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Assignment 2: Option A – Predict Total Daily Sales

Discover: Surface discovery

The forecasting model used a time series approach to estimate store-wide daily sales. It returned a log-likelihood score of minus twenty thousand thirty-two and an AIC score of just over forty thousand. While those numbers may seem unusual at a glance, they are entirely expected in this context. The log-likelihood measures how well the model explains the observed data, and negative values are common with large datasets. The AIC, or Akaike Information Criterion, helps balance how well the model fits the data with how complex it is. These metrics are useful when comparing different models rather than being judged on their own.

Over a two-week forecast window, projected daily sales ranged from about 1.24 million to 1.31 million. The model clearly picked up on weekly sales rhythms, such as midweek dips and weekend spikes. These patterns suggest the model successfully captures the seasonality present in the sales data and offers reliable guidance for short-term planning.

Investigate: Deeper investigation findings

A closer look at the forecasted trends shows that seasonality plays a significant role. Weekly patterns were consistent, with noticeable spikes toward the end of each week. Store type and location also appeared to influence results. Urban stores tended to show more stable trends, while rural or clustered locations had greater fluctuations. Promotions contributed to brief sales increases but didn't shift long-term behavior. Past anomalies like regional holidays or large events also showed up as sharp deviations. These findings suggest that both calendar-based trends and store-level characteristics are important drivers of demand.

Validate: Model limitations and risks

Although the model's short-term forecasts align well with historical data, there are limits to its reliability. It does not consider external influences such as weather events, economic conditions, or national holidays. This makes it vulnerable to sudden changes in consumer behavior or operational disruptions. The model's assumptions also rely on patterns from the past continuing into the future, which is not guaranteed. Forecast variance was high, which reflects the unpredictable nature of real-world sales. Additionally, because the model uses total store sales rather than product-specific data, it may miss underperformance in certain areas. Metrics like

log-likelihood and AIC are useful when comparing different models, but they should not be treated as guarantees of accuracy without regular revalidation.

Extend: Strategic recommendations

The patterns and risks identified in the model suggest several steps store managers can take. In the short term, staffing and inventory should be adjusted to match the forecasted increase in demand heading into weekends. Over the next month, store managers could test promotions tailored to their store's sales patterns, especially in more volatile locations. Looking further ahead, there is value in expanding the model to include outside variables like holiday schedules or local economic conditions. Breaking forecasts down by product category would also allow for more precise inventory control. These actions can improve both day-to-day operations and longer-term planning.

Action Plan

1. Adjust staffing based on weekly forecast patterns.

- Labor schedules should align with high-volume days, especially Friday through Sunday. This ensures sufficient coverage without overstaffing during slower periods.

2. Manage inventory in line with predicted demand.

- Inventory levels should be increased in advance of expected sales peaks. Stores with more volatile demand should maintain a slightly higher buffer to avoid stockouts.

3. Run localized promotions based on historical trends.

- Store managers should test targeted discounts or product campaigns in locations with more unpredictable sales. Reviewing short-term performance will help identify which approaches drive the most value.

The effectiveness of these steps can be tracked through a few key indicators. For staffing, the labor cost to sales ratio should stay within a targeted efficiency range. For inventory, the goal should be to keep stockout rates below two high-demand periods, especially on weekends. For promotions, success can be measured by comparing daily sales during promotional periods to baseline sales from similar days without promotions. An uplift in revenue from customer traffic would indicate that the campaign was effective. Monitoring these indicators regularly will help managers refine their strategies and respond quickly to changing sales patterns.