



# **GENERATIVE AI**

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# AGENDA

- **Introduction to Generative AI**
- **How Generative AI Works**
- **Generative AI Models and Types**



The background is a soft-focus, abstract composition. It features a multitude of out-of-focus light spots, or bokeh, in shades of light blue and warm orange. These spots are scattered across the frame, with a higher density towards the center. A prominent, bright, circular light burst or lens flare is positioned in the upper-middle section, casting a gentle glow. Faint, curved lines of small, bright dots suggest a sense of motion or a digital data stream, curving upwards from the bottom towards the central light source. The overall color palette is a mix of cool blues and warm oranges, creating a futuristic and ethereal atmosphere.

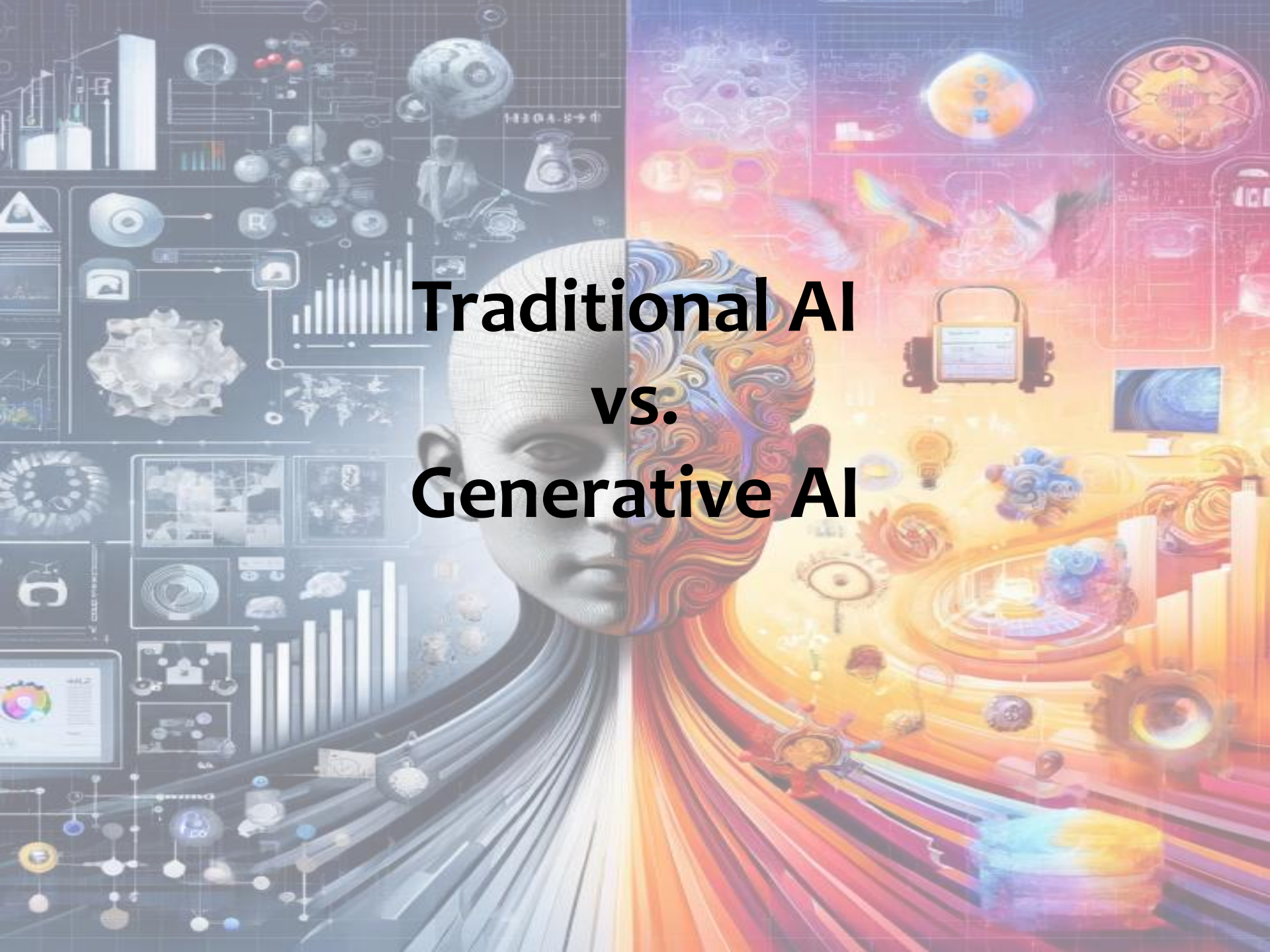
# **INTRODUCTION TO GEN AI**

# What is Generative AI?

- Generative AI refers to a class of artificial intelligence systems designed to generate **new content** —whether text, images, music, or even code—based on learned patterns from vast datasets.
- Unlike traditional AI, which primarily focuses on solving problems or classifying existing data, generative AI creates something novel and original.

# What is Generative AI?

- Generative AI uses techniques such as neural networks, particularly large language models (LLMs), to understand patterns in data and generate outputs that reflect those patterns.
- For example, a generative AI model trained on text can generate sentences, essays, or entire articles. Similarly, trained on images, it can create new, realistic photos or artwork. Generative AI is not limited to mimicking existing content; it can produce entirely new material, often indistinguishable from human-generated work.



# **Traditional AI vs. Generative AI**

- While both traditional AI and generative AI are subsets of artificial intelligence, they differ significantly in their purposes and capabilities

# Traditional AI

- **Purpose:** Traditional AI systems are designed to make decisions, classify data, or perform specific tasks based on pre-existing rules or patterns. They are often used in tasks such as classification, regression, and prediction.
- **Functionality:** Traditional AI focuses on analyzing input data and making determinations about it. For example, a traditional machine learning model might analyze a set of medical images and classify whether a tumor is present or not



# Traditional AI

- **Types of AI:** Traditional AI systems include decision trees, support vector machines, and even older systems like expert systems or rule-based engines.
- **Example:** A recommendation system that suggests products based on user history or a spam filter that classifies emails as "spam" or "not spam" is an example of traditional AI. These models rely on recognizing patterns in existing data but do not create new content.

# Generative AI:

- **Purpose:** Generative AI is focused on producing new content or outputs. It learns from data and can generate something new—text, images, or even music—by understanding the underlying patterns in the input data.
- **Functionality:** Rather than just identifying or classifying data, generative AI creates novel outputs that resemble or improve upon the data it has learned from. The model generates content by predicting what **comes next in a sequence or combining patterns in new ways.**

# Generative AI:

- **Types of AI:** Generative AI often uses deep learning architectures, particularly **Generative Adversarial Networks (GANs)** or **Transformers** (like GPT for text generation).
- **Example:** GPT (Generative Pre-trained Transformer) is a well-known generative AI model that can generate human-like text. DALL-E is another example, which can generate images based on textual prompts. These models are not just analyzing data—they are creating new and often surprising content.

# Key Differences:

- **Output Type:** Traditional AI focuses on **classification** and **prediction**, while generative AI focuses on **creation** and **generation** of new content.
- **Creativity:** Traditional AI is rule-based or pattern-matching, whereas generative AI introduces creativity by forming novel outputs that don't exist in the original data.
- **Flexibility:** Generative AI can be applied across multiple domains (text, images, music, etc.), creating a much broader range of applications compared to traditional AI, which often specializes in specific tasks.

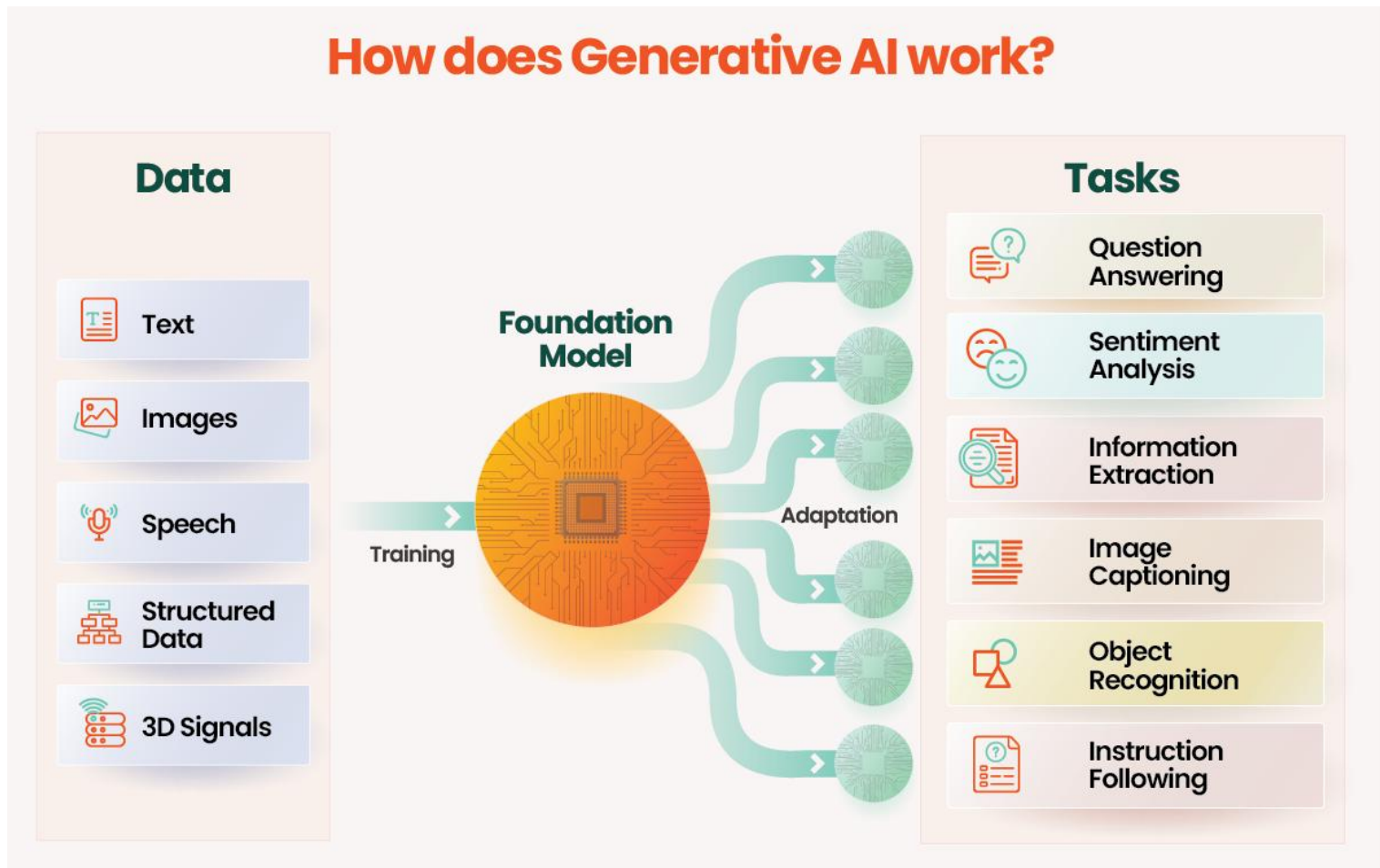


# How Generative AI Works

- **AI models and training**
- **The role of large language models (LLMs)**

- Generative AI relies on advanced machine learning techniques to understand data and produce new, original content.
- It involves several key components, including **AI models**, **training**, and **large language models (LLMs)**. Let's break these down in more detail:

# How does Generative AI work?



# AI Models and Training

- At the core of generative AI is the **AI model**, a computational system that learns patterns from large datasets and generates new outputs based on that knowledge.
- These models, typically based on **neural networks**, mimic the way the human brain processes information but are designed to work with vast amounts of data to understand complex patterns.



# Training an AI Model

- Training an AI model involves feeding it massive amounts of data to help it learn. Here's how it typically works:
- **Data Collection:** A model is trained using large datasets that are relevant to the task it's meant to perform.
- For example, to create a text generator like GPT (Generative Pre-trained Transformer), the model is trained on vast amounts of text data—books, websites, articles, etc. For image generation, the model might be trained on a collection of images.

# Training an AI Model

- **Learning Patterns:** During the training phase, the model analyzes the data to understand the relationships and patterns within it.
- In supervised learning, labeled data (input-output pairs) is used to guide the learning. For example, in a text-based task, the model may learn grammar, sentence structure, and context by seeing many examples of how words and phrases are used.

# Training an AI Model

- **Parameter Adjustment:** The model has **parameters** (or weights) that are adjusted during training.
- These parameters control how the model processes data. The model uses algorithms like **backpropagation** to adjust these parameters after every attempt it makes to predict an outcome, ensuring it gets closer to the right answer over time.
- In essence, the model learns through trial and error, gradually improving its predictions as it sees more data.

# Training an AI Model

- **Optimization:** The training process uses optimization techniques like **gradient descent** to minimize errors in predictions.
- By comparing the model's output with the correct answer, the algorithm adjusts the parameters to improve accuracy.



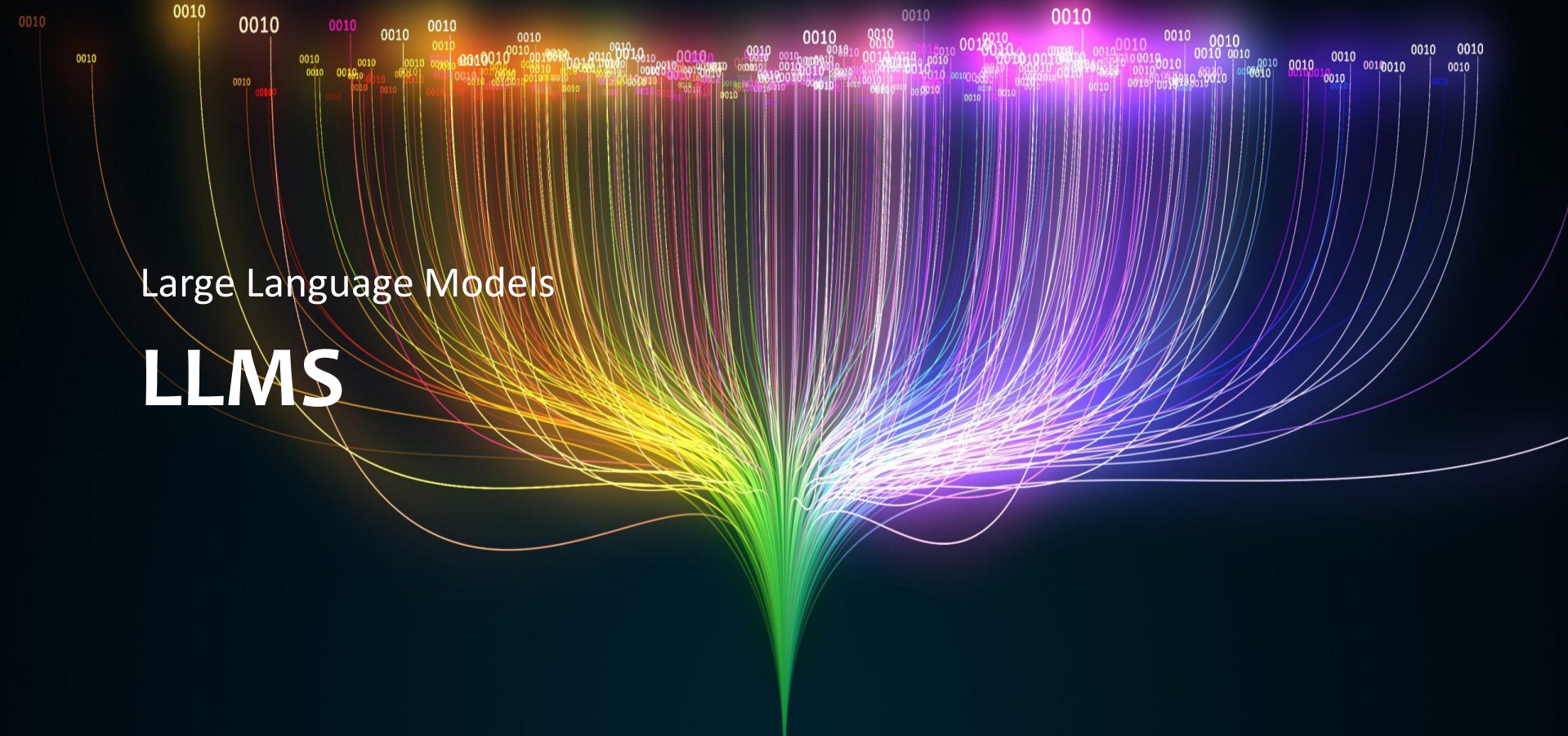
# Training an AI Model

- **Evaluation and Fine-Tuning:** After the initial training phase, the model is evaluated on new, unseen data (validation set) to see how well it generalizes beyond the training data.
- Fine-tuning might also occur, where the model is exposed to specific examples to improve its performance in particular areas.

# What are Large Language Models (LLMs)?

Large Language Models

**LLMs**



# The Role of Large Language Models (LLMs)

- Large language models (LLMs) are a specific type of generative AI model that excels at understanding and generating human language.
- These models are the driving force behind popular generative AI tools like **GPT (Generative Pretrained Transformer)**, **BERT**, and **T5**.
- They are called “large” because they contain **billions or trillions of parameters**, making them capable of handling complex language tasks at an unprecedented level of fluency.

# HOW LLMS WORK

# How LLMs Work

- **Architecture:**
- LLMs are built using a neural network architecture called **Transformers**, which was introduced in a paper titled *Attention is All You Need* in 2017.
- The transformer architecture uses a mechanism called **self-attention** to weigh the importance of different words in a sentence, enabling the model to understand context and relationships between words.

# How LLMs Work

## **Pre-training:**

- In the first phase of training, LLMs are “pre-trained” on vast amounts of publicly available text data.
- This allows them to understand general linguistic structures, patterns, and associations.
- For instance, the model learns the probability of one word following another (e.g., the likelihood of the word "cat" following "the" in a sentence).
- This phase allows the model to generate coherent and contextually appropriate sentences.

# How LLMs Work

- **Language Understanding:**
- Once trained, LLMs are capable of understanding and processing human-like language.
- They can answer questions, complete sentences, summarize text, translate languages, and even generate novel content, all based on the patterns they learned during training.



# How LLMs Work

- **Fine-Tuning:**
- After pre-training, LLMs can undergo fine-tuning, where the model is specifically trained on a smaller, more specialized dataset.
- For example, a fine-tuned model may be trained to generate legal text or medical advice by exposing it to domain-specific data.
- Fine-tuning helps the model become more accurate in specific contexts.

# How LLMs Work

- **Generation:**
- When you provide an input (e.g., a prompt or question) to a large language model, it processes the input by looking at the context and using its learned parameters to predict the most probable next word or phrase.
- It continues this process word by word, ultimately generating coherent and contextually relevant output.

# Why LLMs Are So Powerful

- **Scale:** The massive scale of LLMs—often containing hundreds of billions or even trillions of parameters—allows them to learn more nuanced patterns and produce more sophisticated and human-like output.
- The larger the model, the better its ability to handle complex and diverse language tasks.

# Why LLMs Are So Powerful

- **Versatility:** LLMs are highly versatile and can be used for a wide range of applications beyond text generation.
- They can translate languages, summarize articles, create poetry, generate code, and even assist with customer support, all with a single model.

# Most Popular LLms

- **GPT-4** : OpenAI
- **GPT-3.5** : OpenAI
- **BERT (Bidirectional Encoder Representations from Transformers)**: Google
- **T5 (Text-to-Text Transfer Transformer)**: Google
- **PaLM (Pathways Language Model)**: Google
- **LLaMA (Large Language Model Meta AI)**: Meta (formerly Facebook)

# Most Popular LLms

- **Gopher** : DeepMind (a subsidiary of Alphabet)
- **BLOOM**: BigScience (an open research project)
- **ERNIE (Enhanced Representation through Knowledge Integration)**: Baidu
- **Mistral**: Mistral AI (a startup)
- **Anthropic's Claude**: Anthropic
- **Command R**: Cohere