

Artificial Intelligence

Growth Engine for Present & Future

Artificial Intelligence (AI) is the study and creation of computer systems that can perceive reason and act. The primary aim of AI is to produce intelligent machines. The intelligence should be exhibited by thinking, making decisions, solving problems, more importantly by learning. AI is an interdisciplinary field that requires knowledge in computer science, linguistics, psychology, biology, philosophy and so on for serious research.



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During the Second World War, Alan Turing and his colleagues at Bletchley Park succeeded in building a machine that used electro-mechanical components to decipher the communications to and from German submarines operating in the Atlantic. The German messages were encrypted using the famous Enigma machine. Arguably, the success of Turing and his colleagues was a decisive factor that helped Britain to win the war. In fact, what Turing and his colleagues did was build a special purpose computer designed to solve one particular problem; a problem that was supposed to be solvable only by an intelligent human being. Although the computer that Turing built remained a secret for many years after the war, the idea that general purpose computers, as we know them today, could solve intelligent problems was considered and became an active area of research. This was the genesis of Artificial Intelligence (AI).

Artificial intelligence is based on the assumption that the process of human thought can be mechanized. The seeds of modern AI were planted by classical philosophers who attempted to describe the process of human thinking as the mechanical manipulation of symbols. The field of AI was coined by John McCarthy in 1956 at a workshop held on the campus of Dartmouth College during the summer of 1956. Those who attended became the leaders of AI research for decades. Many of them predicted that a machine as intelligent as a human being would exist in no more than a generation and they were given millions of dollars to make this vision come true. Artificial intelligence is a major part of the most popular science fiction tale in the world, the Star Wars saga where the characters C-3PO and R2D2 were based on AI. The main advances over the past sixty years have

been the advances in search algorithms, machine learning algorithms, and integrating statistical analysis into understanding the world at large. However AI couldn't make any significant commercial impact due to lack of supporting processing power and ready field applications.

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WHAT IS AI?

- **Growth in AI**

Artificial Intelligence covers anything which enables computers to behave like humans. The field of AI has seen a big resurgence since 2015, the major contributor/ enabler for this resurgence are, Massive Storage capacity, Cloud Computing, Big Data, APIs and Open Source. It is predicted that by 2019 start-ups will overtake IBM, Microsoft, Amazon and Google in driving AI based economy & business solutions (Gartner). In Indian context, the economists view

Artificial Intelligence (AI)

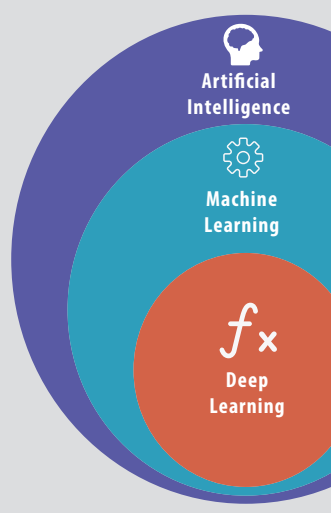
Any technique which enables Computer to mimic human behaviour

Machine Learning (ML)

Subset of AI techniques which use statistical methods to enable machines to improve with experience

Deep Learning (DL)

Subset of ML which make the computation on of multi-layer neural networks feasible



AI, propagated through the flagship programme of Digital India will act as a potential enabler to increase national productivity & growth.

MACHINE LEARNING

Machine Learning is the subset of Artificial Intelligence that deals with the extraction of patterns from data sets. This means that the machine can find rules for optimal behaviour but also can adapt to changes in the world. Many of the algorithms involved have been known for decades, centuries, even earlier. Thanks to the advances in computer science and parallel computing they can now scale up to massive data volumes.

DEEP LEARNING (DL)

Deep Learning is a specific class (subset of methods) of Machine Learning algorithms based on complex neural networks. Deep learning pertains to the use of Artificial Neural Networks (ANNs) in order to facilitate learning at multiple layers. It is a part of machine learning based approach on how data is presented, instead of task-based algorithms. It is a group of related techniques comparable to a group of “decision trees” or “support vector machines”. Due to recent advances in parallel computing, DL has received quite a bit of hype recently. DL has led the way in revolutionizing analytics and enabling practical applications of AI.

**AI TECHNIQUES/
FRAMEWORKS**

The techniques used within the domain of Artificial Intelligence are advanced forms of statistical and mathematical models. These models put together to provide tools to compute tasks that were reserved for humans. The goals of AI research include reasoning, knowledge, planning, learning, natural language processing (NLP), perception and the ability to move and manipulate objects.

RAGE-AI™ is a no-code fully model driven platform built with the goal of bridging the gap between business transformation idea and its realization by automating knowledge work, intuitively and rapidly.

GraphCore-AI IPU accelerators and Poplar software framework together make the fastest and most flexible platform for current and future machine intelligence applications, lowering the cost of AI in the cloud and data center, improving performance and efficiency by between 10x to 100x.

TensorFlow™ is an open source software library for numerical computation using data flow graphs. Nodes in the graph represent mathematical operations, while the graph edges represent the multi-dimensional data arrays (tensors) communicated between them. The flexible architecture allows for deploying computation to one or more CPUs or GPUs in a desktop, server, or mobile device with a single API. TensorFlow was originally developed by researchers and engineers working on the Google Brain Team within Google's Machine

Intelligence research organization for the purposes of conducting machine learning and deep neural networks research, but the system is general enough to be applicable in a wide variety of other domains as well.

Caffe framework is based on expressive architecture and extensible code. It's high speed has made it popular with researchers.

CNTK, the Microsoft's open source AI tool boasts of outstanding performance whether it is running on a system with only CPU, a single GPU, multiple GPUs or multiple machines with multiple GPUs. It is mainly utilized for research in speech recognition, machine translation, image recognition, image captioning, text processing, language understanding, language modelling etc.

DMTK is another Microsoft's open source AI tool designed for use in big data applications, it aims to make it faster to train AI systems. It consists of three key components: the DMTK framework, the LightLDA topic model algorithm and the Distributed (Multisense) Word Embedding algorithm.

Deep learning4J is an Apache 2.0-licensed, open-source, distributed neural net library written in Java and Scala. It integrates with both Hadoop and Apache Spark and runs on several backends that enable use of CPUs and GPUs. DL4J makes it possible to configure deep neural networks which are compatible with Java, Scala and other JVM languages.

NuPIC is an open source AI project based on Hierarchical Temporal Memory (HTM). It's an attempt to create a computer system modelled after the human neocortex. The goal is to create machines that "approach or exceed human level performance for many cognitive tasks."

PRESENT USAGES

- **Email filtering** for incoming emails. Users can train their spam filters by marking emails as “spam”.
- **Personalization:** Online services like Amazon or Netflix, “learn” from a user's

previous purchases and the purchases of other users in order to recommend relevant content for next purchase.

- **Fraud detection:** Banks use AI techniques to determine if there is strange activity on customer's account.

- **Speech recognition** functions as intelligent personal assistants, e.g. Amazon's "Alexa" or Apple's "Siri".

- **AI techniques** in biomedical engineering and informatics, ranging from knowledge-based reasoning for disease classification to learning and discovering novel biomedical knowledge for disease treatment.

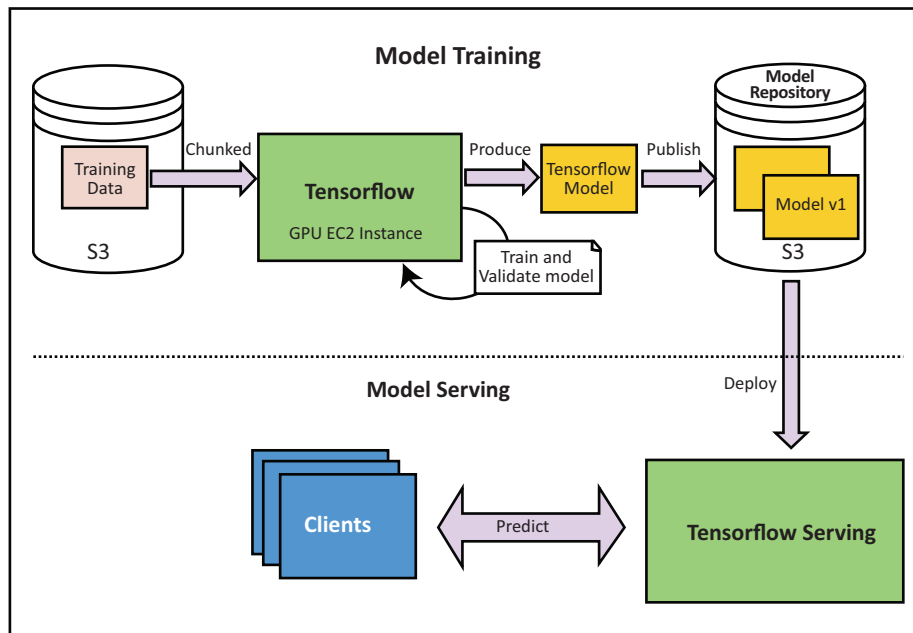
- **AI algorithm** helps the scientists to chart and explain the structure and dynamics of the universe around us with unprecedented accuracy.

FUTURE FOCUS

- **Deep Artificial Neural Networks** are trying to emulate the actual brain, enhanced AI capabilities are continuously coming out by developing better theories of how the brain works though it is still far away from imitating the human brain. The usage of AI is reflected in industrial automation (Manufacturing), Information & Communication Technology and Medical sciences.



- **Smart City:** Cities are facing significant challenges in coping with an aging infrastructure, reducing carbon emissions and energy consumption, integrating renewables, enhancing health services, reducing traffic and diminishing ambient noise. AI tools have a transformational role to play in addressing these challenges, by enabling the integration of



Model Training and Serving Architecture

information technologies with the city physical assets ensuring greener, safer and more efficient urban environments. Self driving (driverless) vehicles equipped to deal with unfamiliar scenes and complex interactions on the road shall be common in public.

- **Enhanced Medical facilities:** as the brain will be able to communicate with a robotic limb to give the patient more control. Patients digital health records study may suggest personalised drugs during treatment and also for prevention.

- **Climate change:** Big Data AI methods analyse the trends and use that information to come up with solutions to the world's climatic disasters.

- **Business Growth:** Potential outcomes from AI study over the organisation's past behaviour will recommend the changes in how work is done and reinforce the role of each personnel to drive growth in business with more accuracy.

- **Robotics:** Using Robots for examining the Extra Terrestrial objects will escalate the effectiveness of Space exploration. Challenging jobs such as producing toxic substances, operating intense heat machines and working in ear

splitting noise, can be outsourced to robots.

Advancements in four basic AI ingredients, data, compute resources, algorithms and human talent all together will sustain the growth of AI. Robotic systems will be incredibly advanced for doing knowledge based back office works and large number of industries will be more and more AI-driven, thus they will change the face of the global economy and the role of the humans soon.

No matter how dangerous AI might be for humanity and how many deponents come out against AI, there's simply no way to stop its advancement since its wheels of progress slowly grind forward with a plethora of social and ethical considerations as well as technical issues.

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