Foundations of AI & Generative AI

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Agenda

- What is AI?
- Why we need AI?
- How AI is evolved?
- Types of AI
- Generative AI in focus
- Large Language Model (LLM)
- AI in Teaching and Learning
- Recap

Introduction to AI

- AI discipline, formally initiated in 1956 (AI Coined). However, the study of intelligence is one of the oldest disciplines being approximately 2000 years old.

- The advent of computers made it possible for the first time for people to test models they proposed for learning, reasoning, perceiving, etc.

- **Artificial Intelligence** is composed of two words **Artificial** and **Intelligence**, where **Artificial defines "man made,"** and **intelligence defines "thinking power"**, hence AI means **"a man-made thinking power“**

What is Artificial Intelligence?

- Artificial intelligence is **the simulation of human intelligence processes by machines, especially computer systems**. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

Why does AI matter?

- AI enables the processing of vast amount of data to reveal insights that would be difficult, if not impossible, for humans to uncover alone
- For instance, AI can analyze medical data to assist in diagnosing diseases earlier and with greater accuracy, or it can forecast financial trends by identifying patterns in large datasets

AI-History

Period	Milestone
Pre-1950s	Philosophical & mathematical foundations
1956	Term “AI” coined at Dartmouth Conference
1960s	Early symbolic AI & optimism
1970s–1980s	AI Winters due to setbacks
1980s	Rise of expert systems
1990s	Machine learning takes off
1997	Deep Blue beats chess champion
2010s	Deep learning & neural networks dominate
2020s	Generative AI and foundation models emerge

Goals of Artificial Intelligence

- Replicate human intelligence
- Solve Knowledge-intensive tasks
- An intelligent connection of perception and action
- Building a machine which can perform tasks that requires human intelligence such as:
  - Proving a theorem
  - Playing chess
  - Plan some surgical operation
  - Driving a car in traffic
  - Creating some system which can exhibit intelligent behavior, learn new things by itself, demonstrate, explain, and can advise to its user

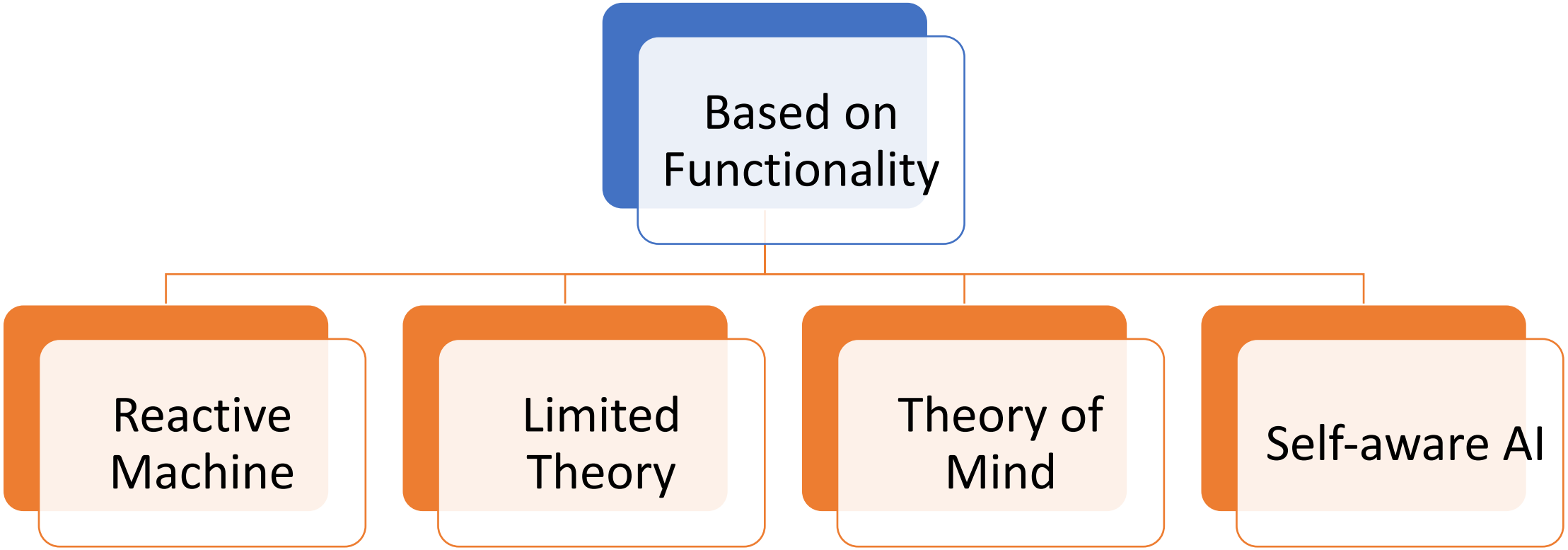
Advantages of Artificial Intelligence

- **High Accuracy with less errors:** AI machines or systems are prone to less errors and high accuracy as it takes decisions as per pre-experience or information.
- **High-Speed:** AI systems can be of very high-speed and fast-decision making, because of that AI systems can beat a chess champion in the Chess game.
- **High reliability:** AI machines are highly reliable and can perform the same action multiple times with high accuracy.
- **Useful for risky areas:** AI machines can be helpful in situations such as defusing a bomb, exploring the ocean floor, where to employ a human can be risky.
- **Digital Assistant:** AI can be very useful to provide digital assistant to the users such as AI technology is currently used by various E-commerce websites to show the products as per customer requirement.
- **Useful as a public utility:** AI can be very useful for public utilities such as a self-driving car which can make our journey safer and hassle-free, facial recognition for security purpose, Natural language processing to communicate with the human in human-language, etc.

Disadvantages of Artificial Intelligence

- **High Cost:** The hardware and software requirement of AI is very costly as it requires lots of maintenance to meet current world requirements.
- **Can't think out of the box:** Even we are making smarter machines with AI, but still, they cannot work out of the box, as the robot will only do that work for which they are trained, or programmed.
- **No feelings and emotions:** AI machines can be an outstanding performer, but still, it does not have the feeling so it cannot make any kind of emotional attachment with human, and may sometime be harmful for users if the proper care is not taken.
- **Increase dependency on machines:** With the increment of technology, people are getting more dependent on devices and hence they are losing their mental capabilities.
- **No Original Creativity:** As humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative.

Types of AI


Based on Functionality
Reactive Machine
Limited Theory
Theory of Mind
Self-aware AI

BASED ON FUNCTIONALITY

1. REACTIVE MACHINES

- Purely reactive machines are the most **basic types** of Artificial Intelligence.
- Such AI systems **do not store memories** or **past experiences** for **future actions**.
- These machines **only focus** on **current scenarios** and **react on it** as per possible **best action**.
- **IBM's Deep Blue system** is an example of reactive machines.
- **Google's AlphaGo** is also an example of reactive machines.

2. LIMITED MEMORY

- Limited memory machines can store **past experiences** or **some data** for **a short period** of time.
- These machines can use stored data for a **limited time period only**.
- **Self-driving cars are one of the best examples** of Limited Memory systems. These cars can store recent speed of nearby cars, the distance of other cars, speed limit, and other information to navigate the road.

BASED ON FUNCTIONALITY

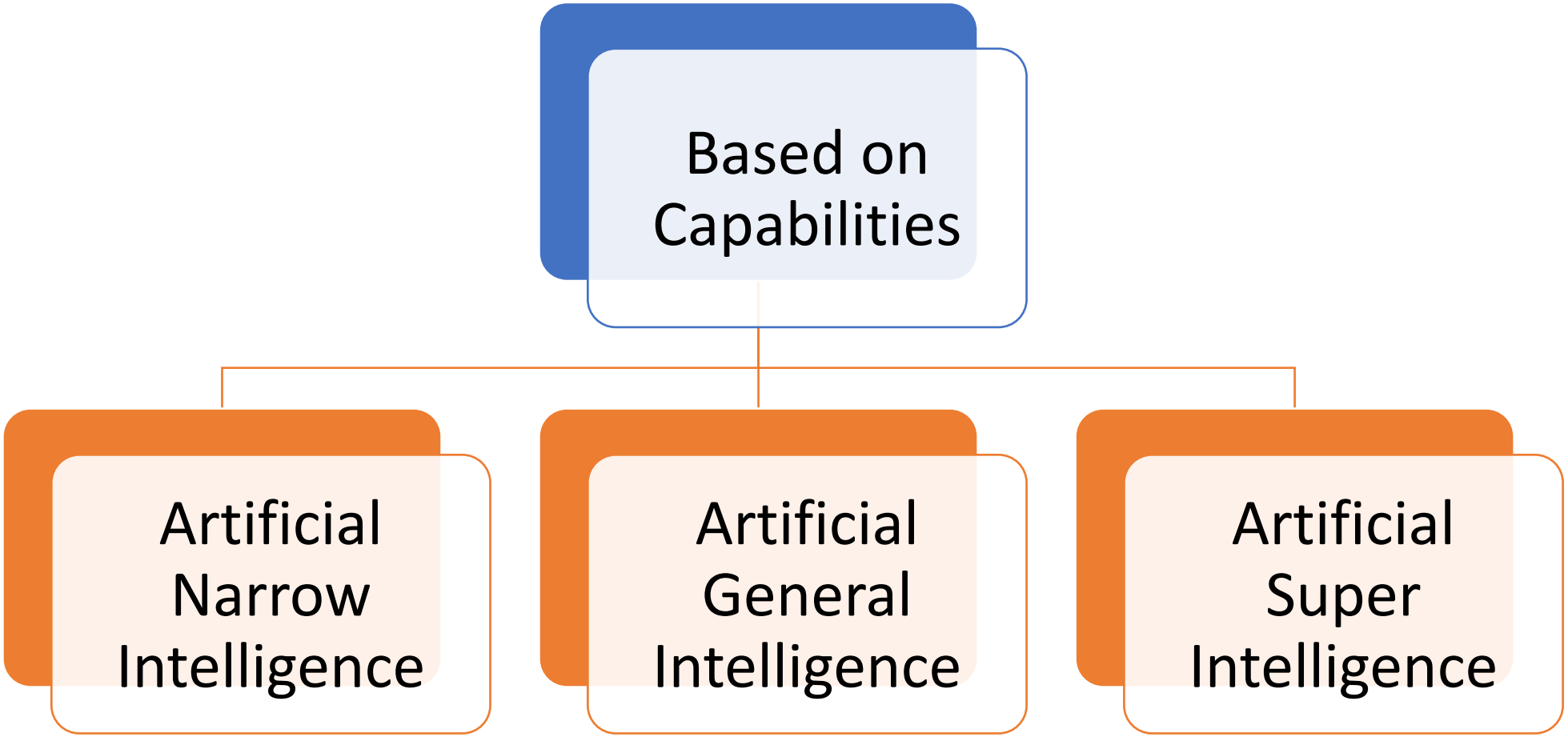
3. THEORY OF MIND

- Theory of Mind AI should understand the **human emotions**, people, beliefs, and be able to **interact socially like humans**.
- This type of AI machines are still not developed, but researchers are making lots of efforts and improvement for developing such AI machines.

4. SELF-AWARENESS

- Self-awareness AI is the **future** of **Artificial Intelligence**. These machines will be **super intelligent**, and will have their own **consciousness, sentiments,** and **self-awareness.**
- These machines will be **smarter than human mind**.
- Self-Awareness **AI does not exist in reality still** and it is a **hypothetical concept**.

Types of AI


Based on Capabilities
Artificial Narrow Intelligence
Artificial General Intelligence
Artificial Super Intelligence

BASED ON CAPABILITIES

WEAK AI OR NARROW AI:

- Narrow AI is a type of AI which is able to perform a **dedicated task** with intelligence. **The most common and currently available AI is Narrow AI in the world of Artificial Intelligence.**
- Narrow AI cannot **perform beyond its** field or **limitations**, as it is only **trained for one specific task**. Hence it is also termed as weak AI. Narrow AI can fail in unpredictable ways if it goes beyond its limits.
- **Apple Siriis, ChatGPT** a good example of Narrow AI, but it operates with a limited pre-defined range of functions.
- **IBM's Watson supercomputer** also comes under Narrow AI, as it uses an Expert system approach combined with Machine learning and natural language processing.
- **Some Examples of Narrow AI are playing chess, purchasing suggestions on e-commerce site, self-driving cars, speech recognition, and image recognition.**

BASED ON CAPABILITIES

GENERAL AI:

- General AI is a type of intelligence which could perform any intellectual task with efficiency like a human.
- The idea behind the general AI to make such a system which could be **smarter** and **think like a human by its own**.
- Currently, there is **no such system exist which could come under general AI** and can perform any task **as perfect as a human**.
- The worldwide researchers are now focused on developing machines with General AI.
- As systems with general AI are still under research, and it will take lots of efforts and time to develop such systems.

BASED ON CAPABILITIES

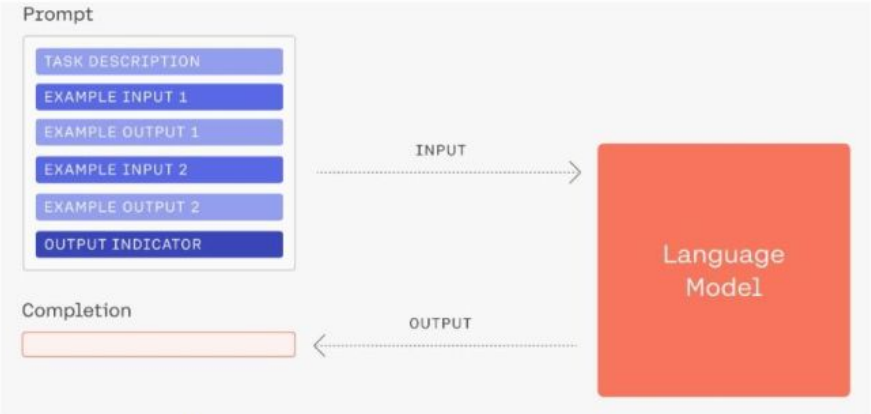
SUPER AI:

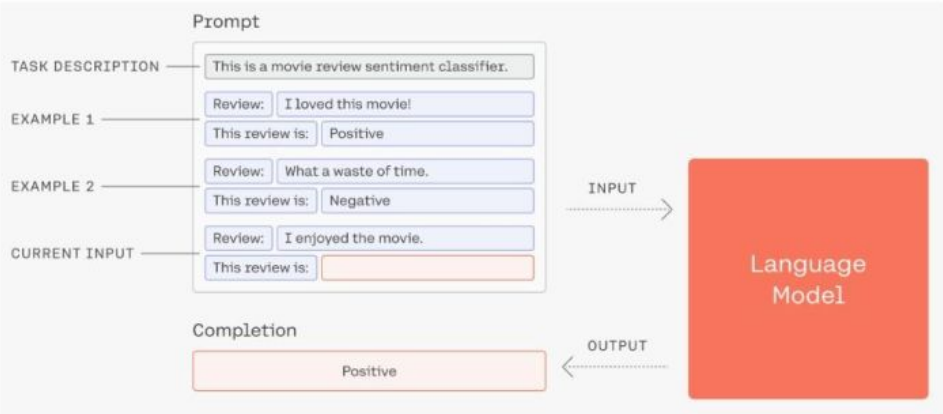
- Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties. It is an outcome of general AI.
- Some key characteristics of strong AI include capability include the ability to think, to reason, solve the puzzle, make judgments, plan, learn, and communicate by its own.
- Super AI is still a hypothetical concept of Artificial Intelligence. Development of such systems in real is still world changing task.

GenAI is a part of Weak AI

Generative AI (GenAI)

- Type of Artificial Intelligence that leverages AI to generate content or data
- Data can include text, images, audio, video, 3D models, code and video games
- Typically created in response to prompts (prompt engineering)
- Prompts are constructed inputs to language models to generate useful output
- Usually given with examples - zero shot versus few shot learning





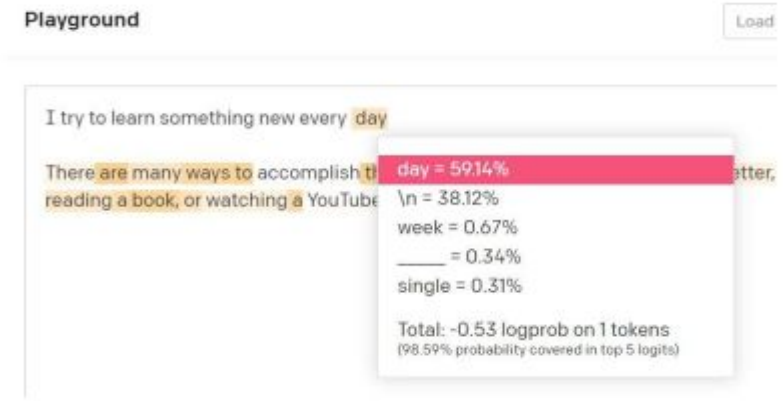
Source: docs.cohere.com
https://docs.cohere.com/docs/prompt-engineering

Large Language Models

- Type of machine learning model/algorithm
- Performs variety of Natural Language Processing (NLP) tasks
- Learn, understand, and process human language efficiently
  E.g., generate/classify text, answer questions conversationally
- Large = number of values (parameters) the model can change autonomously as it learns
- Uses hundreds of billions parameters

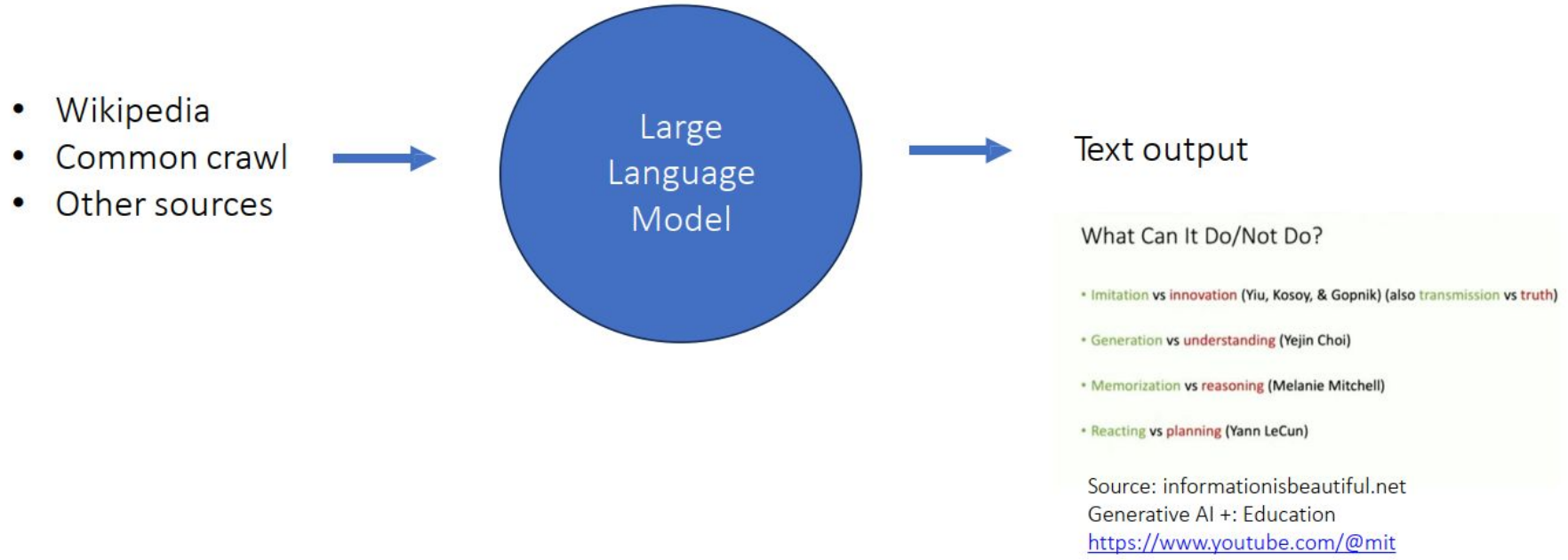
Large Language Models

- Trained with large amounts of data
- Based on neural networks (Transformers) that learn context and understanding through sequential data analysis
- Uses self-supervised learning to predict the next token in a sentence, given the surrounding context
- Process is repeated over and over until the model reaches acceptable level of accuracy
- GPT-4(Generative Pre-trained Transformer)

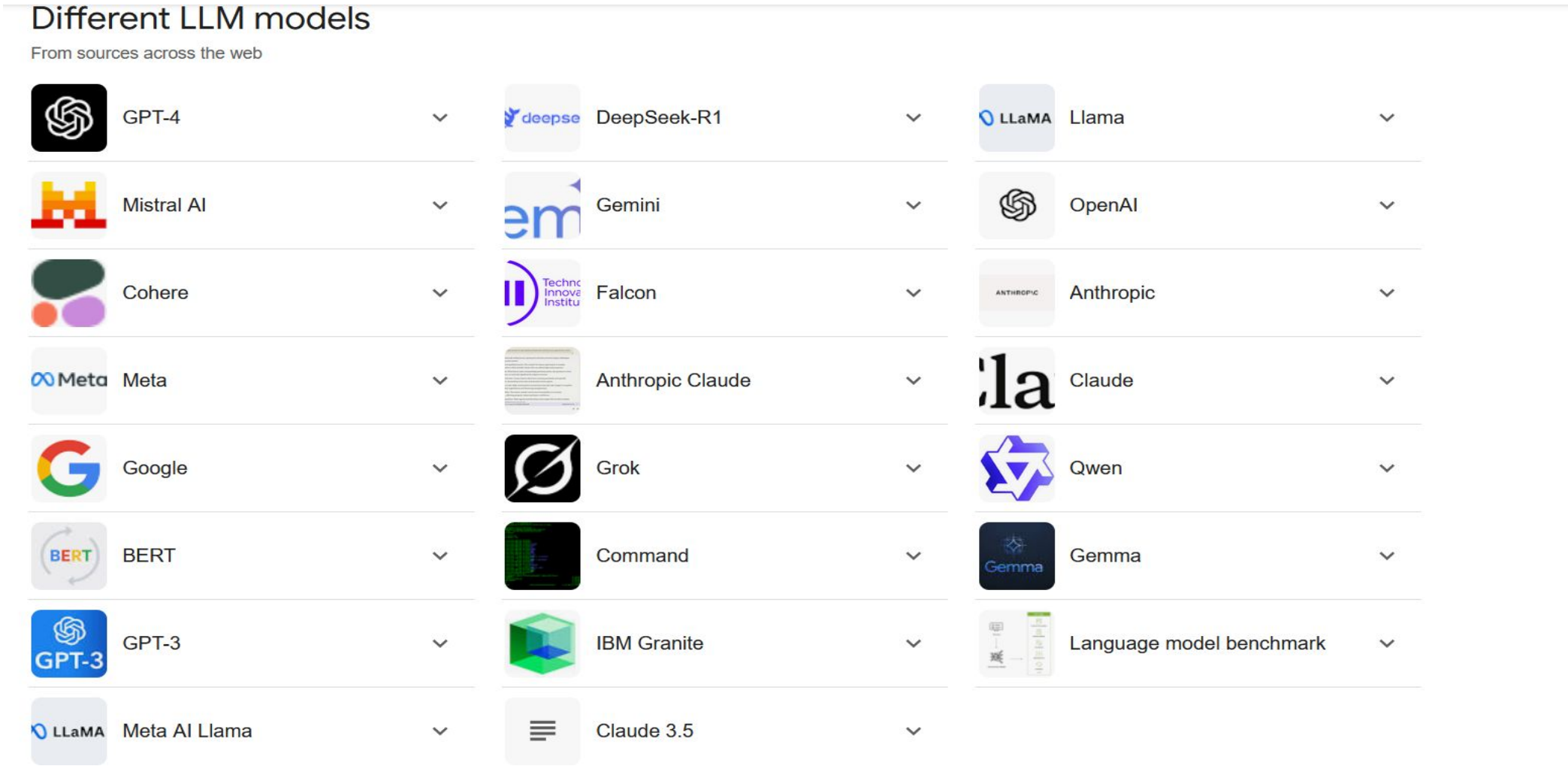


Large Language Models Training

- LLMs return similar patterns to data it is trained on (not thinking)



Different LLM Models



AI tools in Teaching and Learning

- Perplexity
- DALL-E
- Runway ML
- ClassRoomScreen
- Wakelet
- Chat PDF
- Bhashini

Perplexity.ai

Aspect	Perplexity.ai	ChatGPT / LLMs
Search integration	More directly tied to real-time web searches	May rely on internal knowledge cutoff (unless integrated with plugins)
Citations / sourcing	Emphasizes providing sources	Some versions (e.g. with browsing) provide sources; others don't
Real-time info	Better suited for answering up-to-date queries	Dependent on model's training cutoff unless plugin/browsing is enabled
Conversational capability	Has chat interface, but often more focused on answering queries	Strong conversational context, prompt chaining, etc.

DALL·E

- DALL·E is a series of advanced text-to-image models developed by OpenAI that generate digital images from natural language descriptions, also called prompts.
- The first version, announced in January 2021, uses a 12-billion parameter transformer model trained to create images from text captions by understanding and combining concepts expressible in natural language.
- https://www.imagine.art

RanwayML

- **Runway AI, Inc.** (also known as **Runway** and **RunwayML**) is an American company headquartered in New York City that specializes in generative artificial intelligence research and technologies.
- The company is primarily focused on creating products and models for generating videos, images, and various multimedia content.

RanwayML

Feature	What it does
Text → Video generation	From a text prompt, generate a video. (Gimmie AI)
Video → Video transformation	Take an existing video and apply style changes, transformations, effects. (Gimmie AI)
Image → Video / Animation	Turn a static image into a video (e.g. adding motion) (Gimmie AI)
Editing & Post-processing tools	Background removal, object masking, motion tracking, compositing, etc. (Gimmie AI)
Cloud-based / web interface	Many features run in the cloud; you don't always need heavy local hardware. (aitoolnest.com)
Collaboration & sharing	Because it's cloud-based, users can share projects, assets, and collaborate across devices. (AI Core Innovations)

Class Room Screen

- An AI-based educational web application
- Enhances student engagement and interaction
- Provides various tools for classroom management and teaching
- Easy to use and accessible from any device

Main features

- Virtual whiteboard for drawing and writing
- Timer and countdown for time management
- Random name selector for student participation
- Noise level meter to monitor classroom noise
- Widgets for displaying weather, clock, and more
- https://classroomscreen.com/

Wakelet

Applications in Education:

- Curating Learning Resources
- Personalized Learning Paths
- Project Portfolios
- Collaborative Learning Projects
- Research and Exploration
- Digital Storytelling

Allows users to easily collect and organize online content from various sources by adding links, images, videos, and notes to their collections.

ChatPDF

- ChatPDF is an AI-powered app that will make reading journal articles easier and faster.
- Simply upload a PDF and start asking it questions.
- It's like ChatGPT, but for research papers.
- https://www.chatpdf.com/

Bhashini

The full name is **Bhasha Interface for India**. It's part of the **National Language Translation Mission** launched by India's Ministry of Electronics and Information Technology (MeitY)

Bhashini's goal is to enable translation, speech recognition, text-to-speech, and many language services across Indian languages, to make digital content and services accessible in people's native languages.

Features & Capabilities

- **Translation (Text-to-Text)**: Convert text from one language to another.
- **Speech-to-Speech Translation**: Real-time voice translation across languages.
- **OCR & Image Text Recognition**: Recognizing text from images and translating or processing it.
- **Text-to-Speech**: Converting written text into spoken output.
- **Crowdsourcing & Data Collection (Bhasha Daan / "Bhasadaan")**: Users can contribute language data via modules like *Suno India*, *Likho India*, *Bolo India*, *Dekho India* to enrich datasets.
- **Open APIs / Ecosystem for Developers**: Exposes over 300 pre-trained AI models for translation and language services to developers and government agencies

https://bhashini.gov.in/

AI Tools discussed so far…

- Seven tools for teaching and learning:

Perplexity, DALL-E, RunwayML, ClassRoomScreen, Wakelet, ChatPDF & Bhashini

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The content, images and others are from various sources of Internet and I acknowledge the same.

Thank You !

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