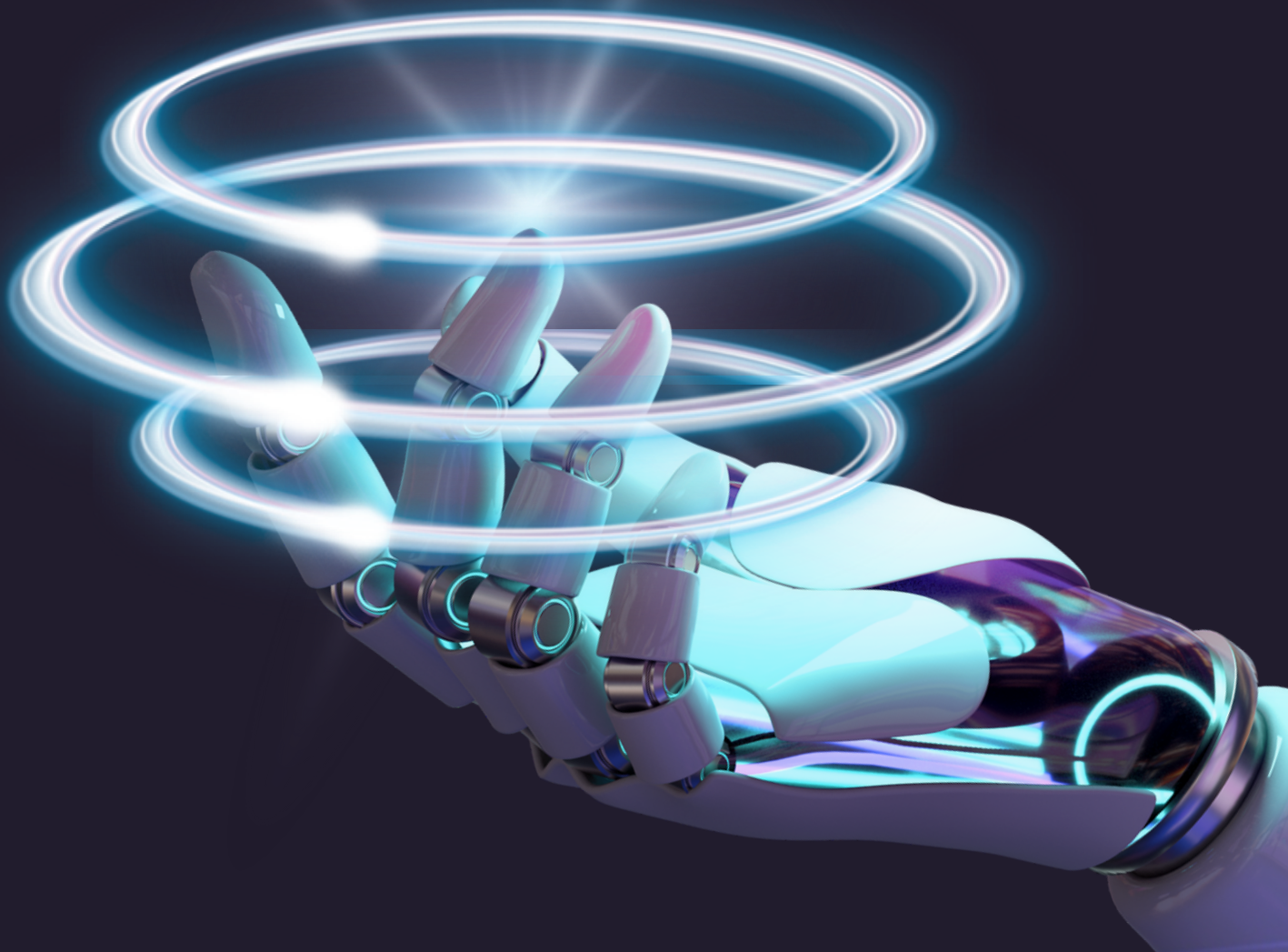


# Application Of Machine Learning And Internet Of Things

**Dr. Imran Baig Mirza**

**Professor Dr. Shaikh Aftab Anwar**



# Application of Machine Learning and Internet of Things



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# Application of Machine Learning and Internet of Things

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## **Application of Machine Learning and Internet of Things**

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## **PREFACE**

We are thrilled to introduce this edited book on the "Application of Machine Learning and Internet of Things" which brings together a comprehensive set of research papers and case studies from experts across the globe. The integration of Machine Learning and Internet of Things has opened up new opportunities for the development of intelligent systems that can collect, process, and analyze data to make informed decisions.

The book aims to provide a comprehensive overview of the latest research and developments in the field of Machine Learning and Internet of Things, including their applications, challenges, and future directions. It covers various topics ranging from data acquisition and pre-processing to predictive analytics and decision-making.

The book begins with an introduction to the concept of Machine Learning and the Internet of Things and then proceeds to explore their integration. It provides an overview of the different Machine Learning techniques used for IoT data analysis, including supervised and unsupervised learning, reinforcement learning, and deep learning.

The subsequent chapters delve into the applications of Machine Learning and IoT in different fields, such as healthcare, smart cities, agriculture, transportation, and energy management. Each chapter highlights the challenges faced in the respective field and provides practical solutions to overcome them.

The book also presents case studies and research papers that demonstrate the successful implementation of Machine Learning and IoT in real-world scenarios. These studies cover various domains, including smart homes, industrial automation, environmental monitoring, and personalized medicine.

In conclusion, this edited book provides a valuable resource for researchers, students, and professionals interested in the application of Machine Learning and Internet of Things. It not only offers an in-depth understanding of the fundamentals but also highlights the potential of these technologies to revolutionize different sectors and improve our daily lives.

## **ACKNOWLEDGEMENT**

We would like to express our sincere gratitude to all the contributors who have made this edited book possible. Their insights, expertise, and hard work have helped to create a comprehensive resource on the application of Machine Learning and Internet of Things.

We would also like to thank the reviewers who have provided valuable feedback and suggestions to improve the quality of the papers included in this book. Their critical evaluation and constructive criticism have been instrumental in ensuring the high standards of the book.

We extend our heartfelt thanks to the editorial and production team who have worked tirelessly behind the scenes to bring this book to fruition. Their dedication, professionalism, and attention to detail have been remarkable, and we are indebted to them.

It gives us immense pleasure to express our heartfelt thanks to Hon. Nisar I. Patel, Chairman and Hon. Hani Ahmed Farid, General Secretary of Y and M Anjuman Khairul Islam Trust, Mumbai for their valuable help during the present work.

We are very much thankful to Hon. Dr. Hanif Lakdawala Trustee Y and M Anjuman Khairul Islam Trust Mumbai for his excellent support and guidance.

We are equally thankful to our Vice Principal Science Dr. Iqbal N. Shaikh, Vice Principal Arts Mr. Mohiuddin Khan for their valuable guidance, advice and help rendered to me.

Finally, we acknowledge the support and encouragement of our colleagues, friends, and family, who have been a constant source of inspiration and motivation throughout this journey.

Thank you all for your contributions and support.

**Dr. Imran Baig Mirza**

**Professor Dr. Shaikh Aftab Anwar**

# TABLE OF CONTENT

<b>Preface</b>	IV
<b>Acknowledgement</b>	V
<b>Table of Content</b>	VI - VII

<b>Title of Chapters</b>	<b>Page No.</b>
<b>A STUDY ON ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN BANKING SECTOR WITH SPECIAL REFERENCE TO SBI</b>	1 – 7
<i>Dr. Prasad M Supekar</i>	
<b>ARTIFICIAL INTELLIGENCE AND STOCK MARKETS: A NEW ERA OF INVESTMENT</b>	8 – 20
<i>Mr. Jitendra Rabada and Ms. Riancy Mascarenhas</i>	
<b>DEEP LEARNING AND APPLICATIONS</b>	21 – 30
<i>Dr. Khan Mohd Imran</i>	
<b>DESIGN AND DEVELOPMENT OF DATA INTEGRATION TECHNIQUES USING IOT DEVICES FOR COMMUNICATION</b>	31 – 43
<i>Mr. Faheemuddin Ahmed and Dr. N. S. Ratnaparkhi</i>	
<b>DIGITAL SERVICES IN EDUCATION SECTOR</b>	44– 54
<i>Dr. Safia Farooqui and Mr. Vikas Pawar</i>	
<b>HEALTHCARE'S FUTURE IN THE HANDS OF AI AND MACHINE LEARNING</b>	55 – 65
<i>Abhishek Kumar, Dr. Ram Babu Tripathi and Shubham Tripathi</i>	
<b>IMPLEMENTING INTERNET OF THINGS (IOT) USING ARDUINO CONTROLLER</b>	66 – 73
<i>Binnaser Aziz Abdullah</i>	

<b>AN OVERVIEW OF MACHINE LEARNING CONCEPTS AND ITS APPLICATIONS</b>	74 – 79
--	---------

*S. Petricia Leema Roseline*

<b>THE IMPORTANCE OF ARTIFICIAL INTELLIGENCE IN MODERN MARKETING STRATEGIES</b>	80 – 84
---	---------

*Dr. Kamran Ambar Mohd Ayyub Rahmani*

<b>AI AND DEEP LEARNING-POWERED COMPUTER VISION: OPPORT-UNITIES AND CHALLENGES IN HEALTHCARE APPLICATIONS</b>	85 - 92
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*Mr. Ramkrishna Reddy and Mr. Jitendra Rabada*



## **A STUDY ON ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN BANKING SECTOR WITH SPECIAL REFERENCE TO SBI**

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(Affiliated to University of Mumbai)

### **ABSTRACT**

*Recent developments and emergence of virtual banking and the trends in the modern banking systems explained in this study. AI is already being applied to enhance productivity and competitiveness while also driving digital transformation in a range of organizations. Artificial intelligence (AI) is now widely acknowledged as one of the most important digital transformation enablers across a significant number of industries. AI is supporting Indian banks in upgrading their operations across the board, from accounting to sales to contracts and cyber security. Machine learning offers countless opportunities to deliver personalized banking solutions leveraging customer data. The banking landscape is constantly changing, and the application of machine learning in banking is arguably still in its early stages. However, banks using AI and ML are quickly going to overtake their competitors. Sophisticated, intelligent security systems and streamlined customer services are keys to business success. Financial institutions, in particular, need to stay ahead of the curve using cutting-edge technology to optimize their IT and meet the latest market demands.*

*Keywords: Artificial Intelligence, Digital Transformation, Customer Services.*

### **INTRODUCTION**

The keeping money division has sent the most recent innovations from center managing an account and installment frameworks to chance administration and, more as of late, computerized procedures. Artificial Intelligence enables banks to manage record-level high-speed data to receive valuable insights. Artificial intelligence (AI) is now widely acknowledged as one of the most important digital transformation enablers across a significant number of industries. Artificial intelligence (AI) has the potential to facilitate enterprises. Indian banks are progressively using technologies of the future in order to serve new-age clientele and expand their development potential. AI is supporting Indian banks in upgrading their operations across the board, from accounting to sales to contracts and cyber security. AI bots, and biometric fraud detection systems further lead to high-quality services for a broader customer base. Artificial Intelligence comprises a broad set of technologies, including, but are not limited to, Machine Learning, Natural Language Processing, Expert Systems, Vision, Speech, Planning, Robotics, etc. The adoption of AI in different enterprises has increased due to the COVID-19 pandemic. Since the pandemic hit the world, the potential value of AI has grown significantly. With over \$630 Billion in assets and 500 Million customers, State Bank of India (SBI)

is one of the Top 50 global banks and well on course to break into the Top 30 in a few years. SBI operates out of 26 countries with over 25,000 branches and 60,000 ATMs generating revenues close to \$61 Billion. Over 70 Million customers actively use their Internet and Mobile Banking channels. About 45% of all transactions in India go through SBI's payment gateways which is setup to handle 50,000 concurrent transactions.

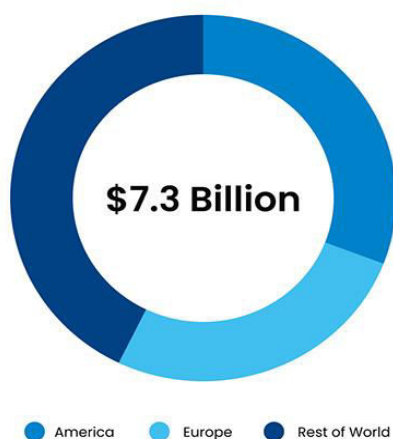
#### ➤ Machine Learning in Banking Statistics:

To substantiate, let's look at some recent statistics about ML adoption in the fintech market.

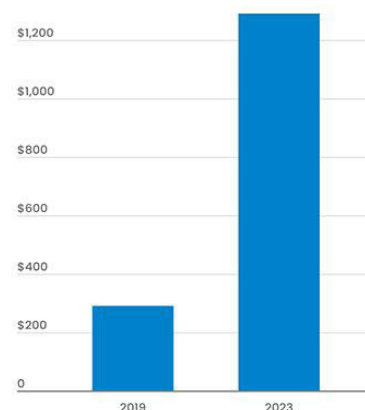
- Financial companies employ 60% of all professionals who have the skills to create AI systems
- Banks around the world will be able to reduce costs by 22% by 2030 using artificial intelligence, Technologies, saving up to \$1 trillion, according to a forecast by the research company. Autonomous Next.
- It is expected that face recognition technology will increase its annual revenue growth rate by over 20% in 2020, and will be implemented in the banking sector to help prevent credit card fraud.
- Implementing artificial intelligence and machine learning in banking will be critical for financial, Institutions to stay competitive and thrive in the market by 2024; both web and mobile banking, Adoption among US consumers will increase, reaching 72.8% and 58.1%, respectively, according, to Insider Intelligence Aggregated cost saving for banks from AI applications is expected to be \$447 billion by 2023, according to Insider Intelligence's AI in Banking report.

#### AI in Fintech: Market Summary & Key Takeaways

Total Banking Chatbots Cost Savings for Businesses (\$bn) in 2023: \$7.3 Billion



Total Gross Cost Saving Assessing Motor, Home, Life & Health Insurance Claims via AI (\$m) 2019 & 2023



## **REVIEW OF LITERATURE**

**Parimalarani, G (2020).** Pointed out that the effort of digitalization on the banking sector created a significant future among the workforce in both public and private sector. The digital transformation that took place in banks had changed the organizational and management level design and hiring processes at banks. The increased automation in banking sector could result in a massive unemployment trend and a fall in demand for human workforce in banking sector. It pointed out that the day-to-day banking operations are going to the pace of digitalization and so the role of work roles like clerks, middle level officers are predicting a loss in their positions.

While analyzing the trend of employment in banking sector its attempted to point out that 70% of the front office jobs are displaced by artificial intelligence and the positions like tellers, loan officers, customer service representatives and clerk are replaced by chat bots, voice assistant and automated biometric technology. It stated that the transformation in banking sector has created some new roles like cyber security specialist, programmer, block chain architect, credit analyst etc.

**Rajesh.R., Palpandi (2015).** analyzed the impact of technology on the banking sector in southern Tamilnadu. The information technology adopted in banking sector offered the banks with benefits such as fast and reliable customer service, development of new products, information system on real time basis etc. The study was conducted to analysis the factors for the customers service accessibility and to examine the possible strategies for improving the technology driven services. Descriptive research design was used and open ended questionnaire was used to collect the data. The factors of service accessibility of the customers were studied on the basis of six factors such as banking services, add on services, front office services, technology enabled services, safety and reliability of services, using principal component factor analysis. It showed that the main factor that influencing the customer in accessing service is the banking services.

**Shukla,T.,Singh, A.(2014).**analysed the major factors that affect the employee perception towards the technology in banking sector. The study conducted was exploratory and analytical in nature. The factors that impact the employee perception towards technology was identified by carrying out an exploratory factor analysis. Adoption of technology and technology enabled solutions had made a structural change in the work environment for bank employees, who are required to reskill, upgrade and retrain in order to provide efficient and quality services. It pointed out that the people; processes and technology are the most supporting activities to create impressive value in the field of banking.

## **GOALS OF IMPLEMENTING AN INTELLIGENT**

### **Virtual Assistant**

- **Improve Customer Life-cycle Experience** - Enable personalized, channel-agnostic customer journey
- **Increase Conversion** - Enable seamless customer onboarding through AI Assistance
- **Maximize Revenue Opportunities** - Upsell/cross sell through AI-led product recommendations
- **Reduce Opex Cost** - Significantly reduce customer support cost through automation.

### **SBI, other banks using AI big time to improve efficiency in Customer services**

Indian banks, including state-owned SBI and Bank of Baroda, have started deploying artificial intelligence (AI) in a big way to improve efficiency, detect human behaviour and reduce operational costs. State Bank of India, the India's largest lender, has SBI Intelligent Assistant, a smart chat assistant, evolved from the "cutting edge technology of artificial intelligence that efficiently resolves queries of NRI customers, similar to that of the bank representative. The bank is also in the process of instituting an 'Innovation Centre' that will explore how emerging technologies such as AI and Robotic Process Automation (RPA) can help in making internal banking processes more efficient. With better customer services SBI always make to guide for all customer to use entire facilities which can get work smoothly from customer as well as bank side.

### **Top Use Cases of Machine Learning in Banking and Finance**

Banks are constantly expanding their use of ML to enhance customer experience and back-office operations.

Machine learning tools allow banks to transform their data streams into actionable insights, from operations to business development and marketing. Usually, businesses turn to machine learning use cases in fintech for faster support, more robust security, and smooth, sleek processes. This section will illustrate the most popular machine learning use cases in banking.

#### **1. Onboarding and Document Processing**

Machine learning in banking goes far beyond fraud detection and transaction processing. Document processing is traditionally a labor-intensive process requiring effort and time. Machine learning can ultimately reduce time spent organizing, classifying, labeling and processing documents. First, you need to run copies through the Optical Character Recognition (OCR) process, and then machine learning algorithms can process the text on scanned documents to analyze the context. With the help of this information, the machine learning model classifies and indexes everything for future reference.

## **2. Fraud Detection**

Fraud in the fintech sector is becoming a common problem for many companies, regardless of the number of customers and size. Machine learning in finance can evaluate substantial data sets of simultaneous transactions in real-time. At the same time ML can minimize human input by learning from results and updating models. With the help of machine learning, financial organizations can label historical data as fraudulent or not fraudulent and continue to enhance their ability to detect possible potential fraud by learning from previous patterns of behavior.

## **3. Regulatory Compliance**

Dealing with regulatory issues in the fintech field and banking is resource intense, especially in terms of time and money. Even if companies invest billions of dollars in regulatory compliance, this doesn't necessarily guarantee effective compliance. That's why machine learning among the top machine learning use cases in finance are regulatory technology applications (RedTech). Machine learning algorithms can scan and learn from regulatory documents, and they can easily recognize correlations between guidelines. They can track and monitor regulatory changes when they occur.

## **4. Credit Scoring**

Credit scoring is probably the most promising use case of ML in banking. It evaluates how well the bank's customer can pay and is likely to plan to pay off debt. As there are billions of unbanked people around the world and less than one-half of the population eligible for credit, there's a strong need for credit scoring solutions. Machine learning scoring decisions are based on various data, including work experience, total income, transaction analysis, and credit history. It's a mathematical model which is based on accounting and statistical methodologies.

## **5. Payments**

The payment industry also benefits from incorporating machine learning in payment processes. The technology allows payment providers to reduce transaction costs and therefore attract more business. Among other advantages of machine learning in payments is optimizing payment routing based on pricing, functionality, performance, and much more. By processing various data sources, machine learning systems can smoothly allocate traffic to the best performing combination of variables. This feature allows financial organizations to deliver the best results to merchants based on their specific objectives. Today, there are numerous machine learning applications for finance on the market,

## **RESEARCH METHODOLOGY**

The Researcher is use Secondary data to writer his research article, This study is an observed study based on secondary source. Developing Trends in the modern banking system and the introduction of virtual assistant by the State Bank of India to assist the banking customers to do the virtual baking is the theme of this study. This study is an

explanatory study of modern banking developments especially virtual banking. State Bank of India (SBI) is one of the Top global banks and well on course to break into the Top 30 in a few years. Introduction of virtual banking and the acceptance of virtual banking in India is considered as a disruption in banking industry.

## **CONCLUSION**

Different machine learning techniques can be used for this purpose but the survey shows that the support vector machine can provide the good performance. This can be in the form automating the increasing tasks or providing a quick response to the customers. These machine learning techniques can give the prediction after the learning process. Use of Artificial intelligence is very necessary for the banking sector to survive in the modern time. The prediction of machine learning techniques can help the manager in the decision making process. Banks can also use these techniques for the credit scoring process. It is proved that Artificial intelligence and machine learning techniques are very helpful for the banking sector. Data can also be made secured and error free through the use of Artificial Intelligence.

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## **ARTIFICIAL INTELLIGENCE AND STOCK MARKETS: A NEW ERA OF INVESTMENT**

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### **ABSTRACT**

*Artificial intelligence (AI) is transforming the way investments are made in the stock market, ushering in a new era of investment strategies and opportunities. AI-powered tools can analyse vast amounts of data from a range of sources, including financial statements, news articles, and social media, to identify trends and patterns that humans may miss. This enables investors to make more informed decisions based on data-driven insights. This chapter explores the context of AI in stock markets by discussing the role, application, benefits and its limitations. It also highlights the AI based investment strategies, steps to analyse the performance, key factors to be considered while analysing and the AI tools for investing. The potential impact of AI on traders and the challenges AI poses for the traders have also been discussed in this chapter. Both, traditional investing and AI investing have their advantages and disadvantages. A combination of both approaches can be used to maximize the benefits of each and help mitigate the limitations of each approach and hence a comparison of traditional investing and AI investing is shown in this chapter. AI is also being used to develop predictive models that can forecast market trends and help investors identify opportunities for investment. Machine learning algorithms can be trained on historical data to identify patterns and relationships between different market variables, which can then be used to make predictions about future market movements. Overall, AI is ushering in a new era of investment opportunities in the stock market, enabling investors to make more informed decisions and potentially earn greater returns on their investments. As AI technology continues to advance, we can expect to see even more sophisticated investment strategies and tools emerge in the years to come.*

*Keywords: Artificial Intelligence, Machine Learning, Technology, Algorithms, Investment*

### **INTRODUCTION**

The stock market is a complex and dynamic system that is heavily influenced by many factors, such as economic indicators, geopolitical events, and investor sentiment. Traditional analysis methods, such as technical and fundamental analysis, have been used for decades to analyse these factors and predict future stock prices. However, these methods have their limitations, as they rely on past data and may not consider the rapidly changing market conditions. As a result, investors are always on the lookout for new tools and technologies that can help them make better investment decisions. In



recent years, artificial intelligence (AI) has emerged as one such tool that has the potential to revolutionize the way investors approach the stock market.

### **WHAT IS ARTIFICIAL INTELLIGENCE?**

Artificial Intelligence (AI) is a branch of computer science that aims to create machines that can perform tasks that typically require human intelligence, such as learning, problem-solving, and decision-making. AI algorithms are designed to learn from data, identify patterns, and make predictions. Machine learning is a subset of AI that allows computers to learn from data without being explicitly programmed.

AI is the simulation of human intelligence in machines that are programmed to learn from data and perform tasks that would typically require human intelligence, such as problem-solving, decision making, and language understanding. Machine learning, a subset of AI, is particularly useful for analyzing large datasets and identifying patterns and trends that are not immediately apparent to humans. In the context of the stock market, AI can be used to analyze vast amounts of financial data, news articles, social media posts, and other relevant information to generate insights and predictions about market trends and stock performance. This information can be used by investors to make better-informed investment decisions and manage their portfolios more effectively.

One of the most significant advantages of using AI in the stock market is its ability to process vast amounts of data quickly and accurately. This allows investors to identify trends and patterns in the market that might be missed by human analysts, who can only process a limited amount of information at any given time. AI can also analyze multiple data sources simultaneously, such as financial statements, earnings reports, and news articles, to provide a more comprehensive understanding of the market and the factors that are driving stock prices. Another advantage of using AI in the stock market is its ability to learn and adapt over time. As machine learning algorithms are fed more data, they become better at identifying patterns and making predictions, which can lead to improved investment decisions. AI can also be used to monitor and analyze the performance of individual stocks and entire portfolios, providing investors with real-time updates and alerts when market conditions change.

While AI has many potential benefits for investors, it is important to note that it is not a silver bullet that can guarantee success in the stock market. Like any tool, it must be used in conjunction with other methods of analysis and investment strategies to achieve the best results. It is also essential to understand that AI is not infallible and can make mistakes, especially in highly unpredictable market conditions. In conclusion, AI has the potential to revolutionize the way investors approach the stock market, providing them with new insights and predictions that can help them make better-informed investment decisions. However, it is essential to approach AI with caution and understand its limitations, using it as a tool in conjunction with other methods of

analysis and investment strategies. As the technology continues to evolve, it is likely that we will see even more significant advancements in the use of AI in the stock market, leading to a new era of investment.

**The role of AI in the stock market and how it can be used to predict stock prices:**

The stock market is a complex and dynamic system that is influenced by many factors, including economic indicators, company performance, geopolitical events, and investor sentiment. Artificial intelligence (AI) has emerged as a powerful tool that can be used to analyze large amounts of data and identify patterns and trends that may be missed by human analysts. AI can be used to predict stock prices by analyzing historical data, news articles, social media posts, and other relevant information to generate insights about market trends and stock performance. There are several ways in which AI can be used to predict stock prices:

- 1. Machine Learning Algorithms:** Machine learning algorithms are a type of AI that can analyze large datasets and identify patterns and trends. By analyzing historical market data, these algorithms can identify patterns and trends that may indicate future market trends and stock performance. For example, machine learning algorithms can be used to analyze past market trends and stock prices to identify patterns that can be used to predict future stock prices.
- 2. Natural Language Processing (NLP):** Natural language processing is a type of AI that can analyze and understand human language. By analyzing news articles, social media posts, and other sources of information, NLP algorithms can identify sentiment and other factors that may impact market trends and stock prices. For example, if a news article mentions a company's positive earnings report, an NLP algorithm can identify this sentiment and predict that the company's stock price is likely to increase.
- 3. Neural Networks:** Neural networks can be used to analyze complex data sets and identify patterns and trends that may be missed by other algorithms. These networks can be used to analyze financial data, news articles, and other data sources to generate predictions about stock prices. AI can be used to analyze social media posts, news articles, and other sources of information to understand investor sentiment and how it is likely to impact the market. By analyzing the tone and volume of these posts and articles, AI can predict how investors are likely to react to different market conditions and how this will impact stock prices.
- 4. Deep Learning:** Deep learning is a type of AI that can analyze complex data structures, such as images, audio, and video. By analyzing stock charts and other visual data, deep learning algorithms can identify patterns and trends that may indicate future stock performance. For example, deep learning algorithms can be

used to analyze stock charts and identify technical indicators that may indicate whether a stock is likely to increase or decrease in value.

- 5. Fundamental Analysis:** AI can be used to analyze financial statements, earnings reports, and other fundamental data to identify companies that are likely to perform well in the future. By analyzing factors such as revenue growth, profitability, and market share, AI can make predictions about which companies are likely to see their stock prices rise over time.
- 6. Technical Analysis:** AI can be used to analyze charts and other technical indicators to identify patterns and trends that are likely to impact stock prices. By analyzing factors such as moving averages, trading volumes, and other technical indicators, AI can make predictions about future stock prices based on historical patterns and trends. AI algorithms can identify patterns and trends in historical stock market data. This analysis can be used to predict future stock prices.

#### **Application of AI in the Stock Market:**

AI is being used in various ways in the stock market to help investors make better investment decisions. These approaches range from predictive analysis and sentiment analysis to algorithmic trading, risk management, fraud detection, and personalized investment recommendations. As AI technology continues to evolve, we can expect to see even more advanced applications in the future.

- 1. Predictive Analysis:** AI algorithms can analyze vast amounts of data from various sources, such as financial statements, earnings reports, and news articles, to identify trends and patterns in the stock market. This data is then used to make predictions about the future performance of individual stocks and the market as a whole.
- 2. Sentiment Analysis:** Identify sentiment (positive, negative, or neutral) related to a particular topic. AI can analyze social media posts, news articles, and other sources of information to identify the sentiment of investors and the public. This analysis can provide insights into how investors are feeling about a particular stock or the market, which can be used to make investment decisions.
- 3. Algorithmic Trading:** AI algorithms can be used to execute trades automatically based on predefined criteria, such as market trends, news events, or other factors. This approach is known as algorithmic trading and can be used to execute trades more quickly and efficiently than human traders.
- 4. Risk Management:** AI algorithms can be used to monitor and analyze the performance of individual stocks and entire portfolios in real-time. This analysis can be used to identify potential risks and opportunities and adjust investment strategies accordingly.

5. **Fraud Detection:** AI algorithms can be used to detect fraudulent activities, such as insider trading or market manipulation. This approach can help to prevent financial fraud and protect investors.
6. **Personalized Investment Recommendations:** AI algorithms can be used to provide personalized investment recommendations based on an individual's investment goals, risk tolerance, and other factors. This approach can help investors to make investment decisions that are tailored to their specific needs.
7. **Portfolio Management:** Natural language processing: AI can be used to analyze text data, such as news articles and earnings reports, to identify relevant information and extract insights that can inform investment decisions.
8. **Natural Language Processing:** AI can be used to analyze text data, such as news articles and earnings reports, to identify relevant information and extract insights that can inform investment decisions.
9. **Reinforcement Learning:** This is a type of machine learning that involves training models through a process of trial and error. In the stock market, reinforcement learning can be used to train models to make investment decisions based on historical data and feedback from market performance.
10. **Cluster Analysis:** Cluster analysis is used to group stocks based on similarities in their characteristics, such as industry, size, and volatility. These groups can be used to inform investment decisions and identify trading opportunities.

### **Benefits of AI Investment in Stock Market**

1. **Increased Efficiency:** AI can analyze vast amounts of financial data much faster and more accurately than humans. This allows for more efficient and effective investment decisions.
2. **Improved Accuracy:** AI is less prone to human biases and emotions, resulting in more objective investment decisions. This can lead to more accurate predictions of stock prices and higher returns.
3. **Speed:** AI can analyze market trends and react to changes in real-time, which can be crucial for successful investment decisions.
4. **Cost Savings:** AI investment can reduce costs associated with traditional investment methods, such as hiring and training human analysts.

### **Limitations of AI Investment in Stock Market**

1. **Limited Understanding:** AI lacks the ability to understand the impact of external events that may affect the stock market, such as natural disasters, political events, or regulatory changes.

- 2. Data Quality:** AI is only as good as the quality of data it is fed. If the data is inaccurate or biased, the investment decisions made by AI will also be inaccurate.
- 3. Overreliance:** Overreliance on AI investment can lead to a lack of human oversight and control, potentially resulting in costly mistakes.
- 4. Black Box Decision-Making:** AI investment decision-making processes can be difficult to understand, which can lead to a lack of transparency and accountability.

#### **Difference between Traditional Investing and AI Investing:**

Traditional investing and AI investing are two different approaches to investing in the stock market. Here are some of the key differences:

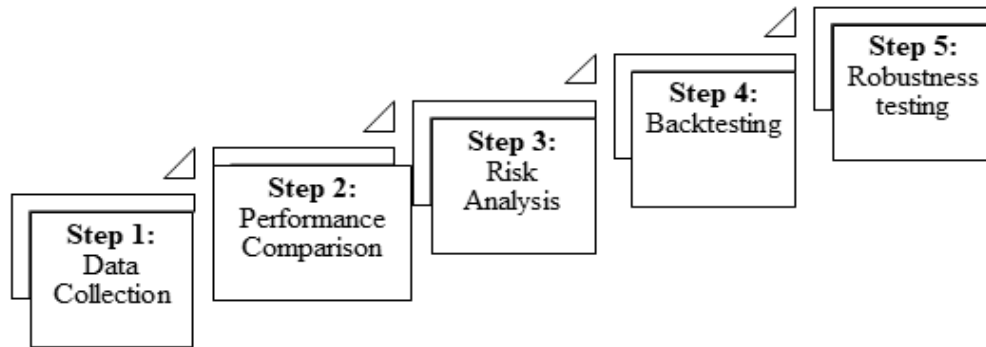
<b>Traditional Investing</b>	<b>AI Investing</b>
<b>1. Decision Making</b>	
Traditional investing relies on human analysts to research companies, study financial reports, and make investment decisions based on their analysis, intuition, and experience.	AI investing relies on machine learning algorithms to analyse vast amounts of financial data, identify patterns, and make investment decisions based on statistical models.
<b>2. Speed and Efficiency</b>	
Traditional investing may take longer to analyze data and make investment decisions.	AI investing can analyze and process large amounts of data much faster than humans, which can lead to quicker decision-making and more efficient use of resources.
<b>3. Emotions and Biases</b>	
Traditional investing may be more susceptible to human emotions and biases, which can impact investment decisions.	AI investing is less likely to be influenced by emotions and biases.
<b>4. Understanding of External Factors</b>	
Traditional investing may take into account external factors such as political events, natural disasters, or regulatory changes that may impact the stock market.	AI investing may not have the ability to understand and analyze these external factors.
<b>5. Transparency and Accountability</b>	
Traditional investing may offer greater transparency and accountability as investment decisions are made by human analysts who can explain their thought process.	AI investing, on the other hand, may be considered a "black box" as it can be difficult to understand the decision-making process of machine learning algorithms.

In conclusion, both traditional investing and AI investing have their advantages and disadvantages. A combination of both approaches can be used to maximize the benefits of each and help mitigate the limitations of each approach.

### **AI based Investment Strategies**

As artificial intelligence (AI) continues to play an increasingly important role in the stock market, many investors are turning to AI-based investment strategies to improve their returns. However, while AI has the potential to provide significant benefits, it is important to evaluate the performance of AI-based investment strategies using data analysis to determine their effectiveness. Here are some key data analysis techniques used to evaluate the performance of AI-based investment strategies:

- 1. Backtesting:** Backtesting involves using historical data to simulate how an investment strategy would have performed in the past. This allows investors to evaluate the strategy's performance and identify potential strengths and weaknesses. Backtesting can be particularly useful when evaluating AI-based investment strategies, as it can help investors understand how the strategy would have performed under different market conditions.
- 2. Risk Analysis:** AI-based investment strategies often involve taking on additional risks in order to achieve higher returns. As a result, it is important to perform a thorough risk analysis to understand the potential downside of the strategy. This can include analyzing factors such as volatility, drawdowns, and correlation with other assets.
- 3. Benchmarking:** Benchmarking involves comparing the performance of an investment strategy to a relevant market benchmark, such as the S&P 500. This allows investors to determine whether the strategy is outperforming or underperforming the broader market.
- 4. Machine Learning Algorithms:** Machine learning algorithms can be used to analyze financial data and identify patterns and trends that may be missed by human analysts. These algorithms can be used to develop more sophisticated investment strategies that are better able to adapt to changing market conditions.
- 5. Portfolio Optimization:** AI can also be used to optimize investment portfolios by identifying the optimal allocation of assets based on an investor's risk tolerance and investment objectives. This can help investors achieve better returns while minimizing risk.

**Steps to analyse the performance of AI-based investment strategies:**

**Step 1: Data Collection:** The first step in analyzing the performance of an AI-based investment strategy is to collect data on the strategy's investment decisions and returns over a specific period. This data can be collected from the strategy provider or by using software tools that track the strategy's trades and returns.

**Step 2: Performance Comparison:** Once the data has been collected, it can be compared to the returns of traditional investment strategies and benchmark indices. This comparison can be done by calculating the strategy's returns over a specific period and comparing them to the returns of other investment strategies or benchmark indices over the same period.

**Step 3: Risk analysis:** In addition to comparing returns, it is important to analyze the risk associated with an AI-based investment strategy. This can be done by calculating measures such as standard deviation, Sharpe ratio, and maximum drawdown, which provide insight into the strategy's volatility and risk-adjusted returns.

**Step 4: Backtesting:** Backtesting is another important tool for evaluating the performance of AI-based investment strategies. Backtesting involves running the strategy on historical data to see how it would have performed in the past. This can provide valuable insights into the strategy's historical performance and help identify areas for improvement.

**Step 5: Robustness Testing:** Robustness testing involves evaluating the performance of the strategy under different market conditions or scenarios. This can help identify the strategy's strengths and weaknesses and provide insights into how it may perform in the future.

**Key factors to consider when analyzing the performance of AI-based investment strategies**

**1. Data quality and quantity:** The quality and quantity of the data used by the AI system can have a significant impact on its performance. AI-based investment strategies require vast amounts of high-quality data to make accurate predictions, and poor quality or insufficient data can lead to inaccurate results.

- 2. Algorithms and models:** The algorithms and models used by the AI system are also critical to its performance. Sophisticated machine learning algorithms and predictive models can help the system identify patterns and trends that may not be apparent to human analysts.
- 3. Backtesting:** Backtesting involves testing the performance of an investment strategy against historical data to see how it would have performed in the past. This can help investors evaluate the effectiveness of an AI-based investment strategy and identify any potential weaknesses or limitations.
- 4. Out-of-sample testing:** While backtesting can be useful for evaluating the performance of a strategy using historical data, it is important to also evaluate its performance on out-of-sample data. This involves testing the strategy on data that was not used in the original backtesting process. Out-of-sample testing can help to validate the performance of a strategy and identify any potential biases or overfitting that may have occurred during the backtesting process.
- 5. Interpretability:** It is important to understand how the AI system is making its predictions and to be able to interpret its outputs. This can help investors identify potential biases or errors in the system and make more informed investment decisions.
- 6. Market Conditions:** Market conditions can have a significant impact on the performance of AI-based investment strategies. For example, strategies that perform well in bull markets may struggle during market downturns. It is important to evaluate the performance of an AI-based strategy across a range of market conditions.
- 7. Risk Management:** AI-based investment strategies should also be evaluated in terms of their ability to manage risk. This includes factors such as diversification, position sizing, and stop-loss orders, which can help minimize losses in the event of a market downturn.
- 8. Regulatory Compliance:** AI-based investment strategies are subject to regulatory compliance requirements, and it is important to ensure that these strategies comply with applicable regulations. This can involve ensuring that models are transparent and auditable, and that investment decisions are made in accordance with applicable laws and regulations.
- 9. Costs:** Finally, investors should consider the costs associated with AI-based investment strategies. These may include fees for data analysis and processing, as well as costs associated with the implementation and management of the strategy.

### **AI Tools for Investing in Stock Markets**

There are many AI tools available for investing in the stock market. Here are some examples:



- 1. Sentiment Analysis Tools:** These tools use natural language processing (NLP) to analyze news articles, social media posts, and other sources of textual data to identify trends, sentiment, and other factors that can impact stock prices. Examples of sentiment analysis tools include Accern, Yewno, and RavenPack.
- 2. Robo-Advisors:** Robo-advisors are online platforms that use algorithms to manage investment portfolios. These platforms use AI and machine learning algorithms to analyze market data, identify investment opportunities, and adjust portfolios based on market conditions. Examples of robo-advisors include Betterment, Wealthfront, and Robinhood.
- 3. Trading Algorithms:** Trading algorithms use AI and machine learning to identify patterns and relationships in stock prices and make investment decisions based on this analysis. These algorithms can be used to automate trading and generate consistent returns. Examples of trading algorithms include AlphaSense, Kensho, and Quantopian.
- 4. Portfolio Optimization Tools:** Portfolio optimization tools use AI and machine learning to identify the most effective combination of stocks for a given investment portfolio. These tools can help investors minimize risk and maximize returns. Examples of portfolio optimization tools include BlackRock's Aladdin platform, Axioma, and Analytic Investors.
- 5. Prediction Tools:** Prediction tools use AI and machine learning to predict stock prices and identify investment opportunities. These tools can help investors make informed investment decisions based on accurate predictions. Examples of prediction tools include Market Prophit, VantagePoint, and StockBrain.

#### **The potential impact of AI on traders**

- 1. Increased Efficiency:** AI can help traders to quickly and accurately analyze large amounts of data, enabling them to make more informed trading decisions. This can lead to increased efficiency and speed in executing trades.
- 2. Improved Accuracy:** AI can analyze data in real-time and identify patterns that may not be visible to humans. This can lead to more accurate predictions of market trends, enabling traders to make more profitable trades.
- 3. Reduced Bias:** AI is less prone to emotional biases than human traders, which can lead to more objective and rational trading decisions.
- 4. Better Risk Management:** AI can analyze historical data to identify patterns and predict market trends. This can help traders to better manage risks and make more informed decisions about when to buy and sell stocks.

- 5. Changes to Job Roles:** The increased use of AI in trading may lead to changes in job roles for traders. Traders may need to develop new skills such as data analysis and programming to work alongside AI algorithms.

However, there are also potential negative impacts of AI on traders, including the risk of overreliance on AI and the potential for AI algorithms to make mistakes or be influenced by biased data. Traders may also need to be trained on how to use and interpret the output of AI algorithms. In addition, there may be ethical considerations around the use of AI in trading, such as the potential for AI to be used for insider trading or to manipulate markets. Overall, the impact of AI on traders is complex and requires careful consideration of both the potential benefits and risks.

**Challenges that AI poses for traders:**

1. **Complexity:** AI algorithms can be very complex, and traders may not have the necessary expertise to fully understand and interpret the output of these algorithms. This can lead to a lack of transparency and accountability, and may increase the risk of errors or biases.
2. **Data Quality:** AI algorithms require large amounts of high-quality data to function effectively. Traders may struggle to access high-quality data, particularly if they are working in niche markets or if the data they require is not readily available.
3. **Ethics:** The use of AI in trading raises ethical considerations, particularly around issues such as fairness, transparency, and accountability. For example, there may be concerns around the use of AI for insider trading or market manipulation.
4. **Regulation:** As AI becomes more prevalent in trading, there may be a need for increased regulation to ensure that traders are using AI ethically and responsibly. This may require regulators to develop new guidelines or standards for the use of AI in trading.
5. **Cybersecurity:** The use of AI in trading may increase the risk of cyberattacks, particularly if AI algorithms are used to automate trading decisions. Traders will need to ensure that their systems and data are secure to prevent against such attacks.

Overall, the challenges posed by AI for traders are significant and require careful consideration. Traders will need to be proactive in addressing these challenges to ensure that they can effectively leverage AI to improve their trading performance.

**CONCLUSION**

The integration of artificial intelligence (AI) in stock markets has ushered in a new era of investment. The use of AI algorithms and machine learning techniques has revolutionized the way traders analyze market trends, identify patterns, and make investment decisions. AI has the potential to greatly increase the speed and efficiency of trading, while also improving accuracy and reducing bias. However, the use of AI in

trading also poses significant challenges, including the complexity of algorithms, the quality of data, ethical considerations, and cybersecurity risks. It is important for traders to understand the benefits and limitations of AI in order to effectively leverage its potential for improved trading performance. The future of investment in the stock market is undoubtedly intertwined with AI, and it will be interesting to see how this relationship develops and evolves in the coming years.

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## DEEP LEARNING AND APPLICATIONS

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### ABSTRACT

- *Artificial intelligence is one of the hot topics in today's world and deep learning is a subgroup of machine learning in artificial intelligence.*
- *Deep learning is constantly entertaining us with its cutting-edge capabilities such as self-driving cars, fraud detection, and much more.*
- *Hence, in this chapter, we will discuss this very interesting chapter “Deep Learning and application” in more detail.*
- *Deep learning is at the very beginning of what machines can do, and developers and business leaders absolutely need to understand what it is and how it works.*
- *Therefore, deep learning algorithms are used, especially when we have a large number of inputs and outputs. So, from now on, let's understand in detail the many faces of deep learning!*
- *Deep learning is the work of artificial intelligence that mirrors the activities of the human brain in preparing and labelling information for use in decision making.*
- *It is also called deep neural learning or deep neural network. It is a type of machine learning that prepares a computer to perform human-like tasks, for example, perceiving speech, distinguishing between images, or making predictions.*
- *Instead of arranging information to wade through predetermined conditions, deep learning places basic boundaries around the information and trains the computer to learn on its own by perceiving designs using multiple layers of processing.*
- *Deep learning contains networks worth learning without supervision from unstructured or unclassified information.*
- *In simple language, deep learning is a kind of algorithm that seems to work well for predicting things.*
- *This piece of machine learning simulates a human neural network.*
- *This artificial neural network saves us time because it prevents individuals from doing monotonous activities, and this measure reduces the risk of human error, and therefore it is additionally appreciated.*

## **INTRODUCTION**

Deep learning is one category of machine learning that focuses on training a computer on the basic instincts of humans. In deep learning, a computer algorithm learns to perform classification tasks directly on complex data in the form of images, text, or audio. These algorithms can achieve SOTA accuracy, sometimes even outperforming a human. They are trained using a large set of labelled data and neural network architectures, which include many layers. Furthermore it; Deep learning is a key technology behind such technology as virtual assistant, facial recognition, driverless cars, etc. Deep learning work involves training data and learning from experience. The learning procedure is called "deep", as with every passing minute neural networks rapidly discover new levels of data. Every time the data is trained, it focuses on improving performance. As the depth of data increases, this training performance and deep learning capabilities are greatly improved, which is why it has been widely adopted by data experts. Along with the huge amount of benefits, threats also emerge due to the unexplored capabilities of deep learning. Deep learning uses supervised, semi-supervised and unsupervised learning to train from data representations. The deep learning function is based on the following points:

1. It mimics the function of the human brain to manage data and form patterns for reference in decision making.
2. The trained data set can be interrelated, diverse and complex in nature.
3. The larger the data set, the more efficient the training, which directly affects the decision-making process.

### **Advantages of Deep Learning**

- The ability to create new features from the limited training datasets available.
- Working on unsupervised learning techniques can help generate significant results that are actionable and reliable.
- It reduces the time required for feature engineering, which is one of the time-consuming tasks in machine learning practice.
- Through continuous training, her architecture has become adaptive to change and able to work on diverse problems.

### **Disadvantages of Deep Learning**

- With its increasing popularity, deep learning also has a few threats that need to be addressed:
- The entire training process relies on a continuous flow of data, which reduces the scope for improvement in the training process.
- The cost of computational training increases exponentially with the number of data sets.

- Lack of transparency in error review. There are no intermediate steps to provide arguments for a particular error. In order to solve the problem, a complete algorithm is reviewed.
- The need for expensive resources, high-speed processing units, and powerful GPUs to train datasets.

## **1. Application of Deep Learning**

This section discusses the focus and problems surrounding deep learning work:

### **1.1 Virtual Assistants**

The core function that requires speech translation and human speech language, is deep learning. Common examples of virtual assistants are Cortana, Siri, and Alexa.

### **1.2 A Vision for Self-Driving Self-Driving Cars:**

In order to navigate a self-driving car, say, a Tesla, one needs human-like experience and expertise. To understand road scenarios, the functioning of signals, pedestrians, the meanings of different signs, speed limits, and many other situations like these, a great deal of real data is required. With big data, the efficiency of the algorithms will be improved which will subsequently increase the flow of decision making.

### **1.3 Service and Chat Bots**

The constant interaction between chatbots and humans to deliver customer services requires robust responses. To respond in a meaningful way with all difficult questions and appropriate response, deep learning is required to train the algorithms.

### **1.4 Translations**

Automatic speech translation in multiple languages requires deep learning supervision. This is a useful mechanism for tourists, travellers and government officials.

### **1.5 Facial Recognition**

Face recognition has many features from its use in security to the tagging mechanism/feature used on Facebook. Besides importance, it has its fair share of issues as well. For example, to get to know the same person who is overweight, losing weight, beard, no beard, new hairstyles, etc.

### **1.6 Shopping and Entertainment**

Shopping apps like Amazon and Myntra and entertainment apps like Amazon Prime and Netflix all store your data and buying habits to display future purchase and viewing suggestions. It always comes as a "You may want to view/buy" headline. The more data is fed into the deep learning algorithm, the more efficient it becomes in its decision making.

### **1.7 Pharmaceutical**

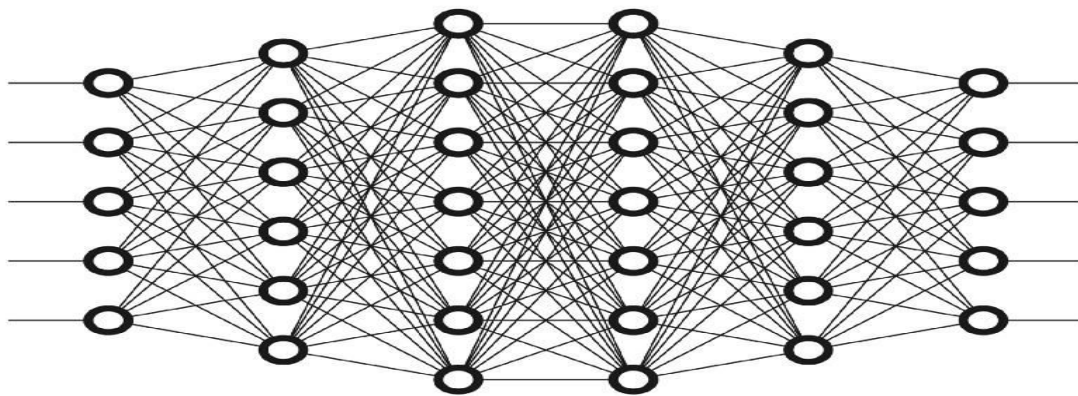
Allocate medications based on specific genomes and diseases. Deep learning has expanded the range of such applications and has gained the interest of the largest

pharmaceutical companies. Besides, other deep learning applications are fraud detection, virtual recognition, healthcare, entertainment and many more.

## 2. Deep Learning Work

Deep learning algorithms use supervised and unsupervised learning algorithms to train the outputs through the given inputs. Look at the image below, these circuits represent interconnected neurons. Neurons are categorized into three different hierarchies of layers called input, hidden, and output layers.

- The first neuron layer, that is, the input layer, receives the input data and passes it to the first hidden layer.
- Hidden layers perform the calculations on the received data. The biggest challenge in creating neural networks is determining the number of neurons and the number of hidden layers.
- Finally, the output layer produces the required output.



### Working of Network of Deep Learning

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This is the basic flow of working. Now, comes the point where the method of computation is explained. Every connection between the neurons consists of weights, it denotes the significance of the input values. In order to standardize the outputs, an activation function is used. For training the network, two important measures are considered. The first is to create a large data set and the second is large computational power. The 'Deep' in deep learning signifies the number of hidden layers the model is using to train the data set. The work of deep learning can be summed up in four final points:

1. ANN requests a set of binary True/False queries.
2. Extract numeric values from data blocks.
3. Sort the data according to the answers received.



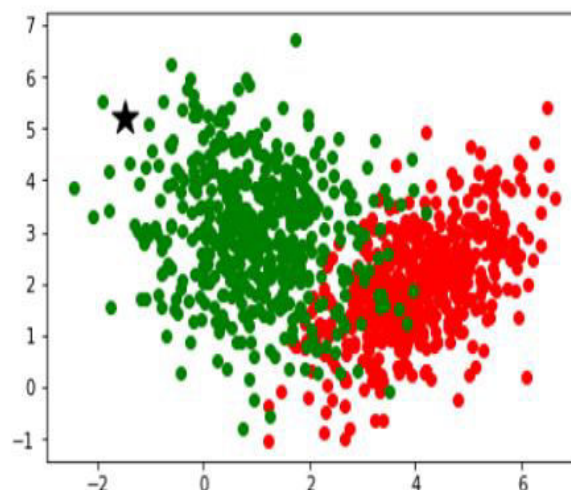
4. The last point is data annotation/classification.

### 3. Top Algorithm in Deep Learning

1. KNN (K-nearest neighbour) method
2. Artificial Neural Network (ANN)
3. Convolutional Neural Network (CNN)
4. Recurrent Neural Network (RNN)
5. Deep Neural Network (DNN)
6. Deep Belief Network (DBN)
7. Back Propagation
8. Stochastic Gradient Descent

**3.1 K-Nearest Neighbour (KNN):** The K-Nearest Neighbour workbook is a supervised introductory workbook that every data science learner should be familiar with. This algorithm was first used for pattern classification task first used by Fix & Hodges in 1951. For similarity, the name was given as KNN classifier. KNN is aimed at pattern recognition tasks.

K-Nearest Neighbour also known as KNN is a supervised learning algorithm that can be used for regression as well as classification problems. Generally, it is used for classification problems in machine learning. KNN works on the principle that every data point located close to each other falls into the same category. In other words, it classifies a new data point based on similarity. Let's understand the concept by taking an Example: Two green and red items and a data point being highlighted



Showing a black data point which is classified as of green class

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Above is the graph showing different data points which are red ones, green ones, and a black data point categorized between these two categories. The graphs above show the same red and green categories, a black data point that is categorized by the algorithm as either red or green. But how is it calculated by the KNN algorithm? KNN algorithms determine the number  $k$  which is the nearest neighbour of the data point to be classified. If the value of  $k$  is 5, it will search for the 5 closest neighbours to that data point. In this example, if we assume  $k = 4$ . KNN detects about 4 nearest neighbours. All data points near black data points belong to green class which means all neighbours belong to green class, so according to KNN algorithm it will only belong to this class. The red category is not considered because the red category data points are not close to the black data point. The simple version of K-nearest classifier algorithms is to predict the target label by finding the nearest neighbour class. The closest category to the point to be classified is calculated using the Euclidean distance.

**3.2 The importance of KNN:** Specifically, the KNN algorithm works in the following way: finds a distance between a query and all examples (variables) of the data, selects a certain number of examples (such as  $K$ ) that are closest to the query, and then decides The most common label if used for taxonomy-based problems, or Label averages if used for regression-based problems Therefore, the algorithm is highly dependent on the number of  $K$ , like this  $k$  value - The larger the  $k$  value, the greater the confidence in the prediction. Decisions may be skewed if the value of  $k$  is too large.

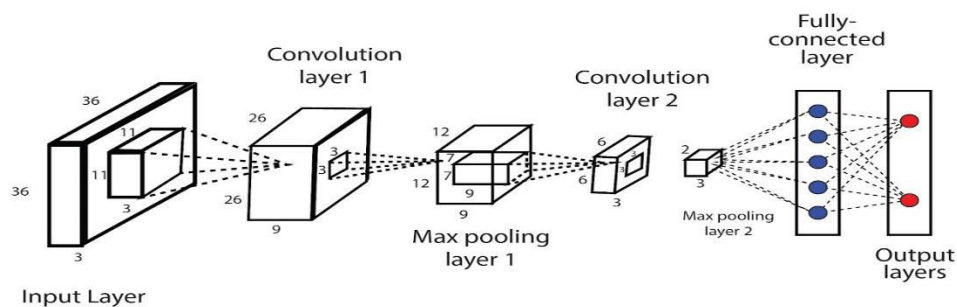
**3.3 Convolutional neural networks:** are neural networks that are mostly used in image classification, object detection, face recognition, self-driving cars, robots, neural pattern transmission, video recognition, recommendation systems, and so on. CNN classification takes any input image, finds a pattern in the image, processes it, and classifies it into different categories like car, animal, bottle, etc. CNN is also used in unsupervised learning to group images by similarity. It is a very interesting and complex algorithm, driving the future of technology.

### **3.4 What is a Convolutional Neural Network (CNN)?**

Convolutional neural networks indicate that these are just neural networks with some arithmetic operation (generally matrix multiplication) between its layers called convolution. It was proposed by Yann LeCun in 1998. It is one of the most common uses in image classification. Convolutional neural network can be broadly categorized into the following steps:

1. Input layer
2. Convolutional layer

### 3. Output layers



The architecture of Convolutional Neural Networks (CNN)

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IFnl5jwkR6FoT\_v2Vbi14s414fJSORuGLRQbHyYp6dtHDItrcSQnRWcd1JRGbZC5VlGTvH80gFZrHw8qg2Tx7ca2HYKFc

**3.4.1 Input Layers:** are associated with convolutional layers that perform many tasks such as padding, skipping, kernel work, and many other representations of this layer, and this layer is considered as a building block for convolutional neural networks.

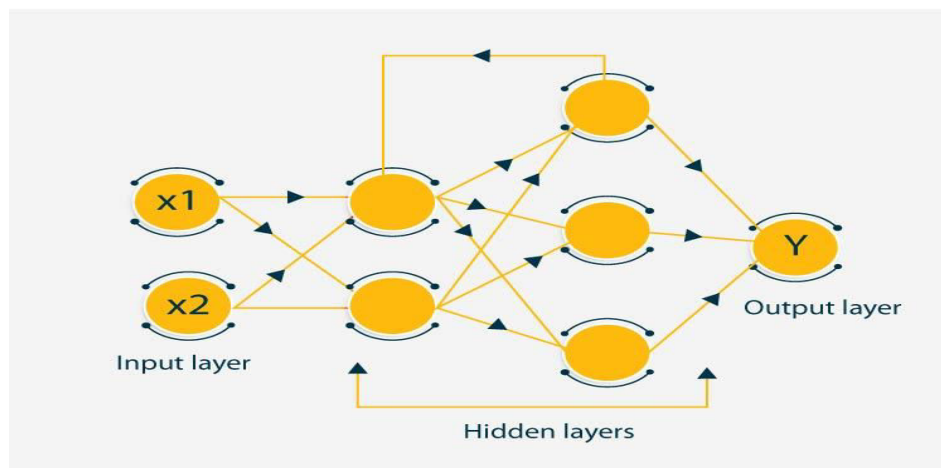
**3.4.2 Convolutional Layer:** The main goal of the convolutional layer is to extract features from images and find out all the features of the image that would help in object detection techniques. As we know, the input layer will contain some pixel values with some weight and height, and our beads or filters will wrap around the input layer and give results that return all the features with the lowest dimensions. Let's see how the kernel works.

**3.4.3 Introduction to RNN:** First, let me introduce the recurrent neural network (RNN) and its image in action. You have already seen the definition of RNN, "a type of neural network in which the output of previous steps is fed as input to the current steps", suppose you want to predict the next word in a sentence, so you may know the previous words in this sentence, and thus all previous words are expected to be memorized of the sentence, so a recurrent neural network appears in the picture.

Typically, RNNs are designed to study sequence data presented in patterns, such as text recognition, different handwriting, spoken words, and genomes. In addition, neural networks are largely implemented in digitally rendered time series, which originate from stock markets and sensors. Different RNN algorithms are very time consuming and consider data in a sequential pattern, which is why this also applies to images, images can be parsed into a set of patches and processed as sequential data. From a broad research standpoint, neural networks are the most powerful and versatile. Tools such as memory networks, as well as neural networks have memory and take a long time, and therefore use recurrent neural networks for themselves.

**3.4.4 Understand the structure and functioning of the RNN model:** The architecture of RNN has a design similar to that of CNN and other artificial neural networks. Like general neural networks, it has three large-scale input layers, namely the input layer, the hidden layer, and the output layer. Again, these layers work in sequence. The input layers fetch the data and perform the data pre-processing, later, when filtering this data, it is transferred to the hidden layers where many neural networks are implemented as algorithms and activation functions in order to retrieve the useful information, then this set of information goes to the output layer.

The hidden layer is the most important feature of RNN, it stores and remembers some information about the sequence. Consider an example of a network in which we have one input layer, four hidden layers, one output layer, four hidden layers which have their own weights and biases, let's say all the hidden layers carry weights and biases like  $(w_1, b_1)$ ,  $(w_2, b_2)$  and  $(w_3, b_3)$  and  $(w_4, b_4)$  respectively, these weights and biases are independent of each other and therefore do not retain the prior information.



Recurrent Neural Network Structure

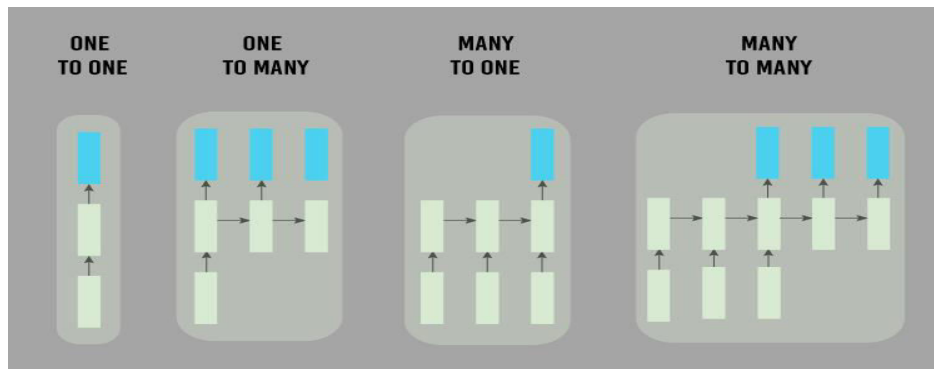
<https://www.analyticssteps.com/backend/media/uploads/2019/09/24/image-20190924153803-1.jpeg>

Here comes the main function of RNN, RNN provides the same weight and equal bias to each layer, thus converting the independent variables into dependent variables, it will minimize the parameters and save each previous output by providing each output as input to the next hidden layer, thus the four layers can be linked together so that they are weights. The biases of all hidden layers are identical, in one iterative layer.

### 3.4.5 There are four types of RNN

1. One to one
2. One to many
3. Many for one

#### 4. Many to many



Recurrent Neural Network Types

<https://www.analyticssteps.com/backend/media/uploads/2019/09/24/image-20190924153803-3.jpeg>

#### 4. CONCLUSION

The Deep Learning Chapter is a sub-branch of artificial intelligence and machine learning that follows the workings of the human brain to process data sets and make effective decisions. Deep learning uses both structured and unstructured data for training. Practical examples of deep learning are virtual assistants, vision for driverless cars, money laundering, face recognition and many more. The more experience deep learning algorithms have, the more effective they are. As technology advances over the years, it has the potential to become extraordinary.

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7. Showing a black data point which is classified as of green class Image [https://lh6.googleusercontent.com/Nu4ZO7i94JZyaVARVEoGg9GFCQlnz17U\\_DqEnM0hl2I6Lcrh1QE7dISFcS1PjlX8rYrEm79la3Fb2061\\_PsnIcVcO14H9WGv1exa0Kv4qbrilGqZYheQ6-1yByn9BdiNzMbpBdO8](https://lh6.googleusercontent.com/Nu4ZO7i94JZyaVARVEoGg9GFCQlnz17U_DqEnM0hl2I6Lcrh1QE7dISFcS1PjlX8rYrEm79la3Fb2061_PsnIcVcO14H9WGv1exa0Kv4qbrilGqZYheQ6-1yByn9BdiNzMbpBdO8)
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9. Recurrent Neural Network Structure <https://www.analyticssteps.com/backend/media/uploads/2019/09/24/image-20190924153803-1.jpeg>
10. Recurrent Neural Network Types <https://www.analyticssteps.com/backend/media/uploads/2019/09/24/image-20190924153803-3.jpeg>

## DESIGN AND DEVELOPMENT OF DATA INTEGRATION TECHNIQUES USING IOT DEVICES FOR COMMUNICATION

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### ABSTRACT

*Nowadays the Internet of Things (IoT) is one of the most trending technology. It is anticipated that via 12 months 2025 there may be 70 billion of Internet-linked devices. Fields like clever towns and clever homes in large part rely upon IoT phenomena with the aid of using a extensive type of sensors for facts series, evaluation and corresponding actions. This trending and comparatively new generation can be applied for layout of new facts integration techniques. These techniques may be correctly utilized in clever houses and clever faculties.*

*Keywords: IoT, Data integration, Communication Protocols, Sound, Ngrok, Annaconda, Flask, Alexa, DB sqLite Browser.*

### 1. INTRODUCTION

The concept of the Internet of Things (IoT) indicates that in preference to having a small quantity of powerful computing devices e.g. Laptop, tablet you have got a massive number of devices, which are much less effective e.g. bracelet, related light bulb. Name itself means that the IoT includes key parts – community and diverse gadgets related to it. The “Internet” part could take numerous forms and serves as the medium for sending and receiving the facts; at the same time as the gadgets known as “Things” act as facts resources and actuators. Explosive increase of smartphones and pill PCs brought the quantity of Internet-connected gadgets in keeping with character to greater than 1 device in 12 months 2010 for the primary time in history [1]. In 12 months 2015 the full range of linked devices reached 18.2 billion [2]. Cisco predicts that there will be a complete of fifty billion Internet related devices through year 2020. The IoT devices are gift bodily inside the real international, in your house, paintings, and vehicle or worn round your body. This means that they get hold of inputs from the bodily world, remodel them into information and convey outputs that may be accumulated and processed for similarly action, e.g. processing and analysis [3]. The sensor originating statistics are become information, understanding, and, in the end, wisdom. In this context, the IoT becomes immensely crucial in enriching our day by day enjoy. Even now the IoT has already made the Internet sensory with real-time records about measurable homes, such as temperature, strain, vibration, mild and moisture. This serves as a riding pressure for growing cyber-bodily systems which have the capacity of dramatically Enhancing the way human beings stay, examine, work and entertain themselves. In addition, the Internet is expanding into locations that till now have been

unreachable. Patients are consuming IoT devices into their personal bodies to help docs diagnose and determine the causes of certain sicknesses. Extremely small Internet-related sensors may be located on plant life, animals, geologic capabilities and in buildings [1]. Those sensors offer information that supply actual-time insights and can also be used for predictive analysis. Lorence Heikell [4] has documented an example from a dairy farm in which IoT primarily based monitoring is used for enhancing milk production, smoothing calving technique and making sure suitable fitness of the cows. The German farmer has recounted that cow farming has come to be plenty easier thanks to the applied IoT solution. The time for evaluating the health of the animals has gone down from 2–3 hours in keeping with day to 3 minutes that can be spent while searching at IoT based totally reviews in a mobile application. Another area of application is the building monitoring structures that present facts to professionals in real-time allowing them to evaluate the modern-day state of a building, predicting viable harm or even collapsing dangers. Experiments documented in [5] show that such IoT based constructing monitoring systems perform well and meet specialists' requirements IoT solutions may be composed of a massive range of devices that must be supplied with powerful methods of records alternate. Maximizing the inter-tool communication distance and minimizing the strength intake are an essential task within the location of IoT, and new technology is rising to cope with it [6]. One of such technologies is the Wireless Sensor Network (WSN). It is an architectural version containing a number of sensor nodes and a principal node (hub). In the WSN, the accrued statistics from the sensor nodes are transferred to the critical node for processing and in addition actions. One of the conversation protocols that may be applied for IoT node communication is the Bluetooth low power (BLE) wireless verbal exchange protocol. Another choice imparting low electricity and comparatively extensive verbal exchange range is the Zigbee Wi-Fi communicate fashionable. Zigbee supports introduction of IoT networks with up to sixty four 000 gadgets [7]. Data Integration is the mixture of technical and business approaches used to combine statistics from disparate assets into significant and treasured records. The technique of Data Integration is ready taking information from many disparate resources (including files, various databases, and mainframes) and mixing that statistics to offer a unified view of the data for enterprise intelligence. Data integration is wanted whilst a business makes a decision to enforce a brand new utility and migrate its statistics from the legacy systems into the new utility. It becomes even significantly important in instances of organisation mergers in which companies merge and that they need to consolidate their applications. One of the most typically known use of records integration is building a facts warehouse for an enterprise which allows a enterprise to have a unified view of their facts for analysis and enterprise intelligence (BI) desires.



## **DATA INTEGRATION TECHNIQUES**

There are many state-of-the-art methods the unified view of facts can be created today. No more ETL is the best way to attain the goal and that could be a new level of complexity inside the discipline of Data Integration. There are several organizational degrees on which the Data Integration may be done.

### **1. Manual Data Integration**

Technically speakme, this is truly no longer a Data Integration. In this method, an internet based consumer interface or software is created for customers of the machine to reveal them all the relevant data by way of getting access to all the supply structures immediately. There isn't any unification of facts in fact.

### **2. Middleware Data Integration**

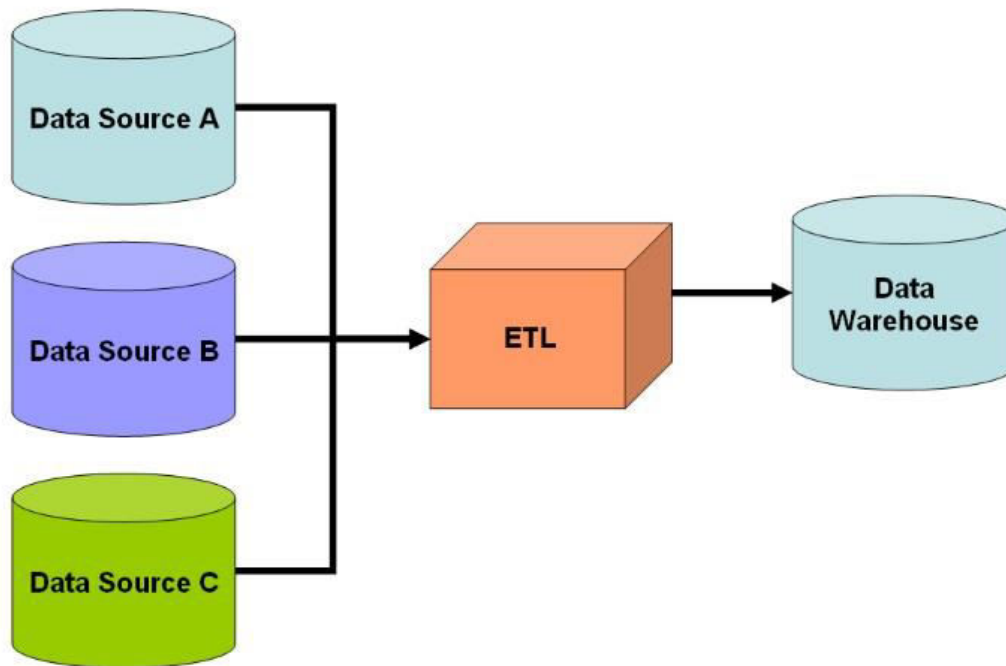
A middleware records integration solution is basically a layer between disparate structures allowing them to talk. Middleware integration can act like glue that holds together multiple legacy applications, making seamless connectivity viable without requiring the 2 packages to speak without delay.

### **3. Data Virtualization Integration Approach**

Data Virtualization allows us to go away facts inside the supply structures while allowing creating a new set of unified perspectives. This offers a way for users to get entry to the unified view of disparate supply system's information across whole agency. A lot of corporations today prefer this approach due to the blessings and technology that exist these days to help this approach. The main advantage of the digital integration method is near actual time view of statistics from the source systems. It gets rid of a need for separate information store for the consolidated unified facts. However, that doesn't mean it's the best way to do Data Integration although it virtually has a short time period advantage. The drawbacks of this approach encompass restrained opportunity of records's availability or information version management and extra load on the supply systems involved which may also have an detrimental effect on the overall performance of the supply structures.

### **4. Data Warehouse Approach of Data Integration**

This is the most commonly known technique to Data Integration you may already recognize if you have study Ralf Kimball and/or Bill Inmon. This method calls for advent of a new Data Warehouse (of Data Marts) which shops a unified version of information extracted from all the source structures concerned and manipulate it impartial of the original source structures. The blessings of this technique encompass capability to effortlessly manage history of information (or records versioning), ability to combine statistics from very disparate assets (mainframes, databases, flat files) and to store them in a principal repository of records.[8]



## 2. REVIEW OF LITERATURE AND DEVELOPMENT IN THE SUBJECT

The IoT facts integration answer is prepared for deployment and is deliberate to be installed via the quit of yr 2016. Currently our solution can perform measurements only in a unmarried vicinity since it uses a single set of boards and sensors; however, this could be effortlessly prolonged by way of including greater additives. The particular function of our IoT records integration solutions is the integration with Twitter, that's planned to be prolonged with help for other social media networks, such as Instagram. Student feedback can be accumulated serving as enter for specifying additional necessities for future improvements. The cutting-edge information integration answer is simplest at its early degrees and supports information accumulating from a single vicinity; therefore, work on in addition improvement will be related to expansion of machine competencies. Authors are making plans to extend the Twitter integration with extra instructions that can be used in tweets. For example, customers might be able to find out the statistics approximately real time conditions on the university through just tweeting a syntactically valid command e.g. @rtu-iot get temperature to the IoT answer's Twitter account and getting the response in form of a tweet. This could provide clean get entry to to the IoT information from drugs, smart phones and computer PCs. The present range of sensors may be extended with a sound stage detection sensor. Increasing the quantity of devices will permit placing them in several rooms in such manner gathering facts from a larger place. Our IoT solution can also be supplemented with actuators performing diverse moves underneath positive context situations. For example, the conditioner in one of our labs may be powered by means of a signal from an infrared (IR) transmitter in case of temperature going above a

predefined margin. Authors also are making plans to feature a Wi-Fi adapter inside the tracking mode that will be able to collect all broadcasted SSIDs (Service Set Identifiers) that cell telephones or laptops are broadcasting even as trying to hook up with Wi-Fi access factors that they have got already been linked to previously. The end result may be displayed on Smart TV elevating the awareness that our gadgets are broadcasting excessive statistics. Bluetooth adapter also can be used to accumulate records about cell phones or laptops that have their Bluetooth enabled. Another capability characteristic of the IoT records integration answer is people counting the usage of cameras and picture processing applications that are deployed to the cloud. However, in this example the privacy elements have to be taken into consideration based on EU Regulation on the protection of natural humans with regard to the processing of private records and on the unfastened motion of such facts. Currently best Wi-Fi is used as a way of verbal exchange; however, Authors are making plans to experiment with different extra perspective conversation technologies. In next versions of our solution, the connected sensors could be primarily based on AVR MCU and sensors may want to ship facts to the board wirelessly. In this example, we also have to reflect on consideration on protection troubles, as an instance, whether or not the records might be sent in plaintext or encrypted shape. After putting in the variety of sensors and monitored rooms, authors are planning to display a live map of the sensor places on the Smart TV. Authors are also making plans to put in custom designed Bluetooth beacons for demonstrating the in room positioning talents and tracking the movement of users, who have mounted a Bluetooth connection with our beacons.[10]

IoT has been regularly bringing a sea of technological modifications in our each day lives, which in turn enables to making our existence less difficult and extra comfortable, though various technologies and applications. There is innumerable usefulness of IoT programs into all the domain names inclusive of scientific, manufacturing, business, transportation, training, governance, mining and habitat. Though IoT has considerable blessings, there are a few flaws in the IoT governance and implementation level. The key observations within the literature are that [11] There isn't any fashionable definition in worldwide [12]. Universal standardizations are required in architectural stage [13] and technologies are varying from vendor-vendor, so wishes to be interoperable [14]. For higher international governance, we need to construct fashionable protocols.

The Internet of Things concept arises from the want to manage, automate, and discover all gadgets, devices, and sensors within the global. In order to make sensible decisions both for people and for the matters in IoT, statistics mining technology are integrated with IoT technology for choice making support and machine optimization. Data mining includes discovering novel, thrilling, and probably beneficial patterns from information and making use of algorithms to the extraction of hidden facts. In this paper, authors survey the data mining in 3 one-of-a-kind views: understanding view, method view, and application view. In know-how view, authors overview category, clustering, affiliation

evaluation, time series evaluation, and outlier evaluation. In application view, authors evaluation the everyday information mining application, together with e-trade, industry, fitness care, and public carrier. The technique view is discussed with expertise view and alertness view. Nowadays, huge statistics is a warm topic for information mining and IoT; we additionally speak the brand new traits of huge information and analyze the demanding situations in facts extracting, information mining algorithms, and facts mining system location. Based on the survey of the cutting-edge studies, a suggested big statistics mining gadget is proposed [15].

David Lago et al., 2008:[16] This paper presents an educational laboratory that has been implemented for the sensible education in sensors, records acquisition, and primary manipulate skills. The use of the laboratory has been optimized by way of the provision of a faraway access infrastructure that allows the definition and booking of time slots related to the laboratory websites. Given the various styles of present sensors, conditioning circuits, and actuators, setting up an educational framework is a complex (and high priced) challenge, although handiest the primary design options are taken into account.

Emiliano Miluzzo et al., 2010:[16] Mobile telephones or Smartphone's are rapidly turning into the critical laptop and conversation tool in human beings's lives. Authors agree with that sensor-prepared cell telephones will revolutionize many sectors of our financial system, such as business, healthcare, social networks, environmental monitoring, and transportation. In this text they survey current cellular cellphone sensing algorithms, applications, and systems. Authors speak on the emerging sensing paradigms, and define an architectural framework for discussing a number of the open problems and challenges emerging inside the new region of telephone research area.

The Romanian engineering schooling started out to offer to college students the essential abilities to code programmable forums, to create intelligent gadgets, and in some branches, to use 3-D printers. However, earlier than being enrolled in academic studies, the scholars have the possibility to gain such competencies best in remoted instances. Since the IoT effect is predicted to increase, the real project is to educate as many students as possible on what IoT can add to their existence and future career. Here, no longer best the students who desire to turn out to be engineers are considered, considering that lower and specifically higher secondary college need to introduce related IoT content material in formal and non-formal schooling activities. More, transferring IoT basic competencies to students, starting from early ages, they will have a good sized assist to be competitive within the labour market. It is apparent that the consequences presented in this text show that IoT and 3D printing technologies are nevertheless in the starting, in the Romanian education, but small steps for promoting such technologies are recorded within the ultimate current years. On the opposite hand, it's far absolutely encouraging to peer that

maximum of the college students who participated to the described survey confirmed openness and preference to study those topics. By positive, the actual voice of young era is in-line with the surveyed college students' answers, who need to recognise extra about this rising technology which will become an important a part of our regular existence very soon.[17]

Internet of Things depends on Internet, sensors era which makes the conversation feasible among gadgets by using implementing specific protocols. After doing the literature survey some principal issues are located, like the interrupted connectivity among devices effecting the verbal exchange. Also there may be compatibility issue in gadgets. Security of gadgets all through verbal exchange manner and security of communicate channel or link is likewise a prime issue. Lots of work is to be performed for the betterment and development of this area; still there's more paintings to do, extra standardization of generation, protocols and hardware are required to make

Absolutely reliable and at ease area of Internet of Thing. Some worldwide hints ought to be used for this cause. The destiny is completely depends on Internet of Thing, so lot of component to do at implementation level. In order to solve safety problems in IoT domain we recommend to put into effect the idea of Block Chain in IoT. Authors may have deep dialogue on principals and implementation of Block Chain in our in addition works.[18]

Internet of in undergraduate schooling Marlin H.Mickle IoT schooling method repurpose traditional laptop networking path as "Introduction to IoT" equip the pupil with a "Toolbox" of wi-fi networking techniques from the past encourage undergraduates to participate in palms-on projects and research.[19]

### **3. GOALS AND OBJECTIVES OF RESEARCH**

The Goal of this research is the effective use of data integration by using IoT technology in certain real-life application.

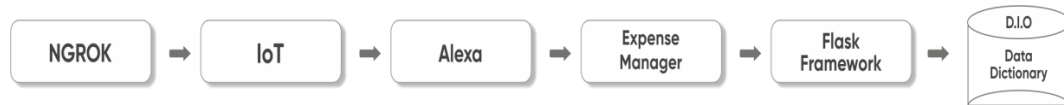
#### **OBJECTIVES OF THIS RESEARCH PROPOSAL ARE**

- a) To study IoT technology and data integration technology in depth.
- b) To design and develop a new steps for data integration using IoT technology.
- c) To implement the developed new steps by using appropriate software platform.
- d) To apply the newly developed application which is integrated IoT technology and produced integrated data from the various data sources by using IoT devices.

### **4. METHODOLOGY TO BE ADOPTED**

Methodology to be used in this research is the design and creation methodology. In this research we will initially perform experiment to understand the limitation of existing technologies and then we will design the new algorithm to remove such limitations.

## 5. ARCHITECTURE OF DATA INTEGRATION



**Figure 1.4 :** Architecture of Data Integration

### 1. NGROK

NGROK is a reverse proxy that creates a secure tunnel from a public end point to a locally running web service. NGROK captures and analyses all traffic over the tunnel for later inspection and replay. Expose any http service behind a fire wall to the internet on a sub domain of NGROK expose any TCP service behind a firewall to the internet on a random port on NGROK.com. Inspect all http request/responses that are transmitted over the tunnel. Whatever request transmitted over a tunnel will replay securely

### 2. IoT

Internet of things (IoT) is playing a critical role in various technologies that are greater useful in various packages. IoT is a network, in which all bodily items are related to the internet via network gadgets inclusive of router

### 3. Alexa

Amazon Alexa Echo dot device is a hands-free smart speaker that control using voice it connects to Alexa a cloud based voice service to expense manager which gives income intent, expense intent, expenditure report it has a built in speaker so we can also use Alexa to find the date, month and year .

### 4. Expense Manager

Expense Manager is a base package of an application which have intents that can be created in a alexa\_skill\_env

### 5. Flask Framework

Class application integrated with front end framework which is written in Python language we require two package to set up environment one is a) Virtual env b) Flask.

### 6. Data Dictionary

All the records are stored at the back end site

### 6. Importance of study/ Society application

Importance of my study is focusing on data integration technology using IoT. Which will most beneficial for society because now a days human being is depend on Internet connected devices. This trending and relatively new technology can be useful in many application like smart homes smart colleges and wearable computers.

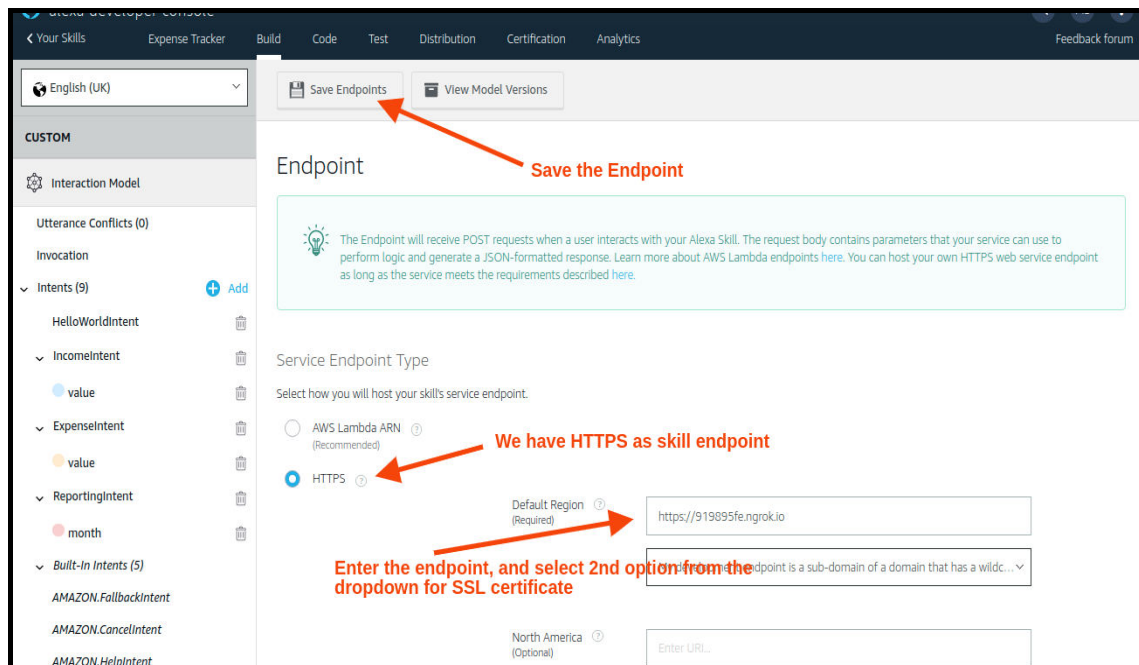
## 7. APPLICATION

Below are the key steps in configuration of alexa skill : (For all steps internet connection is a must)

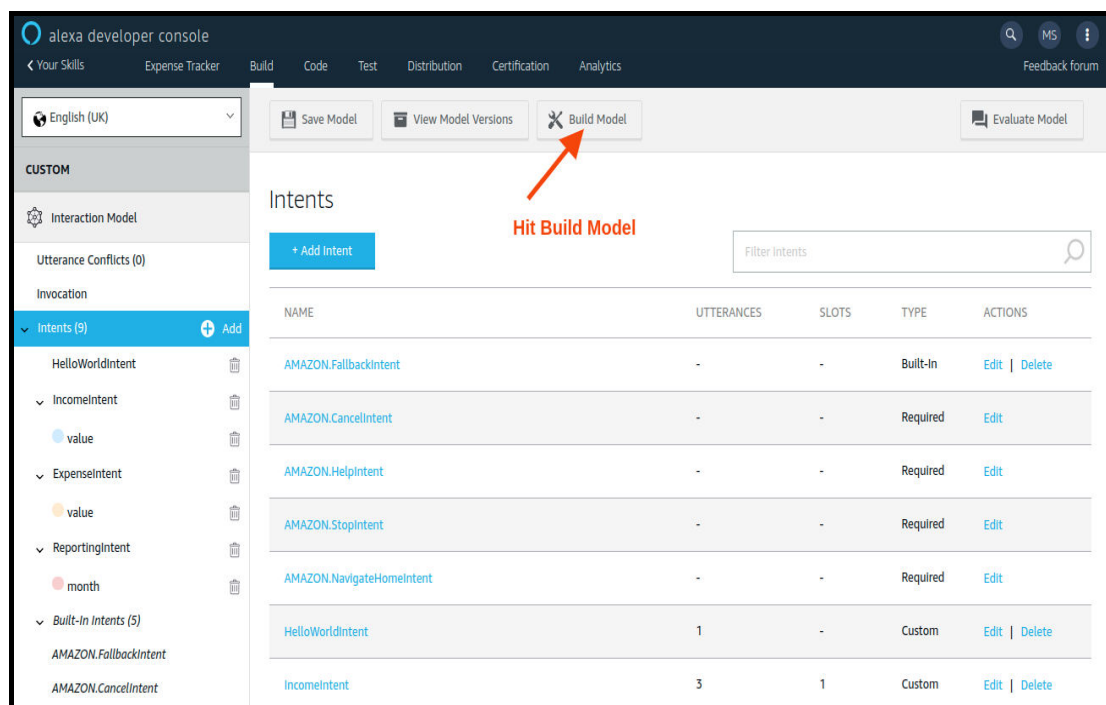


We need to build the skill as we need to allow training for the skill which is in development.

We will now add the NGROK endpoint to point our skill to.

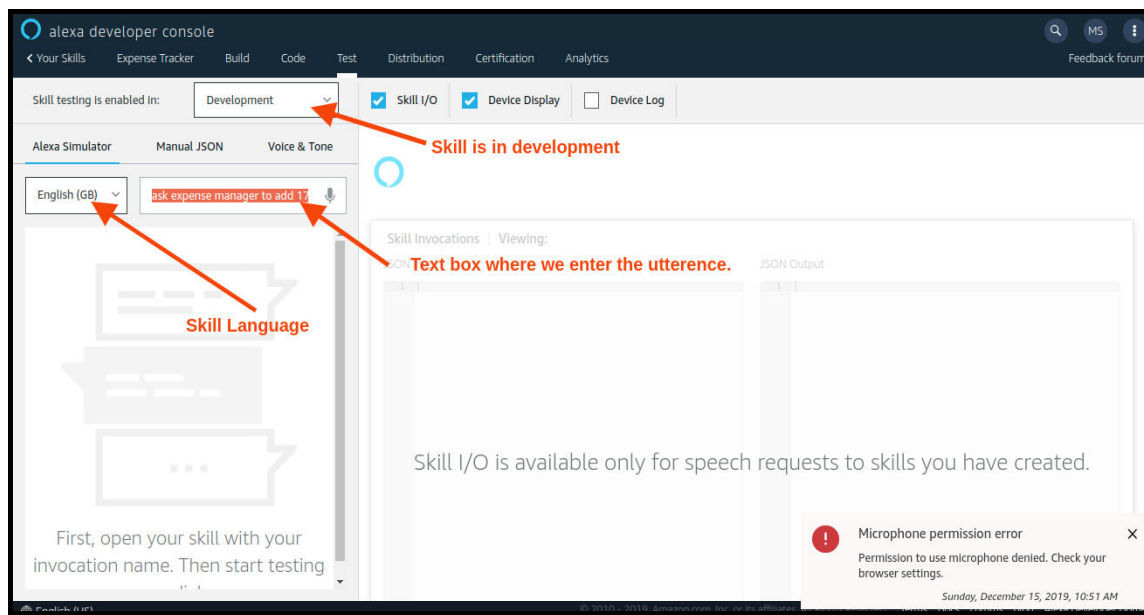


Build the skill, This will train the NLP model of alexa for our skill intents and utterances.



Testing the skill





Utterances which user can enter are

### 1. Income Intent

Ask expense manager to add <amount> as income

### 2. Expense Intent

Ask expense manager to add <amount> as expense

### 3. Reporting Intent

Ask expense manager to give expenditure report

## CONCLUSION

In this Research we have implemented the IoT features through IoT device i.e Alexa echo dot, and we have created an application i.e Expense manger which provide us to four intent like welcomeintent, incomeintent, expenseintent and Expenditure reportintent. We have used a alexa developer console for accepting the commands for the intent. Ngrok used to port forwarding using wildcard SSL.and anaconda prompt is used to activate the environments. Data is stored at the backend for future reference.so we can implement such kind of features in the different fields which will help to grow a better productivity.

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## DIGITAL SERVICES IN EDUCATION SECTOR

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### ABSTRACT

*Technology is quickly evolving these days across all facets of existence. From communication to visual and auditory pleasure to transport, electrification, and other things, everything is reliant on the use of ITC technology. Due to the traditional education system's incapacity to meet today's complicated needs, where everything is not only dynamic but also growing at a very rapid rate, the education system around the world has been forced to undergo a radical transition. Hence, smart classrooms with the audio and visual equipment and PowerPoint presentations are replacing traditional classrooms with blackboards. E-books are replacing textbooks in a same way. Due to its flaws, physical methods of teaching and learning are being abandoned in favour of virtual ones, which address the problems and difficulties associated with conventional education. In fact, digital education combines technology, digital instruction, and content into the educational system, making it more effective and efficient than the conventional method. By broadening the pupils' knowledge base, this educational shift has provided several benefits. They become more capable of coping with the changing environment. But because they believe they can get internet material at any time, students are being stupid because they are not paying enough attention in their online lectures.*

*Keywords: Digital Services, Online Education, MOOC'S, E-learning, Technology*

### INTRODUCTION

Higher education now faces a new set of opportunities and challenges because of digitization, and many educators and students are taking part in related educational initiatives. The primary learning environments in overall education are shifting from campus to a virtual, digitalized environment. For teaching and learning in professional & Non-professional education, digital learning is a popular and quickly developing strategy. Using a range of modalities using information and communication technologies, including computer-assisted, mobile, and digital simulation-based learning, it provides learning content to enhance each learner's knowledge and abilities as well as successful teaching methods. Digital teaching materials (e-textbooks, digital data, and content delivered in digital format), digital tools (computers and smart devices), and digital delivery (Internet), which are offered in an integrated fashion, make up digital learning.

Digital technologies are required in schooling the use of digital technologies has already become necessary because of the globalisation of education. There were online tools available for administering day-to-day operations at academic institutions, conducting classes, exchanging resources, and performing assessments. Nonetheless, these platforms were utilised proactively. The institutes were compelled to switch to an online teaching model by the COVID-19 Agreement to maintain the educational system. Developed nations were prepared to handle this issue. Nonetheless, poorer countries fought hard to achieve this need. In this crucial period, digital technologies have emerged as education's saviour. The need for international integration in the educational system is highlighted by the current global crisis. Digital technologies assist in building talents that will demand students' professional performance, such as problem-solving, thinking structure development, and process comprehension. The children are also preparing for a future that will be more erratic and dynamic and in which technology will be essential. The learned traits and skills of students will be crucial to their success in the workplace. Digital technologies and educational resources support improvement.

### **ELECTRONIC LEARNING**

This is a type of distant education that enables students to access from various geographical areas. An electronically designed course delivers several educational strategies (such as visuals, graphics, videos, blogs, discussions, and quizzes) using a variety of formats. E-learning platforms allow both synchronous and asynchronous use by both teachers and students. Even when simultaneous online access is not possible, forums, e-mails, and mailing lists can enhance student-instructor relationships and enable flexible learning. Synchronous e-learning can be conducted in a real-time interactive manner.

### **MOBILE LEARNING**

a type of online education that has developed with the introduction of mobile devices in education and is primarily used outside the classroom. Individuals can utilise their mobile devices to get to educational resources, communicate with others, or produce content inside and beyond the classroom. hugely popular online courses (MOOC) "MOOC integrates the connectedness of social networking, the facilitation of a known expert in a field of study, and a collection of publicly accessible online resources," according to the statement. Videos, exercises, presentations, and exams are all part of the course.

### **MASSIVE OPEN ONLINE COURSES (MOOC)**

MOOC integrates the connection of social networking, the facilitation of a recognized expert in a subject of study, and a collection of publicly accessible online resources," according to the statement. Videos, assignments, presentations, and exams are all part of the course. The type of digital learning design, integrated subject, context, comparison group, in-depth learning activities, and significant findings were tallied together with

the theme material that was found and retrieved from each study. Textual descriptions were produced following analysis in accordance with the type of digital design.

The ability for students, instructors, and administrators to access and exchange information from any location has completely changed the educational landscape.

### **EXAMPLES OF DIGITAL SERVICES IN EDUCATION INCLUDE THE FOLLOWING**

**Platforms for Online Education:** Websites like Coursera, edX, and Udemy provide online diplomas and certificates in a variety of topic areas.

**E-books and Digital Libraries:** Students can use e-books and digital libraries like Google Books and Project Gutenberg to enhance their educational experience.

**Educational Apps:** educational apps like Duolingo, Khan Academy, and Brainly offer interactive learning experiences that make learning more exciting and pleasurable.

**Augmented Reality (AR) and Virtual Reality (VR)** Technology such as augmented reality (AR) and virtual reality (VR) are being employed in schools to develop engaging learning environments. Students can, for instance, take virtual tours of historical sites, museums, and other places.

Teachers use online collaboration technologies like Google Classroom, Microsoft Teams, and Zoom to offer lectures, assignments, and group projects to students online.

**Gamification:** With gamification, learning may be made more engaging and fun. For instance, instructors can create tests and other interactive exercises using the gamification application Quizzes!

**Digital Assessments:** Teachers can assess pupils utilising digital assessments by employing online quizzes and tests.

Since technology continues to advance and change how students learn and teachers educate, digital services have grown in significance in the education industry. The following are some of the most well-known digital services in education:

**Learning Management Systems (LMS)** Learning management systems (LMS) are online tools that give teachers authority over the creation of curricula, homework, and exams. Some LMS examples include Moodle, Blackboard, and Canvas. Companies that create digital instructional resources for use in classrooms, such as interactive exercises, videos, and e-books, are known as educational content providers. Examples include Khan Academy, Coursera, and TED-Ed.

**Online Resources:** Collaborative platforms that enable online collaboration between students and professors include Google Docs, Slack, and Microsoft Teams.

**Online Tutoring:** This is a service that provides tailored online tutoring for students. Varsity Tutors, Chegg, and Tutor.com are a few examples.

These tools enable students to participate in immersive learning environments and simulations, such as virtual field trips, lab experiments, and historical re-enactments.

Student information systems are programmes that organise student data like schedules, grades, and attendance. Examples include PowerSchool, Infinite Campus, and Skyward.

Using digital services in education has many benefits, including improved administration, individualised learning experiences, and increased accessibility to education. The need of making ensuring that digital services are fair and accessible to all students is underscored by the fact that not all students have equal access to them.

Digital services have had a significant impact on the education sector since they have altered how students learn and academics deliver knowledge. These services span a wide range of tools and technology that make it easier to complete administrative, collaborative, and educational duties online.

### **DIGITAL SERVICES IN EDUCATION INCLUDE, FOR INSTANCE**

**Learning management systems (LMS)** are online tools that let teachers manage course materials, monitor student progress, and interact with learners.

**Virtual Classrooms** -Real-time communication and collaboration between teachers and students are made possible in virtual classrooms.

**Digital Content** -Digital content refers to online-accessible educational resources including e-books, films, and interactive tools.

**Assessment Tools**-Digital platforms that enable teachers to design and deliver tests, quizzes, and other forms of assessment are known as assessment tools.

### **NEW DEVELOPMENTS IN DIGITAL EDUCATION**

**Digital/Flipped Classrooms:** The teacher might be able to use the class to digitally record each student's full potential. Because several instructional approaches were used, it has boosted student engagement. Every student may be able to receive a world-class education with this course in a more engaging, entertaining, and tailored way. Nonetheless, a teacher's goal should be to create an environment where all students are motivated to learn.

**Video-based instruction:** Via a variety of great apps, interactive software, videos, podcasts, e-books, and online electronic whiteboards, this aspect of digital education has not only improved the Indian educational system but also provided an atmosphere for entertainment, exploration, and engagement.

**Massive open online courses, or MOOCs:** It is an online course that is open access and allows for many participants. India's large population makes it the second-largest market for MOOCs behind the United States. It might be the entry point for Indians to bring about a revolution in the sphere of education. In fact, we can access top-notch education through a distance learning programme.

**K12 Sector Education through Game Sector:** It is known to as Kindergarten through XII grade in K–12 schools. It is being donated and promoted by many start-up companies. It develops game-based educational learning that makes it simple for learners to understand Indian education.

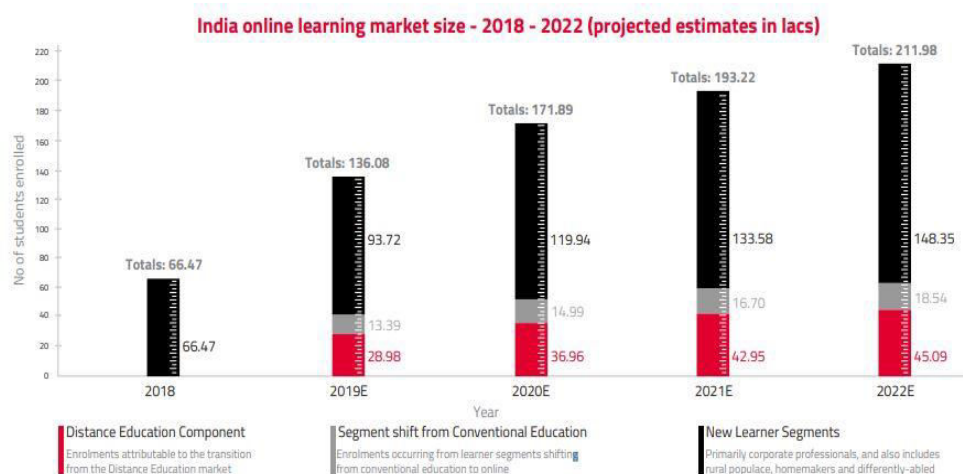
**Google Class:** It is a free online tool that schools may use to design, distribute in bulk, and grade assignments and notes without using any paper. The teacher may post study materials in this classroom for the students to review at home when they have free time. Learning is also made incredibly simple and streamlined because files can be quickly shared between teachers and students. Also, students can submit questions about lectures and receive responses from both the teacher and other students.

**E Pathshala:** This portal, which is accessible on Android and Windows platforms, was introduced by the HRD and NCERT in November 2015 to create a massive educational reserve of different videos, audios, textbooks, periodicals, and other printed and non-printed materials for teachers, parents, researchers, students, and educators. According to the capabilities of their equipment, it enables teachers and students to download them to read them offline on their laptops or mobile devices.

**Kahoot:** It is a platform for educational gaming. It is a multiple-choice test that a web browser may grade. Using this platform, the kids play as they study as materials are displayed into the classroom and questions are answered by them. By increasing students' engagement, it fosters a lively and enjoyable learning environment.

**BYJU's:** It is one of India's top edutech startups. It combines several gamification strategies to encourage math and science students to learn while having fun. Teachers employ a variety of interactive forms, techniques, and mediums through this technology or software to teach the idea to students in the most individualised way possible.

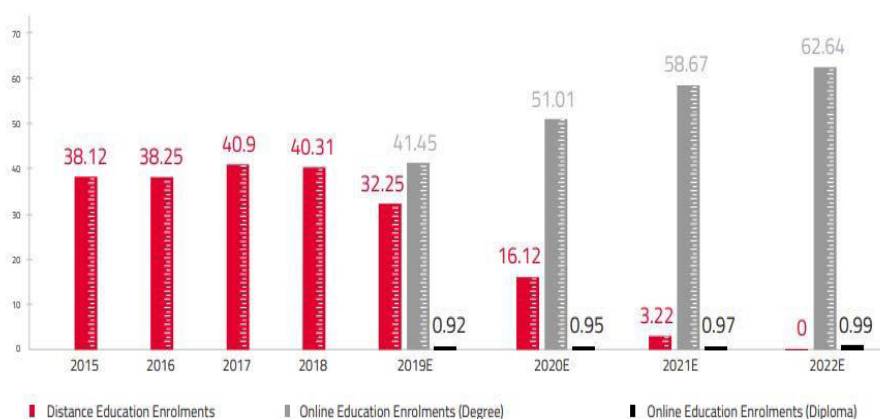




Online Education enrolments are estimated to grow at 33.6% CAGR, to 2.12 crore, over the 4-year period of 2018 – 2022. Enrolments in the Degree/Diploma component of Online Education will grow at 14.5% CAGR, from 42.37 lacs to 63.63 lacs over 2019 – 2022.

**Source-**[https://www.indiaeducationforum.org/research-report/Trends\\_and\\_Opportunities\\_in\\_the\\_Online\\_Learning\\_Market.pdf](https://www.indiaeducationforum.org/research-report/Trends_and_Opportunities_in_the_Online_Learning_Market.pdf)

**No of students enrolled in Online (degree / diploma) and Distance Education in India - 2015 - 2019 (in lacs)**



Degree programs are estimated to grow at 14.75% CAGR over 2019 – 2022. Diploma programs are likely to get fresh impetus with Online and Blended Online Education but growth is estimated to be slow at 2.5% CAGR over 2019 – 2022. The Distance Education market will gradually decline – over 2019 through 2022, based on the number of universities obtaining permissions to start online education – and learners will transition into Online Education with the new regulations kicking in 2019.

**Source-**[https://www.indiaeducationforum.org/research-report/Trends\\_and\\_Opportunities\\_in\\_the\\_Online\\_Learning\\_Market.pdf](https://www.indiaeducationforum.org/research-report/Trends_and_Opportunities_in_the_Online_Learning_Market.pdf)

## **DIGITAL SERVICES IN EDUCATION OFFER SEVERAL ADVANTAGES, SUCH AS:**

**Increased Access** – Students can now benefit from educational opportunities and resources regardless of where they live or their socioeconomic status thanks to digital services.

**Customization** - Digital services can be created to satisfy the unique requirements and learning preferences of each student.

**Collaboration** - Thanks to digital services, students may work together and share knowledge regardless of where they are in the world.

**Efficiency:** Digital services reduce the time and effort required to manage educational operations by streamlining administrative activities.

Generally, the role of digital services in the education sector is expanding since they offer chances to raise educational standards and broaden access to learning for all pupils.

**There Are No Physical Limits:** There are no time or place limits with digital learning, unlike in face-to-face systems. In this type of learning, students have the flexibility to attend sessions whenever they want, wherever they are convenient or comfortable.

**No Geographic Restrictions:** Due to students' inability to physically attend classes, online and distance learning are now more significant. Many international colleges have started offering online degree programmes that Indian students may also enrol in. Hence, the thirsty students' appetite for information has no bounds thanks to the digitization of education.

**Students with greater intelligence:** with the aid of different readily accessible tools and technology, students can acquire efficient and self-directed learning skills in digital learning. People can use internet resources and use the knowledge to resolve their problems. It undoubtedly boosts the efficiency as well as the output of the pupil. Instead of relying solely on temporary memorization of notes or textbooks, analytical reasoning, open-ended questions with creativity, and logic are used in digital learning to help students develop their critical thinking and learning skills. By working in groups, students can also learn about collaboration and teamwork.

**Self-driven and more responsible Students** are becoming more engaged and enthusiastic in expanding their knowledge with the aid of digital learning tools and approaches. Through fun learning and memorization techniques like cooperation, reverse teaching, peer education, concept maps, role acting, gamification, and storytelling, kids are learning and remembering information, but they are not feeling the same as they would in a typical educational system. As a result, they frequently provide a more engaging and intriguing approach to process information. Both their test scores

and retention rate are always affected. As a result, students may become more accountable and motivated.

**Learning Comfort Zone:** Unlike traditional classrooms where each student must be present when the teacher is teaching, digital learning allows us to study whenever it is most convenient for us.

**The involvement of parents and educators:** the use of social learning platforms by teachers allows them to develop and administer a variety of groups. Digital learning includes benefits of tutoring to individual and small groups at the time of freeing up. A teacher has the option to join a variety of online professional learning groups where they can ask questions, offer advice, and maintain connections with other teachers across the world. As a result, they can keep themselves informed about the curriculum's substance. By gamifying the process and making it more entertaining and engaging, interactive exercises can be used by parents and teachers to encourage their children's enthusiasm in learning. In addition, parents should help their children explore online learning activities that can enhance what they are learning in school.

**Increasing Student Employability:** It is a key duty of institute that each student must be equipped with higher education and hold a career at a young age. Digital learning programmes that focus on problem-based learning place an emphasis on teaching strategies that are constructive, collaborative, and draw students' attention to a real-world learning approach. Digital learning tools and technology in elementary, secondary, and high schools prepares students not only for further education but also for modern vocations by assisting them to develop skills which includes problem-solving, knowledge with current technologies, and self-motivation.

**Efficiency and Cost:** Compared to traditional learning, digital education is more affordable because textbook costs for high school and college are much lower. In reality, textbooks frequently become outdated after a certain amount of time.

## **DEMERITS TO ADOPT THE DIGITAL EDUCATION**

Without a question, the digitalization of Indian education has benefited both students and teachers by enabling a constant flow of knowledge wherever and at any time, which is why it is gaining popularity day by day. In spite of this, it has the following demerits which need to be resolved:

Being Dependent ongoing reliance on information seeking. Due to their attachment to electronic devices, students' health is seriously harmed when they finish their homework and assignments online, write their notes, and turn them in to be evaluated.

**Effects on Physical Fitness:** Since children of all ages spend most of their study time on computers, they choose to play online games during their spare time rather than outdoor or active games. It drives people towards the fatness, obesity, diabetes, heart disease, neck ache, improper posture, physical as well as emotional tension etc.

**Emotional Aloofness and Social Isolation:** The fact that people are constantly occupied in their own virtual world has increased emotional distance between them despite the fact that physical distance has decreased. While people are with their relatives and friends, they frequently forget about the actual world.

**Absence of Emotional Expressiveness:** as a result of few face-to-face interactions In a traditional system, instructor and student build trust and understanding through direct face-to-face communication, but with digital learning, we use online communication that may not be able to comprehend the feelings, leading to their becoming more individualistic and introverted. Hence, in order to express genuine emotions to them, face-to-face communication is necessary.

**False Information:** when a boy is young Students use the most recent mobile and laptop technology with 4G and 5G connectivity to search the information linked to the required course materials. They are not only seeing various illegal and superfluous websites and material, which pollutes their thoughts and compels them to perform various undesired and needless tasks that may constitute a crime, but they are also using such instruments for negative and irrelevant objects.

**Promotion of Test Fraud:** Owing to the usage of graphical calculators, high-tech smart watches, small cameras, and other similar tools, it is simpler for students to cheat on examinations by copying formulas and notes onto graphic calculators because there is minimal possibility of getting caught doing so.

**Slowing down the Ability to Calculate:** Calculation skills among students are progressively deteriorating as a result of the use of scientific and programmable calculators in both the classroom and during exams. Even for simple amounts and subtraction, they are totally dependent on the calculator. Yes, it hurts students because it impairs their ability to use their brains.

## **CONCLUSION**

The education sector has seen a considerable transformation in digital services. Students and teachers can now remotely access educational resources, documents, and support at any time from any location thanks to the growth of e-learning platforms. A new type of teaching called blended learning, which blends traditional classroom instruction with online components, has also been adopted by schools and colleges as a tool for education in terms of digital technologies.

Together with these advantages, digital services in education have also brought with them certain drawbacks, such as the "digital divide," which is the discrepancy between those who have access to technology and those who do not. Also, there are debate regarding the dependability and quality of digital services, particularly in relation to the validity of online sources and the efficiency of e-learning systems.

Notwithstanding these difficulties, digital services have shown to be an effective tool in the educational field, and it is expected that they will continue to play an increasing role. We may anticipate more creative digital services arising to satisfy the requirements of both learners and educators as technology develops and becomes more widely available.

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## HEALTHCARE'S FUTURE IN THE HANDS OF AI AND MACHINE LEARNING

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### ABSTRACT

*Machine learning (ML) can assess and predict biological and clinical data outcomes. In numerous ways, ML models may increase healthcare efficiency. Algorithms that anticipate prognosis help healthcare administrators manage resources and doctors choose better treatments. Screening, risk stratification, and treatment recommendations can employ diagnostic models. This would minimize physician workload, speed up patient treatment, conserve resources, and save expenses. ML's relevance in medicine is restricted despite its scientific breakthroughs. Large volumes of high-quality data may be needed for model creation and validation. For each illness, diagnostic models must be constructed. Black box algorithms may also be hard to trust psychologically. ML research may allow fewer datasets and more transparent models. Before ML's more significant benefits, like diagnosis, can be deployed, clinic trials must be done. AI.*

*Keywords: Healthcare, diagnosis, Machine learning, Artificial intelligence*

### MACHINE LEARNING

Machine learning employs algorithms to find patterns in massive data sets and improves with more data. Pattern algorithms can forecast outcomes. Neural networks, SVMs, and decision trees are popular machine-learning techniques. Classification and regression trees (CARTs), boosting, and random forests are decision trees that employ computer techniques to divide giant sets of instances into various outcomes (life/death, response/nonresponse, mobile phone contract renewal/non-renewal). In large data sets, machine learning is used to predict which Internet banner ads people will click on, which credit card offers will attract new customers, and which products shoppers would like based on their past purchases (or even their history of mouse clicks while online)(Nevin, 2018). Amazon.com employs machine learning to determine product preferences. These algorithms categorize people into "pure" groups. Machine learning techniques optimize group purity mathematically (minimizing false positives and negatives). Many machine learning styles are "semi-supervised" or "unsupervised," meaning that computer algorithms can identify optimum algorithms without much input from a statistician. Machine learning employs algorithms to find patterns in massive data sets and improves with more data. Pattern algorithms can forecast outcomes. Neural networks, SVMs, and decision trees are popular machine-learning techniques(Hong et al., 2020). Classification and regression trees (CARTs), boosting,

and random forests are decision trees that employ computer techniques to divide giant sets of instances into various outcomes (life/death, response/nonresponse, mobile phone contract renewal/non-renewal). In large data sets, machine learning is used to predict which Internet banner ads people will click on, which credit card offers will attract new customers, and which products shoppers would like based on their past purchases (or even their history of mouse clicks while online)(Dai et al., 2021).



**Figure1:** Machine learning

Amazon.com employs machine learning to determine product preferences. These algorithms categorize people into "pure" groups. Machine learning techniques optimize group purity mathematically (minimizing false positives and negatives). Many machine learning styles are "semi-supervised" or "unsupervised," meaning that computer algorithms can identify optimum algorithms without much input from a statistician(Rohini et al., 2021).

### **AI in Context Intelligence**

Intelligence is the mental ability of an agent to reason, plan, solve problems, think abstractly, comprehend complex ideas, and learn from experience. This definition says nothing of the agent's capacity for self-awareness, consciousness, emotional response, or moral reasoning, nor that intelligence should replicate human reason. There is nothing essentially human about intelligence and nothing that prevents it from being instantiated in computer code. This matters because humans erroneously associate AI with other human characteristics like empathy, emotion, or morality. There is also no good reason for intelligent machines to imitate biological processes to produce valuable results. In the same way, airplane flight is not modeled on flapping a bird's wings(Jain, 2020).





**Figure 2:** AI in Context Intelligence

Computer scientists use algorithms to specify the steps necessary to solve a problem by beginning from a known initial state and known input and following a series of instructions that end by producing an output. This kind of algorithmic computation can perform valuable functions regardless of how accurately it describes the human cognitive part of problem-solving(Waring et al., 2020). Therefore, it is essential to understand that when AI researchers talk about “learning,” they mean the process of maximizing the reward function of an algorithm and not the more nebulous concept of learning as it relates to human beings. By anthropomorphizing algorithms, there is a risk of expecting them to display other human characteristics when, in fact, it should be clear that they are being optimized for the particular cognitive function of enhanced intelligence.AI is a diverse research field that includes a wide variety of subdomains, including expert systems, knowledge representation, robotics, natural language processing, intelligent agents, computer vision, navigation, predictive analytics, and planning. These are all very different and specialized research areas but are often referred to under the umbrella term of AI(Chae et al., 2018). It becomes meaningless when “AI” describes a wide range of technologies and research fields. In addition, different authors use a variety of terms interchangeably when describing AI, including cognitive computing, machine intelligence, and neural networks, which only adds to the confusion. Clinicians must be aware that research in AI is influenced by a variety of intellectual, commercial, and philosophical issues that are implicated in the development of AI-based systems, and that many different agendas are being served, all of which influence the words used to describe the field(Payedimarri et al., 2021).

### **Economic Impact**

AI's economic effect is crucial since much of medical AI's worth has yet to be realized. Therefore, promises of progress are typically inflated to attract attention and financing. Suppose people closest to the patient are to drive medical AI deployment and guarantee that patient interests are best served in this burgeoning field of clinical research. In that

case, they must be able to make sense of AI research in clinical practice. Clinicians must know about this study and who and what impacts claims (Chiu et al., 2022).

### **Predicting Prognosis**

Prognosis prediction estimates illness susceptibility, recurrence likelihood, life expectancy, and treatment response. Many illnesses have complicated, multifactorial causes, making prognoses challenging. Accurate prognosis prediction helps doctors decide on resource allocation and therapy. A therapy response prediction program would allow doctors to customize therapies. This technique would help doctors determine which patients might benefit from adjuvant or alternative medicine and which would not, avoiding treatment risks and adverse effects. Oncology has extensively studied ML prognostic approaches. One review found that ML improves cancer prognosis by 15–25%. High-throughput sequencing has made genetic markers a therapy option, and ML can model complex genetic data. A classification ML system based on breast tumor microarray data discovered genetic markers related to metastatic phenotypes and treatment prognoses (Ting et al., 2017).



**Figure 3:** Predicting prognosis

These trends may indicate various therapy, improving patient outcomes. Hepatitis B virus-positive metastatic hepatocellular cancer was studied using ML to find signals from 153 genes that predict metastasis and survival. Screening (Qiao et al., 2021).

### **Screening, Diagnosis, and Access to Care**

AI might reduce healthcare diagnostic costs and time. ML screens stratify patients by risk and help doctors make decisions. Congenital cataracts, skin cancer, heart disease, hepatitis, and autism screening models exist. Given the high stakes of medical choices, a compassionate model might be a cheap tool to rule out diagnoses, leaving possibly favorable situations for professionals to study. Individuals might use these models to assess risk and prioritize at-risk patients. Example. Trained algorithms to diagnose skin lesions as malignant or benign, like dermatologists. Mobile can set other illnesses (Flies et al., 2019).



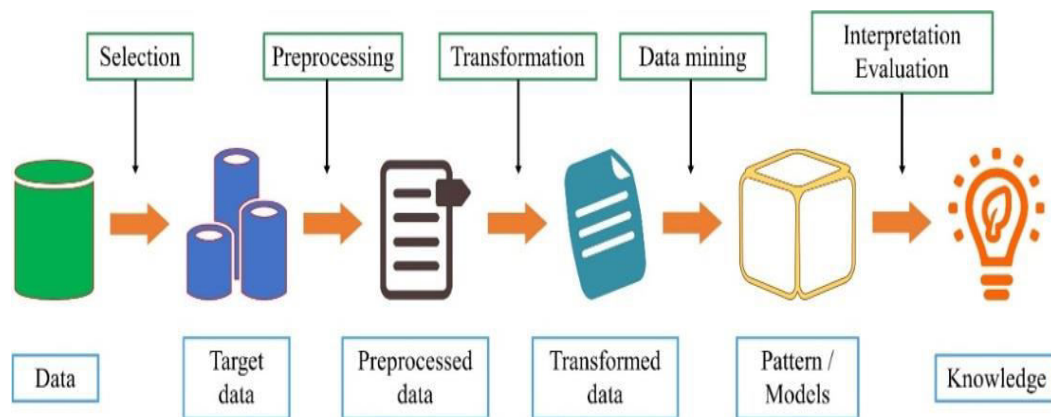
**Figure 4:** Screening, diagnosis, and access to care with AI&ML

I created a precise diagnostic model. Mobile applications might help identify a larger population as autism rises, and evaluation requires home video analysis. Many disease models might be used on mobile devices to improve care. Screening may benefit uncommon disorders. Rare illnesses are hard to diagnose, which can postpone or mistreat patients. Rare illness patients may have trouble finding professionals to diagnose and treat them(Lareyre et al., 2020).

Thus, Long et al. investigated if AI could handle uncommon illnesses uniquely. ML models screened, risk-stratified, and recommended therapy for congenital cataracts—models devoted to ophthalmology lists. A widespread system of such models might expand access to rare illness knowledge(Ting et al., 2017).

### **Benefits and Pitfalls of Machine Learning Algorithms**

Machine learning algorithms may find patterns and update themselves with new data. Internet sales and huge hospital clinical laboratories provide new data and outcomes, which might optimize an algorithm. This can be automated without daily statistician model revisions. This technique outperformed traditional predictors in our recent study on algorithms to detect clinical outcomes in thiopurine-treated inflammatory bowel disease patients(Qiao et al., 2021). If a predictor variable (like temperature) or outcome variable (like a clinical response) needs manual data collection or expert interpretation, these benefits are decreased. Data capture and model updating are slowed. Machine learning research has different problems. First, reviewers may be skeptical of an undefined pattern hypothesis. Second, machine learning has yet to establish sample-size estimation methods for models(Hassan et al., 2021).



**Figure 5:** Benefits and pitfalls of machine learning algorithms

Mobile phone data sets are enormous when each call represents an observation; therefore, the sample size is essential. Machine learning on smaller datasets will take much work. Interpreting machine learning models is a third danger. Standard statistical models quickly analyze the impact of individual variables on outcomes. Machine learning models are opaque, with numerous variables and possible interactions. Most machine learning methods have variable importance scores(Gui & Chan, 2017).

### Advantage

Last year, mainstream medical literature embraced machine learning. JAMA exhibited three deep-learning algorithms identifying retinopathy and breast cancer metastases photos and clinical experts. Our multidisciplinary team created a deep-learning model to detect sepsis using tens of millions of EHR data points. Well-developed models outperform human diagnostics at scale. Healthcare operations use machine learning in small numbers. Epic Systems Corporation's cognitive computing platform supports machine learning models. EHRs include patient deterioration models and FDA-approved medical imaging segmentation software. Adopting such models and technology eases machine learning in health healthcare icons(Mateen et al., 2020).

### Disadvantage

Healthcare statistical models uncovered data patterns to improve clinical reasoning. Machine learning models are generally expected to match clinical reasons for improvement and efficacy. Clinical reasoning is established across institutions, while machine learning models are generated using data from one institution and have limited generalizability. A *Clostridium difficile* model examined at two academic medical institutions showed characteristics that were top risk factors in one environment and protective in the other. Machine learning methods incorporate local biases from clinical care practices(Hicks et al., 2022). Although a model cannot improve clinical thinking, it can enhance and improve specific local judgments. If heal health system officials must invest in staff and equipment to test a newly certified machine learning model locally, significant characteristics in healthcare data are costly and time-consuming. Our

institution spent \$220,000 creating, verifying, and integrating a single analytics solution to detect high-risk dialysis patients. Abstracting and standardizing EHR data for quality indicators costs \$15.4 billion nationwide. Resources preclude even the most generalizable model from scaling across institutions. Most machine learning-health care research uses distantly obtained, stale data without transdisciplinary domain expertise. The Journal of Machine Learning Research published three healthcare issues in 2015–2017, including a special unique and two proceedings from the "Machine Learning in Healthcare Conference." 23 (57.5%) of 40 papers had a clinical collaborator, 10 (25%) employed non-MIMIC (Medical Information Mart for Intensive Care) EHR data, and only seven (17.5%) had both a clinical collaborator and local EHR data (Sendak et al., 2019). Three of the seven papers were collaborative efforts. New York University, UCSD, and USC were among the seven academic medical facilities with quantitative sciences and clinical departments. Clinicians and health information technology executives will not use machine learning without partnering across disciplines to tackle local challenges (Rowe, 2019).

### **The Opportunity**

Machine learning in clinical care requires new abilities, transdisciplinary resources, and platforms. Thomas Davenport and Julia Kirby identified five ways knowledge workers might adapt to automation in 2015. In health care, practitioners can step up (examine the overall picture of the business), step aside (create strengths that aren't codifiable cognitively), step in (change and monitor software), step narrowly (specialize in something for which no computer program exists), or step forward (build the next generation of technology). Financial and societal constraints force physicians to specialize and avoid technology at worst. At best, informatics and statistics training prompt doctors to adjust and monitor software. Health system executives must invest in initiatives that allow clinicians to build next-generation technology for advanced clinicians (Waljee & Higgins, 2010). This demands that system management regard technology development as an investment in growth rather than a cost. Transdisciplinary academic medical facilities are appropriate for integrating machine learning into clinical treatment. Duke Health combines clinical and quantitative scientific specialists with medical students and computer science students. We trained 40 undergraduate and master's students in statistics and computer science, two doctorate students in statistics, and eight medical student research researchers during 2015–2017. Our medical student scholars have presented 18 abstracts at research conferences, published nine publications that operationalized seven healthcare technology items, and revealed six inventions to our technology transfer office. We improved clinical care through career development and prototype initiatives. Health system executives must shift focus from isolated machine learning apps to the platforms needed to extend machine learning throughout health care. Duke Health and the industry have seen various projects and collaborations. Reflect on lessons and tear down obstacles to

establish platforms for numerous machine learning applications. Health system executives must shift from maximizing model performance metrics to emphasizing scalable expansion in high-impact clinical researcher-machine learning collaborations (Ben-Israel et al., 2020).

### **Data Producing**

Humans provide data set samples and label data in HILML applications. The following sections detail these two categories (Maadi et al., 2021).

#### **(i) Providing data set samples**

Human data access is accessible, durable, and efficient for ML training. HILML applications sample data sets using crowd workers and domain experts. Researchers have focused on comparing the quality of data samples provided by different groups of humans and analyzing the performance of ML models formed from these data examples. Crowdsourcing can create data sets used crowdsourcing to develop an operation recognition training data set. In their article, human crowd workers calculated feature values using image attribute queries. Crowdsourcing systems can effectively generate data, but they must restrict the problem of error-prone data. In the crowdsourcing literature, this challenge has been addressed by developing new incentives for crowd workers to work more effectively, collecting and aggregating crowd worker replies to get reliable considering crowd worker talents, and so on. According to the research, domain experience increases the likelihood of delivering high-quality data sets. HILML literature emphasizes domain human expert engagement in protein-producing quality examples despite cost and time constraints. Domain experts created training instances in a HILML manner. Medical professionals used a grading system to score the training events in their articles. The proposed ML approach's success validated its power and the experts' training data set. The suggested ML approach was evaluated using two training data sets from two groups of doctors with various degrees of skill as experts and interns. The suggested ML performed better with experts' training data than the intern ones in sensitivity, specificity, and accuracy. Recommender systems use HILML to capture data by analyzing human behaviors while engaging with an algorithm. Thus, people create data sets for ML-based recommender systems. Recommender systems should adapt to human needs. Humans provide data to train ML models and enhance their results using a HILML strategy in an unknown detection issue to discover misclassified samples with high confidence and to performance by adding labeled examples to the training data set (Garg & Mago, 2021).

#### **(ii) Data labeling**

Data labeling is the most prevalent human-ML collaboration in applications. Training supervised ML algorithms require tagging and labeling data. Several studies have examined the role of humans in data labeling and the challenges that come from this cooperation, such as the quality of human labels, the number of human specialists

involved, and the degree of knowledge of those labeling data (Qiao et al., 2021). Like the data-producing process, two popular methods for human involvement in data labeling include labeling all data samples and specific training data samples. Crowd workers and domain human specialists are important human–AI data labeling interaction concepts. Unsupervised ML approaches emphasize human participation to identify all data. How humans correctly recall data at little cost is the major research topic. Literature has examined how various human communities solve this dilemma. For instance, attorneys analyzed docket entry data categorization data labeling and outlined the labeling method to obtain proper labels. Two data labeling users to assist users in describing and refining their data labeling concepts are offered and contrasted, along with a collaborative crowdsourcing technique for ML applications. Their article suggested voting, explaining, and categorizing unclear data labels. Two crowdsourcing systems labeled plant phenomics image processing data. One class was tested for accuracy, speed, and time. Crowdsourcing platforms outperformed students in data labeling. Domain specialists classify data more accurately than crowdsourcing and non-experts. Snow et al. compared crowdsourced labels to natural language processing domain expertise. For a natural language processing recognition challenge, four non-experts may provide high-quality data labels almost as well as one domain expert (Ting et al., 2017).

## **CONCLUSION**

ML might boost hospital efficiency. It predicts prognoses and diagnoses and expands medical care. As novel health-related outcome factors are found, ML discoveries will advance research and disease knowledge. ML demands vast amounts of high-quality data, making progress expensive and slow. However, improvements imply that this technology may become essential to our healthcare system, relieving physicians and increasing patient care. Physicians will continue to provide compassionate treatment since ML discoveries require domain expertise.

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## IMPLEMENTING INTERNET OF THINGS (IOT) USING ARDUINO CONTROLLER

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### ABSTRACT

*Internet of Things IoT device is a burning topic in the current era. The smart devices developed by mankind for mankind are impacting in both positive and negative ways. In this chapter, we will come to know about IoT device which is the Internet of Things, the types of devices which include IoT in our day to day life and the process in which the IoT devices make a user's task simple and quick. We will see how this technology which is increasing drastically is going to impact the future of mankind and the working principle of IoT devices. With these points, we believe the time is not too far, in which we will see each and every individual, home using and depending on these "Internet of Things". The Chapter shows how to implement Internet of Things (IoT) using the Arduino controller which is a simple controller & inexpensive freeware open source hardware.*

*Keywords: IoT, Sensor, Cloud, Arduino*

### INTRODUCTION

Internet is a network of networks that consist of Private, Public, Academic, Business & Government Network of local to global scope which carries a wide range of Information resources & Services, such as the inter linked hypertext documents & application of the world Wide Web (WWW). It is the largest network of networks in the world which uses TCP/IP protocols and packet switching.

Internet Of Things (IOT) is the networks of physical objects, devices, vehicles, buildings & other items embedded with electronics, software, sensors & networks connectivity that enables these objects to collect & exchange data. It is the concept of connecting any device to the Internet & to other connected devices which forms a giant network of connected things and people all of which collect and share data. IoT is also referred to as Machine-to-Machine (M2M), Sky net or Internet of Everything. It comprises things that have unique identities and are connected to the Internet. IOT also Focus on configuration, control and networking via Internet and Things that are not associated with the internet directly. E.g.: pump, utility meter, car engine. IoT is a new revolution in the capabilities of the endpoints that are connected to the internet.

### History

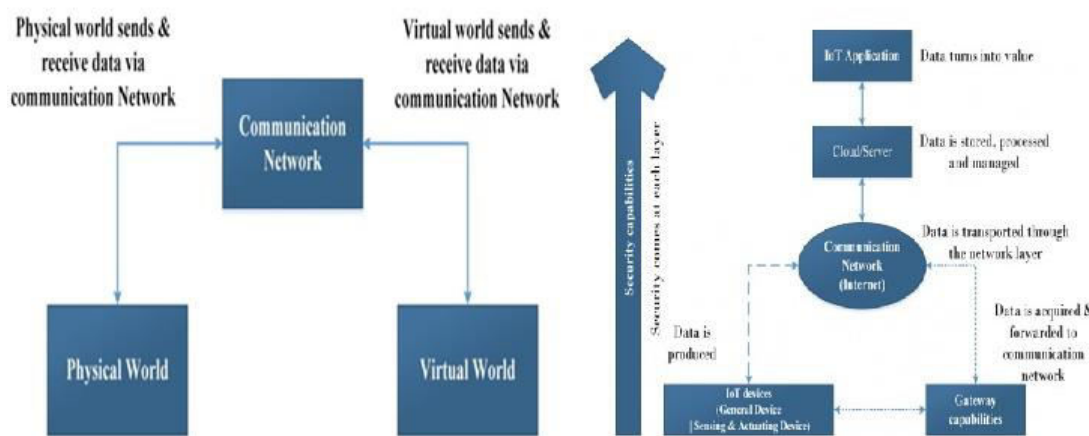
The term IOT is 19 years old. But the actual idea of connected devices had been around longer; at least since the 70s back then, the idea was often called embedded internet or

pervasive computing. But the actual term IOT was coined by Kevin Ashton in 1999 during his work at Procter & Gamble. Kevin Ashton wanted to attract senior management's attention to a new exciting technology called RFID (Radio Frequency Identification). Because the internet was the hottest new trend in 1999 and because it somehow made sense, he called his presentation "Internet of Things". Even though Kevin grabbed the interest of some P&G executives, the term Internet of Things did not get widespread attention for the next 10 years.

Cisco Systems estimates that nearly 12.1 billion Internet connected devices were in use in April 2014 the figure is expected to zoom to above 50 billion by 2020. The networking firm also notes that about 100 things currently connect to the Internet every second and the number is expected to reach 250 per second by 2020.

### IOT Architecture

IOT allows things in the physical world (Devices/objects) to interact with the virtual world (cloud services, platforms and applications) through a communication network enabling exchange and sharing of context aware information with each other. So, any IOT system is built from the physical world, virtual world and a communication network



**Figure1: IoT Architecture**

### Implementing IOT

For implementing the IOT System the following are required

- 1) Controlling Device (Desktop/Laptop/Mobile/Tablet)
- 2) Controller (Arduino, Raspberry Pi, Intel Galileo etc.)
- 3) Modules (Bluetooth, Wi-Fi, IR, Biometric etc.)
- 4) Sensors (Switch, Temp Sensor, Light Sensor etc.)
- 5) IoT Devices.

6) Cloud Services.

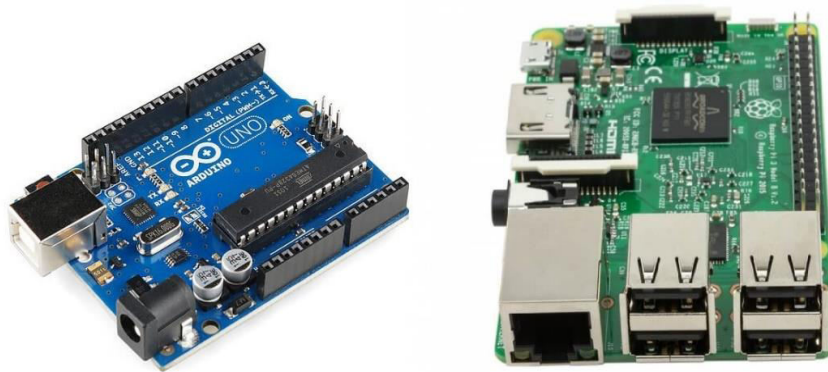
7) IoT Platform

### 1) Controlling Device

Controlling system includes controlling device which has controlling authority over the controlled device or sensor. There may be a second controlling device which requests and receives the controlling authority over the controlled device from the first controlling device. The controller is attached to controlling device (Computer/Laptop), a program is written in IDE or compiler which is compile and then loaded in the controller. The devices can be control from this controlling device or a mobile application is developed for controlling. Examples of controlling device are Computer, Laptop, Mobile, Tablet etc.

### 2) Controller

Controllers are middle-tier components that primarily collect information from sensors devices. However, the role of controllers in consuming this information varies widely. It is associated with data collection, aggregation, and transmission will vary from real-time streaming and queuing to batch processing. It work as a brain for the IOT system which control all sensors & I/O devices connected to it. It takes the data from input devices/sensors, processed it according to program feed. Controller consists of Microprocessor, Memory, I/O ports, ADC, DAC, etc. some controller have Ethernet port, Wi-Fi, Bluetooth, USB Port. There are many different types of Controllers used for IOT like Arduino, Raspberry Pi, Intel Edison, Udoo Neo, LightBlue Bean, Adafruit Flora, Tessel Particle Photon, Mediatek Linkit One, and C.H.I.P.



**Figure2:** Controller

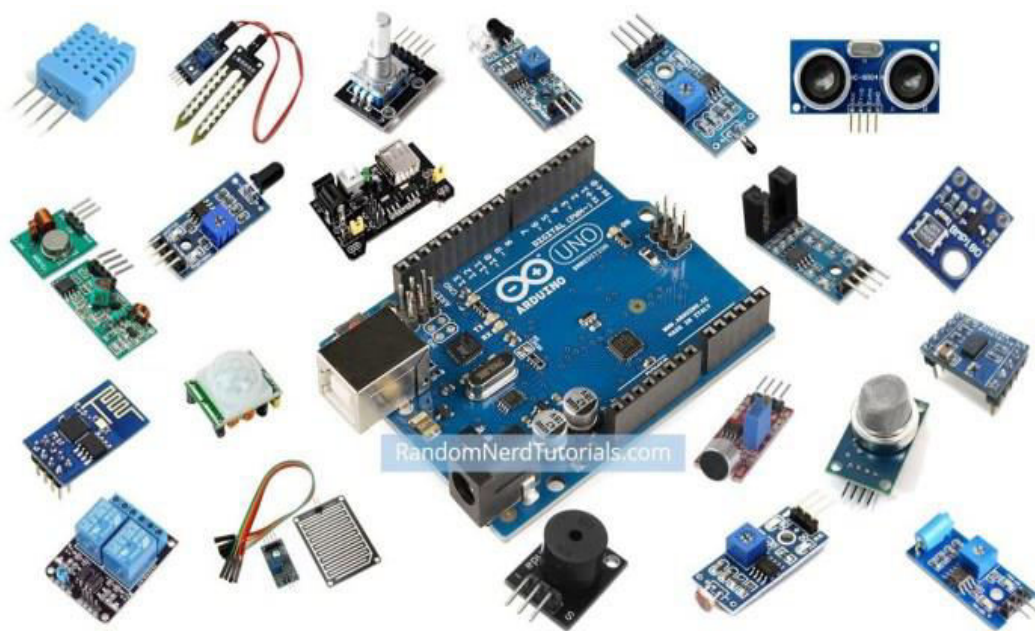
#### Arduino

Arduino is an open source controller used for building electronics projects which consists of both a physical programmable circuit board (microcontroller) & a piece of software called as IDE which runs and used to write and upload computer code to the physical board. Arduino boards are able to read inputs data & turn it into an output activating a motor, turning on an LED, publishing something online. We can tell board

what to do by sending a set of instructions to the microcontroller on the board. To do so we use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board. We can simply use a USB cable. , the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

### 3) Modules

At the heart of IoT is a tiny device called the IoT module responsible for connecting virtually anything to wireless networks. IoT Modules come with a wide range of wireless technology standards, and they provide a variety of features that can impact the success of IoT applications. An IoT module is a small electronic device embedded in objects, machines, and things connected to wireless networks and sends and receives data. Sometimes referred to as a "wireless module", "rf module" or "IoT chip," the IoT module contains the same technology and data circuits found in mobile phones but without features like a display or keypad.

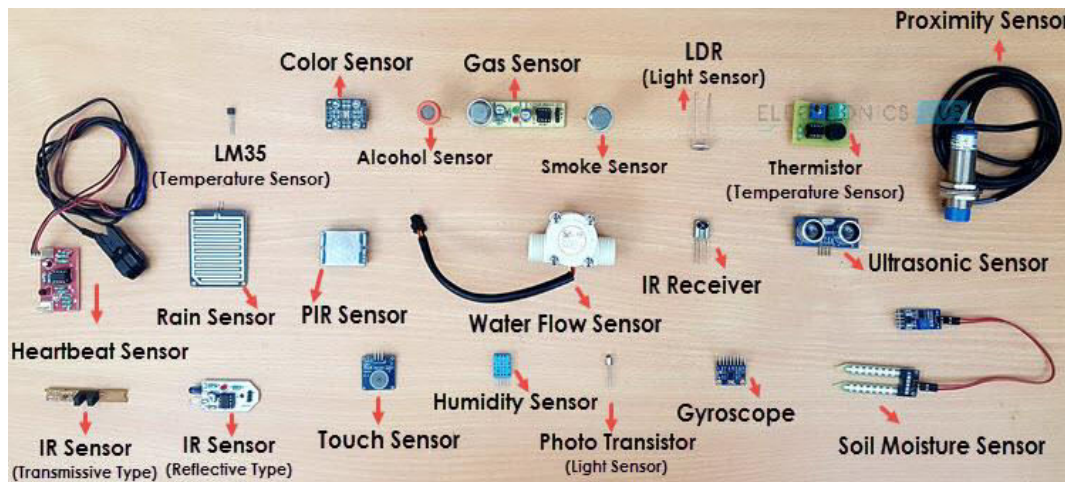


**Figure3: Different Modules**

#### 4) Sensors

We live in a World of Sensors. We can find different types of Sensors in our homes, offices, cars etc. working to make our lives easier by turning on the lights by detecting our presence, adjusting the room temperature, detect smoke or fire, make us delicious coffee, open garage doors as soon as our car is near the door and many other tasks. All these and many other automation tasks are possible because of Sensors.





**Figure4: Sensors**

Sensor as an input device which provides an output (signal) with respect to a specific physical quantity (input). The term “input device” in the definition of a Sensor means that it is part of a bigger system which provides input to a main control system (like a Processor or a Microcontroller). Another unique definition of a Sensor is a device that converts signals from one energy domain to electrical domain. The simplest example of a sensor is an LDR or a Light Dependent Resistor. It is a device, whose resistance varies according to intensity of light it is subjected to. When the light falling on an LDR is more, its resistance becomes very less and when the light is less, well, the resistance of the LDR becomes very high. We can connect this LDR in a voltage divider (along with other resistor) and check the voltage drop across the LDR.

### 5) IoT Devices

Anything that has a sensor attached to it and can transmit data from one object to another or to people with the help of internet is known as an IoT device. The IoT devices include wireless sensors, software, actuators, computer devices and more. They are attached to a particular object that operates through the internet, enabling the transfer of data among objects or people automatically without human intervention. For example, the IoT systems in your car identifies the traffic ahead and automatically sends out a message of your impending delay to the person you are about to meet. Even a pacemaker can be an IoT device that seamlessly communicates with other machines for a greater ease of life and convenience.

IoT devices are basically smart devices which have support for internet connectivity and are able to interact with the other devices over the internet and grant remote access to a user for managing the device as per their need. There are several top devices in the market. Smart Mobiles, smart refrigerators, smart watches, smart fire alarms, smart door locks, smart bicycles, medical sensors, fitness trackers, smart security system, etc., are few examples of IoT products. IoT product/devices are basically physical devices integrated with software and can connect with each other over the internet to exchange

information, they help the user for more simple and direct integration of the physical world. Some of the top Internet of Things devices that are used all over the world are

### **Google Home Voice Controller**

It is a smart IoT device which allows the user to enjoy features like media, alarms, lights, thermostats, control the volume and much more functions just by their voice.

### **Amazon Echo plus Voice Controller**

It is capable to run songs, do phone calls, set timers and alarms, ask questions, provide information, check the weather, manage to-do & shopping lists, manage house instruments, and several other things.

### **Amazon Dash Button**

Amazon Dash Button is basically a device that gets connected over internet Wi-Fi and makes sure that the user does not lack important household items like soft drinks, grocery material, medical and personal care, kids and any pet items ever again.

### **August Doorbell Cam**

August Doorbell Cam allows you to answer your door from anywhere or remote location. It constantly checks your doors and also captures motion changes in your doorstep.

### **August Smart Lock**

It has proven to be a reliable security IoT device. It allows the user to manage their doors from any location hassle-free. It helps the user to keep thieves away and family in your home.

### **Kuri Mobile Robot**

Kuri is the first sort of home robot and most popular too. It is specifically designed for entertainment. Kuri interacts with the users and captures moments all around the house daily.

### **Footbot Air Quality Monitor**

Footbot is a reliable IoT device which is helpful in measuring indoor pollution & leads to improved air quality in houses, workplace, & indoor public spaces.

### **Nest Smoke Alarm**

It is a smoke alarm that thinks, speaks & alerts your mobile phone about any un-wanted emergencies in your home.

### **Ring Doorbell**

Ring Doorbells is a reliable IoT product & allows the user to answer the door from any place using your smartphone. Protect your home with security cameras from Ring video doorbell.

### **WeMo Insight Smart Plug**

WeMo smart plug is a good IoT product which helps to turn on your lights, turn appliances on/off and provides the ability to monitor them from anywhere remotely.

## **6) Cloud Services**

Cloud services are infrastructure, platforms, or software that are hosted by third-party providers and made available to users through the internet. Cloud services facilitate the flow of user data from front-end clients (e.g. users' servers, tablets, desktops, laptops anything on the users' ends), through the internet, to the provider's systems, and back. Users can access cloud services with nothing more than a computer, operating system, and internet connectivity or virtual private network (VPN). Cloud computing means storing and accessing data & programs over the internet instead of your computer's hard drive. Word Cloud is used as a metaphor for "the Internet," so the phrase cloud computing means "a type of Internet-based computing. Common Example (Dropbox or Google Drive).

## **7) IoT Platform**

An IoT platform is a set of components that allows developers to spread out the applications, remotely collect data, secure connectivity, and execute sensor management. An IoT platform manages the connectivity of the devices and allows developers to build new mobile software applications. It facilitates the collection of data from devices and enables business transformation. It connects different components, ensuring an uninterrupted flow of communication between the devices. The IoT platform helps in understanding the customers' needs better and facilitate the creation of products that fulfill their requirements. It provides organizations with greater intelligence and visibility into operations, which enables better decision-making. IoT platforms serve as the bridge between the devices' sensors and the data networks.

## **CONCLUSION**

Internet Of Things (IOT) is the networks of physical objects, devices , vehicles, buildings & other items embedded with electronics, software, sensors & networks connectivity that enables these objects to collect & exchange data. IOT allows things in the physical world (Devices/objects) to interact with the virtual world. IOT had seven components, Controlling Device, Controller (Arduino, Raspberry Pi, Intel Galileo etc.), Modules (Bluetooth, Wi-Fi, IR, Biometric etc.), Sensors (Switch, Temp Sensor, Light Sensor etc.), IoT Devices, Cloud Services & IoT Platform. To implement the IoT five stages are Identify IoT objectives & IoT use cases suitable for your business, Select necessary IoT components suitable for your use case, Implementation & Prototyping, Integrate IoT system with other advanced technologies, Apply necessary security measurements

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## AN OVERVIEW OF MACHINE LEARNING CONCEPTS AND ITS APPLICATIONS

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### ABSTRACT

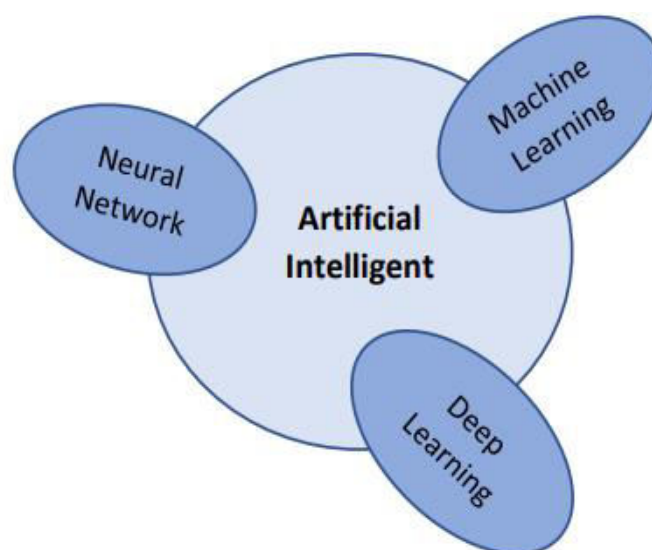
*Machine Learning is a field of artificial intelligence that allows systems to learn and upgrade from experience without being explicitly programmed. It has come an increasingly popular content in recent times due to the numerous practical operations it has in a variety of diligence. ML is one of the most instigative technologies that one would have ever come through. As it's apparent from the name, it gives the computer that makes it more analogous to humans: The capability to learn. Machine learning is laboriously being used moment, maybe in numerous further places than one would anticipate. The function of a machine learning system can be descriptive, meaning that the system uses the data to explain what happed; predictive, meaning the system uses the data to prognosticate what will be; or conventional, meaning the system will use the data to make suggestions about what action to take the experimenters wrote.*

*Keywords: Diligence, Descriptive, Predictive, Machine Learning, Conventional.*

### UNDERSTANDING THE CONCEPT OF MACHINE LEARNING

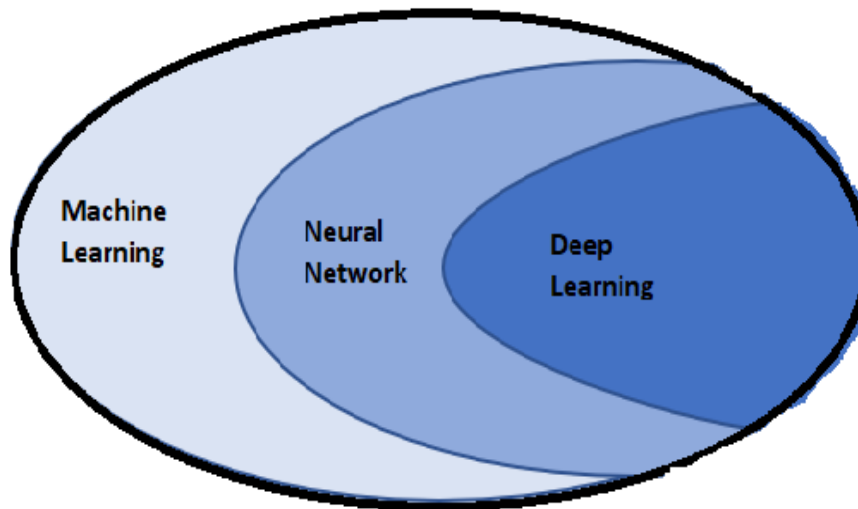
In Computer science field Machine learning is a small branch of Artificial Intelligence (AI). The area focuses on the use of algorithms and data to imitate like humans learn and it gradually increasing its accuracy in learning.

The following figure shows that Deep learning, Neural Networks and Machine learning are all sub-fields of Artificial Intelligence.



**Fig 1:** AI Sub-fields

However, Deep learning is a sub-field of neural networks, neural networks are a sub-field of machine learning.



**Fig 2:** Relationship between ML, NN and DL

### **ML Brief History**

IBM has a rich history with machine learning. One of its own, Arthur Samuel, is credited for coining the term, “machine learning” with his research around the game of checkers. Robert Nealey, the self-proclaimed checkers master, played the game on an IBM 7094 computer in 1962, and he lost to the computer. Compared to what can be done today, this feat seems trivial, but it’s considered a major milestone in the field of artificial intelligence.

### **Why Machine Learning Needed?**

Machine learning is a vital component of the growing field of Computer Science, particularly data science. Using statistical methods, algorithms are trained to make predictions or classifications, and to uncover key insights in data mining projects. These understandings consequently drive decision making within businesses and applications, ideally impacting key growth metrics. As big data continues to grow and expand, the market demand for data scientists will rise. They will be required to help identify the most relevant business questions and the data to answer them.

Machine learning algorithms are typically created using frameworks that accelerate solution development, such as TensorFlow and PyTorch.

### **How it works?**

University of California, Berkeley categorized the learning process of machine learning algorithm into three main parts: Decision Process, Error Function, and Model Optimization Process

**1. A Decision Process**

These machine learning algorithms are used to make a prediction or classification. Based on some raw input data to the algorithm, it will generate some kind of prediction that will define a pattern inside input data algorithm will produce an estimate about a pattern in the data.

**2. An Error Function**

An error function evaluates the prediction of the model and depicts the percentage of failing to achieve the desired output. If there are known examples, an error function can make a comparison to assess the accuracy of the model.

**3. A Model Optimization Process**

If the model can fit better to the data points in the training set, then weights are modified to minimize the difference between estimated output and actual output. The algorithm will repeat this “evaluate and optimize” process, updating weights autonomously until the desired threshold value is achieved.

**ML METHODS AND COMMON ALGORITHMS****METHODS**

- supervised machine learning
- unsupervised machine learning
- Semi-supervised learning
- Reinforcement machine learning

**ML Algorithms**

- Neural networks
- Linear regression
- Logistic regression
- Clustering
- Decision trees
- Random forests

**List of Application Areas**

1. ML applications in software engineering
2. ML and Knowledge Discovery in Databases
3. ML for Multimedia Content Analysis
4. Cost-sensitive in ML
5. ML for Audio, Image and Video Analysis Theory and Applications

6. ML and Data Mining for Computer Security Methods and Applications
7. ML in Medical Imaging
8. Probability for Statistics and Machine Learning
9. ML in Cybernetics
10. Self-Evolvable Systems ML in Social Media
11. Artificial Neural Networks and ML
12. Speech recognition
13. Customer service
14. Automated stock trading
15. Fraud detection
16. Healthcare Sector

### **FUTURE SCOPE**

Some of the unborn compass of the machine learning technology that will give great impact in forthcoming times.

- **Robotics:** In forthcoming times, this technology will boom the robotics sphere. As a lot of exploration is going on in this field for illustration, Japan created its robot “Erica” that becomes the first robot news anchor. In Dubai, they created “Sophia” and it becomes first robot that's carrying Saudi Arabian Citizenship. With the advancement in AI and ML, robots mimic the mortal gestures and perform tasks with high delicacy.
- **Computer Vision:** As the name suggested “Computer Vision” it works same as it's known for. It provides vision to the machine or computer. This fashion empowers the machines to fete and dissect digital images, videos, and graphics. On the basis of the reorganization and analysing it'll deliver the output with minimal error.
- **Quantum Computing:** The discipline of machine literacy has the implicit to be converted and founded by amount algorithms. It could digest data at a far quicker rate, allowing it to make conclusions and consolidate knowledge more snappily.
- **Automotive Industry:** The conception of “Safe Driving” came into picture with the help of ML. In the present script famed enterprises like Google, Tesla, Mercedes Benz has formerly invested a huge quantum of sweats in designing “Bus Airman” conception. By means of wireless detectors, Internet of effects, HD cameras and audio/videotape recognition system it's possible to apply this conception duly.
- **Cyber Security:** Currently, banks and fiscal institutes apply machine literacy to halt malpractices. Phishing is one of the major concern these days, to rectify phishing

emails various classification and regression techniques are imposed to prevent customers from online frauds.

## CONCLUSION

There is no doubt that expansion of the machine learning across every domain is a burning matter nowadays. Industries like automotive, entertainment, gaming, finance, and healthcare are revolutionized with the integration of machine learning techniques. The emerging scope of ML will enhance the performance of machines with less intervention of human beings. The main motive of the integration of machine learning into various domains is to reduce error function and improve the real time results at minimum cost and time.

## Research Papers

Table covers few research papers in various field of Machine Learning during the year 2023. These papers are published in IEEE and some renowned journals. Some more papers are available only few listed out.

Sno	Author's	Title	Year
1	LH Kong, W He, WS Chen, H Zhang	Dynamic movement primitives based robot skills learning	2023
2	Aidan Boyd, Patrick Tinsley, Kevin W. Bowyer, Adam Czajka	CYBORG: Blending Human Saliency Into the Loss Improves Deep Learning-Based Synthetic Face Detection	
3	P Kumar, A Nandi, S Chakrabartty	Bias-scalable near-memory CMOS analog processor for machine learning	
4	Z Liu, L Chen, X Zhou, Z Jiao, et al.,	Machine Learning for Time-of-Arrival Estimation with 5G Signals in Indoor Positioning	
5	M Méndez, MG Merayo, M Núñez	Machine learning algorithms to forecast air quality: a survey	
6	M Maqsood, S Yasmin, S Gillani, M Bukhari	An efficient deep learning-assisted person re-identification solution for intelligent video surveillance in smart cities	
7	M Senyuk, M Safaraliev, F Kamalov, H Sulieman	Power System Transient Stability Assessment Based on Machine Learning Algorithms and Grid Topology	
8	TW Cenggoro, B Pardamean	A systematic literature review of machine learning application	

		in COVID-19 medical image classification	
<b>9</b>	JS Banerjee, M Mahmud, D Brown	Heart Rate Variability-Based Mental Stress Detection: An Explainable Machine Learning Approach	
<b>10</b>	THH Aldhyani, H Alkahtani	Cyber Security for Detecting Distributed Denial of Service Attacks in Agriculture 4.0: Deep Learning Model	
<b>11</b>	K Kethineni, G Pradeepini	Intrusion Detection in Internet of Things Based Smart Farming Using Hybrid Deep Learning Framework	
<b>12</b>	ASF Kamaruzaman, AIC Ani, MAHM Farid	Systematic literature review: application of deep learning processing technique for fig fruit detection and counting	
<b>13</b>	S Singh, KVS Babu, S Singh	Machine learning approach for climate change impact assessment in agricultural production	
<b>14</b>	FY Wang, Q Miao, X Li, X Wang	What does chatGPT say: the DAO from algorithmic intelligence to linguistic intelligence	

## THE IMPORTANCE OF ARTIFICIAL INTELLIGENCE IN MODERN MARKETING STRATEGIES

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### ABSTRACT

*With the developing and fast changing technology, marketing strategies have also necessarily changed in order to meet the demands and needs of consumers. The fact that businesses don't keep up with this changing system puts them out of the wheel. In daily life, where consumption never ends, marketing strategies are also consumed very quickly. Its name changes according to the ages, but the main goal is always more profitability. Sales and marketing are now digitalized and shopping has become widespread in virtual environments. Most customer services are performed by Chatbots. Each one from Siri to augmented reality application is in our lives. In addition to the fact that the study contributes to the academic world, it is thought that it will also be useful in artificial intelligence studies.*

*Keywords: Marketing, Artificial Intelligence, Robot, Big Data, Learning of Machines.*

### INTRODUCTION

#### Marketing

Marketing refers to activities a company undertakes to promote the buying or selling of a product or service. Marketing includes advertising, selling, and delivering products to consumers or other businesses. Some marketing is done by affiliates on behalf of a company.

Professionals who work in a corporation's marketing and promotion departments seek to get the attention of key potential audiences through advertising. Promotions are targeted to certain audiences and may involve celebrity endorsements, catchy phrases or slogans, memorable packaging or graphic designs and overall media exposure.

#### Artificial Intelligence

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving.

The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal. A subset of artificial intelligence is machine learning (ML), which refers to the concept that computer programs can automatically learn from and adapt to new data without being assisted by



humans. Deep learning techniques enable this automatic learning through the absorption of huge amounts of unstructured data such as text, images, or video.

### **Research Mythology Used**

The inferences derived from the above through an **explorative study** that provided a clearer understanding of the marketing management, recent technologies, and the actual degree of incorporation, implementation and effect of AI in enterprises.

### **Data Collection**

The data is collected through secondary data, which the overall view of the current marketing management practices and AI. The benefits AI are gathered from the previous data and reveals about the future growth of marketing through AI.

### **Artificial Intelligence and Marketing**

Leveraging on AI, marketers segregate customers into core groups by segmenting them based on highly-targeted niches. They no longer create a single generic ad campaign to reach all types of their target customers and look forward to better conversion. Instead, they create more tailored marketing content that targets each core group based on their specific patterns and interests. AI is not perfect. Well, neither are we. However, its scale, dynamism, and capacity enable marketers to rethink and develop better strategies to deliver services to their customers in tangible and relevant ways throughout customer lifecycles. Below I have enumerated approaches for applications of AI in Marketing and ways in which AI makes marketing better.

### **Applications of AI in Marketing**

Leveraging on AI, marketers segregate customers into core groups by segmenting them based on highly-targeted niches. They no longer create a single generic ad campaign to reach all types of their target customers and look forward to better conversion. Instead, they create more tailored marketing content that targets each core group based on their specific patterns and interests. AI is not perfect. Well, neither are we. However, its scale, dynamism, and capacity enable marketers to rethink and develop better strategies to deliver services to their customers in tangible and relevant ways throughout customer lifecycles.

### **How Artificial Intelligent Influenced The Marketing Strategies**

A few main elements make AI marketing as effective as it is today, including big data, machinelearning and the right solutions.

**A. Big Data:** It is a relatively simple term. It refers to the capacity of a marketer to compile and classify broad datasets with minimal manual work. Marketing teams will then use this data to ensure that the correct message is sent to the correct person who asked about the query.

**B. Machine learning:** When marketers try to make sense of this massive data collection, Machine learning systems will give an easy way to feed data. They can

help recognize patterns or common events and forecast common observations, responses, and reaction effectively

**C. Making up right solution:** Marketing strategies for artificial intelligence actually acts in the same way a person do decisions. This means that, extremely quickly, the platforms can recognize informative concepts and trends through large data sets. AI solutions also view emotion and communication as like a human being, thereby allowing such networks to understand open form content such as social media, natural language and email responses. Elimination of time-consuming and laborious routines. AI automates repetitiveness and repeatable tasks (**e.g., data collection and analysis, image search, and processing / adaptation**).

### **Examples of AI in Marketing**

#### **1. Search Engines**

Back in November of 2015, Google officially confirmed they had implemented a machine learning AI called Rank Brain into their query-filtering process. Rank brain learns from each user query and applies these learning to each successive query. Machine learning AI in marketing helps Google recognize the natural language people use when they type online and then use this information to provide the most relevant search results. The goal is to optimize the user experience by providing nothing but the highest quality information.

#### **2. Website Design**

Designing a website for your brand is a painstaking process. The Grid aims to take the pain out of website design with their AI web designer. You give “Molly” the information you want on your site, and you get a serviceable website within hours. Plans for this service start as low as \$100 per year for a single website. Instead of paying for a web designer, you can save yourself thousands of dollars by using AI to take care of your site.

#### **3. Content Creation**

Would you read an article written by AI? If you follow sports or stocks, there is a good chance you already have. In the year 2016, an article-writing AI called Wordsmith cranked out 1.5 billion pieces of content. There is good news for human writers, though. Wordsmith and similar content-creation AI can only write articles based on hard stats. It can write hard news stories, sports stories, and financial reports, but cannot write features and opinion pieces. Still, AI-generated content will continue to be a major tool for content marketers within these niches.

#### **4. Predictive Customer Service**

What if you could know what your customers want before they ask? Predictive analytics makes this dream a reality. Servicing existing customers is cheaper than acquiring new ones. Predictive customer service allows marketers to create personalized micro-

campaigns for each customer. This type of AI in marketing draws on its ever-growing database of customer behaviour to serve the right information at the right time.

### **5. Chatbots**

Messaging apps like Facebook Messenger and Whatsapp are hot amongst younger millennial and older members of Gen Z, and Slack dominates the professional messaging space. With the popularity of such apps, savvy marketers are using chatbots to provide customer service through these apps. Many companies also have chatbots on their website. These bots answer common customer questions by using machine learning to draw upon past customer questions. In other words, chatbots get smarter with each conversation.

### **6. Speech Recognition**

As I mentioned earlier, smart home assistants are currently dominating the market. Voice search will become increasingly important to marketers as more users become comfortable with asking Alexa to search for information instead of typing it into a search bar. The first marketers to figure out how to best optimize their content for voice search will gain a huge competitive advantage.

### **7. Ad Targeting**

Have you ever searched for a product on Google, only to visit a website later on and have an ad for the product served to you in the sidebar? This is the work of ad-targeting AI. Ad-targeting AI scores the performance of each ad and uses this data to serve the ads shown to convert best. It takes the guesswork out of targeting an ad campaign.

### **8. Dynamic Pricing**

Discounts have always been a great way to increase sales. The problem is customers who would have paid full price end up paying less, which means fewer profits. Dynamic pricing eliminates this problem by using machine learning to only send discounts to customers who need it to make a purchasing decision. Dynamic pricing also allows you to send different discounts to different types of customers, which allows you to test multiple promotions at once.

### **Major Companies India Providing Services of AI**

**IBM** empowers companies to fine-tune their marketing strategies with artificial intelligence. The AI assistant IBM Watson locates prospective audiences, selects relevant creative content and engages target audiences in one-on-one conversations. As a result, businesses have found better ways to spend their marketing budgets while shaping ad campaigns around audiences' interests.

**Google's** responsive search ads enable marketers to enter up to 15 headlines and four description lines. With the Google Ads feature, entrepreneurs can jumpstart their businesses by tailoring their ads to geographic range, budgetary needs and other factors.

This tool also pairs well with Google Cloud, which relies on AI and machine learning to deliver even more in-depth audience insights to marketers.

**Thankful** designs artificial intelligence for businesses to use to level up their customer support across text-based channels like email, SMS and chat. The company's AI-powered suite automates routes, assists, tags and resolves common customer issues. Some of the features of Thankful's products include language translation, ticket merging, OMS integration, fraud alerts and trend analytics.

## **CONCLUSION**

AI in marketing appears to be applied at the organizational level at present, typically as one program or events. It can be attributed to the fact that we are dealing with the first instances of the realistic implementation of AI, and businesses are careful to introduce and experiment with this new technology. Such developments have an unquestionable effect on marketing departments and organisations operations. Above all, it needs marketing departments to incorporate new roles and skills, i.e. people with the right knowledge about AI, data science and expertise in developing and implementing innovative solutions. This is also about developing a new paradigm of collaboration with the organizations providing advanced AI solutions and creating an impact of synergy with respect to AI and other functions.

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## AI AND DEEP LEARNING-POWERED COMPUTER VISION: OPPORTUNITIES AND CHALLENGES IN HEALTHCARE APPLICATIONS

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### ABSTRACT

*Computer vision technologies based on AI and deep learning are reshaping healthcare applications. For the early identification, diagnosis, planning, and monitoring of disease, new techniques are now accessible. Computer vision can aid in the medical profession to achieve high accuracy, decrease mistakes, and save time and money. Yet, there are several difficulties with using computer vision technologies in medical settings. Healthcare was one of the first industries to recognize the immense potential of computer vision powering the technology. Application of computer vision in the medical field is based on leveraging the capabilities of artificial intelligence and deep learning in a variety of contexts. In the healthcare profession, where misinterpretation or missed diagnoses can have serious consequences, accuracy and dependability of technology are crucial. Privacy and security concerns must also be considered because patient data is sensitive.*

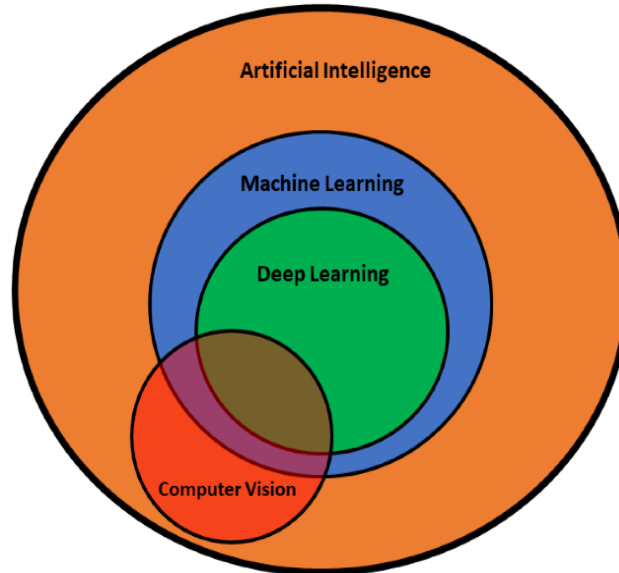
*Keywords: Computer Vision, Artificial Intelligence, Deep Learning, Healthcare Applications, diagnosis, Improved Patient Care*

### INTRODUCTION

The field of computer vision has made remarkable progress in recent years, largely due to the advent of artificial intelligence (AI) and deep learning techniques. These technologies have enabled machines to interpret and analyze visual data with unprecedented accuracy and speed. As a result, computer vision is becoming an increasingly attractive research area for a variety of applications, including healthcare. In the healthcare industry, computer vision technologies based on AI and deep learning have the potential to revolutionize many aspects of patient care. By analyzing medical images and videos, computer vision algorithms help medical professionals detect, diagnose, plan and monitor disease early. This allows for more accurate diagnosis, improved patient outcomes and improved patient care.

Despite the potential benefits, implementing computer vision technology in healthcare also presents some challenges. Accuracy and reliability are key factors in healthcare where misdiagnosis or missed diagnoses can have serious consequences. Additionally, patient data is highly sensitive, so privacy and security issues need to be addressed. This white paper explores the opportunities and challenges of using computer vision technologies powered by AI and deep learning in healthcare applications. It discusses

various use cases and provides a comprehensive overview of the state of the art in this area. Finally, we provide insight into the future of computer vision technology in healthcare and its potential impact on patient care.



**Fig: 1.1:** Relation between Artificial Intelligence, Machine Learning, Deep Learning and Computer Vision.

### What Is Computer Vision?

Computer vision is a field of study in computer science and artificial intelligence (AI) that deals with enabling computers to interpret and understand visual information from the world around them. It involves using algorithms and mathematical models to analyze digital images or videos and extract meaningful information from them.

Computer vision has a wide range of applications, including object recognition, facial recognition, autonomous vehicles, medical imaging, and robotics. It is also used in various industries, such as healthcare, manufacturing, and retail, to improve processes and enhance user experience.

Computer vision technology uses a combination of image processing techniques, statistical methods, and machine learning algorithms to analyze visual data. This enables computers to identify patterns, objects, and features within an image or video, and make decisions or take actions based on that analysis.

### AI vs Deep Learning

AI is a broad field of computer science that aims to create machines that can perform tasks that typically require human intelligence, such as problem-solving, decision-making, and language understanding. AI encompasses a wide range of techniques, including rule-based systems, expert systems, machine learning, and more.

Deep learning, on the other hand, is a subset of machine learning that uses artificial neural networks to learn from large datasets. These neural networks consist of multiple layers of interconnected nodes that can process and analyze vast amounts of data, allowing machines to identify patterns and make predictions. Deep learning has been particularly effective in computer vision, natural language processing, and speech recognition.

### **Opportunities In Healthcare Applications**

There are numerous opportunities for using AI and deep learning-powered computer vision in healthcare applications. Here are some examples:

- 1. Early Disease Detection:** AI and deep learning algorithms can analyze medical images and identify early signs of diseases such as cancer, Alzheimer's disease, and cardiovascular diseases. This can lead to early detection and intervention, which can significantly improve treatment outcomes.
- 2. Diagnosis:** AI and deep learning algorithms can assist healthcare professionals in making accurate diagnoses by analyzing medical images and providing automated diagnostic support. This can help reduce the risk of misdiagnosis and improve patient outcomes.
- 3. Treatment Planning:** AI and deep learning algorithms can analyze medical images to identify the best treatment options for patients. This can help healthcare professionals develop personalized treatment plans that are more effective and efficient.
- 4. Monitoring:** AI and deep learning algorithms can analyze medical images and other patient data to monitor the progress of treatment and identify any changes or complications that require attention.
- 5. Telemedicine:** AI and deep learning-powered computer vision can be used to develop telemedicine applications that enable remote patient monitoring, virtual consultations, and remote diagnostics.
- 6. Drug Discovery:** AI and deep learning algorithms can analyze large datasets of biomedical information to identify new drug targets and develop more effective treatments for diseases.
- 7. Workflow Optimization:** AI and deep learning-powered computer vision can be used to optimize healthcare workflows, automate administrative tasks, and improve the efficiency of healthcare delivery.

### **Applications of AI and deep learning-powered computer vision in healthcare**

AI and deep learning-powered computer vision have a wide range of applications in healthcare, particularly in medical imaging and diagnosis. Here are some of the most significant applications:

1. **AI tumor detection:** AI and deep learning algorithms can analyze medical images to detect tumors with high accuracy, helping doctors to diagnose cancer in its early stages. These algorithms can also predict the growth and spread of tumors, aiding in the development of effective treatment plans.
2. **Cancer detection with computer vision:** Computer vision can identify cancerous lesions in medical images, such as mammograms or CT scans. By analyzing images with deep learning algorithms, doctors can detect cancerous cells earlier, leading to faster treatment and improved patient outcomes.
3. **Disease and infection prevention:** AI and computer vision can be used to monitor and track the spread of infectious diseases and identify high-risk areas. By analyzing patterns in disease spread, healthcare professionals can develop effective prevention strategies.
4. **Track chronic conditions:** By using computer vision to analyze medical images and other patient data, doctors can track the progression of chronic conditions like diabetes or heart disease. This allows doctors to adjust treatment plans and medication doses, helping patients to better manage their conditions.
5. **Automating cell counting:** Computer vision algorithms can automatically count cells in medical images, which is particularly useful in research and drug development. This can save researchers significant amounts of time and improve the accuracy of their findings.
6. **Detecting tissue structure changes:** By analyzing medical images with AI and deep learning algorithms, doctors can detect changes in tissue structure that may indicate the development of diseases like cancer. This can lead to earlier diagnosis and more effective treatment.
7. **Skin cancer detection using AI:** AI and computer vision can be used to analyze skin lesions and identify potential signs of skin cancer. This can help doctors to diagnose skin cancer earlier and improve patient outcomes.
8. **Automated medical transcription and documentation:** AI-powered tools can transcribe medical notes and documentation, saving doctors and nurses significant amounts of time. This can also improve accuracy and consistency in medical records.
9. **Analysis of fetal heart rate monitoring:** AI and deep learning algorithms can analyze fetal heart rate monitoring data to detect potential problems and predict outcomes. This can help doctors to develop effective treatment plans and monitor high-risk pregnancies.



- 10. Identification of brain hemorrhages:** AI and deep learning algorithms can be trained to detect brain hemorrhages from medical images, which can assist doctors in making accurate diagnoses and prompt treatment decisions.
- 11. AI-powered virtual assistants for patient support and care:** AI-powered virtual assistants can be used to provide patients with personalized support and care, assisting them in managing their conditions and medications, as well as providing emotional support.
- 12. Automated diagnosis of diabetic retinopathy:** AI and deep learning algorithms can be used to analyze retinal images and detect signs of diabetic retinopathy, which can lead to early detection and treatment of the condition.
- 13. Detection of pneumonia from chest X-rays:** AI and deep learning algorithms can be trained to detect signs of pneumonia from chest X-rays, which can assist doctors in making accurate diagnoses and prompt treatment decisions.
- 14. Automated analysis of electrocardiogram (ECG) data:** AI and deep learning algorithms can be used to analyze ECG data and detect signs of cardiac abnormalities, which can assist doctors in making accurate diagnoses and prompt treatment decisions.
- 15. Real-time tracking of surgical instruments during procedures:** Computer vision and AI can be used to track surgical instruments in real-time during procedures, assisting surgeons in making accurate and precise movements.
- 16. Predictive analytics for personalized treatment planning:** AI and deep learning algorithms can be used to analyze patient data and make predictions about the effectiveness of different treatment plans, allowing for personalized treatment planning.
- 17. AI-powered analysis of sleep patterns for diagnosis and treatment of sleep disorders:** AI and deep learning algorithms can be used to analyze sleep patterns from wearables and other devices, assisting doctors in diagnosing and treating sleep disorders.
- 18. Detection of Alzheimer's disease through brain imaging:** AI and deep learning algorithms can be trained to detect early signs of Alzheimer's disease from brain imaging, which can lead to early diagnosis and treatment.
- 19. AI-assisted drug discovery and development:** AI and deep learning algorithms can be used to assist in drug discovery and development, predicting the efficacy and safety of new compounds and accelerating the drug development process.
- 20. Identification of rare diseases through pattern recognition:** AI and deep learning algorithms can be trained to recognize patterns in medical images and data that are associated with rare diseases, assisting doctors in making accurate diagnoses and providing appropriate treatment.

**Benefits to Medical Practitioners:**

There are numerous benefits that AI and deep learning-powered computer vision applications can bring to medical practitioners, including:

- 1. Improved Accuracy and Speed:** AI algorithms can analyze medical images much faster and with greater accuracy than human experts, reducing the risk of misdiagnosis or missed diagnoses.
- 2. Early Detection:** With the ability to detect even subtle changes in medical images, AI algorithms can help medical practitioners identify potential health issues much earlier, improving patient outcomes and reducing the risk of complications.
- 3. Personalized Treatment:** AI algorithms can analyze patient data to identify patterns and make predictions about the most effective treatment plans for individual patients, helping medical practitioners provide personalized care.
- 4. Improved Efficiency:** AI-powered tools can automate many tasks, such as medical transcription and documentation, freeing up time for medical practitioners to focus on patient care.
- 5. Enhanced Decision-Making:** With access to AI-powered insights, medical practitioners can make more informed decisions about patient care and treatment plans, leading to better outcomes.
- 6. Increased Accessibility:** AI-powered tools can help bring medical care to underserved populations by providing remote access to diagnostic tools and medical expertise.
- 7. Cost Savings:** By reducing the need for repeat imaging and tests, and by improving the efficiency of healthcare delivery, AI-powered tools can help reduce healthcare costs for both patients and healthcare providers.

**Challenges in Healthcare Applications:**

There are several challenges associated with the use of AI and deep learning-powered computer vision in healthcare applications. Some of these challenges include:

- 1. Data Privacy and Security Concerns:** The use of AI and deep learning algorithms requires large amounts of data, which raises concerns about data privacy and security. The sensitive nature of medical data means that it must be protected from unauthorized access and breaches.
- 2. Algorithm Bias:** AI and deep learning algorithms can be biased if they are trained on biased data sets, which can lead to inaccurate or unfair results. Ensuring that algorithms are trained on diverse and unbiased data sets is crucial to minimizing algorithm bias.
- 3. Ethical Considerations:** The use of AI and deep learning algorithms raises ethical considerations, such as the potential for algorithms to replace human decision-

making, the risk of algorithmic errors, and the potential for unintended consequences.

4. **Lack of Interpretability:** AI and deep learning algorithms can be difficult to interpret, which can make it challenging to understand how they arrive at their decisions. This lack of interpretability can make it difficult to trust the decisions made by these algorithms.
5. **Regulatory Challenges:** The use of AI and deep learning-powered computer vision in healthcare applications is subject to regulatory frameworks that can vary by jurisdiction. Ensuring compliance with these frameworks can be challenging, particularly when working across multiple jurisdictions.
6. **Technical Challenges:** Developing and implementing AI and deep learning-powered computer vision systems requires significant technical expertise and resources. These technologies also require large amounts of data storage and processing power, which can be costly and time-consuming.

## CONCLUSION

AI and deep learning-powered computer vision present significant opportunities for healthcare applications, including early disease detection, diagnosis, treatment planning, monitoring, telemedicine, drug discovery, and workflow optimization. However, these technologies also present several challenges, including data privacy and security concerns, algorithm bias, ethical considerations, lack of interpretability, regulatory challenges, and technical challenges.

Addressing these challenges is crucial to fully realizing the potential benefits of AI and deep learning-powered computer vision in healthcare applications. It is essential to ensure that these technologies are developed and implemented in a manner that is responsible, ethical, and equitable. This will require collaboration between healthcare providers, technology developers, policymakers, and other stakeholders to establish best practices, guidelines, and regulations that promote the responsible use of these technologies in healthcare.

Despite these challenges, the future outlook for AI and deep learning-powered computer vision in healthcare is promising. These technologies have the potential to revolutionize healthcare delivery and improve patient outcomes, but only if they are implemented in a responsible and ethical manner. As such, it is crucial to continue to invest in research and development to overcome these challenges and harness the full potential of these technologies in healthcare.

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## ABOUT THE BOOK

The book "Application of Machine Learning and Internet of Things" is an edited volume that provides a comprehensive overview of the latest research and developments in the field of Machine Learning and Internet of Things (IoT). The book covers a wide range of topics related to the integration of these two cutting-edge technologies, including data acquisition, preprocessing, predictive analytics, decision-making, and various applications in different fields.

The contributors to this book include leading researchers, practitioners, and experts from academia and industry. Their insights and expertise have helped to create a valuable resource for researchers, students, and professionals interested in the application of Machine Learning and IoT. The book provides a comprehensive understanding of the challenges and opportunities in this rapidly evolving field and highlights the potential of these technologies to revolutionize various sectors and improve our daily lives.



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