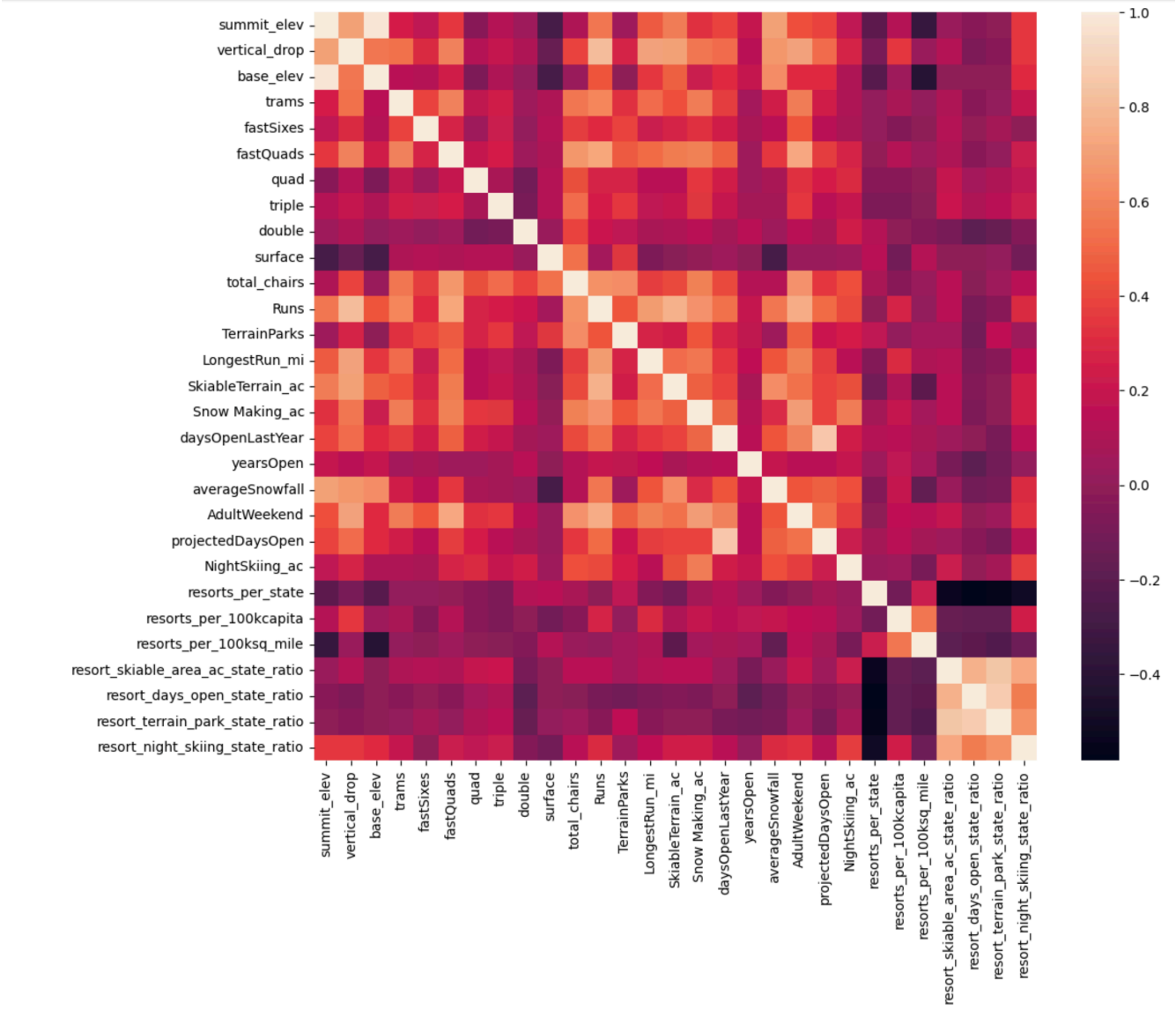
Guided Capstone Project Report

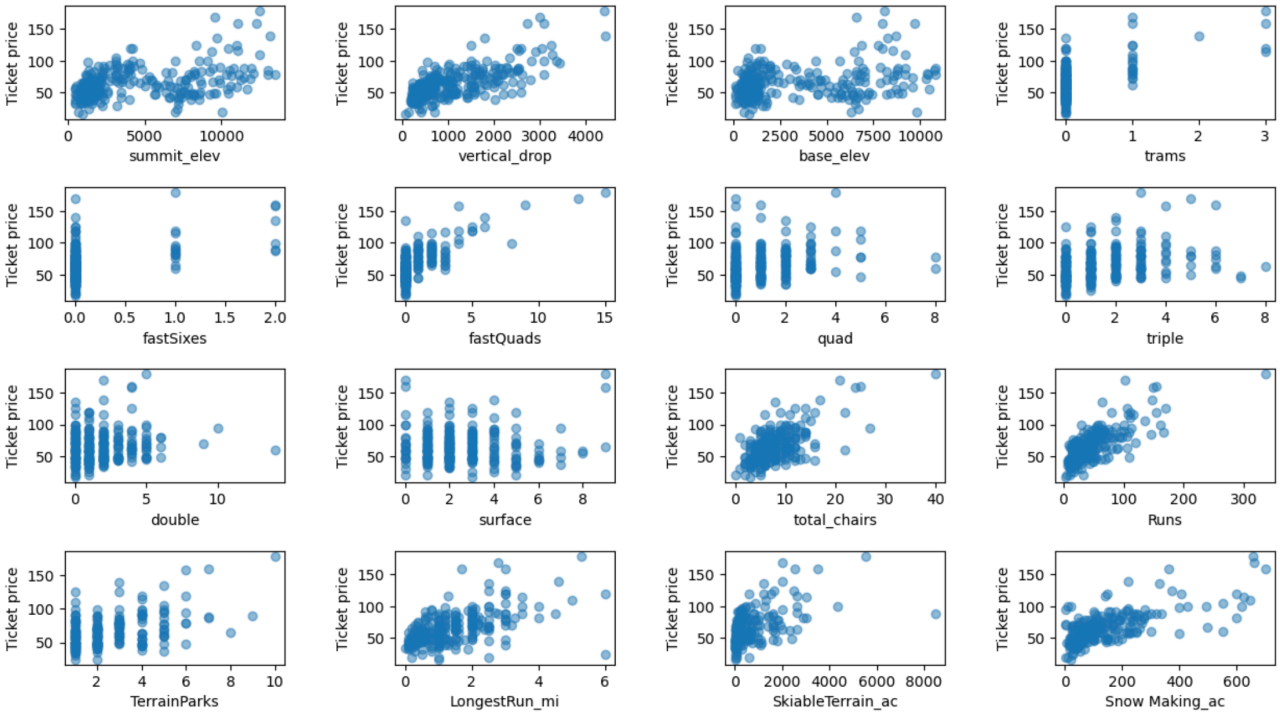
Big Mountain Resort is currently not fully capitalizing on its facilities but there are several avenues of improvement available. At the start of our analysis, we set the goal of increasing the Resort's revenue and decreasing costs by a combined total of at least $1.54m over the next season. We believe the Resort can easily reach or surpass this goal if our recommendations are implemented.

To begin, we determined that there are unique records on each row of the given .csv file. By looking at the distributions of the numerical values of resort features, we found a few outliers that are potential errors and either reconciled them with information from the resorts involved or removed them. We had to eliminate records with missing data after extracting what information we could from them. About 16% of resorts in the .csv file were missing at least some ticket price data. Adult weekend ticket price was chosen as our target feature to model because it had the fewest missing values. Augmenting the dataset with data on U.S. states, we were able to derive statewide summary statistics for the ski resort market and found no discernible pattern in ticket price based on state, so in the rest of our analysis, all resorts were considered part of the same market share as expected.

Next, we added ratios of resort feature/total state feature (such as the ratio of resort skiable area to total state skiable area) to consider each resort in context of its state. This provided valuable insight into which features to focus on when modeling ticket price and which features Big Mountain Resort may be failing to take advantage of or not arranging optimally. See the heat map below.



The vertical drop, total number of chairs, fast quads, runs, longest run, snow making acres, average snowfall, projected days open, days open last year, and years open are positively correlated with ticket price. Summit elevation, which is relatively high at Big Mountain, appears to be a selling point. The number of acres with snow making seems to be a more useful feature than total skiable area. The ratio of night skiing at a resort to total night skiing in its state is quite positively correlated with ticket price. Ticket prices tend to be lower the more chairs there are relative to runs, but having a few fast quads may help increase ticket price. See the scatterplots below for examples of correlations of specific resort features and metrics with ticket price.



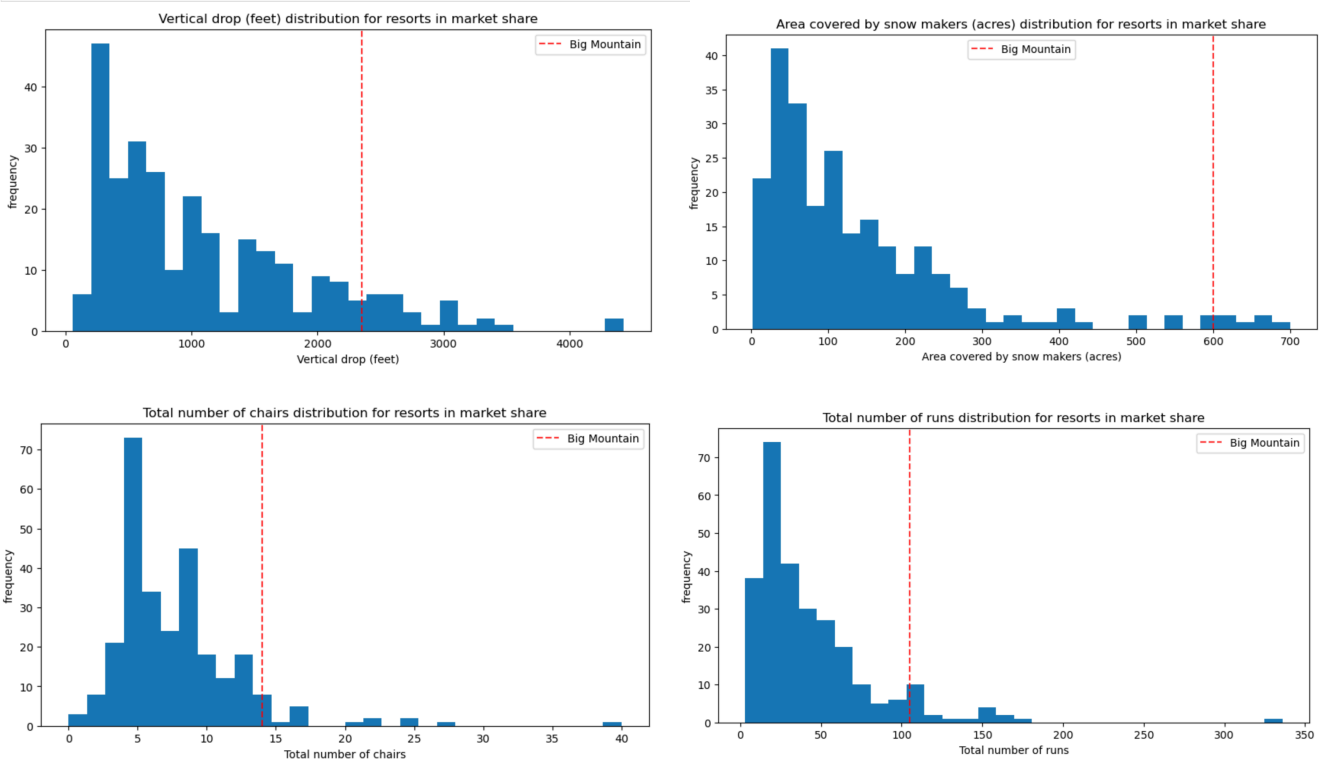
Next, in order to be able to predict adult weekend ticket price using machine learning models, we chose a train/test split of 70/30, giving 193 rows of data to train on and 83 in the test split.

We first tried using the mean of the training set as our prediction for the test set, obtained a slightly negative coefficient of determination as expected, and found that the mean absolute error was a little over 19 for the test set, meaning that on average, we could expect to be off by $19 if we simply used mean ticket price to predict adult weekend ticket price.

Next, we built a linear regression model by using the median to impute missing values and scaling the data. We found that this linear model performed much better as a predictor of ticket price than the mean did, being off by less than $9.50 on average. The R - squared value closer to 1 (around 0.72) was promising but comparing this metric for the train and test sets suggested the model may be overfitted, so we refined it to use the optimal number of features, which was 8. Cross-validation showed the model's performance varied (with a standard deviation of 0.095 for the R - squared scores) across the different chosen folds of training data but its performance on the test fit was close to this range of estimates.

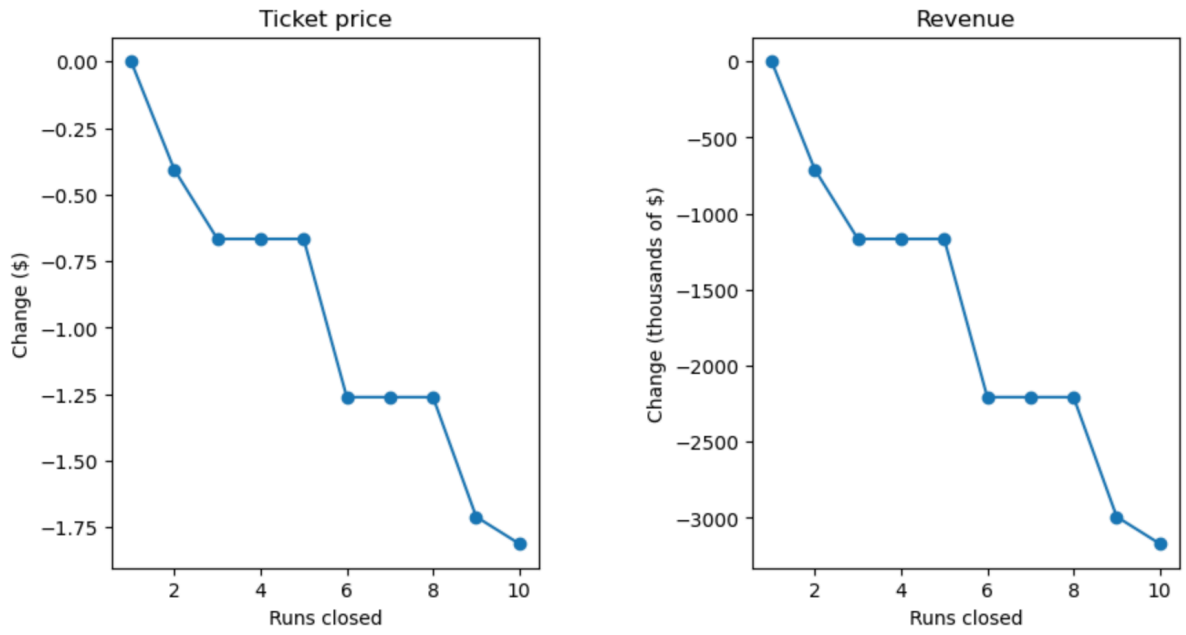
We also tried training a random forest regressor model and found that the median was also the best choice to impute missing values here but scaling the data was not necessary. The random forest model had a lower mean absolute error in cross-validation by almost $1 and showed less variability than the linear model. Therefore, we used the random forest model to price tickets and try out possible scenarios. (Reassuringly, though, both models pointed to the same features as being most important for a resort's ticket price: vertical drop, snow making acres, total chairs, fast quads, and total runs.)

Big Mountain currently charges $81.00 per adult weekend ticket. The price estimated by the model from the resort market data was $95.87, give or take $10.39, so even worst-case scenario, the ticket price should be at least $85.00. Considering that big Mountain measures well against all resorts in several important areas such as vertical drop, snow making acres, total chairs, and total runs (see charts below) and has a high summit elevation and beautiful views, it is not surprising that the Resort's tickets are underpriced.



Given the expected number of visitors over the season is 350,000, a price increase of $4 should more than cover the $1.54m operating cost of the new chair lift since $4 per guest (i.e. assuming a stay of only one weekend day) would generate an extra revenue of $1.4m and guests stay for 5 days on average. To be safe and potentially increase profits more, Big Mountain could try raising the price of adult weekday tickets by $1-$4 as well.

In addition, our model shows that closing one run would not reduce support for ticket price at all, so we recommend that Big Mountain Resort close its least used run to reduce operating costs. See the graphs below for runs closed vs. change in ticket price and revenue.



The resort could also consider closing the 2 least used runs, which would correspond to a ticket price decrease of approximately $0.41, as shown in the graph. Depending on the operating costs saved compared to the loss of revenue, it may be worth closing more. If Big Mountain closes 3 of its least used runs then it may as well close 5, but we do not recommend closing more than 5.

Lastly, we used our model to consider various potential scenarios involving the Resort's facilities. Some of them, such as increasing the longest run by 0.2 miles and adding 4 acres of snow making on that run, made no difference at all. The most potentially profitable scenario was this: If the resort were to increase its vertical drop by adding a run specifically to a point 150 feet lower down (which would require the installation of an additional chair lift to bring skiers back up) without adding any additional snow machine coverage, we estimate that an additional ticket price increase of $1.99 would be justified. This could amount to an additional $3.4m over the season, so we think it is worth considering.

In conclusion, the data strongly suggests that Big Mountain Resort's adult weekend tickets should be priced at $85 and the Resort should close its least used run. Based on 350,000 expected visitors, this price increase would increase revenue by more than$1.54m for the next season, offsetting the cost of the new chair lift and perhaps even leading to extra profits. Closing the run would decrease operating costs without affecting ticket price, which can only benefit the Resort.

Over the upcoming season, we recommend closely monitoring the effects of making these changes should management choose to implement them. It would be useful to collect and store data on operating costs so we can factor them into a future analysis to determine if and to what extent they play a role in Big Mountain's pricing. Data on the number of visitors per year, how many weekdays vs weekend days customers tend to stay, and any additional sources of revenue would also be enlightening.