

Guided Capstone Project Report: Big Mountain Ski Resort

How do you run a profitable ski resort in 2024? Big Mountain Ski Resort, which is situated in the mountains of Montana, charges a higher-than-average price for tickets compared to other resorts in its market segment as its current strategy. However, because operational costs for Big Mountain have risen to over \$1.5 million per year after installing an additional chair lift, the resort is interested in re-evaluating its current ticket-pricing strategy and adopting a more data-driven one. Additionally, the resort is interested in potentially lowering its operational costs without lowering its current ticket price. Given these concerns, we seek to answer the following question: What amenities can Big Mountain bolster that would support its current ticket price, or an increase of it, in the upcoming resort season?

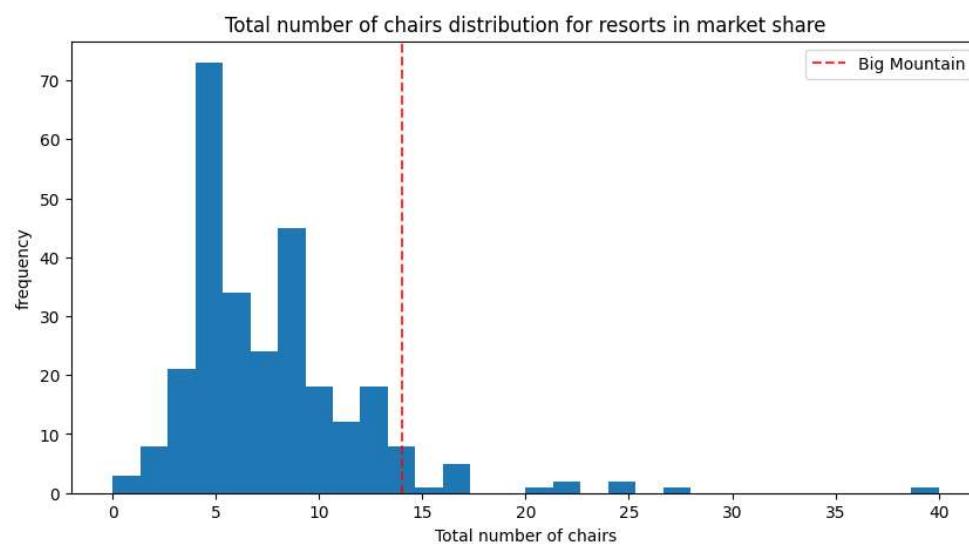
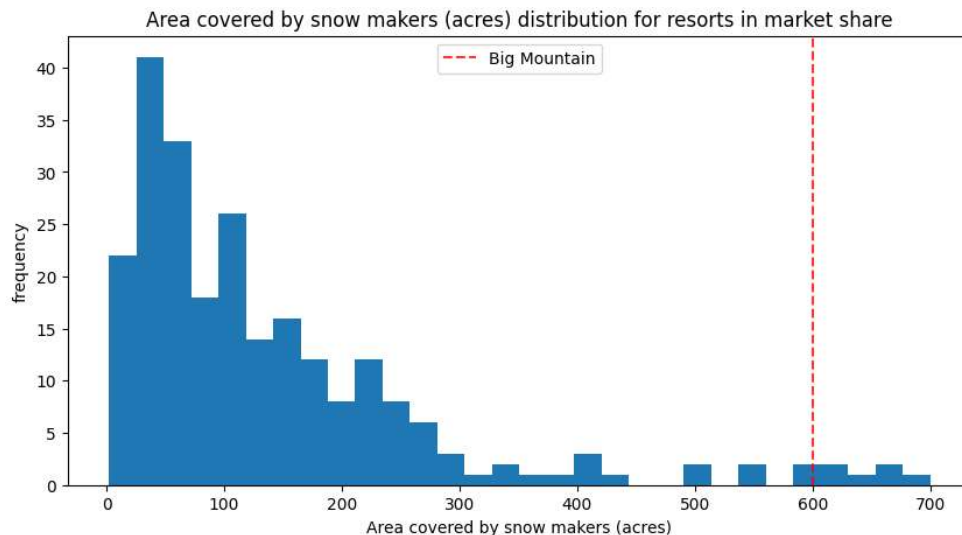
To predict the ideal ticket price for the resort, Big Mountain Resort's ticket prices will be compared to those of other resorts with similar facilities in its market segment. We began by cleaning our main data source, which is a single CSV file on ski resort data, `ski_resort_data.csv`, provided by the database manager for Big Mountain. Since we are aiming to answer the question of how Big Mountain Resort can adopt a data-driven pricing strategy that better reflects the value of its facilities, we removed any resorts that have no price data listed by from the dataset. After cleaning our data and removing any entries that would be of no use to the creation of our model, our CSV file, which originally had 330 rows, had 277 rows of useful data. We also analyzed weekday ticket prices versus weekend ticket prices for completeness and determined that weekend prices had the fewer missing values of the two. Therefore, we used weekend prices of tickets to predict ticket price.

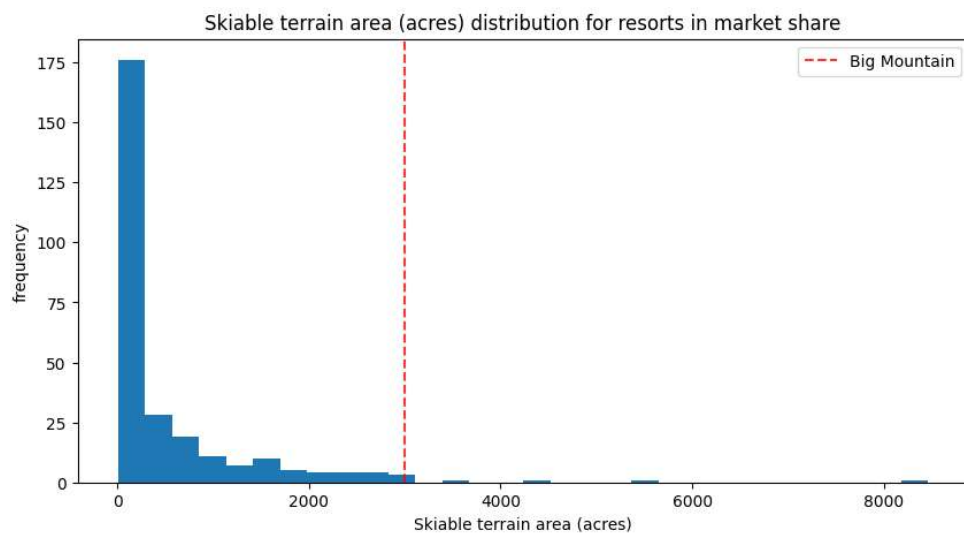
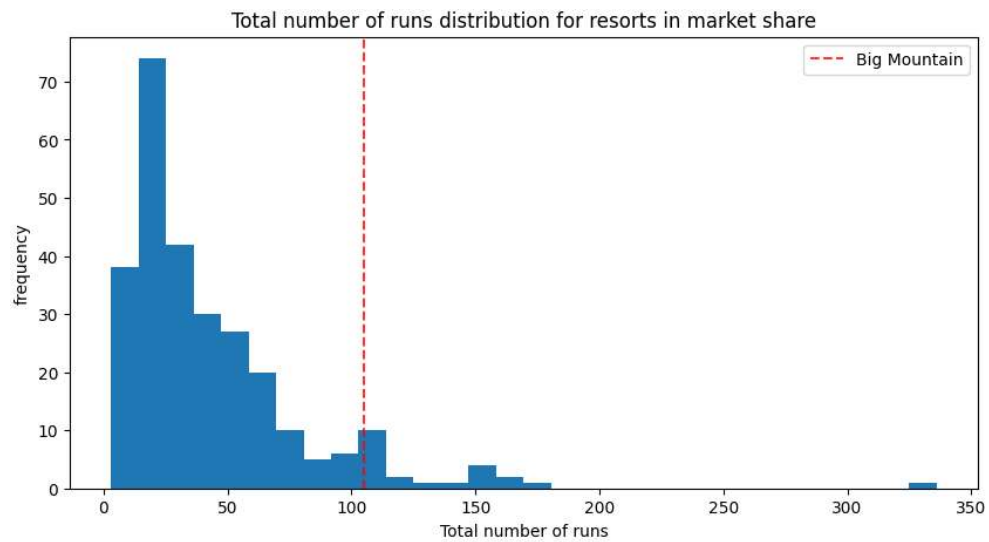
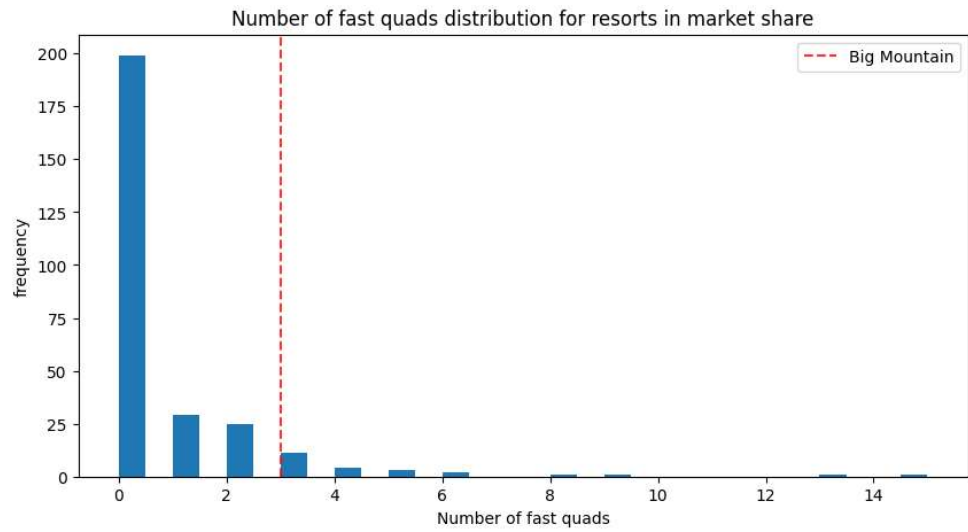
To determine which resort amenities that visitors value most, we explored the numerical features of our state summary data as they relate to ticket price. That is, we analyzed ticket price versus the number of resorts per state, state total skiable area, state total days open, state total terrain parks, state total night skiing, state population, and state area square miles. There was no obvious correlation between state and ticket price; however, we noticed that there was a strong positive correlation with ticket price and the number of vertical drops, as well as number of runs and total number of chairs. We also noticed an interesting relationship between price and number of resorts per 100,000 people in a state's population, which seems to reflect an underlying relationship between price and supply-and-demand: There is a high variability among ricket prices when there are fewer resorts serving an area. As the number of resorts per capita increases, price variability tends to decrease, while the price itself generally increases. The positive correlation between ticket price and number of resorts serving an area seems to indicate that these resorts exist in popular skiing areas with high demand.

To create our model, we used a random forest regressor. We previously tried a dummy regressor and a linear regression model. However, we found that the dummy regressor did no better as a predictor than simply taking the average price, and the linear regression model – while performing slightly better than the dummy regressor – still underperformed compared to the

random forest regressor. When model performance of the random forest regressor was tested against that of the linear regression model, we found that the random forest model had a lower cross-validation mean absolute error by almost \$1. It also exhibited less variability. To set up our random forest regressor, we defined the pipeline, which involved using a simple imputer with a strategy of median, a standard scaler, and setting the random state to 47.

We then used this model to predict our change in ticket price. Currently, Big Mountain charges \$81.00 for tickets. Our model supports a ticket price increase to \$95.87. Below are histograms that show Big Mountain's position, depicted as a red dashed line, compared to other resorts. We can see that there are many features that make Big Mountain competitive in its market sector, including its large snowmaking area, its high number of total chairs, fast quads, and runs, and its sizeable area of skiable terrain. Our model suggests that resort visitors place high value on these amenities and are willing to pay a premium to use them.



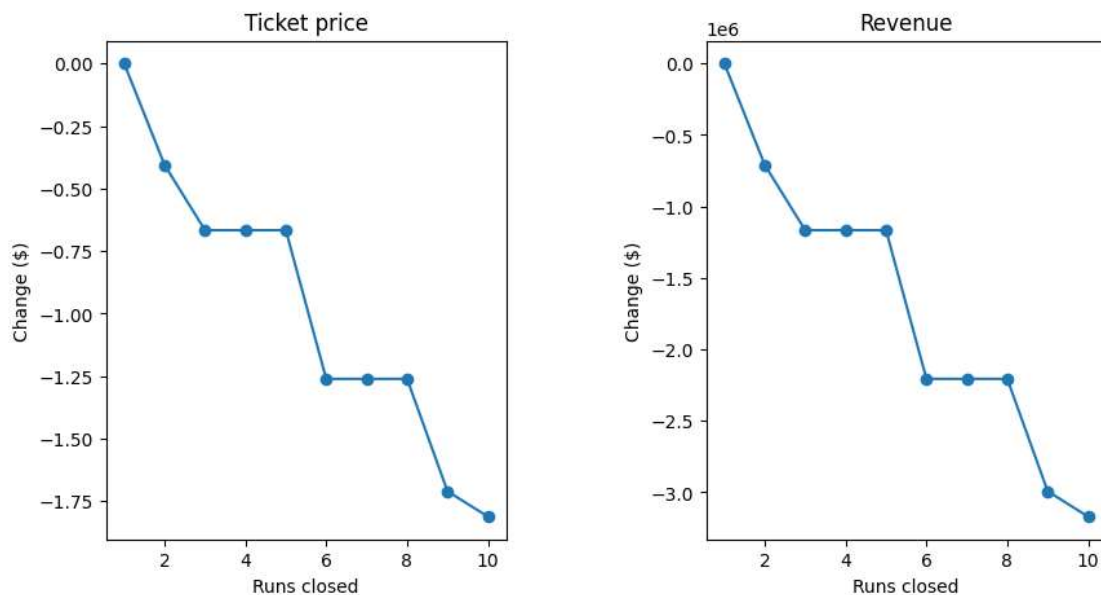


We also used this model to explore four different scenarios and how they might affect ticket prices and revenue:

1. Permanently closing down up to 10 of the least used runs. (This does not impact any other resort statistics.)
2. Increase the vertical drop by adding a run to a point 150 feet lower down but requiring the installation of an additional chair lift to bring skiers back up, without additional snow-making coverage.
3. Same as scenario 2 but adding two acres of snow-making cover.
4. Increase the longest run by 0.2 miles to boast 3.5 miles in length, requiring an additional snow-making coverage of four acres.

For each scenario, we assumed each visitor will buy five day-tickets on average.

The graphs below show our model's prediction for scenario 1. On the left, we compare the number of runs closed to ticket price, and on the right, we compare the number of runs closed to revenue. Scenario 1 suggests that ticket price, and subsequently revenue, generally drops with each successive run closure. There is a significant drop from closures 1 to 2, while there is no drop in from closures 3 to 5. There is another significant drop from closures 5 to 6, and once again, there is no drop from closures 6 to 8. After 8 closures, however, prices drop after each successive closure.



Scenario 2 supports a ticket price increase of \$1.99. This would result in a revenue increase of \$3,474,638 over the season. Scenario 3 supports the same ticket price and revenue increase as scenario 2, suggesting that the additional two acres of snow-making coverage would make no difference. Scenario 4 suggests no increase in revenue or ticket price.

Since Big Mountain is also interested in streamlining operational costs, we were hindered by the fact that we do not have any data on operational costs from other resorts (including Big

Mountain). We acknowledge that there are various other operational costs involved in running a ski resort, including staffing costs, utilities such as electricity and water, maintenance and repair costs, insurance, food and beverage costs, equipment rental and purchase, marketing and advertising expenses, property taxes and government fees, depreciation and amortization of assets. Having this cost information at hand would be useful in creating models for streamlining operational costs.