Guided Capstone Project Report

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Overview:

The Big Mountain Resort is a ski resort located in Montana that offers spectacular views of Glacier National Park and Flathead National Forest. About 350,000 people ski or snowboard at Big Mountain each year. It provides access to 105 trails for skiers and riders of all levels and abilities. It has recently installed a chair lift, which increases the operating costs by $1,540,000 this season. The resort's executive team needs suggestions to develop a strategy to cover this cost, either by charging a premium fee, cutting underused facilities, or other scenarios. Given a data set of 277 ski resorts within the US, their facility information, and ticket price, the data science team, evaluated the market competitiveness for the Big Mountain resort, identified the essential features related to the ticket price, and developed potential business strategies to cover the increased cost of the new lift service.

Resort's Pricing Strategy:

We didn't saw a trend in pricing by states(Fig1), so assuming a free market with the average ticket price of $63.8 and sigma of $24.8 , big mountain ticket of $81 is slightly above average, although it is the most expensive resort in Montana.

Our team explored the data of 277 US resorts and performed ML with both Linear Regression Model (LRM) as well as Random Forest Regression Model (RFRM) to both determine the key features that decide the ticket price as well as predicting the best price for Big Mountain resort.

Across both models the most important features for price prediction were consistent:

- Vertical drop, Longest run (Adventure)
- Snow Making (Guaranteed Skiing),
- Total number of chairs, fast Quads (Convenience)
- Number of runs, Skiable terrain (Variety)

Figure 2, shows the stats of Big Mountain compared to other resorts for these features. As can be seen in all the categories it is among the top tier resorts which encourages the price increase.

For Both ML models we impute data by the mean (median yield similar results as well) and divided the dataset to train and test set as 70% to 30%. We performed k-fold cross validations on train set and evaluate the test set price. As can be seen in the table, Between the two models RFRM shown slightly less variability and lower values of Mean Absolute Error (MAE) , also it generalize better to test sample (LRM is slightly overfitting to train set).

LRM			RFRM		
MAE(test)	Mean MAE(train)	Std MAE(train)	MAE(test)	Mean MAE(train)	Std MAE(train)
$11.8	$10.5	$1.6	$9.5	$9.6	$1.5

We fit our best Model (Random Forrest Model) on the whole data set excluding big Mountain for which we want to adjust the price and then predicted the price based on a free market and the current facilities of Big mountain to came with a suggested price of $95.9.

Our model also enable us to predict price for various scenarios with installing or retiring various facilities on the resort to predict the recommended price and help us optimize the revenue (it would good to include a data set accounting for operating and maintenance costs of various facilities as well as number of visitors for each resorts to help model better assess the ticket price.

For this report, to estimate the revenue from a ticket price, we assumed 350000 visitors to Big Mountain with average of 5 day visits annually. Current revenue from tickets is $141.75M.

Recommendations:

1- Increase the ticket price from $81 to $96, the predicted ticket price by the model. This will increase current annual revenue by $26.25M. which is already more than the additional operation costs of the new lift of &1.54.
2- Increase the vertical drop by adding a run to a point 150 feet lower down but requiring the installation of an additional chair lift to bring skiers back up, without additional snow making coverage. This will support another $1.6 increase of the ticket price (additional $2.8M in annual revenue)
3- Closing, up to 5 least used or harder to maintain runs. Which barely cause a ticket price drop of $0.3 or decrease annual income by $0.5M, as shown in figure 3.
4- We also experimented with a few other scenarios the one worth thinking is: closing the 6 least popular runs, but add a run as stated in recommendation 2, yet instead of chair lifts install a new fast Quad! This seems to support a whopping additional price increase of $21 to a total ticket price of $117 (acceptable range for the top tier national ski resorts).
5- To make model more certain for the top tier ski resorts including data on number of visitors (local, national or international visitors number help more), and the maintenance cost of various facilities can help us improve the model especially in extreme price cases like recommendation 4.

Fig1: current price distributions:

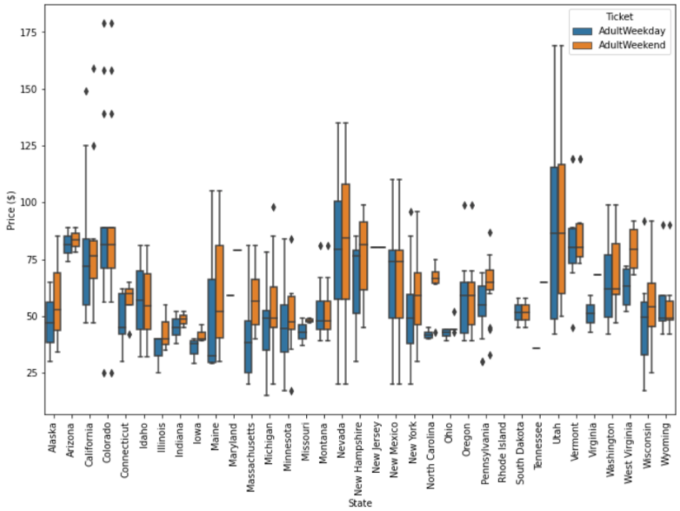
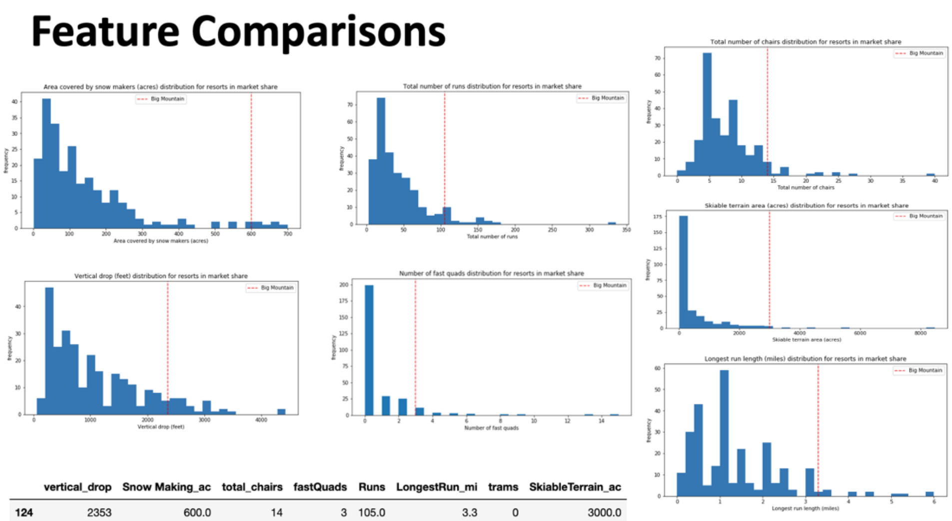


Fig2: State of Big Mountain within important features for determining ticket price



	vertical_drop	Snow Making_ac	total_chairs	fastQuads	Runs	LongestRun_mi	trams	SkiableTerrain_ac
124	2353	600.0	14	3	105.0	3.3	0	3000.0

Fig3: closing a few least used/hard to main runs doesn’t hurt the revenue