Guided Capstone Project Report

How should Big Mountain Resort set its ticket price to increase this season revenue by 10%?

Abstract:

The objective of this project was to develop a methodology to increase Big Mountain Resort revenue by predicting an accurate value of its ticket price and reducing the operational cost. Since the number of features available in the resorts and their location affects the ticket price, it was modeled considering the competitive market price and the number of facilities available. Analyzing data from 330 resorts in the US, linear and random forest regression models were trained. The random forest regression model was found better than the linear regression model. The model predicted Big Mountain resort ticket price to be $94.22 $\pm$ 10.39 based on its features, a price higher than the current price of $81. The revenue can be increased by 10% setting a ticket price of $89.40.

Introduction:

Big Mountain Resort, a ski resort located in Montana, suspected it is not collecting enough revenue considering its position in the market and the number of facilities available within it. The annual revenue collection stands at 141.75 million dollars with an assumption that 350,000 customers visiting the resort purchases five tickets at the price of $81. Recently, it installed a chair lift that costs 1.54 million dollars per season. It wants to increase its revenue by seeking guidance on selecting a better value of their ticket price or reducing the operational cost without undermining the ticket price. Thus, it provided data having information on 330 resorts in the US to develop a pricing model for the ticket price.

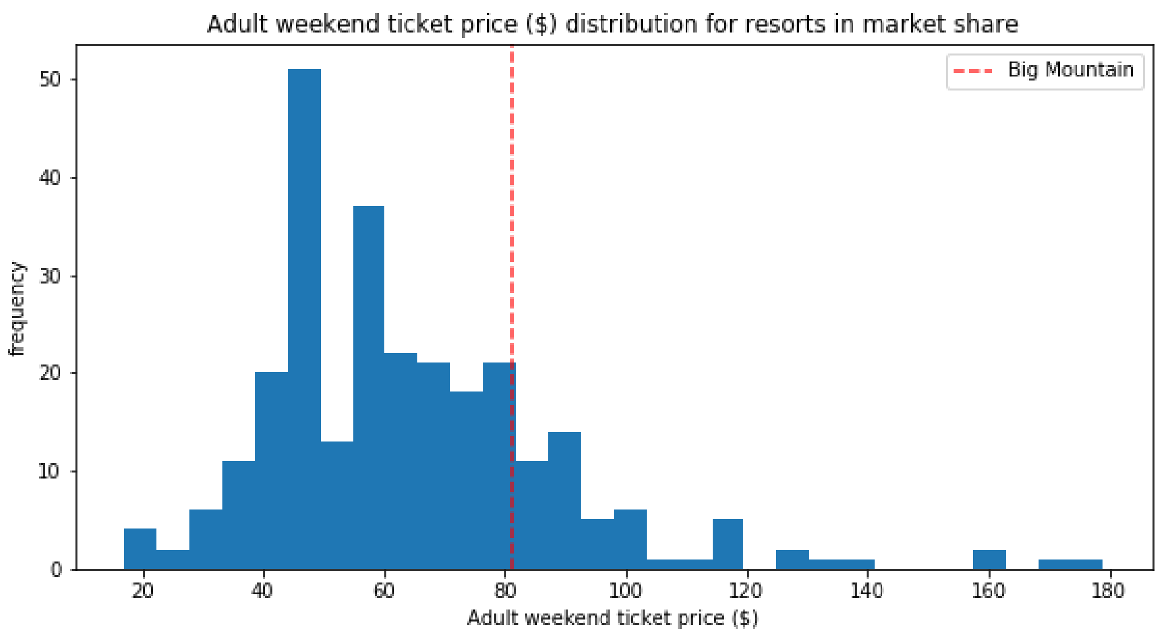

Figure 1: Distribution of ski resort ticket price on weekend. The Big Mountain Resort price is highlighted with dotted vertical line.

Data analysis:

While analyzing the data, 27 features were describing the resort information with two features, AdultWeekday and AdultWeekend, reporting the ticket prices. As the ticket price for weekdays and weekends remained the same in Montana, AdultWeekend having fewer missing values was selected as the attribute for ticket price modeling dropping AdultWeekday. Also, the feature fastEight having half the missing values and the rows missing AdultWeekend were excluded. Additional details providing the State's population, and the area was merged to have state summary statistics. The ticket price of Big Mountain Resort was observed at $81 which lies at the intermediate range in the ticket price distribution of all ski resorts.

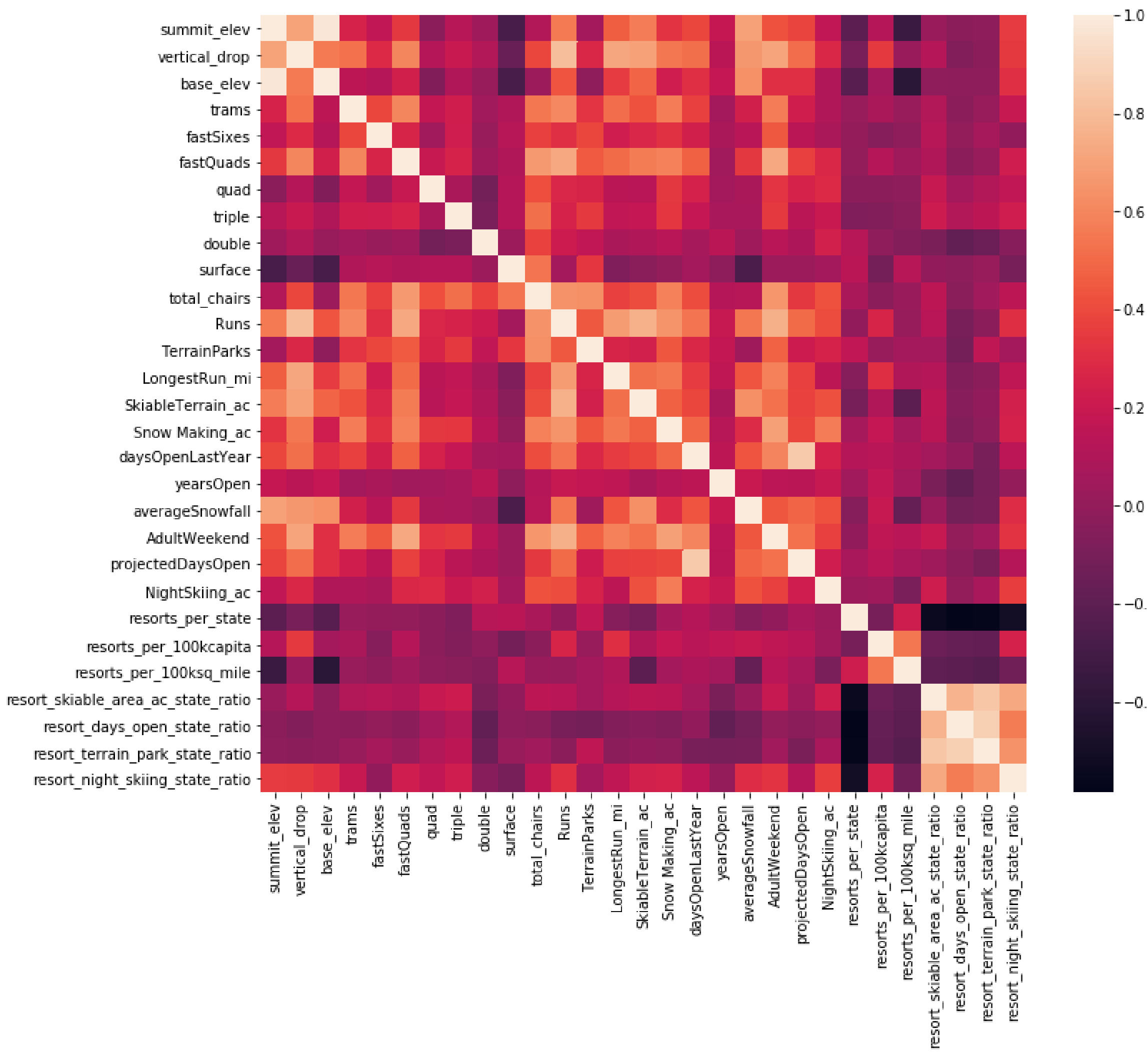

Figure 2: Ski resort feature correlation heatmap. AdultWeekend ticket price shows high correlation with vertical drop, fastquads, total chairs and runs.

The ticket price exhibited a high correlation with the features such as vertical drop, fast quads, runs, snow making ac, runs, total chairs while constructing the correlation heat map (Fig.2). These correlations were also observed with the scatterplot of ticket prices against the other features. The vertical drop appeared the most significant feature that raises the ticket price during exploratory data analysis (EDA).

Data modeling

To build a pricing model, data were divided into training and test sets with a size ratio of 7/3. When the ticket price was simply assumed as the average ticket price, the ticket price was observed to be off by around $19. A linear model based on all remaining features were developed to have a better approach. The training was performed with two models:- linear regression and random forest on datasets imputed with mean and median separately and scaled with zero mean and unit variance.

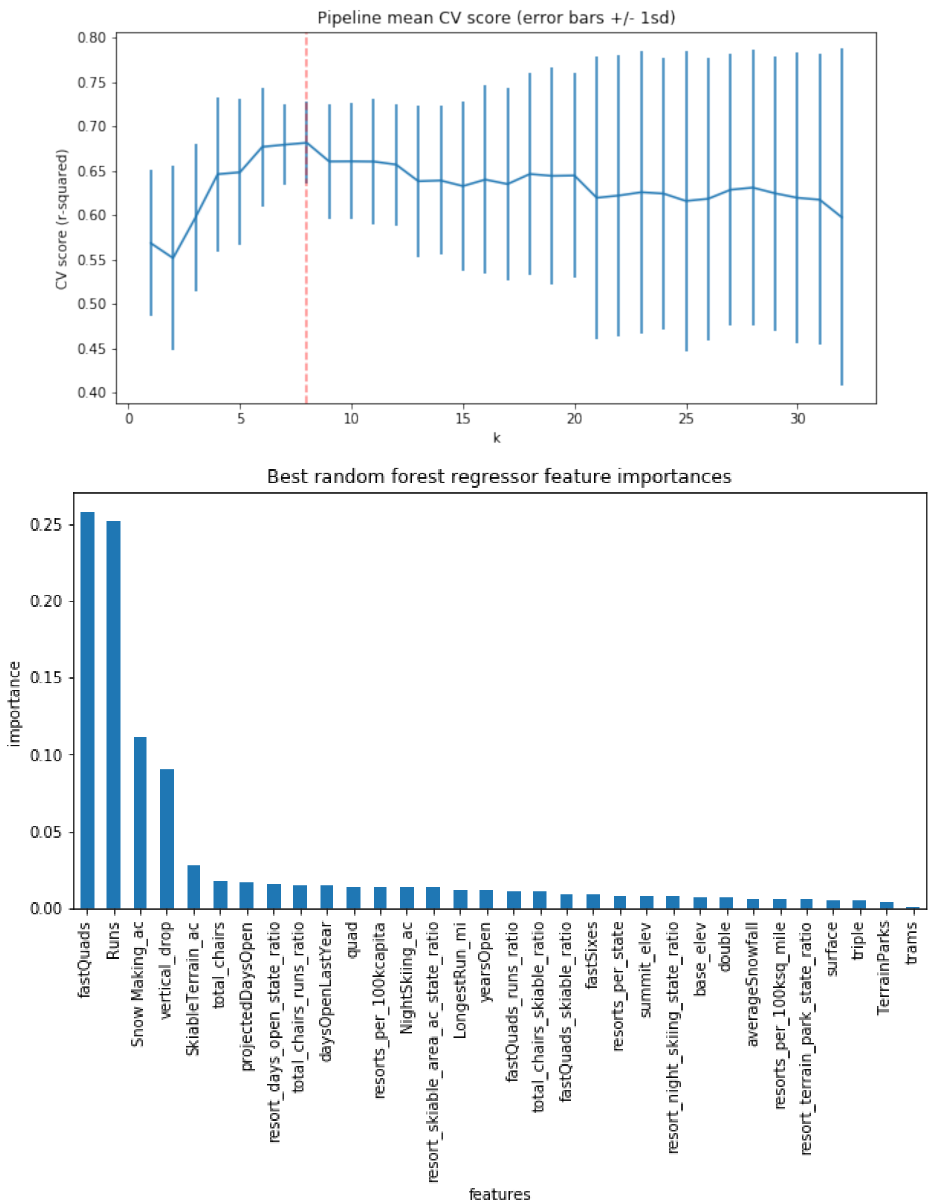

Figure 3: Best features with a) linear and b) random forest regression models.

The linear regression model was indifferent to imputing missing values with mean and median, respectively. It reported eight best features with a vertical drop as the feature having a significant impact with five-fold cross-validation (Fig 3). This observation was indeed the same as observed in EDA. The other attributes were trams, total chairs, fastQuads, Snow Making ac, SkiableTerrain ac, Runs, and Longest Run mile.

The random forest model predicted the median as the best strategy for imputing and no importance of scaling when trained with five-fold cross-validation. It reported improved r-squared scores (0.71) than the linear regression model (0.66). The dominant features with random forest were fastQuads, Runs, Snow Making ac, vertical drop, and total chairs, which also comes as a forefront in the linear regression model (Fig 3).

Pricing model and prediction:

Choosing the random forest model as the best of two employed models, ski resort data was again trained, excluding the target data, Big Mountain Resort. The training was performed with the pipeline using the median as the imputing strategy. This model predicted Big Mountain Resort ticket price to be $94.22 with a mean absolute error of $10.39

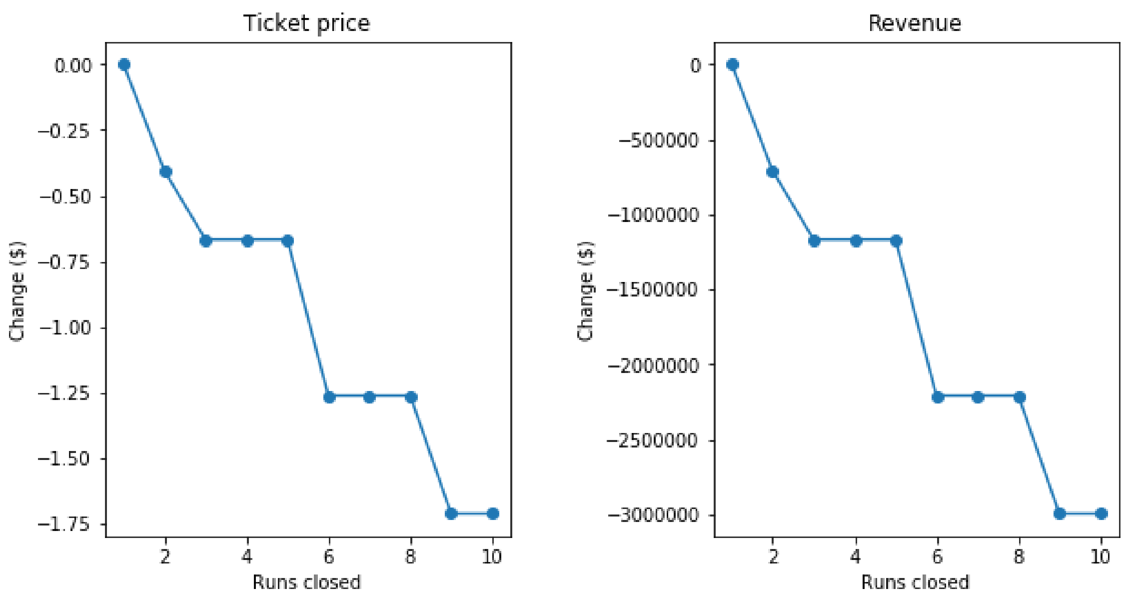

Figure 4: Model prediction of change in the ticket price and the revenue on closing the number of runs.

As the current ticket price was $81, the ticket price can be increased even concerning the mean absolute error. The increase in the ticket price is justified as Big mountain resort lies at a higher rank while comparing features such as vertical drop, snowmaking area, a total number of chairs, fast quad, runs, longest runs, trams, and skiable terrain area compared to other resorts.

The model predicted that the ticket price and the total revenue do not change on closing 1 run, but it decreases as the number of runs closed is higher . The closing of 3 runs is equivalent to the closing of 5 runs as there is no change in the ticket price (Fig 4).

By adding 1 run, 1 chair, and vertical drop by 150 feet, the ticket price can be increased by $1.99. This will account $3,482,500 (2.45%) more in revenue, assuming each individual of

350,000 customers visiting the Big Mountain buys at least 5 tickets. As an additional chair's operational cost accounts $1,540,000, this approach is suitable for increasing the revenue. The resort will not incur losses even if each customer buys at least 3 tickets. Adding 2 acres of snow making capability in this option is futile as the ticket price prediction remained unchanged. Moreover, the model does not support the addition of 0.2 miles of the longest run and 4 acres of snow making capability in increasing the ticket price.

Conclusions and discussions:

The pricing model predicts the ticket price for Blue Mountain Resort at $94.22±10.39. Thus, the ticket price can be set anywhere in the range from $83.83 to $104.61. These prices are certainly higher than the current price of $81, implying that the ticket price can be increased. If the ticket prices are set either $83.83 or $94.22, the revenue collection will be increased by $146,702,500 and $164,885,000, respectively, with the assumption of five ticket purchase by 350,000 customers visiting the resort. To increase the revenue by 10% in the current revenue (141.75 million dollars) , the ticket price should be set at $89.40.

The operational cost can be reduced by closing 1 run as it doesn't produce change in ticket price and revenue collection. Addition of 1 run, 1 chair and vertical drop by 150 feet increases the ticket price by $1.99. This increases revenue by 2.45% ($3,482,500). This approach is also suitable in increasing revenue as the increase in the ticket price overcomes operational cost of 1 chair (1.09%, $1,540,000) by a factor of 2.

While comparing the ticket price of all states, the price of Big Mountain resort lies at the intermediate range. However, the current ticket price of $81 already lies at the peak in Montana. Thus, care should be taken while increasing the ticket price so that it doesn't have a negative effect on the customers.

The ticket price can further set by looking into the different combination of potential features such as run, chair, vertical drop, fast quads and snow making ac.