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Guided Capstone Project Report

Montana's Big mountain resort offers spectacular views, which has a vertical drop of 2,353 ft, a total of 14 chairs, 105 trials, and 350,000 visitors per year. It has 600 acres of snowmaking and 3000 acres of skiable terrain. The resort's current ticket price is **$81.00**, and this strategy that charges a premium above the average price has limitations for capitalization. Therefore, we aim to maximize the resort's profits and provide a guideline for business on how to select a better value for their ticket price.

Three hundred thirty resorts are investigated, it is shown that Montana state is the third-largest resort and with a high total skiable area. Montana has 12 resorts, and the average ticket price in Montana is 52$. Distribution of the feature values has identified erroneous and missing values from the provided information, either corrected or dropped. Ticket price as a target feature is found identical in Montana. Therefore, the ticket price of the weekday is not used in our prediction.

PCA analysis demonstrated the distribution of the states with the ticket price. It is shown that some extreme cases in the first dimension, such as New York and Colorado, and second dimensions such as New Hampshire and Vermont. The separation of New Hampshire and Vermont are due to their high resort density (resorts_per_100kcapita and resorts_per_100ksq_mile). There is not an obvious pattern as for the relationship between state and ticket price. The correlation heatmap is constructed amongst all the features. It demonstrated that the adult weekend ticket price is positively correlated with feature Runs, FastQuads, vertical_drop, total_chairs, longestRun_mi, and Snow_making_ac (Figure 1).

A Dummy Regressor model used the mean ticket price as a predictor to predict the Weekend Ticket price. This baseline model predicted the ticket price is the same as the predictor, thus $R2$ = 0. Mean absolute error (MAE) from this model indicated $19 off the guess ticket price based on the known mean values.

This project built two machine learning models, a Linear Regression model and a Random Forest Regression model. An estimate on the ticket price based on the Linear Regression model is within

$9 of the actual price. Several important features were found either positively or negatively associated with ticket price by refining the model and cross-validation. The top three positive features are Vertical_Drop, Snow Makeing_ac, and Total_Chairs, which have shown a correlation in the heatmap (Figure 1). Trams and Skiabl Terrain_ac are negatively correlated features. The estimate on the ticket price from the linear model with cross-validation is $11.79.

A random forest regressor model was also performed, which has improved the model. Figure 2 showed the best features used in this model in the order of their importance. The top four features are in common with the linear model. They are fastQuads, Runs, Snow Making_ac, and Veritical_drop. The estimated ticket price is **$ 9.54** based on the Random Forest Regressor model. Therefore, the Random Forest model will be the model to go forward.

The modeling ticket price in Big mountain is $ 95.87 with the expected mean absolute error of $10.39, suggesting a potential price increase. There are 4 scenarios concerning the facilities change based on the model. For scenario 1, the model supports close up to 5 runs because the loss of price ticket reduced less than -0.75, and there is no further loss for 5 runs closing down. In scenario 2, the investment of Run, vertical drop, and installing one additional lift support increasing the ticket price by **$8.61**. The expected revenue increase over the season is expected to $15,065,471. The same as scenario two but adding 2 acres of snow making in scenario 3 increase the support for the ticket price is $9.90. The expected revenue increase over the season is expected to $17,322,717. The slight increase shows that it might not be worth adding 2 acres of snowmaking. Scenario 4 demonstrates that increasing the longest Run by 0.2 miles with guaranteeing snow is neither supporting the ticket price increase nor the revenue increase.

In summary, combining scenarios 1 and 2, which is to close down 3 to 5 runs, add a run, increase vertical drop by 150 feet and install an additional lift, may support the ticket price and revenue increases.

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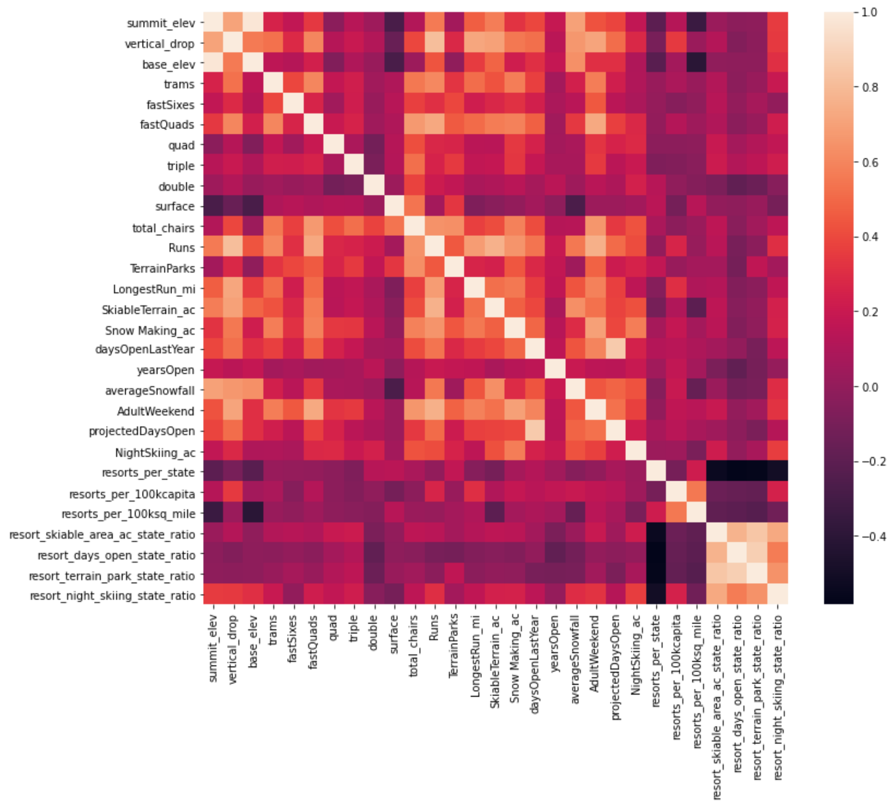

Figure 1 Correlation heatmap amongst all the features

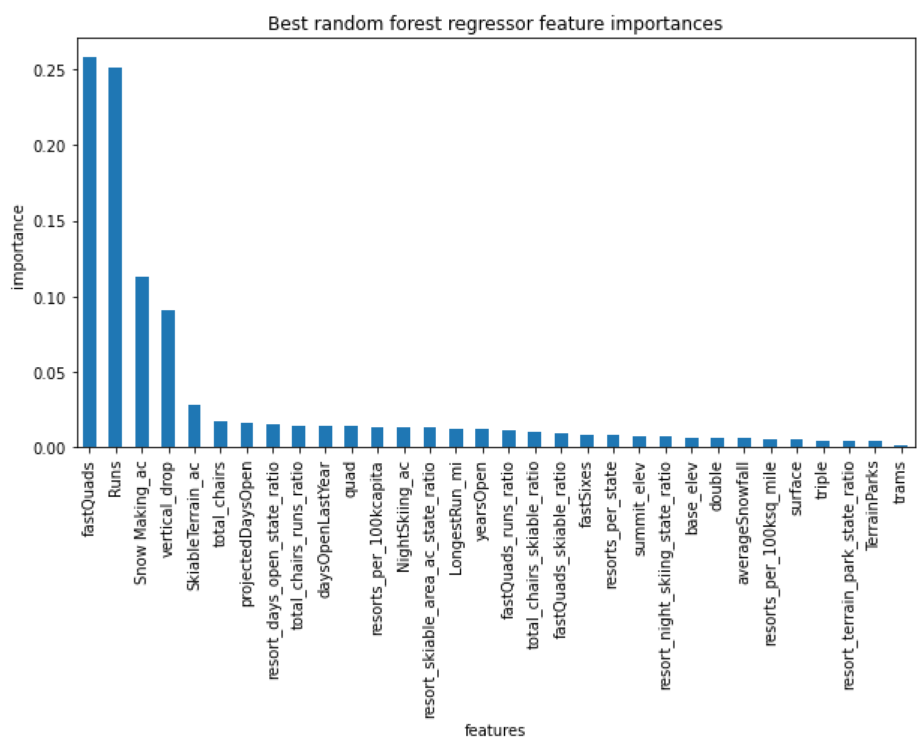

Figure 2 Best features in Random Forest Regression model

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