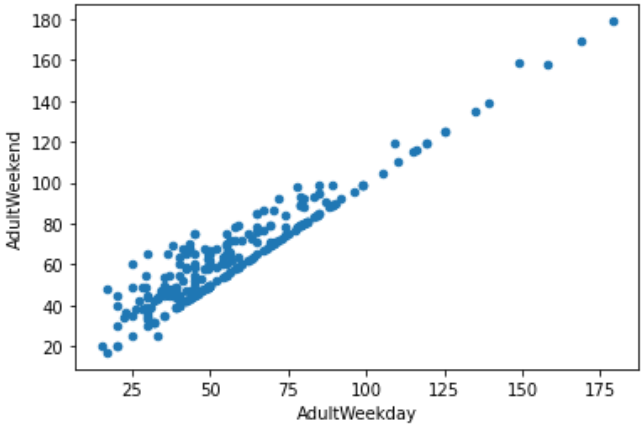
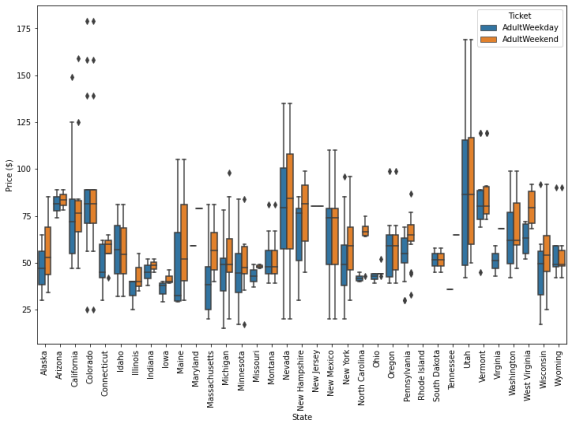
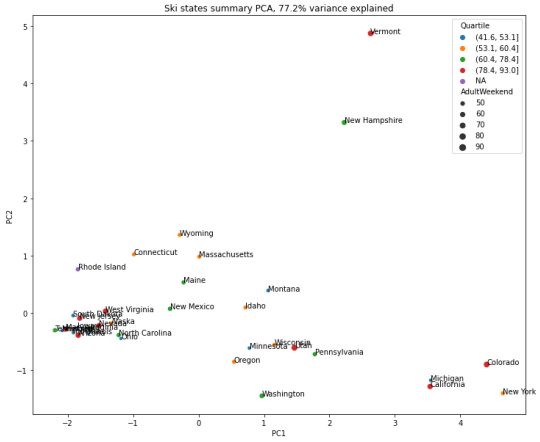
To begin, I organized the data, verifying that our resort was not missing values and making sure all other resorts' values were accurate and not missing. Looking at the graphs below, we can see that the values for weekend data tend toward equal or greater than weekday data, with Montana's data weekend and weekday equal. As such, we got rid of the columns missing weekday prices since we had more weekend prices. Thus, the value we are looking for is the weekend price.





We then calculated the principal component analysis to find the few features of the above list that played the largest role(s) in the variation. Taking the first two, which accounted for a little over 75%, we made a scatter plot with each point being the state. We did not find a pattern in these variables, even when plotted with price quartiles in mind, so we moved into machine learning and other statistical techniques.



The initial linear regression model performed well, accounting for over 80% of the variance on the train set and over 70% on the test set, though the large difference between our train and test sets suggests overfitting. The mean absolute error showed that the estimated ticket price range was much smaller, 9 down from 19. The top categories for the linear regression were, in order: vertical drop, snow-making area, total chairs, fast quads, number of runs, and longest run length. This suggests that the larger the vertical drop, the more expensive you can make ticket prices.

In our random forest regressor model, the most important features were fast quads, number of runs, snow-making area, and vertical drop. The other features held less than 5%

of the influence on ticket price; this is consistent with our linear model, with the top four of the random forest regressor model present in the top five of our linear model.

Currently, Big Mountain charges $81.00 for a weekend ticket. Using Random Forest Regression, we found that the modeled price for is $93.48, with a mean absolute error (MAE) of $10.40. This means that, even though the MAE is high, there is room for Big Mountain to increase ticket costs. However, Big Mountain is already the highest charging ski resort in Montana - it is among the resorts with the most vertical drop, chairs, runs, fast quads, snowmaking area, and skiable terrain, all of which are important factors to ticket price according to our linear regression and random forest regression models.

Based on my model, I analyzed the four options listed to balance cost.

First, closing down runs: according to my model, closing a single run does not make a difference to the ticket price or revenue. Closing 2 runs reduce support for ticket price and therefore revenue. 3-5 run closures all have an identical impact on revenue, about $0.38 ticket price drop, so if you are going to close 3, you might as well close 5. Closing 6 or more runs leads to a large drop in ticket price (at least $1.00) so I do not advise closing 6 or more runs.

Second, increasing the vertical drop by adding a run without increasing snow-making coverage. This supports a ticket price by $0.92, which is an estimated $1,610,795 over the course of a season - this is larger than the $1,540,000 increase to operating costs added by the new chair this season.

Third, increasing the vertical drop by adding a run and increasing snow-making coverage by 2 acres. This also supports a ticket price by $0.92, which is an estimated $1,610,795 over the course of a season, but with the increased time and money spent on increasing snow-making coverage, it is wiser to skip the snow-making coverage expenditures.

Fourth, increasing the longest run by 0.2 miles and guaranteeing its snow coverage by adding 4 acres of snow-making capability. My model predicted that this would have no difference to the ticket price, since the random forest model does not select the longest run to be an important feature. That, paired with the fact that we host one of the longest runs in the country, tells me that this is not worth doing.

Of the four options, the first and the second options listed are the best. Before enacting these changes, you can test these by temporarily closing runs. Surveys of visitors asking if they would pay more for longer runs could also provide helpful information for the second option.