Intelligent Automation Systems at the Core of Industry 4.0

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Abstract. Today's in 21st century, we require Digital Transformation everywhere and want to make human life easier and longer to live. Digital Transformation cannot be accomplished by companies/ industries without the use of artificial intelligence (AI, i.e., analytics process) and Internet of Things (IoTs) together. AI and IoTs are the necessity of next decade and of many nations. On another side, some other technology like Blockchain technology and edge computing make the integration these technologies simple and faster. In near future, Digital Transformation will require more than one technology, i.e., integration of technologies will be ion trend. The word 'Intelligent Automation,' which is essentially the automation of the processes of the business (including general corporate-level processes using BPM and unique task-level processes using RPA), is therefore assisted by Artificial Intelligence 's analytics and decisions. This work discusses about Intelligent Automation, its internal structure, evolution and importance (with future work) in many useful applications (for Industry 4.0). In last, Intelligent Automation Systems has been explained for e-healthcare applications and give a perspective "How it can change Healthcare Industry and can save millions of lives.

Keywords- Intelligent Automation, Industry 4.0, Future with Machine Learning, Blockchain Applications and Internet of Things.

1. Introduction

In previous few months, COVID-19 pandemic has significantly changed human being lives. Countries are introducing several procedures like social distancing measures, including lockdown, to avoid the spread of infection. Also, Industries or Organisations are implementing new ways of continuing their business by facilitating Work from Home (WFH) and avoiding contacts using the Internet of Things (IoTs) (including Internet of Everything) for remote monitoring [1]. Schools and other educational institutes are implementing e-learning. Today most of the work is depend on Internet Connected Devices (ICD) and their operations [2]. For example, Hospitals and health organisations are also using e-medicine and remote patient monitoring utilising Internet of Medical Things (IoMTs) [4]. Online shopping, contactless delivery and virtual social events are becoming popular. Today's authorities are using sensors for contact tracing, traffic control and safety during this COVID 19 pandemic. During this pandemic, Cloud computing, IoTs and IoE are becoming ever more essential in the post- COVID-19 era. But, together this several issues like security, privacy, reliability, sustainability, performance, user experience, power requirements, management and compliance have been raised using such applications/ networking. Authorities are using sensors for contact tracing, traffic control and safety during this COVID 19 pandemic. This article help researchers to think beyond the other side of technology and push researchers/ scientist towards adaption of Intelligent Automation systems in Industry 4.0, which will save cost, time, incorporate value creation, efficiency increments, improving the customer experience, producing inventive opportunities and increasing more value. Today we need to overcome emerged issues and challenges in the post COVID-19 era.

These issue and challenges solve through increasing the use of Intelligent Automation in many/ daily life applications. Intelligent Automation (IA), the idea that may turn into the fundamental driving force behind digital transformation processes. Organizations are amped up for the detailed advantages and investing intensely in intelligent automation. Many organisations are spending billions of USD for making optimal robotic process automation plan. Gartner characterizes intelligent automation benefits as an umbrella term for an assortment of methodologies, skills, devices and procedures that service providers are utilizing to expel the requirement for labour and increase the consistency and unwavering

quality of services while decreasing the expense of delivery. We are seeing the production of another model of working, Intelligent Automation (IA). It drastically changes the manner in which people and machines interact with one another under the quick development of data flows, digitization of life and for all intents and purposes unlimited computing power.

Intelligent automation software really has an "understanding" of our business procedures and their varieties and considers that knowledge when executing automated business process approval to check that the correct business result occurred. Today Industries mainly focus on work costs, productivity, compliance, accuracy, and system efficiency. Improving at least one component in any given parameters means it increases revenues for an industry. For example, better customer experience increase demand of Product. Intelligent automation tends to a developing need that organizations operationally overlooked throughout the years. It likewise addresses the work process and systems integration gaps left out by software suppliers. Note that together in current scenario/ post COVID 19, Robots (machine with Intelligence or machine intelligence) can reduce human contact, transmission of COVID-19. For example, robots can serve as a doctor-patient interface in which they can conduct diagnosis and treatment processes, minimising human interaction and the risk of infection transmission during the coronavirus pandemic.

Organisation of this work: Section 2 discusses our motivation behind writing article related to this emerging area or hot topic. Section 3 discusses about Necessity (or Objectives), Features and Possibilities of intelligent Automation in current or future next decade. Further, Section 4 discusses various future Possibilities with AI and IoT towards Intelligent Automation. Then, Section 5 discusses related work in detail. Section 6 concludes this work in brief with including several interesting future remarks for future researchers and scientists.

2. Motivation

Industry 4.0 is the necessity of future and modern society. Intelligent automation systems will be in trend in near future in all possible sectors. Millions of lives can be saved or profit can be increased if fully automation is allowed in all sectors, on other side, millions of people will get many opportunity like to development new systems, write new code or solve new problems (raised in near future according to the scenario). Together information technology, Machine Learning (ML) is the fastest growing area in current/ past decade. Here, using ML in Healthcare like Health Informatics (HI) have most application services/ challenges, like providing improved medical diagnoses, disease analyses, and pharmaceutical development. These enhancement/ improvement change the living standards of a patient to a new level. And make a patient happier to recover himself. In near future, Robots can serve as an intermediary between a doctor and a patient during the duration of COVID 19, where they can conduct diagnosis and treatment processes, minimising human interaction and the risk of infection during the coronavirus pandemic. Hence, this kind of aim has been covered in this article. This work will provide information about Computer Vision and automated analytics mechanisms, or intelligent automation system for Medicare or Healthcare with discussing its role in a person's life (in real). In near future, we will see many things automated and intelligent like driverless vehicles, drones in logistics, etc.

3. Intelligent Automation – Necessity (or Objectives), Features and Possibilities

Smart automation's key goal is to maximise consumer and employee loyalty and improve productivity [4]. Moreover, it creates savings in time and expenses, dramatically decreasing human involvement in the process cycle, enabling workers to have more time to concentrate on innovative changes, strategy, decision-making, etc. The reduction of errors in the systems, as well as a reduction in the use of paper, is another goal, as this trend is entirely geared towards solely digital management. Figure 1 discusses about progress towards Artificial Intelligence for Industry 4.0. Note that Industry 4.0 encourages full automation with intelligence in all sectors and benefits the modern society with its reliable services.
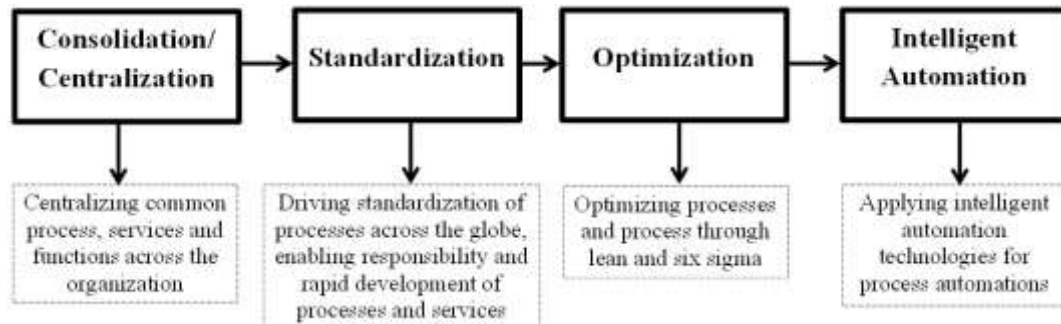
Figure 1: Progress towards Artificial Intelligence for Industry 4.0

Intelligent Automation used/ is an effective and integrated application of four main technologies to provide tangible solutions to society / industry 4.0 [5].

a) BPM: BPM is a process automation application that requires effective human, processes and data communication. BPM's goal is to ensure that the infrastructure for organisational and business processes is strong.

b) Robotic Process Automation (RPA): Robotic Process Automation is a technology aimed at reducing the level of human intervention in computer applications, particularly in the case of repetitive tasks which differ very little in each iteration [6]. RPA operates mainly by communicating with "high level" applications as opposed to machine language or computer code, which are the software layers at the graphical interface level. Implementation is a relatively quick technology and therefore can bring immediate benefits to a business through time and cost savings, particularly if it can be applied to the bottlenecks of some processes.

c) Artificial Intelligence: Artificial Intelligence is a machine-simulation of human intelligence. In other words, it is the discipline that is attempting to build structures that can understand and reason like a human being. Other principles such as machine learning, deep learning, Natural Language Processing (NLP), image recognition, big data, etc. are included in Artificial Intelligence [7]. While it is a very broad term that encompasses several levels (from basic automations to advanced virtual assistants), the following virtues of the current business climate are worth highlighting:

- Deciphering trends from past experience.
- Wise decision making.
- The analytics are prescriptive and predictive.
- User experience enhanced.

d) Integrations: One of the greatest headaches for an organisation is the relation and integration between systems, because each system or software has its own particularities. They typically offer to communicate with an Application Programming Interface (API), which is normally based on certain principles such as SOAP (applied in Web Services) or REST (based on HTTP protocol),

Possibilities for Intelligent Automation: Intelligent Analytics (or advanced analytics) will be a part of intelligent automation. Also, it will analysis a large amount of data [10] without any interruption, i.e., will make computer systems more decisions supported. In other words, computers will be able to provide intelligence in doing tasks and will do every task efficiently, perfectly (without any delay/ error).

4. Future Possibilities with AI and IoT towards Intelligent Automation

Intelligent Automation and Intelligent Automation are two different terms, but related to computer vision. Note that AI and IoTs will be used in near future in various applications/ areas like cyber security (find vulnerabilities/ secure systems), software development (design software or finding bug quickly), cloud computing (storing data at optimal location, according to importance), education (provide best optimal solutions for reliable e-learning classes), agriculture (deciding which soil is good for which crop based on fertilizer and weather condition and using prevention mechanism to avoid any major loses to crops, occurs due to natural hazards), defence (reducing human workforce at borders and providing security through sensing), aerospace (controlling rover speed and recovering of any damages automatically), etc. Major Requirement of future:

- A Contactless World
- Decentralized Economy

- Distributed Web
- Emotion of AI: Emotions in AI need to be come in near future
- Digital Twins: Digital twins are virtual replicas of physical devices that can be used by data scientists and IT helps to run simulations before building and deploying real devices. It mainly uses IoTs in its construction process.

Hence, the use of intelligent automation can be discussed in detail as:

4.1 Intelligent Automation/ Robotics/ Artificial Intelligence in Software Development

Technology is at the root of all the innovations we see today in our lives. During the last few years, software development technologies have seen a major transformation (1980- 2020). For example, it makes business very simple, easier and profitable. Together it reduce s load of many consumers. Technology today makes the world go round in almost all industries, and is part of the nation 's economy. In their software development, companies have embraced almost all new technologies, and Artificial Intelligence (AI) is no exception. The impact of artificial intelligence on software creation shifts the way businesses work and make software smarter. Today AI is using by almost all industries which work through software and hardware (AI uses as Cyber Physical Systems).

Traditional software development is not intended to embrace these changes, requiring a sequence of successive stages including manual code writing, requirements planning, software design, and testing to determine that the end product meets specifications. By building flexible and productive workflows to boost efficiency and minimise time-to - market, Artificial Intelligence (AI) is disrupting this process. While several software companies are still in the early stages of the implementation of AI, the use of technology is increasingly rising in the enterprise. Revenues from the application of AI instruments worldwide are projected to hit $119B by 2025. Notice that AI is not a substitute for Human Intelligence (HI). Although helping software development teams save time by reducing human error associated with repetitive tasks, AI constantly learns and produces human interactions. With this development, we are confident that AI can enhance software development, agile test automation, software automation testing, as well as the way RPA bots work with software support [6]. AI instruments seek to make the production of software more effective, quicker and easier. Few possible uses of AI in software development are:

- Requirement Gathering: Being a conceptual phase of SDLC (Software Development Life Cycle), the requirement gathering requires maximum human intervention. Artificial intelligence offers a broad range of techniques/tools like Google ML Kit, and Infosys Nia to automate certain processes to minimize human intervention to some extent. This phase includes plenty of emphasis on detecting loopholes early before moving to design. A technique of AI called Natural language processing will make machines understand the user's requirements in natural language and automatically derive high-level of software models. Also, there are few issues with this approach including difficulties in balancing the developed systems. However, it is one of hot research topics (for research) todays.

- Agile Project Management: The benefits of efficiency gained by applying AI extend beyond routine task management. The application of AI in software development can help developers become more agile and lean in the way code is written, tested, and delivered to production teams. AI algorithms can be used to improve project timelines, cost estimates, and volumes such as enabling development teams to prioritize sections of code needing early completion, and becoming more precise in defining potential failure rates. AI/ ML algorithms proactively search larger code databases looking for abnormalities, communicating possible future steps to developers for prevention [10]. Abnormalities may include missing code, bugs, or alternative product or service names under the same code. This is not only useful in recovery, i.e., the analysis of information may assist with the pre-diagnosis of errors.

- Automate Software Design: Designing software code is an essential, complex, and demanding stage of the development process because teams locate at different geographical location. Planning and designing a project requires developers, designers, R&D (Research and Development), and marketing teams to work collaboratively (needs specialized learning and experience) by being transparent and communicating effectively, which is done manually till now. In other words, settling on a correct design for each stage is an error-prone task for designers. Retracts and forward investigating plan forces dynamic changes to the design until the client reaches the desired solution. But in near future AI/ ML algorithms can help to streamline and automate the planning and designing process by gathering data such as names of project stakeholders, location, customer needs, products, and type of business to auto-create intuitive instructions on what design approach to take without requiring manual intervention. Automating some complex procedures with AI tools can enable the most capable methods to design the projects. For example, using AIDA (Artificial Intelligence Design Assistant, website building platform), designers can understand the needs as well as the

desires of the client and use that knowledge to design the appropriate project. This (AI) can help automate the code design process, saving programmers time, effort, and money.

- Automated Code Generation: Taking a business idea and writing code is time-consuming and labour-intensive for a large project. Experts have approached a solution that writes code before beginning production to confront the time and money issues. The technique, however, is not good for uncertainty such as what the objective code intends to do as it takes a lot of time to gather these information, such as writing code from scratch. An intelligence programming help with AI can decrease the load to some degree. Imagine that it would be understood and translated into executable code if we explain the project definition in our natural language and our framework. It looks like impossible today / science fiction, software development artificial intelligence might flip the script, but it will be feasible in the near future. Natural language processing and AI software would allow for this. Also, it is always labour-intensive and time-consuming to code a broad and complex project with multiple stakeholders.AI coding assistants will dramatically reduce development team workload, while increasing productivity. Note that by concentrating on more innovative and strategic projects, such as enhancing the user interface, developers can improve productivity.

- Software streamlining Testing: Testing is the central component of every software development cycle. A big problem for development teams is the identification and avoidance of errors or bugs. Fixing bugs and errors consists of a large amount of software development costs. Early identification of errors requires continuous monitoring during a project's production life cycle. Current software testing practises, however, are costly, unreliable, and time-consuming because errors are found in the code in many instances after the product has been developed and delivered / launched on the market to end users. Trained AI and ML algorithms will ensure that the testing conducted in less time than manual testing is error-free, allowing code testers to concentrate on more critical tasks such as code maintenance. AI-enabled sample code testing enables development teams to conduct mass testing on thousands or millions of codes. Development teams can tackle case-specific tests while automation tools aided by AI can manage routine and time-consuming tests. This eventually leads to a reduction in errors because AI-assisted tests scope and correct errors with sheer accuracy, leading to an increase in overall software quality improvement. In near future, AI can integrate with cloud and do testing automatically for software testers, it will fix specific bugs, provide deployment to product at before the deadline. As a result, it not only saves time, money and energy, but also provides a high ROI for the organisation (return on investment). Notice that software testing is a critical stage in the production of software, which ensures the product 's consistency. For instance, a few examples of AI and machine learning-based testing platforms are Approach, Feature, and Testim.io.

- Enhance decision-making: Software developers make important decisions about which features to include in a product for a lot of time and money. By analysing the performance of current applications and prioritising products and features for future development, AI will speed up the decision-making process. Computer businesses are able to make data-driven business decisions on a wide scale rapidly, optimising market influence and the sales (using AI in software development). Using AI technologies such as advanced Machine Learning (ML), deep learning, natural language processing, and business rules, software developers would be able to create better software quicker. The ability to learn from previous software projects and assess the success of current projects is empowered by machine learning solutions. AI in the development of software not only encourages development but also contributes to better implementation. AI builds better software with strategic decision-making for Software developers.

- In Deployment Control: Phase of implementation is the stage where developers often update programmes or software to newer versions. If developers fail to properly execute a process during update, the execution of the programme would present a high risk. During upgradation, AI will prevent developers from such vulnerabilities and reduce the risk of deployment failure. Another effect of artificial intelligence is that it helps machine learning algorithms to evaluate the deployment process.

- Enhanced Data Protection: A key property that we should not neglect during growth is software protection. The system typically collects data from client-end mounted network sensors and applications.AI helps us to examine the data by learning machine to differentiate anomalies from common behaviours. Other software development companies that implement AI will also prevent delayed warnings, false alarms, and alerts in their development process.

- Improving the accuracy of estimates: AI provides a software estimation approach that includes reviewing historical data from the company's earlier projects to identify similarities and statistics. To deliver reliable expense, time and effort estimates, it uses predictive analytics as well as business rules.

- The Development Future: AI has tremendous potential to reshape software development in the future. Availability of AI-enabled applications enables tech firms to deliver customer-driven interactions by offering business-specific application strategy.

Coding becomes stronger, improved by integrating with AI tools, and error detection becomes easier. AI algorithms and advanced analytics help software development teams to make immediate decisions using real-time data at scale. In contrast to machines that respond to rule-based logic or provide pre-determined responses, AI applications perform complex and intelligent human thought-related functions. By collecting and analysing data from a variety of sources including microchips, sensors, and remote inputs, AI algorithms can automate the coding process using that data to help developers construct accurate code, resulting in more effective, agile, and scalable workflows. AI may also provide highly personalised products or services for customers in software development. Artificial intelligence can have a huge effect on both architecture and software development. Software development companies need to consider the effects of artificial intelligence and the possible benefits it can bring, not just in terms of software design, but also in terms of the essence of the software itself. In the design, code generation and testing of applications, etc., AI will play a significant key role., in near future, will be a game-changer.

4.2 Intelligent Automation/ Robotics/ Artificial Intelligence (AI) in Cloud Computing

In this smart era, two technologies like artificial intelligence and cloud computing are changing the lives of human being to the new level. In other words, Artificial Intelligence (AI) and Cloud Computing (and Edge Computing) have emerged together to improve the lives of millions. Note that Edge computing is a new advanced version of Cloud Computing [8]. Today's many Digital (smart) devices mixing AI and cloud computing in our lives every day, such as Siri, Google Home, and Amazon's Alexa, etc. On a larger scale, AI capabilities are working to make businesses more effective, strategic, and insight-driven in the business cloud computing world. In general, through hosting data and software in the cloud, cloud computing gives organisations greater versatility, agility, and cost savings. A cloud in business (industry) can be public, private, hybrid, providing end-users with services such as SaaS, PaaS, IaaS, etc. An integral cloud computing services is infrastructure that includes the provision of computing and storage devices. Cloud providers also provide data centre services that cover the various databases available. This development chain is moving technology towards the growth of Artificial Intelligence and Cloud Computing.

To produce better results from large amount of data stored by Internet of Things (via their communication), cloud comes into existence with AI. Artificial Intelligence technologies combine with cloud / edge computing and help businesses manage their data, search for knowledge trends and insights, provide better customer service, and optimise workflows [9]. AI has enormous business strengths, the need for technological resources and vast infrastructure has made it less feasible for many companies.

Benefit from AI technology can be like if we lack top technical talent, and access to huge data sets, then AI can help us with its massive computing power for refining this data (in intelligent way), Cost-Effectiveness, Increased Productivity, Reliability, Availability of Advanced Infrastructure. For example, such an AI-powered pricing module ensures that pricing for a business is always optimised. It's not just about making better use of data; without the need for human involvement, it's performing the research and then putting it into effect. That is, the cloud is democratising access to AI by allowing businesses the freedom to use it now. Some other useful benefits will be:

- Significant and promising AI and cloud computing applications: Powering an AI (Artificial Intelligence) Self-Managing Cloud is built into the IT infrastructure to help streamline workloads and automate repeat tasks.
- Improving AI data management: Artificial intelligence solutions at the cloud level are also improving data management.
- Having Things Accomplished with AI-SaaS Integration: Artificial intelligence technologies are now being applied to provide more value as part of broader Software-as-a-Service (SaaS) systems.
- Using Dynamic Cloud Services: As a service, AI is also changing the way companies rely on instruments.

Today Cloud and edge computing acts as an engine to increase an area's reach and AI effects. At all levels, AI and cloud (also Edge) computing are transforming business, especially with a significant impact on large-scale business. A smooth AI flow and cloud-based tools are making many services a reality [11]. For example, it is possible to enjoy services (without creating a unique ML mode) Which parallel systems, i.e. text processing, voice, vision and computer language translation, are available to

end-users. But previously, we need to provide more meaningful data, more human workforces for analysing large amount of data, then prediction gets better and the accuracy is improved.

With these AI-based phases, the number of organisations improving talks profits the craving to put money into cognitive technology capabilities. In conclusion, the use of AI in cloud computing is definitely not a drastic or revolutionary move. It's a revolutionary one, in many ways. We need AI and the cloud's 'test and learn' capabilities. We are optimistic that the merger of cloud computing services and AI technology would bring substantial improvement to the technology sector. In near future, AI will become a factor of production with having capability of large storage. With introducing many examples/ possible use (in next subsections) for future researchers, scientists, etc., towards AI for cloud and edge computing, we assure that with the growth of cloud computing, AI field needs to emerge, investment in AI would advance the cloud sector and be able to hit a new level in terms of income and productivity. Therefore, in the next few years, we should hope that the market will begin to explode, with AI pushing cloud computing higher than ever, as the cloud market will transmit AI 's benefits to the mainstream.

4.3 AI for Cyber Security: Intrusion Detection Automatically by Machine and Artificial Intelligence

In recent years, artificial intelligence approaches have evolved rapidly, and their implementations can be seen in practise in many fields, ranging from facial recognition to image processing. AI-based techniques will provide improved cyber defence capabilities in the cyber security domain and help adversaries refine attack methods. Malicious people, however, are already aware of the emerging prospects and would undoubtedly try to exploit them for sinister purposes.

Cybersecurity includes designing defence strategies that preserve unauthorised access, alteration, or destruction of computer infrastructure, networks, services, and data. New cybersecurity threats are evolving and changing rapidly because of the drastic developments in information and communication technologies. AI is now being used in the area of cybersecurity to advance defensive capabilities. AI can be used to process large quantities of data with reliability, precision, and speed, based on its powerful automation and data analysis capabilities. In order to detect similar attacks in the future, even if their patterns shift, an AI system should take advantage of what it knows and recognise past threats.

The exponential advancement of computer technology and the internet is having a huge effect on the everyday lives and jobs of people. Unfortunately, several new cybersecurity problems have also been triggered by it: First, the data explosion renders manual review impractical. Second, threats are rising at a high rate, meaning that new, short-lived species and highly adaptive threats are becoming widespread as well. Third, at present, the risks compromise different dissemination, infection, and evasion techniques; they are thus difficult to identify and predict. In addition, the cost of avoiding threats should also be weighed. Generating and implementing an algorithm requires a lot of time, resources, and effort. Recently, researchers have suggested numerous techniques to detect or categorise malware, detect network intrusions, phishing, and spam attacks using AI techniques; counter Advanced Persistent Threat (APT); and recognise domain created by domain generation algorithms (DGAs).

In order to improve the efficacy of the malware, AI technology can be further weaponized, making it more autonomous, more advanced, quicker, and more difficult to detect. The new generation of malware is smarter and able to function autonomously, with the help of AI. Intelligent malicious programmes may spread themselves on the basis of a set of autonomous choices in a network or computer system, intelligently tailored to the host system parameters, and autonomous malware capable of choosing lateral movement techniques, thus raising the probability of completely compromising the targeted networks.

In cryptography, the use of AI opens new frontiers for security investigations. Scientists see AI as an important response to the continuous growth in the number of cyber threats and the need for a rapid response and a significantly automated response to security attacks, and the increase in the sophistication of cyber threats. AI technology, on the other hand, also contributes to certain security concerns that need to be addressed. Currently, malware recognition and analysis, intrusion detection (focusing on network-based anomaly attacks), phishing and spam, and advanced persistent threat detection and characterization are the prime targets for AI applications. Usually, intrusion detection systems rely on hybridization strategies that combine many strategies: signature-based methods for rapid detection of known threats with low false alarm rates and methods for flag deviations based on anomalies.

4.4 AI for Industry 4.0

Industry 4.0 is the digital transformation and processes of value development of manufacturing / production and related industries. With the fourth industrial revolution, Industry 4.0 is being used interchangeably and represents a new stage in the organisation and regulation of the industrial value chain. The advent of modern digital industrial technology, known as Industry 4.0, is a revolution that makes it possible to capture and analyse data through computers, allowing higher-quality products to be manufactured at reduced costs in quicker, more versatile and more effective processes [12]. AI techniques coupled with recent developments in the Internet of Things, Web of Things, and Semantic Web-jointly referred to as the Semantic Web-promise to play an important role in Industry 4.0. The authors present, as part of this vision, a Semantic Web of Things for Industry 4.0 (SWeTI) platform. Few examples for AI scope in Industry 4.0 are Machine Intelligence in Medical Imaging, Machine Learning and AI for Penetration Testing and Machine Learning in Chemical Sciences.

AI for Industry 4.0 is comprised of some of the following technologies:

- Advanced analysis techniques
- Predictive analysis
- Machine learning
- Image analysis
- Natural language processing
- Mood, behaviour and personality analysis

AI is one of the emerging technologies already being utilised by manufacturers to improve product quality, efficiency and for cutting down on operating costs. We are beginning to see a working relationship between human beings and robots, an area that benefits from the use of AI in production facilities. The smart factory, consisting of hyper-connected production processes, consists of numerous machines that all interact with each other, relying on AI automation platforms to capture and analyse all kinds of data, including images, structured code text and categorised fixed field text. A recent IDC survey of global organisations currently using AI technologies found that only 25% have developed an enterprise-wide AI approach. To boost their efficiency, many organisations are applying AI. There are vast amounts of data, however, that have not even been digitised or structured in a way that allows them to be used by AI. For example:

Machine Learning in Medical Imaging- Machine learning is a method that can be applied to medical images for the recognition of patterns. Although it is a powerful instrument that can assist with medical diagnosis, it can be misused. Usually, machine learning starts with the machine learning algorithm framework computing the image characteristics that are believed to be significant in the prediction or diagnosis of interest. There are numerous strategies, each with various strengths and disadvantages, that can be used. Most of these machine learning approaches have open-source versions that make them easy to try and apply to images [13]. There are several metrics for measuring an algorithm 's performance; however, one must be conscious of the possible associated pitfalls that can lead to misleading metrics.

Machine Learning and AI for Penetration Testing and Machine Learning in Chemical Sciences- In order to determine its security, penetration testing requires conducting a controlled attack on a computer system. Currently, it is one of the key methods employed by organisations to strengthen their cyber threat defences. Network penetration testing, however, requires a considerable amount of training and time to perform well, and there is a growing shortage of qualified cyber security professionals at present. Current approaches to automated penetration testing have focused on techniques that involve a model of exploit performance, but as new software and attack vectors are produced, the cyber security environment is evolving rapidly, making it a challenge to produce and sustain up-to - date models.

Massive amounts of data on the one hand and cost pressure, disruptive innovations and more and more regulations on the other – modern manufacturing faces challenges that can only be met by the smart use of Artificial Intelligence (AI). AI offers information for production processes and applications with skills that can mimic human cognitive functions. Manufacturing components equipped with these capabilities can perceive their environment, mimic it, learn from data, make predictions and enhance their own programming independently. In manufacturing, Artificial Intelligence is essential to linking humans,

computers, goods and data intelligently, as well as to the smart and quick use of IoT (Internet of Things), cloud solutions, machine learning and predictive maintenance.

4.5 AI for Data Science

In today's time, artificial intelligence, also known as AI, and data science, have become the two most significant technologies sought after. Many times, people think of it as the same thing, but in fact, it's not the same thing. For its processes, Artificial Intelligence is used in the area of data science. After the explosion of massive data collected by them via various internet methods such as a laptop, smartphone, tablet, desktop, etc., there was substantial growth in the need for data processing for the industries. The most widely used interchangeably are Data Science and Artificial Intelligence. Although some aspects of AI may contribute to Data Science, it does not reflect all of it. The most famous field in the world today is Data Science. Actual Artificial Intelligence, however, is far from reachable. While modern data science is considered by many to be Artificial Intelligence, it is simply not so.

In almost all sectors, Data Science has thus brought about a major revolution. All modern societies are data-driven, which is why data science has become a central part of the modern world. Artificial Intelligence is a field where artificial activities are conducted using algorithms. Its models are based on humans and animals' natural intelligence. Similar patterns from the past are remembered, and when the patterns are replicated, related operations are performed automatically. It utilises software engineering principles and computational algorithms to create solutions to a problem. A lot of Artificial Intelligence is yet to be discussed, but Data Science, on the other hand, has already begun to make a significant difference in the market. The data that can be used for visualisation and analysis is transformed by Data Science. New products are developed with the aid of Artificial Intelligence, which are better than ever, and it also brings control by automatically doing several things [14]. Data is evaluated on the basis of careful business decisions, with the aid of Data Science, which gives businesses many advantages.

Data Science Vs Artificial Intelligence:

1. Contemporary AI's limits

Data Science and Artificial Intelligence can be used interchangeably. But between the two sectors, there are some variations. 'Artificial Narrow Intelligence' is the contemporary AI used in the world today. Computer systems do not have full autonomy and consciousness like human beings under this type of intelligence. Instead, they are only able to do tasks for which they are qualified.

2. Data Science is a comprehensive technique

The analysis and research of data is Data Science. The duty of a Data Scientist is to make decisions that favour businesses. In addition, the role of data scientist varies with the industry. The key requirement is to pre-process data in the regular roles and responsibilities of a data scientist, that is, to perform data cleaning and transformation.

3. A platform for data scientists is Artificial Intelligence.

Artificial Intelligence is a tool or a method for a data scientist. This approach is situated at the top of the other methodologies used for data analysis. This is better analysed by the Hierarchy of Maslow, where each part of the pyramid reflects a data activity carried out by a data scientist.

4.6 Artificial Intelligence – IoTs Integration for Other Sectors

In IoT applications and implementations, artificial intelligence plays a rising role. Over the past two years, both investments and acquisitions in start-ups that combine AI and IoT have climbed. Major IoT platform software vendors now offer integrated AI capabilities such as analytics based on machine learning. In this context, AI 's importance is its ability to quickly write insights from data. Machine learning, an AI technology, offers the ability to automatically recognise patterns and identify data anomalies that produce information such as temperature, pressure, humidity, air quality, vibration, and sound from smart sensors and devices. IoT AI applications allow businesses to prevent unplanned downtime, increase operational performance, generate new products and services, and improve risk management.

4.6.1   IoT in Higher Education systems

In the context of information and communication technology and the advancement of society, the Internet of Things (IoT) continues to affirm its significant role. With the help of IoT, by delivering more affluent learning environments, increased operational efficiency, and by gaining real-time, actionable insight into student success, institutions can improve learning outcomes. In many disciplines and at any stage, the IoT stands to radically change the way universities operate and boost student learning. For universities or any other educational institution, it has tremendous potential; if well equipped to ensure widespread and effective implementation by leadership, workers, and students [15]. Where universities can lead, IoT requires growth. To direct the exploration and growth of IoT systems, computers, software, and services, scholars, researchers, and students are in a unique position.

For students to get all types of information, the Digital Campus System is an important platform. Also impacting other aspects of campus management are emerging innovations. Higher education institutions, in particular universities, are increasingly in demand to digitise their content and activities and adapt their methods so that academics and researchers can work effectively in a digital environment. A digital university must have the technology to teach and facilitate teaching. Education, joint study and empowerment. Universities will face all contemporary digital challenges if they compete, but few have the vision, versatility, channels, or sufficient leadership to put policies in place to ensure that they can innovate or respond to market conditions.

4.6.2 Impact of IoT in Education now and in future

The capacity of technology to interrupt teaching, learning, and evaluation has long been realised by universities. In addition, disruption of technology is necessary if a modern university is to differentiate its student bid, thereby increasing admissions, enhancing retention, and achieving desired results. But it is difficult to train students to be confident in the world of work. In all learning environments, IoT will allow better operational effectiveness. By enhancing learning environments, enhancing learning tools, improving learning methods and strategies, increasing management effectiveness, and saving management costs, IoT will facilitate classroom instruction. More engaging and interactive are the tools available for learning on computers, such as e-books.

According to the Citrix 2020 Technology Environment Study (2015), IoT technology will change the learning experience in numerous ways in the next five years. The experience of learning will continue to become more virtual, learners will consume new forms of information and learning, and classrooms will be better prepared to learn. Learning will gradually become an unforgettable experience for teachers and learners with accelerating awareness while taking new ideas and solutions around the world. Students are often trained for the future of jobs and future career aspirations.

4.6.3 A Learning Management System Enhanced with Internet of Things

With the use of Learning Management Systems (LMS) as a method for designing, distributing, monitoring, and handling different forms of educational and training content, a revolution in the advancement of online learning happened. Since the first LMS was released, significant technical advances have turned this tool into a powerful curriculum management application, offering rich-content courseware, assessment and evaluation, and dynamic collaboration.

Learning Management Systems (LMS) are an emerging technology in today's society, offering online learning materials with course development, distribution, management, monitoring, reporting, and evaluation. It is a centralised software application that integrates pedagogical features with the emerging technology of virtual learning environments. In this way, learners can access resources, upload assignments, take tests, and share data with peers and instructors using personal devices such as mobile phones and tablets, thus creating a dynamic learning environment. The learning process is automated by LMS software by registering users, monitoring classes, documenting learner data and handling reports.

Note that to read more about this section, i.e., AI scope in near future or future with emerging technologies, readers are suggested to read our work [18-20]. In near future, Intelligent Automation platforms end user's typical activities and interfacing them in an end-to-end process, utilizing artificial intelligence. Automation together with artificial intelligence makes another sort of workforce that drives digital transformation and widens business opportunities. In last, readers are suggested to find important information from work [16,17] related to Computer vision, Artificial intelligence (machine learning and deep learning).

5. Related Work

Note that Intelligent Automation (IA) systems can be deployed in almost every industrial part. They process immense measures of data as well as analyze information, spot irregularities, check for correctness, learn during the time spent working, adjust to changes and take decisions. Despite the fact that the final confirmation still relies upon a human operator, a significant part of the work is done by the intelligent automation software, resulting in time-saving. Advanced strategies and an incredible computing capacity to make another age of hardware and programming robots that perform both cognitive and physical tasks. Numerous intelligent automation examples can be found in different fields.
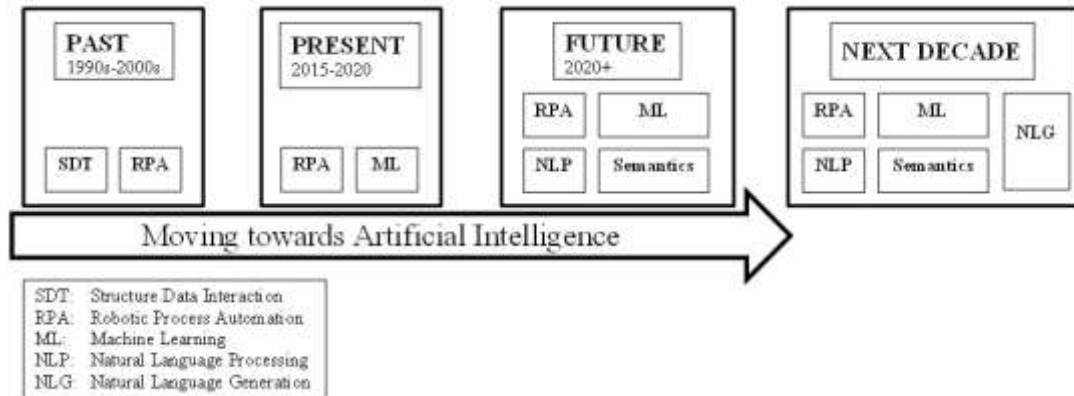

Figure 2: A Comparison of Learning Techniques in Past, Present and Future Decade

Figure 2 discusses about several learning techniques available in the past decade and in present and in the next decade. We can easily find that Machine Learning (ML) is a common learning technique in all era. Connected-RPA adoption should be driven not simply by the promise of more prominent cost savings and operational efficiencies however by other criteria as well. Key drivers incorporate value creation, efficiency increments, improving the customer experience, producing inventive opportunities and increasing more value from staff. Other remarkable results incorporate accomplishing more excellent operations, more noteworthy operational agility and progressively significant information for customer insights.

While connected RPA is profiting associations over all sectors, those that work in industries requiring severe administrative or compliance necessities are additionally utilizing the innovation to improve risk reduction. Different parts, where an organisation's core business activities have critical manual-driven procedures, are executing it as well. Note that the intelligent automation race is well in progress in numerous organizations today. Intelligent Automation (IA) is as yet an infant in the realm of innovations, however, it learns and grows quickly, turning into a significant player in the market. Intelligent automation patterns are in the spotlight, catching the attention of CEOs, designers and experts around the globe.

6. Conclusion

Intelligent Automation (IA) is a concept that describes a comprehensive digital transformation approach focused primarily on process management (BPM) for users / industries / systems and robots (RPA) depending on (at any time) business requirements. Born as a concept linked to digital transformation, but with the benefit of being better described, intelligent automation proposes a real solution by integrating four technology branches: BPM, RPA, Artificial Intelligence and Integration. IA involves the use of analytics and AI (especially machine learning) to make automated and smart decisions, and case management to provide adequate flexibility for processes to succeed in end-to - end case management. Finally, it is worth noting that the convergence between the various systems used in the business is another main aspect of this trend. Integration would prevent data from being duplicated in the applications and users will only have to operate on one platform.

Scope of the work

This work is compiled by many research articles (published in recent decade), also includes personal thoughts of author also. In near future, researchers can read this article and find problem for their interest.

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