Retail Shelf Space

19.1)

I would first focus on A/B testing as explained in the lectures. I will allocate different shelf space for the same product in two different stores and measure the sales over a period of time. I will make sure that other factors outside of the shelf space are same in both the stores. To me this would be an effective approach to test the hypothesis that more shelf space generates more sales.

Shelf Space:

Before deciding the shelf space for a product, we have to know the demand for that product. To identify the demand, we can use a Linear Regression model.

Given:

- Product name
- Product SKU
- Category
- Perishable/Grocery
- Normal good or inferior good
- Product manufactured date
- Product expiry date
- Region
- Country
- State
- City
- Store ID
- Population
- Year
- Month
- Day
- AM/PM
- Median income
- Median family size
- Demand/Sales (units)

Model:

Before we fit any model to the above data, it would be good to perform appropriate variable selection methods such as stepwise, Lasso regression to determine the most important variables. Also, as shown above there are a few categorical variables, so it would be good to use one-hot encoding or similar techniques to get the data ready for Linear Regression.

To:

The obtain the demand for any product by the region all the way down to the city and store level.

Clustering:
Once we have the demand by product it would be good to cluster products to see which ones are related to each other i.e., identify the complementary products and put them in one cluster.

Given:

- Product name
- Type
- Category – Grocery/Vegetable/Fruit/Snacks/Beverage
- Form – Liquid/Solid
- Product bought together – 1
- Units of the complimentary product - 1
- Product bought together – 2
- Units of the complimentary product - 2
- Product bought together – 3
- Units of the complimentary product - 3
- Perishable
- Shelf life (days)
- Primary use
- Region
- Country
- State
- City
- Population
- Sales/Demands (units)

Model:

K-Means clustering algorithm. Perform trial and error for varying k values.

To:

Group similar products together i.e., group products that are complementary to each other.

Optimization:
The next step is to determine the optimal shelf space that is required to cater to the demand.

Given:

- Product
- Demand
- Price/quantity
- Time to replace/replenish the shelf space
- Cost to replace/replenish the shelf space
- Time to procure units
- Cost to procure units
- Shelf space in sq. ft for 1 unit or say 100 units
- Shelf space - units
- Shelf life (hours)

Model:

Optimization model.

Variables: Shelf space for each product in terms of units.

Constraints: Total shelf space must be less than the physical footprint for that location, cost to replace the shelf space should be less than the budget, shelf space for a product should be greater than the minimum required, shelf space for a product should be less than the maximum, time to replenish the shelf space should be less than a certain number, the total shelf space on any given day should be greater than the demand for that product on that day.

Objective function: Maximize the profit/sales

To:

Find the optimal shelf space in terms of quantity (units) that would maximize the profits/sales. Specifically, the results would be like 500 units of Pepsi, 500 bags of Lays chips, 100 boxes of cereal and 50 cans of 1-gallon milk and so on.