



# Artificial intelligence as an innovation-enabler in digital age: impact, opportunities and challenges.

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## ABSTRACT

Artificial intelligence (AI) refers to the simulation of human intelligence in machines programmed to think, learn, and problem-solve like humans. It encompasses various sub fields like machine learning, natural language processing, computer vision, robotics, and more. AI systems can perform tasks such as understanding natural language, recognizing patterns in data, making decisions, and even controlling autonomous vehicles or robots. Nothing seems to be free from its impact. This paper is an attempt to discover the innovation that is powered by AI which is creating new ways of turning impossibilities into possibilities. It also talks about the achievements of the past, present and possible future and also summarizes the challenges and the opportunities that lie ahead in the field of technology for AI. The paper also demonstrates how AI is at the forefront of transforming the world, raising questions for economy, society and governance. AI and offers recommendations for policy makers, technologists, and communities to navigate the complex interplay between AI and society in the future. This paper is totally based on secondary sources of data and not any test has been utilized to carry out the research.

**Keywords:** *Digital age, impact, opportunities and challenges.*

## INTRODUCTION

Artificial Intelligence has now become one of the most effective tools that have the power to empower people and the world in a broad sense. AI, as an enabler for innovation, helps the world rethink how intelligence can be enhanced, and discover new possibilities with machines acting smartly than ever before. It plays a crucial role in transforming our lives. Today, it is applied in various fields from business to finance, healthcare to criminal justice, logistics, smart city development, national security, governance, and to effectively address a host of issues that arise from massive growth of data, machine learning, etc. As psychology developed thru centuries and branched out to many application domains, viz., education, clinical, cognitive, industrial, and many similar ones, recent scientific progress led to the use of computers for gradual further enfoldment. Conspicuously, the 1948 work of Claude Shannon's information theory none the less revolutionized information processing in many domains, contemporarily the backbone of today's era of modern communication. Never the less, psychology, primarily the cognitive studies domain, has never been an exception in grasping the advantage of this theory while the mind-information-processing nature became more obviously discoverable. Subsequently, the computer Turing era and concept gradually led to the advent of artificial intelligence and machine learning. American Psychologist

George Miller came out with on 11th Sep 1956 the concept of the ‘Magical number seven plus or minus two’, the same year earlier in the famous summer conference of Artificial Intelligence by John McCarthy. It is interesting to note that Mervin Minsky, a Cognitive Scientist, learned Psychology from George Miller. Notably his invention of the co focal micro scope, an instrument that removed the difficulty of out-of- focus light, became dependable for cell biology laboratory experiments often used in brain laboratory experiments of cellular mapping. In the research of computers since the 1950’s IBM has long remained the pioneer. The phrase "machine learning" is credited to Arthur Samuel of IBM Engineer for his research on the game of checkers (Samuel, 1959). Artificial intelligence (AI) can be defined as the capability of a machine to simulate the human brain and exhibit the capacity to think, learn, and act like humans. It comprises the techniques that enable the machine to exhibit human-like intelligence with minimal intervention from a human being. The emergence of Artificial Intelligence (AI) can be linked to the works of the three giants- Charles Babbage (1791-1871), Augusta Ada King (Ada Lovelace) (1815–1852), and Alan Mathison Turing (1912 - 1954)- who dominated the early development of this field (Grzy bowski, 2024). Some of the landmark discoveries in this field include the Turing test, the General Problem Solver program developed by Herbert Simon, Cliff Shaw, and Allen Newell, the ELIZA computer program, created between 1964 and 1966 by Joseph Weizenbaum, and so on (Haenlein & Kaplan, 2019).

In the present time, AI is completely intertwined with the lives of individuals and society at large. AI applications are used to improve business efficiency (e.g., recommendation systems, chat bots), assist in daily life (e.g., voice command-based digital assistants), and automate complex operations (e.g., autopilot in vehicles) (Kellogg et al., 2020). In healthcare, AI-driven diagnostic tools leverage insights from cognitive psychology to enhance clinical decision-making, while virtual reality-based therapies draw upon principles of behavioral psychology to facilitate interventions for mental health disorders. Similarly, in educational settings, AI tutors harness principles of psychology to tailor learning experiences to individual student needs, fostering personalised and adaptive learning pathways. The advancements in AI largely stemmed from making a system mimic a human brain. While that has been working out for the scientific community so far, it is not without any drawbacks. This paper aims to highlight some of the problems encountered by AI developers and computer scientists and highlight how the discipline of psychology has been of help in tackling those problems. The larger goal of this work is to suggest how psychologists will stay relevant even in an “algorithmically infused society” (Wagner et al., 2021). The first section of the paper describes the black-box problem in AI, i.e., the opacity of the decision-making process of the AI systems, and subsequently suggests how the discipline of psychology has helped in tackling it. The second section of the paper describes how AI is still not superior to humans in some areas, and how psychology offers solutions for the same.

## From past to present

Artificial intelligence (AI) for the first time may take it to be one of the latest technology terms of the 21st century but in reality, it is really not so. Ever since the term, Artificial Intelligence (reportedly coined by the American Scientist, John McCarthy) came into being in the year 1955, there has been a lot of research and development to make machines behave more intelligently, and incomparably beyond the actual capabilities of humans as well (but, long before John McCarthy, the idea of creating machines that can have the capabilities to perform actions like humans was also put forward by the computer genius. The purpose of making machines that can perform intelligent actions was considered to be an un-thought of concept back then but today, it is a reality that has even permeated into various gamut of technologies. There is no doubt that the AI world is fast evolving, making its impact felt greatly, re shaping the nature of the innovation process. Artificial Intelligence (AI) technologies such as speech recognition, natural language generation, machine decision management bots, deep learning platforms, robotic process automation, bio-metrics, emotion recognition, marketing automation, image recognition, text analysis, cyber defense etc, are a only a few that has successfully pervaded in almost all sectors.

## AI is Everywhere

Artificial Intelligence is almost everywhere and all of us are getting our share of benefit from the latest AI Technologies. This is nothing but the power of the AI. The giant search engine is making use of this advanced AI technology to help users get suggestions as they type to search in Google and then there is Face book, one of the most popular social networking sites that also uses. As we open Face book newsfeed, we find the magic rolling in. We find product recommendations on shopping sites such as Amazon, Flip kart, etc. That is nothing but the functioning of the AI. There is this AI technology lurking in the background, analyzing and understanding your needs and then providing you suggestions or recommendations. AI has successfully made its ways from being hype to a more practical usage. It is already making a splash across a wide gamut of applications, tools and processes, platforms, etc. As per the study conducted by PWC it is predicted that by the end of 2030, AI-enabled activities will increase the global GDP by 14% at least. That will be equal to \$15.7 trillion! In 2017 VC investors took the bold step to fund more than \$10.8 billion in startup companies that primarily have AI concepts to move forward, including machine learning, deep learning, etc. And as per the Forbes news, competition among countries on AI is intensifying too.

## AI in the field of Robotics

We are living in the age of AI-powered Robots, the smartest, programmable machines that can carry out multiple tasks in a more intelligent way. They perform operations in such a way that one may doubt if it is artificial intelligence or natural general intelligence. Ever since the time, the first AI robot, called “Deep Blue, a chess playing computer,” made its appearance in the year 1996 the one that is best remembered to have won the chess game against the World Champion, AI-powered robots have considered being the future of the world. Enterprises across the globe, and yes, not just the big and established ones, but even the aspiring startups, have taken on the challenge to come up with the best robotics solutions using AI technology. As per recent analysis, almost 84% of enterprises across the globe are reported to have strong inclination and desire to invest in AI for better and competitive advantage. A much smarter robotic vacuum cleaner that really needs no human assistance in cleaning the floor as it uses AI flawlessly to scan the size of the room, identify and analyze obstacles on its ways and create ways on its own to clean more effectively. This advanced Roomba also perceives how much vacuuming is needed taking into account the size of the room. The makers of the Roomba (I Robot) managed to pull in \$883.9 million in revenue, and have recorded to shift as many as 10 million Rumbas since its launch in 2002. Similarly, another prime example is “Sophia” the humanoid robot, developed by the Hanson Robotics (Hong Kong-based robotics firm). This marvelously wonderful, humanoid robot with more advanced and cognitive artificial intelligence can effectively communicate using natural language.

## AI is impacting the finance industry

AI has made it all the more possible for the businesses in the financial sector to delve deeper into finance with no effort, made real-time and accurate reporting and processing high volumes of quantitative data simpler than ever. For instance, we already see AI-powered financial platforms that help the investors plan their investment, or help with automated tax loss harvesting, trading online, managing transactions, etc. One of the prime examples of financial technology powered by AI is Alpha Sense (Fintech search engine, New York) that has been developed with the sole purpose to help investment firms gain an informational edge. This financial search engine uses flawless AI technology (a perfect combination of linguistic search and natural language processing), to analyze the needs of the investors, scan millions of data points to effectively generate actionable reports for the companies or the consumers alike. As many as 800 financial firms rely on Alpha Sense across the globe for accurate insights. Or in Indian context, the rapid growth of Fin tech is changing the phase of the financial sector too. With Indian companies focusing more on improving financial operations, trying to bring in more accuracy by implementing adaptive intelligence, algorithmic trading, automation, chat bots, and machine learning into financial processes.

## Health care

Healthcare has always suffered from inefficient processes, operational methodologies and skyrocketing medical costs. AI has certainly given this maligned healthcare industry a much-needed makeover, by curtailing down medical costs and obliterating inefficiencies in medical processes. No doubt, Artificial Intelligence in healthcare is a boon. It certainly has simplified the lives of patients, and healthcare professionals too. AI is currently in use to

find links between genetic codes, conduct surgeries, detect diseases, reinvent methodologies for treatment, etc. Moreover, AI in healthcare was valued at about \$600 million in 2014 and it is projected to increase a lot more, expected to reach at least \$150 billion by 2026. It is considered a big game changer, helping with enhancing almost all aspects of the healthcare industry. For instance, robot-assisted surgeries, and AI-powered software or products to safeguard healthcare information, medical records or, to prevent theft against cyber criminals, etc. AI-enabled virtual assistants are now being deployed to reduce unnecessary hospital visits and (this has increased efficiency in performance of the nurses and medical staff by at least 20% and more as they are capable of putting more of their time back in the process). Another example is “Buoy Health” that was born in Boston, Massachusetts is an advanced AI-based symptom and cure checker. It has the capabilities to easily diagnose and treat illness. Harvard Medical School is one among hundreds and thousands of hospitals that use Buoy Health to effectively diagnose and treat patients. It is truly reinventing or reinvigorating modern healthcare via smart machines that can have inexplicable capabilities to predict, comprehend, learn and act. In one study, AI models using advanced deep learning and algorithms recorded to diagnose breast cancer at a higher rate than 11 pathologists.

### **AI in Marketing**

Marketing is not free from AI. In fact, it has fueled the growth of targeted marketing in today’s globalized world of business. Big data with AI in combination helps businesses analyze the data and take more insightful decisions to propel their business forward.

### **AI in Travel and Transportation**

AI is a mega trend in ever-growing travel and transportation industries. AI powered search engines now make travel arrangements simple. There are online platforms and applications that make ticket booking simple, applications that tell you which route can be the best to take to go home after work to avoid heavy traffic. Google map is itself one of the biggest friendlier web/mobile platforms and applications that make journeys simple. We see a steady growth in the number of online travel management firms, making booking of hotels, tours, etc. simple with AI. Besides, there are travel, leisure and hospitality companies that are already capitalizing on the ubiquitous AI usage developing applications that can read the instructions of the users and provide useful suggestions and recommendations. Similarly, you tell a travel chat boot that you want to go to London and it brings to you plenty of information on how you can book your ticket, where you can book, how to book the hotel, places you can visit in London, food, and accommodation, etc.

### **AI in Ecommerce**

Ecommerce stores are known to implement machine learning into e-commerce processes with a little twist so as to enable personal relationships with their customers. Using AI- driven algorithms, ecommerce stores personalize the user experience, and thus increase sales. This is done by deploying chat bots, predicting and analyzing purchase behavior, gathering the data and taking more insightful decisions based on it.

### **AI in Social Media**

It is reported that there are as many as 2.88 billion active profiles across platforms such as Face book, Snap chat, Twitter, and various other social media sites or applications. If we focus a little on Face book, we understand that photo tagging suggestions the profile users receive, the algorithmic news feeds, and other similar features that we find in ad targeting (for paid marketing through Face book Adverts), are based on AI. It is deeply embedded in Face book's platform. Similarly, AI is used by Twitter to help you provide suggestions on who to follow, get new feeds from the users, etc. And various other social platforms like LinkedIn (one of the biggest social networking sites for the professionals), Tumbler, Interest, or other micro blogging sites like Medium.

### **What the future of AI**

Artificial Intelligence will move to a higher level of success. We can see companies across the globe are already taking on the opportunities to develop new and exciting AI-based models, products and machines for the purpose of simplification of the operations, marketing and various other purposes. Now, we see corporations across the globe that is trying to harness the power of AI. But, yes, there are challenges ahead as AI continues to change the world (as it gains traction) for instance, commercial deep fakes may affect retail or change media.

## AI is the creator and terminator of jobs across the global level.

Top companies in five of the best countries that are regarded to be the hub of the AI jobs such as the USA, Japan, China, the UK and India employ AI professionals. But, the growth rate of the employment in other sectors due to the introduction of the machines in the other sectors have no choice but to bear the brunt of its power.. For since, we find chat bots replying to enquiries of the customers instead of real people (There is a possibility that AI will take over 16% of current jobs as almost all of the companies are focusing more on the AI concepts to be more agile in their business which ultimately will lead to loss of jobs for the humans). Moreover, how would the world be like with the rise of machines that act more quickly than humans? For instance, in China, we have already seen a 500% increase when it comes to annual robot installations (comparing the data from 2012 to present).

### CONCLUSION

AI is certainly going to be more impactful in the future and will continue to create ways for the businesses across the globe to cash on opportunities along the way. It is also possible that it will, in combination with the other latest technologies like big data, data science, cloud computing, smart governance, and other technologies, will make way for achieving milestones in the tech field that are deemed impossible now. Artificial Intelligence growing by leaps and bounds, there is no sector that doesn't show its effect. It will continue to benefit but benefit will not come at the expense of some substantial losses, threats, and unethical ventures. Top scientists and technologists like Bill Gates, Stephen Hawking, Elon Musk to name a few believe that Artificial Intelligence can pose threats to humanity as there is a potential to use AI in a way that is not ethical. Some of the world's leading companies such as Google, Microsoft have already stated in their research paper how badly AI may harm potential business. Or to put it in a more funny way, in words of Dr. David Levy, one of the renowned artificial intelligence experts, "people will prefer to marry robots and this would even become legal by 2050 (as heard on CBC Radio).

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