**Executive Summary**

* The selected model suggests ticket price is driven by what Big Mountain is among the best at - snow making acreage, total skiable terrain, fast quads, vertical rise, and longest run length.
* As such, the selected model suggests the market can support a ticket price of ~$96 (MAE = ~$10).
* Every dollar in ticket price increase from $81 is expected to contribute ~$1.75 million for operating costs of the new chair lift and the bottom line.
* With respect to the potential scenarios for improving the bottom line, the model suggests the second of potential scenarios - increasing vertical drop with the installation of an additional chair lift - is worth further consideration. It would justify a further increase of ticket price of ~$2.
* Finally, the selected model suggests that the business could also further consider closing the least used run to start.

**Problem Statement**

Given its facilities, what are appropriate weekday and weekend ticket prices for Big Mountain Resort in the 2021-2022 season? Further, what are two high impact changes that could be implemented in the 2021-2022 season that would either reduce costs or justify higher ticket prices?

**Introduction**

Big Mountain Resort is a ski resort located in Montana that offers spectacular views of Glacier National Park and Flathead National Forest. Big Mountain Resort has recently installed an additional chair lift that increases their operating costs by $1,540,000 this season. While the resort's pricing strategy has been to charge a premium above the average price of resorts in its market segment, there is a suspicion that Big Mountain is not capitalizing on its facilities as much as it could. Basing their pricing on just the market average does not provide the business with a good sense of how important some facilities are compared to others. This hampers investment strategy. The business wants some guidance on how to select a better value for their ticket price and identify changes that may either cut costs without undermining the ticket price or will support an even higher ticket price.

**Methods**

With the original data set of 330 rows of ski resort data, the following steps were conducted:

1. Identifying areas of missing data
2. Investigating where the resort of interest fits into the overall data
3. Reviewing distributions of columns with histograms to identify anything unusual

This was reduced to 277 rows primarily due to lack of price data. One row was removed due to the resort being "2019" years old. The fast eights column was removed due to lack of data (and lack of >0 entries where data was present). One entry, Silverton Mountain had unusually enormous skiable terrain, which was assumed to be a typo and was updated from doing a google search. Further, state population and state area was incorporated into the original dataset.

A handful of target features, such as skiable terrain and number of runs, were identified for helping to predict ticket price. However, state did not suggest a relationship with ticket price, so all data were considered together for model evaluation. Three models were evaluated in this notebook - the mean model, a linear model, and a random forest model.

The mean provided a baseline comparison, coming in with a MAE of ~19. The linear model was evaluated with both median and mean imputed values, with MAE being improved upon the mean model to ~9 for both impute approaches. Refining the linear model using k best features identified 8 features performed the best, and this brought the MAE to ~12.

The random forest model was evaluated using median imputed values and standard scaling, and its MAE came in at ~9. Cross-validation provides consistent CV values with a low standard deviation. It also identified fast quads, number of runs, snow making acreage, and vertical drop as important features. Because the random forest model has a lower cross-validation mean absolute error by almost 1 and exhibits less variability, it has been chosen as the model moving forward.

**Results**

Currently, Big Mountain charges $81 per ticket. While this is on the high end for Montana, Big Mountain does justify it by also providing some of the best facilities in the state. In fact, the model suggests the market can support a ticket price of ~$96. As Figure 1 illustrates, this ticket price can serve as both weekday and weekend ticket prices. Weekday and weekend ticket prices in Montana have indistinguishable distributions, especially when compared with other states.

Chart, bar chart

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Figure 1: Bar plot comparing weekday ticket prices and weekend ticket prices in their respective states.

Additionally, the selected model demonstrates that the factors that drive the ticket price the most are those that Big Mountain provide among the best of. The selected model suggests ticket price is driven by what Big Mountain is among the best at - snow making acreage, total skiable terrain, fast quads, vertical rise, and longest run length. The top ten most important features in the selected random forest model are illustrated in Figure 2.

Chart, bar chart, histogram

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Figure 2: Bar plot of the top ten most important features in the selected random forest model

Every dollar in ticket price increase is expected to contribute ~$1.75 million for operating costs of the new chair lift and the bottom line. With respect to the potential scenarios for improving the bottom line, the model suggests the second of potential scenarios - increasing vertical drop with the installation of an additional chair lift - is worth further consideration. Since the model suggests that closing the first run has no impact on ticket price, the business could also consider closing the least used run to start. This impact – or lack thereof – is shown in Figure 3.

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Figure 3: Projected effect on ticket price and subsequent revenue by closing 1-10 runs

**Future Work**

More operating costs could provide value in future analysis, especially in considerations with what to change in the upcoming season. For example, what's the cost of operating a new chair lift vs. another 100 acres of snow making? It could be more insightful to focus on ROI instead of just focusing on the cost of the ticket.