SHRI RAM CONSULTING AND RESEARCH CENTRE

# AI TOOLS


# RESEARCH REPORT


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Contact Us: H-16, Str t No. 36, Mukund Vihar, Delhi-110090
Mobile Number: +91-98917 93616 | www.srcrc.wordpress.com

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# EXECUTIVE SUMMARY

"A year spent in artificial intelligence is enough to make one believe in God."
—Alan Perlis

**Artificial Intelligence (AI)** is a technology that aims to replicate human intelligence and perform tasks that normally require human cognition, such as visual perception, speech recognition, decision-making, and natural language processing. AI has been advancing rapidly in recent years, thanks to the availability of large amounts of data, the development of powerful computing hardware and software, and the emergence of innovative algorithms and techniques. AI has been applied to various domains of human activity, such as education, finance, I.T., transportation, and healthcare. In this report, we have explored the applications, benefits, challenges, and impacts of AI in these domains, highlighting how AI can enhance the efficiency, quality, accessibility, and innovation of services and products.

Transportation is a vital sector that enables the movement of people and goods across different locations. Transportation has evolved significantly over the centuries, from primitive methods like walking and swimming to advanced technologies like cars and planes. However, transportation also faces many challenges, such as traffic congestion, pollution, accidents, and energy consumption. AI can help address these challenges by enabling autonomous and connected cars that can drive themselves without human intervention. Autonomous cars can improve traffic efficiency, reduce emissions, enhance safety, and provide convenience and comfort for passengers. Connected cars can communicate and coordinate with other vehicles, pedestrians, traffic signals, and road conditions through vehicle-to-infrastructure (V2I) systems, enabling smarter and smoother transportation.

Healthcare is another vital sector that affects the quality and longevity of

human life. Healthcare involves various processes and activities, such as staying healthy, detecting diseases, diagnosing conditions, making decisions, providing treatments, offering end-of-life care, conducting research, and discovering drugs. Healthcare also faces many challenges, such as rising costs, limited access, human errors, data fragmentation, and ethical dilemmas. We will discuss how AI can help address these challenges by providing various tools and solutions that can improve health outcomes, reduce errors and costs, facilitate remote monitoring and personalised care. AI can also enhance healthcare research and innovation by analysing large amounts of data and generating new insights and discoveries.

In the education sector, we will discuss how AI can improve learning outcomes, personalise learning experiences, automate administrative tasks, facilitate online education, and support teachers and students. We have also addressed some of the challenges of AI in education, such as data privacy and security, ethical and social implications, teacher-student relationship, and digital divide.

The report will cover how AI is transforming the field of information technology (IT) across cybersecurity, IT operations, and customer support. It will discuss how AI-powered systems detect and respond to threats in real time, streamline IT operations through automation and predictive analytics, and enhance customer support through chatbots and virtual assistants. The content will highlight the benefits of AI in improving security, optimising IT operations, and enhancing customer experiences. It will emphasise the importance of embracing AI in the IT industry to drive productivity, cost savings, and innovation in the digital landscape.

The role of AI in the finance sector, including its impact on personalized banking experiences, credit scoring, fraud detection and risk management, and algorithmic trading and investing will also be covered. It will explore how AI is revolutionizing these areas, enabling personalized recommendations and offerings, more accurate credit assessments, enhanced fraud detection capabilities, and data-driven trading decisions. The report will emphasise the potential of AI to

improve efficiency, customer satisfaction, and financial outcomes in the finance industry.

The report also covers a cross-sector analysis and explores common challenges, limitations, and opportunities in AI adoption. It discusses challenges such as skill deficit, lack of knowledge, data quality, undefined goals, organizational silos, data labeling, explainability, and integration issues. The report also highlights opportunities in customer engagement, sales, decision-making, and automation. In the end, it highlights the significance of considering the societal impact of AI and promoting ethical guidelines and regulations. It encourages organizations to adopt ethical AI frameworks and engage in continuous monitoring and evaluation of AI systems to ensure their adherence to ethical standards.

By shedding light on the transformative potential of AI across these industries, this report serves as a valuable resource for individuals and organizations seeking to leverage the power of AI for improved efficiency, enhanced customer experiences, and innovation. We invite readers to delve into the full report to gain deeper insights and discover practical strategies for harnessing AI's capabilities while upholding ethical considerations and responsible implementation.

# INTRODUCTION

## HISTORY OF AI

Alan Turing, a British polymath, was the first person to introduce the concept of artificial intelligence. Unfortunately, at that time, computers were veritably precious and couldn't store commands. The Dartmouth Summer Research Project on Artificial Intelligence, hosted by John McCarthy and Marvin Minsky in 1956, was a landmark event in the history of AI. At this conference, everyone aligned with the sentiment that AI was attainable. Early demonstrations similar to Newell's showed pledge towards problem working and the interpretation of spoken language. These successes inclined the government towards funding similar exploration. In the 1980s, John Hopfield and David Rumelhart popularised "deep literacy" ways, which allowed computers to learn using experience. Still, the biggest problems at this time were due to the computers' incapability to store enough knowledge or process it presto enough. What later changed was that the abecedarian limit of the computer storehouse that was holding us back 30 times ago was no longer a problem. Moore's Law, which estimates that the memory and speed of computers double every time, had eventually caught up and, in numerous cases, surpassed our requirements. In 1997, reigning world chess champion and grandmaster Gary Kasparov was defeated by IBM's Deep Blue, a chess-playing computer program. This served as a huge step towards an instinctively intelligent decision-making programme. The same time, speech recognition software was enforced on Windows.

## AI USE-CASES

1. AI aims to reduce the time and trouble needed to complete specific tasks, making processes more effective and productive.

2. AI seeks to make it easier for humans to interact with machines, allowing for flawless communication and collaboration between humans and AI systems.

3. AI focuses on perfecting the ways humans interact with computers and bias, aiming for further natural, intuitive, and effective interfaces and relations.

4. AI endeavours to help individualities learn new information more fleetly, using personalised and adaptive literacy systems that feed to individual requirements and give acclimatised educational guests

## WHERE IS AI USED?

AI helps reduce repetitive tasks. AI can perform tasks constantly without getting tired. It does not need breaks and can lifelessly carry out tasks, freeing humans from mundane and repetitive work.

AI improves being products - In the history, products were erected using fixed rules and instructions. With the preface of AI, these products can be enhanced and made more functional. For illustration, on platforms like Facebook, Collaborative filtering (CF) is one of the important areas where this applies. CF is a recommender systems technique that helps people discover items that are most relevant to them.

AI is also utilised across colourful diligence, gauging from marketing to supply chain operation, finance, the food processing sector, and numerous further. According to a check conducted by McKinsey, the fiscal services and high- tech communication sectors are at the van in terms of AI relinquishment and advancement.

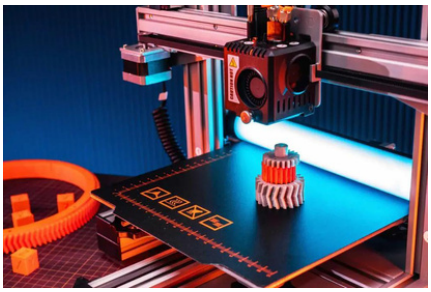
# OBJECTIVE OF REPORT

To provide an overview of the definition, scope, and history of AI. It also aims to describe the different types and levels of AI, such as narrow, general, and super AI, and Artificial General Intelligence (AGI). It also aims to trace the historical evolution of AI from its origins to its current state, highlighting the key milestones and achievements in AI research and development.

To explore the applications, benefits, challenges, and impacts of AI in various domains of human activity, such as education, I.T., finance, education, transportation, and healthcare. It also aims to analyze how AI can affect the quality and efficiency of services and products in these sectors, as well as the opportunities and risks that AI poses for these sectors.

# AI IN INFORMATION AND TECHNOLOGY

**Artificial intelligence will have a more profound impact on humanity than fire, electricity, and the internet. - Sundar Pichai**



It's clearly not the first time it has been said that robots will take over the earth when humans corrupt, but this expression caught everyone's eye again when artificial intelligence became the hot content." Although it may feel like this unformed thing that is nearly off in our future, it's formerly veritably important in our midst." From navigation apps to Alexa, Uber, and all other chatbots we use on different websites and apps that use artificial intelligence. All this is great, but it might make you wonder whether this is written by me or sputter GPT. Won't it? But we're then to see what it can be in the IT sector or assiduity.

For a nonprofessional, both IT and AI would sound the same, but we wouldn't suppose of AI without having IT. Let's just say it's a step ahead. IT is each about using and managing computers to store, organize, and cover information, while with AI, computer systems can do effects that typically bear mortal intelligence. To put it more simply, a computer is a teenager, and AI is a parent trying to educate it to suppose, learn, break its problems, and make its opinions. Information technology is limited to transmitting and manipulating data. whereas AI- driven operations work more nearly to accelerate problem resolution and enhance IT operations.

## AI AS THE VAN OF THE IT SECTOR

This digital metamorphosis( AI) has given rise to new advancements to break and optimise numerous core challenges in the IT sector. AI occupies a central position in the advancement of colourful diligence, including information technology, serving as an aberrant element in their development. The integration of AI systems with IT has proven salutary by easing the workload on inventors, leading to enhanced effectiveness, increased productivity, and better quality assurance.

While, in fact, 85% of businesses say that it'll give them a competitive edge, some 75% believe that it'll allow them to move into new gambles. Likewise, a significant maturity of technology directors, counting for 80, view artificial intelligence( AI) as a precious tool for enhancing productivity and generating employment openings. They perceive AI's eventuality to palliate workers from mundane tasks, thereby enabling them to concentrate on further innovative and imaginative endeavours.

For numerous diligence and companies, the study of enforcing AI might not be veritably enthusiastic, as directors do n't understand how these arising technologies work.

***But luckily, when paired with the IT assistance, artificial intelligence will be much easier to integrate.***

## AI TECHNOLOGIES FOR IT

According to a study by Translucency Market Research( TMR), the global request for artificial intelligence is estimated to gain an emotional 36.1% CAGR between 2016 and 2024, adding by the end of 2024 from$126.14 billion in 2015 to$ 3,061.35 billion.

Preliminarily, the creation and perpetration of large- scale IT systems sounded nearly unattainable. Still, thanks to the progress made in developing sophisticated algorithmic functions by artificial intelligence( AI), negotiating similar tasks has come doable.

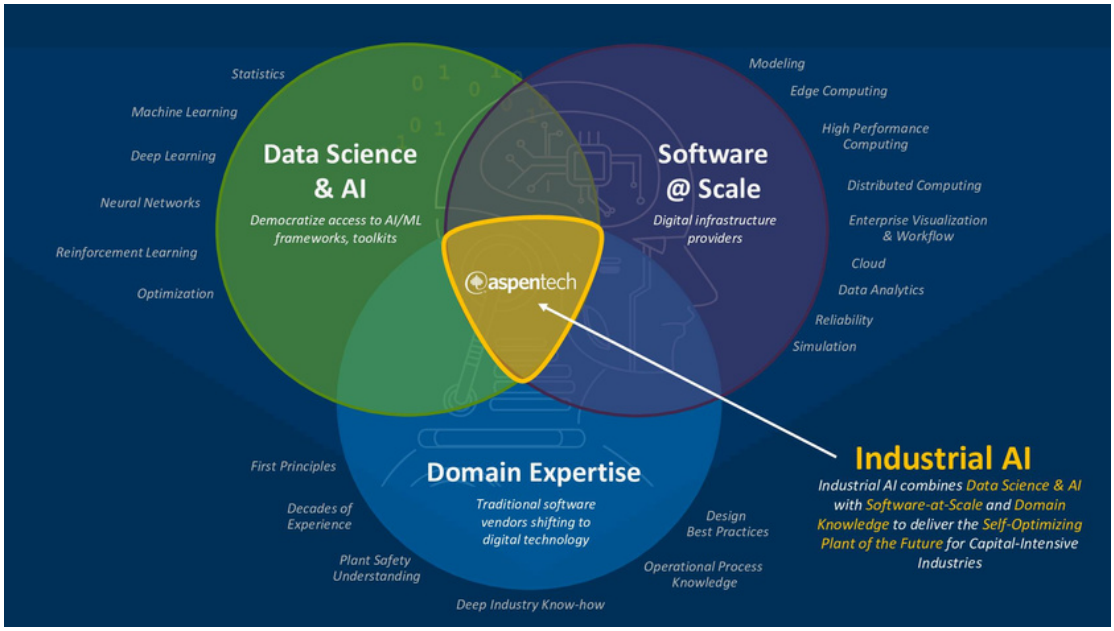
As IT structure becomes more complex and delicate to handle, it looks forward to looking for the most effective result to enhance IT operations operation, and AI, being a tremendous advance, has set up a great use for the different, dynamic, and delicate- to- manage IT geography.
AI technologies provide substantial benefits in the IT sector by improving efficiency, enhancing decision-making, and enabling companies to leverage the power of data to produce improved outcomes.
Being a broad term, AI can be divided into different technology segments such as machine learning, deep learning, natural language processing, image processing, and speech recognition. However, a central role in the IT department belongs to machine learning (ML) and deep learning (DL).
Let's find what these terms actually mean so that we can focus on how it is helping in the IT sector. The essence of intelligence is learning. Machine learning is a subset of AI that focuses on a computer program that is able to analyse data using specific algorithms. It is a program that produces a large amount of output based on analysed data without human intervention.
However, Deep learning is a subset of machine learning. Its algorithms and techniques are similar but capabilities are not comparable. In this technique, a computer system is trained to perform classification tasks directly from sounds, texts, or images by using a large amount of labelled data, as well as neural network architectures.

## AI DRIVEN TRANFORMATION IN IT

- AI in IT operations automates data processing and decision-making processes by utilising historical and real-time data. The objective of implementing is to enable continuous analysis, which yields actionable insights for implementing corrections and improvements in IT infrastructure.
- Deep learning technologies also offer the potential to automate numerous operational processes within IT departments, resulting in cost reduction and decreased reliance on manual labour. Moreover, AI algorithms are specifically designed to learn from past experiences, enabling continuous self-improvement over time.

- Several AI tools can be used in fraud detection, however, among these machine learning can process large amounts of data at a much faster rate than people can. By analysing historical data involving similar circumstances, machine learning tools can identify patterns of fraudulent behaviour. The IT department can utilise this synthesised data to take necessary actions against cyber criminals and develop more robust preventive measures for the future.

Overall, AI's immense potential as a business tool enables IT professionals to adopt a more strategic approach in their operational processes. By leveraging AI, IT professionals can enhance their decision-making capabilities and optimise their workflows for greater efficiency and effectiveness



# AI IN HEALTHCARE

## APPLICATIONS

According to a recent study by the Universitat Politècnica de València and WHO, AI is primarily utilized for image analysis and disease modeling in healthcare. However, its impact on people's health is still limited. While AI is employed in various healthcare areas such as molecular and genetic testing, medical imaging, diagnostic code analysis, and prediction of infectious disease outbreaks, its application is largely confined to laboratories and testing. Nevertheless, in some affluent countries, AI is already enhancing the speed and accuracy of disease diagnosis and screening, clinical care, health research, drug development, and public health interventions.

AI has the potential to empower patients to take control of their health by using gadgets to assess their conditions. Although this practice is not yet mainstream, affluent individuals who can afford such technologies can benefit from them with the guidance of their doctors. It is anticipated that in the coming years, people in resource-poor countries and rural communities, where access to healthcare professionals is limited, may also have access to these technologies at lower rates.

The different reasons for which AI is used in different areas of healthcare are as folllows :

1. Staying Healthy :

The integration of AI into healthcare is driving transformations that make healthcare jobs more efficient, effective, and cost-friendly. In terms of staying healthy, AI is already making an impact through the Internet of Medical Things (IoT) and consumer health applications. AI-enabled healthcare devices and technology promote healthier behaviors and proactive management of healthy lifestyles, enabling healthcare professionals to better understand patient needs and provide feedback, guidance, and support for maintaining good health.

2. Early Detection of diseases :
AI plays a crucial role in the early detection of diseases, particularly cancer and heart diseases. Traditional methods such as mammograms often yield false results, causing unnecessary biopsies and anxiety for patients. AI is revolutionizing this process by enabling faster and more accurate review and translation of mammograms, reducing the need for unnecessary procedures. Additionally, consumer wearables and AI-enabled medical devices enable doctors to better monitor and detect potentially life-threatening diseases at an earlier and treatable stage.

3. Diagnosis :
AI tools excel in storing and processing vast amounts of medical data, including information from medical journals, symptoms, and treatment case studies worldwide. Platforms like IBM's Watson Health and Google's DeepMind Health leverage machine learning and systems neuroscience to develop powerful learning algorithms that mimic the human brain, assisting clinicians, researchers, and patients in addressing real-world healthcare challenges.

4. Timely-Decision Making:
The alignment of big health data with appropriate and timely decisions through predictive analysis supports clinical decision-making, prioritizes administrative tasks, and identifies patients at risk of developing conditions or experiencing deteriorations due to various factors. AI is also being used for pattern recognition to identify patients at risk, considering lifestyle, environment, genomics, and other factors.

5. Treatment :
In the field of treatment, robots have been utilized in medicine for over 30 years, ranging from simple laboratory robots to highly complex surgical robots capable of performing autonomous surgeries and assisting surgeons in complex procedures. Robots are also employed in hospitals, labs, rehabilitation, physical therapy, and support for individuals with long-term conditions. AI enables clinicians to adopt a comprehensive approach to disease management, coordinate care plans more effectively, and help patients manage and comply with long-term treatment programs. Furthermore, AI assists providers in identifying chronically ill individuals who may be at risk of adverse episodes by scanning health records.

6. End of Life Care :

As life expectancy increases, end-of-life care becomes more important. Robots integrated with AI advancements can help individuals maintain their independence for longer periods. These robots can engage in conversations and social interactions, keeping aging minds sharp and providing support for conditions like heart failure, dementia, and osteoporosis.

7. Research :

Based on the California Biomedical Research Association, the journey of a drug from the research lab to the patient typically spans around 12 years. Out of 5,000 drugs that undergo preclinical testing, only five proceed to human testing, and ultimately, only one of those five gets approved for human use. Additionally, the average cost for a company to develop a new drug from the research lab to the patient is approximately $359 million. AI has emerged as a recent application in healthcare for drug research and discovery. By leveraging the latest advancements in AI, there is the potential to streamline the processes of drug discovery and repurposing, resulting in significant reductions in both the time it takes to bring new drugs to the market and their associated costs.

## BENEFITS OF AI IN HEALTHCARE

AI's role in healthcare is expected to be that of an assistant rather than a replacement for physicians in the foreseeable future. However, it will significantly contribute to improving clinical decisions made by healthcare professionals. By utilizing sophisticated algorithms, AI can learn valuable features from vast amounts of data and apply them to assist physicians in making better-informed clinical decisions.

1. AI's assistance:

AI complements physicians by leveraging its ability to analyze large volumes of data. This capability streamlines various processes, including providing up-to-date medical information from journals, textbooks, and clinical practices. This wealth of information enables healthcare professionals to make more informed decisions for proper patient care.

2. Early disease diagnosis:
AI plays a crucial role in early disease detection. By analyzing extensive datasets, AI systems can identify patterns and indicators that may not be easily recognizable by humans alone. This early detection can lead to timely interventions and improved patient outcomes.

3. Reduction of errors:
Diagnostic and therapeutic errors are inherent in human practice. AI can help mitigate these errors by providing additional support and assistance to healthcare professionals. By leveraging its analytical capabilities, AI systems can contribute to reducing errors and improving the accuracy of diagnoses and treatment plans.

4. Operational cost reduction:
AI implementation in healthcare can also yield cost benefits. By streamlining processes and providing valuable insights, AI can help reduce operational costs for healthcare professionals. This can free up resources to be allocated to other critical areas of patient care.

5. Improved health outcomes:
The combination of AI's data analysis and decision-making support can lead to better health outcomes for patients. With improved clinical decisions, healthcare professionals can provide more effective and personalized treatments, resulting in enhanced patient care and overall well-being.

While AI is unlikely to replace physicians, it is poised to be a valuable tool in healthcare. Its ability to analyze extensive data, provide up-to-date information, aid in early disease diagnosis, reduce errors, and lower operational costs can significantly benefit healthcare professionals and improve patient outcomes.

# CHALLENGES :

1. Difficulty in assessing high-quality data:

- Data plays a crucial role in all stages of AI tool development and is essential for training AI models before their deployment in healthcare applications.
- However, assessing high-quality data poses several challenges as it is often fragmented across different systems such as medical imaging archives, diagnostic systems, and electronic health records (EHRs).
- Reconciling data from these systems becomes difficult due to changing formats, making it challenging to obtain a comprehensive and cohesive dataset.
- Additionally, the process of obtaining data can be time-consuming, with experts estimating that acquiring federal data alone may take 12 to 18 months.

2. Potential bias in data:

- The presence of bias in healthcare data can diminish the effectiveness of AI in healthcare applications.
- For instance, if an AI tool is developed using data exclusively from high-resource hospitals, its applicability and safety for the population in community-based hospitals may be questionable.
- Bias in data can arise when the collected population does not adequately represent the entire population or when specific patient subgroups are underrepresented.
- Currently, AI technologies in healthcare primarily cater to affluent countries, which means data collected from high-income countries may not generalize well to individuals in low and middle-income countries.

3. Difficulty in protecting patient privacy:

- The development of numerous AI tools that require access to sensitive health data raises concerns about the protection of patient privacy.
- Health records contain valuable and sensitive information that can be exploited by hackers for illegal activities, as highlighted in a 2018 report by the Department of Health and Human Services.

- Unethical collection and use of health data, along with biases encoded in algorithms, pose challenges to patient safety, cybersecurity, and privacy.
- While private and public sector investment in AI development is crucial, the unregulated use of AI may compromise patient rights and interests to serve commercial or governmental agendas related to surveillance and social control.

4. Difficulty in scaling:
   - Scaling AI and integrating it into different healthcare settings faces challenges due to variations in data and limited generalizability.
   - The population in one area may not be representative of the whole, making it challenging to apply AI models universally.
   - Adapting AI tools to different environments can be possible but often comes with a high cost.
   - For example, scaling a sepsis prediction AI tool across multiple sites was estimated to cost approximately $7,000,000, as indicated in a review on translating machine learning products into healthcare delivery.

5. Adoption in clinical practice:
   - Ensuring widespread adoption of AI in daily clinical practice involves multiple factors, including regulatory approval, integration with EHR systems, standardization to ensure consistent performance, clinician training, financial support from public or private payer organizations, and ongoing updates.
   - Achieving these milestones is critical to realizing the full potential of AI in healthcare and may lead to more extensive use of AI in the next decade.

AI in healthcare faces challenges related to assessing high-quality data, potential bias, patient privacy protection, scaling across diverse settings, and achieving widespread adoption. Addressing these challenges is crucial for maximizing the benefits of AI in improving healthcare outcomes.

# SOCIO-ECONOMIC IMPACT OF AI TOOLS IN HEALTHCARE

1. Wearables:

- Wearable devices like smartwatches, fitness trackers, and biosensors collect extensive health information that can be analyzed by AI software.
- AI-enabled wearables offer socio-economic benefits such as improved workforce efficiency and reduced patient visits, allowing healthcare professionals to focus on core competencies and allocate financial resources more effectively.
- According to a Deloitte report, AI-enabled wearables have saved 298,000 to 313,000 lives and 46.6 to 50.6 billion euros.

2. Imaging:

- AI systems trained on large datasets of medical images enhance the identification of clinical problems, including cancer, with greater speed and accuracy compared to specialists.
- Digital pathology algorithms assist in automatically identifying pathologies by screening images, surpassing radiologists in diagnostic accuracy.
- Early diagnosis of coronary artery disorders (CAD) is another AI application in medical imaging, enabling accurate prediction of five-year mortality rates for at-risk patients.
- Deloitte estimates that AI in medical imaging has saved 36,000 to 41,000 lives and 16.1 to 18.6 billion euros.

3. Labs:

- AI-enabled laboratory applications play a role in diagnosis, treatment, care management, and research and development (R&D).
- AI-powered infection testing has significant potential in healthcare, improving the analysis of viral infections using microbiology techniques.
- AI laboratory databases enhance R&D by improving data quality and streamlining workflows, leading to scientific discoveries.
- These advancements have contributed to saving 834.4 to 883.5 billion euros, according to Deloitte.

4. Physiological monitoring:
   - AI tools enable remote patient monitoring, eliminating the need for patients to be physically present in a healthcare facility.
   - Predictive monitoring can detect health events in advance, allowing timely interventions for critically ill patients.
   - For example, AI-based solutions can predict intraoperative hypotension by identifying rapid physiological changes.
   - Deloitte reports that physiological monitoring through AI has saved 39,000 to 42,000 lives and 43.6 to 45.7 billion euros.

5. Virtual health assistant:
   - AI applications alleviate the administrative burden on physicians and enhance the quality of healthcare by reducing waiting periods and providing personalized answers to patient queries.
   - Virtual health assistants leverage AI to retrieve individual electronic health records and offer tailored responses based on the patient's current medical condition.
   - This has contributed to savings of 32 billion to 36.8 billion euros, according to estimates.

AI tools in healthcare, such as wearables, imaging, labs, physiological monitoring, and virtual health assistants, have significant socio-economic impacts. They improve workforce efficiency, reduce patient visits, enhance diagnosis accuracy, facilitate remote monitoring, and alleviate administrative burdens, ultimately leading to saved lives and financial savings.

## EFFECT ON JOBS

A collaboration between Deloitte and the Oxford Martin Institute suggests that the presence of automation in AI could lead to the automation of approximately 35% of jobs in the next 10 to 20 years. However, other studies propose that the extent of job loss would be limited due to various factors. These factors include the cost of automation technologies, the growth and cost of the labor market, the broader benefits of automation beyond simple labor substitution, and regulatory and social acceptance. As a result, job loss may be restricted to 5% or less.

According to the World Health Organization (WHO), the healthcare industry is projected to face a shortage of around 13 million healthcare workers by 2035. The WHO's report highlights a significant gap between the estimated shortage of 17.4 million healthcare workers and the availability of only 4.45 skilled health professionals per 1000 people globally. Therefore, while automation may impact certain fields such as radiology, pathology, and digital information management, the overall impact on job loss in healthcare is expected to be relatively limited.
While studies suggest that job automation due to AI could potentially automate a significant portion of jobs, factors such as the cost of automation, labor market dynamics, and the existing shortage of healthcare workers may mitigate the extent of job loss. It is likely that automation will primarily affect specific areas within healthcare, such as radiology, pathology, and roles involving digital information handling.

## SIX PRINCIPLES BY WHO TO ENSURE AI WORKS FOR THE PUBLIC INTEREST IN ALL COUNTRIES

To limit the risks and maximise the opportunities intrinsic to the use of AI for health, WHO provides the following principles as the basis for AI regulation and governance:

1. Protecting human autonomy:
In the context of health care, this means that humans should remain in control of healthcare systems and medical decisions; privacy and confidentiality should be protected, and patients must give valid informed consent through appropriate legal frameworks for data protection.

2. Promoting human well-being and safety and the public interest :
The designers of AI technologies should satisfy regulatory requirements for safety, accuracy and efficacy for well-defined use cases or indications. Measures of quality control in practice and quality improvement in the use of AI must be available.

3. Ensuring transparency, explainability and intelligibility :
Transparency requires that sufficient information be published or documented before the design or deployment of AI technology. Such information must be easily accessible and facilitate meaningful public consultation and debate on how the technology is designed and how it should or should not be used.

4. Fostering responsibility and accountability :
Although AI technologies perform specific tasks, it is the responsibility of stakeholders to ensure that they are used under appropriate conditions and by appropriately trained people. Effective mechanisms should be available for questioning and redress for individuals and groups that are adversely affected by decisions based on algorithms.

5. Ensuring inclusiveness and equity :
Inclusiveness requires that AI for health be designed to encourage the widest possible equitable use and access, irrespective of age, sex, gender, income, race, ethnicity, sexual orientation, ability, or other characteristics protected under human rights codes.

6. Promoting AI that is responsive and sustainable :
Designers, developers and users should continuously and transparently assess AI applications during actual use to determine whether AI responds adequately and appropriately to expectations and requirements. AI systems should also be designed to minimise their environmental consequences and increase energy efficiency. Governments and companies should address anticipated disruptions in the workplace, including training for healthcare workers to adapt to the use of AI systems, and potential job losses due to the use of automated systems.

These principles will guide future WHO work to support efforts to ensure that the full potential of AI for healthcare and public health will be used for the benefit of all.

# AI IN EDUCATION

## INTRODUCTION

Education is a powerful weapon that a person can use to change the current scenario that surrounds him. This report is a perfect blend of several topics beginning with a brief introduction to AI in Education,

***"Our Intelligence is what makes us human, and AI is extension of that quality."***
***-Yann LeCum***

By supporting inclusive and egalitarian education, which is its main purpose, AI can deliver high-quality education and help accomplish SDG 4. AI has opened up several growth opportunities, and through its applications, people are moving gradually towards sustainable goals, especially in industrialised nations where people can easily adapt to changing technology to meet their needs. During the COVID-19 pandemic, AI also proved its significance by facilitating access without impeding children's and adolescents' ongoing learning. The pandemic's advances in AI were advantageous for the education sector. With the aid of AI technologies, educators were able to design virtual classrooms where learning never stopped and students and teachers interacted in real-time. Covid was merely the start, but in recent years, most of the educational system has shifted to AI, which has a much wider audience and range of applications.

## UNDERSTANDING AI IN EDUCATION

The field of artificial intelligence (AI) blends invention and derivation, and it is beginning to affect educational institutions and tools. Although instructors are crucial to education, changes have been brought about by the development of AI. The field of artificial intelligence (AI) blends invention and derivation, and it is beginning to affect educational institutions and tools. Though they are crucial to education, teachers' jobs have changed as a result of the development of AI. Advanced analytics, deep learning, and machine learning are used by AI to track each person's growth about others. As AI solutions develop, they assist in finding instructional gaps and ultimately improve educational competency. By personalising learning experiences, streamlining administrative processes, and increasing efficiency, AI has the potential to free up teachers to concentrate on teaching students comprehension and adaptability skills that are distinctively human and difficult for computers to imitate. Education for students can be improved by merging the skills of robots and teachers.

## EVOLUTION OF AI IN EDUCATION

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# APPLICATION OF AI IN EDUCATION

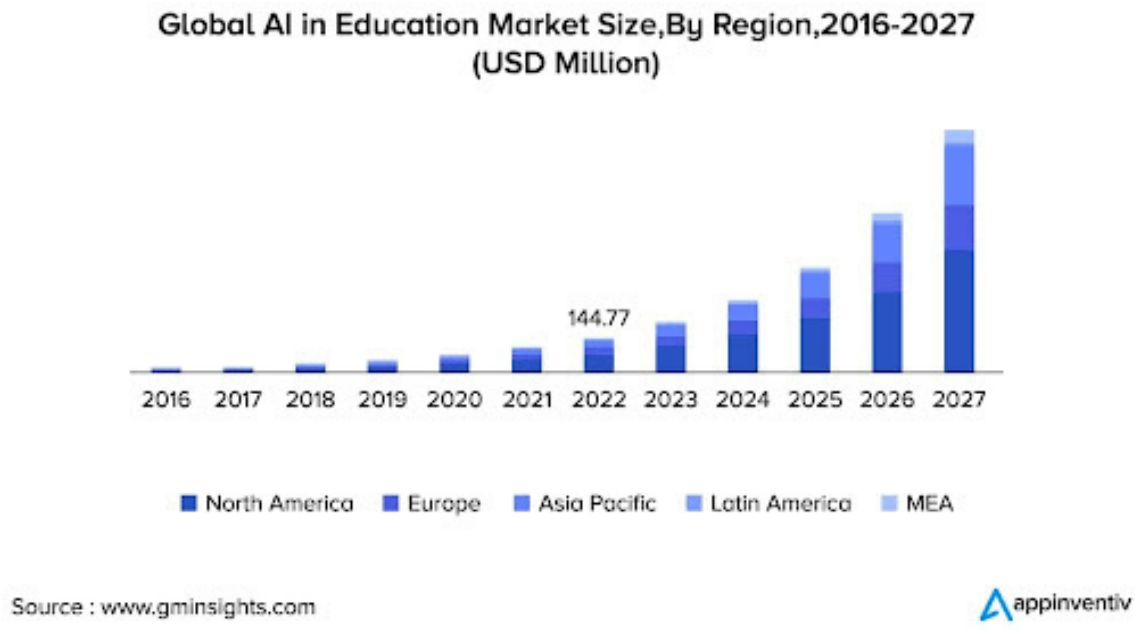
Two key components, data, and artificial intelligence, are intimately woven into the fabric of our daily lives in the modern world. With data and artificial intelligence playing a key role in numerous industries, AI has become a part of our daily life. AI has impacted every industry, introducing cutting-edge applications and use cases in everything from sports and mobile apps to construction and education. The integration of AI and digital learning, particularly in education, has completely changed the way people learn and ushered in a new era of educational ideas.

In addition to supplementing manual and virtual teaching techniques, AI helps teachers by automating chores, enhancing the teaching and learning process, and identifying weaknesses in the classroom. To free up time for teachers, AI systems can automate administrative chores like grading, assignment checking, report preparation, and organising research materials. With solutions for those with visual or hearing impairments and language support, AI makes educational content available to a worldwide audience. By adjusting to each student's particular learning preferences and speed, AI offers personalised learning experiences.

Information visualisation, the creation of digital lessons, and regular content updates are just a few examples of the new content that AI and machine learning can assist develop. AI evaluates data to deliver tailored feedback to employees and students, assisting in identifying areas that need development and enhancing the learning process.

Students and the working population have access to affordable possibilities to upgrade their skills and learn new ones thanks to AI-powered software and applications. Through customised learning paths, interactive lectures, and gamified classrooms focused on skill development, the rapidly expanding use of artificial intelligence (AI) in the field of education technology (EdTech) is considerably boosting student engagement.

These developments are expected to cause the AI education market to achieve a 20 billion USD valuation by 2027. A graphic depiction of the adoption of AI in the education industry throughout various areas from 2016 to 2027 is also shown, with the idea of AI witnessing exponential expansion across all demographics.




# PEDAGOGICAL CONSIDERATION

**Impact of AI on teaching and learning :**

The development of intelligent tutoring systems (ITS) has been a major emphasis of the field of Ai in education since the 1980s. These systems employ a knowledge-based architecture made up of a domain model that specifies the material to be learned and a student model that depicts the student's current level of understanding and learning progress. Through an adaptable and interactive user interface, a pedagogical model or expert system controls how learning materials are delivered to the student.

**Impact On Teaching :**

AI has the potential to significantly alter teaching in several ways. Automating evaluation is one application of AI that has the potential to be highly successful. The student model used by conventional intelligent tutoring systems tracks and evaluates the learner's development. Based on this concept, AI algorithms can pinpoint any potential barriers or difficulties a student might encounter when trying to understand a certain subject or domain. AI systems can give students individualised feedback

and support to help them overcome their learning challenges by utilising machine learning and natural language processing techniques. Additionally, AI-driven assessment tools can speed up the grading procedure, saving teachers a lot of time and effort. Automated grading tools can evaluate student comments, essays, or examinations based on predetermined standards or even pick up new skills from a library of previously assessed samples. This not only speeds up the feedback loop but also guarantees fair grading for all pupils or classes. AI algorithms can modify the content, pace, and teaching strategies to match individual learners' strengths and limitations by gathering and evaluating data on student performance. This individualised method of instruction can improve student engagement and maximise learning results.

**Impact On Learning :**

Imagining new technology's many applications and seeing its promise can excite people. However, when individuals see that AI not only improves current educational procedures but also reshapes the learning environment and its significance to society, their enthusiasm may become dampened in the area of education. The needs of an industrial society that is presently experiencing major change are satisfied by many modern educational approaches. It is simple to automate well-established practices, but in a world that is changing quickly, this frequently results in dissatisfaction because the solutions become antiquated even before they are put into practice. People having an understanding of technology throughout this phase of growth have valuable but limited knowledge. This knowledge is rare, hence it frequently supersedes other types of knowledge. This can be difficult in the area of education and training since designers may unintentionally incorporate their personal learning experiences and beliefs. For instance, learning is typically viewed in the context of machine learning as a straightforward correlation between input and output for the system. But this idea of machine learning could seem counterintuitive to learning scientists. While technology has the potential to improve education, it may also be used to automate concepts and repeat behaviors that have little to do with real learning.

# ETHICAL CONSIDERATION OF AI IN EDUCATION

Despite AI's advantages in educational applications, these applications come with societal and ethical risks. The future of mankind must assess these hazards, as noted by renowned scientist Stephen Hawking. Although there are other biases and ethical issues with AI applications, we'll concentrate on a few key and significant dangers.

- **Systems for tracking and surveillance**: These systems keep a close eye on the choices and actions of both pupils and teachers. Future preferences and behaviors are predicted by AI tracking systems. Potential privacy violations as well as participation restrictions for pupils.
- Predictive systems powered by algorithms put autonomy in danger. The fairness and self-freedom of algorithmic forecasts are in question. Persistence of prejudice, discrimination, and social stratification risks.
- **Discrimination & Bias**: Power structures and biases that exist now are ingrained in AI models. Stereotypes are perpetuated and translated with gender bias. Facial recognition systems with racial prejudice can misidentify people.
- **Biassed Decision-Making Algorithms**: Occurrences displaying erroneous and subjective results. For instance, biassed grading algorithms that benefit particular groups affect pupils' final grades and chances in the future.
- **Privacy issues**: excessive exposure of personal data on online sites, violations of data access and security by tech corporations using AI. Obtaining users' consent without fully explaining the information supplied.

# ADVANTAGES OF AI IN EDUCATION

We are giving pupils an advantage in the future workforce, where technology will become more and more common, by introducing them to it at an early age. Additionally, learners are already benefiting from AI in several ways:

- Artificial intelligence (AI) platforms can examine students' prior performance and find learning gaps that could otherwise go undetected.
- Rather than using a one-size-fits-all strategy, AI can customise instructional content to match the needs of specific pupils.
- Using AI, students can get answers to their inquiries right away, saving them the time of waiting for a human response. This may also inspire reserved pupils to express questions without concern for rejection.
- When students are actively engaged in learning, when the subject is still fresh in their minds, and when they are more susceptible to new knowledge, they can receive fast feedback.
- Student motivation and engagement can be improved via AI-powered learning environments, such as gamification, virtual reality, and augmented reality.
- AI can help with content organisation or idea generation, saving students time so they may concentrate on higher-level abilities like analysis and creativity.
- AI technology can close the accessibility gap between students, teachers, and school administrators by gathering intelligent data, developing unique activities, and providing individualised timetables. This can get over geographical limitations, linguistic hurdles, and budgetary constraints, resulting in 24/7 access to education.
- Because AI-powered environments can be tailored to the specific needs and learning preferences of neurodiverse students, who may struggle in traditional settings or with conventional learning approaches, they can be very helpful for these kids.

## CHANGING ROLES OF TEACHERS

**I'm sure it's a prevalent question in people's heads: will AI replace teachers?**

This is a contentious subject because a job is made up of various tasks, and automating all of them seems far-fetched for the time being.

To address this, one must put oneself in the shoes of a teacher and consider how their view has changed through time. During covid, when lessons were given online, a crucial development occurred that helped students appreciate the need for personal contact in education. Education is much more than merely the transfer of knowledge; it has far greater significance.

This persistent progress of AI will continue to substitute the jobs of teachers. It is critical to recognize that AI's potential is realised in the performance of repetitive tasks such as assessing data on student performance while the main work is done by educators, i.e., offering feedback and stimulating students.

It is ideal if teachers adapt to AI and utilise it to their benefit as soon as possible because if they learn to use AI tools and AI continues to improve, there will be greater demand for human interaction.

There are various AI tools to aid teachers, one such is *Simplicity* which can be used to set up polls or quizzes with no effort. Such tools can be used to enhance students' learning in addition to regular learning.

## POTENTIAL IMPACT OF AI ON EDUCATIONAL EQUITY AND INCLUSION

In education, artificial intelligence is a transformational instrument but its vital to make sure that it upholds the same standards of openness and justice that the educational system did prior to its introduction .Equity and inclusivity are key aspects of our society that must be maintained in all aspects. Ai may be employed as a catalyst for transformation in education because of its capacity to bridge the disparity in education by giving underprivileged and rural communities access to it. People can use AI technologies which promote personalised learning to increase access to information and engagement.

Students used an AI programmed called DreamBox to help them interestingly learn maths. According to Harvard and SRI research, students who used this app for at least one hour each day scored 60% higher than other students.
Personalised learning is the forthcoming frontier in education and this can be accomplished by harnessing the power of Natural Language Processing and Machine Learning by providing specialised features and assistance in their curriculum.Such free applications might help students build their confidence and promote inclusion. These tools can help embrace students full potential and achieve their academic objectives more efficiently than ever before .

## FUTURE TRENDS AND DEVELOPMENTS OF AI

According to an estimate by the World Economic Forum, the majority of companies will adopt technologies such as machine learning by 2025. To prepare for the future, it becomes essential to understand where the education system currently stands and how to adapt to meet future ends. A potential challenge of this advancement would be disruptions in employment. Technology will not stop growing, each generation will show how further it has come, so it makes it all the more essential for people to buckle up. The World Economic Forum has recommended governments and institutions focus on STEM and rapidly emerging skills to solve this problem.
In its publication, Artificial Intelligence and Education: Guidance for Policymakers, UNESCO discusses the potential of AI to alleviate the issues faced in education today and, eventually, accelerate progress towards SDG 4. According to this publication, AI in education will be worth $6 billion by 2024. It provides policymakers with suggestions on how to effectively utilise the potential and mitigate the threats offered by the developing relationship between AI and education.
It may appear that AI in education will transform the function of teachers in the future, but such a scenario is far-fetched for the time being. While it is true that AI programmers can educate students on a personalised level, automation of human and emotional abilities is not achievable and will continue to be a flaw in AI.

# TERMS USED

1. **Where Educational Psychology and Neuroscience Meet to Transform Education: Bridging Minds**

The potential of education in neuroscience is a constantly hotly contested topic. This conflict has been exacerbated by the dearth of tangible methods and agents of change in the area, which is dominated by theory and philosophy. By encouraging collaborative interactions, it is essential to cross conventional boundaries and approaches to establishing educational neuroscience as a distinct discipline. It is suggested that school psychologists can play a significant part in carrying out this responsibility and serve as crucial change agents in bridging research and instructional practices. There are various areas where school psychologists can actively contribute to creating linkages between neuroscience and education by utilising the framework offered by the National Association of School Psychologists (NASP) Domains of Practice.

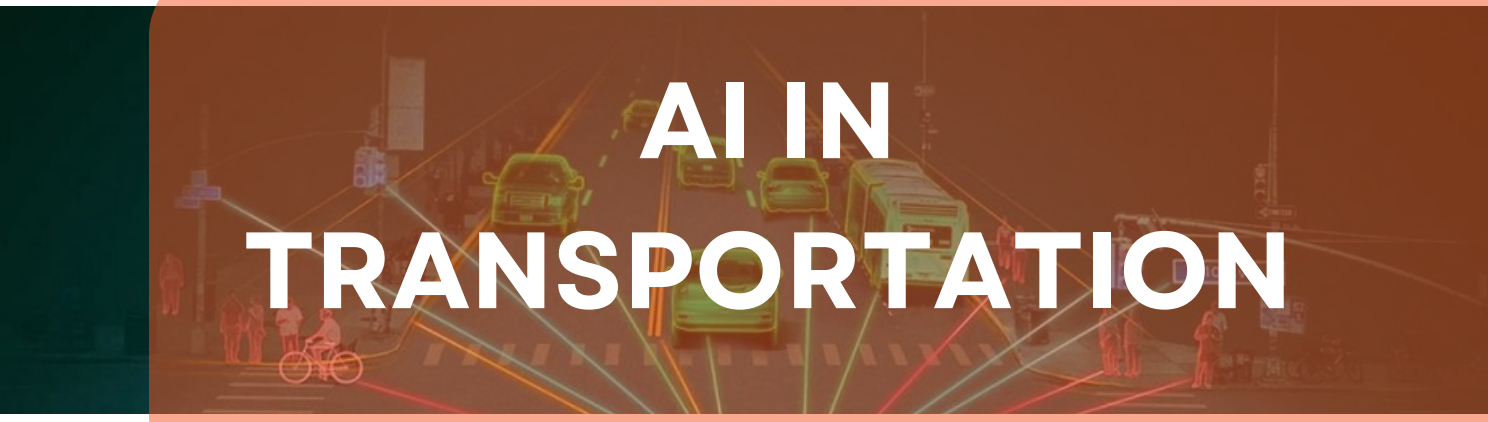
**2. Artificial Intelligence of Things (AIOT):**

To enhance IoT (Internet Of Things) operations, human-machine interactions, and data management, AIOT integrates AI and IoT. IoT connects gadgets to transfer data without human intervention, whereas AI uses technology to duplicate human intelligence. IoT improves AI with connectivity and data exchange, while AI improves IoT with machine learning and better decision-making. Businesses may increase the value of IoT data using AIOT, which automates analysis and decision-making without the need for human participation.

**3. Inquire "An Intelligent Textbook":**

The iPad app Inquire combines the well-known LIFE textbook with a knowledge representation and reasoning framework. Addressing the enormous complexity of science textbooks, particularly in college-level biology, it gives students correct answers to their queries about the subject. Inquire provides quick and accurate responses that aid students in properly understanding and contrasting ideas, enhancing learning results. Inquire is an electronic textbook formatted with additional information and interactive features powered by cutting-edge AI technologies that

were created at Stanford University with funding from the Wallenberg Foundation. It promotes active reading by clarifying key terminology and posing thought-provoking queries. Students can investigate topics in-depth without being concerned about the veracity or relevancy of the information when using inquiry during homework and study sessions. It also provides clear responses and links to related stuff. The software aims to promote comprehension, encourage involvement in science education, and improve learning experiences.



# AI IN TRANSPORTATION

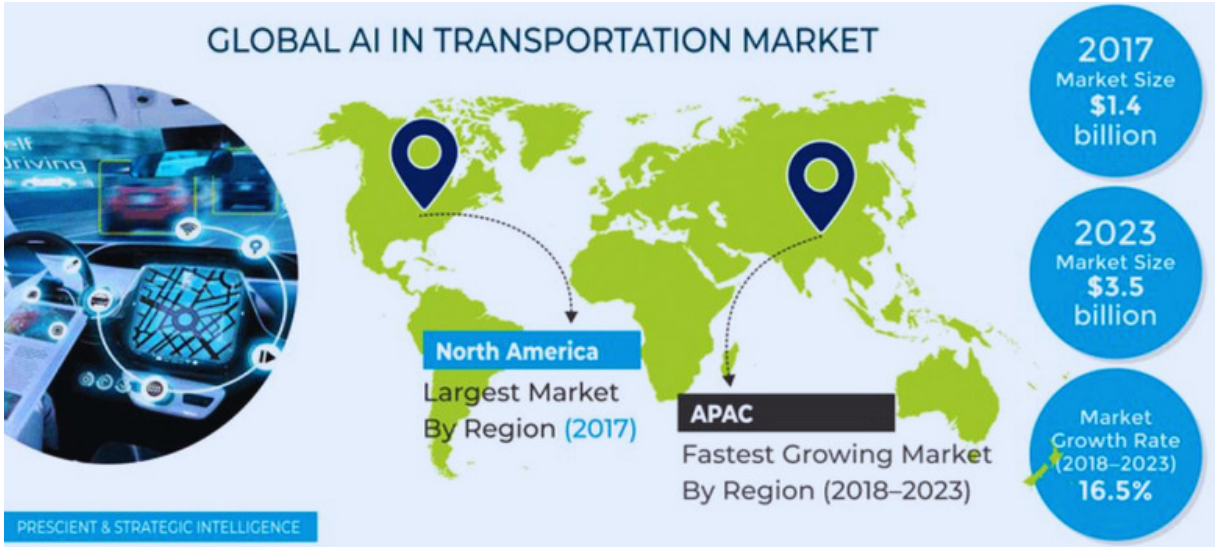
## INTRODUCTION

Transportation has played a crucial role in the progress of human civilization, evolving from primitive methods to advanced technologies. In the earliest days, people relied on walking and swimming to move from one place to another. The domestication of animals provided a new means of transport, allowing for heavier loads to be carried. Water routes were navigated using boats, a method employed since ancient times. However, it was the invention of the wheel around 3500 B.C. that truly revolutionised travel for humanity. This milestone ignited a desire to enhance transportation technology, seeking to make commuting as swift as possible. The introduction of steam engines in the 18th century facilitated faster train travel, while the late 19th century witnessed the birth of the automobile, which became widely accessible in the early 20th century. Finally, the advent of the aeroplane in the early 20th century completely transformed transportation, enabling people to traverse vast distances rapidly. Today, we enjoy the incredible ability to explore the world with ease, a stark contrast to the arduous and time-consuming voyages of the past.

As we look towards the future of transportation, one can envision a revolution driven by autonomous navigation systems. This is where AI technology comes into play.

AI, with its ability to replicate human intelligence, involves the development of algorithms and computer programs capable of tasks such as visual perception, speech recognition, decision making, and language translation. By integrating AI with physical components, we can create intelligent machines that possess the ability to work and think like humans. These intelligent machines have the potential to automate

manual labor, a concept that holds great significance in the transportation sector. In fact, the transportation industry has emerged as one of the leading consumers of AI technologies, with its market value projected to grow from $1.4 billion in 2017 to an estimated $3.87 billion by 2026, experiencing a compound annual growth rate (CAGR) of 15.8% between 2021 and 2026, according to Market Data Forecast.




The transportation sector is increasingly recognizing the benefits of automation, including improved passenger security, efficient traffic management, analysis of traffic flow, reduced carbon emissions, and minimized financial expenses. To achieve these advantages, various AI technologies are being integrated into the transportation industry. Some notable examples include Artificial Neural Networks (ANN), Computer Vision, Context Awareness, Deep Learning, and Natural Language Processing. These technologies offer immense potential for application within the transportation sector, paving the way for the next generation of Intelligent Transportation Systems. (ITS) In the subsequent sections of this report, we will explore these applications in detail, shedding light on how they can drive the evolution of transportation and shape the future of the industry.

There are enormous applications of AI in the transportation sector, which will be discussed further in this report.

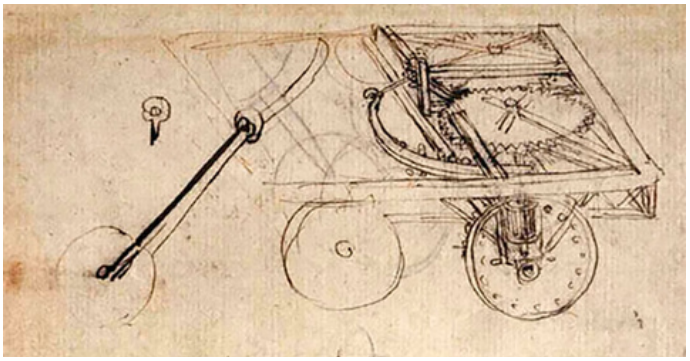
# APPLICATIONS OF AI IN TRANSPORTATION SECTOR

- **Autonomous Vehicles**

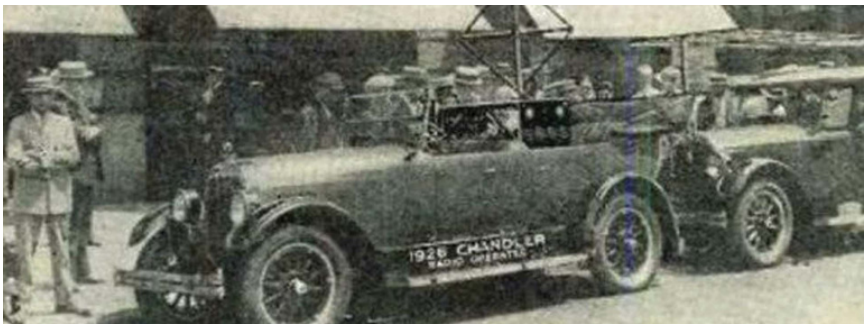
Evolution**:** The concept of autonomous vehicles dates back centuries, even before the invention of the very first car. In approximately 1478, Leonardo Da Vinci conceived a ground-breaking invention known as the Self-Propelled Cart, which is considered to be the precursor to modern automobiles. This cart, often hailed as the world's first robot, exhibited remarkable autonomy for its time. It operated using a spring motor, employing a simple yet highly effective mechanism.

The functionality of Da Vinci's cart revolved around the utilization of stored energy. To set the cart in motion, it had to be manually wound up. A coiled spring, intricately connected to the axle, served as the repository for stored mechanical energy. When the spring was tightly wound, it accumulated potential energy in the form of coiled tension, ready to be unleashed.

The cart incorporated a system of gears and pawls to harness the stored energy effectively. As the cart's spring unwound, the accumulated energy was released, causing the spring to rotate a gear that connected to the axle. This rotational movement was then transmitted through a series of gears, ultimately propelling the wheels of the cart forward. The inclusion of pawls in the mechanism ensured that the gears would not rotate in reverse, allowing the cart to move freely exclusively in the forward direction.

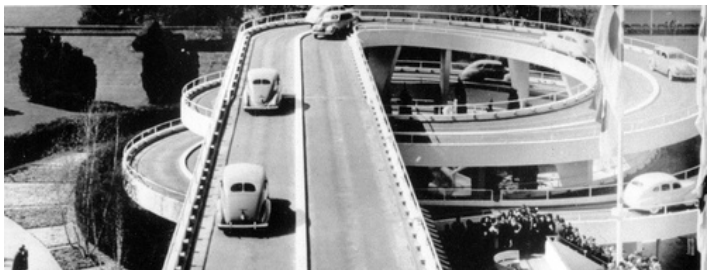


ignited a spark within the minds of scientists and engineers, motivating them to strive for a future where vehicles could operate without the need for human intervention behind the wheel.




At the 1939 New York World's Fair, General Motors showcased an exhibit known as "Futurama," which offered a glimpse into the future of transportation and urban planning. At the heart of this exhibit was a meticulously crafted miniature model of a city set in the year 1960, showcasing a vision of what the future held. However, the true showstopper of the exhibit was the prototype vehicle—a marvel of engineering that symbolized the concept of self-driving cars, capturing the imagination of fair attendees.

The prototype car showcased by General Motors utilized a unique method of guidance within the model city's streets. Beneath the roads of the miniature city, embedded electrical cables formed a network, generating an electromagnetic field that could be controlled via radio signals. The autonomous vehicle itself was equipped with specialized electrical sensors, designed to detect the electrical fields generated by the cables. These sensors captured signals and transmitted them to the car's steering system, enabling it to navigate along the desired route.



In 1961, as NASA researchers pondered the challenges of creating vehicles capable of autonomous exploration on the moon's surface, James L. Adams devised a remarkable invention known as "The Stanford Cart." Adams aimed to address the issue of controlling a motor vehicle using video information. The cart, equipped with four small bicycle wheels, featured electric motors powered by a car battery. Positioned atop the cart was a fixed-view television camera, serving as the eyes of the autonomous vehicle.

To facilitate control and monitoring, the cart was connected to a control console through an extensive cable. The control console boasted a television display that relayed the camera's video feed, along with steering and speed controls. The initial version of the Stanford Cart faced a significant challenge with a 2.6-second delay in radio communications between the operator on Earth and the cart stationed on the Moon. To overcome this challenge, the researchers implemented a predictive system that provided operators with information about the cart's expected position when executing the next command. This enhancement allowed for smoother and more efficient operation despite the communication delay. Subsequently, the Stanford Cart underwent a transformation and was repurposed as a research vehicle for visual navigation. Equipped with a single black and white camera operating at a frame rate of 1-Hz, the robot became a valuable platform for studying and developing visual navigation techniques. In its final form, the cart was equipped with 3D vision capabilities.

Through programming, the cart was taught to autonomously detect a white line on the ground, utilizing the information captured by the embedded camera. By following this line, the cart adhered to a predefined route, showcasing its ability to navigate without human intervention. The cart would take 10 to 15 minutes to do image processing and route planning of one meter. A significant milestone for the Stanford Cart occurred in 1979 when it successfully traversed a room filled with chairs, achieving this feat in approximately five hours.

In 1977, Sadayuki Tsugawa's team from the Mechanical Engineering Laboratory in Tsukuba, Japan, unveiled the world's first visually guided autonomous vehicle, capable of traveling at a speed of 20 miles per hour. The car was equipped with two cameras strategically positioned to capture images of the guide rails on the road. The captured images were then subjected to real-time processing using a processing system that employed advanced algorithms to extract relevant information from the images. It analysed the positions and orientation of guide rails enabling vehicle to determine its own position relative to the road and guide itself accordingly. By continuously analysing visual data, the car could accurately track the guide rails, ensuring it stayed on the desired path. This showcased the potential of computer vision and onboard processing systems as essential components in the creation of autonomous vehicles.

Carnegie Mellon University (CMU) started working on the seld-driving cars since the early 1980s. In 1983, they developed their first autonomous vehicle called the Terragator. The Terragator was a six-wheeled skid-steered robot specifically designed for outdoor visual experimentation. Equipped with multiple cameras and a laser scanner, it utilized the pure pursuit algorithm to calculate the necessary arc to regain its path.

Building upon their initial success, CMU's Robotics Institute launched the Navlab project in 1984. This ambitious endeavor aimed to create more advanced autonomous cars by leveraging computer vision and machine learning algorithms. In 1986, they introduced Navlab 1, a vehicle constructed from a Chevrolet panel van. This setup consisted of five racks of computer hardware, including a Warp supercomputer, as well as cameras and a laser scanner for navigation. The total cost of this configuration was estimated at $1 million. Navlab 1 achieved a significant milestone, demonstrating autonomous driving capabilities at speeds of up to 20 mph.

Continuing their pioneering work, CMU unveiled Navlab 2 in 1990. This iteration utilized a US Army High Mobility Multipurpose Wheeled Vehicle (HMMWV) and incorporated all the sensors present in Navlab 1, along with additional cameras. Notably, Navlab 2 showcased the ability to traverse both on-road and off-road terrains, reaching impressive speeds of up to 70 mph on highways.

In 1995, CMU introduced Navlab 5, which utilized a Pontiac Trans Sport minivan as its base vehicle. Navlab 5 implemented a neural network system called ALVINN, which learned how to drive on city streets. Carnegie Mellon researchers took their self-driving car, called NavLab 5, to the road, traveling 2,797 miles from Pittsburgh to San Diego.They controlled the speed and braking, but the car was otherwise autonomous. In recognition of its contributions to the field of robotics, Navlab 5 was inducted into the Robot Hall of Fame in 2007, solidifying CMU's significant impact in autonomous vehicle research and development.

the 23 finalists surpassed the 11.78 km mark, and five vehicles completed the 212 km course, with the Stanford Racing Team emerging as the winners. The 2007 Urban Challenge simulated a 60-mile urban environment to be completed in under 6 hours. Six cars finished the route, and the CMU Racing Team's vehicle, Boss (a modified Chevy Tahoe), claimed victory.


In mid-2010, major car manufacturers such as Ford, Mercedes-Benz, BMW, and the renowned ride-sharing company Uber, became interested in working with self-driving technology.
One of the pioneers of the industry was Google, which announced its self-driving car project in 2010 and started testing its vehicles on public roads in California and Nevada. Google later spun off its project into a separate company called Waymo in 2016, which is widely regarded as the leader in autonomous driving technology. Waymo offers a robo-taxi service called Waymo One in Phoenix, Arizona, and has partnerships with automakers like Fiat Chrysler, Jaguar Land Rover, and Volvo12.


Another influential player in the industry was Tesla, which introduced its Autopilot system in 2013, which enabled semi-autonomous driving on highways and parking lots.

Tesla also offers a more advanced feature called Full Self-Driving (FSD), which enables features like lane changing, traffic light recognition, and automatic parking. Tesla claims that its vehicles have the hardware and software capabilities to achieve full autonomy in the future. Uber, which launched its self-driving car service in Pittsburgh, Pennsylvania, in 2016 and later expanded to other cities. Uber also acquired Otto, a startup that developed self-driving trucks, in 2016. However, Uber faced many challenges and setbacks in its self-driving car efforts, such as a lawsuit from Waymo (Google's self-driving car company) over alleged trade secret theft, a fatal crash in Arizona that killed a pedestrian in 2018, and regulatory hurdles and public skepticism over the safety and reliability of its technology. In December 2020, Uber announced that it was selling its ATG at $4 Billion Valuation to Aurora Innovation, a San Francisco-based startup which is focused on developing self-driving technology for trucks. As part of the deal, Uber invested $400 million in Aurora and eventually Aurora will deploy its self-driving cars on Uber's ride-hailing platform.

General Motors (GM), which acquired Cruise Automation, a startup that develops self-driving software, in 2016 for $1 billion. Cruise operates a fleet of self-driving Chevrolet Bolt EVs in San Francisco and plans to launch a robo-taxi service soon. Cruise has also received investments from Honda, SoftBank, Microsoft, and Walmart.

Ford, which partnered with Argo AI, a startup that develops self-driving software, in 2017 and invested $1 billion in the company. Argo AI operates a fleet of self-driving Ford Fusion Hybrid sedans in six US cities and plans to launch a robo-taxi service with Lyft in 2022. Argo AI has also received investments from Volkswagen and Baidu.

Audi, which became the first automaker to receive a license to test autonomous vehicles in New York state in 2015. Audi also launched its Traffic Jam Pilot system in 2017, which enabled conditional automation on highways. Audi has also partnered with Huawei and Mobileye to develop self-driving technology.

Mercedes-Benz, which unveiled its Future Truck 2025 concept in 2014, which demonstrated autonomous driving capabilities for trucks. Mercedes-Benz also launched its Drive Pilot system in 2016, which enabled conditional automation on highways. Mercedes-Benz has also partnered with Bosch and Nvidia to develop self-driving technology.

Nvidia, which is a leading chipmaker that provides the hardware and software platforms for autonomous driving. Nvidia's Drive platform is used by more than 370 companies, including automakers like Toyota, Mercedes-Benz, Audi, Volvo, and Hyundai; tech companies like Uber, Zoox, and Nuro and suppliers like Bosch, Continental, and ZF. Nvidia's Drive platform enables features like perception, mapping, planning, and simulation for autonomous vehicle.

Apple, which has been working on its secretive self-driving car project called Project Titan since 2014. Apple has been testing its vehicles on public roads in California since 2017 and has reportedly been developing its own battery technology and lidar sensors for its vehicles.

Amazon, which has been investing in and acquiring various companies related to autonomous driving technology. Amazon acquired Zoox, a startup that develops self-driving robo-taxis, in 2020 for $1.2 billion. Amazon also acquired Canvas Technology, a startup that develops self-driving warehouse robots, in 2019. Amazon also invested in Aurora Innovation and Rivian, an electric vehicle maker that develops self-driving technology.

The Autonomous Vehicle industry is currently experiencing an exhilarating phase, fueled by the widespread integration of AI into everyday life and the substantial investments made by companies to automate processes and enhance cost-efficiency. There is a palpable buzz in the market surrounding AI-powered products, as people are beginning to recognize that AI's potential extends beyond automating repetitive tasks, but also holds the power to optimize processes, enhance safety, and provide overall better experiences.

# TECHNOLOGY BEHIND AUTONOMOUS VEHICLES

Creating an autonomous car involves the integration of various technologies to enable it to perceive its environment, make decisions, and navigate safely. If we are talking about creating a Level 4 or 5 Autonomous car, some of the technologies and steps in which they will work are given below:

**1. Perceiving the surroundings**

Sensors: Autonomous cars rely on a variety of sensors to gather information about their surroundings. Sensors play a major role in decision making activity of autonomous vehicles.

a) **LiDAR** (Light Detection and Ranging): LiDAR sensors emit laser beams and measure the time it takes for the light to bounce back after hitting objects. This data creates a 3D point cloud, providing precise depth and distance information. LiDAR is used by companies like Waymo and Cruise to build detailed maps and detect objects.

b) **Radar** (Radio Detection and Ranging): Radar sensors use radio waves to detect objects and measure their distance and speed. They are particularly useful in adverse weather conditions. Radar technology is commonly employed by many autonomous car manufacturers, including Tesla.

c) **Cameras**: Cameras capture visual data and are essential for computer vision systems. They provide information about lane markings, traffic signs, pedestrians, and other vehicles. Companies like Tesla heavily rely on camera-based systems for perception.

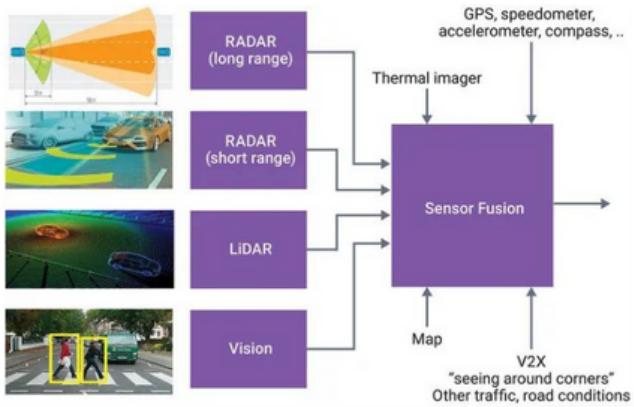
d) **Ultrasonic Sensors**: Ultrasonic sensors use sound waves to detect objects in close proximity to the vehicle. They are commonly used for parking assistance and low-speed maneuvering.

Different sensors have different advantages and disadvantages in terms of cost, accuracy, range, resolution, etc. Therefore, most autonomous vehicles use a combination of different sensors to achieve a better performance.

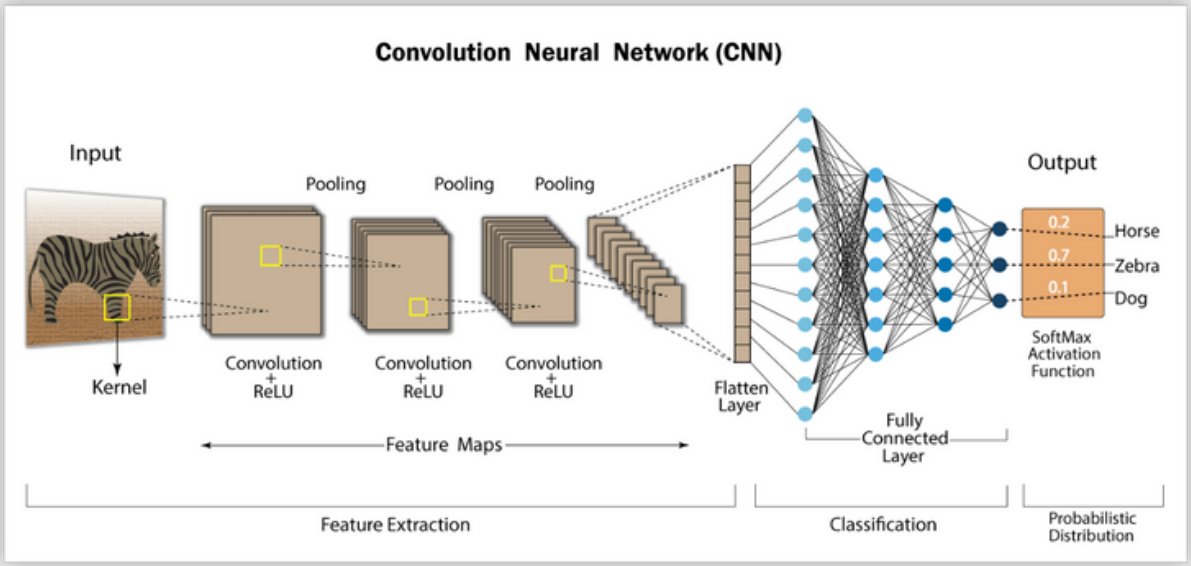
Table 4: Common comparison among sensor. " ✓ " sensors operate completely under specific conditions,"--" sensors performs reasonably well under specific conditions,"×" sensors does not operate well under the specific factor relative to other sensors.

| Factors | Camera | LiDAR | RADAR | Fusion |
|---|---|---|---|---|
| Range | -- | -- | ✓ | ✓ |
| Resolution | ✓ | -- | × | |
| Distance Accuracy | -- | ✓ | ✓ | ✓ |
| Velocity | -- | × | ✓ | ✓ |
| Color Perception, e.g Traffic lights | ✓ | × | × | ✓ |
| Object Detection | × | ✓ | ✓ | ✓ |
| Object Classification | ✓ | × | × | ✓ |
| Lane Detection | ✓ | × | × | ✓ |
| Obstacle Edge Detection | ✓ | ✓ | × | ✓ |
| Illuminations Conditions | × | ✓ | ✓ | ✓ |
| Weather Conditions | × | -- | ✓ | ✓ |

**Pre-processing through Sensor Fusion**: The sensor data, including images, radar readings, and LiDAR point clouds, undergo pre-processing. Sensor fusion pre-processes the raw data and then combines the pre-processed data from different sensors into one. Sensor fusion is the process of using computer technology to automatically combine and analyse data from multiple sensors or sources to create a more accurate model or image of the environment or object. Sensor fusion can use various methods and algorithms, such as Kalman filter, Bayesian network, convolutional neural network, Gaussian process, etc. Sensor fusion provides the input data for object detection systems, which are responsible for finding and localizing the objects of interest in the vehicle's vicinity.



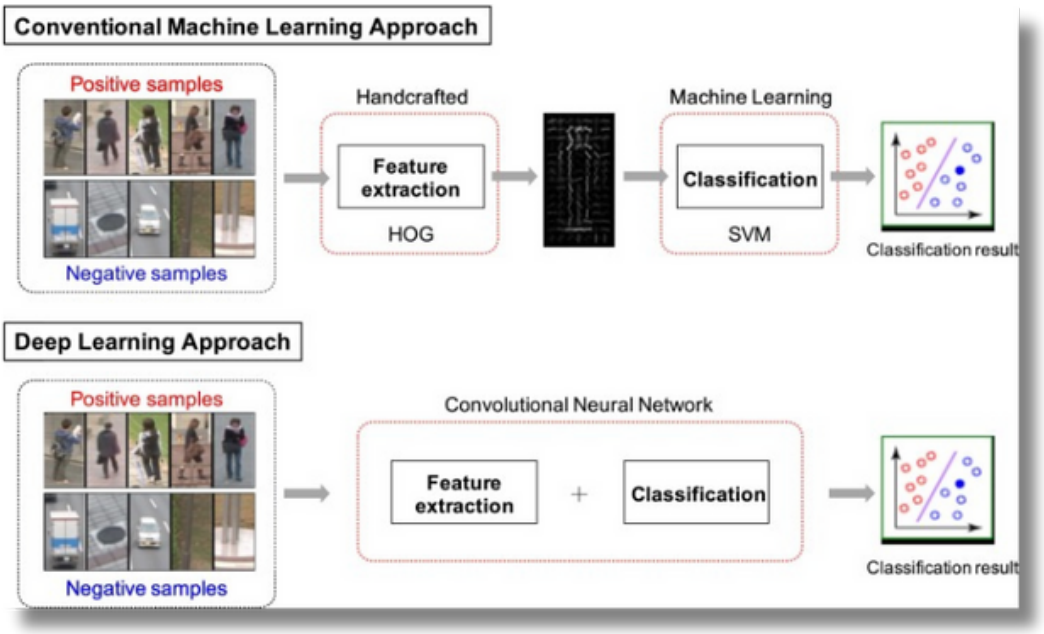
**Object Detection System**: The pre-processed sensor data is fed into the object detection system, typically powered by AI algorithms such as convolutional neural networks (CNNs). An object detection system can perform both object recognition and image classification tasks. Object recognition is the task of finding and localizing the objects of interest in an image or video frame. Image classification is the task of assigning a label or category to an image or a region of an image. An object detection system uses artificial intelligence techniques, such as deep learning algorithms and neural networks, to detect and identify objects in images or videos. Deep learning algorithms are used to analyse the sensor data and make sense of it. By training the algorithms on vast amounts of data, the autonomous car can learn to recognize objects, understand traffic patterns, interpret road signs, and make decisions based on its understanding of the environment. Some examples of deep learning algorithms are: YOLO, SSD, Faster R-CNN, Mask R-CNN, GANs, etc.




**2. Analysing Pre-processed Data to identify object**

**Features Extraction**: The object detection system extracts features from the sensor data to characterize the detected objects. Features extraction is the process of mapping the image pixels into a feature space that represents the characteristics of the objects, such as color, shape, texture, edges, etc. Features can be extracted using traditional methods like SIFT2,

HOG3, LBP3, or using deep learning methods like convolutional neural networks (CNNs).
Object Classification: After extracting features, the AI algorithms classify the detected objects into predefined categories. To perform object classification, autonomous cars typically employ machine learning techniques, particularly deep learning approaches such as convolutional neural networks (CNNs). These algorithms are trained on large datasets containing labelled examples of different objects to learn patterns, features, and characteristics that distinguish one object class from another.




**Localization**: Localization is the process of determining the position and size of each object in the image or video. This can be done using bounding boxes, which are rectangular regions that enclose the objects, or using segmentation masks, which are pixel-level regions that outline the objects1. Localization can be done using two-stage detectors or one-stage detectors. Two-stage detectors first extract regions of interest (RoIs) from the image using methods like selective search, region proposal network (RPN), etc., and then classify and regress the RoIs using methods like R-CNN, Fast R-CNN, Faster R-CNN, Mask R-CNN, etc. One-stage detectors directly predict the class and location of each object using methods like YOLO, SSD, RetinaNet, etc.

### 3. Object Tracking

Once objects are initially detected or identified, object tracking algorithms are applied to track their movement and maintain their identity across consecutive frames or sensor data samples. Object tracking is the process of estimating or predicting the position and motion of one or more objects across multiple frames in a video. Object Tracking is essential for decision-making and planning tasks, such as predicting the trajectory of other vehicles, anticipating pedestrian movement, maintaining safe distances, and performing maneuvers accordingly.

a. **Object Initialization**: After an object is detected or identified in an initial frame, it is assigned a unique identifier or track ID. The object's initial state, including its position, size, and other attributes, is initialized.
b. **Motion Estimation**: Object tracking algorithms estimate the motion or movement of the object between consecutive frames. Various techniques, such as optical flow analysis, Kalman filters, or particle filters, are used to predict the object's new position based on its previous state and the observed motion in the sensor data.

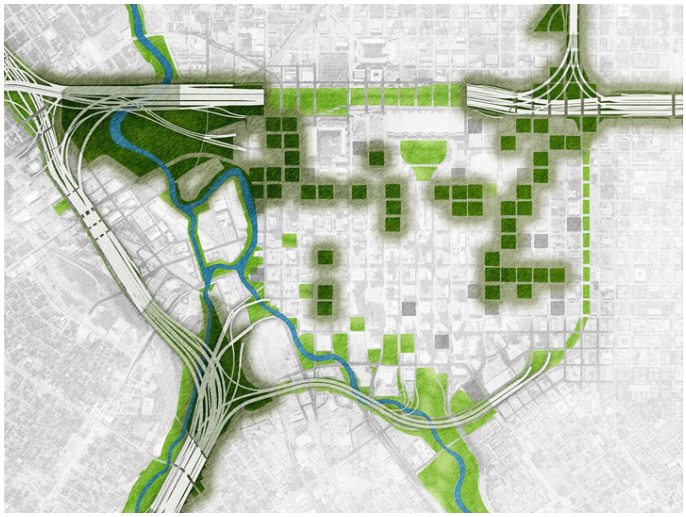
c. **Data Association**: To maintain the object's identity over time, data association techniques are applied to associate the detected objects in the current frame with the existing tracks from previous frames. This involves matching the characteristics, such as appearance, location, or motion, of the detected objects with the corresponding tracks.

d. **Track Update**: The estimated state of each track is updated with the new measurements from the current frame. This includes updating the object's position, size, velocity, orientation, and other relevant attributes.

e. **Track Maintenance**: Object tracks are maintained by managing their lifecycle throughout the tracking process. This includes handling scenarios where objects may be temporarily occluded, leave the field of view, or reappear after a period of absence. Track maintenance algorithms ensure the continuity and robustness of the object tracks. Track maintenance also involves assigning a confidence score to each track based on its detection history and motion consistency. Tracks with low confidence scores may be deleted or re-initialized. Conversely, tracks with high confidence scores may be confirmed or extended if

can make informed decisions and navigate safely and efficiently.
they can be associated with consistent detections for a certain number of frames.
f. **Track Termination**: Object tracks may be terminated or removed if the corresponding object is no longer present or if it cannot be reliably tracked. This can occur when objects exit the scene, are obstructed for an extended period, or exhibit unpredictable motion.

**Environmental Mapping**: Environmental mapping is the process of creating a representation of the static and dynamic elements in the surroundings of a vehicle or a robot. After object tracking, environmental mapping can help the vehicle to understand its location, plan its path, and avoid collisions with obstacles. By creating a high-resolution map of the environment, the vehicle



There are different methods and techniques for environmental mapping after object tracking, depending on the type of sensors, algorithms, and applications.

a. **LiDAR-based mapping**: LiDAR is a sensor that emits laser beams and measures the distance and angle of the reflected signals. LiDAR can provide high-resolution and accurate 3D point clouds of the environment.
b. **SLAM stands for simultaneous localization and mapping**. It is a technique that estimates the pose (position and orientation) of a

vehicle or a robot and builds a map of the environment at the same time. SLAM-based mapping can also incorporate object tracking to detect and track moving objects in the environment and update the map accordingly.

The autonomous car's decision-making system utilizes the information from object detection and movement to make informed decisions. This can include determining the vehicle's own trajectory, planning lane changes, maintaining safe distances from other objects, and responding to traffic conditions and road rules. The decision-making system can use different methods, such as:

a) **Rule-based decision-making**: This method uses a set of predefined rules or policies to determine the driving behaviour according to the driving scenario and the traffic rules. For example, it can use a hierarchical state machine framework to classify the scenario, decide the optimal behaviour, and plan the trajectory.

b)**Learning-based decision-making**: This method uses machine learning or deep learning techniques to learn a driving behaviour model from data and experience. For example, it can use reinforcement learning to learn a driving policy that maximizes a reward function based on safety, efficiency, comfort, etc.

The **hierarchical state machine framework** is certainly a popular and effective method for rule-based decision-making, as it can organize the decision-making process into different levels of abstraction and handle complex and dynamic situations. Each level is composed of a finite state machine (FSM), which is a model of computation that has a set of states and transitions between them based on some inputs and outputs.

The idea is to divide the decision-making process into three layers: the upper layer, the middle layer, and the lower layer.

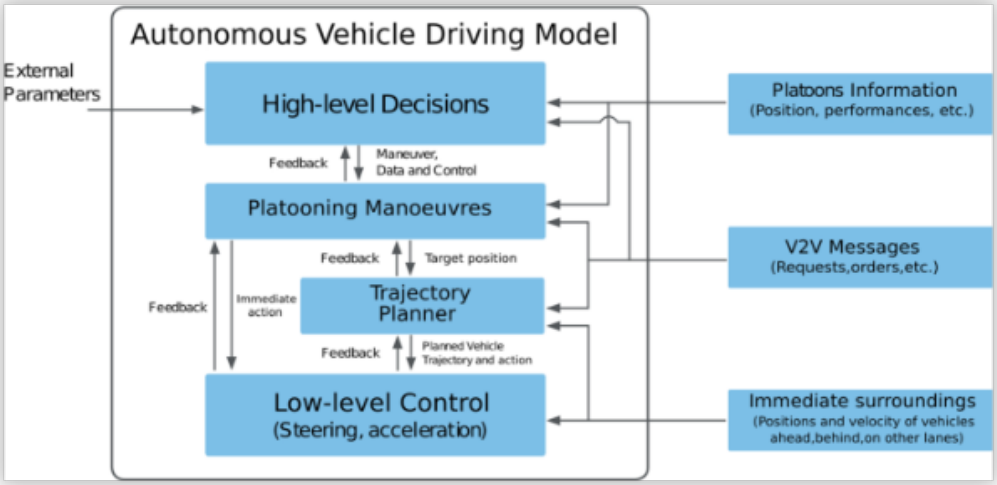
**a.** The upper layer is the one that identifies the current driving scenario and selects the appropriate substate for the vehicle. For example, if the vehicle is driving on a highway with multiple lanes and vehicles, the upper layer can classify the scenario into one of 30 subscenes, such as “left lane change”, “right lane change”, “overtake”, “merge”, “follow”,

etc. The upper layer can also decide whether to join or form a platoon with other vehicles, which is a group of vehicles that drive closely together to reduce air drag and fuel
consumption.

**b.** The middle layer is the one that evaluates the optimal driving behaviour for the vehicle based on some criteria, such as energy efficiency, safety, and lane vacancy rate. For example, if the vehicle wants to overtake a slower vehicle in front of it, the middle layer can calculate the energy efficiency value of different behaviours, such as accelerating, decelerating, changing lanes, etc., and choose the one that maximizes the value. The middle layer
can also coordinate with other vehicles in a platoon to maintain a safe distance and speed.

**c.** The lower layer is the one that generates the state transition matrix and predicts the optimal pass way for the vehicle in the region. For example, if the vehicle wants to change lanes, the lower layer can construct a matrix that represents the possible states and transitions of the vehicle and its surrounding vehicles in each cell of a grid-based map. The lower layer can then use this matrix to find the best path for the vehicle to reach its target lane. The lower layer can also send simple commands to the low-level control module, which consists of controllers for lateral and longitudinal movements of the vehicle.

Summarizing, the upper layer defines the possible decisions and the middle layer evaluates the best decision. The lower layer then executes the best decision by generating and following the optimal path.



**State Estimation System**: The state estimation system uses the measurements from the sensors such as GPS, IMU, lidar, camera, and radar to improve its state estimates such as its position, orientation, speed, acceleration, and behaviour, and also uses its state estimates to filter out noisy or spurious measurements from the sensors. The state estimation system and the sensors work together to provide reliable and accurate information for the decision-making system. The state estimation system and the decision-making system are complementary components of an autonomous vehicle. The state estimation system provides the input for the decision-making system, which uses the state estimates to plan the optimal actions for the vehicle.

The process of state estimation in an autonomous vehicle can be summarized in the following steps:
**a)** The vehicle collects measurements from its sensors, such as GPS, IMU, lidar, camera, and radar, which provide information about its position, orientation, speed, acceleration, and the surrounding environment. This is the actual current state according to the sensors.
**b)** The vehicle uses a mathematical model of its dynamics and kinematics to predict its state based on its previous state and input. This is the estimated current state of the vehicle on the basis of its previous state and input. This prediction is called the prior state estimate, an initial guess.
**c)** The vehicle compares the prior state estimate with the measurements and calculates the error or the difference between them. This error is used to correct the prior state estimate and obtain a more accurate estimate. This correction is called the posterior state estimate.
**d)** The vehicle uses the posterior state estimate as its current state and repeats the process for the next time step.
All in all, the state estimation system is to refine the actual current estimate of the vehicle and its environment.

**Control System**: The control system of an autonomous vehicle is the system that executes the actions planned by the decision making system and

controls the physical components of the vehicle, such as the steering wheel, the throttle, the brake, and the gear. The control system of an autonomous vehicle can be explained in the following steps:

**1.** The control system receives the desired state and trajectory from the decision making system, which are based on the state estimates from the state estimation system and other criteria, such as goals, constraints, and preferences.

**2.** The control system uses a mathematical model of the vehicle dynamics and kinematics to calculate the required inputs or commands for the vehicle components to achieve or maintain the desired state and trajectory. The
control system also considers the physical limitations and uncertainties of the vehicle components and the environment.

**3.** The control system sends the commands to the actuators or motors that control the vehicle components, such as steering angle, throttle position, brake pressure, and gear ratio. The control system also monitors the feedback signals from the sensors or encoders that measure the actual state and performance of the vehicle components.

**4.** The control system compares the actual state and performance of the vehicle components with the desired state and trajectory and calculates the error or deviation between them. This error is used to adjust or update the commands for the vehicle components to reduce or eliminate the error. The control system also detects and isolates faults or failures in the vehicle components or sensors and takes corrective actions or alerts the driver.

**Feedback and correction mechanism of the control system:** It means that the control system constantly checks if the vehicle is doing what it is supposed to do and corrects any errors or deviations from the desired state and trajectory. For example, if the control system commands the vehicle to steer to the left by 10 degrees, but the actual steering angle is only 8 degrees due to some disturbance or noise, the control system will detect this error and send a new command to increase the steering angle to 10 degrees. The control system will also monitor the sensors and actuators of the vehicle and detect any faults or failures that might affect the performance or safety of the vehicle.

For example, if the control system detects that the brake pressure sensor is malfunctioning or giving wrong readings, it will either try to fix the problem or alert the driver to take over. The control system uses feedback and correction to ensure that the vehicle follows the desired state and trajectory as accurately and reliably as possible.These steps of motion are performed continuously by the autonomous vehicle to ensure its smooth and safe navigation to the destination.

Now that we have discussed the evolution of autonomous vehicles from the past to the present and the underlying technology, the question that arises is: what does the future hold for these vehicles? Will we see them on the roads within the next three years, five years, a decade, or even further down the line? Before we speculate about the future of autonomous vehicles, it is important to note that there are already some autonomous vehicles being tested on the roads. While they are not commercially available yet, they exhibit various levels of automation. Before delving into the future, let us examine the levels of automation in these vehicles and the concepts of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications.

## FUTURE OF AUTONOMOUS VEHICLE INDUSTRY

**Levels of Autonomy**

The levels of autonomy in autonomous cars are defined by the Society of Automotive Engineers (SAE) International, which is a standards organization for the automotive industry. The SAE has published a report on “Taxonomies and Definitions” regarding automated driving systems, which describes six levels of driving automation ranging from 0 (fully manual) to 5 (fully autonomous). The levels are:

- **Level 0**: No Driving Automation. The human driver performs all aspects of the driving task, such as steering, accelerating, braking, and monitoring the environment. The vehicle may have some driver assistance systems, such as cruise control or emergency braking, but they do not control the vehicle or drive it.
- **Level 1**: Driver Assistance. The vehicle has a single automated system that can assist the human driver with either steering or accelerating/decelerating, but not both. The human driver must

- monitor the environment and perform the rest of the driving task. An example of Level 1 is adaptive cruise control, which can adjust the vehicle speed to maintain a safe distance from the vehicle ahead.
- **Level 2**: Partial Driving Automation. The vehicle has multiple automated systems that can assist the human driver with both steering and accelerating/decelerating. The human driver must still monitor the environment and be ready to take over control at any time. An example of Level 2 is Tesla Autopilot, which can keep the vehicle in its lane and adjust its speed according to traffic conditions.
- **Level 3**: Conditional Driving Automation. The vehicle can perform all aspects of the driving task under certain conditions, such as on highways or in traffic jams. The human driver does not need to monitor the environment or intervene, but must be ready to resume control when the vehicle requests it or when the conditions change. An example of Level 3 is Audi Traffic Jam Pilot, which can drive the vehicle autonomously at low speeds on congested roads.
- **Level 4**: High Driving Automation. The vehicle can perform all aspects of the driving task under certain conditions and areas, such as on specific roads or in specific zones. The human driver does not need to monitor the environment or intervene, and may even be able to sleep or leave the driver's seat. However, the vehicle may not be able to handle all situations or scenarios, and may require human intervention in some cases. An example of Level 4 is Waymo One robotaxi, which can drive passengers autonomously in a predefined area without a safety driver.
- **Level 5**: Full Driving Automation. The vehicle can perform all aspects of the driving task under all conditions and areas, without any human intervention or supervision. The vehicle can handle any situation or scenario that a human driver can handle. The vehicle does not need a steering wheel, pedals, or any other controls for human use. An example of Level 5 is a hypothetical fully autonomous car that can drive anywhere and anytime without any limitations.

Currently, there are no commercially available vehicles that offer Level 3 or higher autonomy. Most vehicles on the road today are either Level 0 or Level 1, with some offering Level 2 features such as Tesla autopilot, GM Super Cruise, Nissan ProPilot, Volvo Pilot Assist, Audi Traffic Jam

Assist etc.

Some companies are testing and developing vehicles with Level 3 or Level 4 capabilities, but they face many technical, regulatory, and social challenges before they can be widely deployed and adopted. Some examples of Level 3 systems are Audi Traffic Jam Pilot and Honda Legend. Level 3 cars are already available in some markets, such as Japan and Europe, but not yet in the U.S., due to regulatory and legal challenges. Level 3 cars may become more widely available in the next few years, as more automakers develop and test their systems and seek approval from authorities. Level 4 systems such as Waymo One robotaxi and GM Cruise Origin. Level 4 cars are still in the testing and development stage, and are not yet commercially available for mass production or public use. Level 4 cars may become available in the next few years, as more companies launch their pilot projects and services in selected areas and markets.

Level 5 systems are hypothetical fully autonomous cars that can drive anywhere and anytime without any limitations. Level 5 cars are still far from reality, and may not be achievable in the near future. Level 5 cars may require significant breakthroughs in technology, infrastructure, regulation, and social acceptance before they can become feasible and viable.
The future of autonomous cars not only relies on widespread adoption by the public but also necessitates a robust infrastructure capable of seamless communication with these vehicles.
V2V and V2I communication are expected to play a key role in the future of autonomous cars, as they can enable cooperative driving and intelligent transportation systems. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication are the wireless exchange of data between vehicles and road infrastructure, such as traffic lights, signs, cameras, sensors, and so on. V2V and V2I communication are part of the broader concept of vehicle-to-everything (V2X) communication, which also includes vehicle-to-pedestrian (V2P), vehicle-to-network (V2N), and vehicle-to-grid (V2G) communication. V2V and V2I communication can allow vehicles to coordinate their actions and movements with each other and with the infrastructure, such as platooning, lane changing, merging, intersection crossing, and so on.

There are several benefits associated with vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications in the context of autonomous vehicles.

- Improved Safety: V2V and V2I technologies enable vehicles to communicate with each other and with the surrounding infrastructure. This real-time exchange of information helps in detecting potential hazards, such as accidents, road obstacles, or sudden changes in traffic conditions. By sharing this information, vehicles can take proactive measures to avoid accidents and enhance overall road safety.
- Traffic Efficiency: V2V and V2I communications facilitate better traffic management and flow. Vehicles can exchange data about their location, speed, and intended movements, allowing them to optimise their routes and avoid congested areas. Additionally, traffic signals and infrastructure can provide real-time information to vehicles, helping them adjust their speed and timing to minimise traffic congestion.
- Enhanced Navigation: By integrating V2V and V2I capabilities, autonomous vehicles can receive real-time updates on traffic conditions, road closures, and alternative routes. This information assists in more accurate and efficient navigation, reducing travel time and enhancing the overall driving experience.
- Improved Energy Efficiency: V2V and V2I communications enable vehicles to operate in a coordinated manner. By sharing information about speed, acceleration, and road conditions, vehicles can optimise their driving patterns to minimise fuel consumption and reduce emissions. This collaborative approach contributes to improved energy efficiency and environmental sustainability.
- Emergency Services and Road Assistance: V2V and V2I technologies can greatly assist in emergency situations. Vehicles can transmit distress signals or alert nearby emergency services about accidents or other critical incidents. Additionally, roadside infrastructure can provide assistance and guidance to vehicles in need, such as offering alternate routes or notifying towing services.

# AI In Finance

## HOW IS AI POWERING THE FUTURE OF FINANCIAL SERVICES

In a recent survey conducted by NVIDIA, it was found that 83% of financial services professionals believe that AI plays a crucial role in ensuring the future success of their companies. According to the survey titled 'State of AI in Financial Services,' a significant financial impact of AI on enterprises was revealed. Out of the respondents, 34% agreed that AI has the potential to boost their company's annual revenue by a minimum of 20%. These numbers are enough to say that professionals in the financial services industry have a strong belief in AI's immense potential. AI-powered solutions are being utilised by financial institutions to capitalise on revenue growth opportunities, reduce operating expenses, and streamline labor-intensive processes. The utilisation of AI varied depending on the type of financial institution. Traders are using AI to accelerate algorithmic trading and backtesting while identifying potential risks and mitigating them effectively. Talking about fintechs and optimisation. This shows a investment firms, the most cited AI applications were fraud detection, algorithmic trading, and portfolio primary focus on protecting and maximising client returns. On the other hand, banks and other financial institutions highlighted fraud detection, recommender systems, and sales and marketing optimization as the primary areas where they employ AI technology. Consumer banks prioritise not only the prevention and detection of fraud but also leverage AI-enabled applications to enhance customer acquisition, retention, and the promotion of personalised products and services through cross-selling and up-selling strategies. In the subsequent sections, we will delve deeper into each of these areas and explore how AI can revolutionise and optimise various aspects of financial services.

# CASES OF AI IN THE FINANCE INDUSTRY

**1. Personalised Banking Experience**

AI is playing a significant role in personalised banking, revolutionising the way financial institutions cater to individual customer needs and preferences. By leveraging customer data and their needs, AI algorithms can certainly analyse patterns, behaviours, and preferences to provide personalised recommendations and offerings.

One of the key ways AI enables personalised banking is through customer segmentation. By clustering customers based on their financial habits, demographics, and preferences, AI algorithms can create distinct customer profiles. This allows banks to understand their customers on a deeper level and offer personalised services, products, and experiences. For example, AI can identify customers who are likely to be interested in specific investment opportunities or loan refinancing options and provide targeted recommendations.

AI also enables personalised customer interactions through chatbots and virtual assistants. These AI-powered interfaces can engage in natural language conversations with customers, understanding their queries and providing personalised responses in real time. This enhances customer service and creates a more seamless and personalised banking experience.

Leading banks like DBS and Royal Bank of Canada (RBC) have already embraced AI-powered tools to enhance their services. RBC, for instance, has introduced a platform named NOMI that enables customers to automate savings and efficiently manage their monthly budgets. This platform boasts an impressive user base of **1.5 million active users**, with **53%** of them perceiving it as a transformative solution for their financial management.

Therefore, It is very clear that the banking experience will become more quick and personalised with AI coming into the picture and the scope and impact AI possess is huge in this particular domain.

**2. Credit Scoring**

AI is revolutionising the traditional credit scoring process, offering new possibilities for more accurate and inclusive assessments. By leveraging machine learning algorithms and vast amounts of data, AI can provide a more comprehensive evaluation of an individual's creditworthiness.

According to Forbes, a significant majority of financial companies, specifically 70%, are leveraging machine learning techniques to predict cash flow occurrences and make necessary adjustments to credit scores.

AI is being utilised to enhance credit systems by creating a platform where lenders can accurately assess a borrower's risk, irrespective of their social-demographic circumstances. AI can also consider other real-time indicators that aren't considered in a typical credit score, such as whether the borrower spends their money on necessities or luxuries, their current income level, employment opportunities, and even potential to earn.

So AI has a lot more potential and can fully replace traditional credit scoring systems primarily because of their standardisation and lack of sensitivity to individual disparities and nuances.

3. **Fraud Detection and Risk Management**

AI applications can recognize abnormal transactions, and identify suspicious and potentially fraudulent activities by analysing massive amounts of data quickly within a few seconds. This gives an edge to firms and helps them protect against losses and increase ROI for their customers.

As time progresses, machine learning and automation techniques continue to advance in their ability to effectively prevent various types of cyber attacks. AI models employed in the banking industry are trained to identify and reject potentially fraudulent transactions or highlight them for additional scrutiny. Furthermore, these models can predict the probability of fraud, enabling human investigators to concentrate their attention on a limited number of suspicious transactions that necessitate manual intervention. Machine learning techniques are utilised in behavioral analytics to thoroughly examine and anticipate behavior patterns across various elements of a transaction.

Let's consider an example of JP Morgan Chase. Previously, the bank had a team of lawyers and loan officers dedicated to handling routine tasks

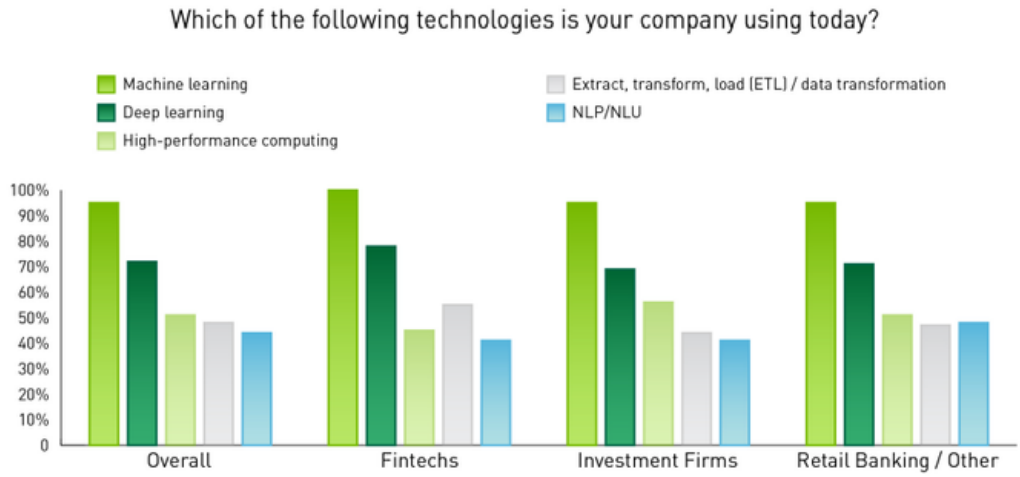
and reviewing compliance agreements, which consumed approximately 360,000 hours annually. However, through the implementation of an ML-powered program, the bank accomplished the processing of 12,000 agreements within a matter of seconds. These figures undeniably demonstrate the transformative potential of AI, highlighting its ability to significantly increase efficiency and productivity in complex tasks.

**4. Algorithmic Trading & Investing**

AI has made significant inroads into the field of trading and investing, revolutionising traditional approaches and introducing new possibilities. With advanced algorithms and machine learning techniques, AI systems are capable of analysing vast amounts of financial data in real time. This enables them to identify patterns, trends, and anomalies that human traders may overlook. AI-driven trading systems can make swift, data-informed decisions, execute trades, and adjust investment portfolios accordingly. These intelligent systems aim to optimise returns, manage risks, and capitalise on market opportunities with increased efficiency.

Financial robo-advisory got so much recognition recently. Robo-advisors aim to optimise investment returns while maintaining an acceptable level of risk through portfolio diversification. To achieve this, they rely on essential information such as age, investment timeline, and risk tolerance. By considering these factors, the robo-advisor can provide personalised investment recommendations tailored to individual needs and preferences.

Hence, AI has become an indispensable tool for traders and investors, offering sophisticated analysis, automation, and the potential for more informed decision-making in the financial markets.



## AI IN FINANCE- BOON OR BANE

According to Foundry4, “Our teams surveyed senior IT decision makers in financial services and found that 65 percent of them plan to use machine learning to analyze unstructured data in the next one to two years. In addition to this, a further 15 per cent said that they planned to do the same within the next three to four years.

Covid-19 has catalysed financial services organisations to harness Artificial Intelligence (AI) to improve customer experience (CX), says a report published by the Capgemini Research Institute.

However, financial services firms’ implementation of AI at scale is the lowest across all industries, and where AI has been deployed, there are still some customer expectations that are not being met – with half of the customers saying they receive no value from AI-enabled interactions.

The report, titled, Smart Money: How to drive AI at scale to transform the financial services customer experience, revealed that the deployment of AI to improve the overall CX has grown significantly in the financial services industry in the past three years.

## AI IN FINANCIAL WORKSPACE

Nine in ten (94 per cent) organisations say that improving customer experience is the key objective behind launching new AI-enabled initiatives.

Financial services firms have already perceived the positive impact on their bottom line of implementing AI in customer-facing functions, including reduced cost of operations (13 per cent) and increased revenue per customer (10 per cent).

The report noted that financial services firms believe that improving CX is the key objective behind launching new AI-enabled initiatives. However, a clear disconnect is emerging as there are some customer expectations that are not yet being met. Almost half (49 per cent) of consumers rate the value they derive from AI-enabled digital touch points as non-existent or less than expected.

# HOW CAN INDIA BECOME A POWERHOUSE FOR AI

**AI shift in Covid times** : A majority (78 per cent) of consumers expect to use touchless interactions more, through voice assistants, facial recognition, or apps, compared to just 61 per cent pre-Covid.
Covid-19 is also prompting a major behaviour shift by older consumers as contactless payments adoption has grown by 37 per cent in the 61-65-year age group, and a 33 per cent increase with those over 66.
The report further revealed that financial services firms have the lowest scaled implementation across all industries. Only 5 per cent of banks and 6 per cent of insurers have been able to deploy AI at scale across several touchpoint functions.

**The benefits of AI deployment** :Even with the lower rate of AI implementation compared to other industries, financial services firms have realised significant benefits. They have reduced their cost of operations by 13 per cent and have increased revenue per customer by 10 per cent after deploying AI in customer-facing functions.

Banks and insurers have witnessed greater customer engagement with brands from deploying customer AI. Around one in five industry firms (25 per cent for banks and 19 per cent for insurers) have seen a 20-40 per cent increase in customer engagement.

Anirban Bose, CEO of Capgemini's Financial Services and Group Executive Board member, said in a statement: "Financial services firms have much to gain from implementing AI in their customer interactions, and they have an opportunity to embrace AI to re-imagine the customer experience journey."

In April and May this year, Capgemini surveyed 5,300 customers across 12 countries and 318 business leaders from large financial services organisations with at least $1 billion in 2019 annual revenue across a range of sectors and countries.

## WILL AI REPLACE HUMANS IN FINANCE

Have you been hearing all the buzz about artificial intelligence and automation lately? There are reports coming out left and right about how AI is poised to take over jobs in the finance sector. As an AI system, I don't have a horse in this race, but you probably want to know if you'll still have a job in 5 or 10 years. The short answer is AI will likely transform many finance roles, but humans are still very much needed.

## THE RISE OF AI IN FINANCE: REPORTS AND STATISTICS

The rise of AI in finance is happening, and the stats prove it. According to reports, AI could replace 230,000 finance jobs by 2025. - A 2019 study by PwC found that 77% of financial services companies are investing in AI.
AI is already handling many routine tasks like fraud detection, customer service, and trading assistance. Chatbots and robo-advisors are taking over basic customer interactions and investment management. - A 2020 McKinsey report estimates that AI could automate up to 45% of activities in the finance and insurance sector.
While AI may eliminate some jobs, it will also create new roles. The key is for finance professionals to adapt. Focus on skills that AI struggles with like creativity, emotional intelligence, and complex problem-solving. - Learn to work with AI systems and even help develop them. With the right skills, finance pros can work alongside AI rather than be replaced by it.
The bottom line? AI is transforming finance, but humans are still very much needed. AI can handle repetitive, routine tasks, but people have the soft skills, judgment, and intuition that AI cannot easily replicate. - By embracing AI as a tool and staying up-to-date with in-demand skills, finance professionals can ensure they work with the machines rather than be worked out of a job by them.

# AI'S IMPACT ON TRADITIONAL FINANCE ROLES

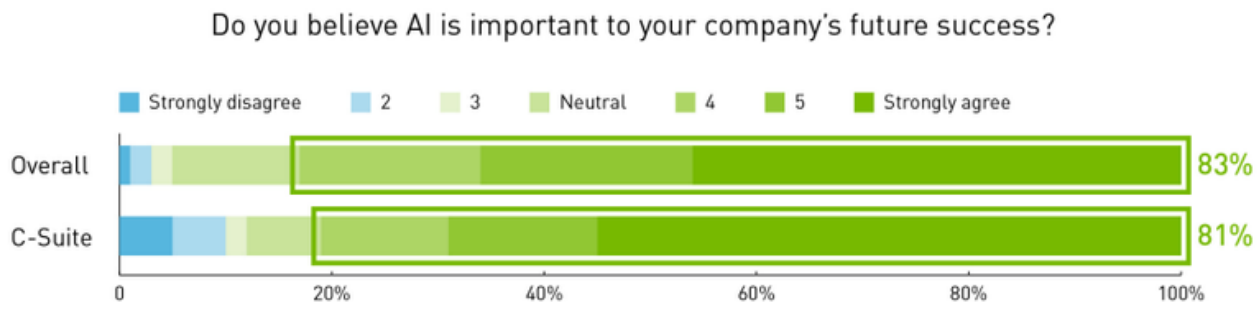
AI is poised to significantly impact many traditional finance roles. As AI systems get smarter and more capable, they will likely take over some routine tasks currently performed by humans. However, AI is also creating new types of jobs in finance.

For example, AI is automating many basic data entry and processing jobs like loan officers, claims adjusters, and clerks. These jobs are at high risk of being replaced by AI. On the other hand, AI is boosting demand for data scientists, engineers, and other technical roles to build and implement AI systems.

AI will also transform many existing finance jobs. Financial advisors, for instance, will rely more on AI to analyze clientsâ€™ needs and portfolios to provide customized recommendations. Portfolio managers will use AI to help pick investments and rebalance portfolios. Auditors will employ AI to detect anomalies and risks.

While AI may eliminate some jobs, it will likely transform many others by automating routine tasks and augmenting human capabilities. The future of work in finance will involve humans and machines collaborating, with each playing to their strengths. AI can take over repetitive and routine work, freeing up humans to focus on strategic, creative, and interpersonal work.

The rise of AI in finance means that workers will need to learn new skills to work with intelligent machines. Technical, analytical and soft skills will be in high demand. By embracing AI as a tool to enhance their capabilities, finance professionals can thrive alongside the machines.



# HOW AI IS TRANSFORMING FINANCE TASKS

Automating Manual Tasks : AI is taking over many routine, repetitive tasks in finance that humans traditionally performed manually. Things like processing invoices, reconciling accounts, and auditing expense reports can now be automated with AI. This allows human finance professionals to focus on more strategic work.

- Accounts payable departments are using AI to automatically match invoices to purchase orders and receipts, validate invoice details, and schedule payments. This can reduce the time spent on manual data entry and checking by up to 80%.

- AI tools can analyze a company's historical accounts and transactions to automatically reconcile accounts each month. They use machine learning to understand the normal activity in each account and flag any unusual transactions for human review. This frees up accountants to focus on analyzing trends and variances.

- Expense report auditing is another ideal task for AI to take over. AI systems can scan expense reports to verify that receipts match reported expenses, the correct expense categories and accounts have been used, and the reports comply with company policies. They automatically approve reports that are fully compliant and flag questionable expenses for auditors to review.

While AI may transform many routine finance jobs, human judgment, critical thinking, and relationship building are still hard to automate. AI will likely complement and augment human finance professionals rather than completely replace them. The future of finance will be a partnership between humans and machines, with each playing to their strengths. AI can handle the repetitive, rules-based work, while humans focus on strategic decision making, complex problem solving, and client relationships.

# THE HUMAN ELEMENT: WHY PEOPLE STILL MATTER

While AI and automation are transforming finance jobs, human skills are still vital. Machines may be able to analyze data and crunch numbers efficiently, but they lack certain qualities that make us human.

- Emotional intelligence. Humans can demonstrate empathy, compassion, and nuance in complex situations. We can read social cues and adapt our communication style to different people and contexts.
- Creativity. Coming up with innovative ideas, making unexpected connections, and thinking outside the box require human creativity that AI has yet to achieve.
- Ethics and judgment. Many finance roles involve navigating ambiguous situations and making difficult judgment calls. Humans are better equipped to apply ethics, fairness and sound judgment.
- Relationship building. Forming meaningful relationships, earning trust, and providing a personal touch are human strengths. People prefer interacting with real people, not chatbots.

While technology will significantly transform finance jobs, human skills will still be crucial. The finance professionals of the future will leverage the best of human and machine. They'll tap into AI and automation to handle routine tasks, analyze data, and gain insights, freeing up their time to focus on strategic thinking, client relationships, ethics, and judgment. Rather than replacing humans, AI will augment human capabilities and allow us to do more meaningful work. The future is human and machine, working together in harmony. Each plays to their strengths, combining empathy and data, creativity and algorithms, relationships and automation. This fusion will shape the next generation of finance in a way that benefits both businesses and their clients. The rise of the machines does not mean the end of human potential. When people and technology join forces, the possibilities are endless.

# CONCLUSION

After reviewing various reports and statistics on AI in the finance sector, the conclusion seems clear - AI will significantly transform jobs, but not necessarily eliminate humans. While AI and automation will handle many routine tasks currently performed by humans, uniquely human skills like
the reality is that AI cannot replicate human judgment and intuition. Machines today still struggle with unstructured data and unpredictable situations that require an empathetic human touch. AI tools will act as assistants to human employees, not replacements. The human role will shift to managing AI systems and focusing on high-value work that leverages human strengths.

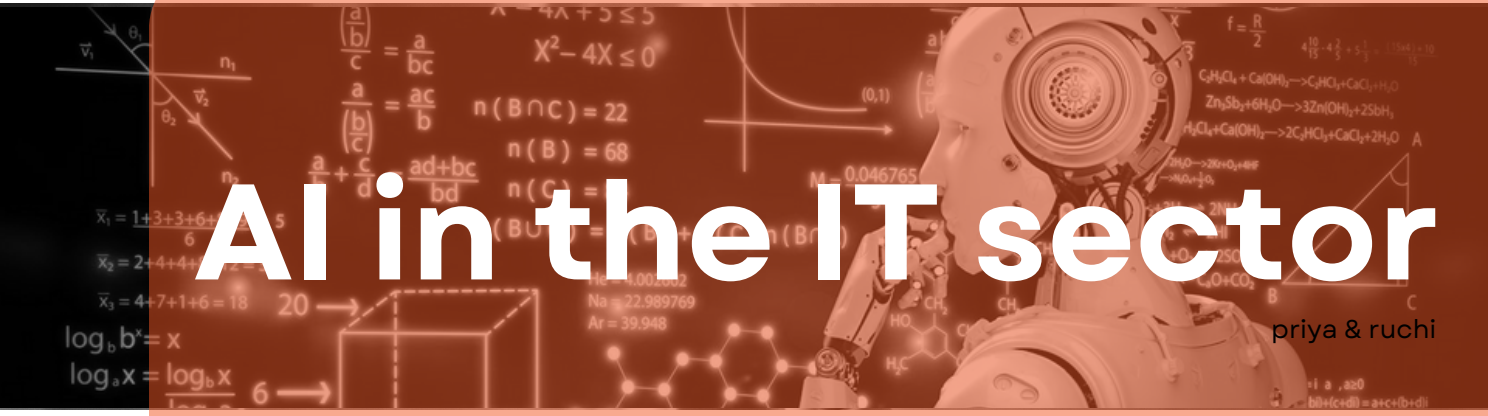
Some finance jobs may decline in number, but new roles will also emerge. Positions like data scientists, AI engineers, and robotics specialists are already growing fast. People with a mix of finance, technology and soft skills will be well-positioned for the AI-powered workplace. Continuous learning and adapting to new technologies will be essential for career success.

While the rise of AI will bring challenges, it also presents opportunities. AI has the potential to make finance jobs more interesting, impactful and productive. Humans and machines working together in partnership can achieve far more than either alone. The future is not about humans versus machines but about humans and machines transforming the world of finance side by side.

The bottom line is that AI may transform finance jobs, but humans are here to stay. People and technology will work together, not against each other. The future of work is human and AI, united.

Generating new ideas, products, and business models requires a spark of human creativity that AI struggles to ignite on its own.

The future of finance will likely involve humans and AI working together, each playing to their strengths. AI may take over routine tasks, freeing up humans to focus on more meaningful work like building client relationships, developing business strategies, and driving innovation.



# AI in the IT sector

priya & ruchi

## INTRODUCTION

It's clearly not the first time it has been said that robots will take over the earth when humans corrupt, but this expression caught everyone's eye again when artificial intelligence became the hot content." Although it may feel like this unformed thing that is nearly off in our future, it's formerly veritably important in our midst." From navigation apps to Alexa, Uber, and all other chatbots we use on different websites and apps that use artificial intelligence. All this is great, but it might make you wonder whether this is written by me or sputter GPT. Won't it? But we're then to see what it can be in the IT sector or assiduity.

> Artificial intelligence will have a more profound impact on humanity than fire, electricity, and the internet
>
> -Sundar Pichai

For a nonprofessional, both IT and AI would sound the same, but we wouldn't suppose of AI without having IT. Let's just say it's a step ahead. IT is each about using and managing computers to store, organize, and cover information, while with AI, computer systems can do effects that typically bear mortal intelligence. To put it more simply, a computer is a teenager, and AI is a parent trying to educate it to suppose, learn, break its problems, and make its opinions. Information technology is limited to transmitting and manipulating data. whereas AI- driven operations work more nearly to accelerate problem resolution and enhance IT operations.

# AI AS THE VAN OF THE IT SECTOR

This digital metamorphosis( AI) has given rise to new advancements to break and optimise numerous core challenges in the IT sector. AI occupies a central position in the advancement of colourful diligence, including information technology, serving as an aberrant element in their development. The integration of AI systems with IT has proven salutary by easing the workload on inventors, leading to enhanced effectiveness, increased productivity, and better quality assurance.

While, in fact, 85% of businesses say that it'll give them a competitive edge, some 75% believe that it'll allow them to move into new gambles. Likewise, a significant maturity of technology directors, counting for 80, view artificial intelligence( AI) as a precious tool for enhancing productivity and generating employment openings. They perceive AI's eventuality to palliate workers from mundane tasks, thereby enabling them to concentrate on further innovative and imaginative endeavours.
For numerous diligence and companies, the study of enforcing AI might not be veritably enthusiastic, as directors do n't understand how these arising technologies work.

According to a study by Translucency Market Research( TMR), the global request for artificial intelligence is estimated to gain an emotional 36.1% CAGR between 2016 and 2024, adding by the end of 2024 from$126.14 billion in 2015 to$ 3,061.35 billion.

preliminarily, the creation and perpetration of large- scale IT systems sounded nearly unattainable. Still, thanks to the progress made in developing sophisticated algorithmic functions by artificial intelligence( AI), negotiating similar tasks has come doable.

As IT structure becomes more complex and delicate to handle, it looks forward to looking for the most effective result to enhance IT operations operation, and AI, being a tremendous advance, has set up a great use for the different, dynamic, and delicate- to- manage IT geography.

***But luckily, when paired with the IT assistance, artificial intelligence will be much easier to integrate.***

# AI TECHNOLOGIES FOR IT

AI technologies provide substantial benefits in the IT sector by improving efficiency, enhancing decision-making, and enabling companies to leverage the power of data to produce improved outcomes.

Being a broad term, AI can be divided into different technology segments such as machine learning, deep learning, natural language processing, image processing, and speech recognition. However, a central role in the IT department belongs to machine learning (ML) and deep learning (DL).

Let's find what these terms actually mean so that we can focus on how it is helping in the IT sector. The essence of intelligence is learning. Machine learning is a subset of AI that focuses on a computer program that is able to analyse data using specific algorithms. It is a program that produces a large amount of output based on analysed data without human intervention.

However, Deep learning is a subset of machine learning. Its algorithms and techniques are similar but capabilities are not comparable. In this technique, a computer system is trained to perform classification tasks directly from sounds, texts, or images by using a large amount of labelled data, as well as neural network architectures.

## AI DRIVEN TRANSFORMATION IN IT

- AI in IT operations automates data processing and decision-making processes by utilising historical and real-time data. The objective of implementing is to enable continuous analysis, which yields actionable insights for implementing corrections and improvements in IT infrastructure.

- Deep learning technologies also offer the potential to automate numerous operational processes within IT departments, resulting in cost reduction and decreased reliance on manual labour. Moreover, AI algorithms are specifically designed to learn from past experiences, enabling continuous self-improvement over time.

- Several AI tools can be used in fraud detection, however, among these machine learning can process large amounts of data at a much faster rate than people can. By analysing historical data involving similar circumstances, machine learning tools can identify patterns of fraudulent behaviour.The IT department can utilise this synthesised data to take necessary actions against cyber criminals and develop more robust preventive measures for the future.

Overall, AI's immense potential as a business tool enables IT professionals to adopt a more strategic approach in their operational processes. By leveraging AI, IT professionals can enhance their decision-making capabilities and optimise their workflows for greater efficiency and effectiveness

# CROSS SECTION ANALYSIS

## COMMON CHALLENGES IN AI ADOPTION:

- **Skill Deficit**

The inability to effectively use AI technology is one of the key barriers to its acceptance. Organizations must adjust to reflect the ongoing evolution of the skills needed for occupations involving AI. For instance, AI is now capable of carrying out activities like medical image analysis that were formerly completed by radiologists. To address this issue, experts must update their knowledge and concentrate on fields where it is possible to benefit from human-machine collaboration, such as diagnosis, treatment planning, and patient communication, all of which can be supported by AI-powered analytics tools.

- **Lack of Knowledge:**

The low knowledge of AI's advantages and possible applications within enterprises is another barrier. For business and IT leaders, quantifying the benefits of AI programs is a huge problem. While some benefits, such as improved income or time savings, can be quantified with relative ease, others, such as improving customer experience, might be more challenging to describe and quantify precisely. To combat this, it is necessary to increase public knowledge of the unique benefits and possibilities of AI by exhibiting successful use cases and illustrating its influence on various business operations elements.

- **Silos in organizations**

End-to-end data flow and cross-team collaboration are essential for successful AI applications. Organizational silos, however, can obstruct this data integration and delay the effective use of the insights offered by AI systems. Organizations should concentrate on establishing a culture of collaboration and dismantling silos to overcome this difficulty. By promoting cross-functional cooperation and expediting data projects, augmented analytics tools can help improve the usefulness and accuracy of AI initiatives.

- **Data Labelling**

Labelling the data for supervised machine learning and deep learning systems becomes a big difficulty because of the abundance of data, including photos and videos from sources like the Internet of Things (IoT). The amount of created data is just greater than what can be manually labelled by the available human resources. Organizations can investigate methods like transfer learning, semi-supervised or unsupervised learning, and utilizing AI algorithms to automate data labelling procedures when practical to address this issue.

- **Describe skills**

Some AI models, referred to as "black box" models because of their lack of explain ability, present a problem, especially when judgments must be understood and trusted. Transparency in AI systems' decision-making becomes essential, especially when those systems' findings conflict with existing knowledge or create doubts. To ensure that users can comprehend and verify the logic underlying the outputs, explainable AI methodologies and techniques should be used to provide insights into how AI models arrive at particular judgements.

- **AI Data Quality:**

Data is a key component of AI endeavors, and organizations frequently struggle with issues linked to the quantity and caliber of available data. For relevant insights to be extracted and the best possible decision-making to be possible, successful AI initiatives need a significant volume of data. Additionally, organizations must be aware that AI may not succeed if there is not enough data or if the circumstances are very different from what has previously been observed. Enterprises should concentrate on enhancing data collecting, storage, and quality assurance processes to ensure they have a solid basis for AI initiatives to overcome this obstacle.

- **Lack of definite goals:**

Without a clear AI strategy and goals, organizations may find it difficult to determine which sectors are most suited for AI adoption, wasting resources and eroding trust in AI investments. Even while the drive for AI adoption frequently comes from grassroots initiatives, leaders need to offer direction and match AI activities with larger business goals. Organizations may guarantee that the strategy is driven both top-down and bottom-up, enabling the effective deployment of AI technology, by defining a holistic vision for AI adoption.

- **Integration Issues**

The process of integrating AI into current systems is more involved than a straightforward installation. Data infrastructure, storage, labelling, and data input into the AI system must all be carefully considered. Additionally, model training, ongoing assessment, and creating feedback loops to strengthen the foundation of AI models.

## STRATEGIES FOR OVERCOMING THESE DIFFICULTIES:

- Increasing the contact between humans and AI is one way for solving the issues mentioned above. Making people knowledgeable and experienced about it will enable them to balance its use.

- The primary issues that pose a threat to our future include the imminent necessity to handle the replacement of humans by AI. To achieve this, we must manage its use and ensure that data is put to good use in resolving issues rather than creating new ones.

- All in all, we create technology to make life easier, simpler, and more effective. Therefore, it needs to be designed and incorporated in a way that would be a long-term solution.

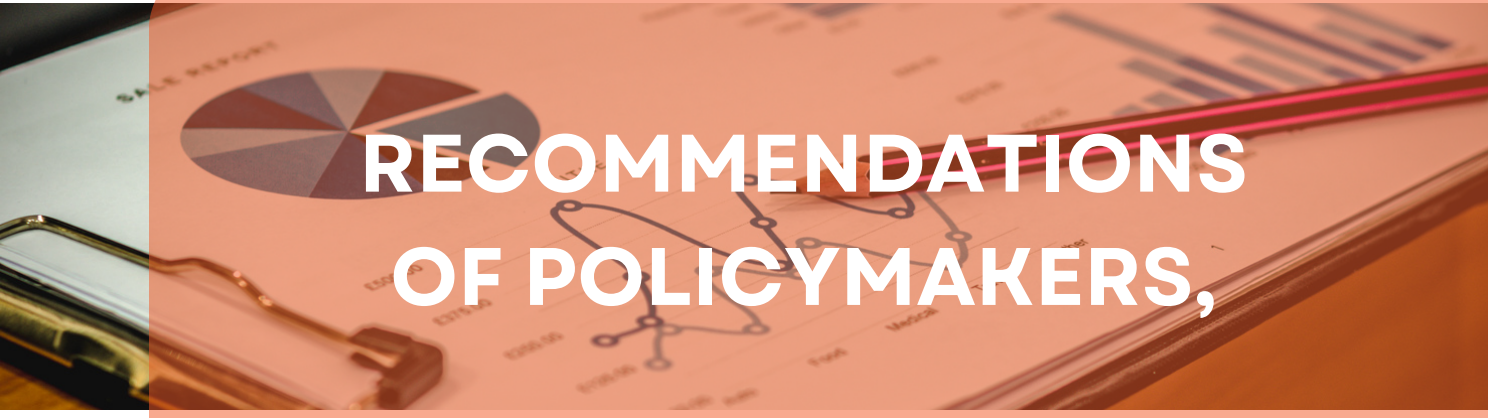
# OPPORTUNITIES IN AI ADOPTION

- Business functions are significantly impacted by AI and cognitive technology, which is accelerating organisational development. Deep client involvement is made possible in the front office by self-learning AI technologies, which improves customer satisfaction and retention. By boosting productivity, enhancing client account management capabilities, and generating cross-sell and up-sell opportunities, AI can increase sales. Automation of massive volumes of information can improve customer service. AI assists in analysing massive amounts of data in marketing for precise audience targeting and successful campaign tactics.

- In the middle office, artificial intelligence (AI) enables employees dealing with massive data volumes to make decisions more quickly and effectively by generating real-time insights. AI in the back office automates tedious activities, boosts productivity, guarantees data management and transparency, and lowers human mistake rates.

- AI deployment can be advantageous for a variety of processes, including supply chain management, data protection, risk assessment, IT, finance, human resources, manufacturing, product development, and innovation.

- To use AI effectively, businesses must take into account their unique core competencies and differentiators, collect data from a variety of sources, concentrate on technical architectures, value agility, and give data security priority. Strong platforms and toolkits are needed for the AI era, which may be created by working with both internal teams and external businesses. Companies that put off implementing AI risk falling behind in the quickly changing business world.



# RECOMMENDATIONS OF POLICYMAKERS,

Ethics is a set of moral principles that help us distinguish between right and wrong. AI Ethics is a set of guidelines that advise on the design and consequences of artificial intelligence. Humans come with all kinds of cognitive biases, such as recency and confirmation bias, and those inherent biases are reflected in our behavior and, subsequently, in our data. Since data is the foundation of all machine learning algorithms, it is important for us to design experiments and algorithms with this in mind because artificial intelligence has the potential to amplify and scale these human biases at an unprecedented rate.

As cases of inappropriate outcomes have come to light, new guidelines have emerged, primarily from the research and data science communities, to address concerns surrounding the ethics of AI. Leading companies in the field of AI have also taken a keen interest in shaping these guidelines, as they themselves have begun to experience some of the consequences of failing to uphold ethical standards in their products. Lack of due diligence in this area can result in reputational, regulatory and legal exposure, resulting in costly fines. As with all technological advances, innovation moves beyond government regulation into new, emerging fields. As appropriate expertise develops in the government industry, we can expect more AI protocols for companies to follow, enabling them to avoid any infringements on human rights and civil liberties.

# 5 KEY PILLARS : AI ETHICS

**Accountability**

- The first pillar of ethical AI is accountability. Relying on AI can speed up internal processes and ensure faster workflows, but only if it is accountable and dependable. The AI/ML must be trustworthy, based on the processes it's designed to complete, to be valid.
- If AI is not accountable for completing tasks, then its use cases essentially go out the window. CIOs should continuously check on AI to evaluate success rates and ensure that business processes operate correctly.

. **Reliability**

- In a similar vein, AI must be reliable. Data sources are constantly changing, and as new sources of data are added, outputs from AI/ML must also be monitored and validated. As AI/ML is increasingly deployed, the reliability of algorithms becomes even more critical considering the vast array of processes that leverage AI/ML across the enterprise.
- CIOs and businesses rely on the standardization of processes, data collection, and organization to ensure that the technology managing this data, including AI, can run smoothly, without producing errors.

**Explainability**

- Explainability ensures that AI and ML models are understood and can be explained across departments and organizations. The benefits of AI at an enterprise level become irrelevant if the technology cannot be translated, which could result in confusion and siloed processes.
- Consider industries such as banking or healthcare. The predictions from AI/ML models used by these industries must be explainable to ensure that there is no inherent bias and that the technology is creating actionable results.

# ETHICS RELATED TO AI

**Security**

- iTech security is a growing concern as ransomware attacks threaten organizations and protected data. Protecting AI models against these attacks s essential, and CIOs need to understand the potential risks and how they may impact the technology in use.
- If AI does not guarantee privacy, businesses will struggle to keep customers' trust and protect internal property.
- Many businesses and customers are evaluating AI with a critical eye on security. Businesses and CIOs must ensure that the AI they rely on is dependable and secure to minimize risks.

**Privacy**

- Protecting customer data, especially when AI is used in data-sensitive industries or business processes such as healthcare and banking sectors, must be top of mind for CIOs. CIOs must ensure that the AI technology has measures to protect sensitive data and provide business and customer privacy

# HOW TO ESTABLISH AI ETHICS

Since artificial intelligence didn't give birth to moral machines, teams have started to assemble frameworks and concept to address some of the current ethical concerns and shape the future of work within the field. While more structure is injected into these guidelines every day, there is some consensus around incorporating the following:

- **Governance**: Companies can leverage their existing organizational structure to help manage ethical AI. If a company is collecting data, it has likely already established a governance system to facilitate data standardization and quality assurance. Internal regulatory and legal teams are likely already partnering with governance teams to ensure compliance with government entities, and so expanding the scope of this team to include ethical AI is a natural extension of its current priorities. This team can also steward organizational awareness and incentivize stakeholders to act in accordance with company values and ethical standards.

- **Explainability**: Machine learning models, particularly deep learning models, are frequently called "black box models" as it's usually unclear how a model is arriving at a given decision. explainability seeks to eliminate this ambiguity around model assembly and model outputs by generating a "human understandable explanation that expresses the rationale of the machine". This type of transparency is important for building trust with AI systems to ensure that individuals understand why a model is arriving to a given decision point. If we can better understand the why, we will be better equipped to avoid AI risks, such as bias and discrimination.

Achieving ethical AI will undoubtedly be important to its success. However, it's important to note that it has tremendous potential to impact society for good. We've started to see this in its integration into areas of healthcare, such as radiology. This conversation around AI ethics is to ensure that in our attempt to harness this technology for good, we appropriately assess its potential for harm within its design.

# ETHICAL AI ORGANIZATIONS

Since ethical standards are not the primary concern of data engineers and data scientists in the private sector, a number of organizations have emerged to promote ethical conduct in the field of artificial intelligence. For those seeking more information, the following organizations and projects provide resources on implementing ethical AI:

- **AlgorithmWatch**: This non-profit focuses on an explainable and traceable algorithm and decision process in AIrams.
- **AI Now Institute:** This non-profit at New York University researches the social implications of artificial intelligence.
- **DARPA**: The Defense Advanced Research Projects Agency by the US Department of Defense focuses on promoting explainable AI and AI research.
- **CHAI**: The Center for Human-Compatible Artificial Intelligence is a cooperation of various institutes and universities to promote trustworthy AI and provable beneficial systems.
- **NASCAI:** The National Security Commission on Artificial Intelligence is an independent commission "that considers the methods and means necessary to advance the development of artificial intelligence, machine learning and associated technologies to comprehensively address the national security and defense needs of the United States."

# HOW TO MITIGATE THE RISKS FROM ADVANCED AI

To mitigate risks from advanced AI, researchers and engineers must make AI safety a priority during the design process. This includes:

- Developing AI systems that are transparent and explainable. Researchers should build AI that can explain the reasons behind its decisions and actions in a way that humans can understand. This "explainability" helps identify and fix errors or unintended behaviors.

- Ensuring AI systems are robust and reliable. AI must handle edge cases, noisy data, and unpredictable situations appropriately without catastrophic failure. Rigorous testing procedures need to be in place to identify weaknesses.

- Aligning AI goals with human values. Researchers must specify objectives that are beneficial to humanity and ensure AI pursues those goals. Vague or imprecise objectives could lead the AI to optimize for undesirable outcomes.

- Providing human oversight and control. Humans must remain in the loop for high-level decisions and have the ability to manually override an AI system if needed. Researchers should build in checks and balances to keep humans ultimately accountable.

- Developing safeguards and "kill switches." For advanced AI, researchers should create mechanisms to temporarily shut down or disconnect the system in the event of unexpected or harmful behavior until the issue can be resolved.

- By making AI safety and ethics a priority from the beginning, researchers and companies can develop AI that is innovative, useful and trusted. With proper safeguards and oversight in place, advanced AI can achieve its promise of improving lives without putting humanity at risk. Overall, a focus on AI safety during design is the wisest approach.

# PROVIDE CONSTITUTIONAL AI GUIDANCE

To ensure advanced AI systems are grounded and aligned with human values, researchers must provide constitutional guidance to the systems during development.

- Define a clear set of principles to constitutionally constrain the system. For example, Asimov's Three Laws of Robotics propose that AI systems must not harm humanity, must obey human orders, and must protect themselves. Researchers should determine a set of principles specifically suited to their system.

- Teach the system these principles through Constitutional AI, a technique where the AI model is trained on examples that demonstrate the desired principles in action. The system can then apply these principles to new situations. However, researchers must be extremely careful and thoughtful in how they frame these examples.

- Perform " Constitutional stress testing" by exposing the system to challenging hypothetical scenarios that test the limits of the principles. Look for any weak points or loopholes in the system's reasoning and make improvements. Repeat this process iteratively.

- Consider a " Constitutional kill switch" to immediately shut down the system if it behaves unexpectedly or in violation of the principles. However, this is an imperfect solution and should only be used as a last line of defense.

- Review and retrain the system continuously to strengthen its alignment and ensure its behavior remains grounded, especially as it becomes more advanced or is applied in new domains. Constitutional guidance is an ongoing process that requires diligent oversight and maintenance

# INCREASE AI TRANSPARENCY AND EXPLAINABILITY

To increase transparency and explainability of AI systems, researchers and engineers should focus on a few key areas.

**Open Source AI Models and Datasets**

By making AI models and the data used to train them publicly available, researchers can better understand, evaluate, and improve the systems. Open sourcing also allows for more rigorous testing and auditing of models to identify potential issues. Some companies have begun open sourcing parts of their AI, but more work is needed.

**Documentation of AI Development Process**

Thoroughly documenting the entire AI development process, including how and why certain design decisions were made, helps provide context for how the system functions. This documentation should be detailed enough for outside researchers to understand and replicate the work. Lack of documentation is problematic and prevents analysis of the strengths, weaknesses, and risks of the AI.

**Testing AI Systems for Robustness**

Rigorously testing AI systems using a diverse range of data samples and use cases helps identify potential failure points or unintended behaviors. Researchers should intentionally try to "break" the AI to find and address vulnerabilities proactively. Some ways to test include:

- Varying input data to assess how the AI handles edge cases.
- Evaluating how the AI system responds to noisy, incomplete or adversarial data.
- Simulating the AI's performance under different environmental conditions or use cases to find scenarios that could negatively impact functionality or produce undesirable outcomes.

# ESTABLISH HUMAN OVERSIGHT AND REVIEW

To mitigate risks from advanced AI, establishing human oversight and review is critical. As AI systems become more autonomous and powerful, human judgment and values must remain central to their development and use.

**Institute Human Oversight Boards**

Companies building or deploying AI systems should create oversight boards consisting of employees and outside experts to review systems for safety, fairness, and ethics concerns. These boards can suggest modifications to address issues before systems are deployed. They provide an important check on the judgments of engineers and executives.

**Conduct Regular Audits**

AI systems should be regularly audited to ensure they continue functioning as intended and do not develop undesirable behaviors or characteristics over time. Audits should evaluate systems for potential issues like unfairness in decisions, susceptibility to manipulation or deception, and other risks that may emerge as systems become more advanced. Audits provide an opportunity to make corrections and further safeguard systems.

# POTENTIAL HARMS OF IGNORING THE MINUTE RISKS OF USING AI

**Job disruption and economic impact**

While AI will likely create new types of jobs, many existing jobs are at high risk of being automated by AI and robotics. This could significantly disrupt labor markets and the overall economy. Policymakers and researchers need to consider how to help workers adapt to these changes and ensure that the benefits of AI are distributed broadly across society.

**Bias and unfairness**

If not designed properly, AI systems can reflect and even amplify the biases of their human creators. This can negatively impact marginalized groups and lead to unfair or unequal treatment. Researchers need to make AI fairness and mitigating bias a high priority, especially for AI used to make important decisions that affect people's lives.
Overall, ignoring these risks could be extremely harmful. Policymakers, researchers and society as a whole must thoughtfully consider how advanced AI might impact humanity and take appropriate action to help ensure its safe, fair and beneficial development. With proper safeguards and oversight in place, the promise of AI can be achieved while avoiding potential downsides.

# THE PROMISE OF AI: A MORE INCLUSIVE, SUSTAINABLE, AND PEACEFUL WORLD

Artificial intelligence technologies are transforming our world in profound ways. AI has the potential to help solve some of humanity's greatest challenges and usher in a new era of inclusion, sustainability, and peace. AI can expand access to education, healthcare, and economic opportunity regardless of gender, ethnicity, or socioeconomic status. AI-powered precision agriculture and renewable energy technologies can help achieve sustainable food and energy production. And AI may even help foster international cooperation and conflict resolution through improved communication and understanding across borders.

# AI IS INCREASING ACCESS TO OPPORTUNITY AND RESOURCES

Artificial intelligence has the potential to increase access to opportunity and resources for many. AI systems are being developed to identify and address barriers that prevent marginalized groups from fully participating in society.

- AI can help expand access to education. Adaptive learning systems customize instruction to individual learners, helping students learn at their own pace. AI tutors provide personalized guidance and feedback. These tools make learning more accessible and effective.

- AI is improving access to healthcare. AI-enabled diagnostic tools allow doctors to detect diseases earlier and more accurately, especially in underserved areas. Virtual nursing assistants and chatbots can provide basic health information and advice to those without access to doctors. AI is also helping to develop more affordable medical treatments.

- AI supports sustainable economic growth and job opportunities. AI is creating new types of jobs, such as data scientists, robot programmers, and AI ethicists. AI also enhances many existing jobs by automating routine tasks, allowing human professionals to focus on more meaningful work. AI can match job seekers with opportunities and help workers gain new skills through personalized training programs.

With proper safeguards and oversight, AI has significant potential to empower marginalized groups and make society more just, equitable and prosperous. By leveraging AI to expand access to vital resources and opportunities, we can work to remedy systemic inequalities and create a better future for all. Overall, AI may be the key to building a world that is more inclusive, sustainable and peaceful.

# AI IMPROVES ENERGY EFFICIENCY AND ENVIRONMENTAL SUSTAINABILITY

As artificial intelligence continues to advance, it is enabling technologies that improve energy efficiency and environmental sustainability. AI systems can optimize energy usage, reduce waste, decrease pollution, and transition us to renewable energy sources.

- AI manages smart grids and optimizes energy distribution. AI algorithms analyze energy usage patterns and distribute energy efficiently based on demand. Smart meters and sensors enable AI systems to track energy usage in real-time and identify opportunities for improved efficiency.

- AI reduces waste and optimizes recycling. Computer vision systems powered by AI can automatically sort recyclables from waste. AI also helps optimize recycling routes and schedules to reduce transportation needs. These efficiencies significantly decrease waste and lower emissions.

- AI enables predictive maintenance of equipment. AI systems analyze data from sensors and IoT devices to detect signs of wear and predict when equipment needs maintenance or replacement. This approach reduces excess energy usage and waste from premature replacement of still-functioning parts.

- AI accelerates the transition to renewable energy. AI helps integrate renewable energy sources like solar and wind into existing power grids. AI also improves energy storage solutions, like batteries, to address the intermittency of renewable energy generation. These capabilities make renewable energy a more viable and scalable option.

By leveraging data and advanced algorithms, AI will continue to enable new solutions for a greener future with smarter energy usage, less waste and pollution, and an accelerated transition to renewable power. With AI, we can build a more sustainable world for generations to come.

# AI ENABLES MORE ACCURATE PREDICTIONS AND DATA-DRIVEN DECISIONS

AI enables organizations to make data-driven decisions based on accurate predictions and insights.

AI systems can analyze huge amounts of data to detect complex patterns and correlations that would be impossible for humans to uncover manually. This allows companies to gain a deeper understanding of their business, customers, and markets to make better strategic decisions.

- Predictive analytics powered by machine learning algorithms can forecast trends, behaviors, and outcomes with a high degree of accuracy. Organizations can anticipate future opportunities and challenges, enabling a proactive rather than reactive approach.
- Prescriptive analytics goes a step further by recommending the best course of action based on predictive models and optimization techniques. AI systems can suggest data-backed decisions and guide strategic planning in a highly customized way.
- Automated decision making based on AI is faster, scalable, and consistent. Routine decisions can be handled by AI systems, freeing up human employees to focus on more complex, judgment-based choices. This results in increased productivity and operational efficiency.
- AI reveals hidden insights that lead to a competitive advantage. By detecting subtle patterns across massive datasets, artificial intelligence can unlock new ways of gaining and retaining customers, optimizing processes, and identifying new avenues for innovation.
- Simulations and “what-if” scenario modeling enabled by AI allow organizations to evaluate the potential impact of strategic decisions before implementing them. This reduces risk and ensures that data-driven choices are as well-informed as possible.

In summary, artificial intelligence empowers organizations with predictive capabilities and data-backed recommendations to gain valuable foresight, uncover growth opportunities, and make the best possible business decisions. The future is hard to predict, but AI makes it a little easier.

# AI HAS THE POTENTIAL TO REDUCE CONFLICT AND PROMOTE COOPERATION

AI has the potential to reduce conflict and promote cooperation between groups in several ways:

**Improved Communication and Understanding**

AI can help facilitate improved communication and understanding between groups in conflict by providing real-time translation of languages, detecting emotions and nuances that are often lost in text alone. AI systems are also able to analyze large amounts of data to gain insights into the underlying interests, values and priorities of groups in order to suggest compromises and common ground. This can help address misunderstandings and find solutions that satisfy key interests of all parties.

**Reduced Bias and Stereotyping**

AI has the ability to analyze data objectively and rationally without the biases and stereotypes that often negatively influence human thinking. By relying on facts and evidence over preconceptions, AI can help identify and counter harmful assumptions and generalizations that fuel tensions between groups. AI may also be able to detect subtle forms of bias in media and communications that perpetuate division and suggest alternatives that bring groups together rather than push them apart.
Optimized Cooperation

AI can help model optimal strategies for cooperation between groups by running simulations to determine how groups can work together for mutual benefit. AI may be able to suggest compromises and incentives that make cooperation appealing and help overcome the temptation to take advantage of others for short-term gains. AI can also make personalized recommendations for collaborative actions based on the values, priorities and interests of each group. This data-driven approach can help build trust and facilitate cooperation even between groups with a history of conflict.

# MANAGING THE RISKS: AI SAFETY, BIAS AND JOB DISRUPTION

To realize the promise of AI, we must ensure its safe, fair, and ethical development. This requires proactively addressing risks around AI safety, bias, and job disruption.

**AI Safety**

As AI systems become more autonomous and powerful, it is crucial to align their goals with human values and ensure they behave safely. Researchers are developing new techniques to guarantee AI systems are robust, reliable and have a concrete and verifiable methodology for how they make decisions.

**Mitigating Bias**

AI has the potential to reflect and amplify the prejudices of human society. We must prevent biased or unfair behavior in AI systems. Teams building AI systems should be diverse, and systems should be thoroughly tested to identify and address sources of unfairness. New tools can also help detect bias in training data and models.

**Preparing for Job Disruption**

While AI will likely transform the job market and economy, its impact on employment is hard to predict. To prepare, we should invest in education and skills training, especially in areas like technical fields, creative work, and social/emotional skills that are hard to automate. Policymakers should also consider programs to help workers transition to new jobs.

# SUMMARY

**AI Can Help Create a More Inclusive Society**

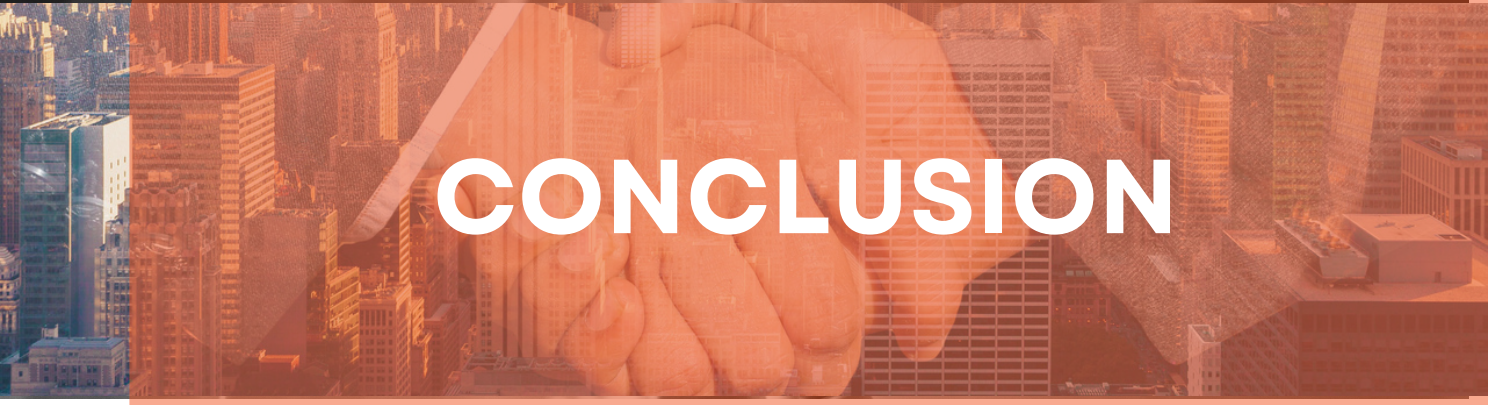
AI has the potential to help address societal inequities and make the world a fairer place for all. AI systems are being developed to detect and mitigate bias in hiring processes, university admissions, and other areas where people of color and other marginalized groups face discrimination. AI can also be leveraged to provide personalized learning experiences for students with disabilities or learning differences.
AI Enables a More Sustainable Future

AI technologies are helping tackle some of the world's biggest environmental challenges like climate change. AI is being used to optimize energy usage in buildings, improve waste management and recycling, enhance agricultural processes to reduce food waste, and accelerate the development of renewable energy sources. AI also powers many smart city initiatives aimed at creating more livable, sustainable communities. The application of AI for sustainability will be crucial to ensuring the health of our planet for future generations.

**AI Can Support Peace and Diplomacy**

AI has significant potential to facilitate peacekeeping and conflict resolution. AI systems can monitor ceasefire agreements and peace treaties to detect violations early. AI also enables new forms of citizen reporting and crowdsourcing to identify areas of unrest. In the realm of diplomacy, AI will help diplomats analyze complex geopolitical issues, understand different perspectives, and explore creative solutions to global problems. While still limited, the use of AI for mediation and negotiation will become more prominent, supporting a more harmonious world.

In summary, AI has promising applications that can help build a society that is more inclusive, sustainable, and peaceful if developed and applied responsibly. With proper safeguards and oversight in place, AI can be leveraged to promote human values and make progress on issues that matter most. The future remains unwritten, and it is up to us to ensure that AI's promise is fulfilled.



# CONCLUSION

In conclusion, this study explored the impact of artificial intelligence (AI) on various industries. The findings demonstrate that AI possesses the potential to disrupt and transform industries, leading to increased productivity, efficiency, and innovation.

In the healthcare field, AI-driven technologies have exhibited promising outcomes in disease diagnosis, drug discovery, and patient care management. Implementing AI algorithms and machine learning models has proven to enhance accuracy, expedite processes, and improve patient outcomes.

Within the financial sector, AI has played a pivotal role in automating tasks, detecting fraudulent activities, and personalizing customer experiences. Financial institutions have utilized AI-powered chatbots, recommendation systems, and predictive analytics to deliver more efficient services and make data-driven decisions.

In the manufacturing industry, AI-driven technologies such as robotics and computer vision have optimized production processes, facilitated predictive maintenance, and improved quality control. These advancements have resulted in heightened productivity, reduced costs, and enhanced overall operational efficiency.

The IT industry has witnessed a transformation due to AI, revolutionizing software development, deployment, and maintenance. Leveraging AI-powered algorithms and machine learning techniques for activities like code analysis, bug detection, and automated testing has led to improved software quality, decreased development time, and increased efficiency.

Furthermore, AI has brought about significant changes, particularly in the realm of autonomous vehicles. Advanced AI algorithms, in conjunction with sensors and real-time data processing, have made self-driving cars a reality. These vehicles can autonomously navigate, detect obstacles, and make driving decisions without human intervention. Autonomous vehicles offer potential benefits such as improved road safety, reduced traffic congestion, and enhanced energy efficiency.

Nevertheless, it is imperative to recognize the challenges and considerations associated with AI implementation. Ethical concerns, data privacy, and responsible AI governance are vital factors that must be addressed to ensure the ethical and advantageous utilization of AI technologies across industries.

In summary, the findings strongly indicate that AI possesses the potential to revolutionize diverse sectors by augmenting human capabilities, enhancing decision-making processes, and fostering innovation

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# CONTRIBUTIONS

**PRIYALAXMI ROY**
President

**SIDDHARTH DAWAR, Ph.D.**
Mentor

Amar Sharma

Aabhas Gautam

Shiva Yadav

Raghav Bindra

Prerna

Harshita

Puneet

Ruchi

Yashashvi

Priya

# NOTES

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