



White Paper

Sales Forecasting with No-Code, Explainable Machine Learning for Supply Chain Optimization

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SUMMARY

Large and mid-size retail organizations must stay on top of millions of product inventories every day to maintain high levels of margins and efficiency of their operations. Sales forecasting is the key to operational success in such a demanding environment where the flow of information is constantly changing.

Companies can use conventional forecasting methods to find patterns from previous sales information. However, these methods cannot extract information from complex data patterns. Therefore, they are not sufficient to make predictions in a dynamically changing world. Batch machine learning models can also be used for sales forecasting although these models rarely succeed in deployment as they are hard to retrain and environments like customer segments can change daily. These models also lack explanations and the ability to be understood by business experts. Sales representatives and inventory managers need a real-time prediction system to accurately satisfy the demand on time.

This paper will discuss how TAZI's Continuously Learning ML platform enables AI-Assisted Sales Forecasting for supply chain optimization. TAZI's patented continuous learning technology will help business experts analyze the number of products sold and the demand for the future.



INTRODUCTION

Retail organizations must stay on top of their product inventories every day to maintain their profitability. Sales forecasting is the key to inventory and supply chain management in such a demanding environment where the flow of information is constantly changing.

A sales forecast with minimal uncertainty is the only way inventory managers can predict which products are needed for each sales point and channel on any given day, which leads to an increase in product availability and customer satisfaction. Other than decreasing stock-out rates, a reliable demand forecasting model can support budgeting and staffing decisions, and help with complex lead-time distributions.

Even though creating a reliable sales forecasting model can be easily done with a team of data scientists and data engineers, the retail conditions are highly unstable in today's world and hundreds of variables continuously impact sales. Every day, inventory managers and sales representatives have to deal with a wide range of factors such as seasonality, price adjustments, or promotions to stay ahead of the competition. In such an environment where the data and information is updated continuously, there is a need to use continuous and explainable machine learning. With continuous and explainable AI predictions, inventory management can understand the predictions and make business decisions in real-time.

TAZI's Continuous ML platform is designed to be understood by business experts from all backgrounds, regardless of data science experience. Thanks to its continuous learning technology, the platform is continuously synchronized with the business changes. This technology allows business users to receive continuous feedback on the models they build and consequently take action from the interpretable ML.

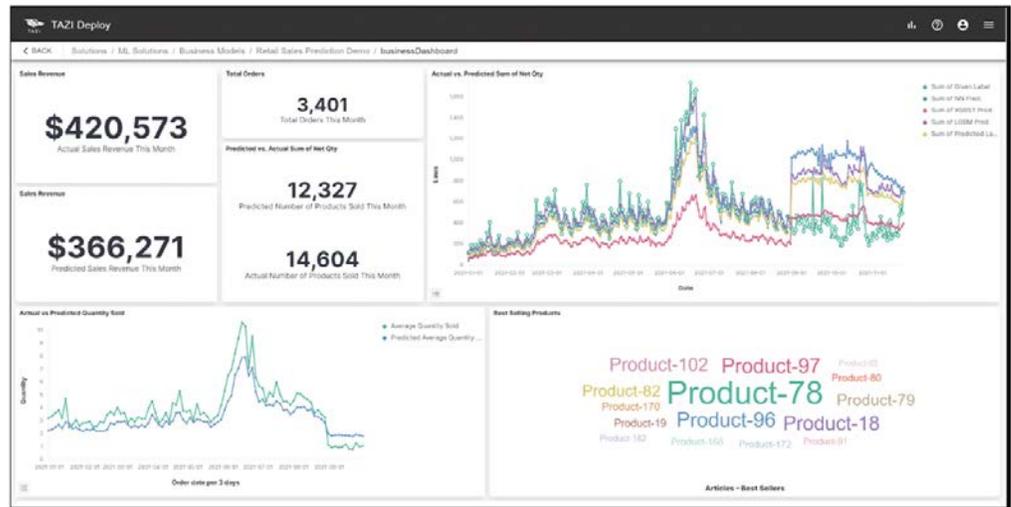


Figure 1: TAZI Executive Dashboard

TAZI’s customizable dashboards allow business users and executives to see the predicted and actual sales revenue to examine the business value. Highlights which SKUs will be sold for the upcoming days.

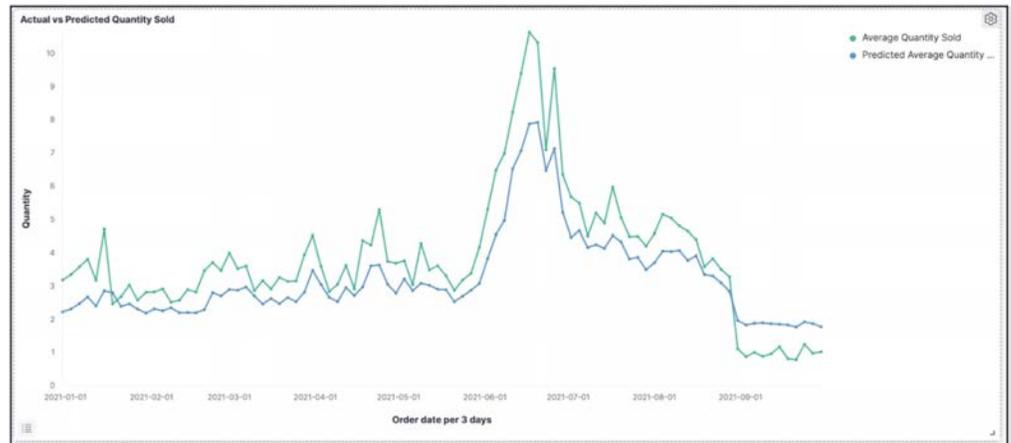


Figure 2: Dynamic dashboards that show TAZI’s continuous model predictions. Allows business to schedule replenishment actions directly from the platform.

Figure 1 and 2 presents the dynamic and interactive dashboards that are used by inventory managers or sales representatives. Every day, business users can log onto these dashboards and take data-driven business decisions to optimize their operational metrics.



Conventional machine learning pipelines cannot observe the changes in seasonality and internal decisions. Additionally, these traditional models are black-box. In other words, the decisions of these models cannot be explained satisfactorily.

The recent Covid-19 pandemic showed how the statistical methods and conventional ML pipelines failed to predict supply chain disruption. Therefore, we understand that models should be adaptive enough to capture those changes.

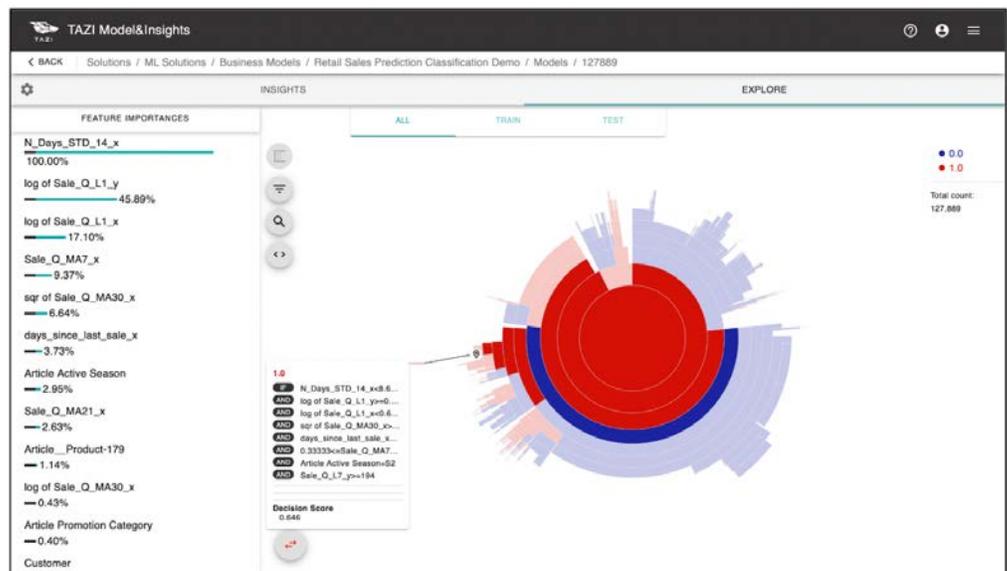


Figure 3: Explainable AI interface showing predicted sales patterns (in red) and highlights a particular micro-segment. The most important features used by the model are sorted on the left.

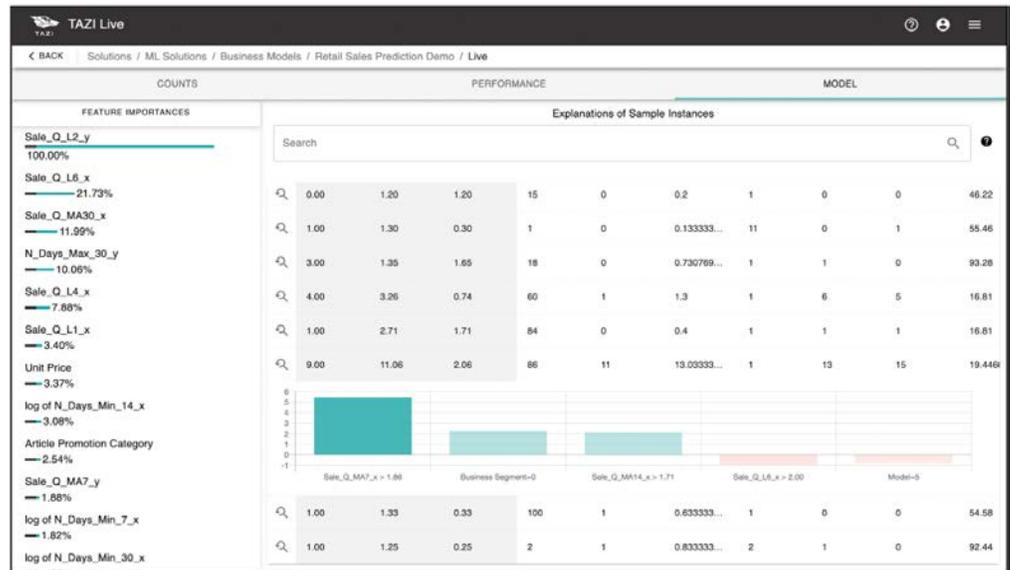


Figure 4: Explanation for each instance is provided with bar graphs. SKU's can be examined in detail each day.

TAZI's APPROACH



Figure 5: TAZI's Sales Forecasting Approach

TAZI Sales Forecasting approach starts with predicting the SKUs that will be out of stock. The business experts examine these SKUs, and which product and how many of them to supply is determined beforehand. Continuous algorithms such as online decision trees and neural networks can learn and predict the SKUs. After determining the products to be replenished, salespeople are notified and inventory management is optimized. This way, over or understocking is prevented and sales revenues are increased by the company.



Feature Name	Feature Description	Feature Type	Sample1	Sample2	Default Value
Index	index number ready to use for pre and post process	int	1254		-
Model	Model name of the product	string	Model-15		unknown
Article	Product name of the product	string	Product-89		unknown
Article Active Season	Season code of the product	string	F0		unknown
Article Category	Category name of the product	string	CAT_C		unknown
Business Segment	Business segment name of the product	string	CSM		unknown
Gender Group	Gender group name of the product	string	KIDS BOYS AND GIRLS		unknown
Gender	Gender category name of the product	string	UNISEX		unknown
Order Date	Date of sale	date	2020-10-21		-
Customer	Name of the sales channel	string	Customer-01		unknown
Article Promotion Category	Promotion category code	string	FP		unknown
Unit Price	Price of one unit of product	decimal	20.97		472
Net Qty_x	Number of units of the product sold	decimal	4	4.00	-
days_since_last_sale_x	Number of days passed since the date of the last positive sale of th	decimal	46	32.00	594
Sales_Flag_x	Flag indicating existence of positive sales that day, 1.0 there is posi	decimal	1	0.0	-
N_Days_Mean_7_x	Mean of the last 7 days' days_since_last_sale_x values	decimal	43		588
N_Days_STD_7_x	Standart Deviation of the last 7 days' days_since_last_sale_x value	decimal	2.160246899		314
N_Days_Max_7_x	Max of the last 7 days' days_since_last_sale_x values	decimal	46		594
N_Days_Min_7_x	Min of the last 7 days' days_since_last_sale_x values	decimal	40		582
N_Days_Mean_14_x	Mean of the last 14 days' days_since_last_sale_x values	decimal	39.5		582
N_Days_STD_14_x	Standart Deviation of the last 14 days' days_since_last_sale_x valu	decimal	4.183300133		298

Figure 6: TAZI's Sales Forecasting Solution Data Dictionary

SEASONALITY

Retailers should provide products on shelves whenever demand shows up. Otherwise, it would lead to profit losses. Some items need to be sold in a concise period of time. Some of them are seasonal products only sold at a particular time of a period. These constraints make the supply chain processes more complex. TAZI's Continuous ML solution can capture complex patterns by learning from the data continuously while making the predictions. These prediction results are much more accurate than all of the conventional methods.

HOW A GLOBAL BEVERAGE FIRM MANAGES DAILY PRODUCT DISTRIBUTION WITH TAZI

The daily demand pattern of a beverage is fluctuating due to consumer demand and pricing strategies. The company needs a real time stock prediction system for the inventory management. Continuous machine learning provides real-time monitoring for which and how many products should be supplied for each stock-keeping unit (SKU).

To overcome the volatile demand issue, this beverage firm enabled continuous machine learning enterprise-wide for the logistics experts that have no previous coding experience. Profits and real-time revenue are also monitored by the business experts.



Apart from the previous sales data that the company kept, external data is also used such as holidays, location, weather, etc. Enriched data led to better forecasts for the beverage firm. TAZI's Sales Prediction Solution provided successful predictions for both low and high-selling products.

TAZI identifies the sales patterns and which features are more impactful for each SKU type. Additionally, the effect of the discounts is examined by the pricing teams. Such automation is possible with continuously learning ML models that do not require re-training.

The beverage firm takes business actions from the sales forecast that TAZI provides such as stock replenishment for better inventory management. Some beverages are consumed more on special days. For instance, at Christmas, demand patterns are very different from other times of the year. Forecasting the demand accurately beforehand solves unexpected stockout problems.

Sales representatives use the below table to see which products need to be replenished. Models also take into account the profitability of each product. Below list suggests the most profitable products that need to be replenished beforehand. So that the company captures a larger profit.

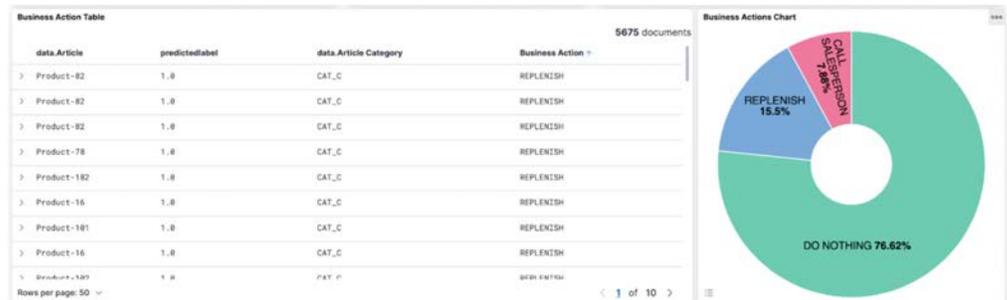


Figure 7: Business action table and chart that indicates which products need to be replenished for the next day.

CONCLUSION

TAZI increases the profits gained by providing the right amount of product at the right time better than traditional ML pipelines, thanks to its continuous learning technology. Periodic model maintenance and rebuilding phases are a financial burden for the companies due to long rebuilding and maintenance phases.



Therefore, TAZI's easy, understandable, continuous AutoML platform lets you increase profits gained from the sales.

To understand and quantify the impact on your book of business, please visit the [TAZI Sales Prediction Solution](#) web page.

Do you want to learn:

- Do you have sufficient and clean data to predict which products should be resupplied?
- How you can build your own evolving sales forecasting models within 10-30 days?
- How you can start increasing your sales revenue in 1-2 months?
- How you can up-skill your business and data teams to adopt machine learning?

Contact us at: info@tazi.ai

For more information visit our website [TAZI.AI](#)



ABOUT TAZI

Artificial intelligence (AI) is a source of both huge excitement and apprehension, transforming enterprise operations today. It is more intelligent as it unlocks new sources of value creation and becomes a critical driver of competitive advantage by helping companies achieve new levels of performance at greater scale, growth, and speed than ever before, making it the biggest commercial opportunity in today's fast changing economy.

TAZI is a leading global Automated Machine Learning product/solutions provider with offices in San Francisco. TAZI is a Gartner Cool Vendor in Core AI Technologies (May 2019) and is considered as "[The Next Generation of Automated Machine Learning](#)" by Data Science Central.

WHO WE ARE

Founded in 2015, TAZI has a single mission which is to help businesses to directly benefit from Automated Machine Learning by using TAZI as a superpower, shaping the future of their organizations while realizing direct benefits like cost reduction, increasing efficiency, enhanced (dynamic) business insight, new business (uncovered), and business automation.

WHAT WE OFFER

Through its understandable continuous machine learning from data and humans, TAZI is supporting companies in banking, insurance, retail, and telco industries in making smarter, more intelligent business decisions.



TAZI solutions are based on a most compelling architecture that combines the experiences of 23 patents granted in AI and real-time systems, proven at different global implementations.

Some unique differentiators of TAZI products are:

- Business users can automatically configure custom ML models based on their KPI and the available data. TAZI's Profiler accelerates this process through data understanding and automated cleaning, feature transformation, engineering, and selection capabilities.
- TAZI models learn continuously, and are suitable for today's dynamic, realtime data environments.
- TAZI models are GDPR compliant (no black-box models). They provide an
- explanation in the business domain's terminology for every result they produce.
- TAZI supports multiple (heterogeneous) data sources, i.e.,...: external, batch, streaming, and others.
- TAZI can learn both from human domain experts and from data, which speeds up accuracy improvement.
- TAZI's hyper parameter optimization feature reduces human time spent for model configuration. TAZI products contain algorithms that are developed and coded to be lean, efficient, and scalable.