



Forecasting Daily Sales of Perishable Foods to reduce spoilage

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SPOILAGE OF VEGETABLES CAN BE REDUCED BY ACCURATELY FORECASTING SALES ON A DAILY BASIS

Business Goal



Exotic Vegetables

- Yellow/Red Capsicum
- Broccoli
- American Corn

Beans

- French Beans
- Broad Beans
- Peas



Typical Product
Margin: 25%+

Assumption:

Cost of Over-stocking: 100%

Cost of Under-stocking: 10%

FORECASTING DAILY SALES FOR THE ENTIRE NEXT MONTH ENABLES HEALTHY RELATIONSHIPS WITH SUPPLIERS

Data Mining Goal



- a) Use data for the past year to generate a **daily forecast** of vegetable supplies for the **next 30 days**
- b) **Update this model every month** to factor in the errors that affected the model last month

SALES ON EACH DAY HAVE A DAY OF WEEK SEASONALITY AND IS AFFECTED BY THE PRESENCE OF A HOLIDAY IN THE WEEK

Data

Output Variable

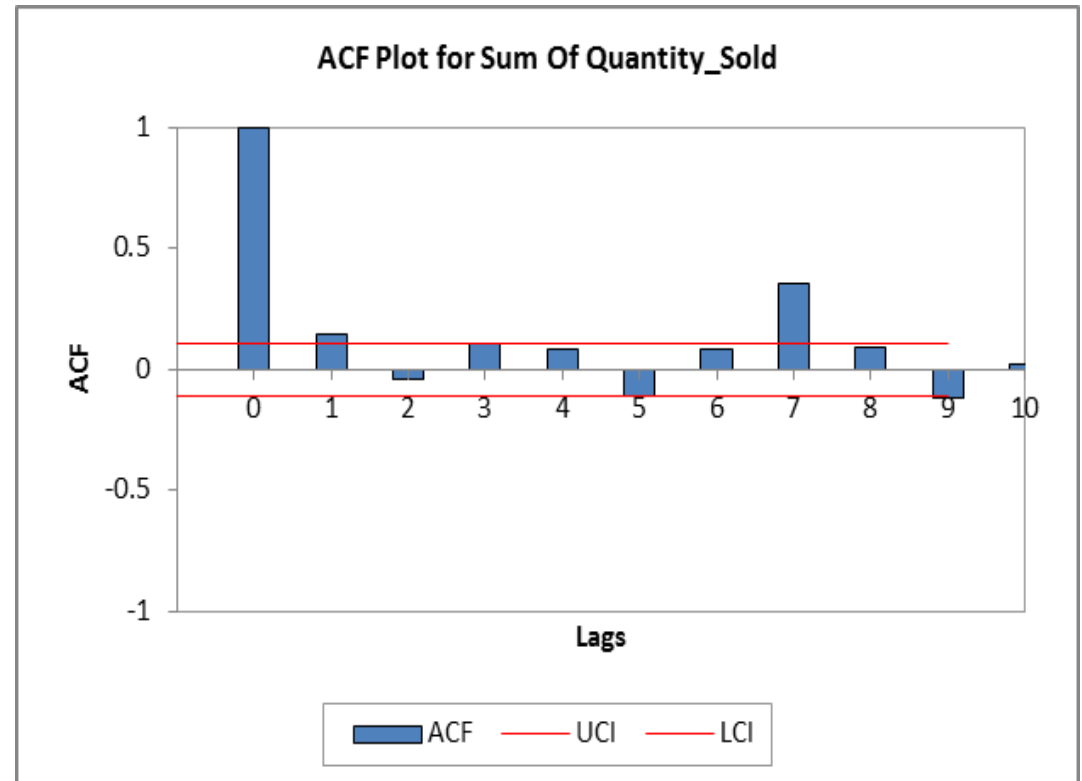
- Quantity sold on Time t

Input Variables

- Sales on Time $t-7$
- Dummy Variable for Holiday

Model Selection parameter

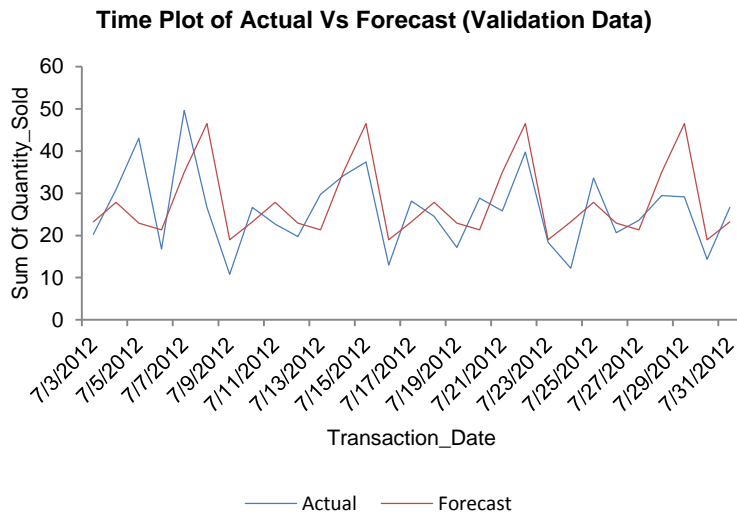
- Cost ($Y_t - Y_t^{\wedge}$)
 - 100% CP for overstocking
 - 10% CP for understocking



IN A TWO STEP PROCESS, WE FIRST USED A HOLT WINTER MODEL WITH NO TREND AND THEN, A LINEAR REGRESSION ACCOUNTING FOR HOLIDAYS

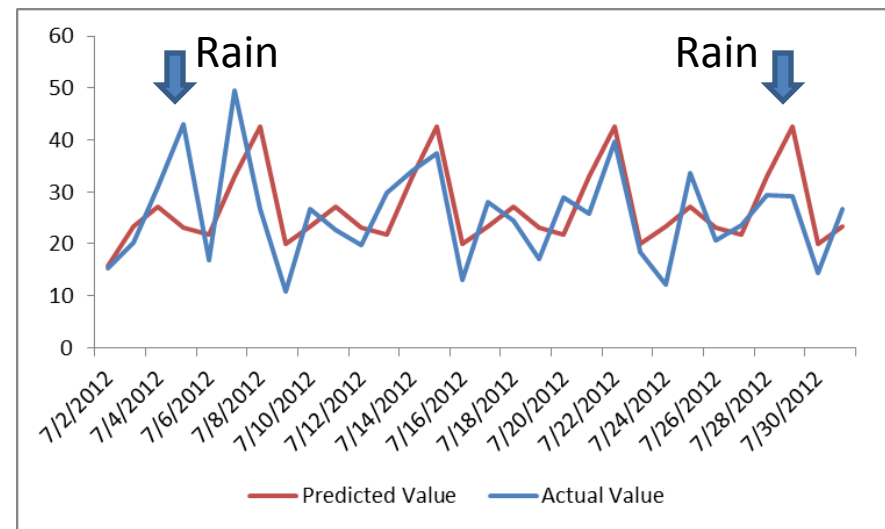
Model for Exotic Vegetables

Step 1: Holt Winter Model, No Trend, Period 7 for Exotic [Month 1]



MAE	6.88
RMSE	8.59

Step 2: Linear Regression using the forecast and relevant Holidays (not weekends)

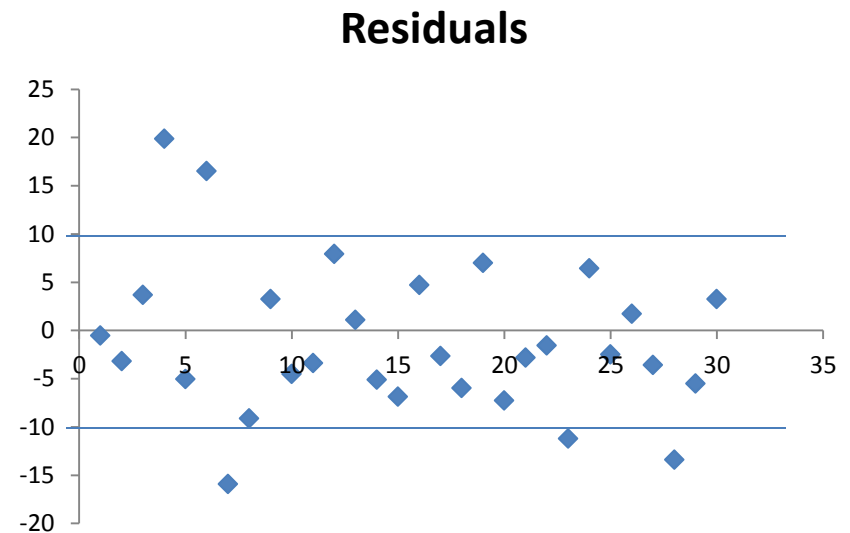
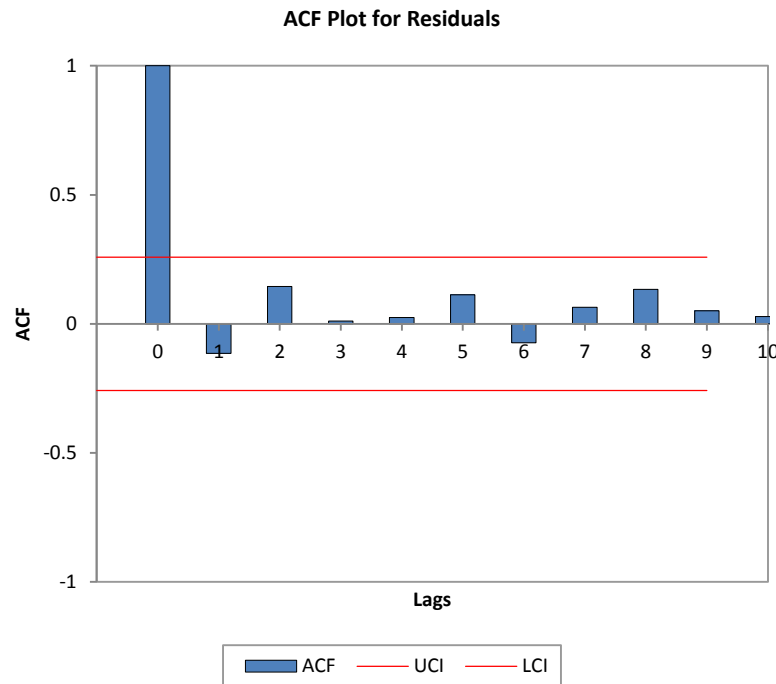


MAE	6.18
MSE	7.78

Naïve Benchmark (Lag 7 days)	MAE	11.39
	RMSE	15.05

RESIDUALS FROM THE MODEL SHOW NO PARTICULAR PATTERN OF SEASONALITY OR TREND AND JUST DISTORTED BY EXTRAORDINARY EVENTS

Insights



INSIGHTS

- Day of Week seasonality:** Sales are highest on Sundays followed by Saturdays and Wednesdays
- Holidays:** Middle of the week holidays can result in an increase in the quantity sold in the particular week
- Rainfall:** Modeling rainfall data can help improve predictive ability of the model
- Spoilage costs:** High demand volatility translates to high business risk and forecasting models should penalize overstocking