



Enhanced Shipping Prediction for **Retail Logistics**

Optimizing order picking and workforce scheduling
through advanced machine learning



Project Overview

Our machine learning solution helped solve critical logistics challenges by accurately predicting order picking and automating shift scheduling. We addressed issues stemming from inaccurate shipping estimates that disrupted workforce scheduling. Our approach integrated sales forecasts into a predictive framework, leveraging advanced metrics to significantly enhance operational efficiency across distribution centers. This solution optimized staffing levels, minimized labor costs, ensured timely shipments, and improved overall customer satisfaction through precise order picking forecasts.

Client Profile

Leading fashion retailer with more than 3000 physical stores and an E-commerce website that serves over 20 million active users.

Business Challenges

The logistics team faces significant issues with the accuracy of their shipping estimates, which directly impacted workforce scheduling at distribution centers. The primary challenges were:



- Overestimating order picking leads to overstaffing, causing inefficiencies and increased operational costs due to unnecessary labor hours.
- Underestimating order picking leads to understaffing, causing shipping delays, stock distribution disruptions, and reduced customer satisfaction.

Business Requirement

Enhance operational efficiency and cost-effectiveness by implementing a machine-learning model to accurately predict shipping volumes and automate shift scheduling.

- Develop and deploy a machine-learning (ML) model to accurately predict order picking volumes and automate shift schedules, ensuring optimal staffing levels.
- Replace existing manual and non-ML systems with the ML model to reduce operational costs and improve prediction accuracy.

QBurst Solution

We implemented a machine learning-based approach focusing on time series modeling. We evaluated ARIMA (AutoRegressive Integrated Moving Average), SARIMA (Seasonal ARIMA), and Prophet models, using metrics like MAPE (Mean Absolute Percentage Error), R-squared (R^2), and MAE (Mean Absolute Error). Prophet emerged as the most effective model.

Sales Prediction

- Sales forecasting was initiated using the Prophet model
- The forecasted sales figures were integrated as regressors in the order-picking prediction framework

Model Selection

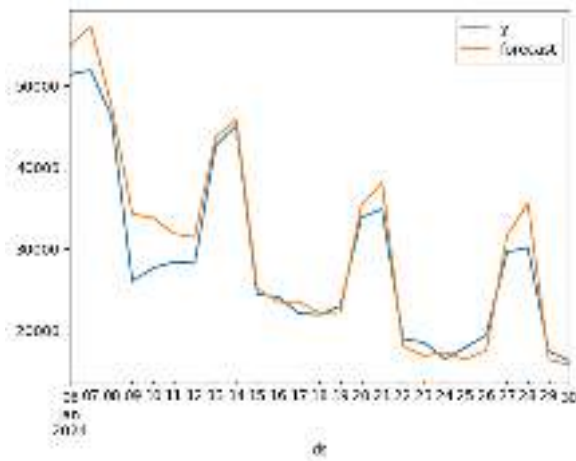
- Time series models (ARIMA, SARIMA, Prophet) were initially explored, aligning with the data's temporal dynamics
- Prophet was definitively chosen for its superior accuracy in forecasting and adept handling of seasonal and holiday variations

Evaluation Metrics

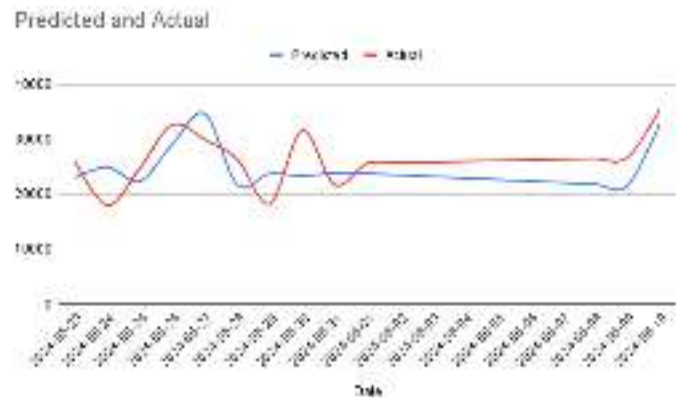
- Robust evaluation metrics such as MAPE, R^2 score, and MAE were employed to validate model performance

- Prophet consistently outperformed alternative models across these benchmarks

Sales Forecasting Graph



Order Picking Forecasting Graph



Project Highlights

- Ability to identify and adjust for seasonal patterns and long-term trends in sales and order-picking data
- Predicted sales values are utilized as key inputs (regressors) in the order-picking prediction model, enhancing accuracy
- Combines sales predictions with other relevant features to forecast order-picking volumes
- Incorporates additional variables such as promotional events, holidays, and historical order volumes to improve prediction accuracy
- Regular updates and fine-tuning based on new data and feedback to maintain high accuracy
- Implemented automated processes designed to scale across multiple distribution centers, accommodating varying volumes and complexities
- Provides an intuitive dashboard for visualizing sales and order-picking forecasts, along with historical performance
- Capable of adjusting predictions in real-time based on new data inputs or changes in external conditions

Technologies Used



Business Benefits

- **Improved accuracy in predictions:** Enhanced forecast precision for sales and order-picking, reducing forecasting errors.
- **Optimized workforce scheduling:** Ensured optimal staffing levels, minimizing labor inefficiencies and disruptions.
- **Increased cost savings and efficiency:** Minimized overstaffing and understaffing, reducing labor costs and operational disruptions.
- **Enhanced decision-making and planning:** Utilized data-driven insights for proactive decision-making and strategic planning.
- **Improved customer satisfaction:** Enhanced forecast precision for sales and order-picking ensured timely shipments, reducing delays and improving overall customer experience and loyalty.

