ARTIFICIAL INTELLIGENCE AND APPLICATIONS

EGCO103 INFORMATION TECHNOLOGY IN THE DAILY LIFE

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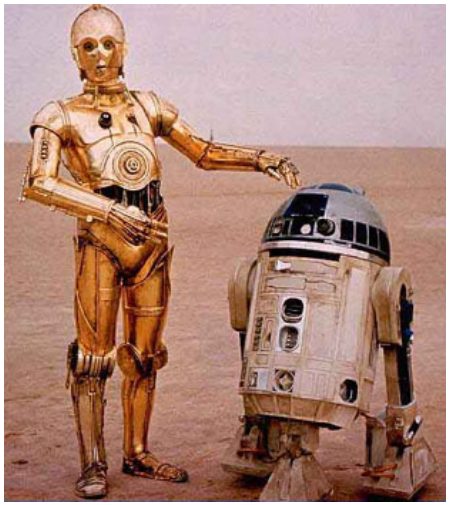
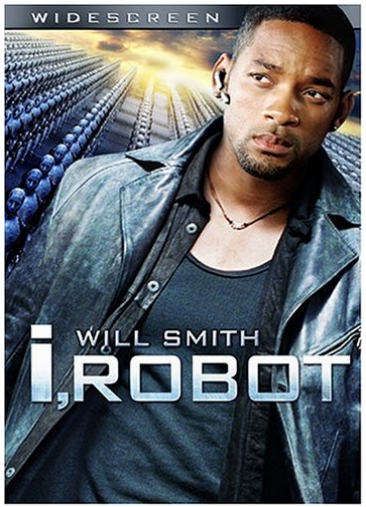
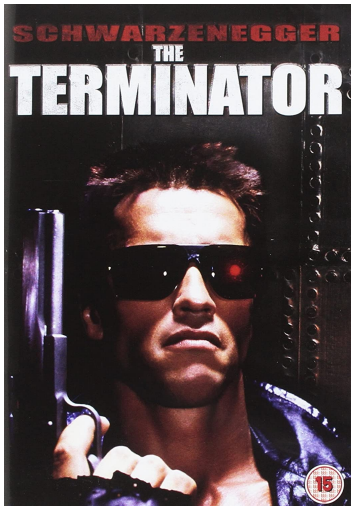
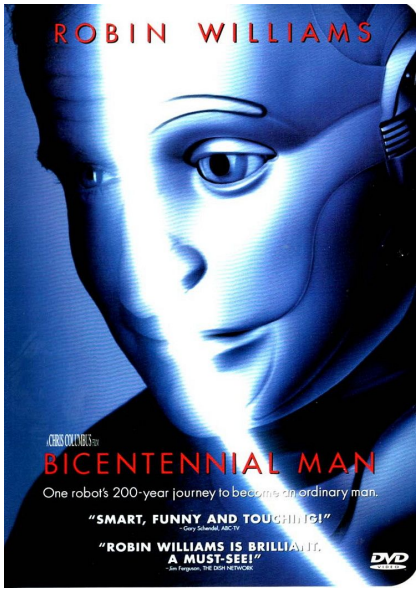
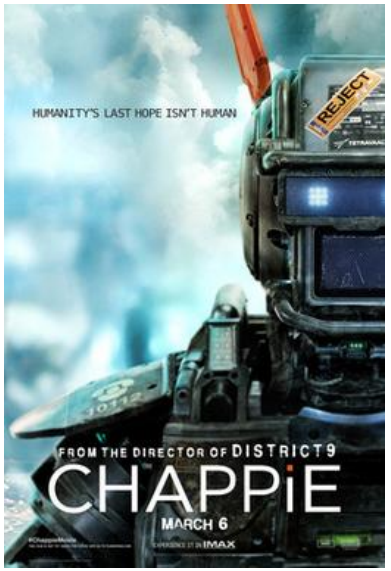
AI IN THE MOVIES





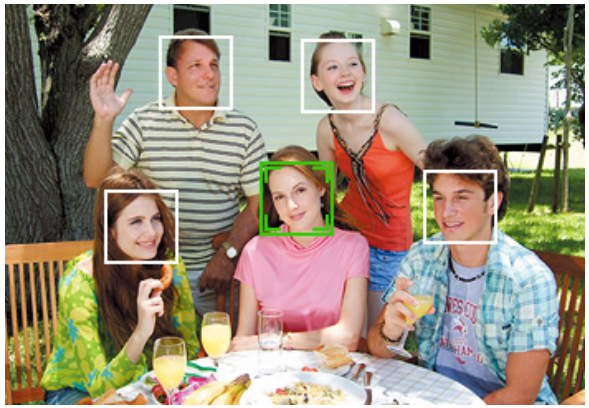




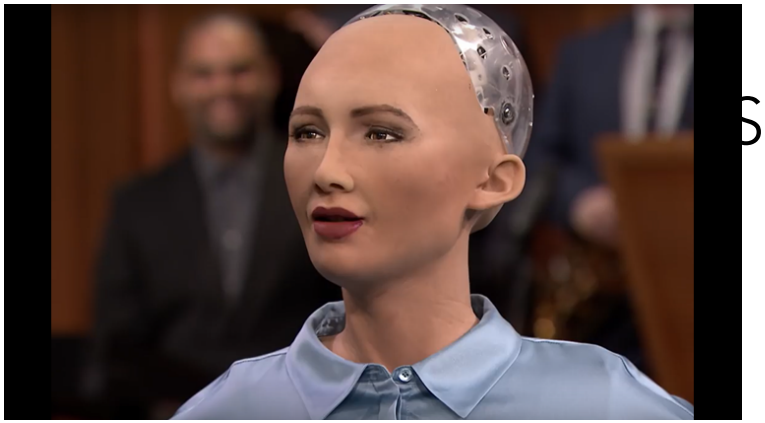


AI IN REAL LIFE

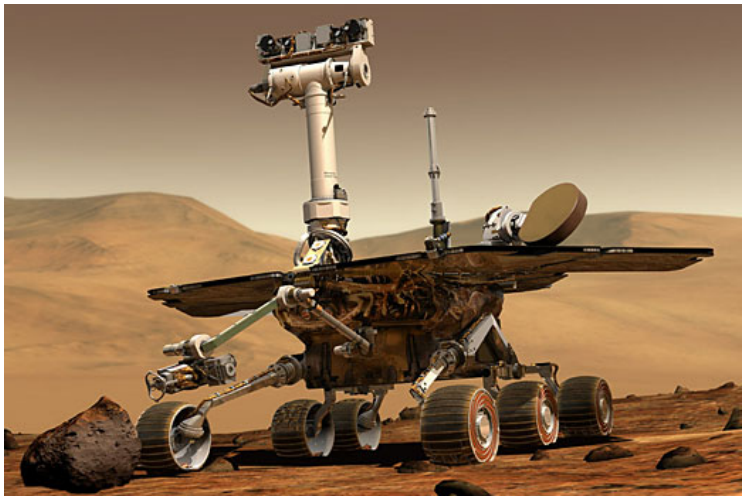
Deep Blue vs Garry Kasparov



Face Detection



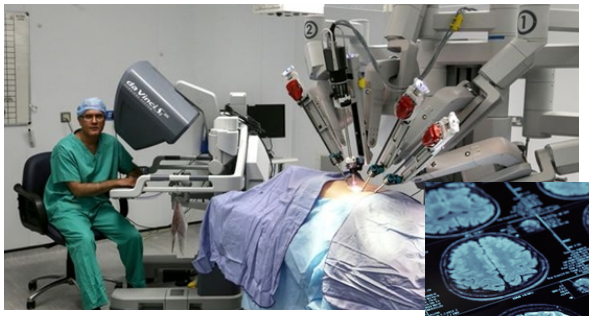
Sophia

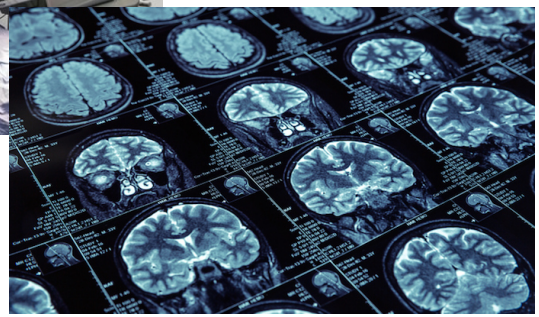


Mars Explorer

WHY THE INTEREST IN AI ?

Labor





Medicine/Diagnosis

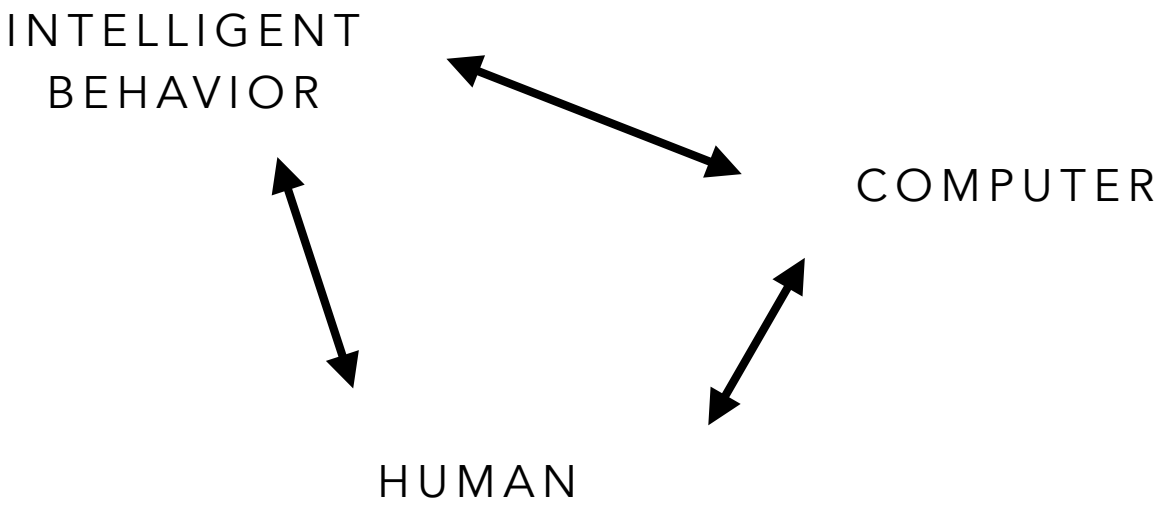
Appliances

APPLICATION FOR AI

- Static image recognition, classification, and tagging
- Algorithmic trading strategy performance improvements
- Efficient, scalable processing of patient data
- Predictive maintenance
- Object detection and classification
- Content distribution on social media
- Protection from cybersecurity threats
- Etc.

WHAT IS AI (1)

- Programs that behave externally like humans?
- Programs that operate internally as humans do?
- Computational systems that behave intelligently?
- Rational behavior?

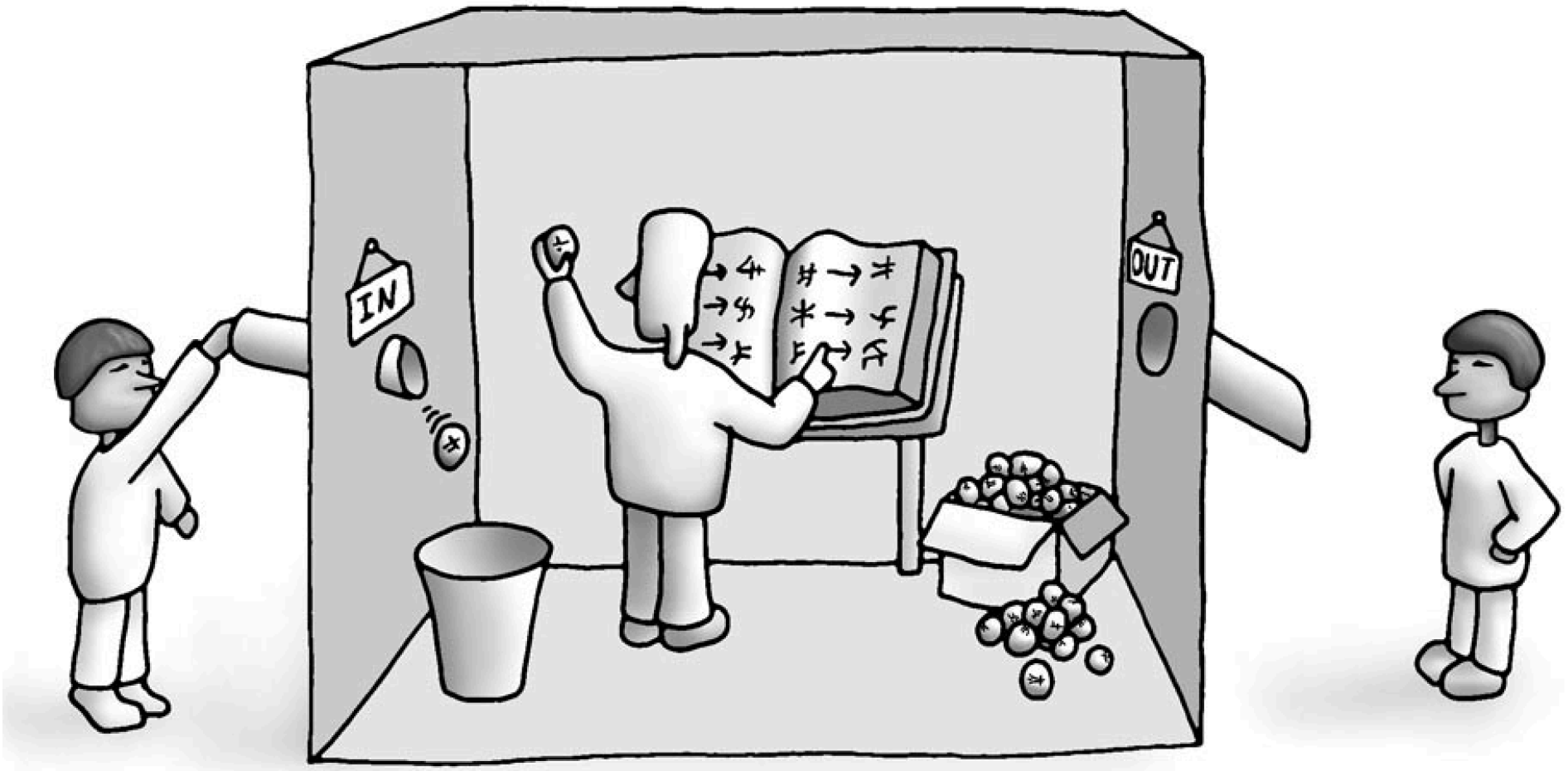


WHAT IS AI (2)

- Discipline that systematizes and automates reasoning processes to create machines that:

ACT LIKE HUMAN	ACT RATIONALLY
THINK LIKE HUMAN	THINK RATIONALLY

THE CHINESE ROOM ARGUMENT



TURING TEST

- To be called intelligent, a machine must produce responses that are indistinguishable from those of a human
- The test assesses whether a machine can engage in conversation indistinguishably from a human.

Alan Turing

FATHER OF AI

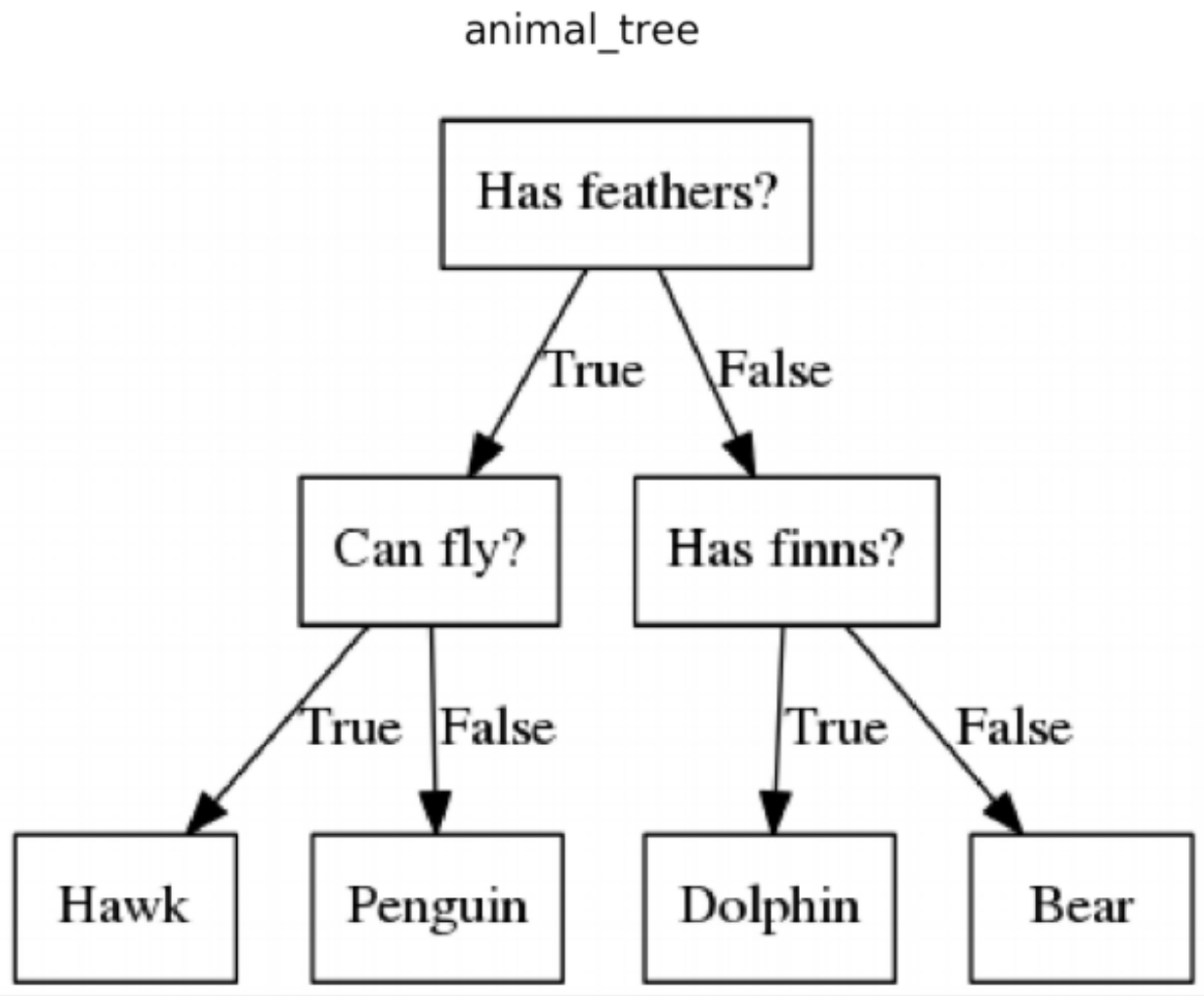
- John McCarthy, considered the father of Artificial Intelligence, defined it as **the science and engineering of making intelligent machines, especially intelligent computer programs.**
- He emphasized that AI aims to create systems that can think and act intelligently, similar to humans.
- This definition has evolved over time, with modern AI focusing on broader applications like prediction, recommendation, and decision-making.

John McCathy

SYMBOLIC AI

- Symbolic AI, also known as Good Old-Fashioned AI (GOFAI), is a branch of artificial intelligence that uses symbols and logical reasoning to solve problems.
- It focuses on representing knowledge explicitly through symbols and rules, unlike machine learning which relies on statistical models and data.

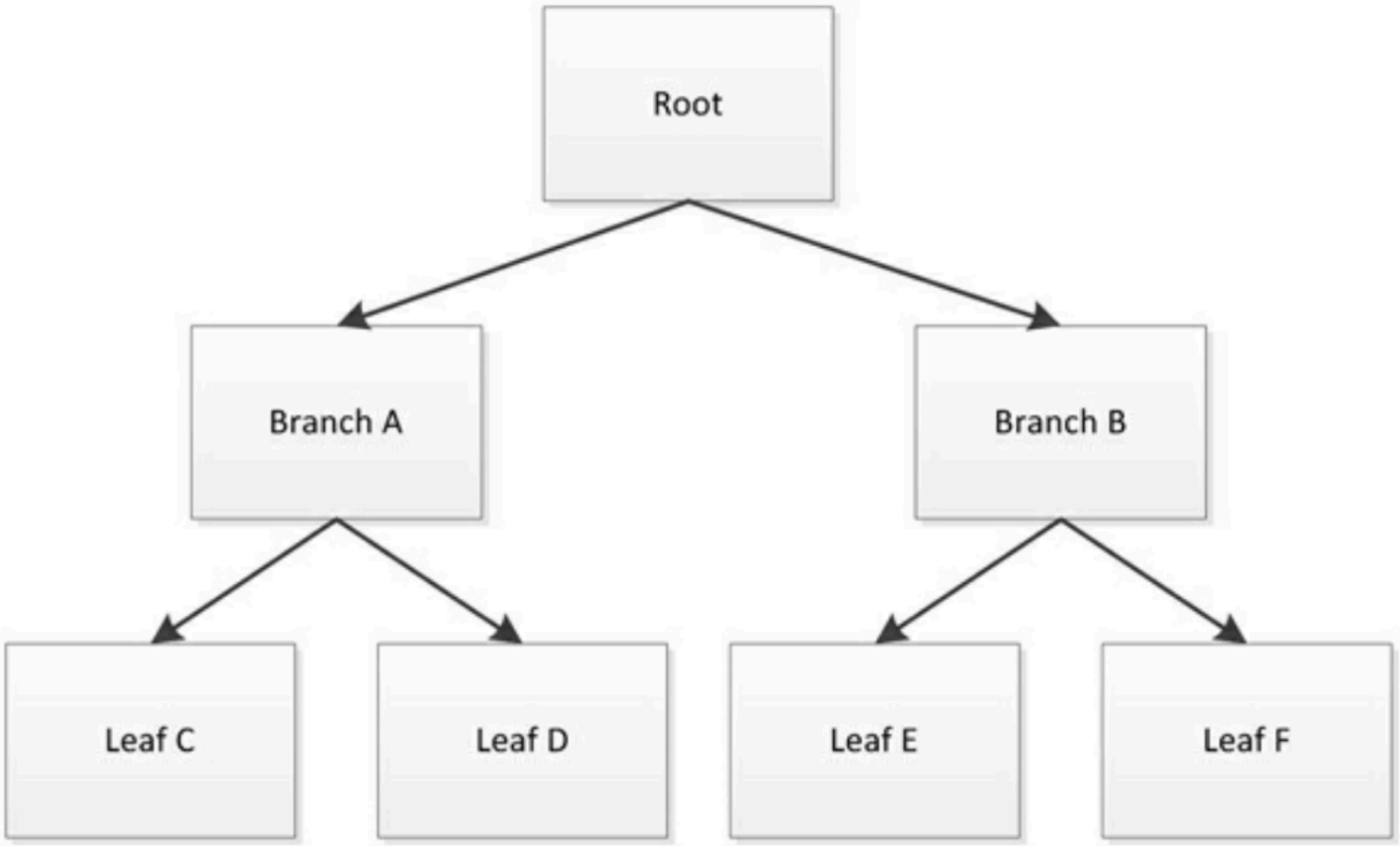
EXAMPLE OF GOFAI: DECISION TREE



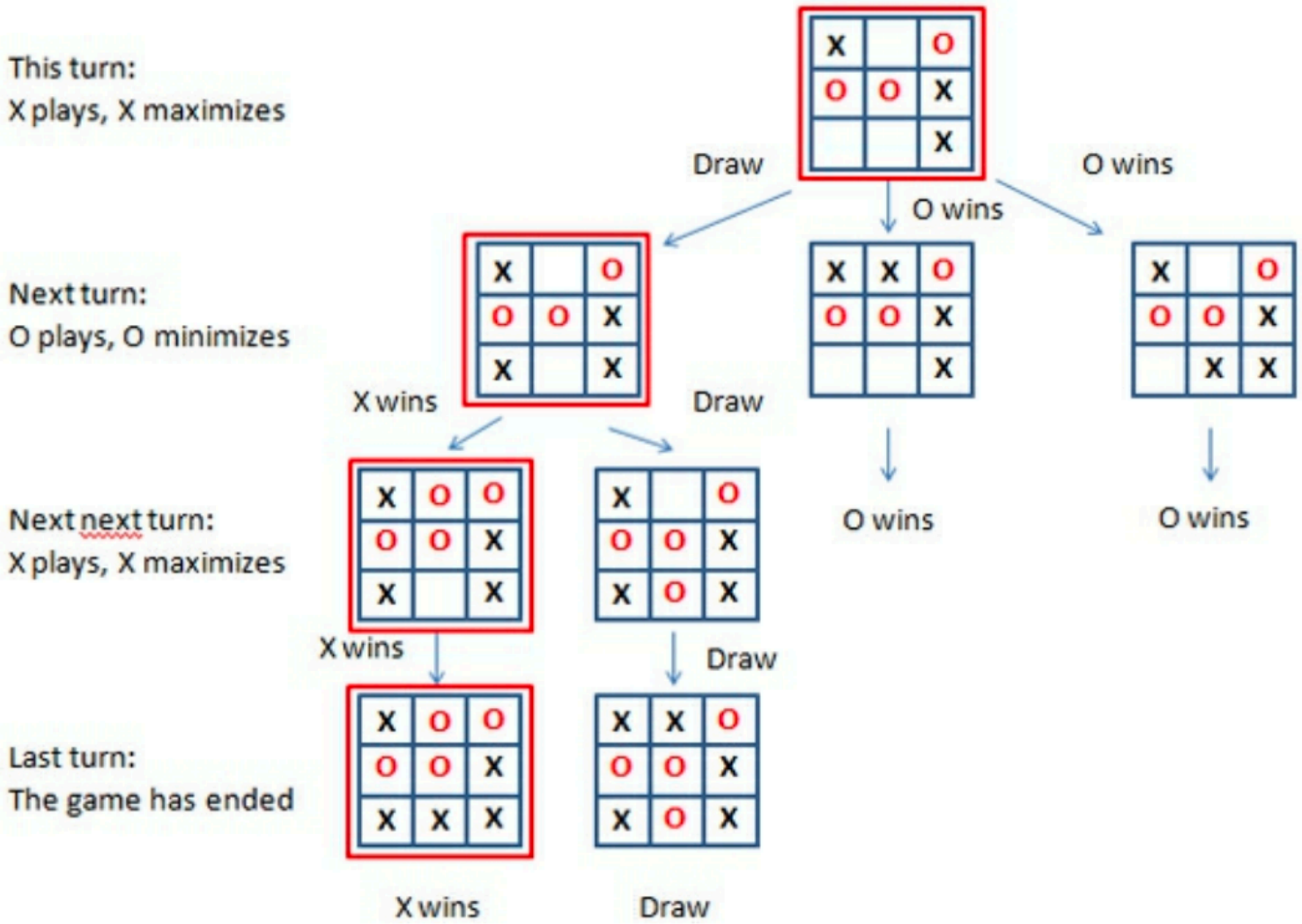
EXPERT SYSTEM: MYCIN

- MYCIN was an early expert system, developed in the 1970s at Stanford University, designed to assist physicians in diagnosing and treating bacterial infections.
- It used a knowledge base of rules and an inference engine to identify the causative microorganism and recommend appropriate antibiotic therapy.
- MYCIN could also explain its reasoning and justify its recommendations.

PLANNING AND BRANCHING (1)



PLANNING AND BRANCHING (2)



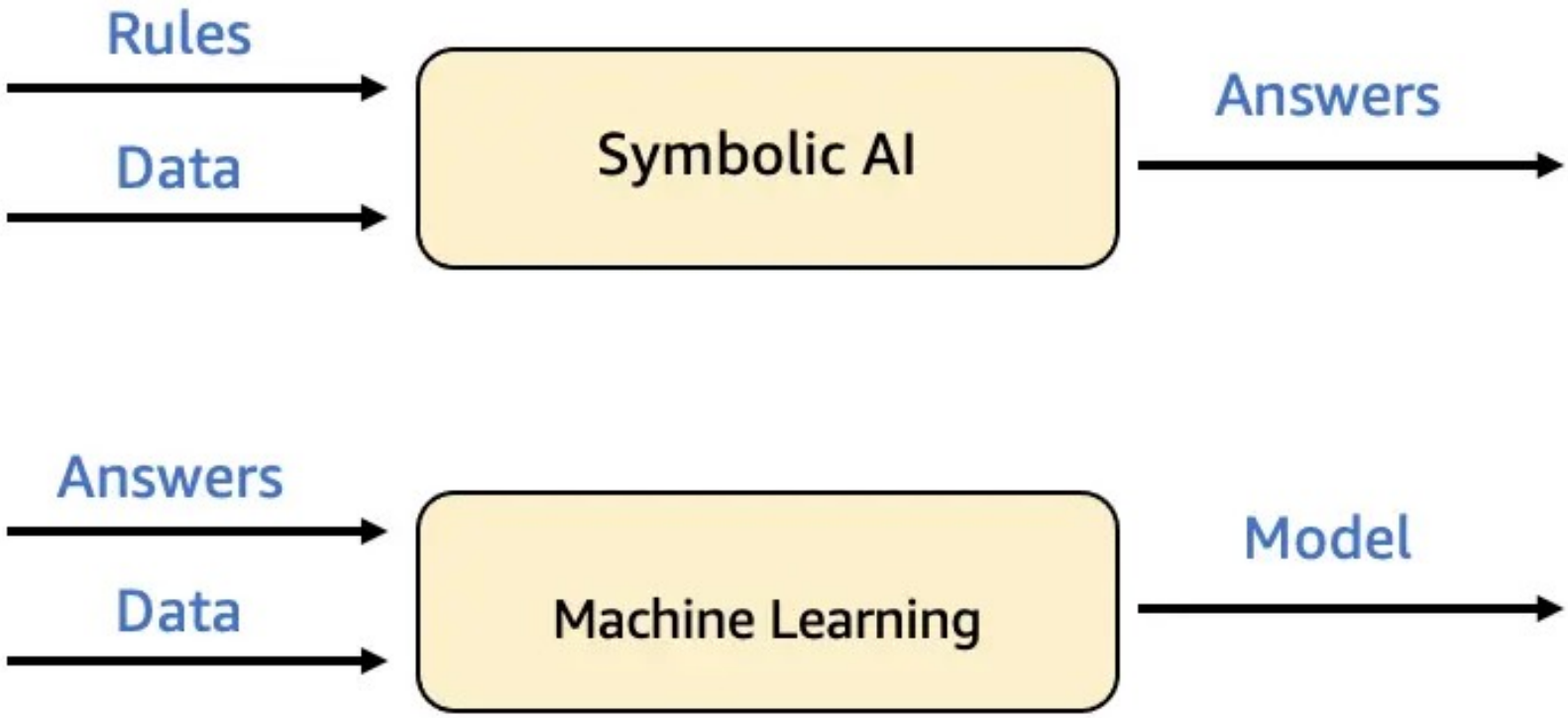
THE PROBLEM OF SYMBOLIC AI

- Symbolic AI faces significant challenges due to its reliance on human experts to manually program knowledge and rules into systems.
- This approach is akin to writing an exhaustive rulebook for every possible situation, an almost impossible task in today's rapidly changing world.

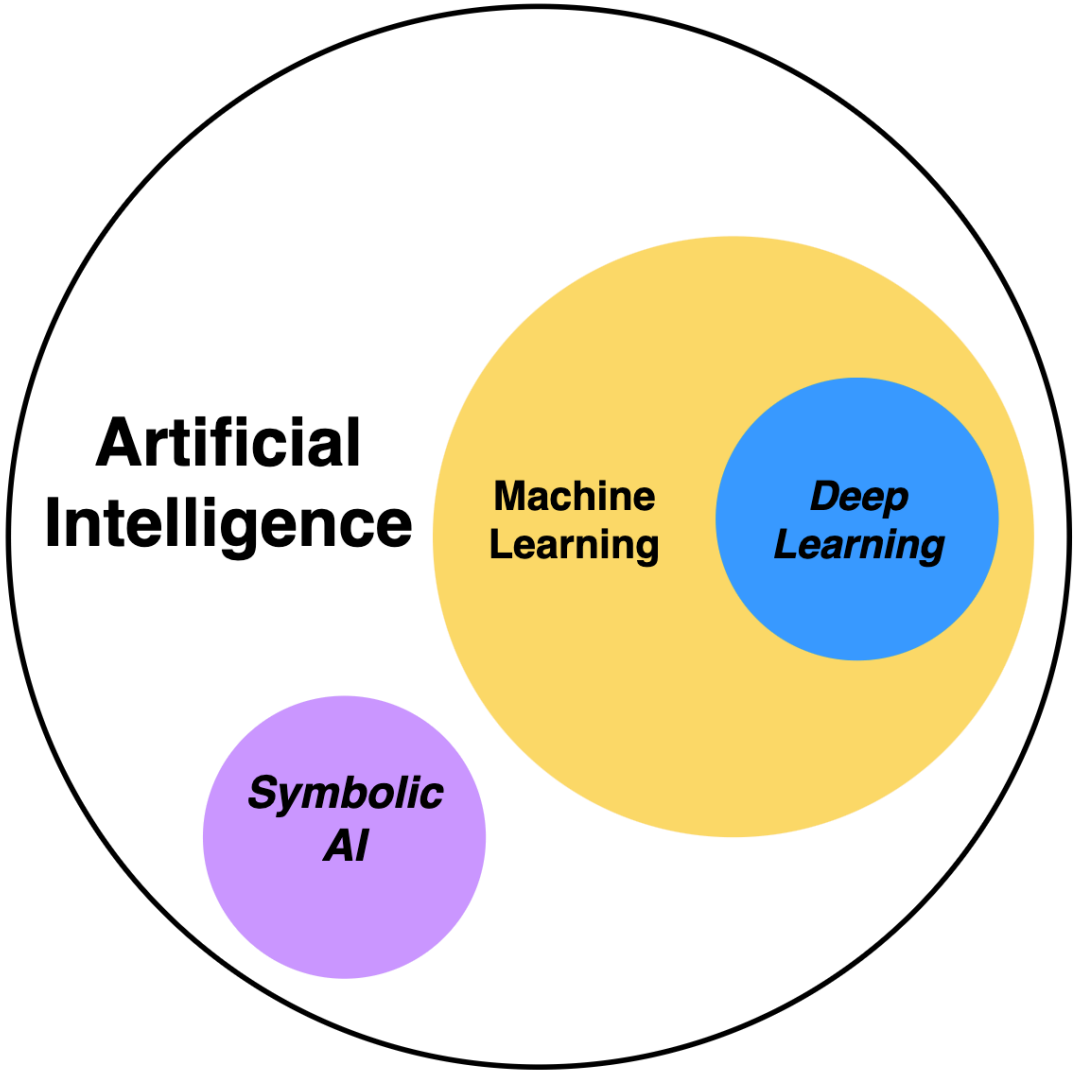
MACHINE LEARNING (1)

- Machine learning (ML) is a subfield of artificial intelligence (AI) that allows computers to learn and improve from experience without being explicitly programmed.
- It involves using algorithms to analyze data, identify patterns, and make predictions or decisions. Instead of being told exactly how to perform a task, ML algorithms learn from data and improve their performance over time.

MACHINE LEARNING (2)



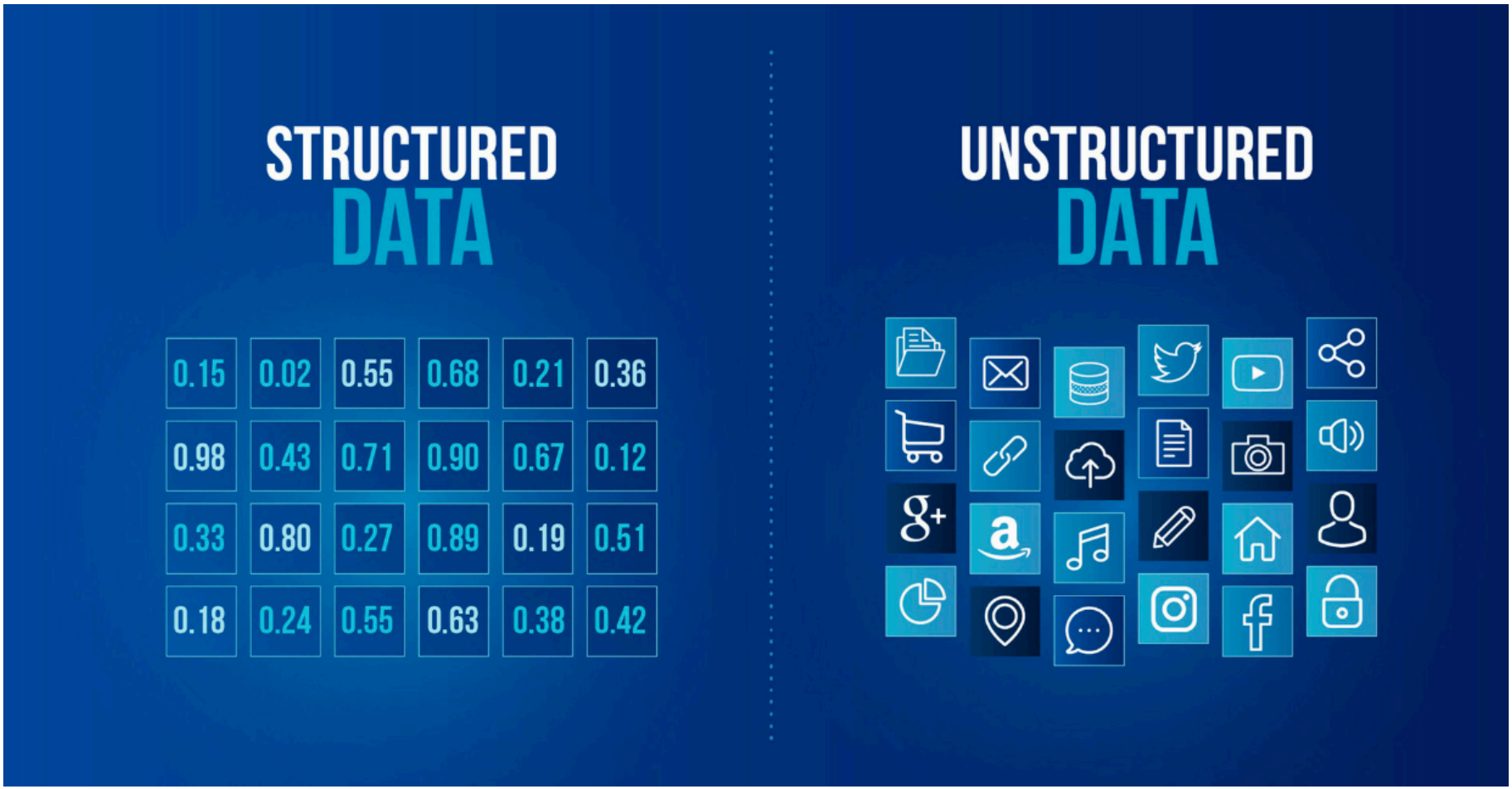
ARTIFICIAL INTELLIGENCE



DATA IS THE NEW OIL

- One well-known saying often heard in the tech community is that “data is the new oil.”
- Today, the world’s most valuable companies are often the ones that have access to the largest quantities of data. It is not only the volume of the data that is important in business, but the quality as well.

STRUCTURED & UNSTRUCTURED (1)



STRUCTURED & UNSTRUCTURED (2)

- Data analysis usually relies on two kinds of information: structured data and unstructured data. To really comprehend AI systems, it is important to recognize the key differences between these two types of data.
- Traditionally, structured data has been used more often than unstructured.
- Structured data includes simple data inputs like numerical values, dates, currencies, or addresses. Unstructured data includes data types that are more complicated to analyze, such as text, images, and video.

UNSTRUCTURED DATA (1)

- In AI, working with unstructured data—like text, images, audio, or video—requires specific steps to convert it into a format that AI models can process and learn from. Here are the typical steps to handle unstructured data—Understand the Data Type, Preprocessing, and Feature Extraction
  - **Understand the Data Type:** Identifying the type of unstructured data you're dealing with, as different types require different processing techniques.

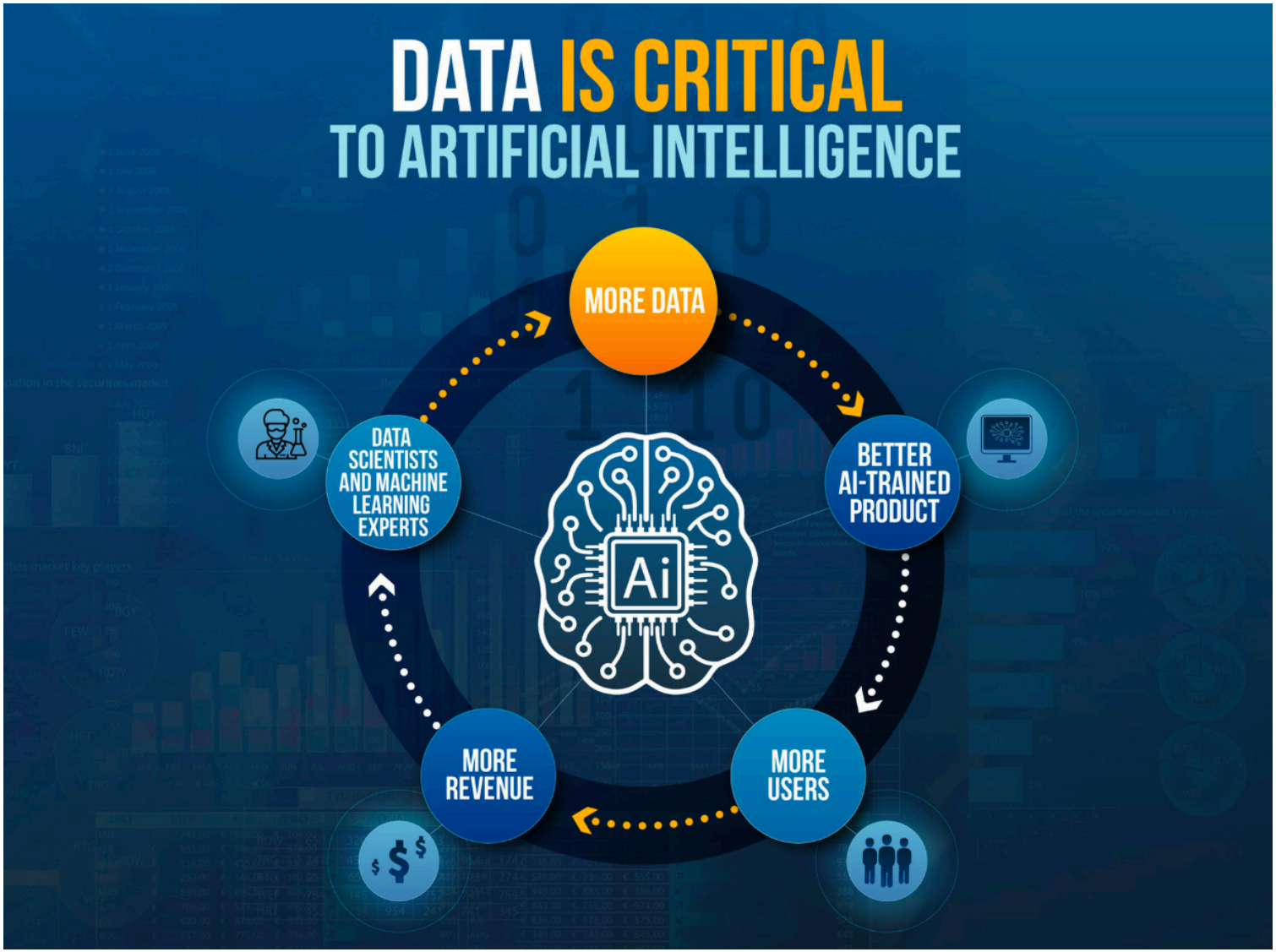
UNSTRUCTURED DATA (2)

- **Preprocessing:**
  - Text Data: Use NLP techniques like removing stop words, tokenization, stemming, and lemmatization to clean the text.
  - Resize, normalize, or augment the images. Converting images to grayscale or reducing dimensions can also help in some cases. With videos, you might extract individual frames or use motion analysis techniques.
  - Audio: Convert audio into a visual representation like a spectrogram, or extract key features like Mel-Frequency Cepstral Coefficients (MFCC) to capture frequency information over time.

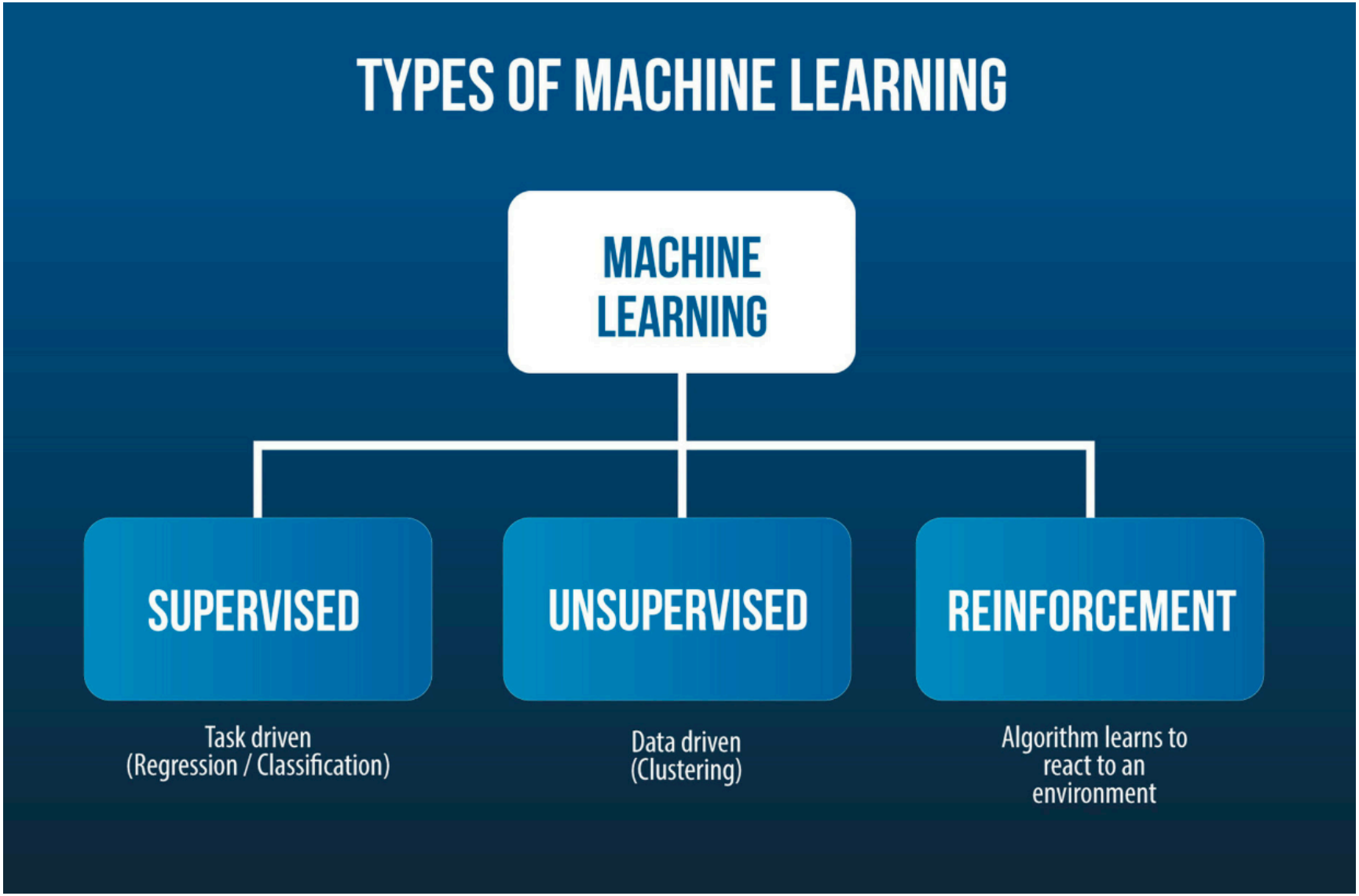
UNSTRUCTURED DATA (3)

- **Feature Extraction:**
  - Text: Transform text into numerical representations using methods like TF-IDF, Word2Vec, GloVe embeddings, or transformer-based embeddings like BERT.
  - Images: Use convolutional neural networks (CNNs) to capture patterns, edges, and shapes in the image that are relevant to the model's learning objectives.
  - Audio: Extract features like pitch, frequency, or energy levels, or create spectrograms that can be analyzed similarly to images.

DATA AND AI


DATA IS CRITICAL
TO ARTIFICIAL INTELLIGENCE
MORE DATA
BETTER AI-TRAINED PRODUCT
MORE USERS
MORE REVENUE
DATA SCIENTISTS AND MACHINE LEARNING EXPERTS
Ai

TYPE OF MACHINE LEARNING



SUPERVISED LEARNING

- Definition: In supervised learning, the model is trained on a labeled dataset, where each input is paired with the correct output.
- Goal: The aim is for the model to learn the relationship between inputs and outputs so it can predict labels for new, unseen data.
- Examples:
  - Classification: Email spam detection, image recognition.
  - Regression: Predicting house prices, stock forecasting.

UNSUPERVISED LEARNING

- Definition: In unsupervised learning, the model works with unlabeled data, attempting to find patterns or structure within the data on its own.
- Goal: The goal is to discover hidden relationships, groupings, or features in the data without predefined labels.
- Examples:
  - Clustering: Customer segmentation, grouping similar images.
  - Dimensionality Reduction: Data compression, feature selection.

REINFORCEMENT LEARNING

- Definition: In reinforcement learning, an agent learns by interacting with an environment and receiving feedback in the form of rewards or penalties for its actions.
- Goal: The agent's objective is to maximize cumulative rewards by learning which actions yield the best outcomes over time.
- Examples:
  - Game AI: Training AI to play chess, Go, or video games.
  - Robotics: Teaching robots to navigate or perform tasks autonomously.

HOW CAN MACHINES LEARN ?

- Machine learning is a subset of the larger field of artificial intelligence (AI) that “focuses on teaching computers how to learn without the need to be programmed for specific tasks.
- In fact, the key idea behind ML is that it is possible to create algorithms that learn from and make predictions on data.”

MACHINES LEARN - DATASETS

- Machine learning systems are trained on special collections of samples called datasets.
- The samples can include numbers, images, texts or any other kind of data. It usually takes a lot of time and effort to create a good dataset.
- Discover more about data preparation for machine learning here.

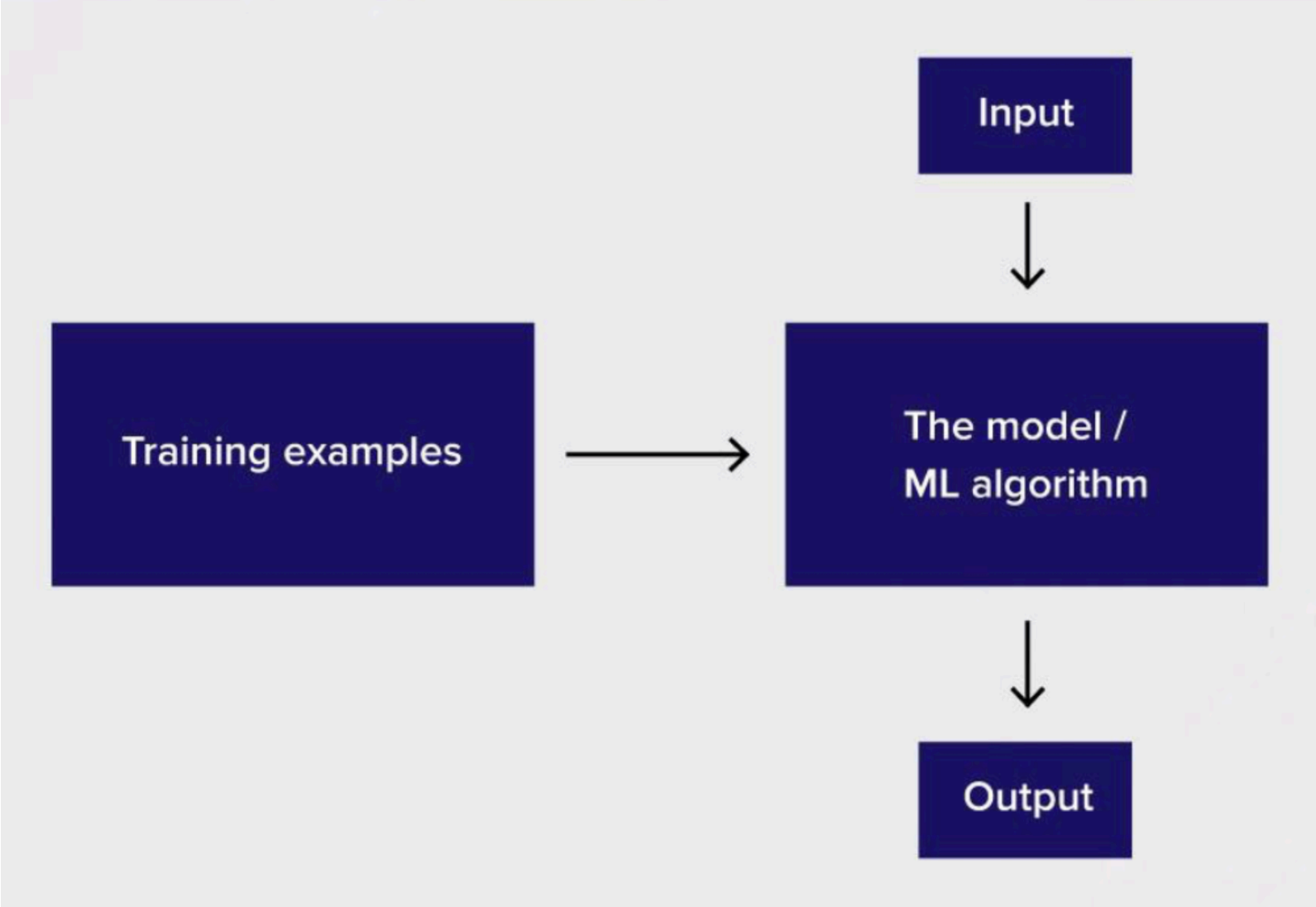
MACHINES LEARN - FEATURES

- Features are important pieces of data that work as the key to the solution of the task. They demonstrate to the machine what to pay attention to.
- How do you select the features? Let's say, you want to predict the price of an apartment. It is hard to predict by linear regression how much the place can cost based on the combination of its length and width, for example.
- However, it is much easier to find a correlation between the price and the area where the building is located.

MACHINES LEARN - ALGORITHM (1)

- It is possible to solve the same task using different algorithms.
- Depending on the algorithm, the accuracy or speed of getting the results can be different.
- Sometimes in order to achieve better performance, you combine different algorithms, like in ensemble learning.

MACHINES LEARN - ALGORITHM (2)

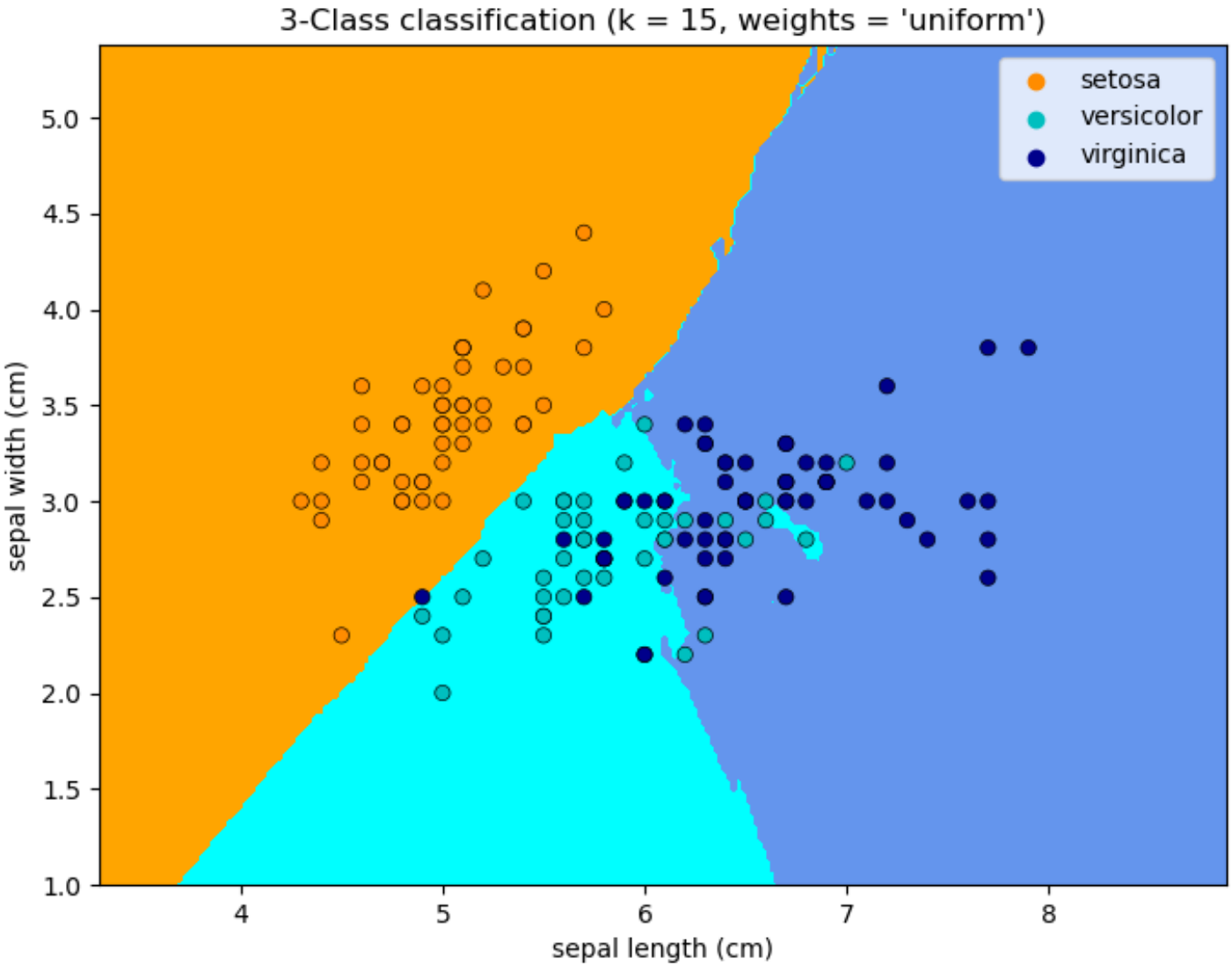


DECISION TREE

Temperature	Humidity	Wind	Play Golf
Hot	High	Weak	No
Hot	High	Strong	No
Mild	High	Weak	No
Cool	Normal	Weak	Yes
Mild	Normal	Strong	Yes

```
1  from sklearn import tree
2
3  features = [[3, 3, 1], [3, 3, 3], [2, 3, 1], [1, 2, 1], [2, 2, 3]]
4  labels = ["NO", "NO", "NO", "YES", "YES"]
5  classifier = tree.DecisionTreeClassifier()
6  classifier = classifier.fit(features, labels)
7  print(classifier.predict([[1, 2, 3]]))
8
```

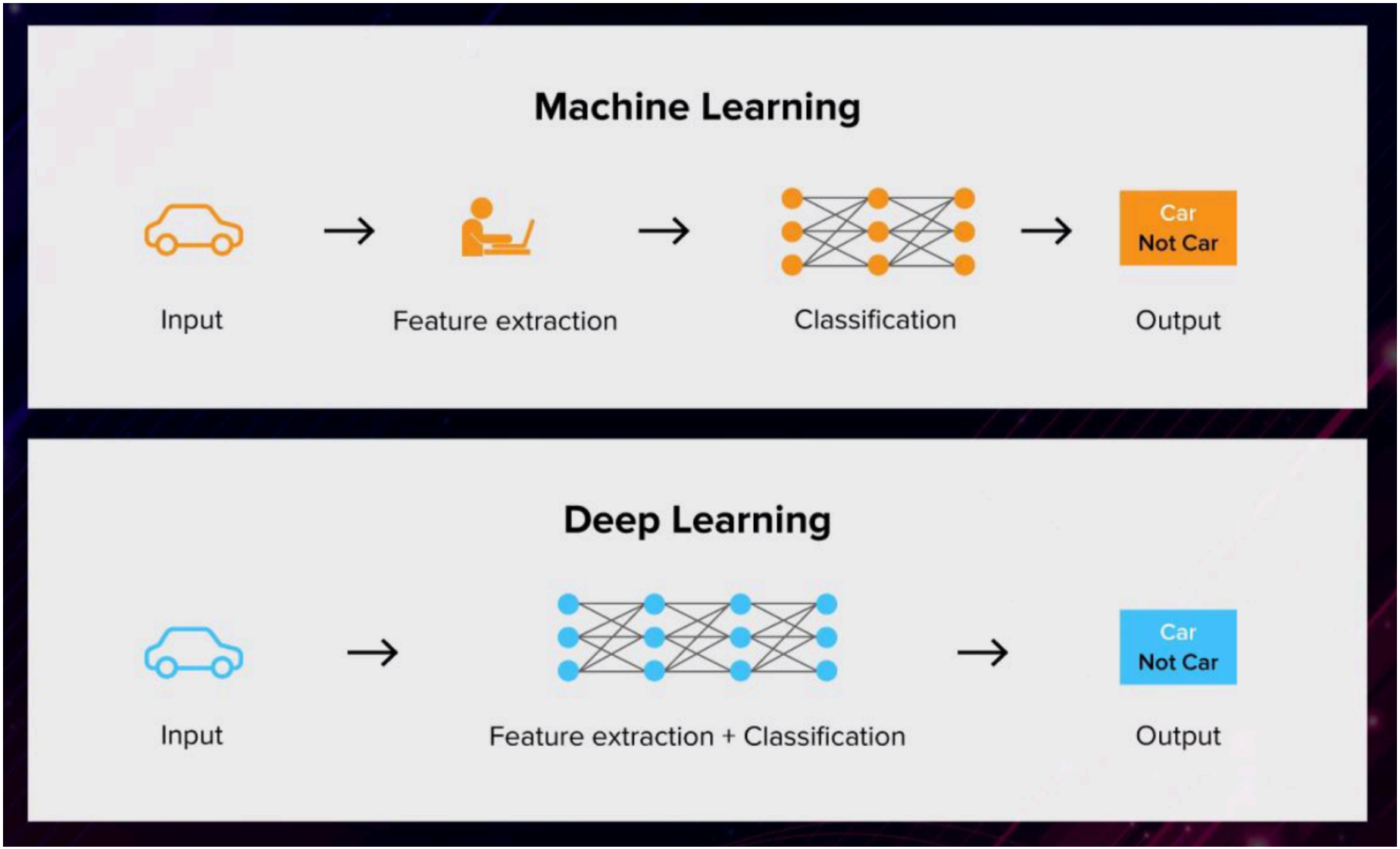
K-NEAREST NEIGHBORS (KNN)



DEEP LEARNING

- Deep learning is a class of machine learning algorithms inspired by the structure of a human brain. Deep learning algorithms use complex multi-layered neural networks, where the level of abstraction increases gradually by non-linear transformations of input data.

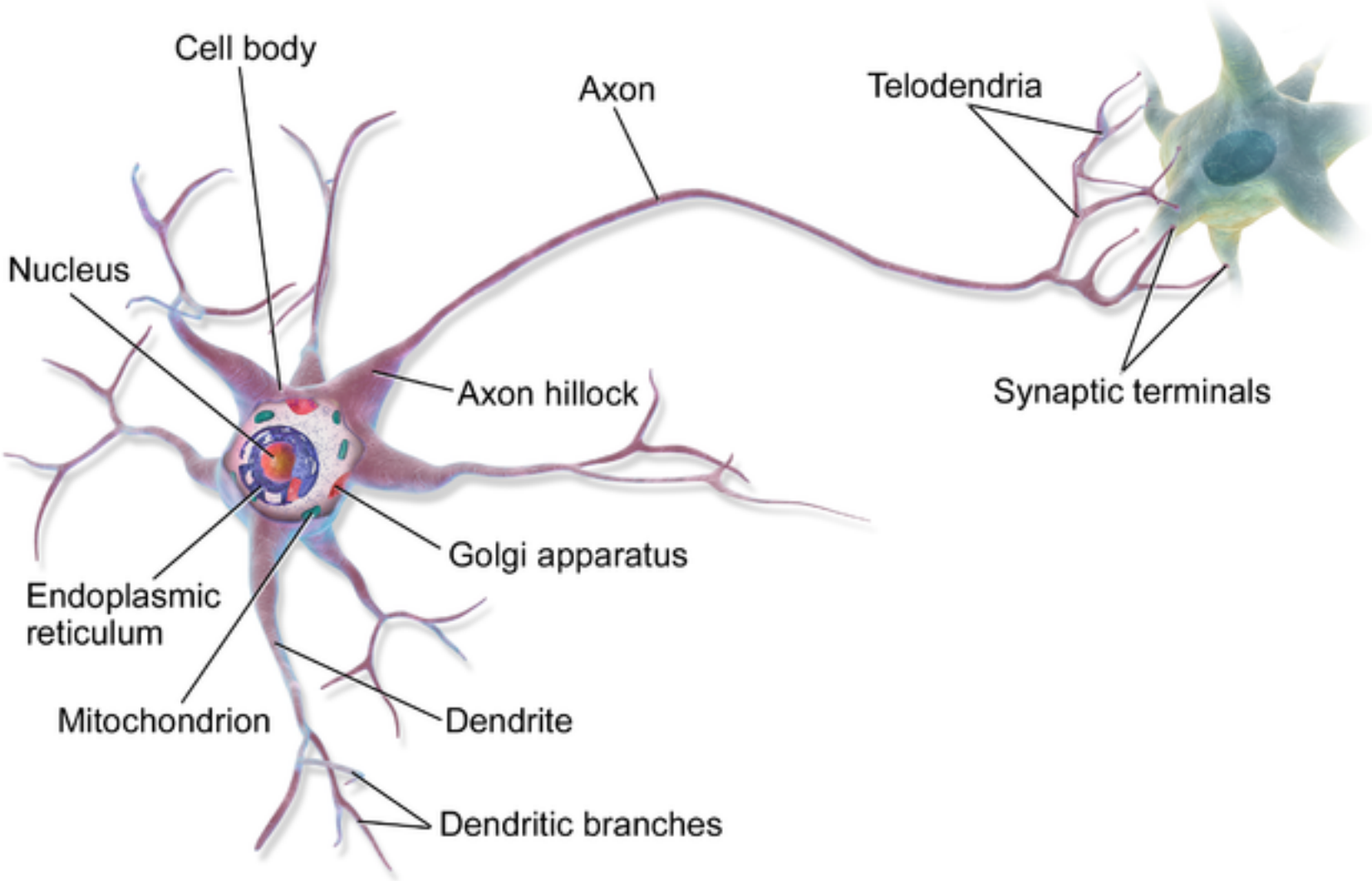
DEEP LEARNING VS MACHINE LEARNING



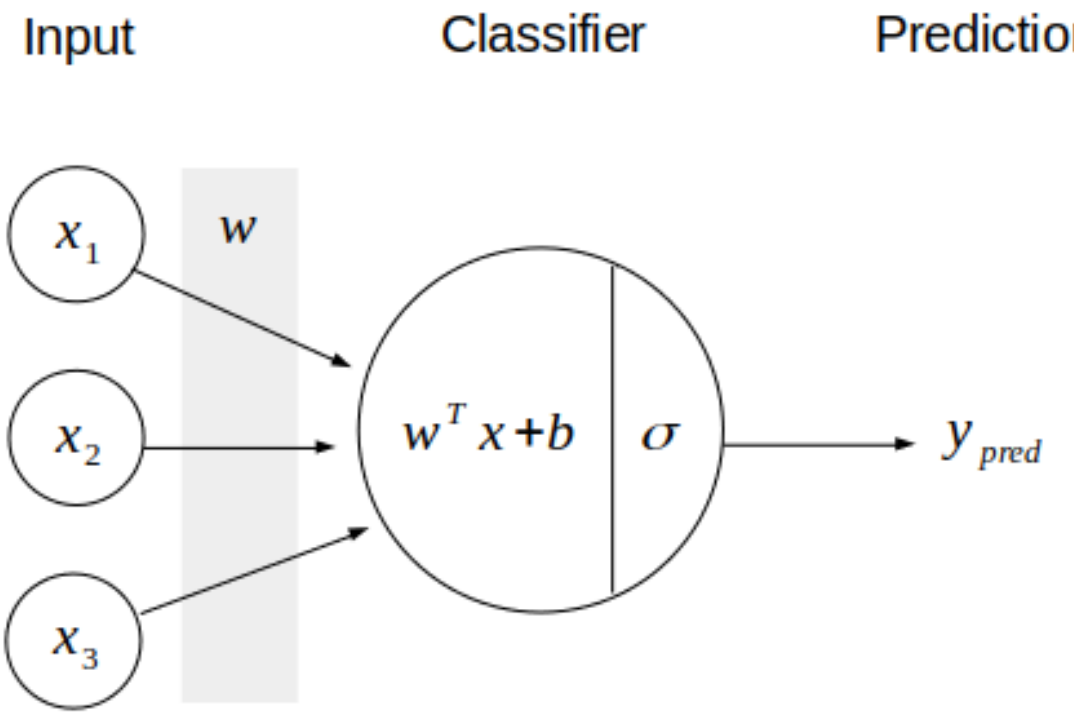
ARTIFICIAL NEURAL NETWORK (1)

- An algorithm is a procedure, which is a sequence of operations, usually dealt with by a computer that guarantees to find the correct solution to a problem in a finite time or tell you that no solution exists.

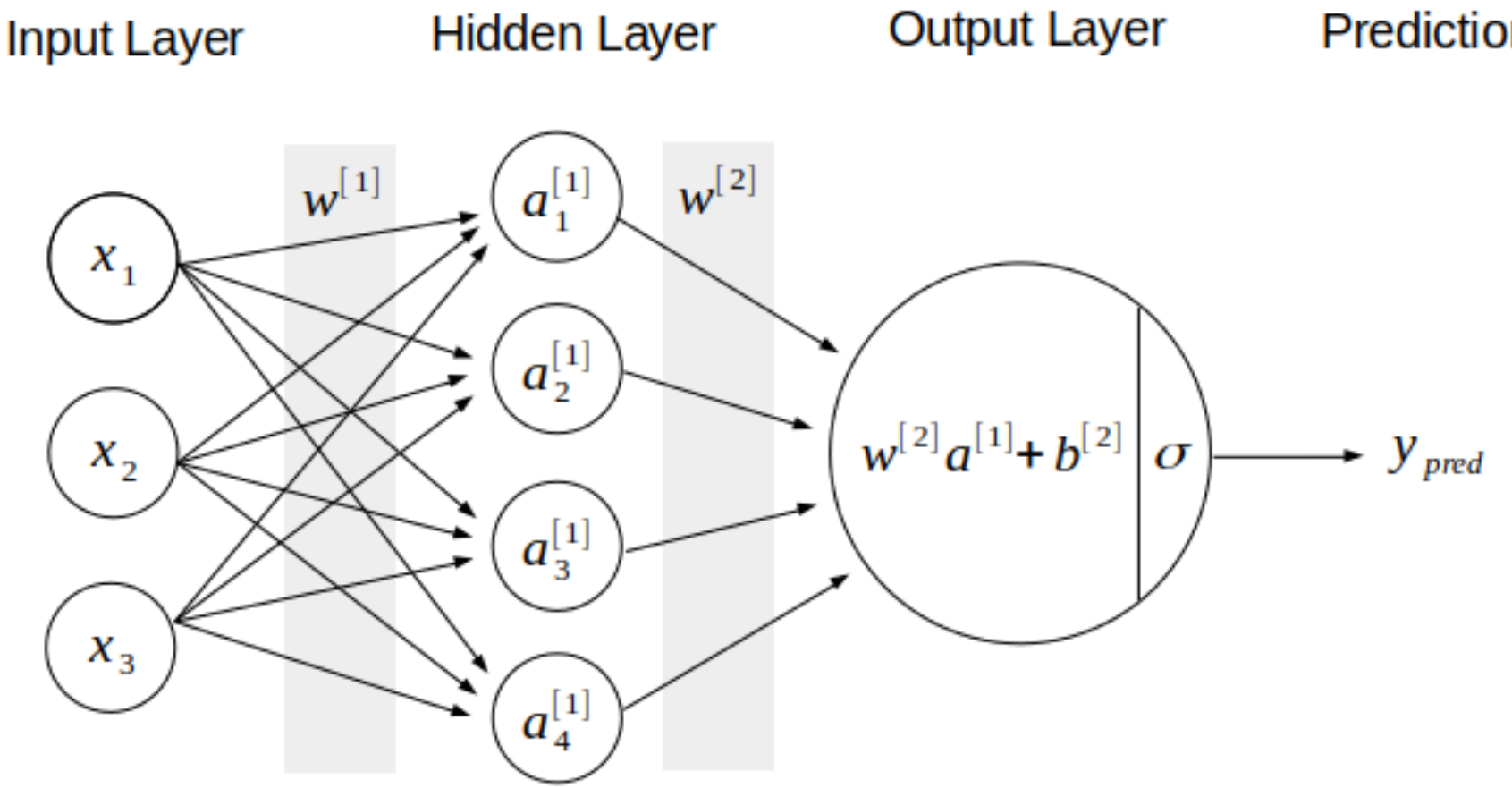
ARTIFICIAL NEURAL NETWORK (2)



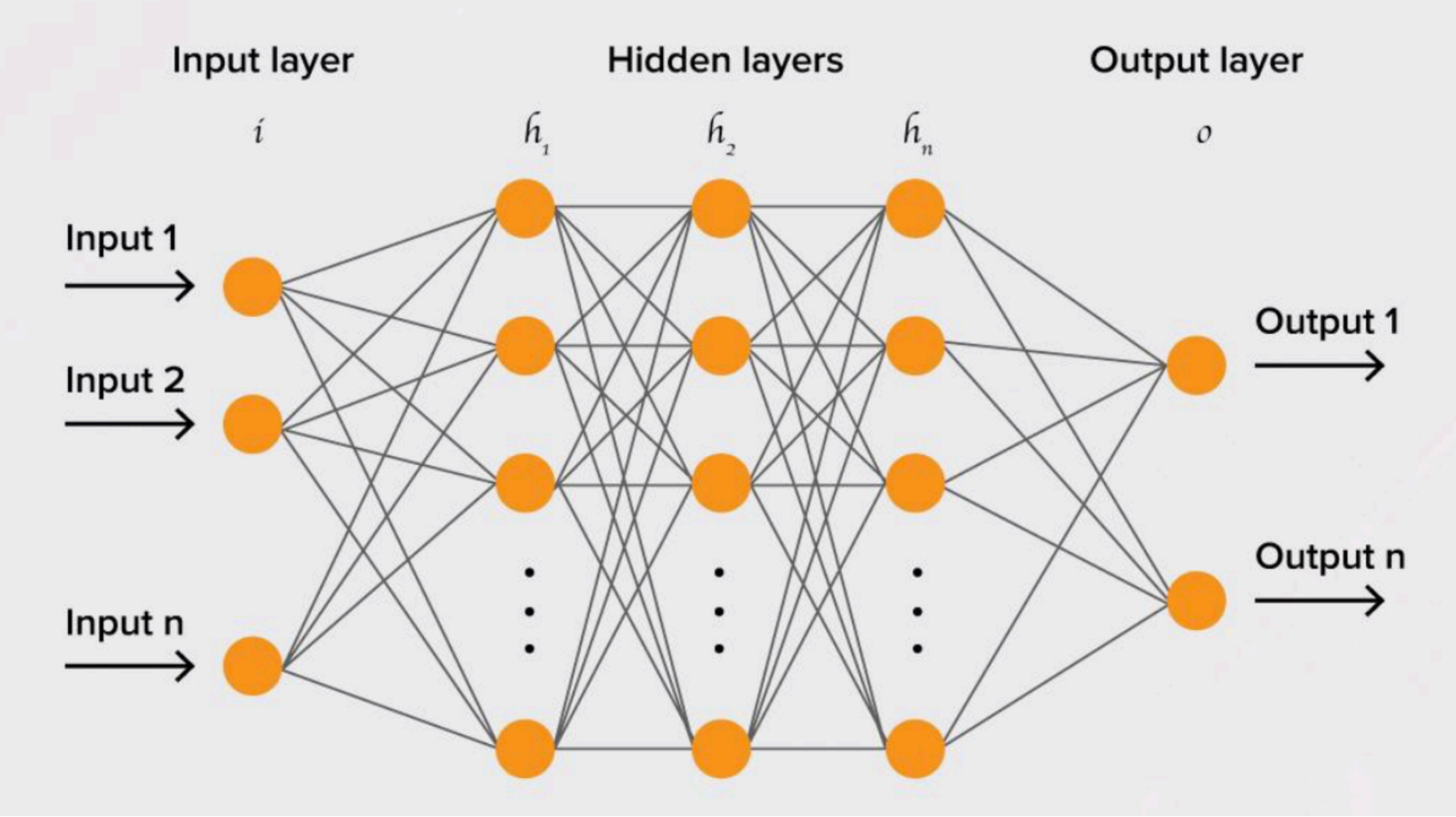
ARTIFICIAL NEURAL NETWORK (3)



ARTIFICIAL NEURAL NETWORK (4)



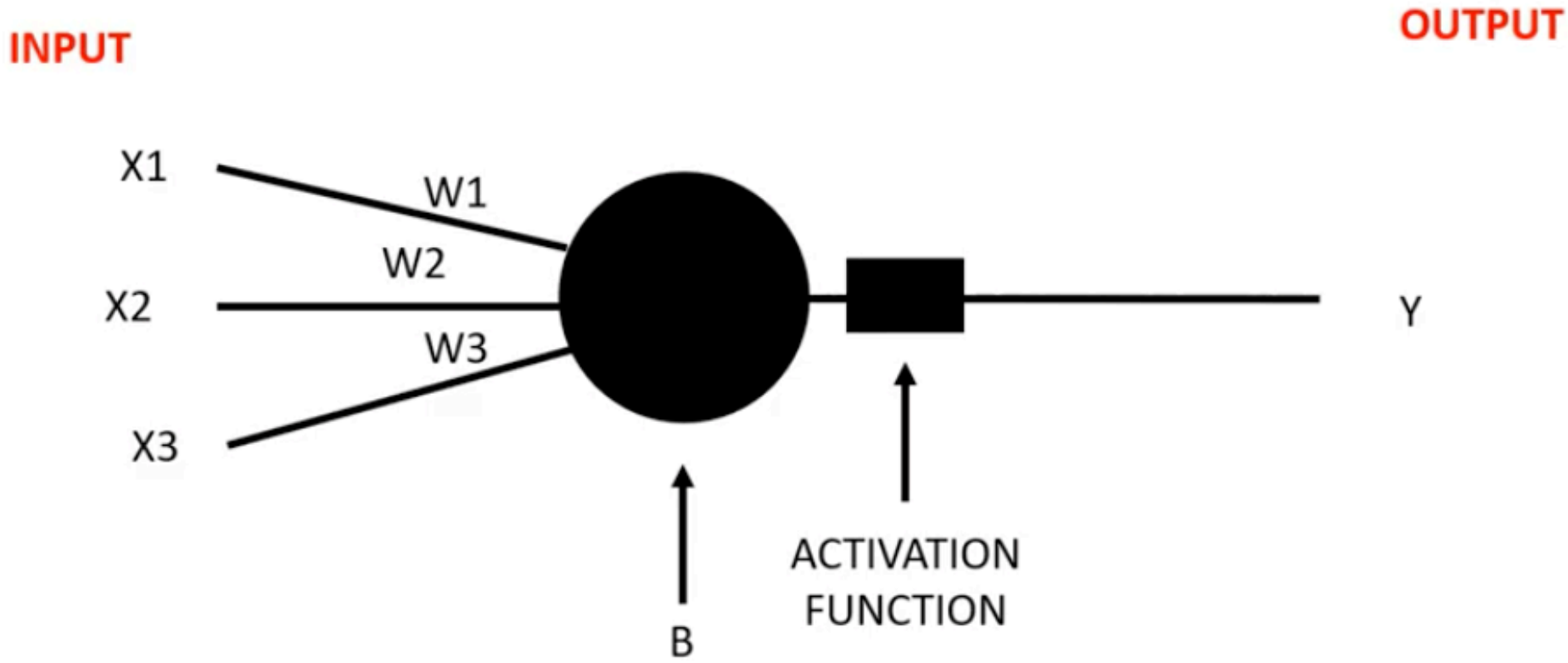
ARTIFICIAL NEURAL NETWORK (5)



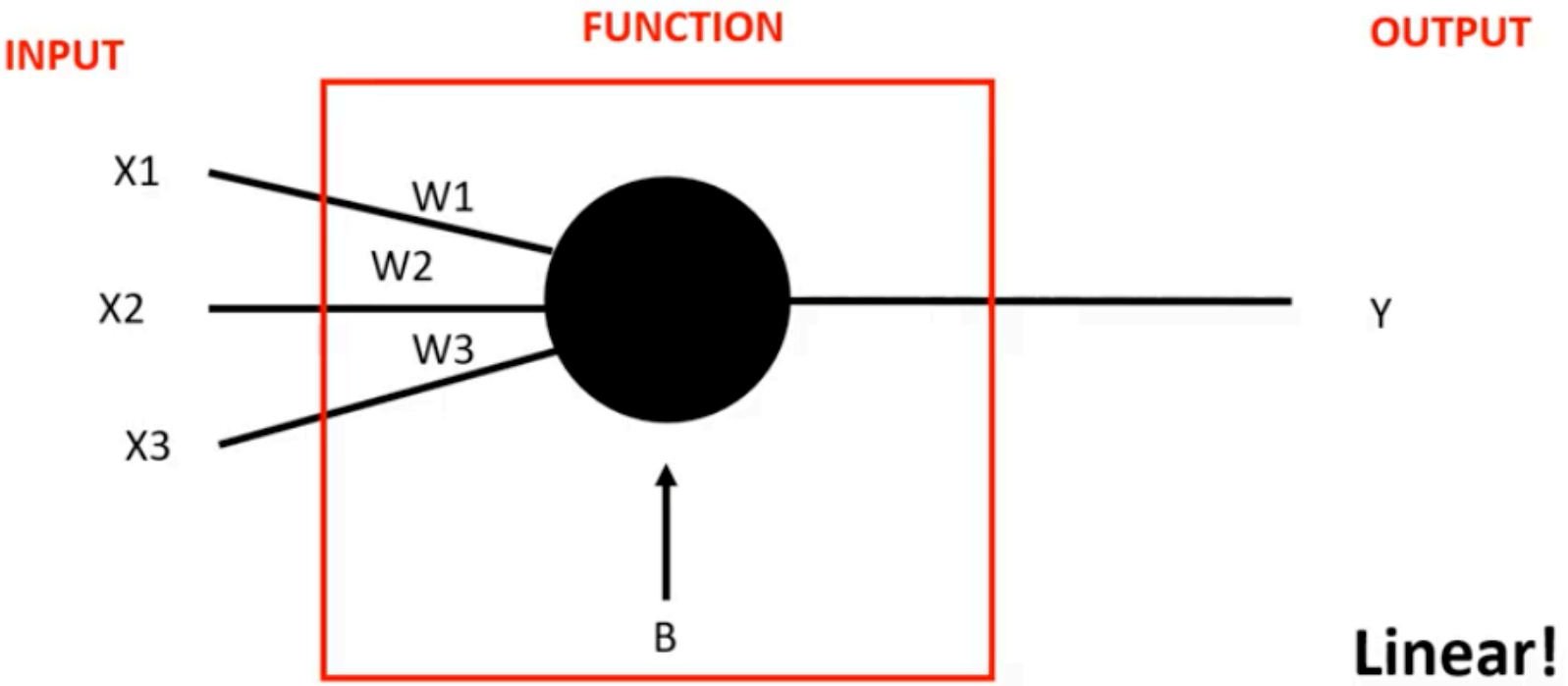
ARTIFICIAL NEURAL NETWORK (6)

- Component of Artificial Neuron
  - Input
  - Output
  - Weight
  - Bias
  - Activation Function

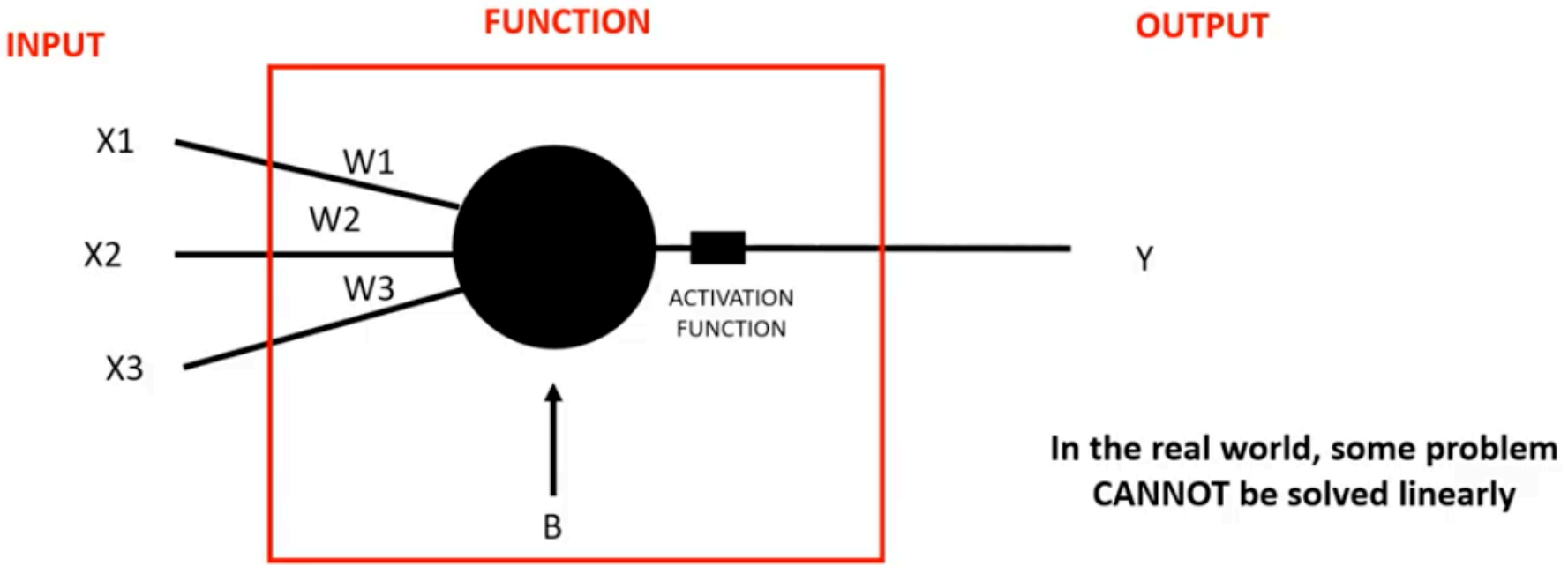
ARTIFICIAL NEURAL NETWORK (7)



ARTIFICIAL NEURAL NETWORK (8)



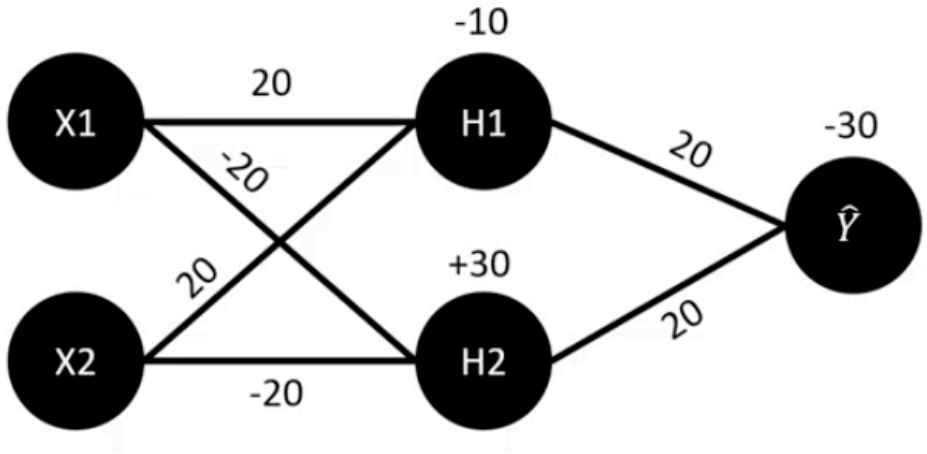
ARTIFICIAL NEURAL NETWORK (9)



In the real world, some problem CANNOT be solved linearly

Y = nonlinear function [W1X1+W2X2+W3X3+B]

EXAMPLE: XOR PROBLEM



X1	X2	Y
0	0	0
0	1	1
1	0	1
1	1	0

X1=0,X2=0 H1 = sigmoid[(20*0)+(20*0)-10] = 0

H2 = sigmoid[(-20*0)+(-20*0)+30] = 1

$\hat{Y}$ = sigmoid[(H1*20)+(H2*20)-30] = 0

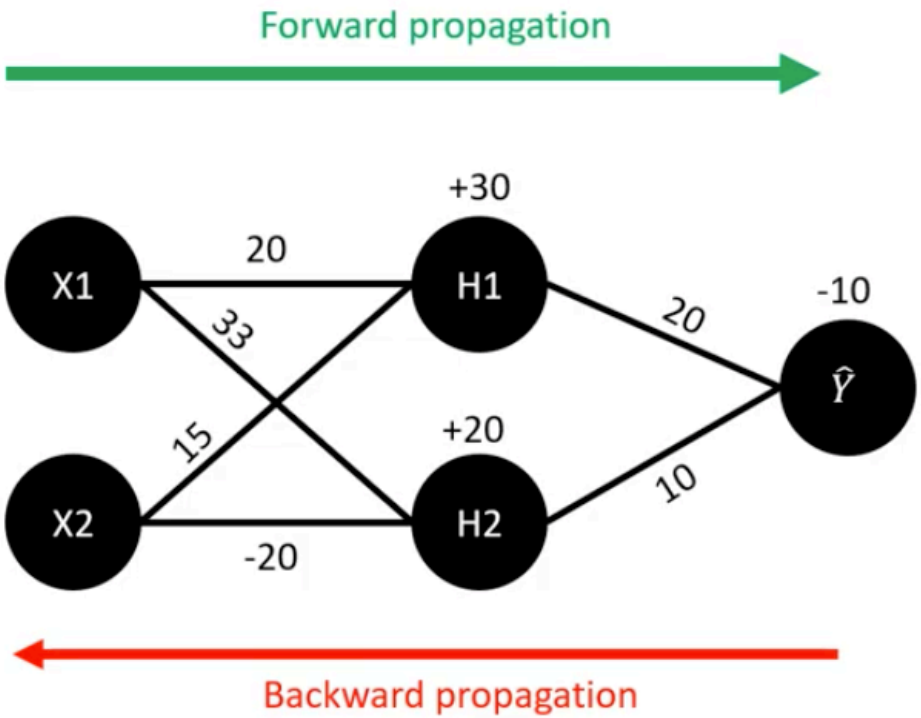
X1=1,X2=0 H1 = sigmoid[(20*1)+(20*0)-10] = 1

H2 = sigmoid[(-20*1)+(-20*0)+30] = 1

$\hat{Y}$ = sigmoid[(H1*20)+(H2*20)-30] = 1

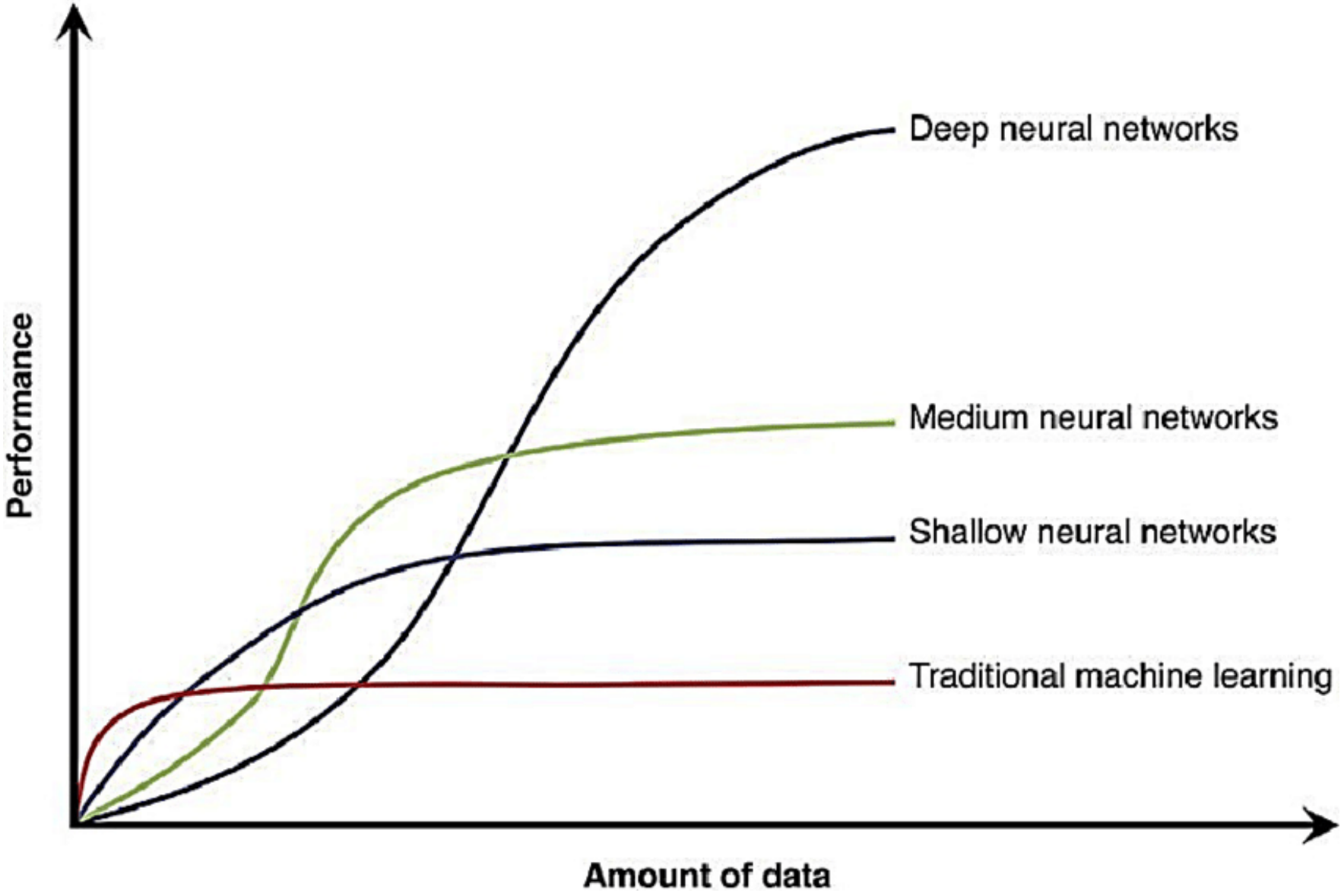
$$\text{Sigmoid}(x) = \frac{1}{1+e^{-x}}$$

ANN TRAINING

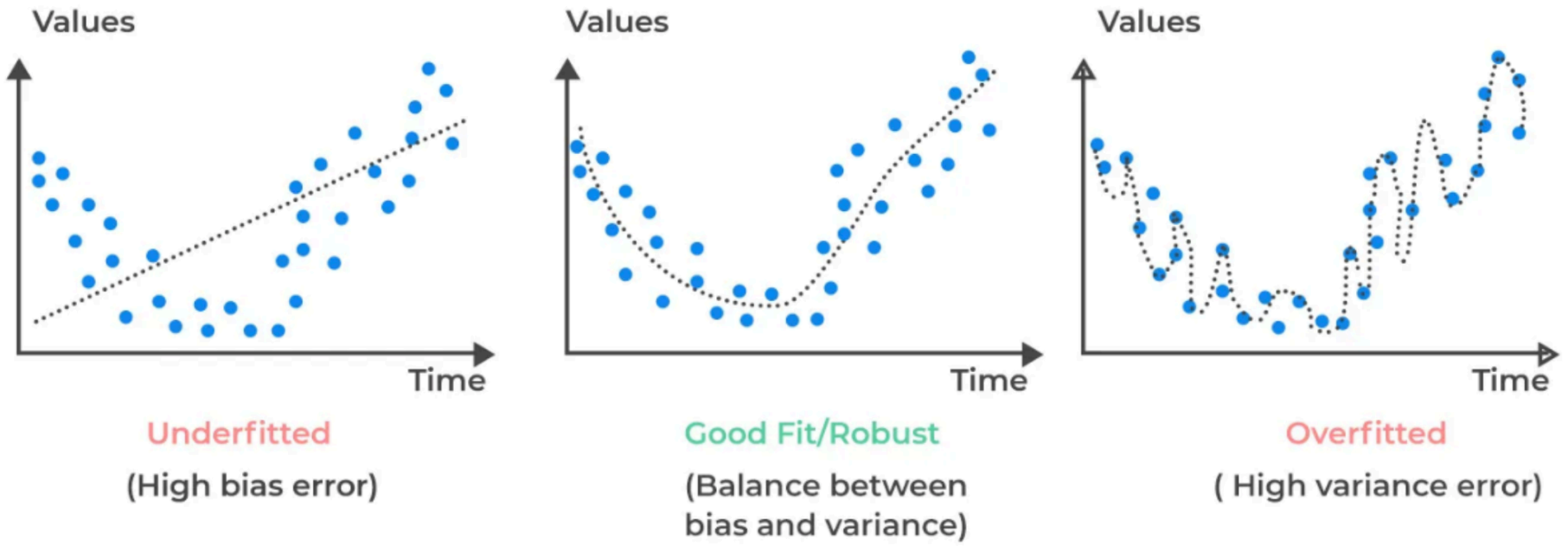


Compute error between predicted y and actual y

AI TECHNIQUES VS DATA VOLUME



GENERALIZATION AND OVERFITTING



HOW TO SPLIT DATA SET (1)

TRAINING SET

The subset of data used to train a machine learning model

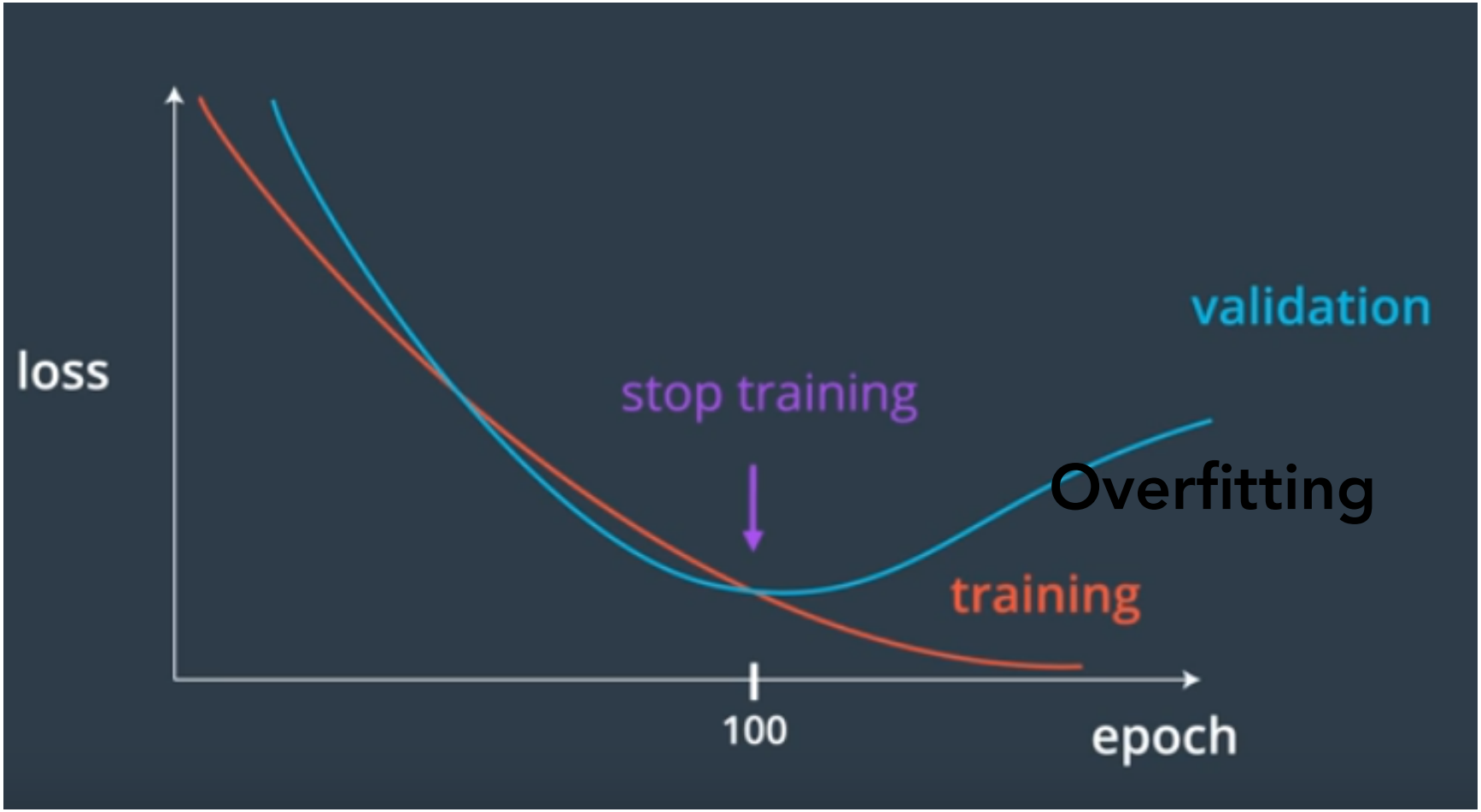
TEST SET

The subset of data used to evaluate the performance of a trained machine learning model on unseen examples, simulating real-world data

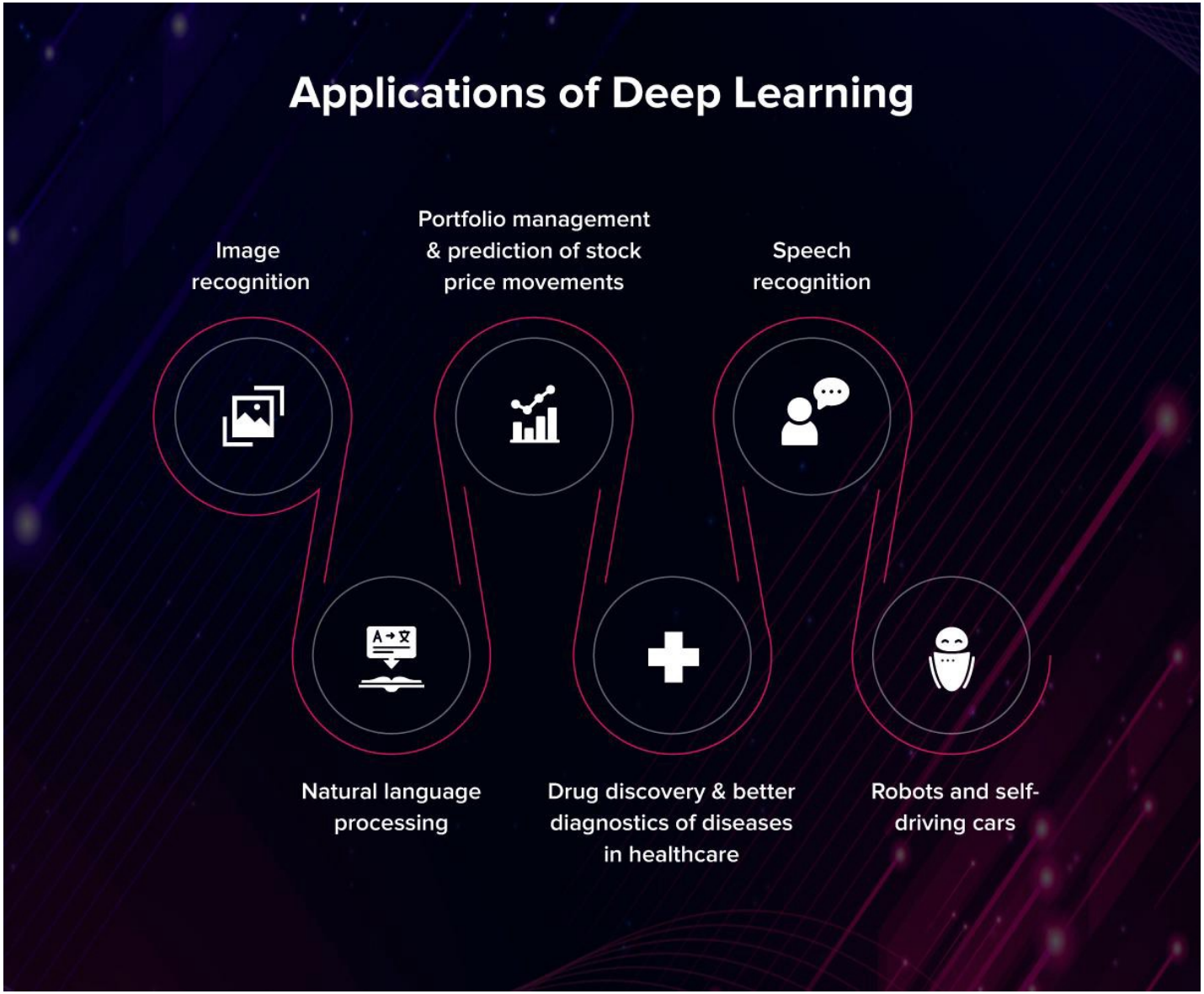
VALIDATION SET

The intermediary subset of data used during the model development process to fine-tune hyperparameters

HOW TO SPLIT DATA SET (2)



APPLICATIONS OF DEEP LEARNING



HOW WILL AI MODERNIZE THE TRAVEL INDUSTRY

HOW WILL AI IMPROVING HEALTH CARE ? (1)

- Robot-Assisted Health Care

- Case study from COVID-19:
  - China was also the first country to use robots to disinfect hospital rooms and carry supplies, reducing the risk of infection for medical personnel.

HOW WILL AI IMPROVING HEALTH CARE ? (2)

- Another example of fantastic work coming out of Spain is a Valencia-based company called Quibim, which has developed a neural network that can use medical images to ascertain the level of seriousness of a COVID-19 patient's condition.
- Based on this information, this product can provide recommendations regarding the infected person's care, including whether hospitalization is advisable.

HOW IS AI TRANSFORMING THE TRANSPORTATION INDUSTRY ?

HOW IS AI REVOLUTIONIZE THE RETAIL STORE ?

HOW WILL AI IMPROVING EDUCATION ?

- Personalize Learning Platform
- Individualized AI Tutors
- Personalize Games
- Crafting a More Enjoyable Learning Experience
- Case Study:
  - Adaptive Learning System

CHATBOT AND HOW THEY WILL CHANGE COMMUNICATION

- A chatbot is a computer program that allows humans to interact with technology using a variety of input methods such as voice, text, gesture and touch, 24/7 365.
- For several years chatbots were typically used in customer service environments but are now being used in a variety of other roles within enterprises to improve customer experience and business efficiencies.

CHATBOT CASE STUDY

- Shiseido, one of the world's largest cosmetic companies reached an influential teen audience by providing make-up and advice and tips with a unique and engaging chatbot.
- Shell achieved a 40% reduction in call volume to live agents by answering 97% of questions correctly and resolving 74% of digital conversations with its Teneo based intelligent virtual assistants
- Widiba takes intelligent chatbots to a new dimension with its virtual reality banking app which has customers giving the company a 4.8/5 on its "happiness index".

GENERATIVE AI (GAI)

- Generative AI is a type of artificial intelligence that creates new content like text, images, music, and video, using predictive models trained on large datasets.
- It learns patterns from data and generates new content that resembles the training data but is not a direct copy, like a remix.

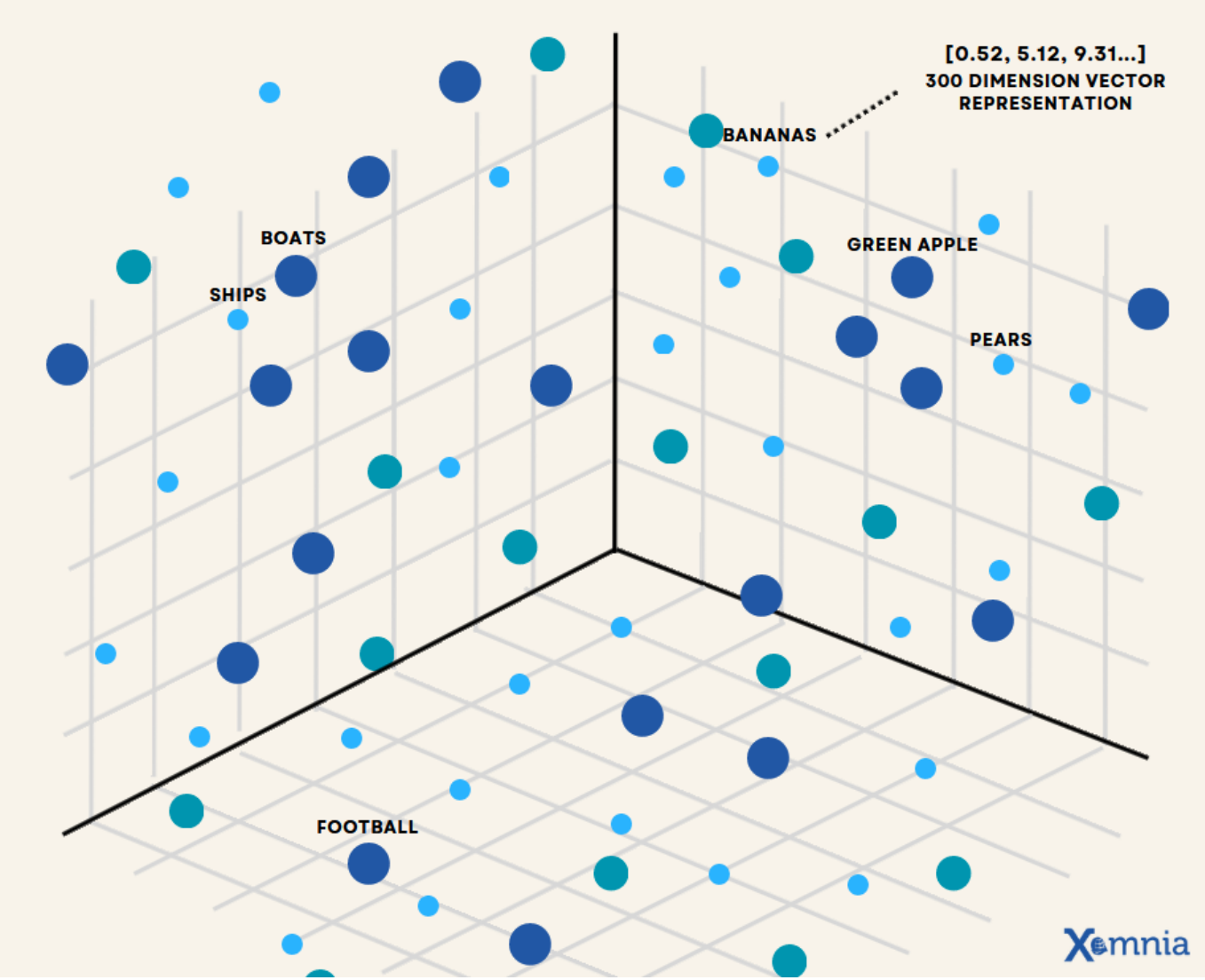
LARGE LANGUAGE MODEL (LLM)

- LLMs are typically based on transformer architectures, like OpenAI's GPT (Generative Pre-trained Transformer), Google's PaLM, or Meta’s LLaMA.
- They work by predicting the next word in a sentence, using billions (or even trillions) of parameters to make informed guesses based on context.

VECTOR DATABASE (1)

- A vector database specializes in storing, indexing, and retrieving data represented as vectors or vector embeddings.
- These databases are designed to manage large volumes of unstructured and semi-structured data, offering features like metadata storage, filtering, scalability, dynamic updates, and security.
- The use of embedding models allows vector databases to measure and understand the similarity between data objects, facilitating advanced search capabilities across high-dimensional vector spaces

VECTOR DATABASE (2)



WHAT IS AN EMBEDDING MODEL IN LLM?

- An embedding model is a neural network that transforms data (like words, sentences, or images) into numerical representations called vectors.
- These vectors capture the semantic meaning of the data, allowing the LLM to understand relationships between concepts and perform tasks like text generation or image recognition.

RETRIEVAL-AUGMENTED GENERATION (RAG)

- Retrieval-Augmented Generation (RAG) is a technique that enhances large language models (LLMs) by incorporating an information retrieval mechanism.
- This allows LLMs to access and utilize external knowledge bases, improving their accuracy and relevance when generating responses.
- RAG works by retrieving relevant information from a knowledge base, combining it with the user's query, and then using the LLM to generate a response.

LLM AND VECTOR DATABASE

Component	Role
LLM	Understands natural language & generates responses
Embedding Model	Turns text into vectors
Vector DB	Stores and retrieves vectors based on similarity
RAG Architecture	Combines all of the above to enhance LLMs with real info

LIMITATION OF GAI (1)

Limitation	What it means
No real understanding	Mimics intelligence, but doesn't know
Inaccuracies (hallucinations)	Can make things up confidently
Bias	Reflects unfair or harmful ideas
Ethical misuse	Can be used for scams, fakes, plagiarism
Data dependency	Flawed data → flawed output
Weak resoning	Struggles with logic and common sense
Not truly creative	Repackages existing content
High resource cost	Expensive to train, energy-intensive

LIMITATION OF GAI (2)

- If you're using Generative AI (GAI) for something serious, it's best to double-check anything important.

USING AI TO WRITE THE PROMPTS (1)

- The easiest way to create effective prompts is to ask an AI to do it for you. Here's a step-by-step guide to get you started:
  - Step 1: Choose your AI assistant for this guide, we'll use Claude, but you can use ChatGPT, Google Gemini, or another LLM of your choice.
  - Step 2: Clearly define your objective. Before asking the AI to write a prompt, you need to know what you want to achieve. For example:
    - Analyze competitor strategies
    - Generate blog post ideas
    - Etc.

USING AI TO WRITE THE PROMPTS (2)

- Step 3: Ask the AI to write a prompt for your objective
  Here's a template you can use:

"I need to [your objective]. Can you write an effective prompt for an AI assistant to help me accomplish this task?"

- **Example:** I need to ***create a month's worth of social media content for an eco-friendly clothing brand.*** Can you write an effective prompt for an AI assistant to help me accomplish this task?

USING AI TO WRITE THE PROMPTS (3)

- **Step 1: Role** - Specify the role or task you want the AI to perform, such as “You are a personal assistant” or “You are a marketing expert.”
- **Step 2: Task** - Specify the task you want the AI to perform or the question you want it to answer.
- **Step 3: Details** - Specify any additional information or conditions required for the operation, such as restrictions, preferences, or specific details.
- **Step 4: Output Format** - Specify the desired format or structure of the results.
- **Step 5: Additional Requirements** - Specify any additional requirements, such as language, display format, or other constraints. [Optional]

USING AI TO WRITE THE PROMPTS (4)

Try this to Generative AI (chatGPT, DeepSeek, etc.)

“คุณเป็นผู้เชี่ยวชาญด้านการท่องเที่ยว ช่วยวางแผนการเดินทางไปเที่ยวเชียงใหม่ 3 วัน 2 คืน ฉันชอบประวัติศาสตร์และร้านกาแฟเก๋ๆ งบประมาณ 18,000 บาท โปรดแสดงผลลัพธ์ในรูปแบบแผนการเดินทางพร้อมคำอธิบายสั้นๆ ขแงแต่ละกิจกรรมในรูปแบบภาษาไทย”

USING AI TO WRITE THE PROMPTS (5)

“คุณเป็นผู้เชี่ยวชาญด้านการโฆษณาสื่อโซเชียล ช่วยปรับแต่งข้อความต่อไปนี้ให้น่าสนใจและพร้อมที่จะโพสต์ลง Facebook marketplace”

ทุเรียนปลอดสารสวนศรสุข
กก.ละ 300 บาท ค่าส่งเหมาตามระยะทาง

ทุเรียนภูเขาไฟอร่อย ปลอดภัย ไร้สาร ส่งตรงจากสวนถึงบ้านของคุณ ด้วยการควบคุมการผลิตทุกขั้นตอน มั่นใจได้ว่า ทุเรียนอร่อย เนื้อดี ไร้สารพิษแน่นอน

ติดต่อสั่งซื้อ
Line id: suansornsook
โทร: 0xx-xxx-xxx

ขนส่งเอกชน ประมาณ 1-3 วัน
ยินดีคืนเงินหากสินค้าเสียหายระหว่างการจัดส่ง
(กรุณา ถ่ายวิดีโอขณะเปิดกล่องพัสดุ)

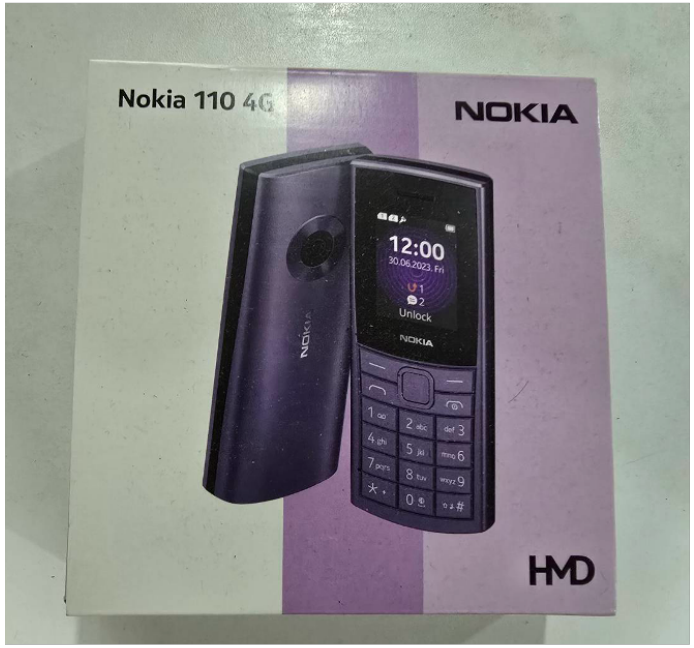
USING AI TO WRITE THE PROMPTS (6)

- Meta AI (https://www.meta.ai)

ภาพทุเรียนจัดวางดูน่าทานหลายๆลูก มีบางลูกแกะเปลือกให้เห็นเนื้อที่ดูสวยน่าทาน ชวนให้คนอยากซื้อ สำหรับนำไปโพสต์ใน Facebook Marketplace โดยให้มีพื้นหลังเป็นภาพการจัดวางบนโต๊ะสวยๆที่อยู่ในสวน

USING AI TO WRITE THE PROMPTS (7)

- pebblely.com (https://pebbely.com)



Before

After

GENERATIVE AI ETHICS