

Machine Learning for Smart Production

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Abstract

The industrial sector values innovations and adaptation greatly. This progress ought to result in the use of new technologies for sustainable manufacturing. Smart manufacturing calls for a global perspective on the technology being used in order to be environmentally friendly. In this context, Thanks to the continuous research in the field of artificial intelligence, AI-based approaches, such as machine learning, are currently established in the industry to achieve sustainable production (AI). As a result, the current study's goal was to thoroughly analyse the number of studies on applying machine learning (ML) and artificial intelligence (AI) in industry. With the introduction of Industry 4.0, machine learning and artificial intelligence have been lauded as the transformative forces underpinning the smart factory. Designing human-centric, safe, and trusted systems has never been more difficult due to the integration of AI-enabled solutions in manufacturing. Humans will still be required to continue playing a crucial part in the design, operation, and control of AI-assisted production system as opposed to developing a system with as little human input as possible. However, there has been relatively little discussion on the demands of human-centred designs in an AI environment up until now. A human-centric design methodology was developed and tested through co-creation workshops targeting industrial use cases of AI deployment in manufacturing in order to ease the consideration of human skills, capabilities, and human factors.

Keywords :- Artificial intelligence, Machine learning, manufacturing, production, data, deep learning, computer vision, future, technology, supply, machines, future, developments, needs

I. INTRODUCTION

One of the most significant developments in modern human history is the development of artificial intelligence (AI). Our global environment has long come to be most significantly shaped by human activity. In the two millennia after the introduction of technology and the first industrial revolution it spurred, progress has accelerated considerably. A new revolution is about to begin, and it is being sparked by the revolutionary potential of contemporary technology. Upcoming developments in technologies like genetic engineering, virtual reality, robotics, and 3D printing will radically alter our way of life. They outpace previous technologies in terms of their power and speed of development. Our living conditions have significantly improved during the previous few hundred years as a result of technology and ingenuity. Technology is undoubtedly one of the causes of a variety of our issues, but it is also obvious that technical advancement and development will be essential to achieving a sustainable future.

In the middle of the 1940s, Turing had already identified and debated the potential of machine or artificial intelligence. Tegmark, an AI researcher and technology enthusiast, discusses the potential of AI in his 2017 article. Tegmark is certain that automation may increase global prosperity without depriving people of work or meaning in their lives. Tegmark also contends that when AI is used in this way, mankind need not worry about an arms race.

II. APPLICATIONS OF MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE IN MANUFACTURING AND SMART PRODUCTION :INDUSTRY SECTOR

The combination of data analytics and AI technology can increase productivity, and product quality, and can improve production-process safety. Thus, one of the primary forces pushing the manufacturing industry forward the growth of practical AI and Machine Learning in These four categories, which are constantly going digital,

A. Quality Inspection of fullymanufactured products

Modern manufacturing techniques have increased levels of automation and it necessitates automating material quality testing, which requires less human involvement. The goal of automated quality inspection is to obtain accuracy levels higher than those of humans. Modern

industrial firms work to attain both quantity and quality through automation without sacrificing either in order to stay competitive. Quality inspectors at manufacturing companies often evaluate the quality of products after they are made to fulfill industry requirements. This is a labour-intensive manual operation, and rejecting the result wastes the capacity, consumables, manpower, and prices of the upstream firm. Industrial businesses are attempting to automate material quality inspection using deep learning-based computer vision technologies in the production cycle itself in response to the recent artificial intelligence trend. The objective is to attain accuracy at or above human levels while limiting human B Preventive Maintenance

In order to stop equipment from degrading from normal wear and tear and to identify early warning signs of failure, preventive maintenance schedules are made to inspect and maintain it on a regular basis. Machines can boost worker safety, improve product quality, and decrease downtime by utilizing preventive maintenance rather than reactive maintenance. The capacity to foresee when a mechanical element would need to be replaced is one of the primary reasons preventative maintenance could be beneficial. Combining machine learning with historical data results in an algorithm that recognises potential issues as they arise, enabling organizational professionals to take the necessary action to resolve issues that could impede or even stop development. Statistical decision-making techniques have been utilized for a while in both proactive and predictive maintenance. When there are a lot of variables, machine learning techniques like neural networks can be used for categorization. Angius et al. (2016), however, have shown that

the policies in such systems can only be ineffectively implemented and have sporadic effects on the completion and delivery dates of customer orders. Therefore, before choosing them, it is important to take into account not only the state of the machines but also how these system policies will affect the level of service provided by the system.

B. Preventive Forecasting

Businesses must be always on the lookout for even the smallest shifts in market behavior that may portend significant future differences in demand in order to remain

C. Real Time Monitoring

One of its most advantageous uses of AI in production is real-time monitoring, which offers a higher level of accuracy. An explanation of the bottleneck's causes, its place in the production process, and any efficiency issues. Firms can swiftly address problems and save time and money by being able to determine the exact procedure that needs to be modified. The benefits outlined in Kumar et al (2018) 's paper show how cloud manufacturing could lead to higher resource efficiency if it uses a real-time monitoring technique that takes the status of the system into consideration. by monitoring sensor data, condition-based real-time surveillance can be used to decrease system downtime. Then, this information can be used once more by protocols for machine-to-machine communication and cloud services. Furthermore, this concept Additionally, this concept can help small and medium-sized enterprises (SMEs) that are members of the network because they stand to gain from this collaboration and provide reasonably priced production services with quick turnaround times. In relation to real-time monitoring systems, the following points are crucial: -

- The Smart Connected Worker's real-time monitoring system, which will increase energy efficiency.
- Object detection for automating behaviour control and machine status monitoring.
- Text recognition and finger detection for controlling human-machine interaction.
- Machine learning for predicting power use and energy disaggregation.
- Graphical user interface for data visualization and analysis on the web.

Here are some ways in which machine learning can help in Supply chain management: -

3. Real-time visibility can boost customer satisfaction:- Visibility was recognised as a persistent issue facing the supply chain businesses in a Statista survey. For a supply chain organization to be successful, visibility and tracking are essential, hence new technology is



constantly being sought after to ensure increased visibility. A few examples of machine learning techniques that can be used to dramatically improve supply chain visibility include deep analytics, IoT, and real-time monitoring. This will enable businesses to change the customer experience and achieve delivery deadlines more quickly. Machine learning models and workflows accomplish this by analyzing historical data from numerous sources and then determining connections between the operations along the supplier value chain. Amazon is a great illustration of this, as it uses machine learning methods to provide its users with fantastic customer service. This is accomplished by ML, which gives the business insights into the relationship between product recommendations and subsequent customer website visits. real-time analysis of the findings to uncover anomalies or divergence from expected patterns. Additionally, machine learning algorithms can prohibit privileged credential abuse, which is one of the major causes of breaches throughout the global supply chain..

D. Purchasing

The purchasing departments of businesses produce enormous amounts of data, but regrettably, the vast potential inherent in data volumes of this size is sometimes not completely realized. This data is frequently not adequately evaluated and processed, whether for lack of resources or knowledge. Additionally, shopping areas are still growing. Markets are growing in size, complexity, and level of competition. Here is where ML and AI are useful. Neural networks can be used to improve procedures that have been in use for a long time in decision-making in general. The so-called decision tree is one of the main tools used in supervised learning. Issue trees attempt to identify the optimal answer for each decision by considering as many potential outcomes as they can. Process automation and optimization is one of the most popular ways to implement AI in purchasing departments. Similar methods employed in supply chain management can be utilized to make these improvements. The number of markets has also grown as a result of globalization. It is challenging for people to maintain an overview due to the wide variety of products. This is where neural networks, which categorize the offers based on specific qualities, can be utilized once more to either completely automate or greatly simplify the purchasing choice. Through the use of this application, businesses could get a sizable advantage over rivals that do not employ such techniques.

E. Others

Machine intelligence on the cloud is enabling manufacturers to streamline interaction among their numerous branches. Information gathered from one production line can be understood and sent to other branches to automate material provision, maintenance, as well as tasks that were formerly done manually, manufacturing with AI is gaining more and more adoption, and for good cause. According to McKinsey, that by 2025, "smart manufacturing" would generate \$37 trillion in new value (Puittinen, 2018). AI makes it easier to overcome the internal obstacles that have existed in the Industry: problems ranging from a lack of competence to complex decision-making information overload and integration. using AI in industrial facilities Robots have the ability to operate a production line continuously. Businesses are expanding their production capacities to keep up with the rising demand from clients throughout the world. Less labor-intensive and hazardous work will be done by humans as we move closer to AI. There will be a global decline in workplace accidents when humans are replaced by robots in routine and dangerous tasks. Despite the large capital expenditure required to implement AI in the industrial sector, organizations stand to benefit from drastically reduced operating costs. Allows organizations to drastically alter their processes.

III. APPLICATIONS OF MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE IN MANUFACTURING AND SMART PRODUCTION :ENERGY SECTOR

The energy industry is very excited about the installation of intelligent networks that connect producers, consumers, and storage and provide energy just in time when needed. Energy consumption peaks can be predicted using artificial intelligence (AI), and AI can also help with real-time operation setting optimization..



An output that is resource- and energy-efficient is a crucial key performance measure for industrial firms to function economically and so sustain competitiveness.

In order to perform analysis, evaluation, diagnosis, and planning, software systems are needed. As a result of considerable research efforts in the field of AI, many AI- based technologies, such as machine learning, deep learning, and artificial neural networks (ANN), have already left their mark on business, commerce, and society. Willenbacher et al. focused on the subject of resource and energy efficiency (2018). They provide a strategy for improving resource and energy efficiency through the use of AI. To support ecological sustainability, a detailed database of statistics was constructed.

IV. SOCIAL EFFECTS

What effects AI will have on society today and in the future are not yet apparent. There is a big influence, with both good and bad outcomes, and the future sustainable growth of AI in society will depend greatly on value, collaboration, sharing responsibilities, and ethics. Academic research and books have looked at a variety of topics, including how intelligent robots can change labour markets, alter social interaction, and even pose a threat to human survival.

The management of energy and the environment will likely be impacted by the development of computing and artificial intelligence, along with healthcare, education, cybersecurity, and privacy. It will entail a change in the educational system's emphasis from arithmetic and reading to a different set of social and intellectual abilities that make working easier. The study of digital ethics, which aims to create rules to ensure that autonomous creatures abide by our moral and ethical norms, raises additional issues.

As corporations and intelligence agencies increasingly view data as the most valuable resource for creating more effective algorithms, protecting people's privacy will become ever more crucial. To avoid deepening the global divide and giving a very small number of nations and organizations an unfair edge, it is essential to promote widespread AI education and accessible.

Population is increasing in some countries while decreasing in others, the middle class is expanding, consumer markets are moving from the west to the east, population that is ageing and fewer individuals are entering the manufacturing industry Three significant societal trends for 2019 are:

1) The worth of personal information is rising. People have a right against being forced to disclose. They are entitled to their privacy. We can choose to renounce that right either collectively or individually, as we do with many other rights. More people adopt technology that secure their personal data and appreciate their right against being forced to provide information. The reevaluation of the value of their own data is a factor in the move toward encryption and ad blocking. By combining it with other data sources, more businesses are able to increase the value of the personal data they obtain. Your CV, for instance, is valuable on its own.

The ability of information technology (IT) to produce fresh data, particularly from sensors integrated into wearable and linked devices. Because it is more valuable to the individuals who own it and to the businesses who rent the right to use it, the value of personal data is rising.

2) There is a rising demand for equity. An approach for ensuring that everyone has an equal chance to succeed is called equity. It should not be confused with equality, a tactic employed to ensure fair results. Recommendation engines are under the umbrella of this movement. Inherent societal biases can occasionally be seen in the data that society generates. Due to this, there is now more interest in machine learning's fairness, accountability, and transparency. A growing regulatory and learning requirement for the explicability of the conclusions reached by a recommendation engine.

3) There is an increasing sense of division. There are many reasons why people are more divided. Despite improvements in wealth and communication, it also appears that our political



and economic systems are growing more polarizing. The major socioeconomic dynamics are driving the creation of new legislation. State rules that govern the gathering, processing, and usage of data differ greatly. Under GDPR, for instance, information concerning racial or ethnic origin, health, sexual orientation, and political, philosophical, or religious opinions is not permitted. One tactic to lessen the negative effects in the sustainability dimension and allow society to benefit from AI is to align the values of all stakeholders during the design process of AI-enabled apps.

A. Impact on Jobs

Manufacturers will experience difficulties as the talent pool shrinks. There will be sufficient qualified workers to fill future employment openings. Given that higher percentages of the population in their more developed counterparts hold postsecondary degrees, the available pool of workers is likely to come from developing nations.

Employers will continue to face difficulties as a result of an increasingly mobile workforce, which could result in a worldwide talent war. They have significantly different requirements and wants than the generation before (Hall, 2017).

Humans will be replaced by the current and upcoming wave of artificial intelligence faster than we can adapt through the development of new abilities and education. The race will be won by the robots. On the other side, some people want to emphasize how the adoption of new technology typically results in an increase in employment overall as the economy adjusts and demand is generated in new industries. More than

1.3 million industrial robots have been working in companies throughout the world since the end of 2018. Theoretically, workers will receive training for more specialized positions in design, maintenance, and programming as more and more jobs are replaced by robots. As more industrial robots enter the production floor alongside human workers, human-robot collaboration will need to be effective and secure during this transitional phase. Up to 800 million jobs will be obsolete due to automation by 2030. Even if sectors are disrupted and replaced by new ones, overall employment is constant. Assume that the human need for new things (i.e., products or services) is virtually limitless. Technological innovation is driven by consumer demand for new goods.

More technology creates even more new opportunities for goods and services, opening up previously unimagined employment opportunities for workers. The process of labour absorbing would be disrupted by expansion driven by intelligent machines that generate like skilled workers but do not consume.

Workers will be able to concentrate on challenging and creative activities as AI takes over the manufacturing facility and automates mundane and uninteresting human labour. Automation does replace human labour, but it also enhances it and increases productivity in ways that increase demand for labor. The decline in the cost of performing ordinary activities using computers, which complements more abstract and creative services, can be attributed to the growth in high-skill employment. AI is more likely to change your work in manufacturing than to remove it (Fig. 3). If workers are competing against technology, how long will education continue to give them an advantage? Jobs that need a significant amount of decision-making, creativity, and persuasion tasks—tasks that are difficult to quantify and codify—are less suited for automation. Jobs requiring adaptability, visual and linguistic recognition, and face-to-face communication are also not able to automation. Automation alters the sorts of jobs available, leading to major job displacement in some industries, job growth that benefits high- and low-skilled employees differentially, and the disappearance of ordinary middle-class occupations. Automation will continue to pull low-skilled workers' pay lower and is already having an impact on their employment prospects. The potential benefits of hiring highly trained and adaptive individuals are rising, in contrast.

Computerization has benefited managerial, professional, and technical occupations because it has complemented the work of those doing abstract tasks by requiring less time for research,



calculation, and acquisition and greater focus on application and interpretation (Author, 2015). Due to the complementarity of information technology with these jobs, the rise in demand for their services, and the relatively small pool of available workers, workers in these abstract-intensive occupations have seen increases in pay.

The same has not held true for people in occupations that require a lot of manual labour, are only marginally enhanced by computerization, do not profit from growing demand, and have a sizable labour pool. Globalization and trade agreements have an impact on job dynamics as well. Because labour is not as mobile as capital, trade conditions can have a negative impact on employment in tradeable sectors. The following factors influence the possibility that a job will eventually be automated: The possibility that a profession will be automated in the future depends on several factors, including the job's characteristics, such as whether it requires creativity or persuasion, the capabilities of technology, or how well robots can imitate human intelligence, and social and cultural standards.

Both the future of automation and society's willingness to direct and influence its acceptance are difficult to forecast. Strengthening social protection systems, implementing education policies that foster the skills needed for a flexible work force, policies that promote shifting the labour force from low to higher skilled jobs, with enhanced retraining and safety nets for workers affected by trade agreements, and policies that promote flexible work arrangements are some of the issues that policymakers should take into account. investment in R&D, encouraging creativity in affluent nations, and encouraging imitation in developing nations. Operations research (OR) positions would increase

V. AI UNDER A SUSTAINABILITY ANALYSIS PERSPECTIVE

Utilizing AI entails both opportunities and hazards for detrimental sustainability effects. The following is a definition of each of the sustainability dimensions. The individual dimension includes human fulfilment, human dignity, and individual freedom and agency (the capacity to act in a given context).

The social dimension deals with interpersonal relationships (trust, communication, and maintaining a balance between divergent interests). The economic dimension deals with monetary issues and business value (capital growth and liquidity, investment concerns, and financial operations). The technical dimension deals with the capacity to sustain and develop artificial systems over time. The usage and management of natural resources are included in the environmental dimension (waste production, energy consumption, balance of local ecosystems, climate changes).

A. *Economical Dimension*

Large technological businesses and the governments of developed nations are both investing in the application of AI to gain a competitive edge. Such investments provide industrialized economies a national economic advantage, but they can have detrimental effects on the globalization of manufacturing and services. AI's skills will bring services in-house and minimize or cease outsourcing in the rising industry. These will have a negative impact on emerging economies' small companies and labour markets, increasing unemployment and lowering people's purchasing power. The global economy will eventually be impacted by this. Low-skilled labour may be replaced by AI, an industry that is currently very large.

B. *Technical Dimension*

Models made out of numerous processing layers can use deep learning to learn several levels of abstraction for data formats. This will result in AI development that can code AI (Simonite, 2018) is making jobs less secure in the IT sector. Positive effects include more capable systems being created that is capable of taking over increasingly difficult jobs. Regarding the detrimental effects, we can see how improved engineering ethics are becoming an increasingly important issue. The system engineers who work on developing the

systems are given duties. ahead and must therefore anticipate both desired and undesirable usage scenarios.

C. Environmental Dimension

Artificial intelligence (AI) could be helpful in assisting us in supporting Predictive systems can be utilized for waste and pollution management as well. To better understand the likelihood of extreme events, use earthquakes and weather forecasting occurrences. One potential turning point for autonomous vehicle adoption cutting back on fuel use to reduce greenhouse gas emissions

The environmental dimension, in particular, can be negatively impacted by AI because it aids in further accelerating the process and consumes instruments of technology. More technological products are being produced and consumed, planned obsolescence and the depletion of resources are two negative effects that devices organic materials

D. Individual Dimension

Over the past 50 years, our productivity has increased steadily (Lightman, 2018). However, people are working more than ever before because of increased job demands and inflation. A person who works longer hours is far more likely to judge their own health poorly, which can have negative effects on their mental and emotional health.

Robots, chatbots, analytical tools, and digital assistants driven by AI may enable people to work less hours, more efficiently, more healthfully, and with fewer accidents at work. The person will interface with machines more frequently. As a result, our interactions with other people will be less meaningful and we will become more socially isolated and constrained by our ability to express our feelings in digital form. Further concerns arise around how much privacy people actually have in the age of AI when data is collected knowingly or inadvertently.

E. Social Dimension

AI can play a tiny part in supporting social media management, automating routine jobs that are typically outsourced, and assisting in local communities. The potential to enhance communities is present, but there is also a need to create legal frameworks around AI. All of these advantages and disadvantages are accompanied with the risk of giving AI too much power. An AI system's incorrect interpretation of a real-world event could result in deadly disputes. Resources such as time, energy, money, and the great transformations are all scarce in our planet. Nations and organizations strive to design AI-enabled systems in this setting in order to increase their power and influence.

VI. PROS OF ARTIFICIAL INTELLIGENCE IN MANUFACTURING INDUSTRY

A. Using predictive analytics to boost output

Businesses may quickly implement a predict-and-fix maintenance strategy thanks to a predictive setup. AI identifies anomalies more quickly and recommends tools and methods to fix the issue. This aids manufacturers with production scheduling, which lowers downtime and boosts output. An AI predictive maintenance model, according to a McKinsey report, can boost productivity by 20% and cut maintenance expenses by 10%. When a machine component or system malfunctions, production can avoid a sudden stop because one can fix the issue before it happens by being aware of downtime beforehand. By using AI, the costs associated with shutting down machinery can be avoided. Data from the manufacturing industry is plentiful. AI algorithms can evaluate any issue in machines and equipments.

B. Using predictive analytics to boost output

AI enables better quality. It's challenging for manufacturing organizations to uphold strict quality standards and regulations while still maintaining high levels of quality. Increased production without attention to quality can result in flaws that not only cost a firm money but also adversely harm its reputation. The greatest quality is maintained throughout the manufacturing process thanks to AI.



Workers can be alerted by AI algorithms to manufacturing flaws that may later result in poor quality. Manufacturers can maintain quality standards by addressing these problems. A more inventive production method and improved product quality are made possible by AI. Additionally, it boosts productivity and decreases process downtime. Tracking sensors, for instance, could be used in logistics and hauling to monitor location, take stock etc.

C. Ever-changing market adaptability

AI plays a vital role in manufacturing's other important areas outside of production. These include client behaviour, change patterns, supply networks, monitoring, and the possibility of market changes. All of this results in better production and other cost management processes being strategically planned. Manufacturers can also access market demands using AI algorithms. Because AI makes use of data from customer behaviour, raw material inventories, and other production processes, these estimates are accurate.

D. AI can enhance production designs

The way products are created and designed is being redefined by AI. For instance, including the AI algorithm into the process is one strategy used by designers and engineers. The summary information would include things like limitations and guidelines for the kinds of materials that can be used, production techniques that can be used, time constraints, and financial restraints. The information can be processed using an AI system to match a list of potential product selections. The best option is then put to the test in a manufacturing environment. The generative design distinguishes out from the competition since it eliminates human bias in the design possibilities and then suggests better performance requirements.

VII. CONS OF ARTIFICIAL INTELLIGENCE IN MANUFACTURING INDUSTRY

A. AI is expensive

Although integrating AI in the industrial sector can lower labour costs, doing so can be rather expensive, especially in small- and medium-sized firms. Initial costs will cover ongoing upkeep as well as costs to protect systems from assault because preserving cyber is extremely essential.

B. You need skill full experts

Since Machine learning is a field that is still in its early stages of development, few AI specialists have the requisite skills. Given the frequent need for technical development, it is imperative to consider the availability of experts. Furthermore, due to their growing market and expensive employment,

C. AI is open to vulnerabilities

As AI becomes more sophisticated and pervasive and is vulnerable to cyber attacks, cybercriminals will attempt to create new hacking techniques. Even a small gap can cause the production line to be interrupted. Even a little breach, in fact, may result in the liquidation of an individual manufacturing operation. As a result, it's critical to keep up with security developments and to be aware of the potential for expensive assaults.

VIII. FUTURE OF ARTIFICIAL INTELLIGENCE IN MANUFACTURING INDUSTRY

Artificial intelligence is transforming and reinventing the manufacturing industry as part of Industrial Revolution 4.0. (AI). The expansion of the manufacturing sector has benefited greatly from AI. With the help of this article, you may investigate how artificial intelligence will affect Industry4.0.

Businesses already use it to improve safety, streamline processes, give manual workers more opportunities to use their skills elsewhere, and ultimately raise profits.

In addition to the present advantages of AI in manufacturing, which include cheaper prices and saved time, businesses will be able to identify problems before they arise, improve their product assembly line, and use computer vision-based strategies to help grow their business.

AI may considerably assist in ensuring the viability of your manufacturing company even in the face of continual transformation. It provides predictive analytics to help manufacturers make wiser decisions. The benefits of artificial intelligence are numerous, ranging from



customer management to product design. Improved process quality, a more efficient supply chain, adaptability, etc. are a few of them. But there are a number of issues with AI technology. Costly as well as vulnerable to cyberattacks. But these disadvantages are outweighed by AI's advantages.

Overall, AI will alter how manufacturing is done. Manufacturing companies can make better judgments thanks to predictive analyses. There are many benefits of artificial intelligence, from product design to customer management. All of this helps to improve supply chain efficiency, process quality, adaptability, and other factors. However, there are also disadvantages to using AI technology, including high costs and vulnerability to cyberattacks. Since everything has benefits and drawbacks, even AI, which is a valuable resource, has some advantages and drawbacks. The advantages of AI, however, outweigh the disadvantages. AI is being used by many businesses to improve the manufacturing industry.

IX. CONCLUSION

Manufacturers must react rapidly to shifting consumer needs in today's global markets and seize fresh business opportunities. All signs point to a substantial period of convergence in which information technology, operational technology, and global megatrends are en route to colliding. This will lead to changes in how we conduct business and relate to clients and suppliers. Students today should closely monitor developments in AI. Focusing on acquiring general abilities that are very flexible, such mathematical modelling, statistics, and science, would be in their best interests. They will be ready to utilize increasingly potent AI tools if they do this. AI will have an impact in a variety of situations. . The key to ensuring that AI contributes to a wiser, more sustainable.

REFERENCES

- [1] A. K. Sharma, A. Nandal, A. Dhaka and Rahul Dixit, "A survey on machine learning based brain retrieval algorithms in medical image analysis," *Health and Technology*, vol. 10, pp. 1359–1373, August 6, 2020.
- [2] K. Gautam, V. K. Jain, S. S. Verma, "Identifying the Suspect nodes in Vehicular Communication (VANET) Using Machine Learning Approach", *Test Engineering & Management*, vol. 83, no. 9, pp 23554-23561, March-April 2020.
- [3] A.K. Sharma et al., "HOG transformation based feature extraction framework in modified Resnet50 model for brain tumor detection," *Biomedical Signal Processing and Control*, vol84, 2023.
- [4] Gautam, K., Jain, V.K., Verma, S.S., Vyas,S. (2023). Vehicular Communication Strategy Using Machine Learning and Image Processing to Enhance Observations and Control on the Road Side Area. In: Gunjan, V.K., Zurada, J.M. (eds) *Proceedings of 3rd International Conference on Recent Trends in Machine Learning, IoT, Smart Cities and Applications. Lecture Notes in Networks and Systems*, vol 540. Springer, Singapore. https://doi.org/10.1007/978-981-19-6088-8_34
- [5] A. K. Dubey, A. Kumar, V. García-Díaz, A. K. Sharma and K. Kanhaiya, "Study and analysis of SARIMA and LSTM in forecasting time series data," *Sustainable Energy Technologies and Assessments*, vol. 47, 2021.
- [6] K.Gautam , V.K.Jain, S..Verma, "A Survey on Neural Network for Vehicular Communication", *Mody University International Journal of Computing and Engineering Research*, vol. 3, no. 2, pp. 59-63, 2019.
- [7] K. Kanhaiya, R. Gupta and A. K. Sharma, "Cracked cricket pitch analysis (CCPA) using image processing and machine learning," *Global Journal on Application of Data Science and Internet of Things*, vol. 3, no. 1, pp. 11-23, 2019.
- [8] K. Gautam, S. S. Verma and V. K. Jain, "Enhancement in the Reliability of Vehicular Communication System for Road Side Area," *2022 International Mobile and Embedded Technology Conference (MECON)*, 2022, pp. 639-644, doi: 10.1109/MECON53876.2022.9752226



- [9] S. Sharma , A. K. Sharma, “An adaptive approach for Decomposition of Space Variant Blur and It’s Restoration using Blind Deconvolution,” International Journal for research & Development in Technology, vol. 7, no. 4, pp. 492-496, April 2017.
- [10] K. Agarwal, G. K. Soni, and K. Gautam , “Flipped Voltage Follower Based Operational Transconductance Amplifier For High Frequency Application” International Journal of Advanced Science and Technology, vol. 29, no. 9, pp. 8104- 8111, 2020.
- [11] Sharma, A.K.; Nandal, A.; Dhaka, A.; Koundal, D.; Bogatinoska, D.C.; Alyami, H. Enhanced Watershed Segmentation Algorithm-Based Modified ResNet50 Model for Brain Tumor Detection. *BioMed Res. Int.* 2022.
- [12] K. Gautam, S.S. Verma, “A Review on Vehicular Communication System”, A Journal of Composition Theory, vol. 12, no. 9, pp. 2037-2044, 2019.
- [13] V., S. Sancheti, A. Dhaka, A. Nandal, H. G. Rosales, D. Koundal, F. E. L. Monteagudo, C. E. G. Tajada, A. K. Sharma. “ Lambertian Luminous Intensity Radiation Pattern Analysis in OLOS Indoor Propagation for Better Connectivity” *Wireless Communications and Mobile Computing*. 2022.
- [14] K. Gautam, S.S. Verma, “ A Latest Development and Opportunity in VANET”, Mody University International Journal of Computing and Engineering Research, vol 2, no. 1, pp. 45-48, 2018.
- [15] A.K.Sharma , S.Jain , C. Goyal , “A Review on Object Detection With Deep Learning” Mody University International Journal of Computing and Engineering Research, Vol 3, No 2. Pages:90-97, 2019.
- [16] S. Pathak, S. Tiwari, K. Gautam, J. Joshi. “ A Review on Democratization of Machine Learning In Cloud”, International Journal of Engineering Research and Generic Science, vol. 4, no. 6, pp. 62-67, 2018.
- [17] N. Bhargava, A. K. Sharma, A. Kumar and P. S. Rathore, "An adaptive method for edge preserving denoising," In 2017 2nd International Conference on Communication and Electronics Systems (ICCES), 2017, pp. 600-604.
- [18] K. Gautam, V. Sharma, R. Mishra, “Drone 2 Drone Communication: A Review”, International Journal on Future Revolution in Computer Science & Communication Engineering, vol. 4, no. 1, pp. 150-153, 2018.
- [19] A.K. Sharma, A. Nandal, L. Zhou, A. Dhaka, T. Wu. “Brain Tumor Classification Using Modified VGG Model-Based Transfer Learning Approach” vol. 337, pp. 538 – 550, 2021.
- [20] A. K. Sharma, K. Kanhaiya and J. Talwar, “Effectiveness of Swarm Intelligence for Handling Fault-Tolerant Routing Problem in IoT,” in *Swarm Intelligence Optimization: Algorithms and Applications*, A. Kumar, P. S. Rathore, V. G. Diaz and R. Agrawal, Eds. Wiley Online Library: John Wiley & Sons Inc., Dec. 2020, pp- 325-341.
- [21] A. K. Sharma, A. Nandal, A. Dhaka and R. Dixit, "Medical Image Classification Techniques and Analysis Using Deep Learning Networks: A Review," in *Health Informatics: A Computational Perspective in Healthcare*, R. Patgiri, A. Biswas and P. Roy, Eds. Singapore: Springer, January 31, 2021, vol. 932, pp. 233- 258.