Manufacturing Redefined

Preface

Manufacturing is one of the main industries that use Artificial Intelligence and Machine Learning technologies to its fullest potential. Smart Factories, also known as Smart Factories 4.0 have major cuts in unexpected downtime, better design of the products, improved efficiency and transition times, the overall quality of the product and safety of the workers. Artificial Intelligence is the heart of Industry 4.0, delivering more productivity while staying environmental-friendly.

Siemens, GE, Fanuc, Kuka, Bosch, Microsoft and NVIDIA among the industry giants which have already heavily investied in manufacturing AI with machine learning approaches to boost every part of manufacturing. TrendForce estimates that Smart Manufacturing (the blend of industrial AI and IoT) will expand

massively in the period from three to five years, by end of 2020 itself the global smart manufacturing market will be valued over $320 billion, with a projected compound annual rate of growth at 12.5%. While in 2015 the number of functioning industrial robots in factories was 1.6 million, in 2019 the number has grown to 2.6 million, according to the International Federation of Robotics. There's been a ton of coverage on how artificial intelligence (AI), machine learning, and robots are helping push the boundaries of manufacturing. However, we can also add blockchain to this list, as it turns out that blockchain, when coupled with other solutions, can also give manufacturers the ability to be digital leaders.

Blockchain's ability to support highly connected interactions, decentralized business networks, and open, yet secure transactions, make it a revolutionary technology that should be explored. When it comes to manufacturing, blockchain has the potential to bring forward-thinking solutions to life.

It's important to remember, however, that blockchain is not a trend in the industry by itself. But, when combined with other technologies emerging in the manufacturing space, blockchain is a great enabler for supporting some of the trends that are happening with industry 4.0.

How AI help Manufacturing?

- **Smart Maintenance**

Being a very important part of every asset-reliant production operation, maintenance of equipment is one of the biggest expenses in the manufacturing — unplanned downtime cost nearly $50 billion to plants and factories worldwide, 42% of it is because of asset failure.

That's why predictive maintenance became a vital solution that will help to save an enormous amount of money, complex AI algorithms like neural networks and machine learning are generating trustworthy predictions regarding the status of assets and machinery. Remaining Useful Life (RUL) of equipment becomes significantly longer. If something needs to be repaired or replaced, technicians will know beforehand and even will know which methods to use to fix the issue.

- **Better Product Development**

Generative design is the method that allows putting detailed brief created by humans into an AI algorithm. The information in the brief can contain different parameters like available production resources, budget and time. The algorithm examines all possible variations and generates a few optimal solutions. This set of solutions can be evaluated by pre-trained deep learning models adding more insights and picking certain options. You can go through this process as many times as you want to settle on a perfect one. Artificial Intelligence is completely objective without any unproven assumptions unlike humans could have.

- ## Quality Improvement

  In the modern world of short **" time to market "** deadlines and increased level of complexity of the products, it becomes even harder to meet the highest standards and regulations in terms of quality. Customers expect impeccable products and defects that cause recalls, which massively damages the reputation of the company and its brand. AI can alert about the problems at the production line that can result in quality issues. These faults could be major or subtle, but they all influence the overall level of production and could be eliminated in the early stages.

  Machine vision, for example, is an AI solution that uses high-resolution cameras to monitor defects way better than a human can. It could be combined with a cloud-based data processing framework which generates an automatic response. Also, manufacturers can obtain data on the performance of their products when they hit the market to make better strategic decisions in the future.

- ## Market Adaptation

  AI and ML are already an essential element of Factory 4.0, but they also can improve supply chains, making them interactive to changes on the market beforehand, managers can improve their strategic vision relying on AI suggestions. Estimates are generated by AI based on linking together a number of factors like political situation, weather, consumer behavior, the status of the economy, etc. Staff, inventory, the supply of materials could be calculated according to predictions.

The biggest companies around the globe are already utilizing Artificial Intelligence and Machine Learning in manufacturing and investing millions in its development. Here are some of the most prominent examples of companies using it.

How ML help Manufacturing?

Machine learning has already proven its viability – it solves more and more tasks in various fields. As technology develops, the scope of application of intelligent systems with machine learning will grow – and the farther away, the more difficult will be the problems solved with the help of data mining. In this article, we have collected ten main problems of modern business, which currently can be solved with AI computing technologies.

- **Correcting Prediction of Events in the Client's Life**

  Machine learning enables to predict not only customer behavior patterns, but also changes in his life. Like behavioral factors, potential changes can be predicted based on the data that users leave publicly available. For example, if a person bought a car on credit, then ML algorithms are able to analyze the purchase history and predict when he needs insurance and come up with motivating product purchase.

- **Predicting Unplanned Breakdowns or Downtime**

  It is always easier to prevent a problem than to solve it. By adhering to this principle, machine learning for enterprise is

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able to analyze the state of the working equipment, collect data on the latest professional development of employees and make a forecast. Thus, with the help of predictive analytics, it becomes possible to foresee equipment breakdowns leading to downtime and prevent them. This approach also allows companies to increase the equipment life due to the maintenance provided in time.

- **Mitigates High Risks and helps develop Winning Strategies**

  Doing business, we are constantly forced to make decisions that are going to determine the fate of our company. Even being fully aware of the pros and cons of his action, a person cannot always be objective. It seems to us that we are guided by logic and common sense, but very often personal interest or other feelings dominate. With Machine learning you can only make rational decisions, analyzing and minimizing possible risks. Thus, one of the benefits of machine learning in business is the fact that it is able to build the most profitable and effective business strategy, which will be based on real indicators of growth and falls and public moods. Moreover, the amount of data analyzed will be incomprehensible to the human brain.

- **Resolves issues around Large Amount of Work and Low Productivity**

  This problem is directly related to the previous one. When employees are forced to perform a large number of tasks in a short time, productivity drops. The same happens to the level of the customer service, profits, and reputation of the

company. With machine learning technologies, it is possible to avoid this problem by outsourcing some of the tasks to the computer systems. The exact implementation of this can be such robots as "Chloe" that sells iPhone chargers and plug adapters, while human assistants can meanwhile focus on goods maintenance and repairs. Another case is with Adidas robotic plant or "Speedfactory", where the manufacturing of textile, footwear and clothing is performed by a robotic hand which will eventually make Adidas product more affordable for everybody.

- **Enables efficient Customer Interaction**

  Chatbots that today are able to answer standard questions have already become a must-have. They significantly reduced the burden on support services. However, modern systems continue their training, and they are able to work not only with FAQs but also with problematic queries including. Such a machine learning model is able to analyze the user's appeal with keywords, and send it to the appropriate department for processing. This contributes to a faster response to incoming requests and frees up more resources to effectively solve customers' problems.

- **Helps create client envisioned products**

  Do you remember how seamlessly Apple products interact with each other? Today, this company continues to use the advantages of machine learning for its favor. So, Apple Watch can recommend playlists from iTunes, which are ideal for the user's heart rhythm. Thus, machine learning for enterprise can not only make recommendations about products that are relevant to the client based on predictive

modeling but also give recommendations about the characteristics of new products that can be created based on the needs of the user.

- **Prevents High Cost of Advertising, Its Mass Nature**

  If ten years ago, companies knew only the socio-demographic profile of their consumers, but today they have data on how they spend their leisure time, where they go shopping, what they buy and how much they pay for it. And it is machine learning that helps companies link this data and use it to increase advertising effectiveness. Today, machine learning in advertising performs the main function – makes advertising campaigns 100% targeted. This allows the business to distribute the advertising budget as reasonably as possible.

- **Custom Content Value**

  Every day tons of useless content are poured into the network. Here it is possible to draw an analogy with spam letters. All that today falls into the Spam folder is just one tiny part of spam letters that freely walk around the network. One of the main benefits of machine learning and AI is the fact that this technology is able to identify spam emails and filter them. Analogously, this tool can effectively work with content, showing your users the information that they need based on their requests and other data known about them. For example, Pinterest, Yelp, Next Door, and Discuss are

already using this approach. As a result, there is improved user experience and increased conversions.

- **Processing, Classifying and Storing Data**

All modern business is built on data that users make available intentionally or unintentionally. Machine learning technology allows you to take all this complex and immense data and describe it using a relatively simple model available for implementation in modern business systems. Machine learning in the enterprise allows you to analyze, group and classify this data while reducing the risk of errors to minimum. In this regard, the possibilities of machine learning are endless. Every company that decides to integrate these innovations will be able to organize work with the data in accordance with its business objectives.

But the most important advantage is that these systems continue to learn by the method of deep learning. That is, laying the right mechanism once, you can use it a million times without the cost of additional resources.

Applications of ML in Manufacturing?

- **Siemens**

The German conglomerate claims that its practical experience in industrial AI for manufacturing already boosted the development and application of the technology. For decades, they leveraged neural networks for monitoring steel factories as well as improving their performance. Over the last ten years, they invested over 10 billion in US dollars in the acquisition of software companies.

In 2016 Siemens presented Mindsphere, a smart cloud that enables manufacturers to monitor machine fleets around the globe. They added IBM's Watson Analytics to the functions offered by the service the same year. The purpose of this solution is to grab every parameter in the manufacturing process from development to delivery and find issues and the ways to solve them.

Siemens uses neural network-based AI in their gas turbines. Over 500 sensors monitor various parameters, and the system is learning and making decisions on adjusting fuel values for the most efficient performance.

Siemens also offers Click2Make – a product that set a goal to make a mass customization a reality. When companies have a complete understanding of their resources and have cutting-edge robots, it will be possible. To illustrate this, imagine a company that needs to deliver a limited edition of chairs. All the company has to do is upload the design, then the systems would provide this information to the factories that have all the necessary tools to build them. After the curtain factory starts production, the management of the

company can seek potential buyers in real-time. This boosts the path from design to delivery significantly.

- **General Electric**

One of the biggest companies on the planet is making everything from home appliances to massive industrial machinery. They have over 500 plants worldwide, but they have only just begun to make them smart.

Brilliant Manufacturing Suite is an attempt from GE to track and process everything in every aspect of manufacturing to find all possible problems and failures. Their first Brilliant Factory in India received $200 million in investments and raised the effectiveness rate of the facility by 18%, thanks to this solution. GE's Brilliant Manufacturing Suite is aiming to connect all elements of manufacturing like design, engineering or distribution, into one global smart system that is scalable. It even has its own Industrial IoT platform Predix. This platform uses sensors to monitor all aspects of the manufacturing process and the performance of sophisticated equipment. Predix has deep-learning capabilities that can process all that information and come up with actionable insights. GE already invested over $1 billion in this system and by 2020 Predix is going to process over 1 million terabytes of information a day.

At the moment General Electric runs 7 Brilliant Factories with the Predix system showing positive improvements in production.

- **Fanuc**

  This company from Japan implements AI to make robots smarter. In fact, it is a leader in industrial robotics integrating deep learning into robots. Fanuc collaborated with Rockwell and Cisco to introduce FANUC Intelligent Edge Link and Drive (FIELD), an IoT platform for the manufacturing industry. The partnership with NVIDIA resulted in using Fanuc's AI chips for the factories of the future. The usage of deep reinforcement learning led to the ability of some industrial robots to train themselves. Fanuc and NVIDIA are aiming to enable multiple robots to learn simultaneously. If robots can learn together, it will be faster for each of them individually. In the future robots will be able to share their skills with each other saving the overall time of the manufacturing processes in the Smart Factory.

Blockchain and Manufacturing

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There are three core features of blockchain that make it a valuable asset for the manufacturing industry:

- **Distributed system of record.** With a distributed system of record in the blockchain network, there is no "central" data store that is controlled by one organization. The distributed ledger provides all participants with a view into the data (depending on the framework and its configuration), thus increasing transparency, data distribution timeliness, information sharing, and data access. Security is also improved as there is no one central data store open to external attacks.

- **Security and Trust.** Because blockchain utilizes cryptographic techniques and supporting data structures to improve the tamper-resistant nature of a network, it brings trust to a potentially trustless environment. Blockchain facilitates the creation of trust in a network without the need for a centralized third party.

- **Smart Contracts.** Smart contracts are embedded business terms or business logic that can be added to a blockchain. This will enable the automation of many processes, the secure handling of contracts, etc.

Epilogue

In the manufacturing industry, when combined with technologies such as IoT and AI/ML, blockchain can support a number of use cases across the various phases of manufacturing, including pre-production, production, and post-production. This may include use cases such as product traceability, simplified information sharing, parts management, supply chain automation, and payments. Blockchain may enhance the ability of organizations to protect the IP associated with design documents, and it may reduce counterfeiting by securing the transactions associated with product provenance. Blockchain is not the ultimate answer as it is only as good as the information provided to it, but it can improve the current status quo by facilitating the secure exchange of information over a decentralized network.

For years robotics, advanced analytics, and automation has been a major part of the manufacturing industry. The increasing scale of adoption of AI in manufacturing seems more like an evolution, rather than industry disruption. Technology is already here, and the more massive implementation is a matter of time — according to McKinsey by 2025 smart factories will generate $37 trillion. Are you ready to step into the future?

About

Venkat C Alla is a Senior IT Executive and Result-oriented Business Leader & Digital evangelist with over 20 Years of work experience helping companies structure and implement Digital strategies, grow revenues, actualize business value and enhance

customer experience across multiple industry verticals in core Manufacturing and IT Organizations. Lead strategy and execution of Digital transformation for multiple Fortune 500 companies across Hitech, Communications, Media and Entertainment, Life sciences, Automotive & BFSI.

I am enabling Digital Transformation for Verizon by partnering and implementing Digital Automation initiatives enterprise wide including Blockchain, ArtificiaL intelligence, RPA (Robotics Automation), Chatbots, Cognitive innovation and other digital initiatives to enable seamless Nationwide 5G Transition. I have been involved in supporting new business deals across domains and sectors, supporting portfolio transformation and execution and strengthening sales win rate by building the Digital Business-Technology operating model blueprint to realize business value through Digital transformation.

I have worked across the entire spectrum of the outsourcing services lifecycle - from Presales, Business Analysis,bid and offer creation, solutioning, due diligence, transition, service analytics and digital transformation as a Customer as well as in the service delivery.

Specialties: Digital transformation, Application Services, Pre-Sales, Program Management, Business Process Outsourcing, Solutioning, Transition, Business transformation and Business Analytics.

With my experience in end-to-end outsourcing life cycle, I believe that success of an engagement lies in an open and collaborative partnership with the client and by ensuring team receives right leadership and mentoring.

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