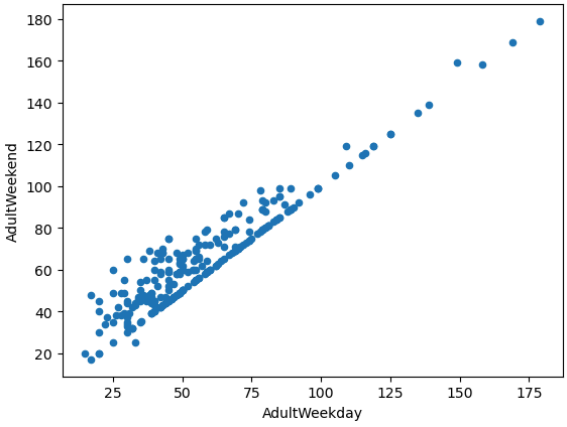
Big Mountain Resort has been reviewing potential scenarios for either cutting costs or increasing revenue (from ticket prices).

After accessing the data of resorts in the United States, raw_data/ski_resort_data.csv, we considered that the data has missing values and needs data wrangling. The number of fast eight person chairs "`fastEight`" has the most missing values, at just over 50%. We are also missing quite a few of our desired target quantities, the ticket price, which is missing 15-16% of values. The column for the price for adults during the week `AdultWeekday` is missing in a few more records than the price for adults during the weekends `AdultWeekend`.

To find out which one is desirable to work with, we study the relation between weekday and weekend prices as you see in the following chart.



These quantities are particularly relevant, and weekend prices have the least missing values of the two, so we dropped the weekday prices and then kept just the rows that have weekend prices.

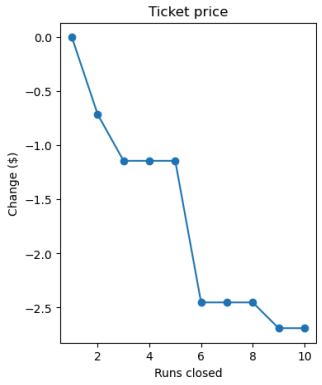
So, the target feature is the weekend price to predict ticket prices.

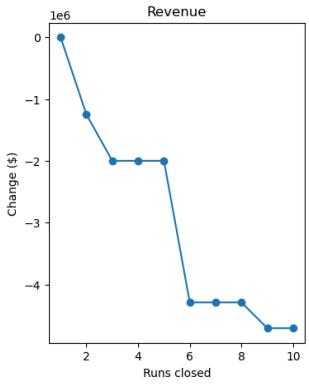
We trained cross-validation for estimating linear regression model performance, and we checked that it gives a smaller Mean Absolute Error (MAE) and Mean Squared Error (MSE) with respect to the mean.

We also build a random forest model. We calculate the mean absolute error using cross-validation. The random forest model has a lower cross-validation mean absolute error by almost $1 with respect to the linear regression model. It also exhibits less variability. Verifying performance on the test set produces performance consistent with the cross-validation results.

Using the random forest model, we consider an expected mean absolute error of $10.26; there seems to be potential for a price increase.

As we can see in the following chart, our model indicates that closing one run at Bing Mountain Resort makes no difference in terms of revenue. Closing 2 and 3 successively reduces support for ticket price and so revenue. If Big Mountain closes down 3 runs, it seems they may as well close down 4 or 5, as there's no further loss in ticket price. Increasing the closures down to 6 or more leads to a large drop.





For cutting the costs, some possible options to consider are:

1. Increase the vertical drop by extending a run 150 feet lower. This would require installing an additional chair lift to bring skiers back up but would not require extra snowmaking coverage.
2. This option is the same as option 1, but it includes adding 2 acres of snowmaking coverage.
3. Increase the length of the longest run by 0.2 miles, bringing it to a total length of 3.5 miles. This would require an additional 4 acres of snowmaking coverage.

However, after running the test, we found that options 1, 2, and 3 will not impact pricing.

The modelling performed here is constrained by deficiencies in the data set, such as the lack of information about other factors, such as service quality and customer demand.

To get a more accurate picture, information about the following costs would help: maintenance costs, labour costs, marketing and advertising expenses, utility costs, and insurance and safety costs.

The model doesn't seem to incorporate demand elasticity. Factors such as the area's economic condition are crucial.

The executive may conduct market research and gather feedback from stakeholders, such as the sales team, to ensure that the model aligns with the actual customer experience and market dynamics.

However, this model could be useful for scenario analysis, cost-benefit analysis, and dynamic pricing strategy.

To make the model accessible and reusable, we may make it more user-friendly by providing interactive tools. Also, the model could be deployed as an API, allowing analysts to send parameter updates and receive predictions without requiring direct interaction with the underlying code.

Our final recommendation to the Executive Board is to close one run and also increase the adult's weekend ticket price by 10 dollars.