

Introduction to Generative AI

Learning Objectives

Upon completion of this module, you should be able to:

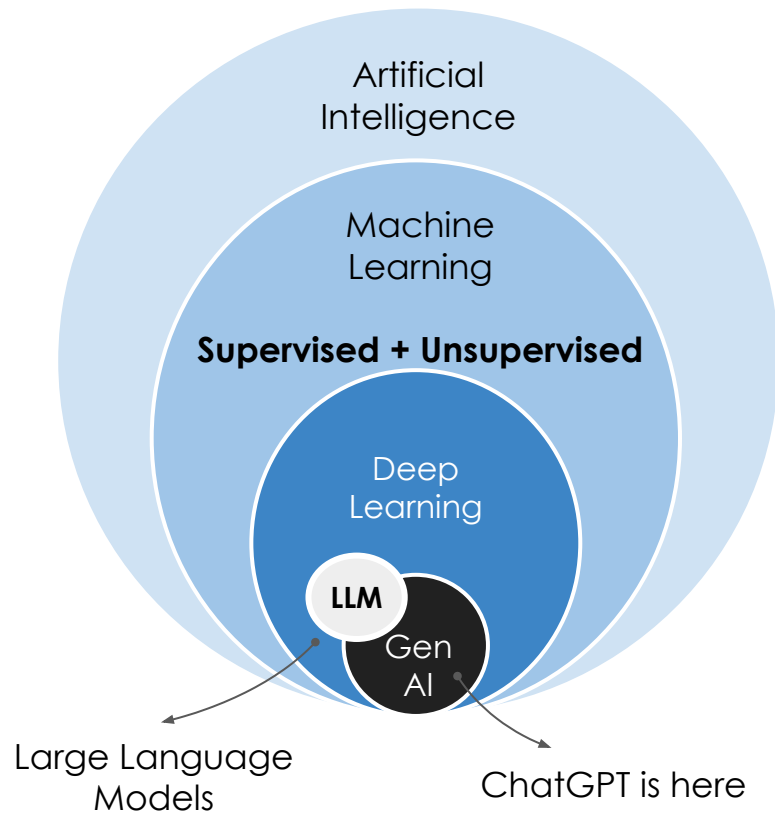
- Define AI Fundamentals and Generative Models.
- Deconstruct Large Language Models (LLMs)
 - a. Analyze the behavior of LLMs and their understanding, completion, and prediction of text.
 - b. Investigate the phenomenon of hallucinations in LLMs and its underlying causes.
- Identify the diverse applications of ML, DL, and Generative AI in business, retail, health, and technology sectors.
- Gain practical experience by working with ChatGPT for text and Code generation

Agenda

Here, we will cover:

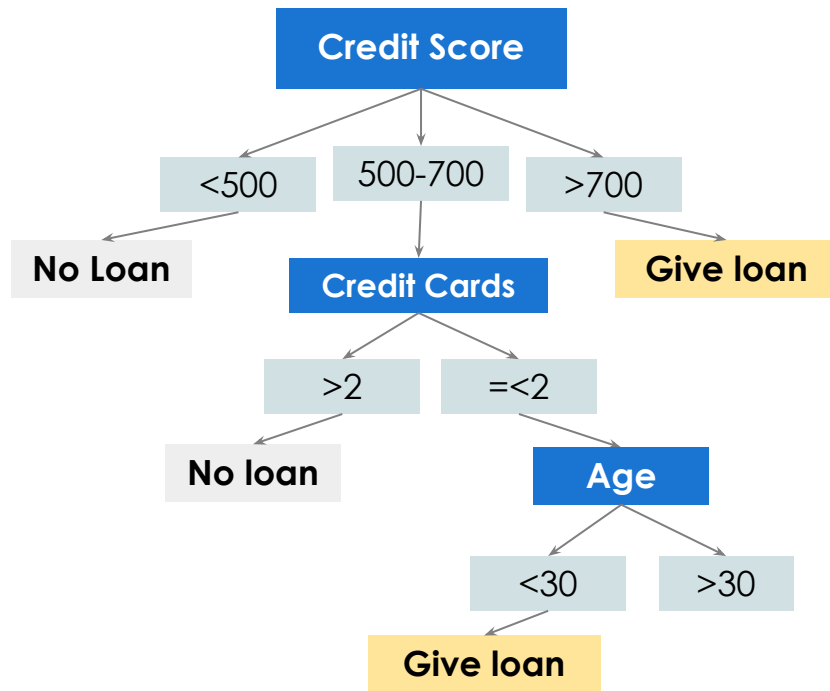
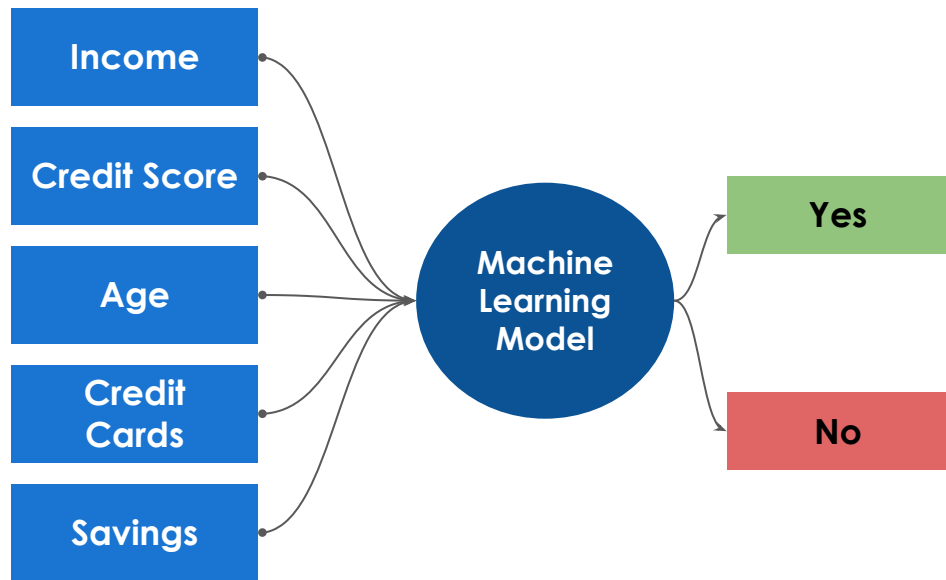
- Defining AI, ML, DL, LLM and Generative Models via Venn diagram
- Learning supervised and unsupervised ML tasks
- Understanding Generative and Discriminative AI
- A brief timeline of Generative AI
- A peek into generative models
- Deconstructing the behaviour of a large language models
- ML, DL and GenAI applications in business
- Hands-on demonstration of ChatGPT for text and code generation

Getting the Definitions Right

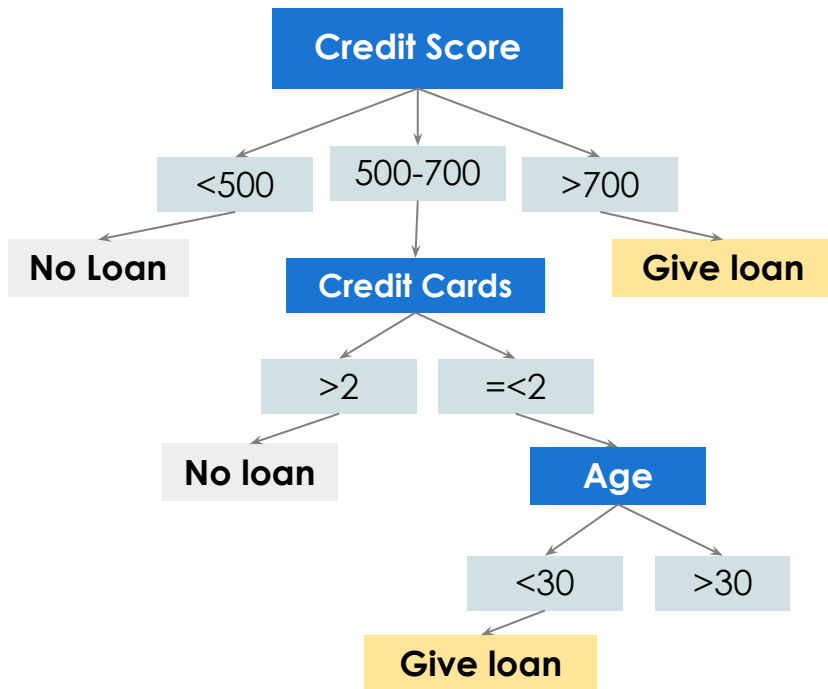


Supervised Learning

Should I give loan to this customer?

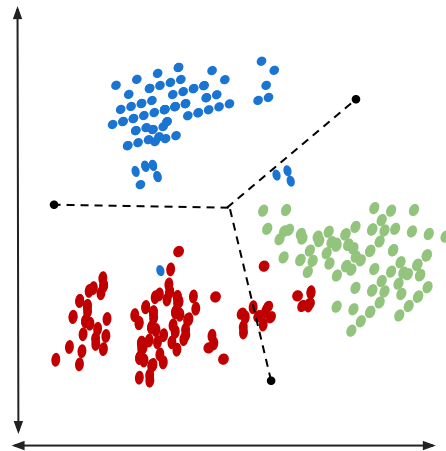
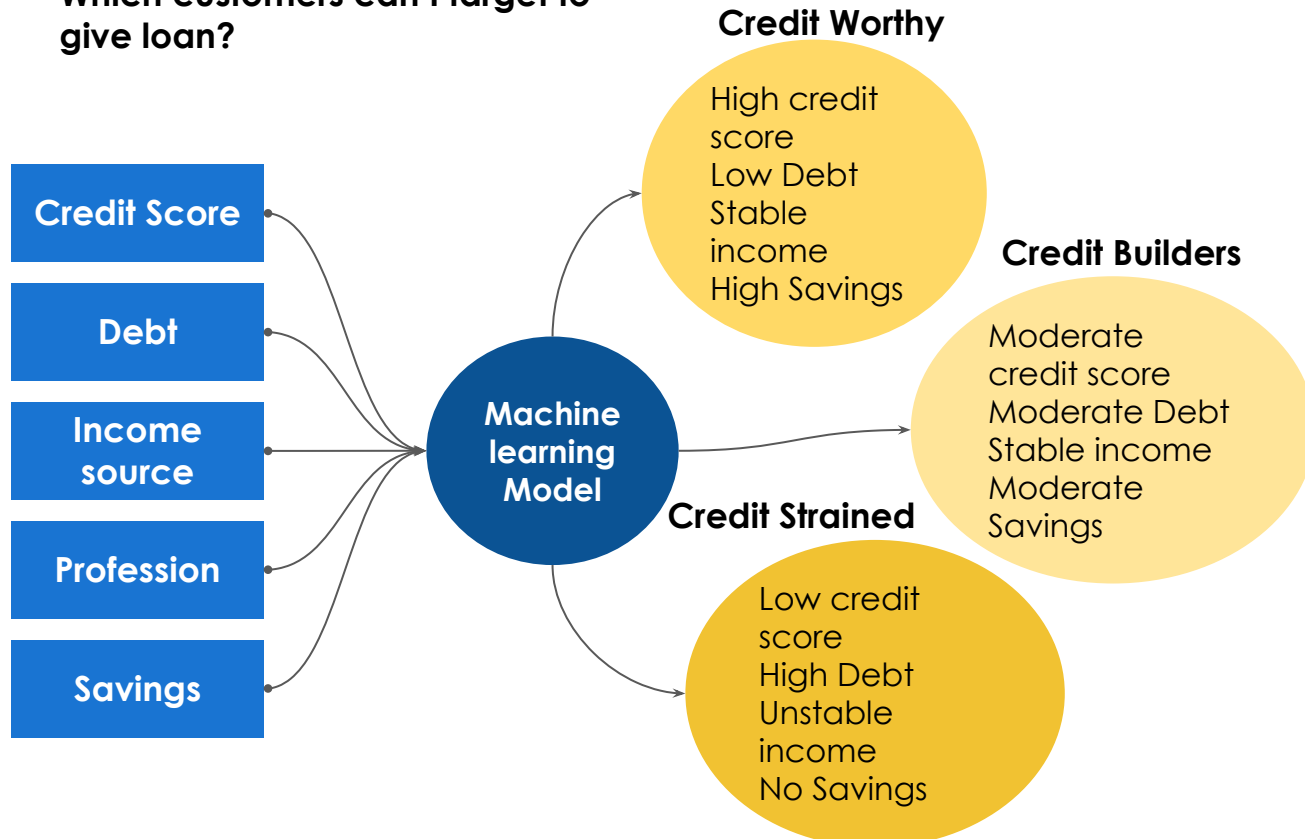


Supervised Learning



Unsupervised Learning

Which customers can I target to give loan?



Discriminative AI vs. Generative AI



Train

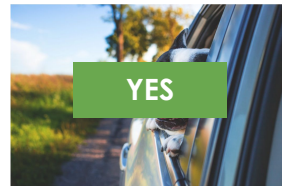


Model

Learns from relationship
between **labels** and
data

Could this be a dog?

Classify



Discriminative AI



+

**Other images on
the internet**

Train



Model

Learns from patterns
in large amounts of
unstructured data


Create an image
of dog, having
fun in a party,
wearing a black
tuxedo with wine
in one hand

Generate

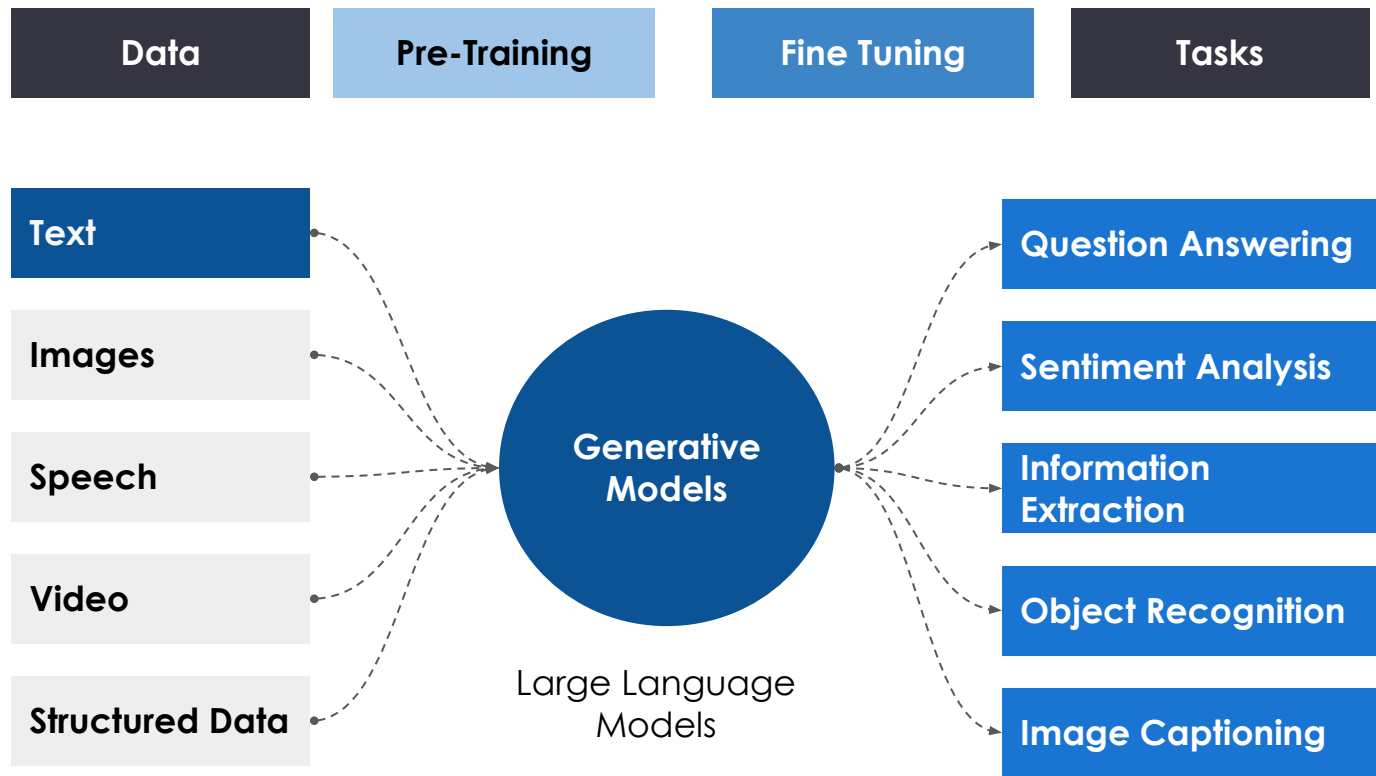


Generative AI

A Brief History of Generative AI

- 
- 2014** Generated realistic images - GANs - Ian Goodfellow
 - 2017** Breakthrough in NLP - Transformer Models
 - 2018** Advent of large language models - BERT, GPT
 - 2019** Advanced GANs - style GANs
 - 2020** OpenAI released GPT-3 - this was state-of-the-art
 - 2021** Vision Transformers - CLIP, DALL-E
 - 2022** OpenAI released ChatGPT (GPT-3.5), DALL-E 2
 - 2023** GPT-4, Stable Diffusion Model - market is flooded with GenAI apps

A Peek into Generative AI Models



Large Language Models (LLMs)

- **Large**, because 2 things:
 1. trained on **large amounts of data**
 2. **billions** of trainable **parameters**
- **Language**, because it deals with text data (takes **input** in text and generates **output** in **text**).
- **Model**, because it **predicts** the next **word**/sentence/token.
- So **LLMs** are **language models consisting of a neural network with billions of parameters**, trained on large quantities of unlabeled text using self-supervised learning.

Interacting with Generative AI Models

Hands-on: **Introducing ChatGPT**

How does the Model understand text?

Is there a numeric way to represent association between text or words?

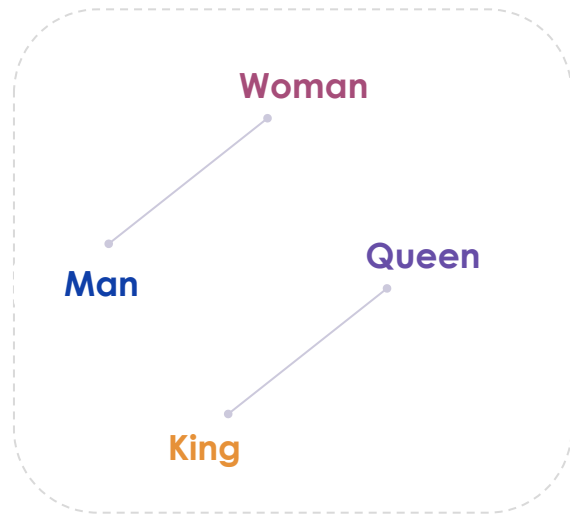
Word embeddings = semantic + syntactic relations in a vector space

similarity+ rules = meaning

Let's try to understand vector space

	Living Being	Human	Gender	Royalty
Man	0.8	0.8	0.8	- 0.7
Woman	0.9	0.9	- 0.9	- 0.8
King	0.8	0.7	0.7	0.7
Queen	0.7	0.8	- 0.8	0.8

King - Man + Woman = ?

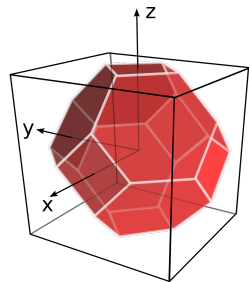


How does it complete text?

The robot must obey instructions given to _____



Learning from the large set of documents, the model has understood that when the word **robot** is referred to again in a sentence, words like “**it**” / “**its**” are most likely to be the completion word.



It memorized this association by knowing they are close to each other in some vector dimension that associates pronouns with words.

The robot must obey instructions given to it

The robot must obey instructions given to its control system or programming

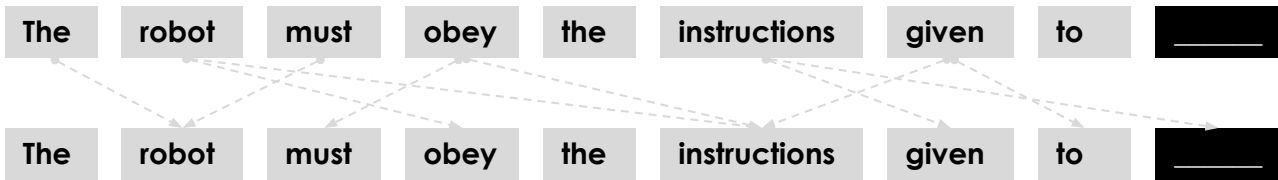
The robot must obey instructions given to its designated operator or user

How does it predict the next word?

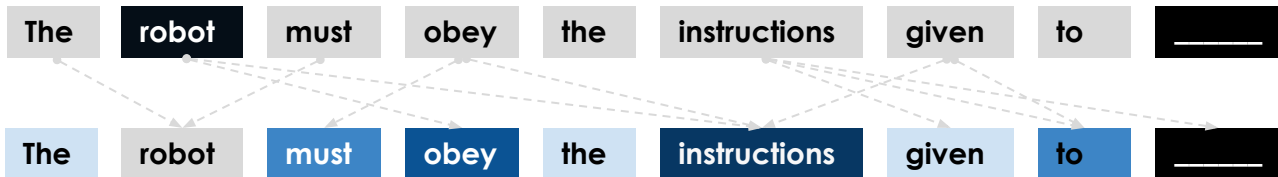
- **Step-1: Word Embeddings** - Break the sentence into words and convert them to embeddings

The robot must obey the instructions given to _____

- **Step-2: Find connections** - Understand which word is related to which word more



- **Step-3: Giving importance/attention**: Each word is assigned a score based on how important it is to other words in the sentence



How does it predict the next word?

- **Step-4: Assigning Weights** - This is for "robot" - but step-3 and 4 will be repeated for all words

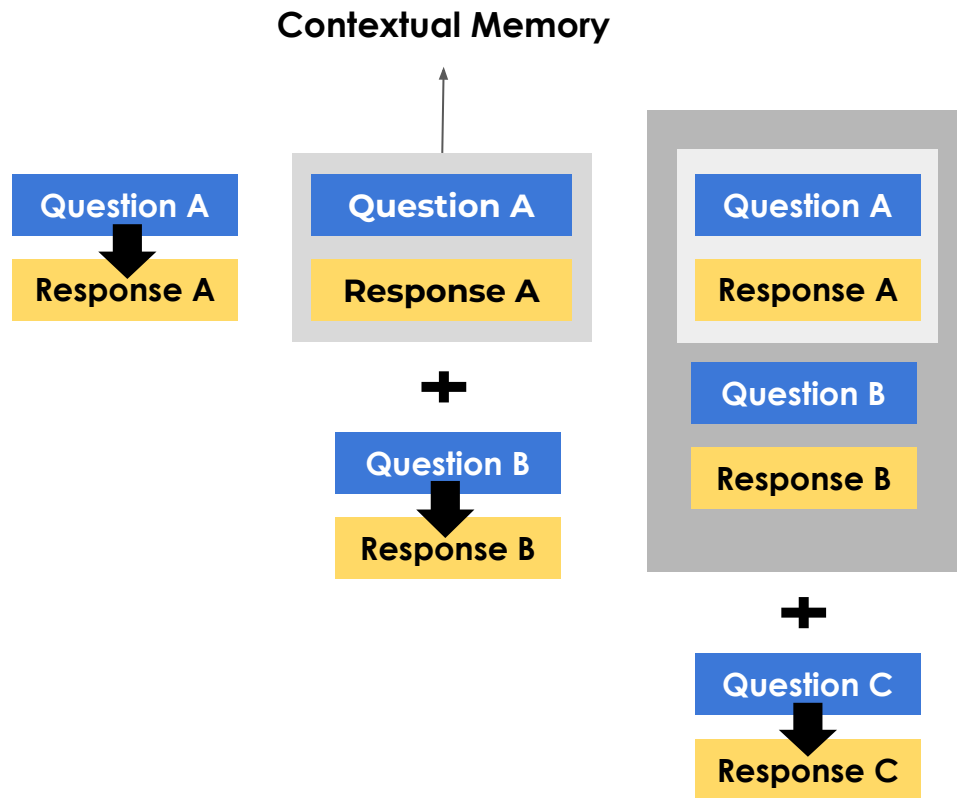
The	robot	must	obey	the	instructions	given	to	_____
0.2	-	0.6	0.7	0.2	0.8	0.3	0.7	-----> Weights

- **Step-5: Find Relevance** - To complete the sentence, which are the words to consider

The	robot	must	obey	the	instructions	given	to	it	it	0.9
0.2	0.9	0.2	0.7	0.2	0.8	0.3	0.2		its	0.8
									itself	0.85
									robot	0.5

- **Step-6: Predict** - Get the next possible words with their probabilities and fill in or do the "chat completion" with the one that has the highest probability

How is it able to remember conversations?



Why do Language models hallucinate?

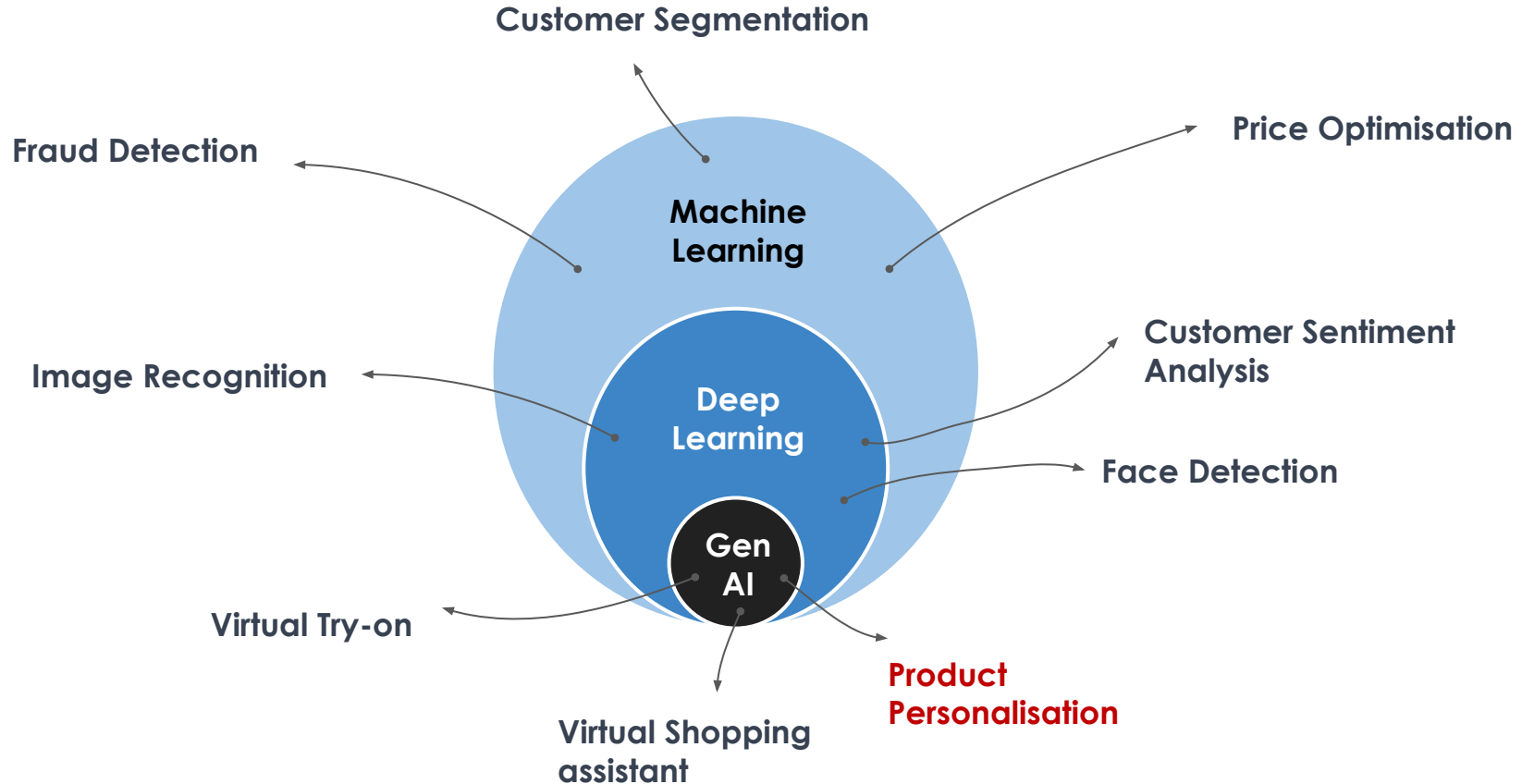
Why does this happen?

Did not understand the context or intent behind the question / prompt

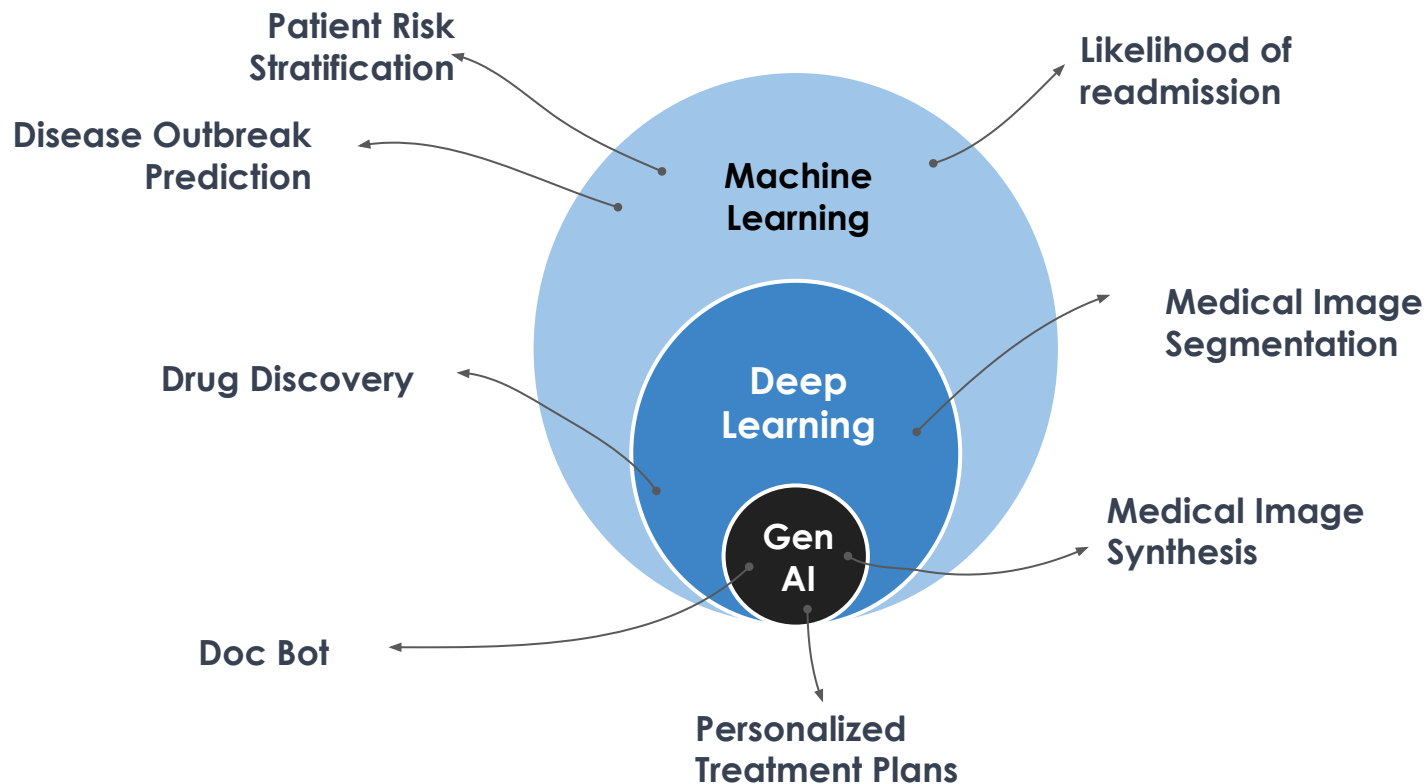
Information needed to give the relevant answer was absent in the training data

These are probabilistic models - leading to inconsistency/randomness in its outputs

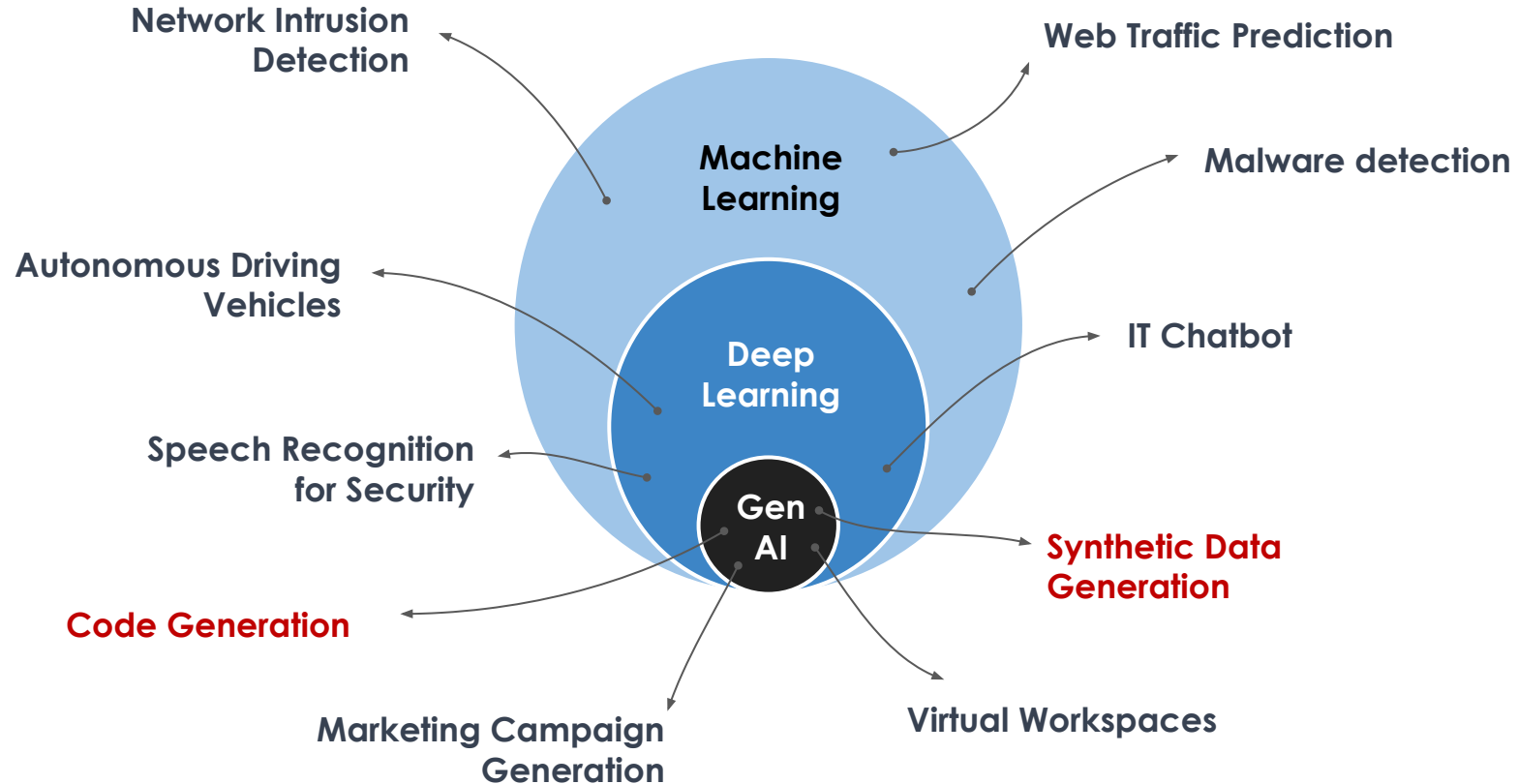
Business Problems solved by GenAI - Retail



Business Problems solved by GenAI - Healthcare



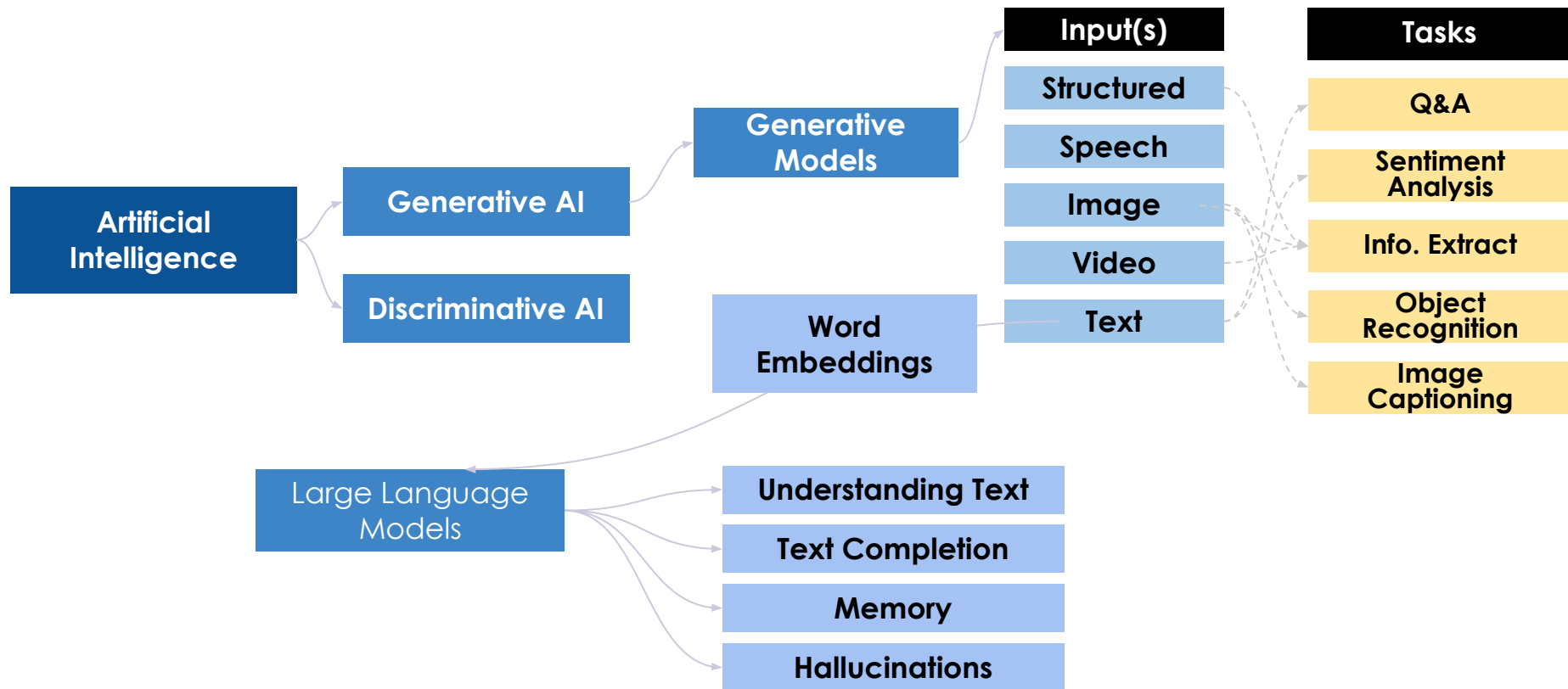
Business Problems solved by GenAI - Tech



Interacting with Generative AI Models

Hands-on: Exploring ChatGPT

Mind Map



Summary

Here's a brief recap:

- We gained a clear understanding of the concepts of Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), and Generative AI including their definitions, key principles, and how they are related to each other.
- Discriminative models aim to classify or differentiate between different classes or categories, while generative models focus on creating new data that resembles a given training dataset.
- The historical perspective provided insights into the evolution of generative AI techniques such as GANs, Stable diffusion and their applications.

Summary

Here's a brief recap:

- We explored various business applications of AI, highlighting how organizations leverage AI technologies to enhance operations, improve decision-making, automate tasks and personalize user experiences.
- We explored state-of-the-art models in the field of AI. ChatGPT, a text-based model, focuses on generating human-like text responses in conversational settings. We also used ChatGPT to generate code.

Learning Outcomes

Upon completion of this module, you should be able to:

- Explain the key definitions and fundamentals of AI, ML, DL and Generative AI
- Identify supervised and unsupervised tasks.
- Explore the difference between Discriminative and Generative AI.
- Explain a brief history of Generative AI.
- Analyze the behaviour of LLMs and understand their processes of text completion and prediction.
- Identify various business use-cases of AI, DL, ML and GenAI.
- Explore ChatGPT (text and code).



Happy Learning !

