Using Machine Learning to Transform Supply Chain Management

Abstract

Companies have traditionally used business intelligence gathering systems to monitor the performance of highly complex order-to-cash (OTC) processes. However, these systems mostly rely on root cause or post-mortem data analysis to identify gaps in the order fulfillment cycles. With rapid advancements in analytics and machine learning (ML), companies can now proactively examine transactional data in near real time and use the insights derived to plug the gaps and revenue losses—the impact can be as high as 10% in some industries.

This paper highlights some of the key challenges in the OTC cycle and recommends a data-intensive, ML-based methodology to address two major problems – late shipment delivery and high volume of return orders.

The Need for Change

Operational inefficiencies in supply chain management can often lead to potential revenue losses, increasing costs, and poor customer service – ultimately diminishing profits. For instance, marine shipment from the United States to Singapore sometimes takes more than 60 days instead of the scheduled 40 days. This uncertainty triggers a series of business and operational issues. Typically, the delays are due to known causes, such as multiple loading and unloading points, congestion along the route, varied quality policies, process bottleneck, and so on.

The order-to-cash cycle, a key process in supply chain management, sees many uncertainties. These include:

- Inadequate inventory to fulfill demand
- Supply shortages and logistical uncertainties
- Huge backlog of orders
- Demand variation
- Communication gaps among stakeholders
- Variation in quality levels of inventory
- Varied performance indicators used at customers end
- Delivery of products not ordered for

The root causes of these variables differ on a day-to-day basis and are difficult to forecast using pre-defined rules. ML that allows real-time analytics and action points can play an important role in understanding these challenges and predicting them well in advance.Having a layer of analytics on top of standard OTC processes can enable data-driven actions in real time. ML uses algorithm models that can process large volumes of data very quickly—something that is not possible through manual methods. This approach can drive operational efficiencies, reduce revenue losses from return orders, and improve customer satisfaction with on-time delivery.

Recommended Architecture for Machine Learning Models

Building models to highlight gaps in the process and predict the probability of return orders and delivery delays requires case-specific information such as customer profile and demographics, order and shipment information, product

portfolio, payment status, and product acceptance. These models can thus:

- Introduce and equip the data analytics platform with machine learning and visualization features capable of onboarding huge volumes of out-of-the-box data.
- Identify the root cause of return orders by combining various data sources such as shipment, transportation, and order booking.
- Predict whether a shipment is likely to be delivered on-time using invoice, transportation, and shipment data.

Insights derived using ML models help identify parameters critical to plugging the gaps and removing inefficiencies in the OTC process. A data-enriched, ML-based methodology can be used to build a real-time, prognostic solution rather than a traditional diagnostic one. Based on business-specific challenges and constraints, the algorithms can be customized by:

- Collecting, cleaning, and combining data from all relevant sources and sifting out the relevant information impacting the OTC process. The data can be categorized as mandatory and optional – a customer's order transaction records is critical while his or her financial data can be optional.
- Ensuring higher weightage to factors that have the maximum impact on transactional data by leveraging insights from business intelligence and customer order data diagnosis.
- Selecting dependent and independent variables based on the unique problem statement such as late delivery.

Companies can choose from robust ML algorithms such as random forest, support vector machine, and gradient boosting to train the transactional dataset and help identify the likelihood of late delivery and returns. They can also generate den ederp rof sdraobhsad dna stroper ecnegilletni ssenisub KPIs, besides periodically recalibrating the model with new learnings.

Win Big with Machine Learning Models: A Use Case

The impact of using an ML approach for OTC can be illustrated in an example. A leading American multinational chemical corporation used a Random Forest ML approach to predict the likelihood of late deliveries and return orders. After collecting one year's data on chemical goods orders, it calibrated the data

model for a marine shipment business, and analyzed two specific business scenarios. The top three reasons for return orders were identified as mode of transport, loading and unloading stops, and system processing time, and the model 'trained' on these variables.

The results of this ML approach was impressive: about 90% instances of delays and returns were accurately predicted. This percentage could be further improved by including parameters, such as reasons for product return, product-level details, and ver osla ledom ehT .atad tnemll luf redro rehtoealed critical insights on orders likely to be returned due to delays between the scheduled time for dispatch and the actual time of dispatch. With such a system in place, businesses will be in a position to take proactive measures to improve shipment delivery timelines.

In addition to this, the company collected relevant data to detect issues with late shipments, and trained the ML model to determine the leading cause under the 'defect' categories, which resulted in goods being returned. It was found that these late deliveries accounted for as much as 60% of the total defect orders. This was a vital parameter to track as the high rate of late order delivery would have led to significant revenue losses. Such a predictive model can help businesses preemptively identify which orders are likely to be returned, proactively act, and expedite order deliveries.

Unlocking Value with Smarter OTC Processes

As the CFO's role expands from that of a cost controller to a strategic enabler of business growth, it has become imperative to establish an internal system that can check and ensure opertsoc dna ycneic fe lanoita-effectiveness. Investing in leading-edge data-enriched models is a compelling option to not only transform legacy OTC processes, but also replace manual judgment with data-driven insights that pave the way for sustainable outcomes. Competing successfully in today's hypercompetitive economy requires businesses to embrace next-generation technologies such as ML and deep learning to devise intelligent, proactive, and efficient solutions for current as well as probable business challenges. The ML methodology discussed here can be further extended to create a completely automated and self-sufficient early warning system for laser sharp decision making across varied use cases. This will not only help enterprises expand, enhance customer satisfaction but also improve financial liquidity.

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