

Machine Learning in Retail: A Key to Supply Chain Survival

Long before the COVID-19 pandemic struck, retail was facing mounting challenges as an industry. Intensifying competitive pressures of expanding ecommerce, shifting consumer preferences and rising expectations around customer service all combine to up-end the status quo. Stores that for decades had been the anchor tenants of shopping malls are shuttering. Amazon is rewriting the retail playbook in ways that are leaving competitors struggling. And to make things even more challenging, consumers are constantly raising the bar in their expectations for an exceptional customer experience. Trends like these are likely influencing your own retail supply chain strategy:

- **Convenience is key** // Customers have placed a premium on convenience and safety this year, driving demand for services such as contactless delivery. Retailers have had to balance trade-offs between the added cost of these services and the business benefits of maintaining high service levels by meeting customers where they are.¹
- **Recalculating the cost of doing business** // As the business landscape has altered in a matter of months, retailers have increasingly leveraged data and analytics to identify the most profitable stores, configurations, services and products and used these insights to make business-critical decisions.²
- **AI, machine learning and process automation** // Given the current capability shortages and cash flow challenges, retailers should now be looking to refocus on the core retail fundamentals of buying and selling while seeking strategic partnerships to deliver the other key requirements.²



Machine Learning Can Improve Customer Experience—and Your Bottom Line

Retailers that have managed to successfully adapt have identified technologies that can tackle the most complex retail supply chain challenges, such as new product introductions, extreme and dynamic seasonality, promotions and even short shelf-life items. Machine learning is helping savvy retailers optimize supply chain planning to increase fill rates, improve on shelf availability, and turn inventory over more rapidly. **With machine learning-augmented forecasting, retailers can optimize inventory and replenishment to achieve higher on-shelf availability while carrying less stock.**



What Is Machine Learning?

Machine learning is everywhere, yet many people don't fully understand how it works. A branch of artificial intelligence (AI), machine learning focuses on how to construct computer programs that automatically improve with experience. Rather than explicitly instructing it on what to do, you feed the program the data and it learns on its own. There are three common types of machine learning:

The most common, **supervised learning**, is frequently applied in business because of its ability to solve real-world computational problems. It learns by identifying patterns and relationships from a labeled training dataset which contains a known value for the target variable for each record. By consulting the correct answers during training, it is then able to "learn" how the rest of the features relate to the target.³

Unsupervised learning, on the other hand, is built on unlabeled training data. You feed the program a set of attributes or features and it then finds the commonality and patterns in the data. Common use cases for unsupervised learning are clustering and association. Unsupervised learning algorithms can create clusters in a more accurate and granular way than traditional techniques. This additional insight can be used to surface unknown unknowns.³

The final type, **reinforcement learning**, consists of an agent learning to take actions in environments from episodes of experience, to maximize long-term reward. The agent learns which actions from a given state yield the highest reward through trial and error, trading off exploration and exploitation in responding to feedback (rewards) for each step taken.

Machine Learning Helps Retailers Better Predict Demand

Retail has a unique challenge. Customers have grown accustomed to choice. They want what they want, in the configuration they want, in the time they want, in the location they want, with the return option they want, and if they can't get it from you they will get it from a competitor. How do you anticipate their desires, stock the right inventory and make the sale? One way of predicting buyer behavior patterns is to apply machine learning to the real-time data that is likely already flowing into your organization.

Innovative retailers like Amazon create closer alignment between functions to achieve greater operational efficiency and provide a seamless customer experience. Consumers don't segregate how they browse, how they purchase, how they get their product and how they return it. Now, multi-channel retailers have no choice but to consider and optimize each channel, both separately and globally. A solid understanding of different demand signals, consumption, forecasting and replenishment helps address this challenge. And machine learning technology is the added fuel that boosts this supply chain performance.

Facilitate growth of ecommerce/multi-channel

With the growing trend of direct-to-consumer business, retailers are adapting their traditional supply chain channels to ecommerce. These channels create greater demand variability and inventory balancing complexities. Many companies resort to holding excess inventory to combat the risk of lost sales due to stock-outs. With advanced planning functionality enhanced with machine learning, you can easily measure and predict ecommerce/multi-channel sales separately from traditional demand signals.



How to Use Machine Learning to Tackle Retail Supply Chain Challenges

Machine learning has long offered retailers an advantage, but in the wake of the COVID-19 pandemic, it is emerging as a necessity. Supply chains must now efficiently serve digital marketplaces, ecommerce, and facilitate multi-channel availability. Machine learning incorporates data from these interactions to proactively address questions such as, "Do we have the right inventory based on excitement generated during a new product introduction? Is it the right price based on the microclimate we're selling in? Is it in the right place to meet the pick-up locations from online orders?"

AI-enabled demand sensing, forecasting and multi-echelon inventory optimization is becoming a requirement of doing business in this new environment. Machine learning in retail fine-tunes these functions by incorporating insights gathered from relevant data streams, enabling more accurate decision making. Here are some of the most common applications:

/ Data-driven promotions and media events: Promotions, advertising, and other “demand shaping” activities are expensive, and determining their impact, or “lift,” is challenging. In a market where everything is just a click away, retailers must engage in these activities while keeping costs and stockouts to a minimum.

In our new multi-channel world, it’s crucial to pinpoint what’s moving the needle when it comes to customer buying patterns. Access to reliable inventory and demand data is invaluable to promotions and events teams.

For instance, at a major global foods manufacturer, more than 30 percent of items are sold on promotion—accounting for nearly 70 percent of forecast error. The company wanted to predict promotional lift to baseline demand to get timely production and balanced inventory deployment for channel and store supplies. Using machine learning, they lowered forecast error by 20 percent and lost sales by 30 percent. The company increased service levels to 98.6 percent, and realized a 30 percent reduction in product obsolescence. They were simultaneously able to cut demand planner workload in half, allowing planners to focus on more value-added activities.

/ Smoother new product introductions: It’s tough to forecast demand for a product without a sales history. But you can use machine learning to predict the performance of a product launch. Models can include early indicators such as web analytics, product attributes or even social media data, predicting the performance and launch profile early on.

For example, a global leader in eyewear adds 2,000 new styles to its collection annually. It uses machine learning to cluster the behaviors of past launches, select the most probable performance for the new product, then “learn” common demand behaviors in the first launch period through detailed demand profiles. The company improved global WMAPE (weighted mean absolute percent error) by 10 percent and reduced the forecast baseline on new launches by about 30 percent.



/ Adjusting for extreme or complex seasonality: Demand planning software can factor in seasonality—like the fact that more ice cream is sold in summer than in winter. But sometimes seasonality can become so extreme or complex that it is not as well suited to normal regression analysis-based techniques.

For instance, Lennox Residential is able to stock their regional stores with the right inventory for heating in winter and A/C in summer by using machine learning and cluster analysis to identify and track seasonality patterns and trends for its HVAC systems. The system recognizes more than 200 “micro-climates” within the United States and their seasonal timing variations. Machine learning sifts through the SKU-Locations to identify “clusters” with similar seasonality profiles. Lennox improved service levels by 16 percent while simultaneously increasing inventory turns by 25 percent.

/ Visibility into external variables: As retail becomes more complex and distributed, external variables that impact demand were previously impossible to incorporate into a demand plan. These variables include things like weather, housing starts, and interest rates. However, micro and macro-economic trends, related indices, weather data and other meaningful information provide a more holistic picture of market activity for a retailer. These data streams can now be captured and used to modify a demand signal, refining their demand forecast. From big box hardware stores using housing starts to determine demand for construction materials to an early rise in temperature creating higher demand for ice cream, machine learning enables retailers’ demand and inventory planning to respond to these factors.



Take the First Step to Digitize Your Retail Supply Chain Planning



ToolsGroup has been innovating to help organizations keep up with the shifting trends and unpredictable demands of the real world for nearly three decades, and pioneered the use of machine learning and AI in supply chain planning years ahead of its time.

Today, our service-driven supply chain planning automation enables companies around the world to predict more behaviors, protect against surprises and perform more efficiently against all the challenges of a complex global economy. With ToolsGroup, you can anticipate real-world uncertainty to be ready for anything.

Ready to take the next step? Download our ebook today to learn critical points every supply chain organization should consider before diving into a machine learning project.

eBook: Six Tips for Success Using Machine Learning for Demand Planning



- ⁽¹⁾ <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-retail-industry-outlook-2020-final-100720.pdf>.
- ⁽²⁾ <https://home.kpmg/ph/en/home/insights/2020/06/rethinking-the-cost-of-doing-business.html>.
- ⁽³⁾ 3 Types of Machine Learning for the Enterprise. Published 29 January 2020 – ID G00465941