**Introduction**

The Big Mountain Resort, which is a ski resort in Montana, charges a premium price of $81 adult weekend price, which is higher than most resorts in its market segment. There is a additional $1.5M annual cost after the Big Mountain newly installed a chairlift. Therefore, the Big Mountain is looking for a proper adjustment of pricing and business strategy to increase the revenue at the end of the incoming ski season. The report is aiming to evaluate the price rationality, or possible investments needed for Big Mountain resort to increase its revenue by a price prediction model. A price model is generated by analyzing and comparing datasets of price and features from the nationwide resort in the market segment. The model states the current price has good support by the resort’s facility. However, increasing vertical drop, adding additional run or chairlift could be a good approach to increase both the ticket price by $1.99, as well as the annual revenue.

**Data**

A dataset of ski resorts is obtained from the Github repository of Springboard Guided Capstone Project. The data presents the price and resort facilities of each ski resort by states in the United States. Dataset of state population is implemented to the ski resort dataset for better analysis.

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 Methodology

There are 330 rows (resorts) and 27 columns in the data of ski\_resort\_data, including the Big Mountain Resort. Some columns were removed due to missing value or zero value, such as fastEight. Some suspicious data from columns “skiableTerrain\_ac” and “yearsOpen” is corrected and filtered out based on internet resources of related resorts and common sense. Rows of missing data from columns “weekday adult price” and “weekend adult price” are removed. Ski resort data is also filtered and cleaned up based on states and regions. Population of states is added into the dataset for further analysis with resort density. After data cleanup, there are 227 rows(resorts) and 25 columns remain.

The price of a ski resort is analyzed and evaluated on the data of price distribution by states. Since Adult weekend price and adult weekday price is the same in Montana, only adult weekend price will be taking account to the price predictive model. Ticket price varies based on states. However, it mainly seats in a range between $25 to $100 when we look at the price distribution by states. Majority of resorts have a higher adult weekend price than adult weekday price. Big Mountain is at the higher end of ticket price at its market segment while comparing to nationwide ski resort’s price data.  Since adult weekday prices and adult weekend prices are equal in Montana, only adult weekend prices will be considered for making the suitable price predictive model for the Big Mountain Resort.

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Figure 1 - Adult ticket price and adult weekend price of each state

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Figure 2 - Distribution of state average prices

By analyzing the correlation between specific features to pricing, some features are revealed as the key feature to ticket price determination. The heatmap suggested that there is a strong positive correlation between the price, vertical drop, snow making ac, and runs. Nationwide, the price also has a negative correlation with state population and density of resorts. The relationship between price and some features, such as “total skiable area”, “fast quads”, “chairs” and “resorts per 100 capital” area are the key features for the study and analysis of price modeling.

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Figure 2- Scatter plot of ticket price versus individual facility

After scaling and visualizing data with the PCA method, the dataset was 70/30 split into train/test sets for a price prediction machine learning model. Linear regression model was used as the first approach, which MAE value suggests the model has a $9 error. To address the possible overfitting issue, a pipeline was used to identify the best k-values for a Randon Forest Model. As result, “fastquads”, “runs”, “snow\_making\_ac” and “vertical\_drop” are the key features used to fit the Random Forest Model. By comparison, the Random Forest Model suggests less error and variance than the linear regression model.

The model was used to test some proposed scenarios, which are closing runs, adding chairlift, increasing vertical drop, extending the longest run or snow making ac coverage. The model revealed that closing more than two runs will significantly decrease revenue, and extending the longest run or snow making ac coverage do not make a difference on the revenue. However, adding additional chairlift or increasing vertical drop could allow the resort to increase the ticket price by $1.99.

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Figure 4 - Change of ticket price or revenue versus number of run closed

**Conclusion**

Big Mountain is currently charging a price of 81 dollars for a weekend adult ticket. The price is at the higher end in Montana state. But Big Mountain has a good support for its ticket price by the nation-wide competitive large snow making area, large number of runs (including one longest run), and a large skiable terrain area. It is not a good idea to close runs since it will significantly reduce the revenue if closing more than 2 runs. It is not recommended to increase the longest run or snow coverage area as there is no difference on the price predicting model, and it may even increase the cost. However, adding additional run, increasing vertical drop, and adding additional chairlift could be a good approach to increase the ticket price by 1.99 dollars, as well as the annual revenue. If the management team is still considering closing runs, they may consider comparing the reduced maintenance cost to the reduced income from tickets, and test the difference on total revenue after closing runs.