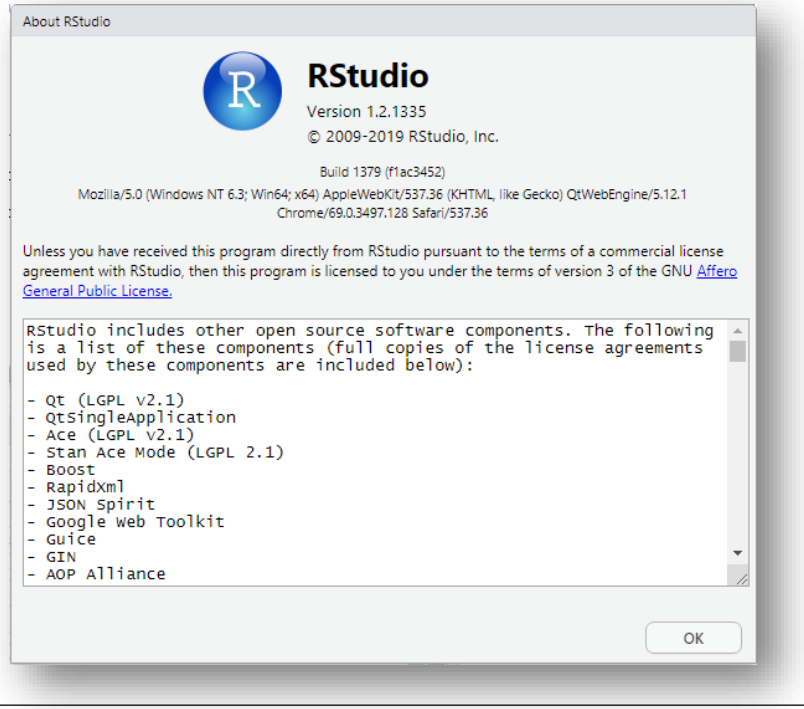
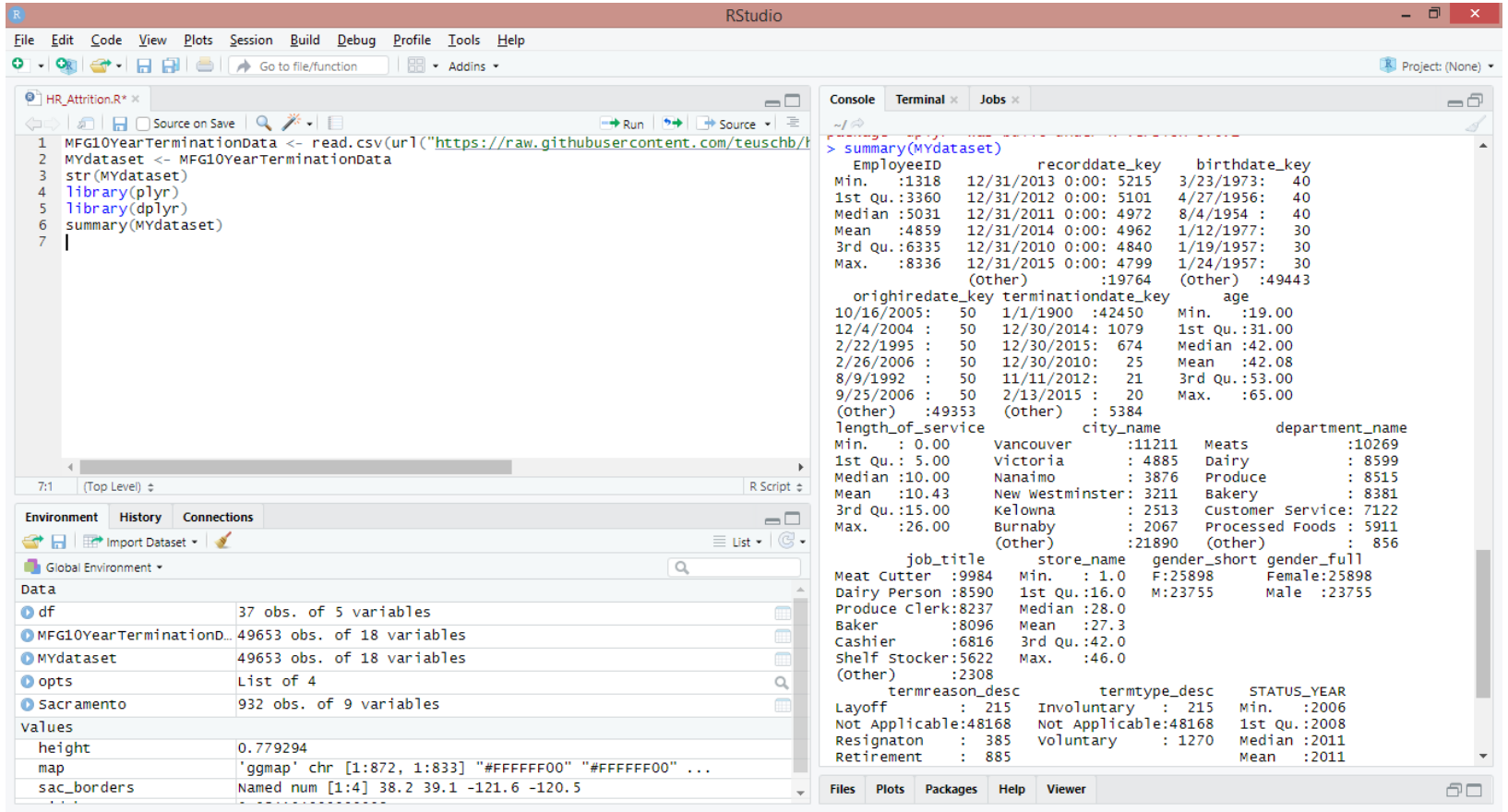


Employee Attrition Analysis in R Studio



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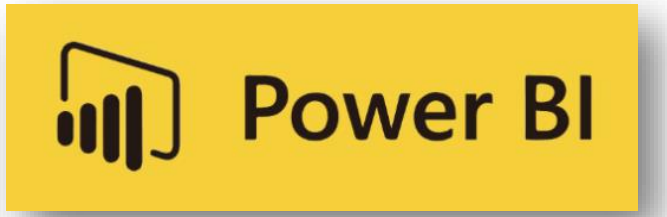

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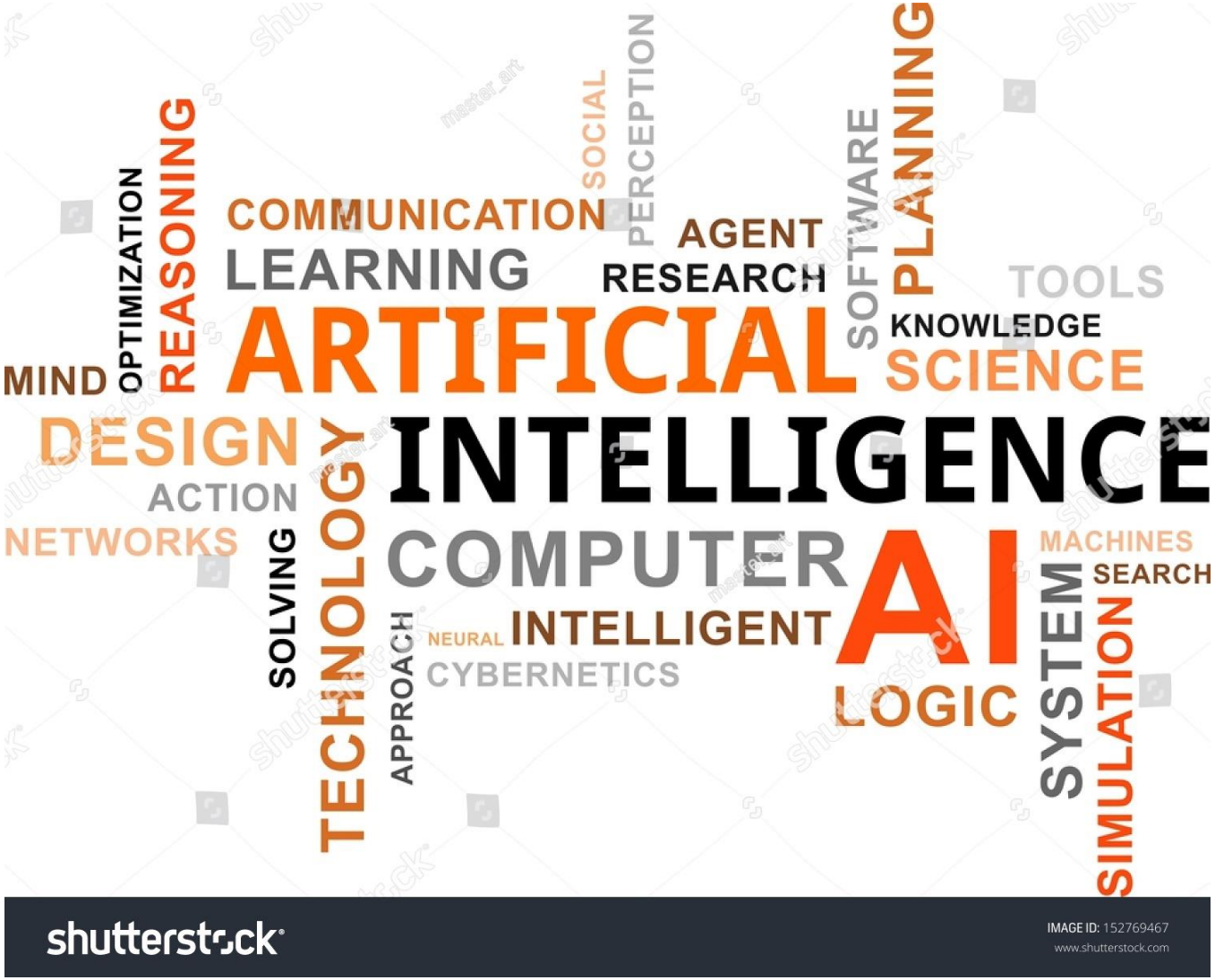
Example: Leadership Team Diversity Score

- Effective leadership teams are diverse leadership teams.
- In a recent study conducted by BCG and the Technical University of Munich, companies with diversity scores above the median generated, on average, 38% more of their revenues from new innovative products and services than companies with scores below the median.
- We can use analytics to highlight the importance of diversity in Gender, ethnicity, experience, and nation/state in team performance.

Artificial Intelligence

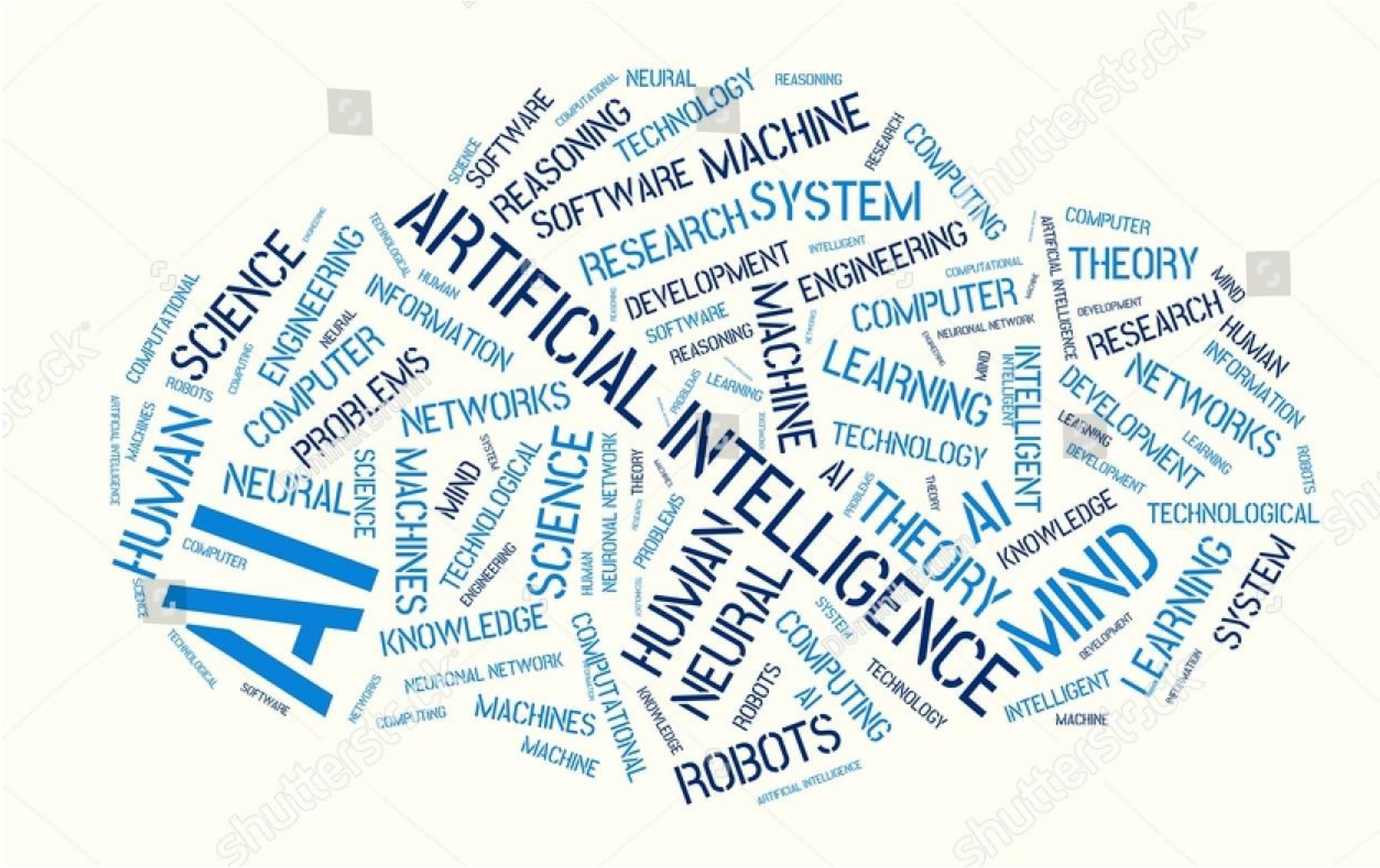
A Primer for Business Professionals

What Thoughts or Terms we Associate with Artificial Intelligence?



AI Word-Cloud

What Thoughts or Terms we Associate with Artificial Intelligence?



AI Word-Cloud

Courtesy: Shutterstock

COGNITIVE ABILITY

- Cognitive ability is defined as a general mental capability involving reasoning, problem solving, planning, abstract thinking, complex idea comprehension, and learning from experience (Gottfredson, 1997).
- Intelligence is an umbrella term used when making summary statements concerning agent's cognitive abilities and potential
- Intelligence is the measure of cognitive capabilities

NATURAL INTELLIGENCE VIDEO

Video Link

ARTIFICIAL INTELLIGENCE

- Artificial Intelligence or Machine Intelligence is a set of related technologies that seems to emulate human thinking and action in machines or agents

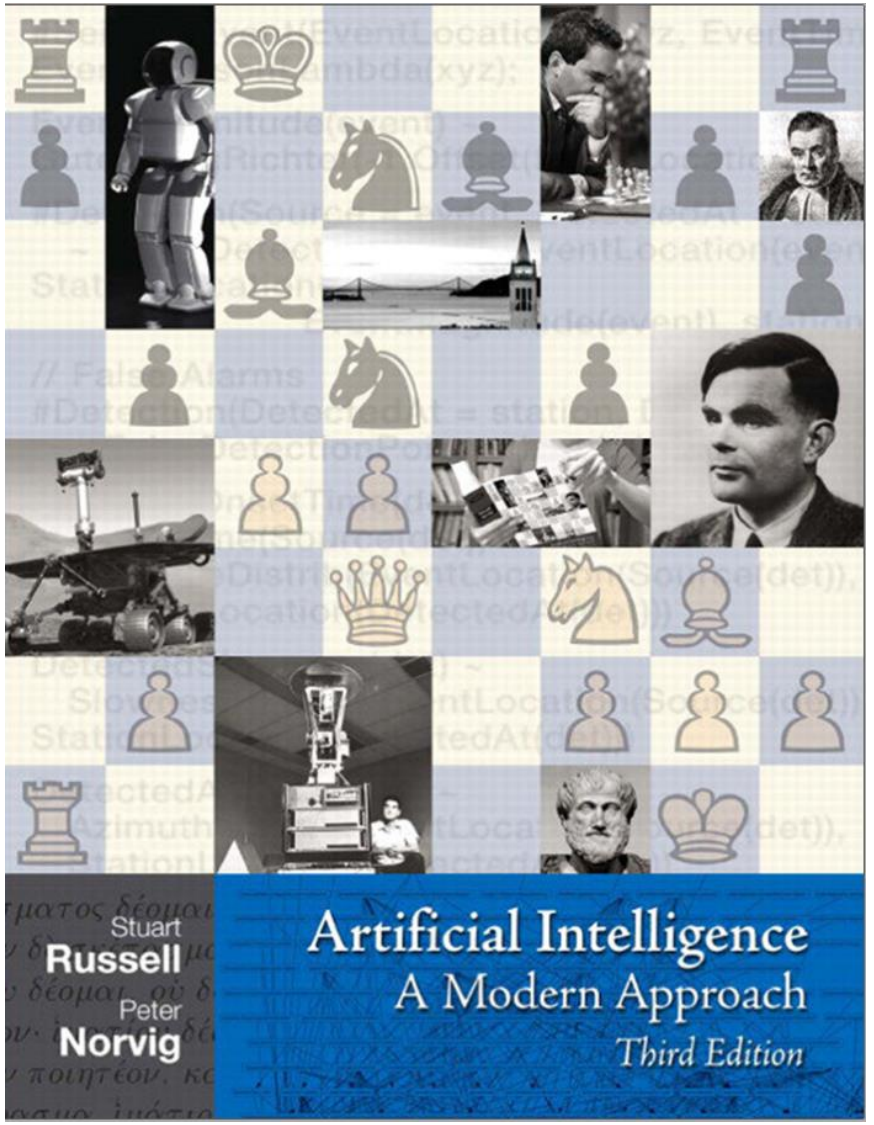
- AI is about idea of building machines or agents which are capable of thinking and acting like humans

- AI systems:
  - learn from experience i.e. data / feedback
  - arrive at their own conclusions
  - appear to understand complex real-world case or scenario
  - participate in natural-language dialogues with people
  - have cognitive capabilities i.e. learning and problem solving

ARTIFICIAL INTELLIGENCE

Rationality

A system is rational if it does the "right thing," given what it knows.



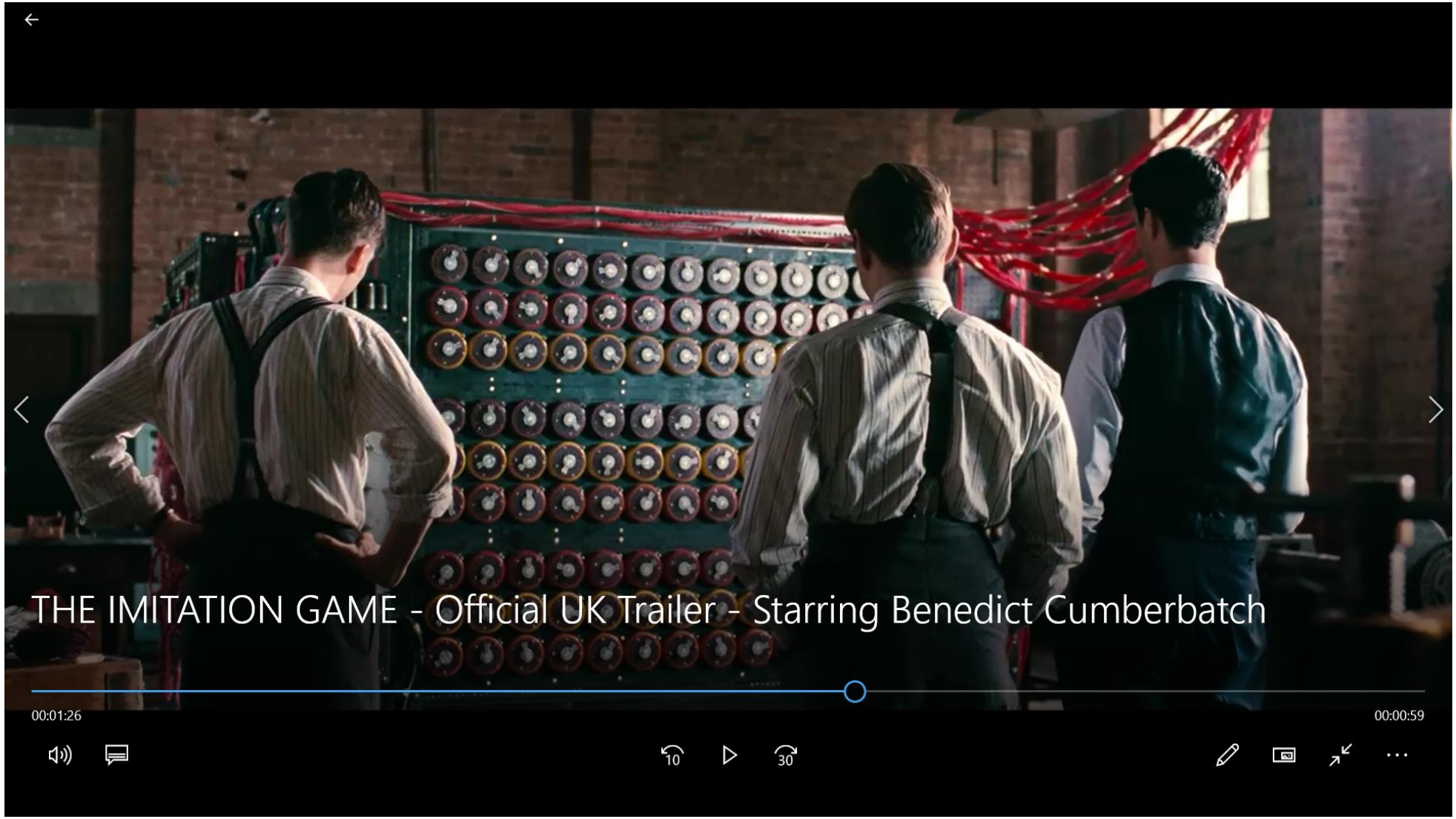
SOME DEFINITIONS OF AI – IN 4 CATEGORIES

Thinking Humanly	**Thinking Rationally**
"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)
Acting Humanly	**Acting Rationally**
"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)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998) "AI . . . is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

Artificial Intelligence – A Modern Approach

Russel & Norvig

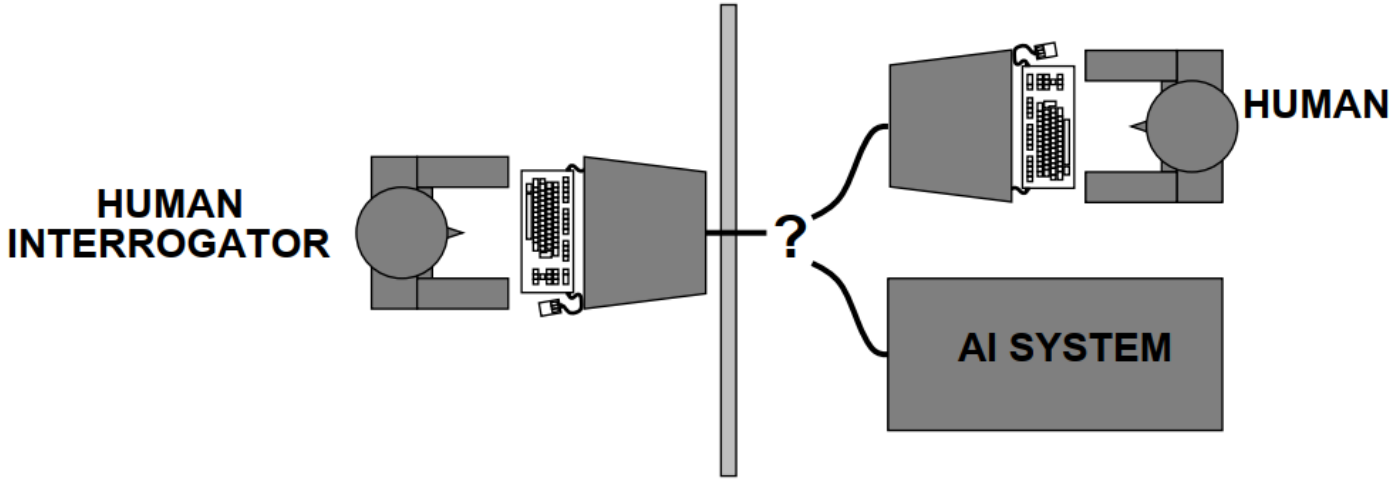
ENIGMA VIDEO



ACTING HUMANLY – THE TURING TEST APPROACH

Turing (1950) "Computing machinery and intelligence":

- "Can machines think?" ⟶ "Can machines behave intelligently?"
- Operational test for intelligent behavior: the Imitation Game



- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
- Anticipated all major arguments against AI in following 50 years
- Suggested major components of AI: knowledge, reasoning, language understanding, learning

THINKING HUMANLY – COGNITIVE SCIENCE APPROACH

- If we are going to say that a given program thinks like a human, we must have some way of determining how humans think.
- We need to get *inside* the actual workings of human minds.
- There are three ways to do this:
  - through introspection—trying to catch our own thoughts as they go by
  - through psychological experiments—observing a person in action
  - through brain imaging—observing the brain in action.
- Once we have a sufficiently precise theory of the mind, it becomes possible to express the theory as a computer program

Allen Newell and Herbert Simon, who developed GPS, the "General Problem Solver" (Newell and Simon, 1961), were not content merely to have their program solve problems correctly. They were more concerned with comparing the trace of its reasoning steps to traces of human subjects solving the same problems

THINKING RATIONALLY – LAWS OF THOUGHT APPROACH

- Aristotle was one of the first to attempt to codify "right thinking," that is, irrefutable reasoning processes.
- His syllogisms provided patterns for argument structures that always yielded correct conclusions when given correct premises
- These laws of thought were supposed to govern the operation of the mind; their study initiated the field called logic.
- Logicians in the 19th century developed a precise notation for statements about all kinds of objects in the world and the relations among them.
- By 1965, programs existed that could, in principle, solve any solvable problem described in logical notation.
- The so-called logicist tradition within artificial intelligence hopes to build on such programs to create intelligent systems.

Artificial Intelligence –
A Modern Approach

Russel & Norvig

"Socrates is a man; all men are mortal; therefore, Socrates is mortal."

ACTING RATIONALLY – THE RATIONAL AGENT APPROACH

- An agent is just something that acts.
- All computer programs do something, but computer agents are expected to do more: operate autonomously, perceive their environment, persist over a prolonged time period, adapt to change, and create and pursue goals.
- A rational agent is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.
- Correct inference is not all of rationality; in some situations, there is no provably correct thing to do, but something must still be done.
- Knowledge representation and reasoning enable agents to reach good decisions.
- The standard of rationality is mathematically well defined and completely general, and can be "unpacked" to generate agent designs that provably achieve it.

Artificial Intelligence – A Modern Approach

Rational behavior is doing the right thing. The right thing is that which is expected to maximize goal achievement, given the available information

Russel & Norvig

RATIONAL AGENT

- Artificial Intelligence is about designing Rational Agents
- Abstractly, an agent is a function from *percept histories* to *actions*:

$$f : P^* \rightarrow A$$

- For any given class of environments and tasks, we seek the agent (or class of agents) with the best performance

Artificial Intelligence –
A Modern Approach

Russel & Norvig

Rational behavior is doing the right thing. The right thing is that which is expected to maximize goal achievement, given the available information

GOALS OF ARTIFICIAL INTELLIGENCE

The Goals of AI is driven by two groups:

1

Industry, whether related to goods or services, is concerned primarily with creating expert systems

- **Expert Systems** should demonstrate intelligent behavior, regardless of their resemblance or non-resemblance to human intelligence.
- The systems which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users.

2

Academia of Cognitive Science, rising out of psychology, linguistics, philosophy, biology, social sciences and computer science which is interested in AI for its ability to

- **Model Human Intelligence** with aim to some day replicating or surpassing human level intelligence.
- Creating systems that understand, think, learn, and behave like humans.

https://www.cs.swarthmore.edu/~eroberts/cs91/projects/ethics-of-ai/sec2.html

TRADITIONAL GOALS OF AI

- Reasoning or Automated Reasoning
- Automated reasoning involves knowledge representation and reasoning
- The study of automated reasoning helps produce computer programs that allow computers to reason completely, or nearly completely, automatically. Although automated reasoning is considered a sub-field of artificial intelligence, it also has connections with theoretical computer science, and even philosophy.
- The most developed subareas of automated reasoning are automated theorem proving and automated proof checking
- Other important topics include reasoning under uncertainty
- Tools and techniques of automated reasoning include the classical logic, fuzzy logic, Bayesian inference, reasoning with maximal entropy and ad hoc techniques.

Source: Wikipedia

TRADITIONAL GOALS OF AI

- Knowledge Representation and Reasoning
- Knowledge representation and reasoning is the field of artificial intelligence (AI) dedicated to representing information about the world in a form that a computer system can utilize to solve complex tasks such as diagnosing a medical condition or having a dialog in a natural language.
- Knowledge representation incorporates findings from psychology about how humans solve problems and represent knowledge in order to design formalisms that will make complex systems easier to design and build.
- Knowledge representation and reasoning also incorporates findings from logic to automate various kinds of reasoning, such as the application of rules or the relations of sets and subsets.
- Examples of knowledge representation formalisms include semantic networks, systems architecture, frames, rules, and ontologies.
- Examples of automated reasoning engines include inference engines, theorem provers, and classifiers.

Source: Wikipedia

TRADITIONAL GOALS OF AI

- AI Planning or Problem Solving
- Automated planning and scheduling is a branch of artificial intelligence that concerns the realization of strategies or action sequences, typically for execution by intelligent agents, autonomous robots and unmanned vehicles.
- Unlike classical control and classification problems, the solutions are complex and must be discovered and optimized in multidimensional space.
- Planning is also related to decision theory.
- In known environments with available models, planning can be done offline. Solutions can be found and evaluated prior to execution.
- In dynamically unknown environments, the strategy often needs to be revised online. Models and policies must be adapted. Solutions usually resort to iterative trial and error processes commonly seen in artificial intelligence. These include dynamic programming, reinforcement learning and combinatorial optimization.
- Languages used to describe planning and scheduling are often called action languages.

Source: Wikipedia

TRADITIONAL GOALS OF AI

- Machine Learning

- Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead.
- Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to perform the task.
- Machine learning is closely related to computational statistics, which focuses on making predictions using computers.
- The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning.
- Data mining is a field of study within machine learning, and focuses on exploratory data analysis through unsupervised learning.
- In its application across business problems, machine learning is also referred to as predictive analytics.

Source: Wikipedia

TRADITIONAL GOALS OF AI

- Natural Language Processing
- Natural language processing (NLP) is a subfield of linguistics, computer science, information engineering, and artificial intelligence concerned with the interactions between computers and human (natural) languages
- In particular, it addresses the issue of programming computers to process and analyze large amounts of natural language data.
- Challenges in natural language processing frequently involve speech recognition, natural language understanding, and natural language generation.

Source: Wikipedia

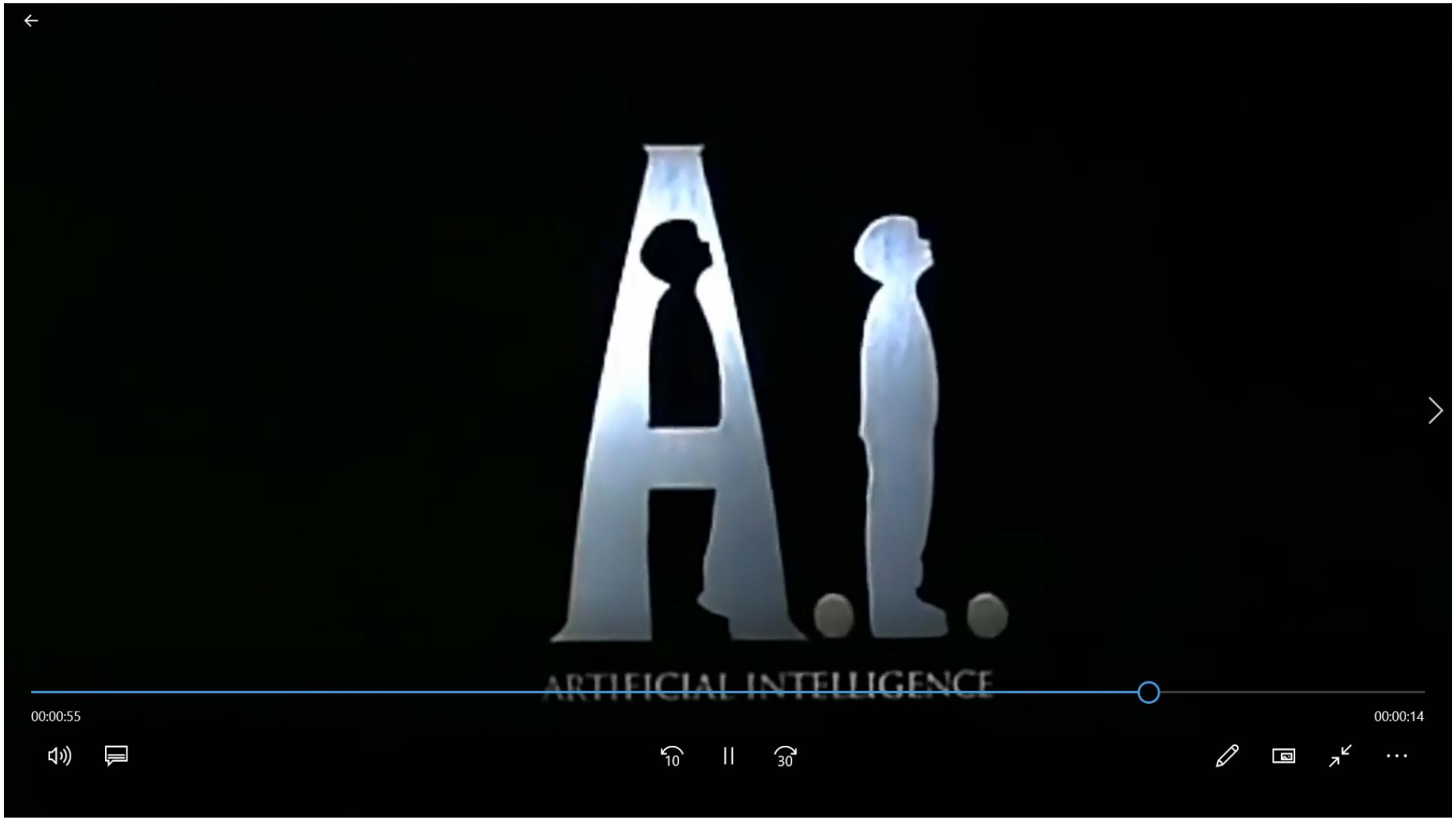
TRADITIONAL GOALS OF AI

- Machine Perception
- Machine perception is the capability of a computer system to interpret data in a manner that is similar to the way humans use their senses to relate to the world around them.
- The basic method that the computers take in and respond to their environment is through the attached hardware.

- Machine perception allows the computer to use this sensory input, as well as conventional computational means of gathering information, to gather information with greater accuracy and to present it in a way that is more comfortable for the user.
- These include computer vision, machine hearing, and machine touch.
- The end goal of machine perception is to give machines the ability to see, feel and perceive the world as humans do and therefore for them to be able to explain in a human way why they are making their decisions, to warn us when it is failing and more importantly, the reason why it is failing.

Source: Wikipedia

AI MOVIE VIDEO



HISTORY OF AI

Year	Milestone / Innovation
1923	Karel Čapek play named "Rossum's Universal Robots" (RUR) opens in London, first use of the word "robot" in English.
1943	Foundations for neural networks laid.
1945	Isaac Asimov, a Columbia University alumni, coined the term *Robotics*.
1950	Alan Turing introduced Turing Test for evaluation of intelligence and published *Computing Machinery and Intelligence.* Claude Shannon published *Detailed Analysis of Chess Playing* as a search.
1955	The first AI system, called *Logic Theorist*, was designed by Allen Newell and Herbert Simon and implemented by J. Clifford Shaw at Carnegie Mellon University. The system proved nearly 40 theorems included in Alfred N. Whitehead and Bertrand Russell's fundamental monograph *Principia Mathematica*.

Source: TutorialPoint

HISTORY OF AI

Year	Milestone / Innovation
1956	John McCarthy coined the term *Artificial Intelligence*. Demonstration of the first running AI program at Carnegie Mellon University.
1958	John McCarthy invents LISP programming language for AI.
1964	Danny Bobrow's dissertation at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.
1965	Joseph Weizenbaum at MIT built *ELIZA*, an interactive problem that carries on a dialogue in English.
1969	Scientists at Stanford Research Institute Developed *Shakey*, a robot, equipped with locomotion, perception, and problem solving.
1973	The Assembly Robotics group at Edinburgh University built *Freddy*, the Famous Scottish Robot, capable of using vision to locate and assemble models.

Source: TutorialPoint

HISTORY OF AI

Year	Milestone / Innovation
1979	The first computer-controlled autonomous vehicle, Stanford Cart, was built.
1985	Harold Cohen created and demonstrated the drawing program, *Aaron*.
1990	Major advances in all areas of AI – •Significant demonstrations in machine learning •Case-based reasoning •Multi-agent planning •Scheduling •Data mining, Web Crawler •natural language understanding and translation •Vision, Virtual Reality •Games

Source:
TutorialPoint

HISTORY OF AI

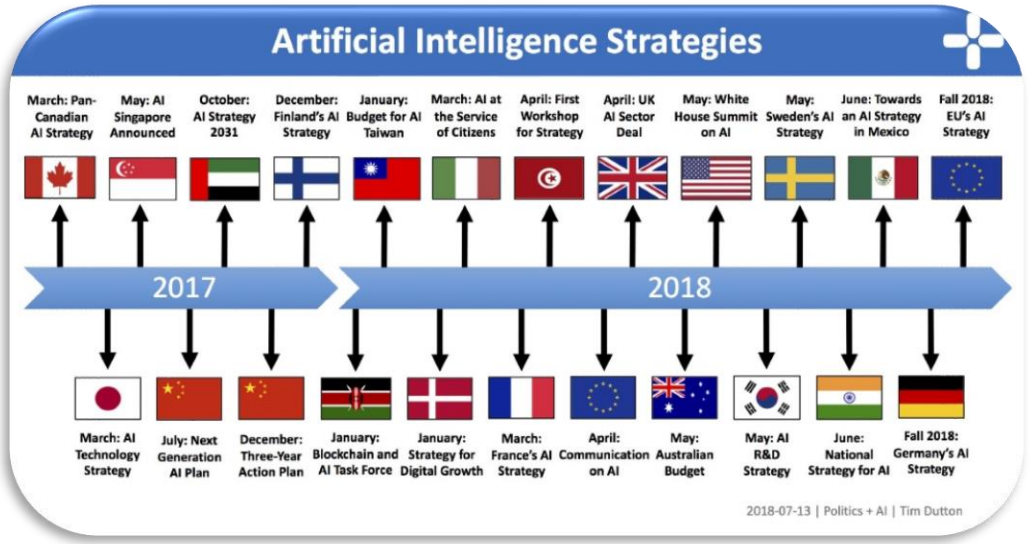
Year	Milestone / Innovation
1997	The Deep Blue Chess Program beats the then world chess champion, Garry Kasparov.
2000	Interactive robot pets become commercially available. MIT displays *Kismet*, a robot with a face that expresses emotions. The robot *Nomad* explores remote regions of Antarctica and locates meteorites.
2011	IBM Watson AI beats human in Jeopardy
2016	DeepMind's AlphaGo AI beats human in Go
2019	Facebook and CMU's AI poker bot is first to beat professionals at multiplayer game

2019 AI Poker Triumph

Source:
TutorialPoint and Nature Journal

WHY ARTIFICIAL INTELLIGENCE?

- The race to become the global leader in artificial intelligence (AI) has officially begun.
- Since 2017, Canada, China, Denmark, the EU Commission, Finland, France, India, Italy, Japan, Mexico, the Nordic-Baltic region, Singapore, South Korea, Sweden, Taiwan, the UAE, and the UK have all released AI strategies.



'Leader in artificial intelligence will rule world'

- Vladimir Putin

GOVERNMENT ARTIFICIAL INTELLIGENCE READINESS INDEX 2019

Country	Rank	Score
Singapore	1	9.186
United Kingdom	2	9.069
Germany	3	8.810
United States of America	4	8.804
Finland	5	8.772
Sweden	6	8.674
Canada	6	8.674
France	8	8.608
Denmark	9	8.601
Japan	10	8.582
Australia	11	8.126
Norway	12	8.079
New Zealand	13	7.876
Netherlands	14	7.659
Italy	15	7.533
Austria	16	7.527
India	17	7.515
Switzerland	18	7.461

- The governments of most countries in the Global North are better placed to take advantage of these gains than those in the Global South.

Source: Oxford Insights

https://www.oxfordinsights.com/ai-readiness2019

ARTIFICIAL INTELLIGENCE PARADIGMS

Symbolic Artificial Intelligence View

The field of AI, since its inception, has been conceived mainly as the development of models using symbol manipulation. The computation in such models is based on explicit representations that contain symbols organized in some specific ways and aggregate information is explicitly represented with aggregate structures that are constructed from constituent symbols and syntactic combinations of these symbols.

Also called Good Old-Fashioned AI (GOFAI)

A physical symbol system has the necessary and sufficient means for general intelligent action.

-Newell and Simon, 1976

ARTIFICIAL INTELLIGENCE PARADIGMS

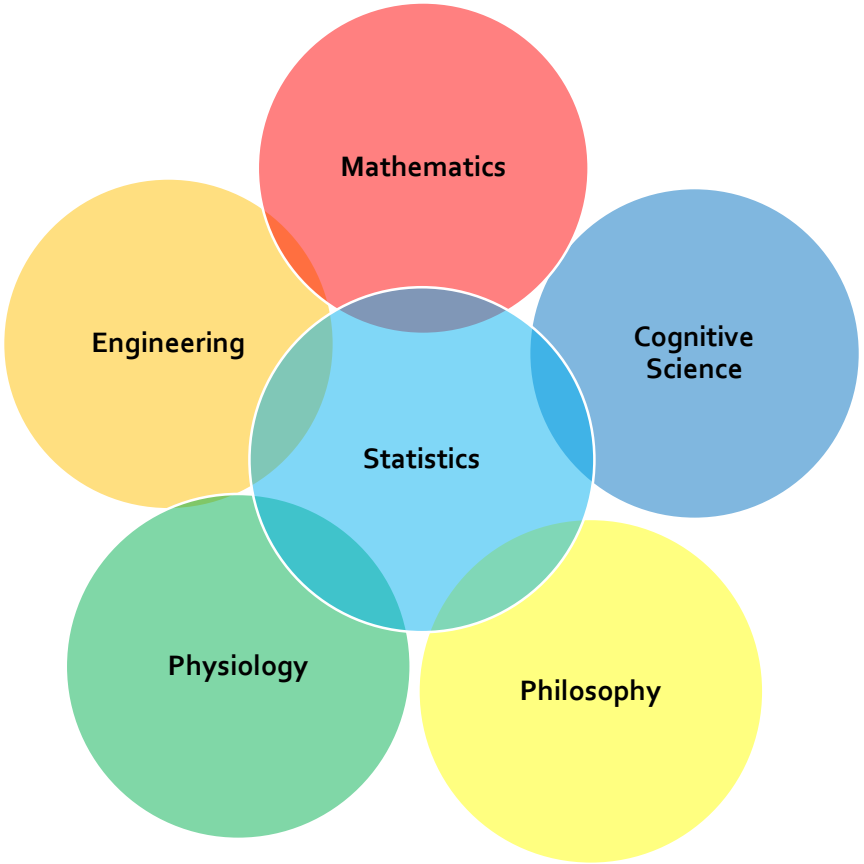
Connectionists View

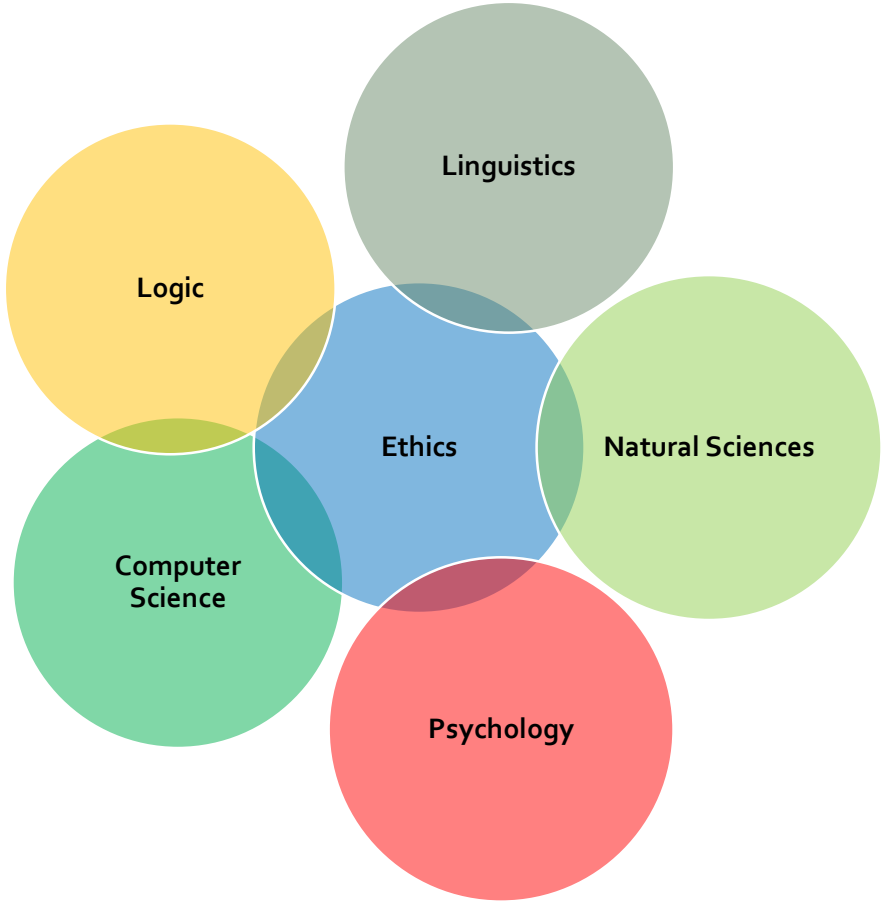
The connectionist paradigm aims at massively parallel models that consist of a large number of simple and uniform processing elements (neurons) interconnected with extensive links, that is, artificial neural networks and their various generalizations.

In many connectionist models, representations are distributed throughout a large number of processing elements. Sometimes the constituent symbolic structures of aggregate information are embedded in a network and difficult to identify.

Due to their massively parallel nature, such models are good at flexible and robust processing, and show promise at dealing with some tasks that have been difficult for the symbolic paradigm.

AI KNOWLEDGE DOMAINS





AI TECHNOLOGICAL REPRESENTATIONS

- Machine Learning including Neural Network
- Robotics
- Popular Search Algorithms
- Fuzzy Logic
- Expert Systems
- Natural Language Processing

TYPES OF ARTIFICIAL INTELLIGENCE

- **Weak AI or Narrow AI**

AI system that is designed and trained for a particular task which it can do at par or better than a human.

Virtual personal assistants, such as Apple's Siri or Google Assistant, are a form of weak AI.

TYPES OF ARTIFICIAL INTELLIGENCE

- **Strong AI or General AI**

An artificial intelligence reaches the general state when it can perform any intellectual task with the same accuracy level as a human would. When presented with an unfamiliar task, a strong AI system will be able to find a solution without human intervention.

An AI is strong when it can beat humans in many tasks.

MACHINE LEARNING

- Machine learning (ML) is a category of algorithms that allows software applications to become more accurate in predicting outcomes without being *explicitly* programmed.

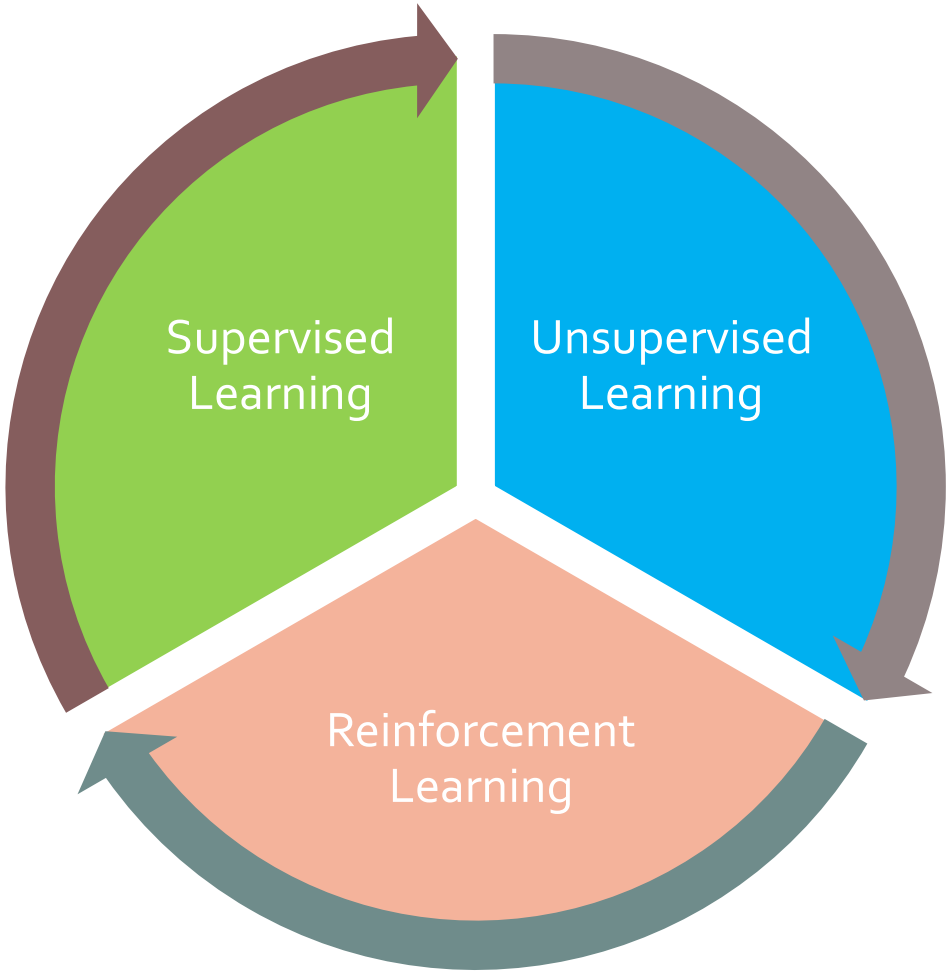
- The basic premise of machine learning is to build algorithms that can receive *input data* and use *statistical analysis* to predict an *output* while updating outputs as new data becomes available.

- Today's AI is largely based on Machine Learning

A computer program is said to learn from *experience E* with respect to some class of *tasks T* and *performance* measure *P* if its performance at tasks in *T*, as measured by *P*, improves with experience *E*.

(Tom M Mitchell)

TYPES OF MACHINE LEARNING



SUPERVISED LEARNING

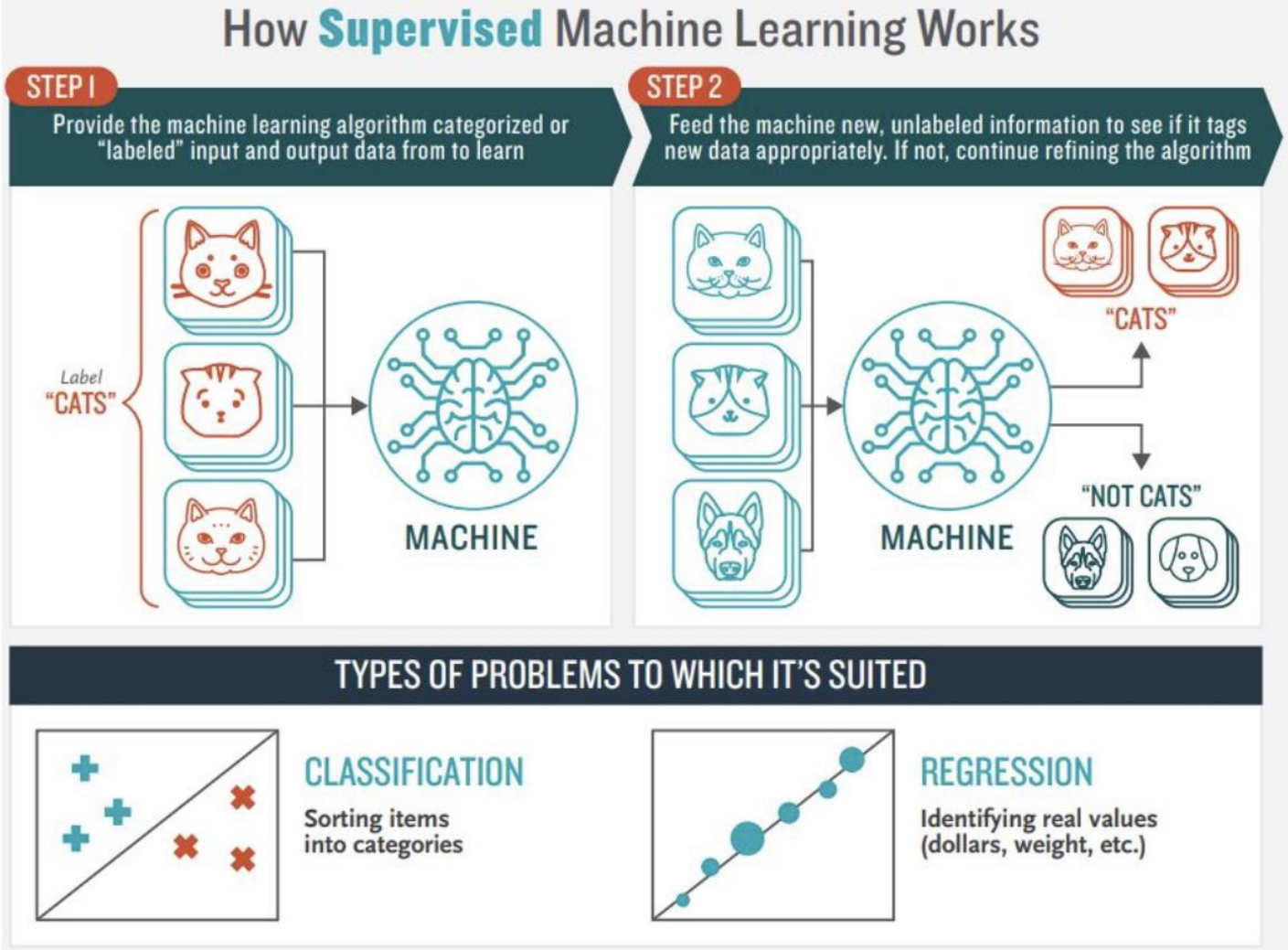
- Supervised Learning Algorithms examples are linear and logistic regression, multi-class classification, Neural networks, and support vector machines etc.

- Supervised learning classified into two categories of algorithms:

  - **Classification**: A classification problem is when the output variable is a category, such as "Red" or "Blue" or "spam" and "not spam".

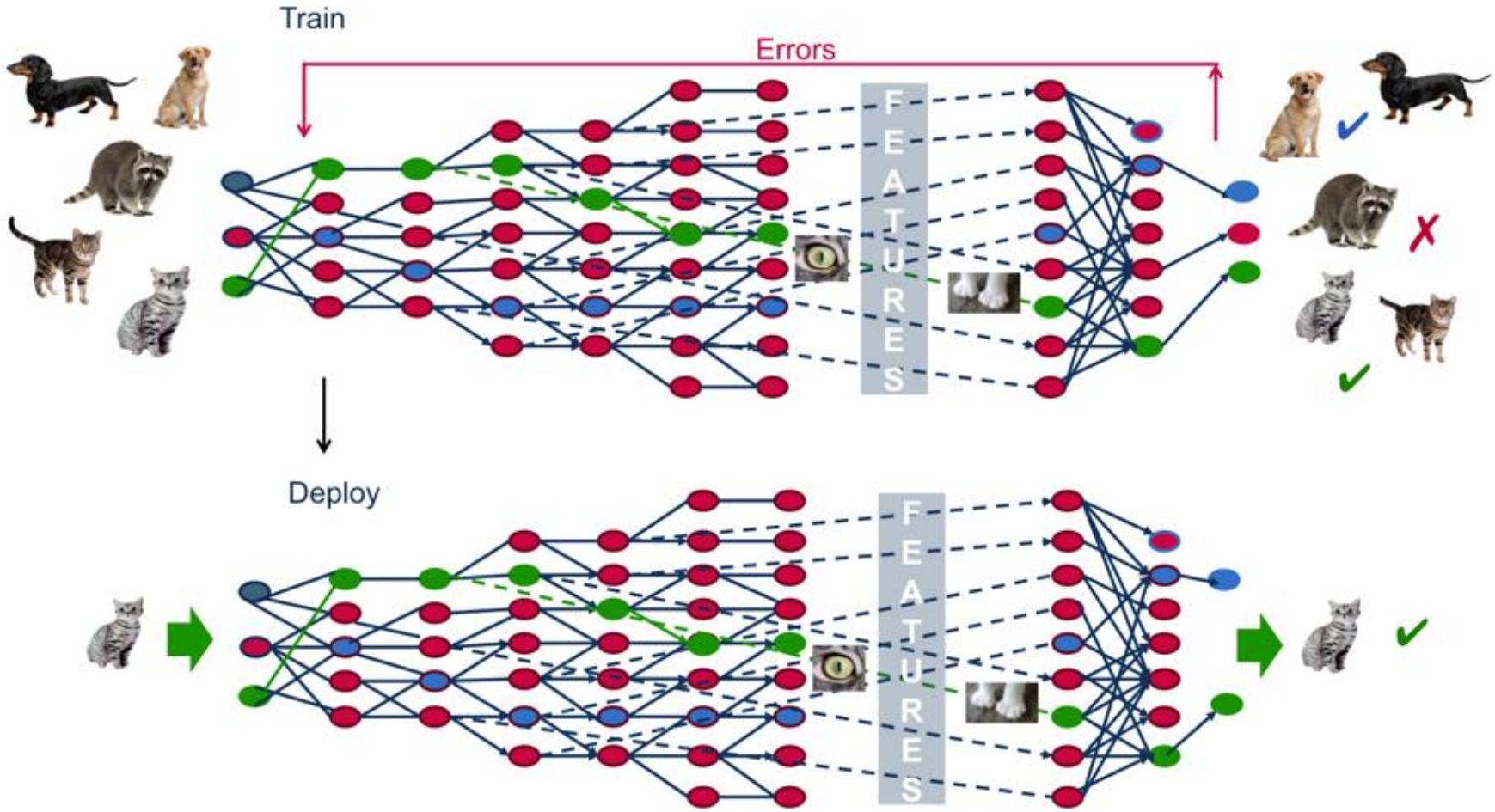
  - **Prediction/Regression**: A regression problem is when the output variable is a real value, such as "Rupees" or "weight".

SUPERVISED LEARNING



Source: https://medium.com/@jorgesleonel/supervised-learning-c16823b00c13

DEEP LEARNING



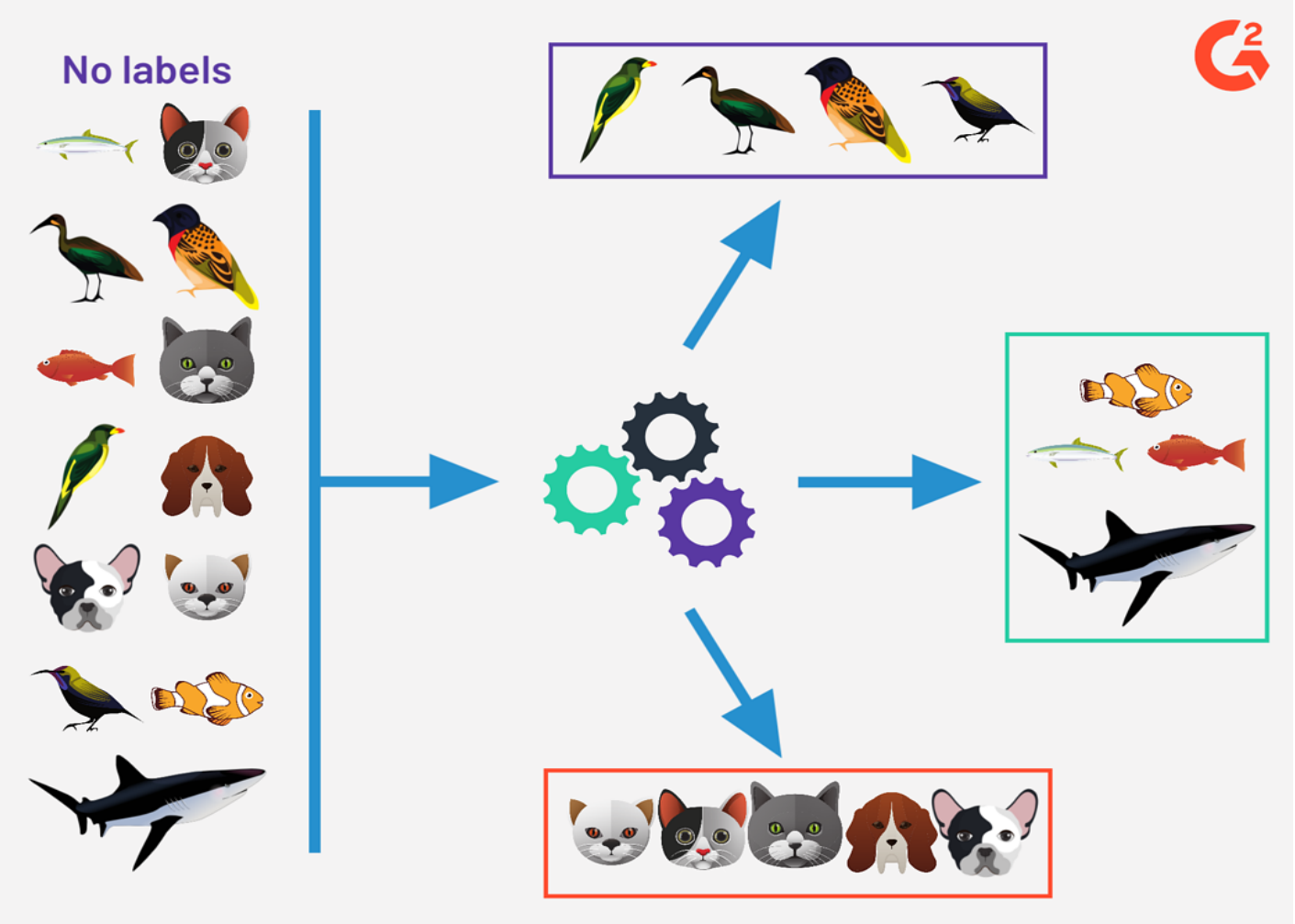
MACHINE LEARNING IN MEDICAL DIAGNOSTICS

- Chatbots: AI-chatbots with speech recognition capability to identify patterns in patient symptoms to form a potential diagnosis, prevent disease and/or recommend an action.
- Oncology: Researchers are using deep learning to train algorithms to recognize cancerous tissue at a level comparable to trained physicians.
- Pathology: Pathology is the medical specialty that is concerned with the diagnosis of disease based on the laboratory analysis of blood as well as tissues.
- Rare Diseases and Depression: Patient photos are analyzed using facial analysis and deep learning to detect phenotypes that correlate with rare genetic diseases.

UNSUPERVISED LEARNING

- Unsupervised Learning is a class of Machine Learning techniques to find the patterns in data without any label.
- **Unsupervised learning** is a type of **machine learning** algorithm used to draw inferences from datasets consisting of input data without labeled responses.
- The most common **unsupervised learning** method is cluster analysis, which is used for exploratory data analysis to find hidden patterns or grouping in data.

UNSUPERVISED LEARNING

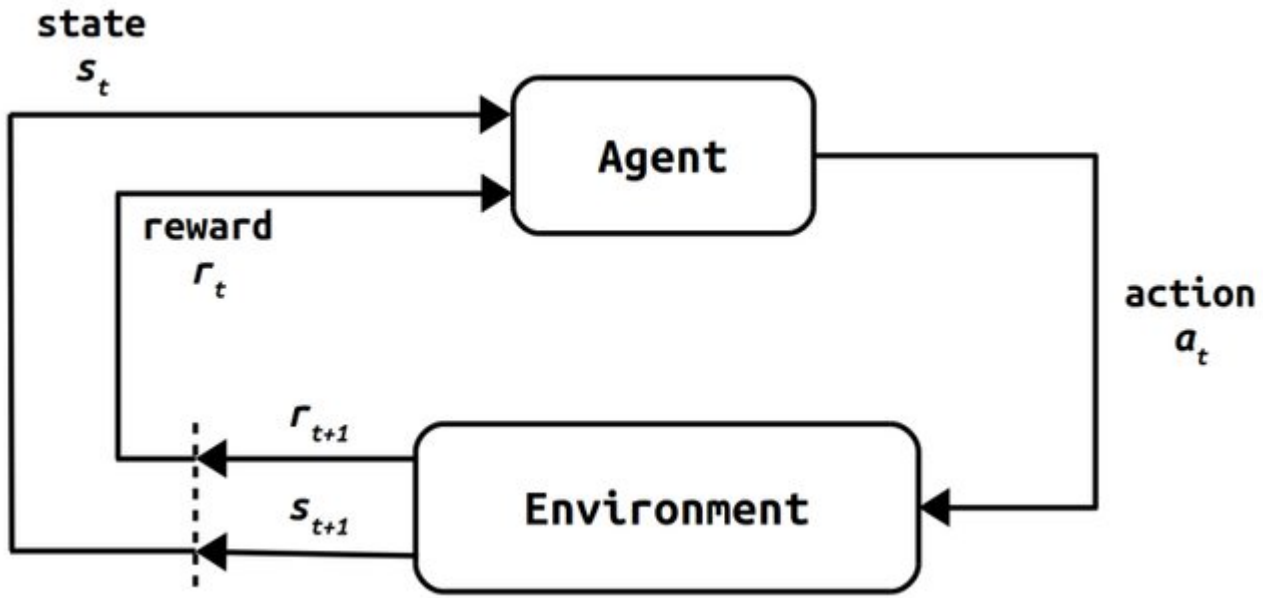


Source: https://learn.g2.com/supervised-vs-unsupervised-learning

REINFORCEMENT LEARNING

- Reinforcement learning is about taking suitable action to maximize reward in a particular situation
- Reinforcement learning differs from the supervised learning in a way that in supervised learning the model is trained with the correct answer whereas in reinforcement learning, there is no answer
- The reinforcement agent decides what to do to perform the given task
- In the absence of training dataset, it is bound to learn from its experience
- It is employed by various software and machines to find the best possible behavior or path it should take in a specific situation

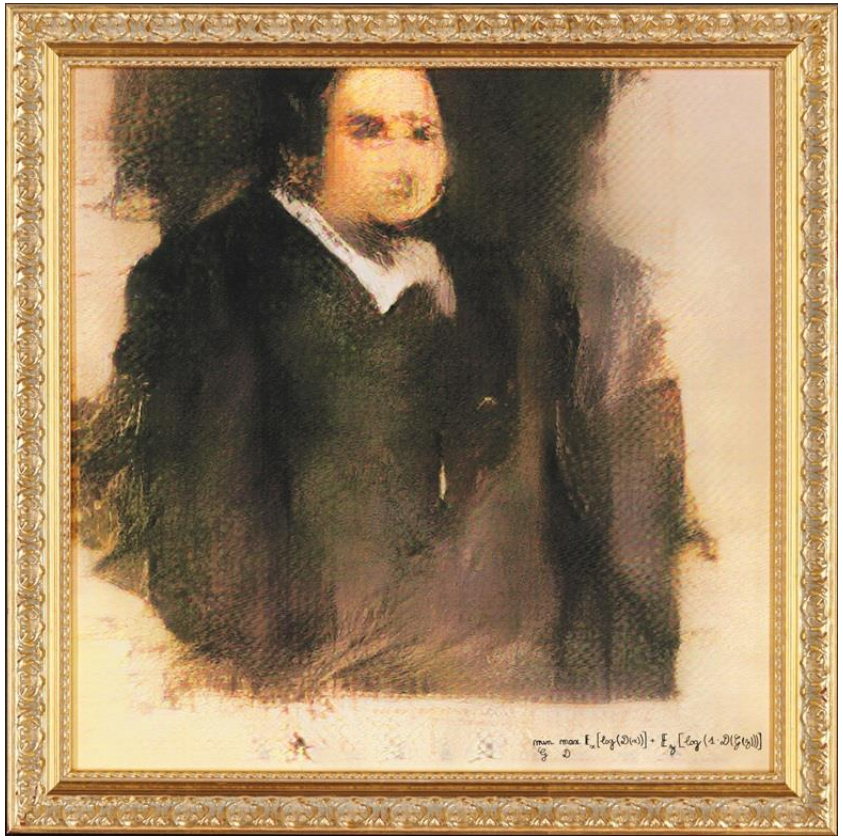
REINFORCEMENT LEARNING



REINFORCEMENT LEARNING

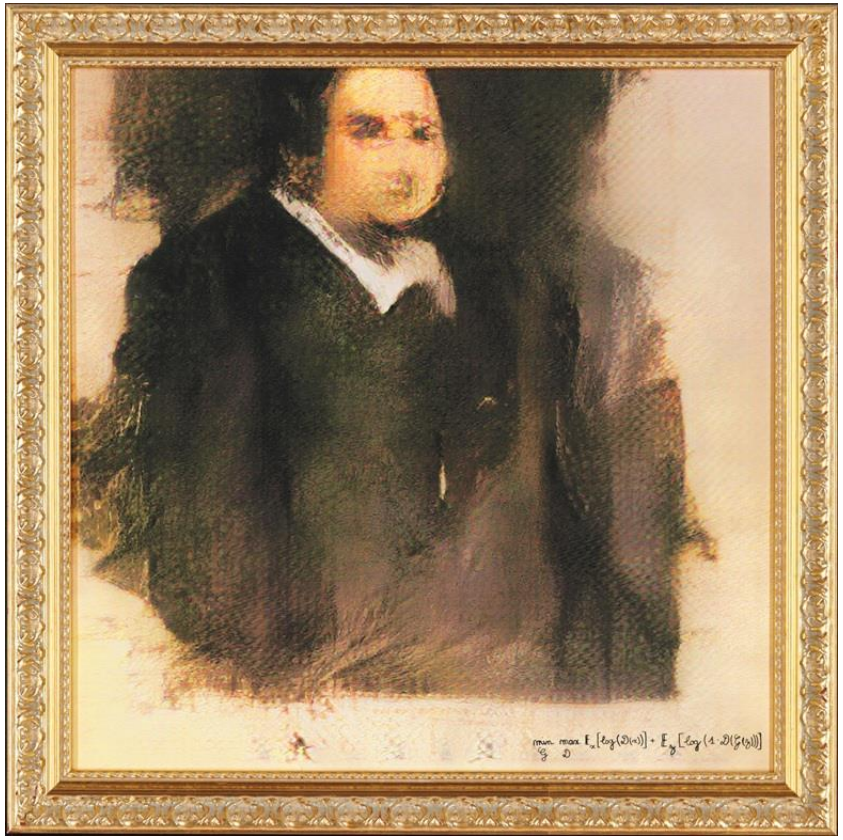
Video Link- Tesla Auto Pilot

AI IS NO MORE TECHNICAL



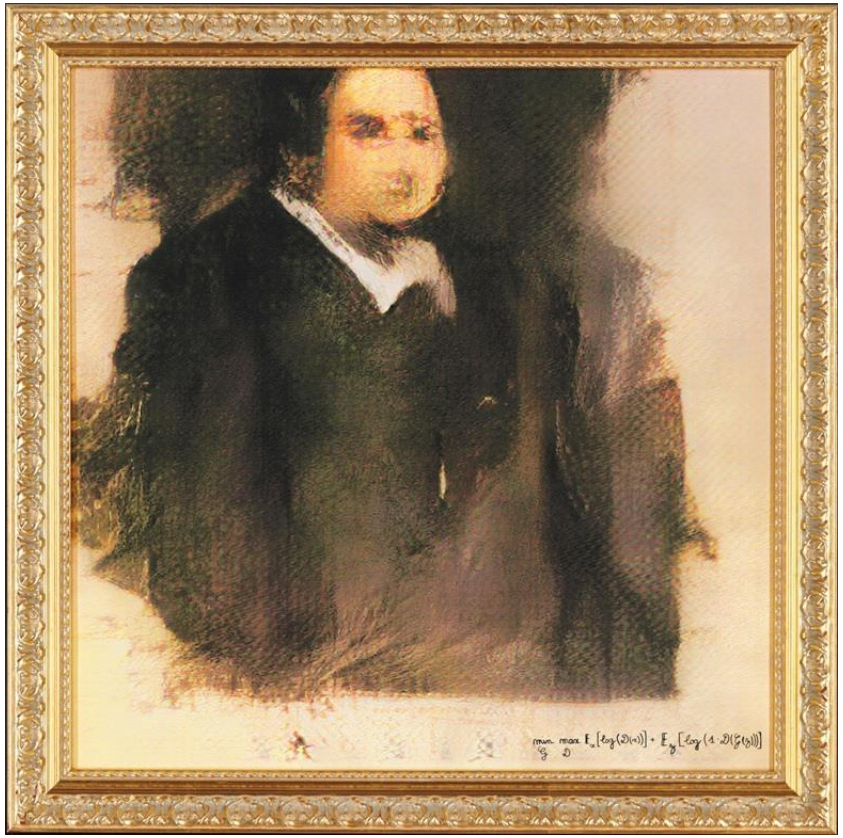
- Christie's, a 252-year-old auction house, has sold its first piece of AI art, a canvas named the *Portrait of Edmond Belamy*

AI IS NO MORE TECHNICAL



- Guess the Price?

AI IS NO MORE TECHNICAL



- Auction Price was
- Rs 2,99,06,294

Almost Rs 3 Crores

The sale at $432,500 is unusual not only as a first for the 252-year-old auction house, but because the expected price for the print was between $7,000 and $10,000 i. e.
Rs 484,085 to Rs 691,550

LEADING CLOUD AI PLATFORMS

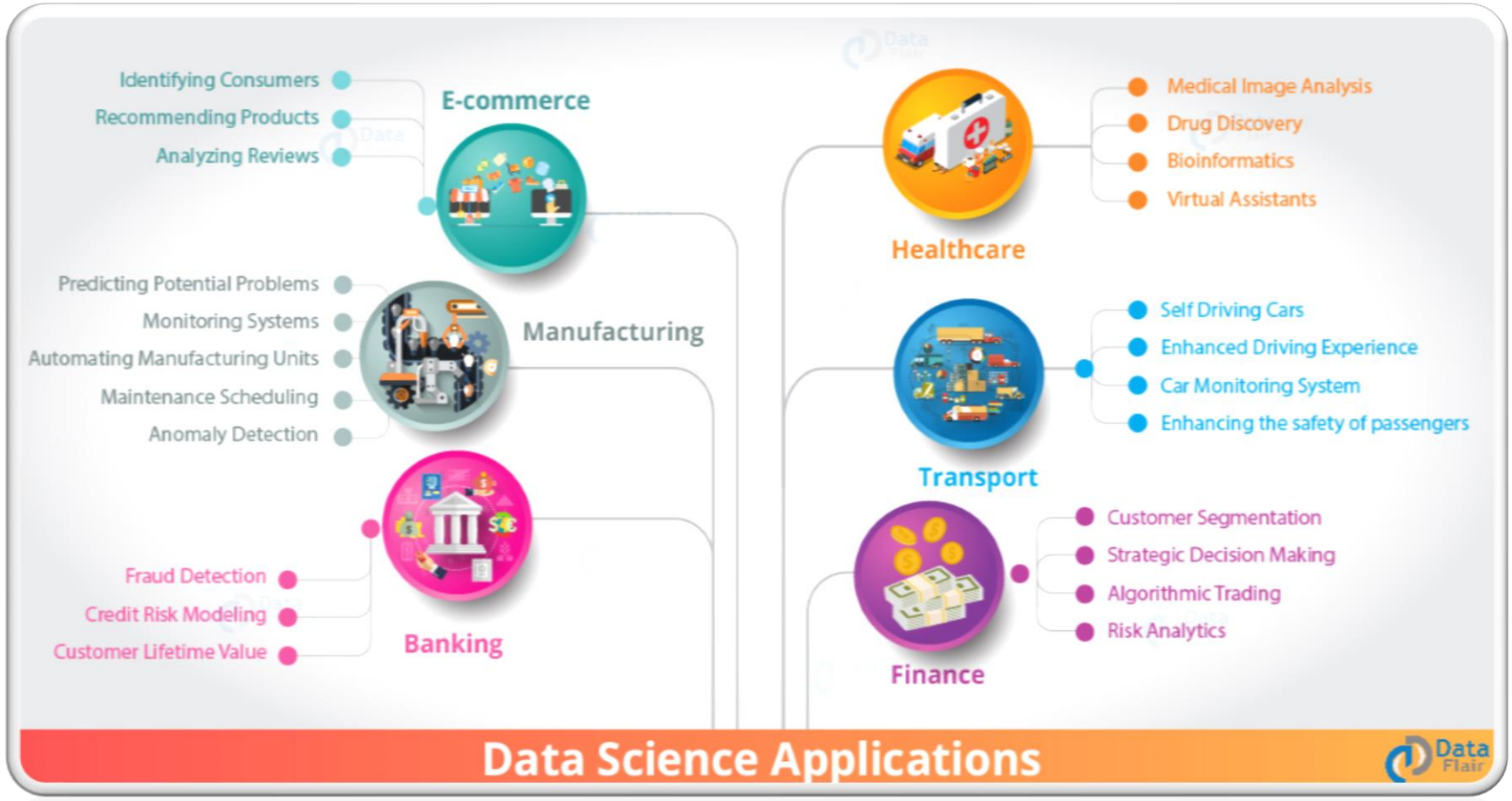
Oracle AI
Salesforce
Baidu
Pega
Infosys Nia

TensorFlow
Wipro HOLMES
API.AI
Premonition
Rainbird

Artificial Intelligence

AI Use-Cases

AI APPLICATIONS



Source: Data Flair

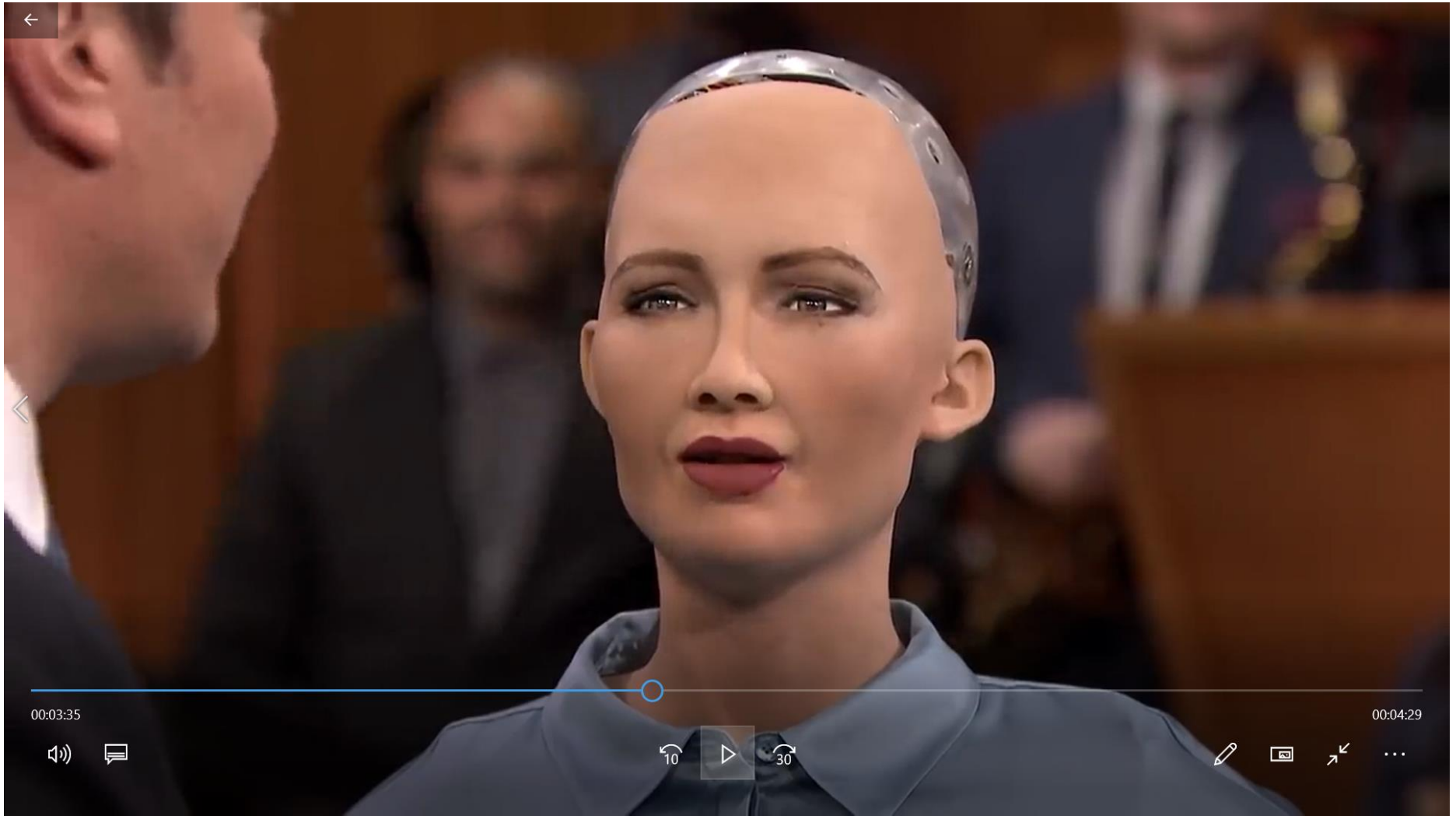
AI APPLICATIONS

- Tesla's self-driving cars
- Amazon's Alexa, Apple's Siri, Google Assistant
- Amazon E-commerce site's recommendation engine
- Google Translate
- Bing Search,
- Netflix, YouTube, Spotify and Flipkart
- Rolls-Royce Trent engine fleet wide-body aircraft.
- Chatbots or virtual agents with natural language processing.
- Sentiment analysis of news or tweets or social media feeds

AI APPLICATIONS

- AI powered drones
- TrailGuard uses machine learning to curb African elephant poaching.
- Contents Facebook and Linkedin feeds
- Prompt for Gmail and Linkedin for message replies
- Google Map
- Uber
- Credit card fraud detection
- Email spam filtering
- Sofia, the robot

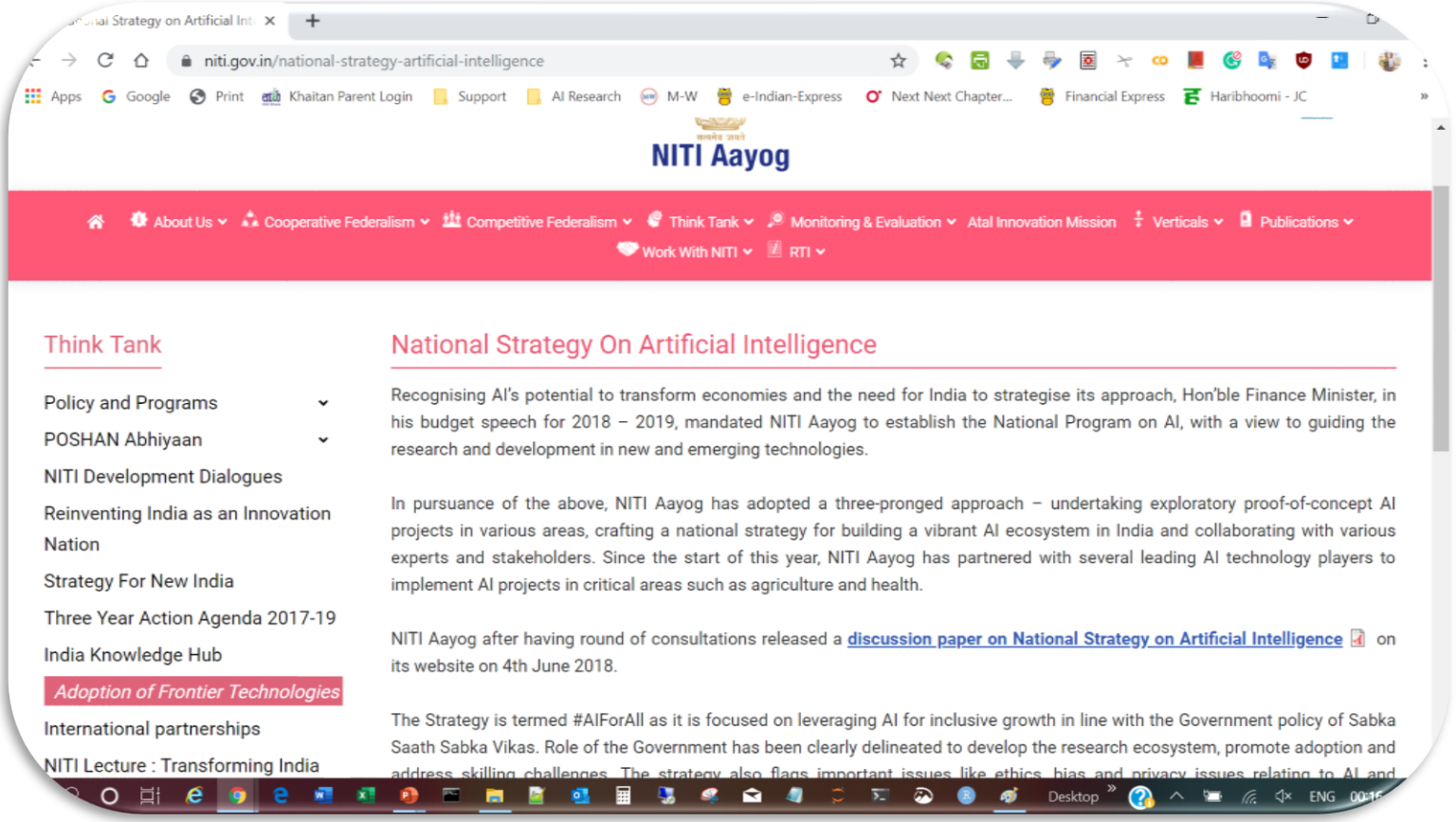
SOPHIA THE ROBOT VIDEO



Why Artificial Intelligence?

- According to McKinsey, AI and machine learning have the potential to create an **additional** $2.6 Trillion in value by 2020 in Marketing and Sales, and up to $2 Trillion in manufacturing and supply chain planning.
- Gartner predicts the business value created by AI will reach $3.9 Trillion in 2022.
- IDC predicts worldwide spending on cognitive and Artificial Intelligence systems will reach $77.6 Billion in 2022.
- According to PwC, Artificial intelligence technologies are forecast to add US$15 trillion to the global economy by 2030.

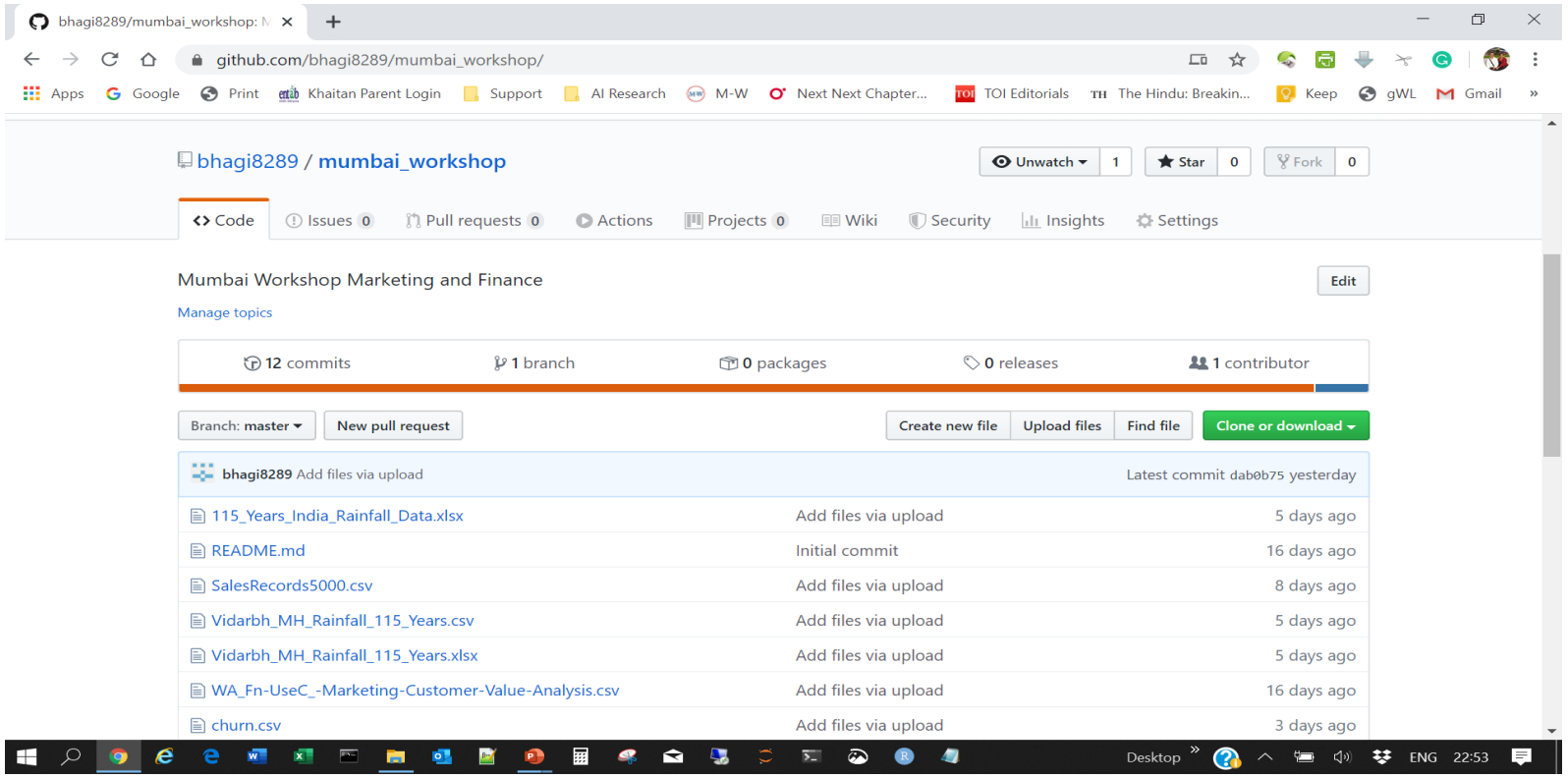
AI STRATEGY FOR INDIA



National Strategy on Artificial Intelligence published on Niti Aayog website on 4th June 2018.

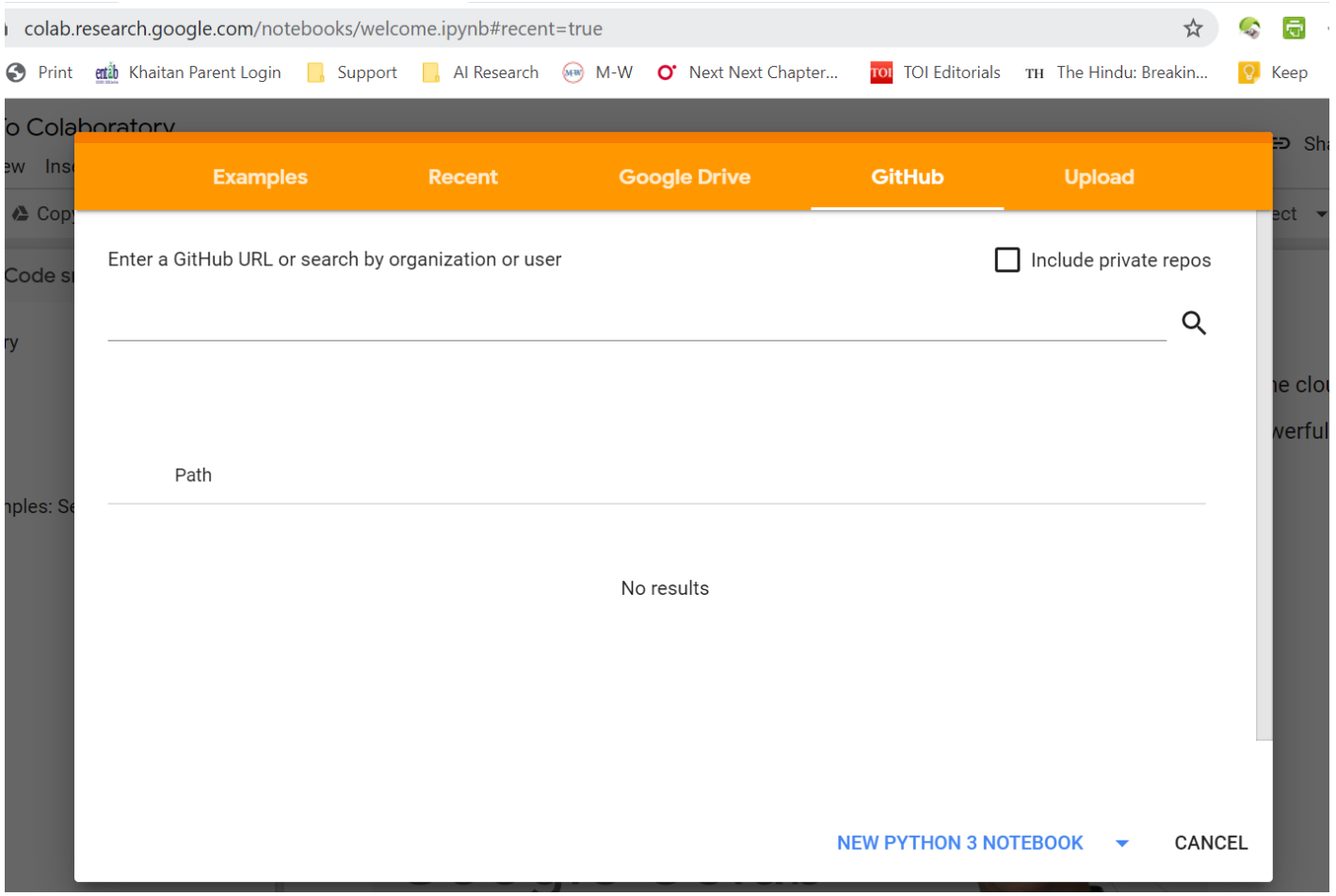
PRACTICAL CASE STUDIES

https://github.com/bhagi8289/mumbai_workshop/



PRACTICAL CASE STUDIES

https://colab.research.google.com/



PRACTICAL CASE STUDIES

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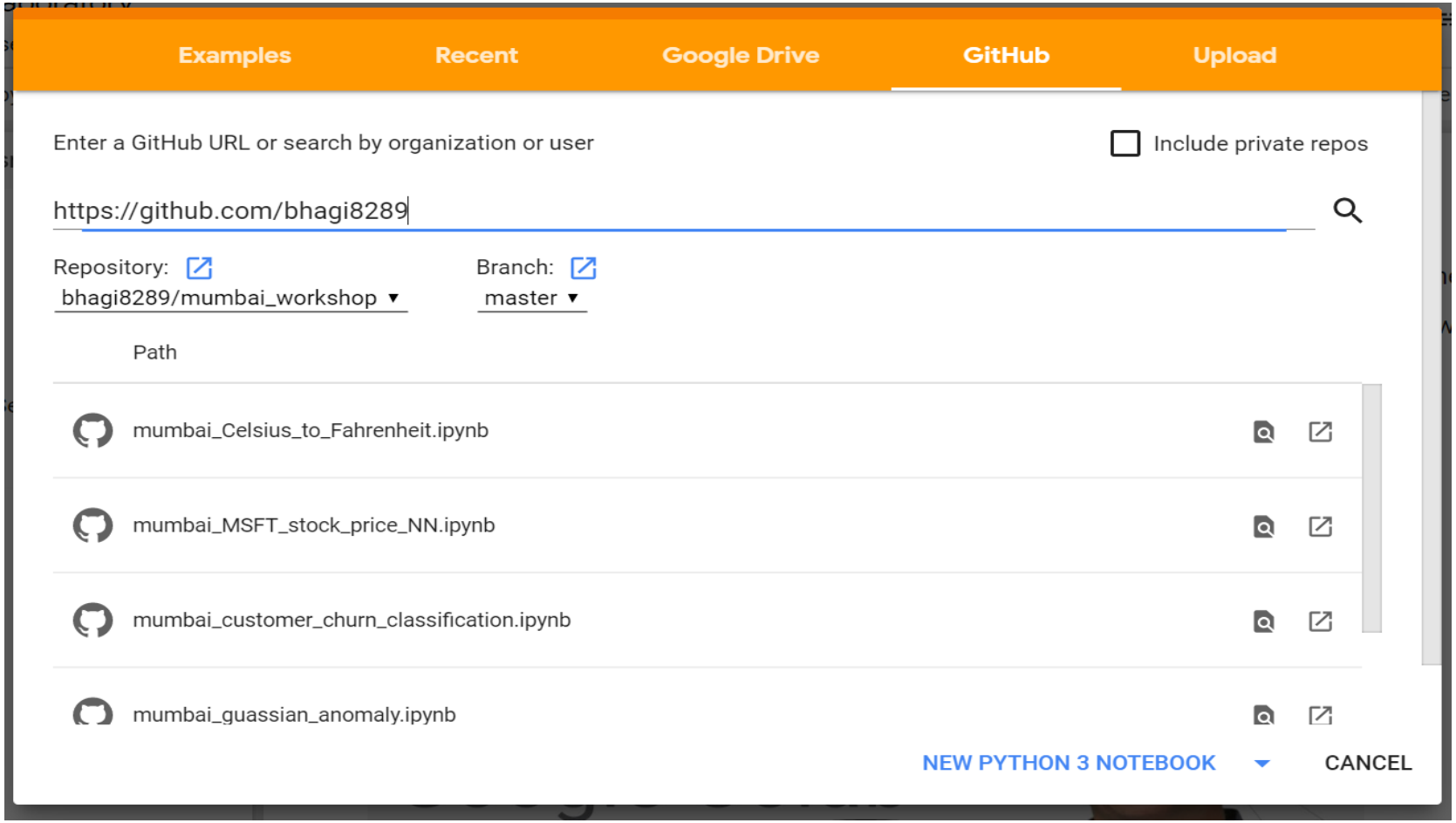


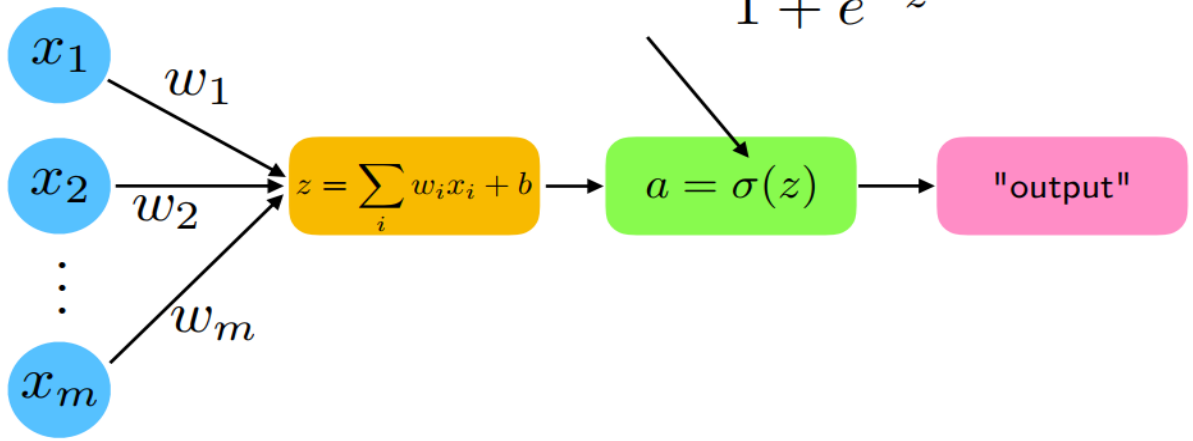
CUSTOMER CHURN PREDICTION

Classification Algorithm: Logistic Regression

Logistic Regression Neuron

For binary classes $y \in \{0, 1\}$

"logistic sigmoid" $\sigma(z) = \frac{1}{1 + e^{-z}}$



- Same as before, except different loss function
- in ADALINE and HW, we minimized the MSE loss:

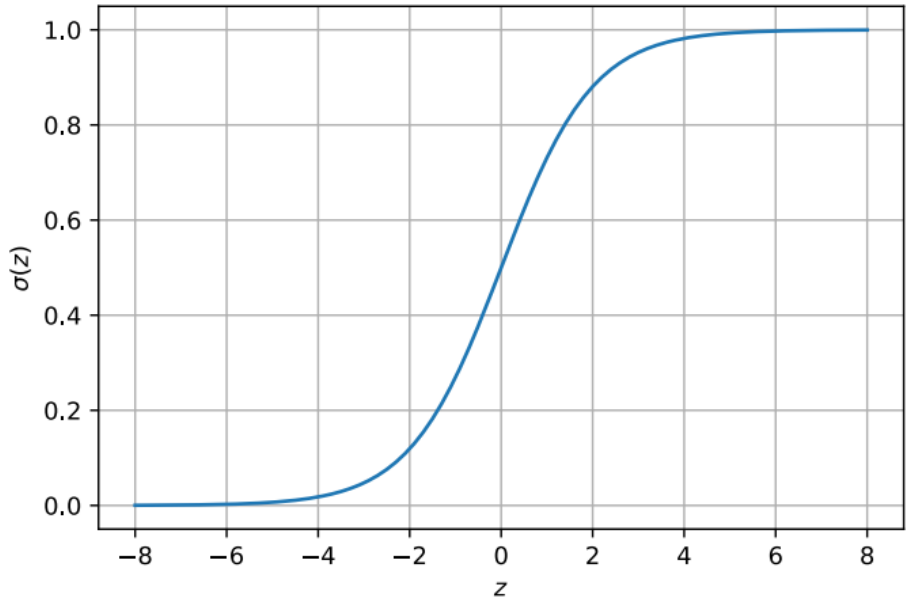
$$\text{MSE} = \frac{1}{n} \sum_i (a^{[i]} - y^{[i]})^2$$

Slide Credit: Prof. Sebastian Raschka

LOGISTIC REGRESSION

Logistic Sigmoid Function

$$\sigma(z) = \frac{e^z}{1 + e^z} = \frac{1}{1 + e^{-z}}$$



Slide Credit: Prof. Sebastian Raschka

LOGISTIC REGRESSION

$$h(\mathbf{x}) = \sigma(\mathbf{w}^\top \mathbf{x})$$

$$P(y|\mathbf{x}) = \begin{cases} h(\mathbf{x}) & \text{if } y = 1 \\ 1 - h(\mathbf{x}) & \text{if } y = 0 \end{cases}$$

want $P(y = 0|\mathbf{x}) \approx 1 \quad \text{if } y = 0$

$P(y = 1|\mathbf{x}) \approx 1 \quad \text{if } y = 1$

Train the model

Slide Credit: Prof. Sebastian Raschka

ANOMALY DETECTION

Algorithm: Isolation Forest

https://blog.easysol.net/using-isolation-forests-anamoly-detection/

- The algorithm is based on the fact that anomalies are data points that are few and different. As a result of these properties, anomalies are susceptible to a mechanism called isolation.
- The Isolation Forest algorithm isolates observations by randomly selecting a feature and then randomly selecting a split value between the maximum and minimum values of the selected feature. The logic argument goes: isolating anomaly observations is easier because only a few conditions are needed to separate those cases from the normal observations. On the other hand, isolating normal observations require more conditions.
- Therefore, an anomaly score can be calculated as the number of conditions required to separate a given observation.
- The way that the algorithm constructs the separation is by first creating isolation trees, or random decision trees. Then, the score is calculated as the path length to isolate the observation. T

ANOMALY DETECTION

Algorithm: Isolation Forest

https://towardsdatascience.com/outlier-detection-with-isolation-forest-3d190448d45e

- A score close to 1 indicates anomalies
- Score much smaller than 0.5 indicates normal observations
- If all scores are close to 0.5 then the entire sample does not seem to have clearly distinct anomalies

ANOMALY DETECTION

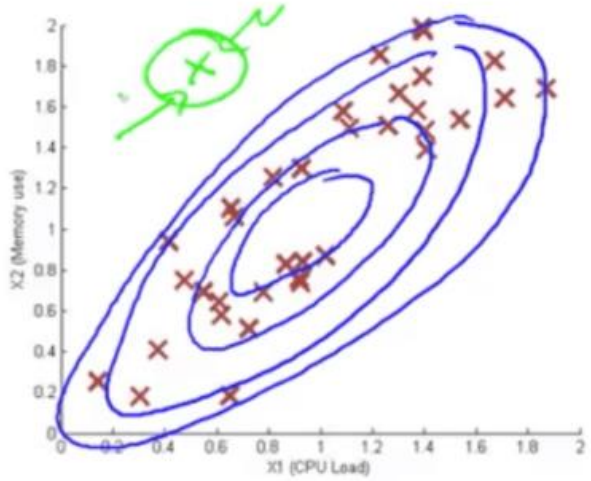
Algorithm: Gaussian

https://towardsdatascience.com/wondering-how-to-build-an-anomaly-detection-model-87d28e50309

1. Fit model $p(x)$ by setting

$$\mu = \frac{1}{m}\sum_{i=1}^{m} x^{(i)}$$

$$\Sigma = \frac{1}{m}\sum_{i=1}^{m}(x^{(i)} - \mu)(x^{(i)} - \mu)^T$$



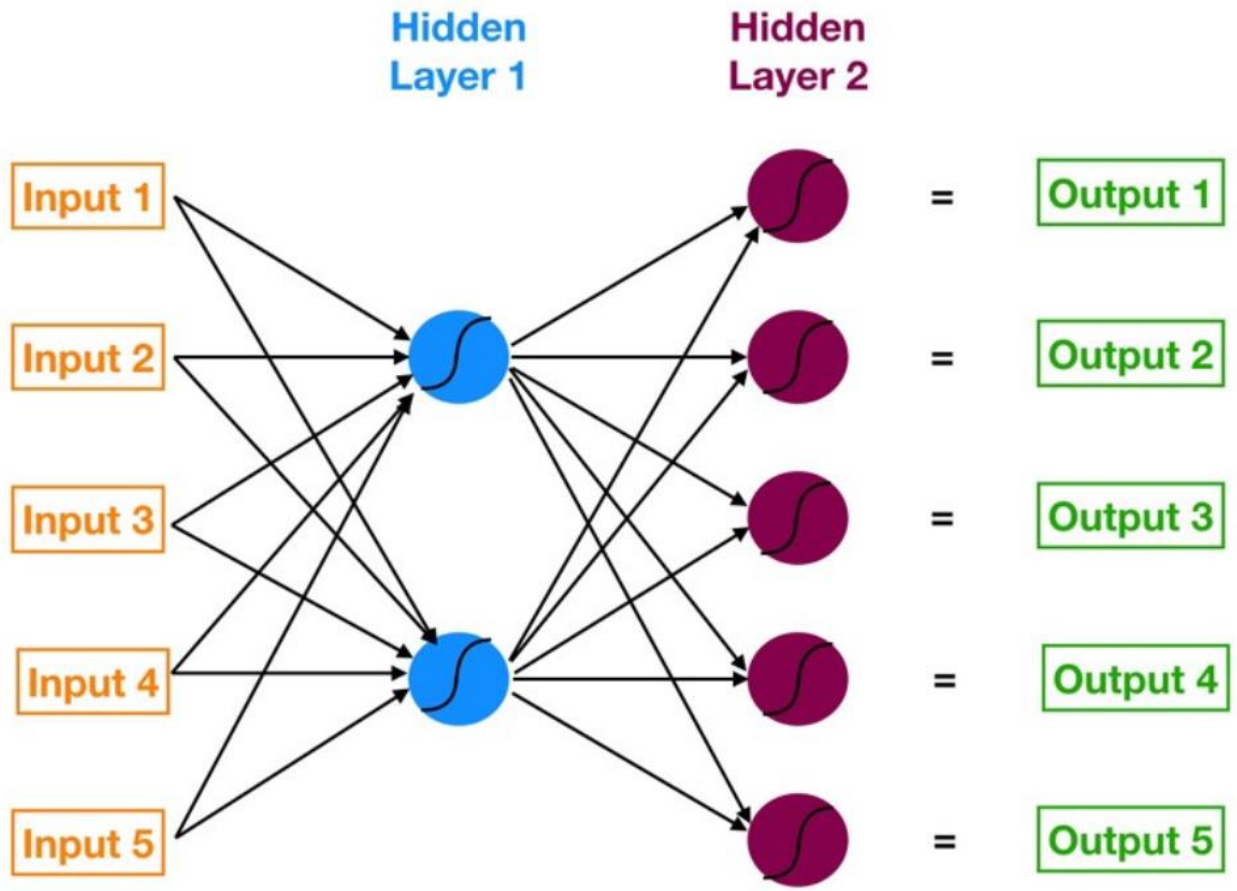
2. Given a new example x, compute

$$p(x) = \frac{1}{(2\pi)^{\frac{n}{2}}|\Sigma|^{\frac{1}{2}}} \exp\left(-\frac{1}{2}(x-\mu)^T\Sigma^{-1}(x-\mu)\right)$$

Flag an anomaly if $p(x) < \varepsilon$

NEURAL NETWORKS

https://towardsdatascience.com/understanding-neural-networks-19020b758230

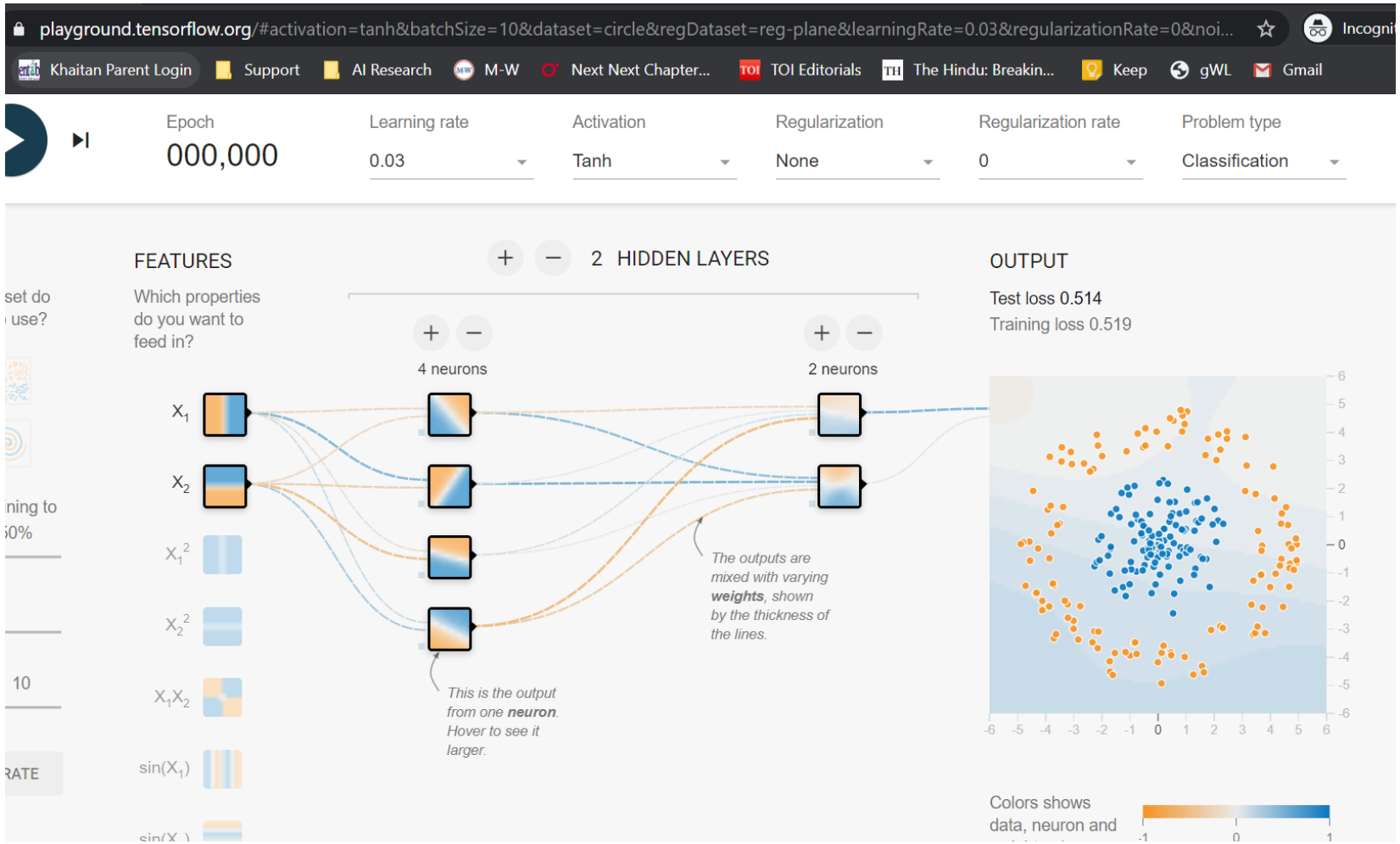


Neural network with two hidden layers

Slide Credit: Tony Yiu

NEURAL NETWORKS

https://playground.tensorflow.org



Slide Credit: Tony Yiu

SENTIMENT ANALYSIS USING NLP

Library: TextBlob

Reference: https://www.analyticsvidhya.com/blog/2018/02/natural-language-processing-for-beginners-using-textblob/

- Sentiment Analysis
- Tokenization
- Noun Phrase Extraction
- Part-of-Speech Tagging
- N-gram
- Lemmatization

NLP Reference: https://www.analyticsvidhya.com/blog/2017/01/ultimate-guide-to-understand-implement-natural-language-processing-codes-in-python/

YouTube: Natural language processing and sentiment analysis by Alice Zhao
https://youtu.be/xvqsFTUsOmc

WAY FORWARD FOR JOURNEY INTO ARTIFICIAL INTELLIGENCE

https://www.linkedin.com/pulse/how-start-artificial-intelligence-journey-simple-guide-lader/

How to Start Artificial Intelligence Journey - A Simple Guide

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