VSIT | Vidyalankar School of Information Technology

# V-Tech

*Technical Magazine of Information Technology and Data Science Department*

**Academic year**

**2021-22**

# Preface

Prof. Makarand Deshpande

I am pleased to present the issue of V-Tech, thetechnical magazine by the Department of Information Technology and Data Science of VSIT, for academic year 2021-22. Teachers contribute articles in their field of interest as well as current/upcoming areas which help in expanding the knowledge base of faculty members.

Continuing with this tradition, this issue deals with different aspects of IT field. Starting from journey of established technologies like NLP, Artificial Intelligence, and the way forward, to current trending topics in the field such as Machine Learning and artificial intelligence in the field of education, IOT. This issue also talks about some of the advances in IOT in the field of education and it also covers the Role of Technology and Innovations in sustainable development.

I hope you will find this issue as interesting as I did. It will help all the readers in enriching their IT knowledge and hopefully strike a chord in at least one area where they can take a deep dive for their research activities.

**Prof. Makarand Deshpande**

**Adjunct Faculty**

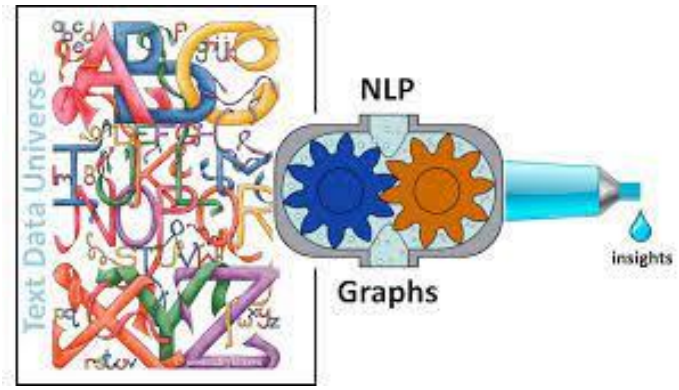
# Index

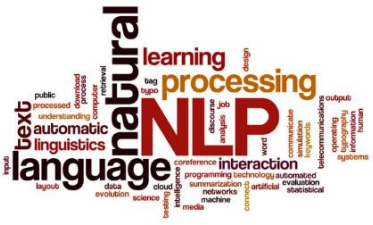
# NLP and its applications

**Natural Language Processing:** – Natural Language Processing (NLP) is basically how you can teach machines to understand human languages and extract meaning from text. Language as a structured medium of communication is what separates us human beings from animals. We are surrounded by text data all the time sourced from books, emails, blogs, social media posts, news and more.

Data having fix number of dimensions – that is fixed number of keys and its values, or fixed number of rows and columns is called a structured dataset. This type of dataset contains information in a well-organized form. Generally, a structure dataset is present in a tabular format like relational databases, where dimension of dataset is fixed, or it is in a key-value pair-json file showing students marks in key-value pairs. Unstructured dataset lacks a particular structure. It doesn't have fixed dimensions i.e. it can take any form For example- audios, videos, images and text. The images and videos are processed by computers and converted to long text of bits and bytes, which human can't identify the right information or context. so, it cannot be well designed in a tabular format.

Social media data like data collected from tweets, posts, comments; Conversation data like data collected from messages, emails, chats; Articles like data collected from news, blogs, transcripts etc are all text data. So, a text data is essentially any written form of Natural language such as English, Russian or Japanese. It consists of characters or words arranged together in a meaningful and a formal manner, which means that text data is driven by the grammar rules and defined structures.

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NLP is the branch of Data Science, which deals with deriving useful information from the text data / Natural Language Text. Also known as Computational Linguistics (CL), Human Language Technology (HLT), Natural Language Engineering (NLE). It contains several different techniques and processes which are used to analyze, understand and utilize the text data for solving business needs. Often, we come across a term Applied NLP. Applied NLP: NLP + Human Interaction. Which means, the use of NLP for designing and developing applications or systems in which there exists an interaction between machines and natural languages.

**Applications of NLP:**

**1: Speech To Text (STT) / Speech Recognition**

Speech to text conversion is the process of converting spoken words into written texts. This process is also often called speech recognition. All speech-to-text systems rely on at least two models: an acoustic model and a language model. In addition, large vocabulary systems use a pronunciation model. To get the best transcription quality, all of these models can be specialized for a given language, dialect(idioms), application domain, type of speech, and communication channel.
Example: dictate in word or power point, siri, Alexa etc.

**2: Text to Speech (TTS)**

Text-to-speech (TTS) is a type of assistive technology that reads digital text aloud. It's sometimes called "read aloud" technology. The voice in TTS is computer-generated and reading speed can usually be sped up or slowed down. Some TTS tools also have a technology called optical character recognition (OCR). OCR allows TTS tools to read text aloud from images. For example, person could take a photo of a street sign and have the words on the sign turned into audio.
Example: Application: ebook reader

**3: Story Understanding**

A large body of work in story understanding has focused on learning scripts. Scripts represent structured knowledge about stereotypical event, sequences together with their participants. 'A narrative or story is anything which is told in the form of a causally (logically) linked set of events involving some shared characters'. Instead of predicting an event, the system is tasked with choosing an entire sentence to complete the given story. Example: Story Wizard.

**4: NL Generation**

Natural Language Generation (NLG) is the process of generating descriptions or narratives in natural language from structured data. NLG often works closely with Natural Language Understanding (NLU). NLG, along with NLU, is at the core of chatbots and voice assistants. For computer science domain, NLG has been used to write specifications from UML diagrams, or describe source code changes.
Example: Tableau

**5: QA systems**

It is used to answer questions in the form of natural language and has a wide range of applications. Typical applications include: intelligent voice interaction, online customer service, knowledge acquisition, personalized emotional chatting, and more. There are two types of QA systems, open and closed. A system that tries to answer any question you could possibly ask is called an open system or open domain system – example Alexa. And then there are closed (or closed domain) systems that are built for a certain subject or function or domain of knowledge or company – example Paypal, Finn AI, Digital genius etc.

**6: Machine Translation (MT)**

Machine Translation (MT) is the task of automatically converting one natural language into another, reserving the meaning of the input text, and producing fluent text in the output language. There are many challenging aspects of MT: the large variety of languages, alphabets and grammars; the task to

translate a sequence (a sentence for example) to a sequence is harder for a computer than working with numbers only; there is no one correct answer. Example: google translator

**7: Text Summarization**

It is a process of generating a concise and meaningful summary of text from multiple text resources such as books, news articles, blog posts, research papers, emails, and tweets. Text summarization can broadly be divided into two categories — Extractive Summarization and Abstractive summarization. Extractive Summarization methods rely on extracting several parts, such as phrases and sentences, from a piece of text and stack them together to create a summary. E.g. Text-Processing, Skyttle 2.0, Textuality. Abstractive Summarization methods use advanced NLP techniques to generate an entirely new summary. Some parts of this summary may not even appear in the original text.
E.g. Digital Tesseract

**8: Text classification**

Text classification also known as text tagging or text categorization is the process of categorizing text into organized groups. By using NLP, text classifiers can automatically analyse text and then assign a set of pre-defined tags or categories based on its content. Unstructured text is everywhere, such as emails, chat conversations, websites, and social media but it's hard to extract value from this data unless it's organized in a certain way. Text classifiers with NLP have proven to be a great alternative to structure textual data in a fast, cost-effective, and scalable way.
Example: Email services / medical report / news

**9: Sentiment analysis / opinion mining**

Sentiment analysis (or opinion mining) is a NLP technique used to determine whether data is positive, negative or neutral. Sentiment analysis is often performed on textual data to help businesses monitor brand and product sentiment in customer feedback and understand customer needs. Sentiment analysis models focus on polarity (positive, negative, neutral) and on feelings and emotions (angry, happy, sad, etc), urgency (urgent, not urgent) and even intentions (interested v. not interested).
Example: pros and cons of a product – useful in e-commerce

**10: Grammar / spell check / Autocorrect**

A word needs to be checked for spelling correctness and corrected if necessary, many a time in the context of the surrounding words. Spell Check is a process of detecting and sometimes providing suggestions for incorrectly spelled words in a text. A basic spell checker carries out the following processes: It scans the text and extracts the words contained in it. It then compares each word with a known list of correctly spelled words (i.e. a dictionary).
For example: word /power point / google search.

Beena Kapadia
MSc IT Coordinator

# AI in Education Field

The impact of artificial intelligence as a powerful technology can be witnessed in different industry domains. The education industry also witnesses the same. Artificial intelligence in education is being used by different schools and colleges in the country. The use of AI in education has given a completely change the perspective of teachers, students, parents.


Before implementing AI in schools we need to consider following points: -

- What would be the role of artificial intelligence in schools or colleges.
- What Key processes of AI need to automate in schools.
- Upcoming challenges of teaching AI in schools and ways to overcome them.
- Making the transition process from the chalkboard and whiteboard to AI in classrooms seamless for the teachers and students.
- How to use AI in schools to provide actionable and effective decision-making.

**1. Artificial intelligence going to automate basic activities in education**

In college, grading assignments, test, homework etc for complete syllabus is a very tedious work, even when term wise assessment split it between them. Teachers find that grading takes a lot of time and efforts that could be used to interact with students, lecture preparation, or work for professional development. While AI may not be able to truly replace human grading. But now it's possible for teachers to automate grading for at least multiple choice question and fill-in-the-blank.

**2. Educational software can be adapted to student needs.**

Nowadays, applications are playing an important role from kindergarten to graduate school students' education, one of the keyways artificial intelligences will impact education isthrough the application of greater levels of individualized learning. Many of the application are already making their place in adaptive learning programs, games, and software. These systems are the current needs of the student.

**3. Students could get additional support from AI tutors.**

While there are obviously things that human tutors can offer that machine can't. But thefuture could see more students being tutored by tutors that only exist in zeros and ones i.e., completely in digital format. Many programs based on artificial intelligence already there andhelping students through concepts. These programs can teach students fundamentals

**Applications of AI In Education**


1. **Data Accumulation: -** Imagine you are searching for something, and you are getting some more related content. Artificial intelligence in education can suggest related content for the students so that they can relate and study.
2. **Chat Campus: -** Because of COVID situation, students are not coming to college, but they want to know the college. They can understand the life on the campus like searching a lecture hall, application procedure for the next semester, assignments details, cafeteria menu, space in parking lot, books in library etc
3. **Adaptive Learning: -** AI in education organisation help the students for adaptive learning by knowing the progress, changing the course.
4. **Chatbot: -** It's a dialog interface which collection opinion of the students. This ia a unbiased system.
5. **Proctoring: -** It can be used for attending competitive exams, school/college admission test, promotions, and, more.
6. **Virtual Facilitator: -** virtual instructors could be used in the educational and therapeutic environment. Virtual facilitator will think, react and respond to the students' queries and act as an assistant for the teacher.
7. **Smart Content: -** In order to make study interesting AI includes flashcards, MCQs, fillin the blanks, pointers, true/false, chapter summary, and so forth.
8. **Automated Grader: -** The Robo-graders replace a part of the grading system, and human grader is always there for further assessment.

**Spruha More**
**Assistant Professor**

# The Role of Artificial Intelligence in Special Education.

The field of ‘Special Educational Needs’ covers a large number of difficulties which can cause pro-blems during the learning process. The field of ‘Special Educational Needs’ covers many difficulties which can cause problems during the learning process. One of such important area is with the children having autism. Autism is a complex, lifelong developmental disability that typically appears during early childhood and can impact a person's social skills, communication, relationships, and self-regulation.

Children with Autism Spectrum Disorder (ASD) have been shown to display high levels of comfort with computers for many reasons. Computer programmes are predictable, logical, and can provide an intellectual outlet for children with specialised interests.

Therapists and educators around the world stated that AI technologies can help children with ASD develop social skills. ASD children tend to feel more comfortable with the predictable range of human expression exhibited by social robots.

Few of the AI technologies that helps in educating the autistic children are

QTrobot is an expressive little humanoid designed as a tool for therapists and educators. It uses facial expressions, gestures, and games to teach children with autism spectrum disorder about communication, emotions, and social skills.

Siri is Apple's voice-controlled personal assistant. Siri helps autistic children to improve their communication skills.

Akshatha Jain

Assistant Professor

# Artificial Intelligence in Education: A Paradigm Shift

Artificial Intelligence (AI) is the machine-displayed intelligence that simulates human behavior or thinking and can be trained to solve specific problems. AI is a combination of Machine Learning techniques and Deep Learning. AI models that are trained using vast volumes of data have the ability to make intelligent decisions.

The function and popularity of Artificial Intelligence are soaring by the day. Artificial intelligence is the ability of a system or a program to think and learn from the experience. AI applications have significantly evolved over the past few years and has found its applications in almost every business sector. This article will help you learn the top artificial intelligence applications in the real world which has changed the way of the education.

Although the education sector is the one most influenced by humans, Artificial Intelligence has slowly begun to seep its roots in the education sector as well. Even in the education sector, this slow transition of Artificial Intelligence has helped increase productivity among faculties and helped them concentrate more on students than office or administration work.

**Some of these applications in this sector include:**

**Administrative Tasks Automated to Aid Educators:** Artificial Intelligence can help educators with non-educational tasks like task-related duties like facilitating and automating personalized messages to students, back-office tasks like grading paperwork, arranging and facilitating parent and guardian interactions, routine issue feedback facilitating, managing enrolment, courses, and HR-related topics.

Creating Smart Content: Digitization of content like video lectures, conferences, and text book guides can be made using Artificial Intelligence. We can apply different interfaces like animations and learning content through customization for students from different grades.

Artificial Intelligence helps create a rich learning experience by generating and providing audio and video summaries and integral lesson plans.

**Voice Assistants:** Without even the direct involvement of the lecturer or the teacher, a student can access extra learning material or assistance through Voice Assistants. Through this, printing costs of temporary handbooks and also provide answers to very common questions easily.

Personalized Learning: Using AI technology, hyper-personalization techniques can be used to monitor students' data thoroughly, and habits, lesson plans, reminders, study guides, flash notes, frequency or revision, etc., can be easily generated.

AI has already been applied to education primarily in some tools that help develop skills and testing systems. As AI educational solutions continue to mature, the hope is that AI can help fill needs gaps in learning and teaching and allow schools and teachers to do more than ever before. AI can drive efficiency, personalization and streamline admin tasks to allow teachers the time and freedom to provide understanding and adaptability—uniquely human capabilities where machines would struggle. By leveraging the best attributes of machines and teachers, the vision for AI in education is one where they work together for the best outcome for students. Since the students of

today will need to work in a future where AI is the reality, it's important that our educational institutions expose students to and use the technology.

**Conclusion:** Artificial Intelligence is a smart and effective way to save time and be productive all the way. The above-listed apps can help you explore the power of artificial intelligence. Let's see what's more to come in the future because everyone loves to work smart, not hard – and the power of artificial intelligence is all about working smart without breaking the sweat. s technology is stretching its arms broadly, digital services playing a vital role in every aspect of life. In particular, mobile technology enabling education service providers and students to be in connection virtually 24/7 and contributing its part in ensuring better results.

Pushpa Susant Mahapatro
Assistant Professor

# Applications of IOT in the field of education

Education represents the greatest way we can ensure our continued growth in technology and culture. The Internet of Things (IoT) can provide us with a way to improve education on a long-term scale, without swallowing a budget.

Today, you can take a class at Harvard in your living room. It is possible to learn any skill, lesson, or philosophy through YouTube. Users can take degrees online, find instructors from all over the world, and have your homework math done just for you, for free. The impact of the internet has spread to the classroom as well. School districts allow students to study online, grade and classroom management systems such as Blackboard are used worldwide, and research and learning materials are more accessible than ever.

This article will examine how IoT will be one of the next major advances in technology in schools, universities, self-study, and general education.

### 1. IoT Applications in Education

One of the most powerful ways to learn foreign languages is immersion, its secret weapon being a real-time response. When you learn French in France, you get a real-time response from native speakers "for free." These areas are difficult to reproduce outside of the vernacular.

That's where IoT comes in. By using connected devices to determine whether students make appropriate statements or choices in foreign language simulation areas, teachers are able to provide real-time feedback to students and automatically monitor student progress.

### 2. Connected / Smart Classrooms

Future classes will be truly technologically empowered. AR will make the day of separation more humane by eliminating the need for real animals. VR will replace the history class with the front seats in Charlemagne to plan war and science with the real-time display of particles that make life, as we know it.
IoT applications in education will be the foundation on which these classes operate. Students will be automatically counted as present or drunk when the bell rings. The wearable equipment will determine when the class is very tired or out of work and may need a break, and whiteboards will record all notes taken in class. Smart microphones can detect even when the teacher says that there is a task to be done and to review the student organizers accordingly.

### 3. Task-Based Learning

Another structural change that takes place in education from a data transfer model to a shared, information-sharing system. IoT will have a huge impact on the way we teach, because connected systems free teachers from recording and monitoring students, enabling them to simplify learning rather than simply reproduce information. In a work-based instruction, students learn by doing and teachers help when needed. IoT systems provide feedback, help, and automatic level monitoring.

By showing help to teachers and increasingly difficult when necessary, no student is left behind or is far behind — a problem that has persisted in the classroom.

**4. Disability Accommodation**

IoT may seem useful to students who identify as disabled. Deaf students can use a system of connected gloves and a tablet to translate from sign language to oral language, converting sound into written language. Using IoT devices and programs is a constructive way to provide educational assistance to students with disabilities.

Ms. Ashwini Koyande

Assistant Professor

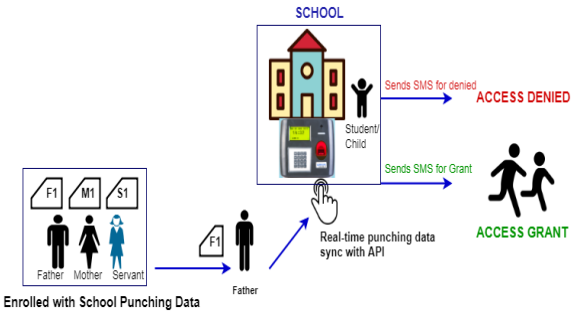
# Not just Smart. Be IoT Smart

Over the past few years, education has been developed by significant measures. The term 'Education' is not just limited to text books, but also is connected to the learning environment. Technology has played an important role in elevating the quality and ambience of learning. It is the technology that has introduced the digital form of reading and has helped in the successful implementation digital books in the classrooms. Technology and learning have made headway for the betterment of the Education sector. Hence, technology, in education acts as a catalyst for learning.

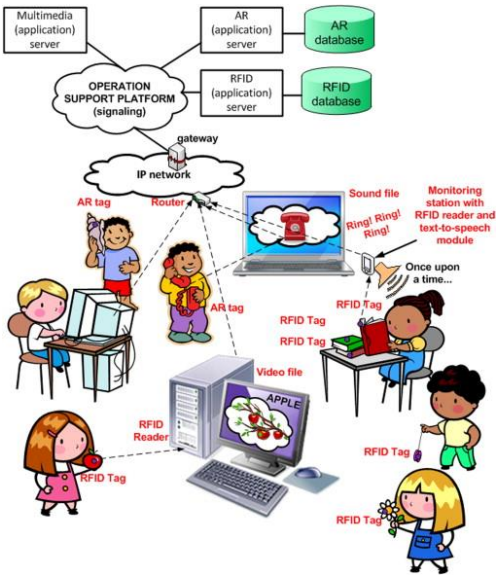
One of the most impactful aspects of technology is IoT (Internet of Things). IoT is the technology by which things can be made smart by making them communicate with each other using internet. In other words, IoT is extension of the internet connectivity into physical devices and everyday objects. This entire system concept is dotted with effective forms of hardware, electronics, and internet connectivity. With the unbending support of IoT, the education sector has noticeably climbed the ladder of ascending success. If you are a teacher, then you should explore these IoT applications in education.

**Smart Boards:** Smart boards are interactive white boards that projects subject images. It enables the teachers and students to interact with it, by simply writing on it or moving it around the class. Words and illustrated figures on a black board or textbooks, fall short at times to express the concept of a lesson in minute ways. Perception clashes become common and hence the classroom ends up in a pool of confusion. With smart boards, info graphics, tutorial videos and complex formulae, be it for any subject and especially of mathematics, could be solved in shorter time frames.

**Smart Attendance System:** With IoT, the school management can pull out accurate data of attendance. That data remains free from human error. Safety and quality of life through real time location of hostel living students could also be traced. Different sensors like fingerprint sensor, RFID, camera etc are used for data acquisition. With IoT based attendance system, calculating student attendance, and generating regularity, punctuality and personality reports becomes effortless. The amount of time it saves will have a tremendous effect on employee satisfaction working for the institute. Additionally, with the intention to make students more regular to the classes, IoT in education made sure to digitally register the student's attendance. If the student is missing anyhow from the institute, a quick electronic message will go to the parents.




**School Safety System:** Emergency indicators, audio enhancers, Wi-Fi clocks and hearing-impaired notifications are tangible forms that generate security. In any case there is a short circuit in the institute, the IoT sensors will immediately detect it and will send out an instant alert to reverse the situation. In case someone will get stuck in the lift, then also an 'automated' real time alert will be sent. In the education sector, data capturing technique obtain the relevant, up-to-date data and information about the education system. These data give the daily updated information about each individual student and their 'state of accesses' to the school or college and use those data for security and safety.




**Adjusting Disabilities:** With the modern technological designs, learning new things and performing just like any other abled student has become possible. There is a part of population that has challenges to the sense of hearing. They can seek help from a system of connected gloves and a tablet to generate verbal speech, translated from sign language. Its excellence in converting sound into written language is noteworthy. The world of disabled children is brighter just because IoT devices have taken the initiatives to provide educational assistance to the disabled children in a constructive way. This channelizes their intelligence and passion insignificant achievements.

On a concluding note, there are several teachers and students who require technological support to unleash the talent they have in the field of education. IoT solutions for education, understand this and have come up with answers to enhance the quality of education across the globe. The scope that was once enjoyed by the healthy students is now equally distributed to the disabled students as well. The simplified expression of complex formulas, concept and theories is now a clear possibility. Classroom studies have now become fun, interesting, and interactive. The Education was never this accessible and interactive before. IoT devices have managed to wonderfully balance modern day education in ways that ultimately uplift the global society as a whole.

Amraja K. Shivkar

Assistant Professor

# Portable RFID and Fingerprint based Attendance system for students

**Background**

Attendance in colleges is generally paper based which may sometimes cause errors. Taking attendance manually consumes more time. So, the proposed attendance system uses RFID technology to take attendance. Additionally, the Biometric attendance system records the biological details of students, such as fingerprints, and facial recognition, to mark the presence of students. It's a highly accurate and secure system of attendance recording. Teachers and parents can be immediately notified of students' presence at the institute.

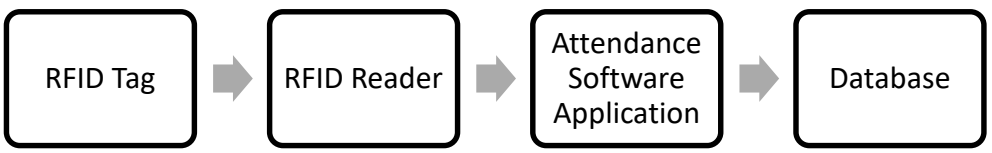
**What is RFID?**

RFID stands for radio-frequency identification. Systems that use RFID usually consist of tags that can be read by RFID devices. The RFID tags can be attached to students' ID cards, uniforms, or school batches. When the tags are read, then the information that is gathered is automatically uploaded to a cloud or other web-based storage system. As students pass through specific locations installed with RFID devices, their attendance can be recorded and updated by teachers and parents. This information can be utilized to track whatever the tag is attached to's progress from one point to another.

RFID Structure is continuously composed of 2 main hardware components. The transponder is located on the product to be scanned and the reader can be either just a reader or a read & write device, depending upon the system design, technology employed, and the requirement. The RFID reader characteristically comprises a radio frequency module, a controlling unit for configurations, a monitor, and an antenna to investigate the RFID tags. RFID Tag – The actual data-carrying tool of an RFID structure, in general, comprise of an antenna (coupling element) and an electronic microchip.

**Based Attendance System**

EM-18 RFID Reader is a very simple yet effective module. It is an RFID module and is used for scanning RFID cards. It's a new technology and is expanding day by day. Nowadays it is extensively used in offices where employees are issued an RFID card and their attendance is marked when they touch their card to the RFID reader.



**Advantages-**

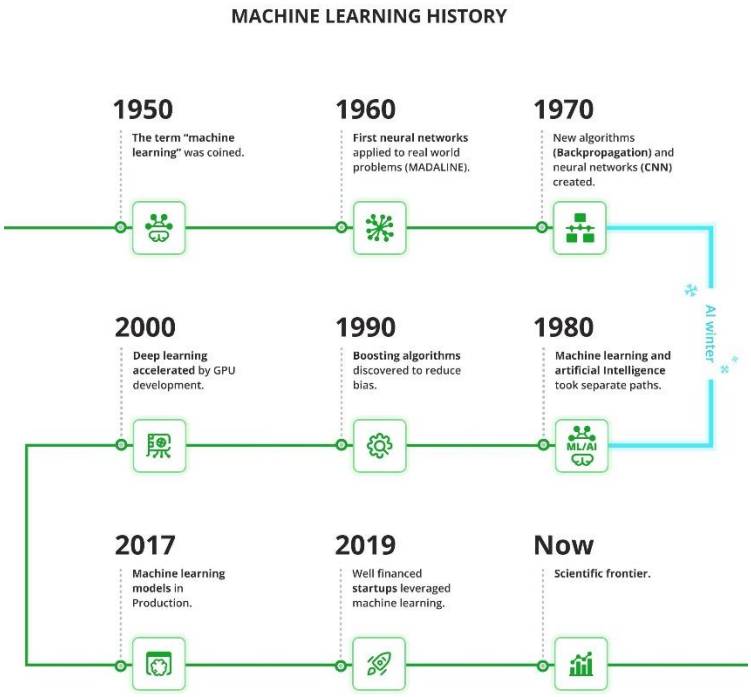
- Paperless: Upgrading to digital attendance recording systems can significantly reduce dependence on paper or notebooks.
- No manual work: Teachers can avoid exhaustion and monotony of attendance taking and bring more energy while teaching students. Errors while noting attendance, too, are reduced as the recorded data is highly accurate.
- Time saver: Automation is the best way to save time, and automating attendance enables schools to save time while managing the attendance of hundreds of students.
- Improved accuracy: The technology is robust and secure, leading to no possibility of error or unauthorized interventions.
- Prompt updates: Information technology enables us to work faster. Student attendance is captured and stored in the database to send a prompt notification to parents and teachers regarding student attendance.
- Better security: With a biometric attendance system and RFID monitoring, students' presence can be accurately monitored. The RFID system will ensure student movement within the school and is a strong security measure for students.
- Easy reporting: As the entire attendance details are maintained digitally, creating multiple reports with various parameters is easy. Institute can view attendance details class-wise or section-wise to make strategic decisions for improving student performance.

Maitreyi Joglekar

Assistant Professor

# Machine Learning Technology Trends To Impact Business in 2022

Machine learning models have come a long way before being adopted into production.




Major trends and the latest innovations in machine learning technologies can benefit the business in 2022 will be:

1. No-Code Machine Learning
2. TinyML
3. AutoML
4. Machine Learning Operationalization Management
5. Full-stack Deep Learning
6. Generative Adversarial Networks
7. Unsupervised ML
8. Reinforcement Learning
9. Few Shot, One Shot, & Zero Shot Machine Learning

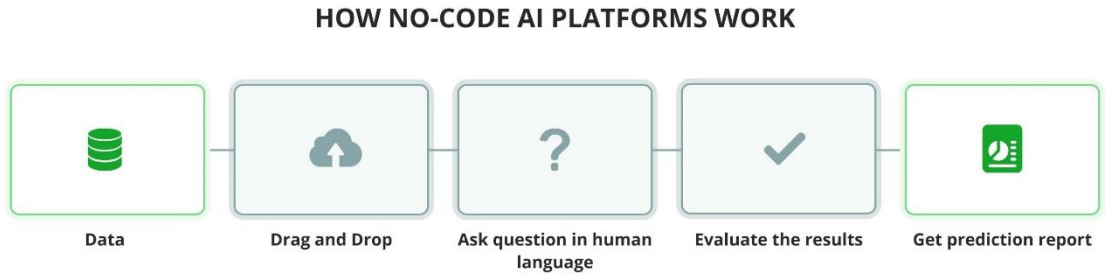
**Trend #1: No-Code Machine Learning**

Although much of machine learning is handled and set up using computer code, this is no longer always the case. No-code machine learning is a way of programming ML applications without having to go through the long and arduous processes of pre-processing, modeling, designing algorithms, collecting new data, retraining, deployment, and more. Some of the main advantages are:

- **Quick implementation.** Without any code needed to be written or the need for debugging, most of the time spent will be on getting results instead of development.
- **Lower costs.** Since automation eliminates the need for longer development time, large data science teams are no longer necessary.
- **Simplicity:** No-code ML is easier to use due to its simplistic drag and drop format.

No-code machine learning uses drag and drop inputs to simplify the process into the following:

- Begin with user behavior data
- Drag and drop training data
- Use a question in plain English
- Evaluate the results
- Generate a prediction report




Since this greatly simplifies the machine learning process, taking the time to become an expert is not necessary. Although this makes machine learning applications more accessible to developers, it is not a substitute for more advanced and nuanced projects.

However, it may be suitable for simple data analysis predictive projects like retail profits, dynamic pricing, and employee retention rates.

No-code algorithms are the best choice for smaller companies that cannot afford to maintain a team of data scientists. Although its use cases are limited, no-code ML is a great choice for analyzing data and making predictions over time without a great deal of development or expertise.

**Trend #2: TinyML**

In a world increasingly driven by IoT solutions, TinyML makes its way into the mix. While large scale machine learning applications exist, their usability is fairly limited. Smaller scale applications are often necessary. It can take time for a web request to send data to a large server for it to be processed by a machine learning algorithm and then sent back. Instead, a more desirable approach might be to use ML programs on edge devices.

By running smaller scale ML programs on IoT edge devices, we can achieve lower latency, lower power consumption, lower required bandwidth, and ensure user privacy. Since the data doesn't need to be sent out to a data processing center, latency, bandwidth, and power consumption are greatly reduced. Privacy is also maintained since the computations are made entirely locally.

This trending innovation has a great deal of applications in sectors like predictive maintenance for industrial centers, healthcare industries, agriculture, and more. These industries utilize IoT devices with TinyML algorithms to track and make predictions on collected data. For example, Solar Scare Mosquito is an IoT project which uses TinyML to measure the presence of mosquitos in real time. This can generate early warning systems for disease epidemics from mosquitos, for example.

**Trend #3: AutoML**

Similar in objective to no-code ML, AutoML aims to make building machine learning applications more accessible for developers. Since machine learning has become increasingly more useful in various industries, off-the-shelf solutions have been in high

demand. Auto-ML aims to bridge the gap by providing an accessible and simple solution that does not rely on the ML-experts.
Data scientists working on machine learning projects have to focus on preprocessing the data, developing features, modeling, designing neural networks if deep learning is involved in the project, post processing, and result analysis. Since these tasks are very complex, AutoML provides simplification through use of templates.

An example of this is AutoGluon, an off-the-shelf solution for text, image, and tabular data. This allows developers to quickly prototype deep learning solutions and get predictions without the need of data science experts.
AutoML brings improved data labeling tools to the table and enables the possibility of automatic tuning of neural network architectures. Traditionally, data labeling has been done manually by outsourced labor. This brings in a great deal of risk due to human error. Since AutoML aptly automates much of the labeling process, the risk of human error is much lower. This also reduces labor costs, allowing companies to focus much more strongly on data analysis. Since AutoML reduces these kinds of costs, data analysis, artificial intelligence, and other solutions will become cheaper and more accessible to companies in the market.
Another example of AutoML in action is OpenAI's DALL-E and CLIP (contrastive language image pre-training) models. These two models combine text and images to create new visual designs from a text-based description. One of the early examples of this in action is how the models can be used to generate images based on the input description "armchair in the shape of an avocado." This technology has many interesting applications, such as the creation of original images for article SEO, creating mockups of new products, and quickly generating product ideas.

**Trend #4: Machine Learning Operationalization Management (MLOps)**
Machine Learning Operationalization Management (MLOps) is a practice of developing machine learning software solutions with a focus on reliability and efficiency. This is a novel way of improving the way that machine learning solutions are developed to make them more useful for businesses.
Machine learning and AI can be developed with traditional development disciplines, but the unique traits of this technology mean that it may be better suited for a different strategy. MLOps provides a new formula that combines ML systems development and ML systems deployment into a single consistent method.
One of the reasons why MLOps is necessary is that we are dealing with more and more data on larger scales which requires greater degrees of automation. One of the major elements of MLOps is the systems life cycle, introduced by the DevOps discipline.
Understanding the ML systems lifecycle is essential for understanding the importance of MLOps.

1. Design a model based on business goals
2. Acquire, process and prepare data for the ML model
3. Train and tune ML model
4. Validate ML model
5. Deploy the software solution with integrated model
6. Monitor and restart process to improve ML model

One of the advantages of MLOps is that it can easily address systems of scale. It's difficult

to deal with these problems at larger scales because of small data science teams, gaps in internal communication between teams, changing objectives, and more.
When we utilize business objective-first design, we can better collect data and implement ML solutions throughout the entire process. These solutions need to pay close attention to data relevancy, feature creation, cleaning, finding appropriate cloud service hosts, and ease of model training after deployment to a production environment.
By reducing variability and ensuring consistency and reliability, MLOps can be a great solution for enterprises at scale.
Kubernetes is a DevOps tool that has proved to be efficient for allocating hardware resources for AI/ML workloads, namely, memory, CPU, GPU, and storage. Kubernetes implements auto-scaling and provides real-time computing resources optimization.

**For remaining trends, Stay tuned to the next article.**

Sanjeela Sagar
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# Metaverse

The Metaverse, also known as the "virtual universe," is a concept that has been around for decades in science fiction literature, but has only recently begun to take shape in the realm of technology.
At its core, the Metaverse is a virtual world that is fully immersive and interactive. It is a place where people can interact with each other and with virtual objects, using avatars and other forms of digital representation. It is not limited to just one platform or application, but rather encompasses a wide range of virtual environments and experiences that can be accessed through various devices, such as computers, smartphones, and virtual reality headsets.

One of the potential benefits of the Metaverse is the ability to connect people from all over the world in a shared virtual space. This could lead to new forms of social interaction, collaboration, and communication, as well as the creation of virtual communities and shared experiences. Another key aspect of the Metaverse is the ability for users to buy, own and trade virtual assets, such as virtual land, items, and even virtual currency. This has led to the emergence of NFTs (non-fungible tokens) and blockchain technology as critical enablers of the metaverse economy.

Several major companies and start-ups are currently working on developing the Metaverse. Some examples include:

Facebook: The social media giant has announced plans to invest heavily in the Metaverse, and is currently working on developing a range of virtual reality and augmented reality technologies Google: The tech giant has also expressed its interest.

Microsoft: The company has invested in the metaverse with their platform called Mesh.

Epic Games: The creators of Fortnite are working on building a metaverse platform called the "Epic Metaverse", which aims to connect players across a range of games and virtual worlds.

Decentraland: It is a virtual reality platform that utilizes blockchain technology to allow users to create, experience, and monetize content and applications.

Cryptovoxels: It's a virtual world built on the Ethereum blockchain where users can buy, own, and trade virtual land, and experience VR in a decentralized environment.

Somnium Space: is a virtual reality metaverse that allows users to buy, own and monetize virtual land, and experience VR in a decentralized environment.

The Metaverse market is currently in its nascent stages, the global market for virtual and augmented reality technologies is expected to reach $215 billion by 2021, and is projected to reach $335 billion by 2027, growing at a CAGR of 20.4% during the forecast period.

Another report by Zion Market Research predicts that the global Metaverse market will grow at a CAGR of around 35% during 2021-2026.

Additionally, the emergence of NFTs and blockchain technology as critical enablers of the metaverse economy, could also lead to significant growth in the value of virtual assets and the metaverse economy.It's important to note that the Metaverse is a complex and multi-faceted concept, and its growth will be influenced by a wide range of factors, including technological advancements, social and cultural trends, economic conditions, and government regulations. Therefore, predicting the growth of the metaverse market with certainty is difficult.

Let's look at the research aspect in metaverse with main stream alignment.

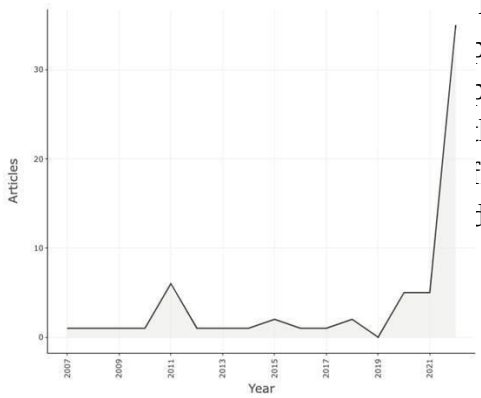


Fig 1: Graph indicating the growth

Figure 1 shows that although the first relevant work was published in early 2007, it has only been since 2019 that publications have started to proliferate rapidly, peakingin 2021, the same year Mark Zuckerberg announced thename change from Facebook to Meta. The metaverse isa new area of inquiry due to the publication trend.

Figure 2 depicts the number of publications on subject in the USA, which is indicativeof the natio output of scientific knowledge.With 36 publicatio the UK is in second place, followed by South Ko with 29 and Italy with 19. The research has be publishedin the blue-hued nations on the map. T amount of scientific production increases with colo intensity.

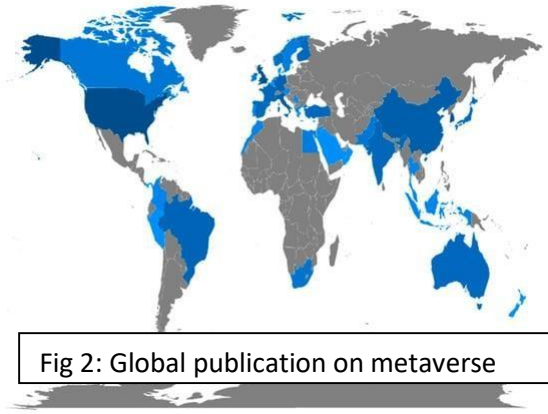

Fig 2: Global publication on metaverse

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# IBM's Quantum Leap: Pioneering the Future of Computing

## Introduction

Quantum computing, a revolutionary field that harnesses the principles of quantum mechanics, has the potential to transform various industries by solving complex problems exponentially faster than classical computers. Among the key players in this domain, IBM has emerged as a frontrunner with its ground breaking advancements in quantum technology. With its quantum computing platform called IBM Quantum, the company is making significant strides in quantum research and development, paving the way for a new era of computation. In this article, we delve into IBM's quantum journey, highlighting its key achievements, ongoing projects, and the potential impact of this quantum leap.

## IBM Quantum's Milestones

IBM's foray into quantum computing began in 2016 with the introduction of the IBM Quantum Experience, a cloud-based platform that allowed users to access and experiment with a rudimentary quantum computer. This initiative aimed to democratize quantum computing and foster collaboration within the scientific community. It provided a stepping stone for researchers and developers to understand and explore the intricacies of quantum systems.

Since then, IBM has achieved several milestones, propelling the field of quantum computing forward. In 2017, IBM unveiled its first commercial quantum computer, the IBM Q System One, designed for stable operation and accessibility. This marked a significant leap in the quest to build scalable and reliable quantum computers.

Another ground-breaking milestone was the development of the IBM Q Network, a global community of partners collaborating on quantum research and exploring practical applications of quantum computing. This network has grown to include over 100 organizations from diverse sectors, including academia, industry, and government, fostering innovation and knowledge sharing.

## IBM Quantum's Current Projects

IBM Quantum's current projects span various areas, aiming to address the key challenges in quantum computing. One of the primary focuses is increasing the quantum bit (qubit) count and improving their coherence time—the duration during which qubits remain in a usable state. By scaling up the number of qubits and enhancing their stability, IBM aims to unlock the true potential of quantum computers.

To tackle these challenges, IBM has developed multiple qubit technologies, including transmon qubits and the recent breakthrough in the development of a four-qubit processor based on the lattice surgery technique. These advancements push the boundaries of qubit scalability and pave the way for building more powerful quantum systems.

Furthermore, IBM Quantum is actively involved in quantum error correction research, a critical aspect for achieving fault-tolerant quantum computers. Error correction techniques can help mitigate errors caused by noise and environmental disturbances, thereby enhancing the reliability and accuracy of quantum computations.

Another significant project is quantum machine learning (QML), where IBM researchers are exploring how quantum computers can accelerate machine learning algorithms. QML holds promise in solving complex optimization problems and data analysis tasks exponentially faster than classical approaches, potentially revolutionizing fields such as drug discovery, finance, and logistics.

**The Impact of IBM's Quantum Leap**

IBM's quantum advancements have far-reaching implications across industries. Quantum computers have the potential to revolutionize cryptography by breaking conventional encryption algorithms and enabling the development of unbreakable quantum cryptographic protocols. This can enhance the security of sensitive data and communications.

Moreover, quantum computing can optimize complex processes and simulations that are impractical for classical computers, driving breakthroughs in material science, drug discovery, and optimization of supply chains. For instance, quantum simulations can accelerate the discovery of new materials with unique properties, leading to advancements in areas like renewable energy and manufacturing.

IBM Quantum's research also impacts artificial intelligence (AI). Quantum machine learning algorithms have the potential to improve AI models' performance, making them more efficient and capable of handling complex data patterns. This synergy between quantum computing and AI could fuel innovations in natural language processing, image recognition, and recommendation systems.

Additionally, IBM's focus on building a collaborative quantum ecosystem through the IBM Q Network is nurturing a vibrant community of researchers, developers, and industry experts. This collaborative approach accelerates progress by sharing expertise and resources, fostering innovation, and building a robust quantum workforce for the future.

**Conclusion**

IBM's quantum leap signifies a significant milestone in the field of quantum computing. Through its pioneering initiatives, such as the IBM Quantum Experience, the Q System One, and the Q Network, IBM has pushed the boundaries of quantum research and development. With ongoing projects centered around qubit scalability, error correction, and quantum machine learning, IBM Quantum is actively shaping the future of computing. As quantum technology continues to evolve, IBM's contributions and collaborative efforts are poised to unlock new frontiers, revolutionizing industries and transforming the way we solve complex problems.

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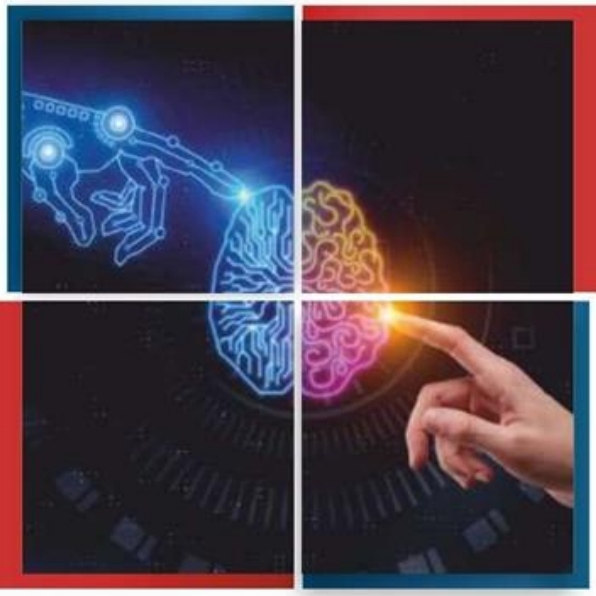

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