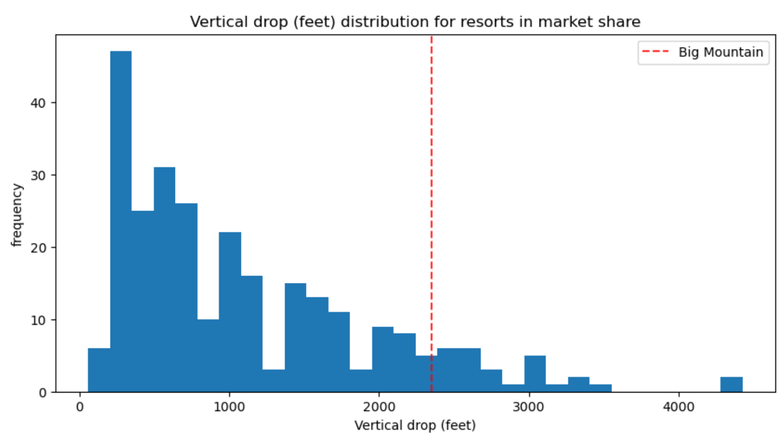
**Executive Summary:**

Big Mountain Resort should extend its vertical drop distance by 150 feet and incorporate one new ski lift and ski run by the end of ski season to maximize their ability to capture the true value of their resort. Their current price point of $81 per ticket is undervalued by roughly 20%, compared to other resorts across the country that offer similar amenities.

**Background**:

Big Mountain (BM) Resort is a premier vacation destination located in the heart of Montana with panoramic views of the awe inspiring Glacier National Park and flathead National Forest. The Resort boasts 11 lifts to a summit height of 6,817 feet. Additionally, BM Resort operates the 23rd largest vertical drop (2353 feet; as seen by the figure to the right) out of 277 ski resorts located across the country. This large vertical face helps support 105 runs across 3000 acres of skiable land. The resort will see 350,000 visitors over the ski season and each visitor, on average, will purchase five days worth of ski tickets.




**Data Prep and Wranging**:

The initial dataset started with 330 rows of data over 27 columns and included, but was not limited to, topographical data on mountains, ski run information, ticket prices and lift quality and quantities for our market segment. Several data are missing, particularly, fast eight lifts (over 50% of data are missing), resorts that offer night skiing (43% are missing), and weekday and weekend adult ticket prices (16%, 15%; respectively). There are also data errors. The two of most concerning are:

- Silverton Mountain in Colorado is listed as having 26,000 acres of skiable terrain yet the resort's website states 1816 acres. This data point was manually changed to 1816.
- Pine Knob Ski Resort is listed as having been open for 2019 years. There is no indication if this is meant to be the year the resort opened or the year that it will open. This data was removed from our dataset.

The most important data for the analysis are weekend and weekday adult ticket prices. Due to data relativity and availability, our model will proceed with weekend adult ticket prices as our metric that future models will try to estimate. Our final dataset now has 277 rows over 26 columns.

Analysis was also done state-wide for commonalities between metrics such as skiable acres, state populations, and resorts per capita. Principal Components Analysis testing was then performed to see how **skiable area** and **days open** (the two factors that accounted for over 75% of data variance) affected state related data.

| state | Resorts per State | Skiable Area (acres) | Days Open | # of Terrain Parks | Acres of Night Skiing | State Pop | State Area (miles) |
|---|---|---|---|---|---|---|---|
| Alaska | 3 | 2280.0 | 345.0 | 4.0 | 580.0 | 731545 | 665384 |
| Arizona | 2 | 1577.0 | 237.0 | 6.0 | 80.0 | 7278717 | 113990 |
| California | 14 | 12060.0 | 1961.0 | 43.0 | 437.0 | 39512223 | 163695 |
| Colorado | 14 | 22232.0 | 2003.0 | 40.0 | 110.0 | 5758736 | 104094 |
| Connecticut | 5 | 358.0 | 353.0 | 10.0 | 256.0 | 3565278 | 5543 |

A heat map was utilized to see high correlation between ticket price and: the number of fast quad lifts, the vertical distance from summit elevation and mountain base elevation, the number of ski runs, the amount of snow making potential, the amount of night skiing available, and the total number of lifts available.

**Constructing the Data Model:**

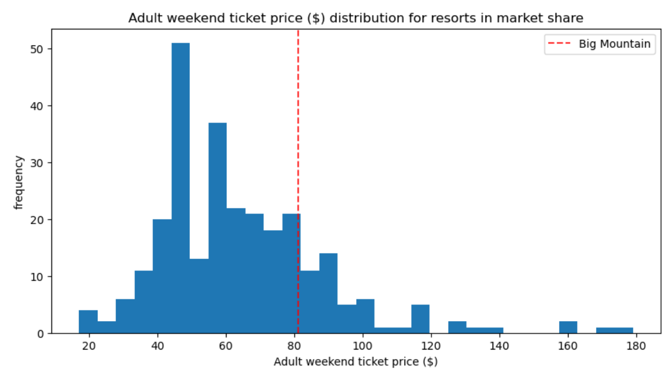
Data wrangling followed with construction, training, and testing models to find performance with correctly estimating ticket prices. Simple is always the first step, so average values were used with the DummyRegressor function from the Sklearn library. Several performance tests were conducted (R2, Mean Absolute Error (MEA) and Mean Squared Error), revealing predicted ticket prices could be off by as much as $19. A linear regression was then applied to the actual dataset to drop the mean absolute error from $19 to $9.

To test for overfit, sklearn's SelectKBest method was used to subset the data to the K best variables. However, adjusting the K value will 'tune' the model to be biased to training sets. This was solved using cross validation with 5 folds to improve our model performance. GridSearch CV was also utilized to reveal that 8 variables are best for performance without over/under fitting our model. The best columns from our original dataset to use in our model are: **vertical drop, trams, fastquads, total_chairs, runs, longestrun_mi, skiableterrain_ac, and snowmaking_ac.**

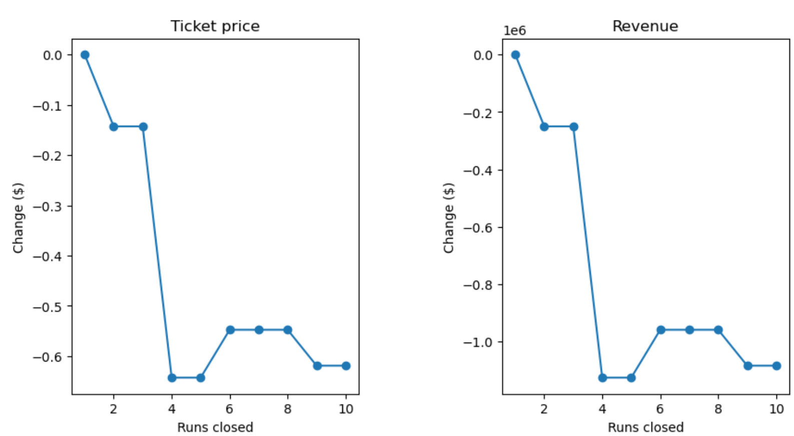
The linear regression model was substituted with a random forest regression due to the number of variables (8) which helped increase performance.The random forest model has a lower cross-validation mean absolute error by almost $1. It also exhibits less variability.

**Final Summary:**

BM Resort currently charges $81 per adult ticket — at the high end for the state of Montana but middle tier relative to the rest of the Country. However, comparable to resorts around the US with similar features and facilities, BM Resort is under charging customers by roughly $19 (with a mean absolute error of $10.34). Several scenarios were modeled to investigate how operating costs could be lowered or revenue could be increased to support the operating costs of the new lift.




The first scenario modeled was a shutting down of ski runs (not to exceed 10 runs). As ski runs are important to customers, each run shutdown will decrease total revenue to the resort (but will support a lower ticket price). If the resort was looking to lower its ticket prices to be more in alignment with Montana resorts, then BM Resort should shut down no more than 3 runs. This would result in a drop in revenue of $200,000 but would dramatically increase as additional runs are shut down (As seen in the figure to the right). Scenario 2 looked at ways to support the resort increasing ticket prices. If the resort were to increase the vertical drop by 150 feet (via adding a run and ski lift), then the resort could justifiably increase ticket prices by $0.95, resulting in revenue by $1,666,667. We could assume that operating a run costs $1,540,000 leaving a profit of $126,667.



The resort also looked at 2 additional scenarios that involved increasing snow coverage and increasing the longest run. These scenarios resulted in no change and should be ignored.

If the resort did want to go with scenario 1, the run closures, then runs should be monitored for popularity and accessibility. Runs that are shut down should also be different in difficulty so those who prefer harder routes or those who prefer easier routes don't feel like they have been robbed of three runs.

**Future Considerations:**

Future models need the operating costs of facilities to make a more accurate model. This increase in performance would better allow the management team to juxtapose the various scenarios they are considering to recuperate the roughly $1.5M associated with the new lift's operating costs. For example, Scenario 1 only depicted the decrease in ticket prices and resort revenue via shutting down ski runs. A proper analysis would also show the decrease in associated operating costs. Similarly, scenario 2 reveals that the resort would see a revenue increase by $1.6M by extending the vertical drop by 150 feet including installation of an additional ski lift and ski run. This analysis however does not include costs associated with installation and operating costs of these new features.