

Machine Learning

Just a buzzword or a
future-shaping trend?

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Foreword



We hear more and more about artificial intelligence and machine learning. Although thanks to Hollywood, we may have begun to look at artificial intelligence as a potential threat to humanity, the reality is somewhat different.

So, what is it all about? Simply put, machine learning is a part of artificial intelligence (AI) that allows systems to learn and improve work automatically, without direct human programming.

Machine learning algorithms build a model based on sample data and use them to make predictions and decisions themselves. We can say that in the case of machine learning, computers actually learn from data.

With the increasing amounts of available data, machine learning will probably become more present as a necessary part of business and technological progress. One example, which most have probably encountered at least once, is automatic text translation. With enough data on the translation and a sufficiently large sample of previous translations, the system itself improves the translated text, considering the translation and grammatical correctness and the context itself.

The pandemic of COVID-19 has prompted new uses and technical advancements in the field. It has advanced AI adoption in industries like healthcare, where AI-based technologies and applications are being deployed in large numbers. Tech giants including Microsoft, Google, Amazon, and Facebook are pursuing remote communication, contact tracing, and medication research.

There is much talk about artificial intelligence and machine learning. With all the attention on it, many are still looking for a clear explanation and examples while seeking a better understanding of this topic and the benefits it could bring to the business.

Through this document, you will learn more about the most popular methods of using machine learning and their application in different industries.

“Artificial Intelligence, deep learning, machine learning—whatever you’re doing if you don’t understand it—learn it. Because otherwise you’re going to be a dinosaur within 3 years.” - Mark Cuban



What are the benefits of machine learning for a business?

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There are almost too many to list. In general, it is about consuming a lot of information to make better decisions. It is all about "data analysis and pattern discovery," according to one of the most referenced publications on machine learning intended for a commercial audience, which goes back to 2001.

Essentially, organizations are constantly seeking a competitive advantage, and the most common place to locate that advantage is in data. In fact, you might claim that firms are not "disrupted" by new technology; instead, they are disrupted because they make inadequate services and product decisions. All those decisions are bad because they looked at the incorrect data or analysed the existing information illogically. Machine learning helps with that.

According to Statista, about 50% of enterprise companies claim to be actively using machine learning programs right now, while 25% of IT leaders are planning to use machine learning for business analytics.



What are the benefits of machine learning for a business?



Real-time decision making

Making the right decision at the right time can be crucial for business success. But without technology capabilities, it would be impossible to extract the correct data and integrate it into everyday business. With machine learning, a company can quickly transform extensive data set into specific knowledge and use it to make proactive measures and stay on top of the competition.

Enhanced security

Cyber-security threats, security breaches, and anomalies frequently occur in real-time, with little prior warning. Any unusual networking actions must be recognized promptly before the intrusion escalates into a full-fledged security breach, information leakage, and service outages for businesses to maintain network security. Machine Learning algorithms assist in anomaly detection in network behaviour.

Improved Business Models

While large companies thrive by dominating market share, numerous businesses pursue competitive advantage in other areas to maintain profitability. In small and medium-sized companies, that advantage is usually provided by innovative technologies, services, and business models. Companies such as Uber, for example, utilize Machine Learning technologies from the beginning.

The Connection Between Machine Learning and GDPR



GDPR requires companies to comply with regulations that will secure consumer data. But questions have been raised about how this regulation will address automation in analytics as the AI and machine learning market grows.

As stated by the European Data Protection Board, „Any processing of personal data through an algorithm falls within the scope of the GDPR.“ Therefore, whenever a machine learning algorithm or AI system uses personal data, GDPR may apply.

The two significant components of machine learning are addressed by GDPR legislation. First, it improves data security by combining AI with data privacy. Companies that collect and process personal data are subject to stringent responsibilities under the law. Second, this regulation specifically targets „automated individual decision-making“ and profiling.

According to Article 22 of GDPR, an individual has the right not to be subjected to either if they have legal effects on them. This gives data subjects the right to be excluded from exclusively automated processing, including profiling.

While Article 22 is a general restriction, Article 15 gives stricter requirements that are linked to automated decision-making and profiling, that include:

- The “existence” of automated decision-making, including profiling.
- “Meaningful information about the logic involved.”
- “The significance and the envisaged consequences of such processing” for the individual.

GDPR outlines six data protection principles, and according to Norwegian Data Protection Authority, AI is facing four of them:

- 1. Fairness**
- 2. Purpose limitation**
- 3. Data minimization**
- 4. Transparency**

The impact of GDPR on Machine Learning and Artificial Intelligence



As previously mentioned, Machine Learning algorithms are based on a large amount of data that needs to be processed for the algorithm to learn. The way this data is used is a critical component in determining fairness. Personal data can be used for research reasons alone, such as detecting patterns and correlations.

On the other hand, the data can also be used to make choices that impact individuals. Even in sectors where complicated decisions must be made based on many aspects and non-predefined criteria, the combination of AI and big data allows automatic decision-making. In recent years, there has been much discussion on the benefits and drawbacks of algorithmic assessments and choices affecting people.

For example, displaying a specific online advertisement to a person based on their social media and web activities may not be considered intrusive and may even be appreciated if appropriate to their interest. However, in some cases, this can be perceived as discrimination.

For instance, a female doctor was shut out of a women's gym locker area because the automated safety system mistook her for a man because the term "Dr" was associated with men.

According to the Federal Trade Commission, there is also a case where people's credit limits were decreased based on a study of the bad repayment records of other people who bought at the same businesses as them.

Building a trustworthy AI

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According to the High-Level Expert Group, seven conditions must be satisfied to deploy and establish trustworthy AI:

- Human agency and oversight, including fundamental rights.
- Technical robustness and safety, including attack resilience and security, a backup plan, general safety, accuracy, dependability, and repeatability.
- Privacy and data governance
- Transparency, which includes traceability, explanation, and communication.
- Diversity and non-discrimination
- Societal and environmental wellbeing
- Accountability, including audibility, minimization, and reporting of negative impact, trade-offs, and redress.

For companies that are purchasing or building IT solutions based on AI, there are a couple of recommendations for the protection of personal data:

- 1. Before you buy a solution, perform a risk assessment**
- 2. Require that the system you build or buy meets the privacy needs by design**
- 3. Conduct regular tests for regulatory requirements compilation**
- 4. Use good systems for subjects data protection**



Industries Disrupted by Artificial Intelligence and Machine Learning

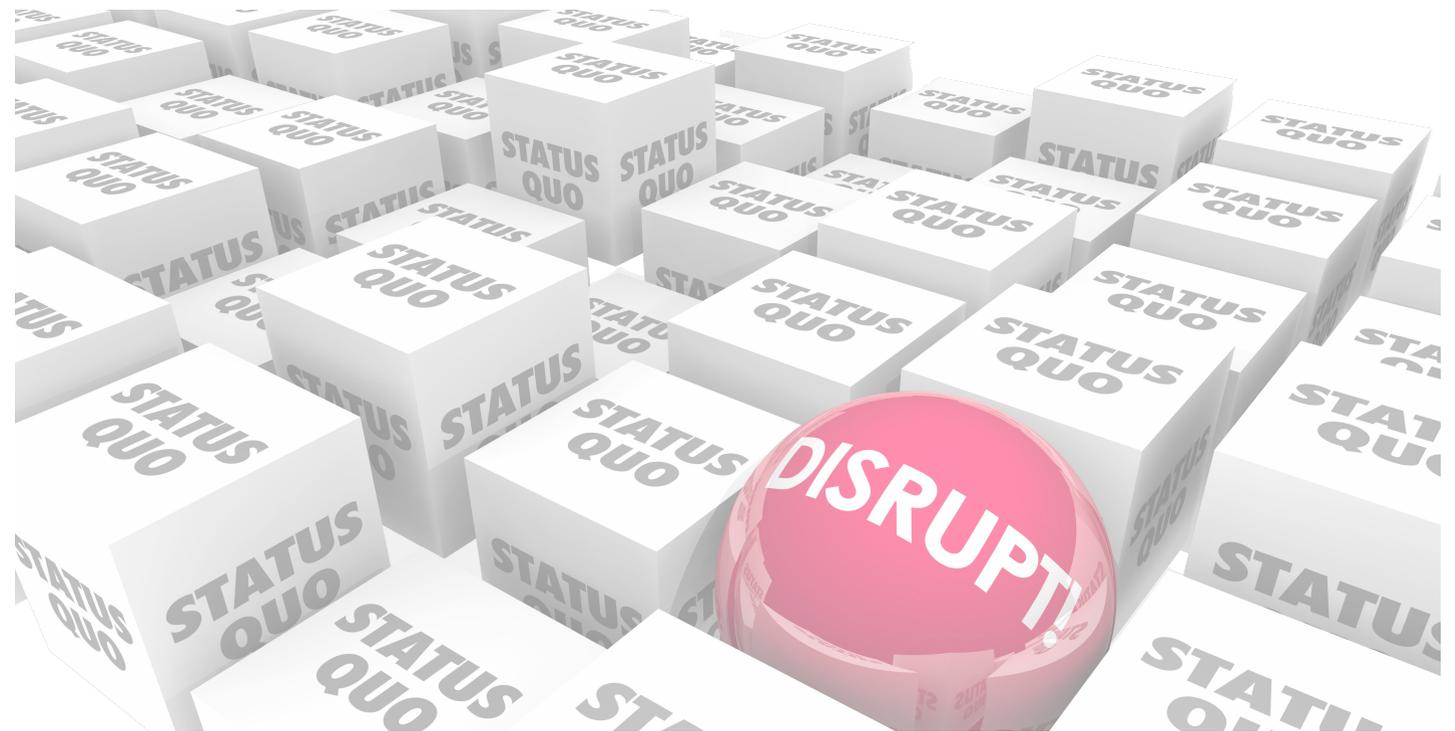


The impact and widespread disruption of Artificial Intelligence (AI) and Machine Learning technologies make it difficult to imagine an industry not being transformed by these technologies. AI technologies are redefining how work is perceived and executed in sectors worldwide.

Artificial intelligence technology like neural networks, NLP, machine learning, and deep learning can assist organizations in getting valuable insight into areas where opportunities can be found. Adopting AI offers businesses several benefits, such as personalization for users, improved process automation, accelerated implementations, and more.

Technology has completely redefined the way we work in various industries. From better decision-making to streamlining operations, it is evident that AI will continue to revolutionize different work areas in numerous industries.

In the following part of this paper, we will look at some industries where AI/ML are causing significant upheavals.

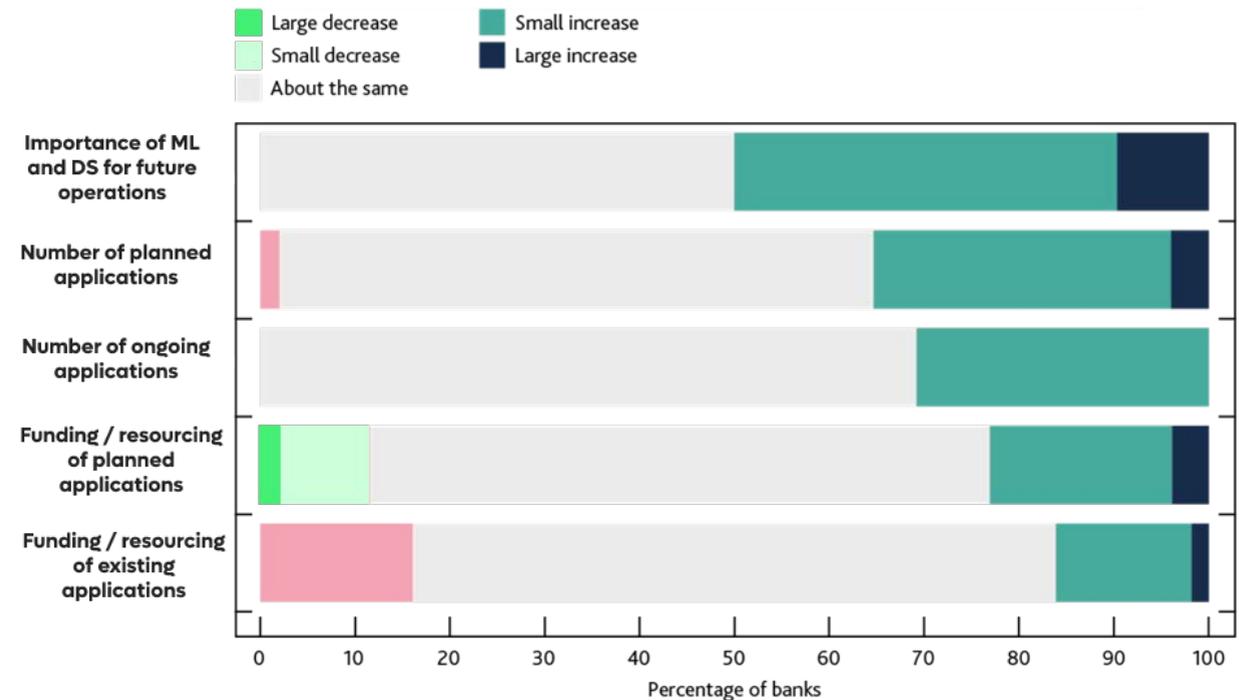


BFSI

Artificial intelligence and Machine Learning will undoubtedly alter the way banks operate and perform their functions. They will contribute significantly to a comprehensive and profitable experience for both the bank and the customer. The financial sector is heavily utilizing artificial intelligence and machine learning to automate and simplify processes.

Financial institutions were early users of artificial intelligence (AI), such as machine learning and other advanced data science methods, prior to COVID-19. As a result, the financial industry was one of the largest spenders on AI services in 2018.

Despite the pandemic, interest in AI and ML implementation has been resilient. According to the survey conducted by the Bank of England, around 40% of respondents said that the relevance of machine learning for future operations has increased, with 10% of institutions reporting a significant rise. The relevance of machine learning has not decreased at any of the banks.



Source: Bank of England



Top Reasons Banks use AI and Machine Learning

According to research company Autonomous Next, banks throughout the world should be able to decrease expenses by 22% utilizing artificial intelligence by 2030. Savings of up to \$1 trillion are possible. To combat credit card or identity theft, machine learning software is likely to be employed in the banking industry.

Some major use cases where these new technologies are being applied are:

- Fraud and Risk Management
- Customer Segmentation
- Digital Assistance
- Credit Service
- Chatbots
- Meeting Regulatory Compliance

Top 3 reasons banks use AI



**DATA
ANALYSIS
& INSIGHT**

60%



**INCREASED
PRODUCTIVITY**

59%



**COST BENEFITS/
SAVINGS**

54%

Source: Aideo



Computer Vision in Banking

There is a lot of opportunity for computer vision in retail banking. The majority of the talk revolves around security and fraud. The use of biometrics and image recognition for authentication aids banks in increasing security and combating fraud.

CaxiaBank has taken it a step further by allowing clients to withdraw money from ATMs using face recognition. To completely authenticate the individual's identity making the withdrawal, the ATM can validate up to 16,000 points on a face picture.

Another example is BBVA, where clients may submit a picture of their ID and a selfie to the bank. The system then takes the data and uses computer vision to ensure that the photos are identical. Computer vision replaces manual tasks while increasing accuracy, performance, and efficiency inside the organization.

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Retail

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Using data to gain a competitive advantage is nothing new for retailers; they have led the cultivation of customer analytics both online as well as in-store. As a result, modern retailers are relying on a growing amount of retail data to understand everything from customer purchasing patterns, product trends, and product price optimization to what to stock, how much to buy, and which products to recommend to regular customers, precise ad targeting, and more.

Retailers, according to McKinsey, should take steps to improve the customer experience and adapt to the current economic climate. Two of them, involving omnichannel innovation and physical store transformation, are executed with a subset of machine learning called computer vision technology.

The main application of computer vision in retail includes:

- Cashierless stores
- Marketing
- Chatbots
- Automating and improving in-store execution
- Tracking trends and possible disruptions based on historical data
- Supply Chain management
- Product categorization
- Store layout improvement

Product suggestion and planning is projected to have the biggest artificial intelligence market share in retail, and this trend is likely to continue over the projection period. For every customer, product suggestion is a highly powerful element of the whole buying cycle. eRetailers are utilizing AI to provide a personalization for their consumers as well as provide product suggestions by displaying relevant items.

When talking about physical stores, in-store visual monitoring and surveillance technology is anticipated to develop at the fastest rate. Using computer software programs, AI for video surveillance analyses pictures to identify persons, cars, or objects.

An example of an AI application for retail is RedAI.

This user-friendly, artificial product solution performs visual perception and brand recognition providing reports with a clear insight into what is happening in the stores. More information about the product is available at the link.



Computer Vision in Retail

Amazon introduced the Amazon Go store to the public, where customers may pay for their goods without standing in line at the checkout counter. The Go shop, which is located in Seattle, Washington, is equipped with computer vision cameras. It was initially solely open to Amazon employees, but in early 2018, it opened to the general public.

According to the company's website, cameras can detect whenever an object is removed from a shelf and take it by using computer vision technology. Customers are free to leave the store after they have completed their purchases. After that, the application will email them an online invoice and charge the purchase price to their Amazon account.



Manufacturing

Manufacturing is one of the most complex but perhaps one of the most evolving and key industries. A manufacturing unit contains far too many functions, each responsible for producing high-quality, enriched products.

To maintain machines and provide quality goods, the manufacturers must rely on technology and automation. Aside from custom software solutions, many manufacturers have begun to incorporate smart devices and technologies to improve output and efficiency.

The “Smart Manufacturing” transformation is already enabling companies to achieve this aim more successfully than ever before. Industrial Artificial Intelligence and machine learning are some of the core technologies powering this innovation.

Predictive Quality & Yield and Predictive Maintenance are the two most common applications of Machine Learning in manufacturing.

Other significant applications of machine learning in manufacturing are:

- Demand Forecasting
- Revenue Estimation
- Supply Chain Management
- Quality Control Improvement

Major benefits of machine learning in manufacturing are:

- **Reducing unpleasant process-related losses** such as production, waste, quality, and throughput
- Because of a more efficient process, it is now possible to **build and expand product lines** at scale.
- **Predictive Maintenance** can help you save money. It reduces maintenance activities, resulting in lower labor expenses as well as less inventory and material waste.
- **Improved Quality Control** with actionable information to enhance the quality of the product continuously.
- **Improved human-robot collaboration** improves worker safety while also increasing overall efficiency.
- **Consumer-focused manufacturing** entails being able to react rapidly to market developments.

The rising amount of vast and complex datasets (commonly referred to as big data), developing Industrial IoT and automation, growing computer power, and increased venture capital expenditures are all key industry drivers for AI / ML implementation in manufacturing.



Computer Vision in Manufacturing

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There are several ways computer vision can improve industry:

- Product assembly (assembly is fully automated)
- Defect detection (A computer vision-powered program collects real-time data from cameras. Machine learning algorithms examine the data streams to find defects and offer the percentage based on the previously specified quality requirements.)
- Die Cutting (To cut any design, the manufacturing sector may use computer vision technology to execute rotary die cutting accurately as laser cutting. Once the design pattern is loaded into the computer vision system, the system will direct the die cutting equipment, whether laser or rotary, to conduct accurate cutting.)
- Predictive Maintenance (Computer vision systems can continually check the equipment based on a variety of parameters. If any deviations from measurements indicate corrosion, computer vision systems can inform appropriate management to perform preventive maintenance operations.)
- Inventory Management (Stock is challenging to locate in large warehouses. These systems can assist inventory managers in finding items in the warehouse by using a computer vision system based on barcode data.)



Energy

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As governments attempt to diversify their energy portfolios and increase their dependence on greener energy, they are confronted with one big issue. The electricity provided by a solar panel or a wind turbine is never consistent and is influenced by various uncontrollable external forces. Network operators may have difficulty predicting how much extra electricity generation will be needed in the next hour of the day, making it difficult to accurately compute what the output of each generator is to accomplish the load-following phase.

Governments and electric corporations are not the only ones focusing on alternative energy sources. Google is well-known for its huge data centers that have been set up all around the world. These data centers generate a lot of heat, which necessitates a lot of power to cool down. They employed machine learning algorithms and reduced cooling costs by 40% at Google data centers to solve the issue.

Machine learning can transform the way we deal with energy, even if it is still in its early phases of deployment. It has an influence on renewable energy forecasts and intelligent grids, among other things.

According to BIS Research, the desire for greater operational efficiency will fuel an increase in investment on artificial intelligence technology by energy industry participants between 2019 and 2024.

Popular applications of machine learning in energy industry are:

- **Detecting anomalies in energy consumption**
- **Weather forecasting**
- **Failure forecasting**
- **Yield enhancement**
- **Making the grid smarter**
- **Energy demand prediction**



Healthcare

Government initiatives to increase the implementation of AI-based technology solutions, rising demand for Artificial intelligence in the field of medicine, an increasing aim to reduce radiologists' workload, an influx of large datasets, an increase in financial support for AI-based start-ups, and an increase in cross-industry collaborations and partnerships are all driving growth in the healthcare sector.

Machine learning in healthcare is becoming increasingly common, helping patients and doctors in many ways. The most common use cases for machine learning in healthcare are medical billing automation, clinical decision support, and clinical treatment guideline development. There are many notable examples of the application of machine learning and healthcare concepts in medicine.

Machine learning in healthcare has lately gotten a lot of attention. To aid in the detection of malignant tumors on mammograms, Google has created a machine learning system. A deep learning algorithm is being used at Stanford to detect skin cancer. According to a new JAMA publication, a deep machine-learning system was able to identify diabetic retinopathy in retinal pictures.

Additionally, deep learning, which is a part of machine learning that works with algorithms inspired by how the human brain works, is increasingly being used in radiology and medical imaging. Deep learning applications can find, identify, and analyze cancerous abnormalities on images using neural networks that can learn from data.

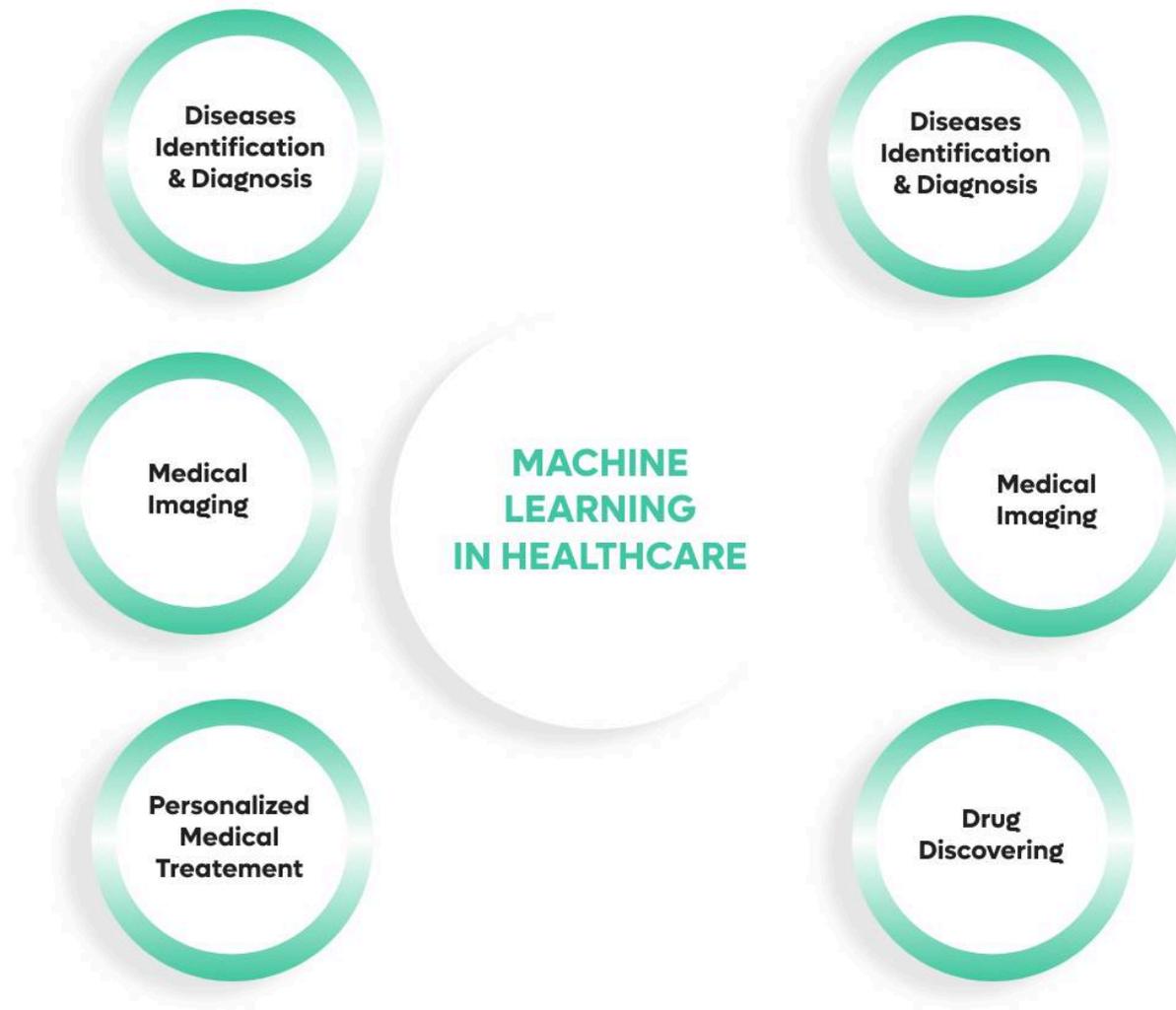


Fields of Application

Implementation of machine learning in healthcare can help create distinctive healthcare solutions, improving patients' experience and care. Additionally, it can help to diagnose certain conditions accurately and reduce costs in different areas.

The pandemic has speeded up the everyday use of artificial intelligence/machine learning. For example, artificial intelligence and big data play an essential role in helping medical professionals respond appropriately to coronavirus. Thermal cameras are used to read temperatures before a person enters a government building or public transport system.

Smartphones can now do on-the-go temperature checks thanks to new technologies. Robots are capable of undertaking contactless distribution and assisting medical personnel in disinfecting huge areas.



Recent Developments

Machine learning advancements in healthcare will undoubtedly continue to transform the industry. The rising use of this technology in the healthcare industry is due to a growing knowledge of the benefits given by AI methods and their broad application areas. Various top healthcare businesses form alliances and partnerships with prominent AI technology providers to develop novel AI-based solutions for healthcare applications.

Some of the important developments are:

- Google's DeepMind unit collaborates with the Moorfields Eye Hospital in the United Kingdom to enhance previous eye illness studies and aid eye physicians in evaluating the danger of a patient's eye issue and guiding them to medical treatment depending on the severity of the ailment.
- NVIDIA teamed up with King's College London to create an AI platform for the NHS. The goal of this collaboration is for the NHS to train computers to automate the most time-consuming portion of radiology interpretation.
- Intel (United States) and Siemens Healthineers (Germany) worked on a ground-breaking AI-based cardiac MRI segmentation and assessment model that may enable real-time cardiovascular illness detection.



Natural Language Processing - NLP

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Natural Language Processing (NLP) is a type of AI that focuses on recognizing, comprehending, and using human languages. It is one of the most intriguing disciplines in AI, having already led to the emergence of technology such as chatbots, voice assistants, translators, and a plethora of other tools we use daily.

The Global Natural Language Processing (NLP) Market was worth USD 10.72 billion in 2020 and is anticipated to be worth USD 48.46 billion by 2026, growing at a CAGR of 26.84 percent over the projected timeframe (2021-2026). Its application in the healthcare market is growing as a result of the current Covid-19 epidemic.

Large corporations are significant drivers and investors in the NLP sector. Since these businesses use deep learning and supervised and unsupervised machine learning methods for a wide range of applications, NLP usage is anticipated to rise. The majority of big end-user businesses in various sectors are primarily employing these technologies to improve their internal and external operations. Furthermore, the ROI of technology is not necessarily financial. Therefore most small businesses feel it dangerous to invest in.

Furthermore, big social media platforms use NLP to monitor and manage social media activities related to political reviews and hate speeches. Platforms such as Facebook and Twitter use these technologies to manage published material.



NLP Market

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The Natural Language Processing Market is extremely competitive, with numerous prominent companies vying for increasing market shares. These leading market players have been focused on growing their client base across international nations and delivering new inventive solutions, along with acquisitions and mergers, to improve their market shares and profitability.

Natural Language Processing (NLP) Market - Growth Rate by Region (2021 - 2026)



NLP Use Cases & Recent Developments

NLP solution vendors have developed new approaches to use NLP throughout the years. Here are some of the most effective NLP applications.

Creditworthiness Evaluation: Banks in developing countries have abandoned manual loan evaluation methods. They now employ NLP algorithms that evaluate social media accounts, location data, browser patterns, and other insights to assist banks in making sound loan decisions.

Chatbots: Chatbots have been around for a while. According to Juniper Research, chatbots will be able to answer 75-90% of questions by 2022. Chatbots are among the most effective applications of NLP combined with voice recognition.

Voice Assistants: Over 110 million voice assistant users live in the United States, and voice assistants such as Alexa, Siri, Cortana, and Google Assistant get millions of requests monthly. NLP is utilized in the voice assistant industry for speech-to-text translation, semantic matching from knowledge bases, and returning responses following text-to-speech translation. Businesses may increase marketing activity and engage consumers by using smart speakers as a marketing tool.

According to Markets and Markets research recent significant developments in the NLP market are:

- IBM introduced Watson Works in June 2020 to address the obstacles of getting back to work. Watson Works would address issues such as managing facilities and improving space allocation through the use of real-time data, prioritizing employee health by enabling businesses to make evidence-based decisions and enhancing the efficacy of interaction tracing by providing organizations with care agents and contact tracers.
- At the same time, Adaptive Biotechnologies joined Microsoft in launching the immunological CODE database to share an immune response to the COVID 19 virus across the population.
- AWS improved NLP AI, speech-to-technical transcription, and picture recognition services in April 2019. AWS introduced additional functions, including Amazon Comprehend, to its AI services.
- The Microsoft Healthcare Bot was introduced in February 2019 on the Azure Marketplace. It is a cloud service that enables conversational AI for medical-related processes.



Conclusion

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Many companies are turning to new technologies to maintain their competitive advantage and increase productivity. Artificial intelligence and machine learning have already altered the way companies conduct their operations. The majority claim to have implemented the technology in significant operations such as marketing and sales, supply chain management, customer support, and cybersecurity.



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Who are we?

An international nearshoring and offshoring software development and consulting company. With our unique Team Extension Model, we help companies with each stage of the development lifecycle, not only with development but also with consulting services. Technical consulting in different domains like Architecture Design, Automated Testing, DevOps and SCRUM was recognized in 300+ projects across different industries such as finance, logistics, hospitality, industrial manufacturing, healthcare, energy, and retail.

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