Nicholas Brower
Springboard DSCT – May 2022
Unit 6.6.3 - Guided Capstone Project Report

Data-Driven Business Strategy for Big Mountain Resort

Big Mountain Resort (BMR) is a skiing destination in Montana located near Glacier National Park and Flathead National Forest. Until this year, the company maintained a premium pricing strategy for admission to the resort, charging a fixed amount above the average ticket price in its market segment. BMR recently installed a chair lift to improve visitor distribution across its 105 trails. This investment increased expected operating costs by $1.5 million, prompting management to reconsider business strategy. BMR intends to increase net income by raising ticket prices or reducing operating costs. An executive consensus led to the involvement of a Data Science Team (DST) to help address these issues. The aim of this partnership is to devise and implement a more data-driven business strategy. This strategy is to be built on customer information provided by BMR and a dataset of resorts considered part of the same market share.

At present, Big Mountain Resort charges $81 per adult weekend admission to the resort. On average, BMR receives 350 thousand visitors each season. On average, these visitors each purchase 5 tickets. Assuming these values are constant, BMR can expect 1.75 million ticket sales in the upcoming season. Assuming no other changes, BMR can maintain the same profit margin as last season by increasing ticket prices by $0.88. This price increase of less than 1.1% covers the $1.54 million increase in operating costs. Conventional wisdom suggests this price difference would be negligible to consumers, provided $81 is the ticket price charged last season (as opposed to a newly set price that is higher than that of last season).

The Data Science Team received a dataset covering Big Mountain Resort and 329 other resorts considered part of the same market share. This dataset provides information on various properties, including region, state, summit elevation, average annual snowfall, and vertical drop. It also includes data concerning specific resort features, including the types and quantities of various lifts, the total area of lift-accessible terrain, the total number of runs, the total area covered by snowmaking equipment, and the total area made available for night skiing. After cleaning and organizing this dataset, the DST proceeded with analysis.

The DST performed a variety of analytical tasks to determine the relationships between ticket price and resort features for resorts in BMR's market segment. The goal of these tasks was to establish a ticket price model representing the combined market value of various resort features. The application of this model to BMR would allow the company to set a ticket price based on what consumers are likely willing to pay, given BMR's specific resort features.

Testing the influence of locality on ticket price, resorts were grouped by state. Ratios of various features to state aggregates were compared against ticket prices with inconclusive results. A resort's state has no consistent relationship with ticket price for resorts in this market segment. Other features, however, seemed to vary more consistently with ticket price. A correlation matrix plotted as a heatmap helped visualize relationships within this dataset (fig. 1). Ratios of lifts to skiable area and fast quads to total runs allowed some insight into potential relationships between a resort's visitor distribution capacity and its ticket price.

The Data Science team constructed three ticket price modeling algorithms. Data was split into training and testing partitions. The first, baseline, model consisted of a simple average. The average adult weekend admission for resorts in the provided dataset is roughly $65. Subsequent models were compared by accuracy relative to mean ticket price. The second and third were linear regression and random forest models. A range of imputation and feature

scaling options were tested with these models. Of all tested combinations, a random forest model proved most accurate. The DST fit this model to the entire dataset and performed the calculations necessary to render its final recommendations.

In this model, the resort features most closely tied to ticket price are fast quads, total runs, total area covered by snowmaking equipment, vertical drop, and total skiable area. A bar plot illustrates the relative impact of these features on modeled ticket prices (fig 2). In terms of these features, Big Mountain Resort compares favorably with other resorts in its market segment. A series of distribution plots helps illustrate these comparisons and depicts BMR's place among competitors (fig 3).

Modelling suggests Big Mountain's assets and existing facilities could support higher ticket prices, assuming ticket prices in the provided dataset are a reliable indicator of the combined market value of various resort features, and resorts in the dataset set their prices accordingly. Using this model, the predicted supportable ticket price for Big Mountain is $95.87. This model carries a mean absolute error of around $10.39 and a standard deviation of 1.47. Conservative estimates based on this model suggest Big Mountain's facilities can support a base ticket price increase of $1.54 to $4.47. The DST recommends increasing ticket prices by $3 per ticket. This price increase of 3.7% is roughly 1% higher than the average annual inflation rate of the last 10 years (excepting 2021-2022). A price increase of this size is unlikely to affect BMR's perceived cost in the eyes of the average consumer, and would increase revenue by $5.25 million this season.

Big Mountain Resort requested separate analysis of four investment scenarios. Scenario 1 involves closing up to ten of the least used runs. Using the ticket price model described above, the DST estimates no change in the market value of Big Mountain Resorts tickets when closing a single run. Closing 2 or 3 runs results in reductions of $0.30 or $0.75, lowering revenue by $0.7 or $1.25 million. The DST recommends closing only one run this season. If operating costs per run are unknown, the DST recommends investing in better record keeping.

Scenario 2 involves adding a run, increasing the resort's total vertical drop by 150 ft, and installing an additional chairlift to serve this run. These combined investments raise the expected value of tickets by $1.99, increasing projected seasonal revenue by $3.47 million. Assuming a $1.5 million increase in operating cost from the additional lift, this raises net income by $1.97 million. For a lift that costs $20 million or less and operates for at least 25 years, this may be a good investment, provided Big Mountain Resort can make a substantial down payment on any loan required to facilitate this investment. If cost analysis agrees, the DST recommends incorporating the changes proposed by scenario 2 in Big Mountain Resort's five-year plan.

Scenario 3 involves the same changes as those proposed by scenario 2, but it adds additional snowmaking equipment to increase total coverage by 2 acres. This did not increase modeled ticket price over that of scenario 2. The DST recommends against adding additional snowmaking equipment.

Scenario 4 increases the longest run length by 0.2 miles and increases snowmaking coverage by 4 acres. The initial investments and increased operating costs associated with these changes are unknown, but ticket price modelling suggests they are irrelevant to this scenario. These changes had no effect on modeled ticket price.

In summary, the Data Science Team recommends increasing ticket prices by $3, closing the least used run, and adjusting investment strategy to focus on the features most closely related to ticket prices according to its ticket price model. The DST agrees that some of this increased income is best invested in improved record keeping, cost analysis of lift installation, and additional market research. Combined, such investments will improve the long-term profitability and sustainability of a data-driven business model.

Figure 1: Feature Correlation Matrix - Heatmap

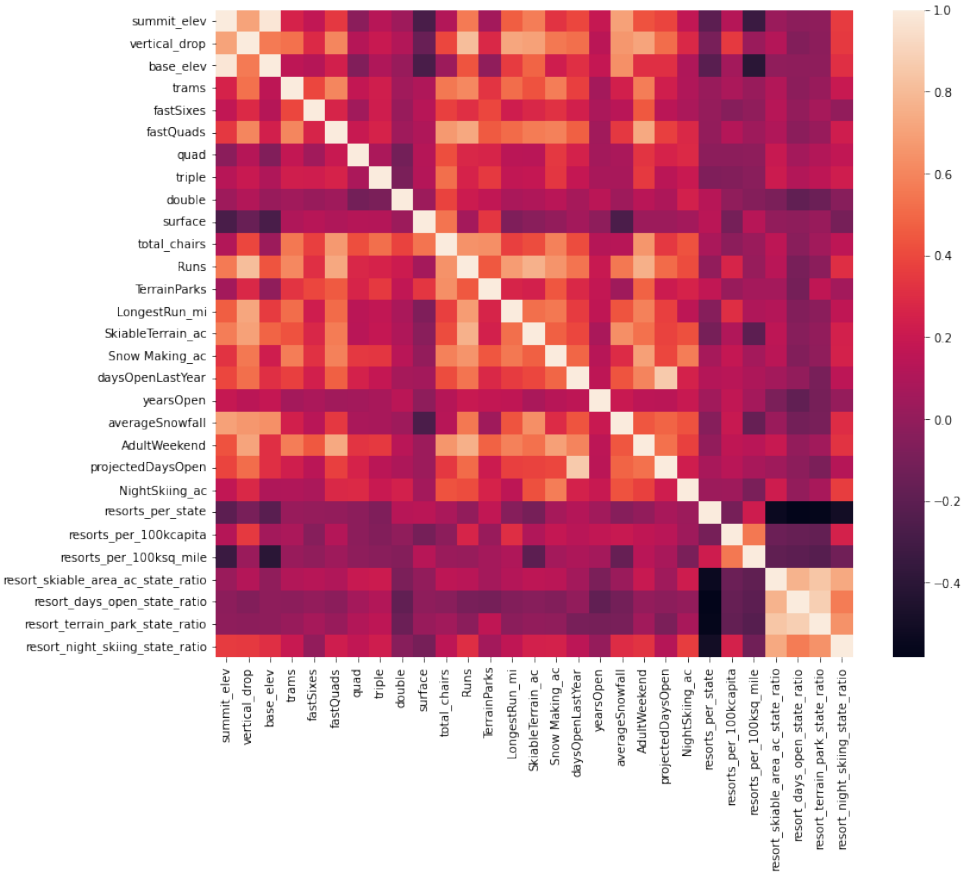

Figure 2: Features by Relative Impact on Modeled Ticket Price

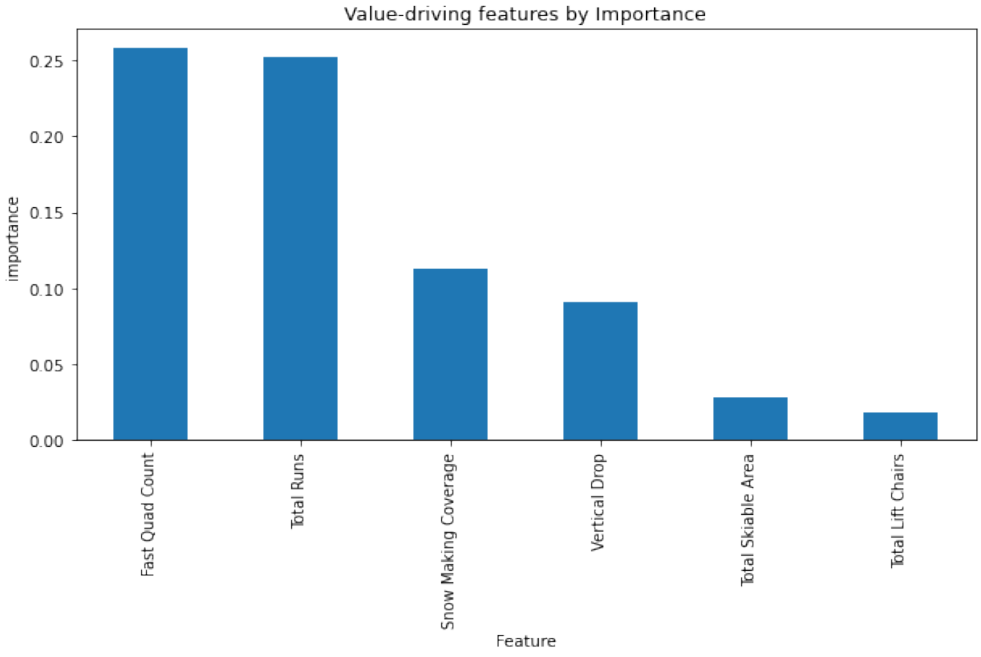

Figure 3: Big Mountain Resort vs Competitors: Feature Distributions