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Impact of AI in Manufacturing Industries

Sreelekha Panda

[1]*Assistant Professor, Department of Electronics & Communication Engineering, REC, Bhubaneswar, Odisha, India*

Abstract:- *Artificial intelligence is based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering. AI is the key to future. The purpose of AI is simply smoothen one's life. The problems that we are facing in present and upcoming future could get solved through AI. There are several reasons for the recent popularity of industrial AI. More affordable sensors and the automated process of data acquisition; More powerful computation capability of computers to perform more complex tasks at a faster speed with lower cost, Faster connectivity infrastructure and more accessible cloud services for data management and computing power outsourcing. This paper is a study on impacts challenges of AI in manufacturing industries.*

***Keywords*:-** AIML, IPL, POP-11, Prolog, STRIPS, Wolfram Language, Haskell.

1. INTRODUCTION

AI is a brain that is created by humans. The brain that acts independently. It comprises of Logic, Knowledge, conscious, emotions, Creativity, natural language processing [1] (communication), Learning, Planning, Sensors that connects its brain to physical environment to interact with Humans, etc

Artificial intelligence (AI) is no longer just a field for academic researchers; machine learning and deep learning are becoming mainstream technologies that any organization can harness. This could have dramatic implications for many industries, including manufacturing. The impact of AI on manufacturing is likely to usher in a whole new era of industrial development. The first three industrial revolutions were triggered by the introduction of mechanical, electrical and digital technologies, respectively. Developing AI's cognition is simply a process similar to raising a new born child. But there is a difference as this conscious doesn't have a physical structure. The physical structure could be a Data server lab or simply a robot that have similar brain structure as of humans.

There's also no question that artificial intelligence holds the key to future growth and success in manufacturing. In a recent survey on artificial intelligence, 44% of respondents from the automotive and manufacturing sectors classified AI as "highly important" to the manufacturing function in the next five years, while almost half—49%—said it was "absolutely critical to success."

There's no doubt that the manufacturing sector is leading the way in the application of artificial intelligence technology. From significant cuts in unplanned downtime to better designed products, manufacturers are applying AI-powered analytics to data to improve efficiency, product quality and the safety of employees.

Here we look at key revolutions AI brings to the manufacturing industry.

2. SMART MAINTANANCE

In manufacturing, ongoing maintenance of production line machinery and equipment represents a major expense, having a crucial impact on the bottom line of any asset-reliant production operation. Moreover, studies show that unplanned downtime costs manufacturers an estimated $50 billion annually, and that asset failure is the cause of 42 percent of this unplanned downtime.

For this reason, predictive maintenance has become a must-have solution for manufacturers who have much to gain from being able to predict the next failure of a part, machine or system.

Predictive maintenance uses advanced AI algorithms in the form of machine learning and artificial neural networks to formulate predictions regarding asset malfunction .This allows for drastic reductions in costly unplanned downtime, as well as for extending the Remaining Useful Life (RUL) of production machines and equipment .In cases where maintenance is unavoidable, technicians are briefed ahead of time on which components need inspection and which tools and methods to use, resulting in very focused repairs that are scheduled in advance.

3. THE RISE OF QUALITY 4.0

Due to today's very short time-to-market deadlines and a rise in the complexity of products, manufacturing companies are finding it increasingly harder to maintain high levels of quality and to comply with quality regulations and standards .On the other hand, customers have come to expect faultless products, pushing manufacturers to up their quality game while understanding the damage that high defect rates and product recalls can do to a company and its brand .Quality 4.0 involves the use of AI algorithms to notify manufacturing teams of emerging production faults that are likely to cause product quality issues. Faults can include deviations from recipes, subtle abnormalities in machine behavior, change in raw materials, and more.

By tending to these issues early on, a high level of quality can be maintained additionally, Quality 4.0 enables manufacturers to collect data about the use and performance of their products in the field. This information can be powerful to product development teams in making both strategic and tactical engineering decisions.

4. HUMAN-ROBOT COLLABORATION

The International Federation of Robotics predicts that by the end of 2018 there will be more than 1.3 million industrial robots at work in factories all over the world. In theory, as more and more jobs are taken over by robots, workers will be trained for more advanced positions in design, maintenance, and programming.

In this interim phase, human-robot collaboration will have to be efficient and safe as more industrial robots enter the production floor alongside human workers. Advances in AI will be central to this development, enabling robots to handle more cognitive tasks and make autonomous decisions based on real-time environmental data, further optimizing processes.

5. MAKING BETTER PRODUCTS WITH GENERATIVE DESIGN

Artificial intelligence is also changing the way we design products. One method is to enter a detailed brief defined by designers and engineers as input into an AI algorithm (in this case referred to as "generative design software").

The brief can include data describing restrictions and various parameters such as material types, available production methods, budget limitations and time constraints. The algorithm explores every possible configuration, before homing in on a set of the best solutions .The proposed solutions can then be tested using machine learning, offering additional insight as to which designs work best. The process can be repeated until an optimal design solution is reached.

One of the major advantages of this approach is that an AI algorithm is completely objective – it doesn't default to what a human designer would regard as a "logical" starting point. No assumptions are taken at face value and everything is tested according to actual performance against a wide range of manufacturing scenarios and conditions.

6. ADAPTING TO AN EVER-CHANGING MARKET

Artificial intelligence is a core element of the Industry 4.0 revolution and is not limited to use cases from the production floor. AI algorithms can also be used to optimize manufacturing supply chains, helping companies anticipate market changes. This gives management a huge advantage, moving from a reactionary/response mindset, to a strategic one.AI algorithms formulate estimations of market demands by looking for patterns linking location, socioeconomic and macroeconomic factors, weather patterns, political status, consumer behavior and more.

This information is invaluable to manufacturers as it allows them to optimize staffing, inventory control, energy consumption and the supply of raw materials.

7. CHALLENGES

The challenges of industrial AI to unlock the value lies in the transformation of raw data to intelligent predictions for rapid decision-making. In general, there are four major challenges in realizing industrial AI.

i) **Data**: Engineering systems now generate a lot of data and modern industry is indeed a big data environment. However, industrial data usually is structured, but may be low-quality. The quality of the data may be poor, and unlike other consumer-faced applications, data from industrial systems usually have clear physical meanings, which makes it harder to compensate the quality with volume. Data collected for training machine learning models usually is lacking a comprehensive set of working conditions and health states/fault modes, which may cause false positives and false negatives in online implementation of AI systems. Industrial data patterns can be highly transient and interpreting them requires domain expertise, which can hardly be harnessed by merely mining numeric data.

ii) **Speed**: Production process happens fast and the equipment and work piece can be expensive, the AI applications need to be applied in real-time to be able to detect anomalies immediately to avoid waste and other consequences. Cloud-based solutions can be powerful and fast, but they still would not fit certain computation efficiency requirements. Edge computing may be a better choice in such scenario.

iii) **High fidelity requirement**: Unlike consumer-faced AI recommendations systems which have a high tolerance for false positives and negatives, even a very low rate of false positives or negatives rate may cost the total credibility of AI systems. Industrial AI applications are usually dealing with critical issues related to safety, reliability, and operations. Any failure in predictions could incur a negative economic and/or safety impact on the users and discourage them to rely on AI systems.[1]

iv) **Interpretability**: Besides prediction accuracy and performance fidelity, the industrial AI systems must also go beyond prediction results and give root cause analysis for anomalies. This requires that during development, data scientists need to work with domain experts and include domain know-how into the modeling process, and have the model adaptively learn and accumulate such insights as knowledge.

8. CONCLUSIONS

The manufacturing sector is a perfect fit for the application of artificial intelligence. Even though the Industry 4.0 revolution is still in its early stages, we're already witnessing significant benefits from AI. From the design process and production floor, to the supply chain and administration, AI is destined to change the way we manufacture products and process materials forever.

Industrial AI can be embedded to existing products or services to make them more effective, reliable, safer, and last longer. With the help of AI, the scope and pace of automation have been fundamentally changed.AI technologies boost the performance and expand the capability of conventional AI applications. An example is the collaborative robots. Collaborative robotic arms are able to learn the motion and path demonstrated by human operators and perform the same task.[19] AI also automates the process that used to require human participation.

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