



Optimizing Logistics by Using Machine Learning Algorithms

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ABSTRACT

Machine learning algorithms and the models they're based on excel at finding anomalies, patterns and predictive insights in large data sets. Many supply chain challenges are time, cost and resource constraint-based, making machine learning an ideal technology to solve them. Machine learning and AI-based techniques are the foundation of a broad spectrum of next-generation logistics and supply chain technologies now under development.

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The most significant gains are being made where machine learning can contribute to solving complex constraint, cost and delivery problems companies face today. Machine learning's most significant contributions will be in providing supply chain operators with more significant insights into how supply chain performance can be improved, anticipating anomalies in logistics costs and performance before they occur. Machine learning is also providing insights into where automation can deliver the most significant scale advantages. Using intelligent machine learning software, supply chain managers can optimise inventory and find most suited suppliers to keep their business running efficiently. An increasing number of businesses today are showing interest in the applications of machine learning, from its varied advantages to fully leveraging the huge amounts of data collected by warehousing, transportation systems, and industrial logistics. It can also help enterprises create an entire machine intelligence-powered supply chain model to mitigate risks, improve insights and enhance performance, all of which are extremely crucial to build a globally competitive supply chain model.

Main challenges in logistics

Inventory management

Inventory management is extremely crucial for supply chain management as it allows enterprises to deal and adjust for any unexpected shortages. No supply chain firm would want to halt their company's production while they launch a hunt to find another supplier. Similarly, they wouldn't want to overstock as that starts affecting the profits.

Inventory management in supply chain is largely about striking a balance between timing the purchase orders to keep the operations going smoothly while not overstocking the items they won't need or use.

Quality and safety

With mounting pressures to deliver products on time to keep the supply chain assembly line moving, maintaining a dual check on quality as well as safety becomes a big challenge for supply chain firms. It could produce a big safety hazard to accept substandard parts not meeting the quality or safety standards.

Further, environmental changes, trade disputes and economic pressures on the supply chain can easily turn into issues and risks that quickly snowball throughout the entire supply chain causing significant problems.

Problems due to scarce resources

Issues faced in logistics and supply chain due to the scarcity of resources are well known. But the implementation of AI and machine learning in the supply chain and logistics has made the understanding of various facets much easier. Algorithms predicting demand and supply after studying various factors enable early planning and stocking accordingly. Offering new insights into various aspects of the supply chain, ML has also made the management of the inventory and team members become super simple.

Inefficient supplier relationship management

The steep scarcity of supply chain professionals is yet another challenge faced by logistics firms that can make the supplier relationship management cumbersome and ineffective.

Machine learning and artificial intelligence can offer useful insights into supplier data and can help supply chain companies make real-time decisions. One of the greatest use of Machine learning in Supply Chain is predicting the future demand of the customer. According to a study by Mckinsey Global Institute [1], marketing and sales have a major impact of new technologies of Machine Learning and Deep learning and these areas are benefitted the most. According to one of the reports by Forbes[2] “61% of organizations picked machine learning as their company’s most significant data initiative for next year.” Few and vital areas of Supply Chain along with applications where Machine learning algorithms are currently in use are following

- ML based demand and sales forecasting
- Personalized product recommendations
- Price and promotion recommendations to optimize markups and margins
- Inventory optimization with correct stock levels
- Logistics planning workbench and warehouse throughput optimization
- Build a 360° view of consumers
- Consumer insights (sentiment analysis/preferences/social listening) using cognitive services
- Shop-floor yield optimization
- Predictive equipment maintenance in factories
- Predictive lead scoring to improve lead qualification, prioritization, and acquisition

Optimization of a Truck-drone in Tandem Delivery Network

Herein, the minimal time of delivery utilizing K-means clustering to find launch locations, as well as a genetic algorithm are used to solve the truck route as a traveling salesman problem (TSP). The optimal solution is determined by finding the minimum cost associated to the parabolic convex cost function. To evaluate the launch locations and finding the optimal min-cost K-means algorithms are used while a genetic algorithm is used to determine truck route. It is concluded that standalone systems do not provide satisfactory results as opposed to in-tandem delivery efforts.

A Gist of Future Use-Cases

Machine Learning and its core constructs are ideally suited for providing insights into improving supply chain management performance not available from previous technologies. Combining the strengths of unsupervised learning, supervised learning and reinforcement learning, machine learning is proving to be a very effective technology that continually seeks to find key factors most affecting supply chain performance. Compiled are the key functions of artificial intelligence applications that are currently beginning to be commercialized or under research trials. Non-linear prediction methods are used to predict the behavior of systems like in traffic congestion forecasting. Control functions of AI are also being used at road intersections and route guidance. Pattern recognition are useful in knowing the behavior of customer and its needs and automatic incident detection. The use of machine Learning techniques will be continually increasing with the advent of more advancement in Supply Chain and the coordination of entities would be more beneficial.

Conclusion

Due to the global connect and as the times are changing, stiff competition and rivalry among organizations are increasing. Technological advancement is occurring at an exponential rate and firms are racing for the growth and revenue generation. We can see in many sectors; the robotics have been adopted to fulfill difficult tasks. Firms are now adopting automation in every field to pair up human and machine working. Nevertheless, the evolution of AI will become more sophisticated than it already is, and this turn of events will intensify the collaboration of human & AI to an even greater heights where it could translate to something ground breaking not only in supply chain, but also other important sectors as well.

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