Guided Capstone Project

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Problem Identification

Context:	**Success Criteria:**
Big Mountain Resort (Montana) with 350,000 visitors annually The resort has new equipment installed: cost $1,540,000 The company may not be fully capitalizing its facilities (tickets underpriced)	The company can make changes to facilities that will either: • Cut costs by $1,540,000, or • Support even a higher ticket price (increase revenue at least $1,540,000)
Scope of Solution Space: Facilities (e.g., chairlifts, chairs, t-bars, run, elevation, terrain parks, area that uses snow making, etc.)	**Constraints within the Solution Space:** Limited time to cut costs
Stakeholders: • Director of Operations, Jimmy Blackburn • Alesha Eisen, the Database Manager.	**Data Source:** CSV file provided by Alesha Eisen

Recommendation and Key Findings

Developed and deployed Machine Learning models.

- Random forest performed better than regression

RF models predicted and supported an increase in ticket prices.

Tested four scenarios.

The recommended scenario: adding a run, increasing the vertical drop by 150 feet, and installing an additional chair lift.

- Supports $1.99 increase in ticket prices (current price $81)
- Revenue increase of $3,474,638

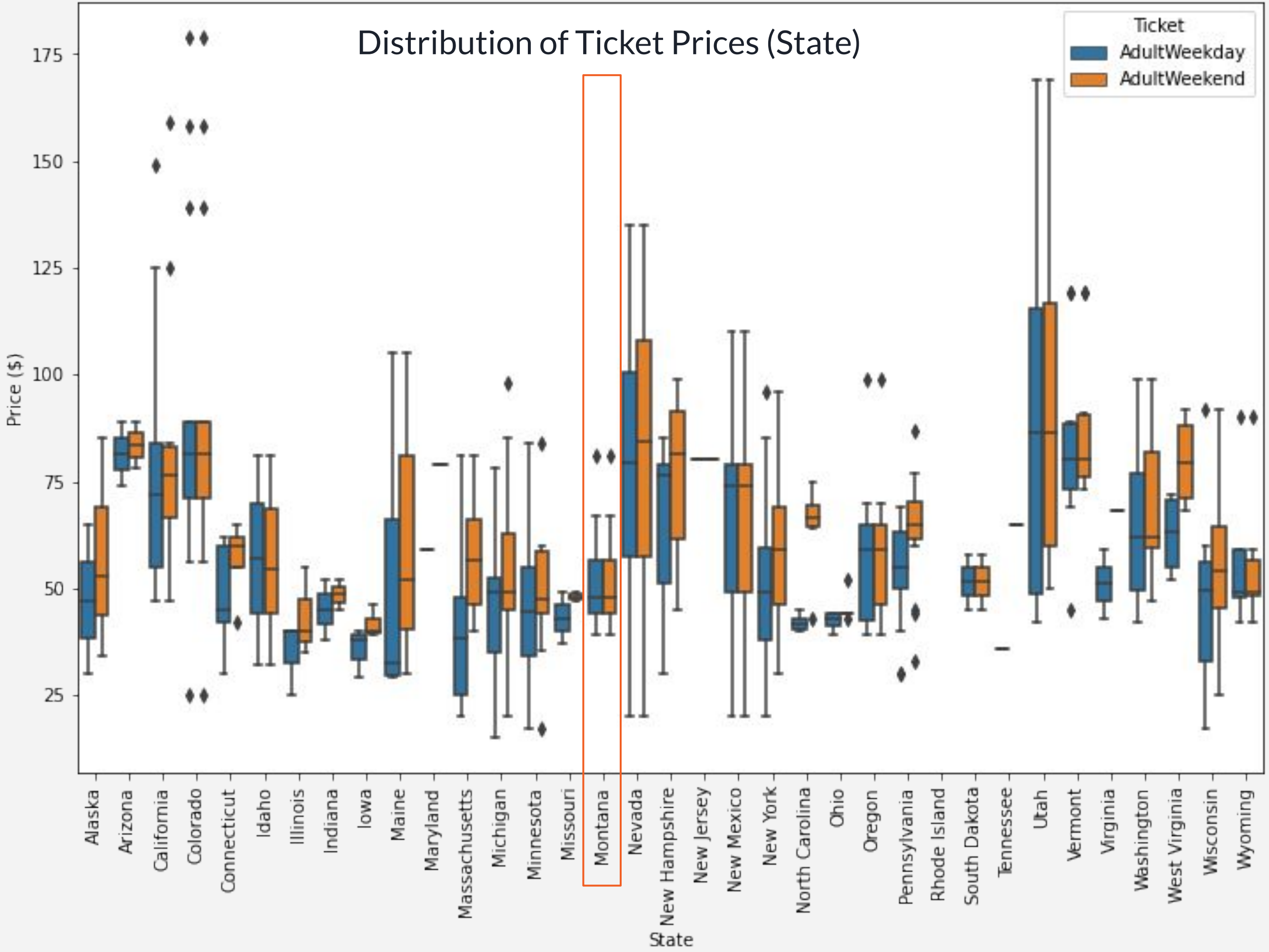
Modeling Results and Analyses: Target Feature, Missing Values

Data: CSV file with 330 rows and 27 columns.

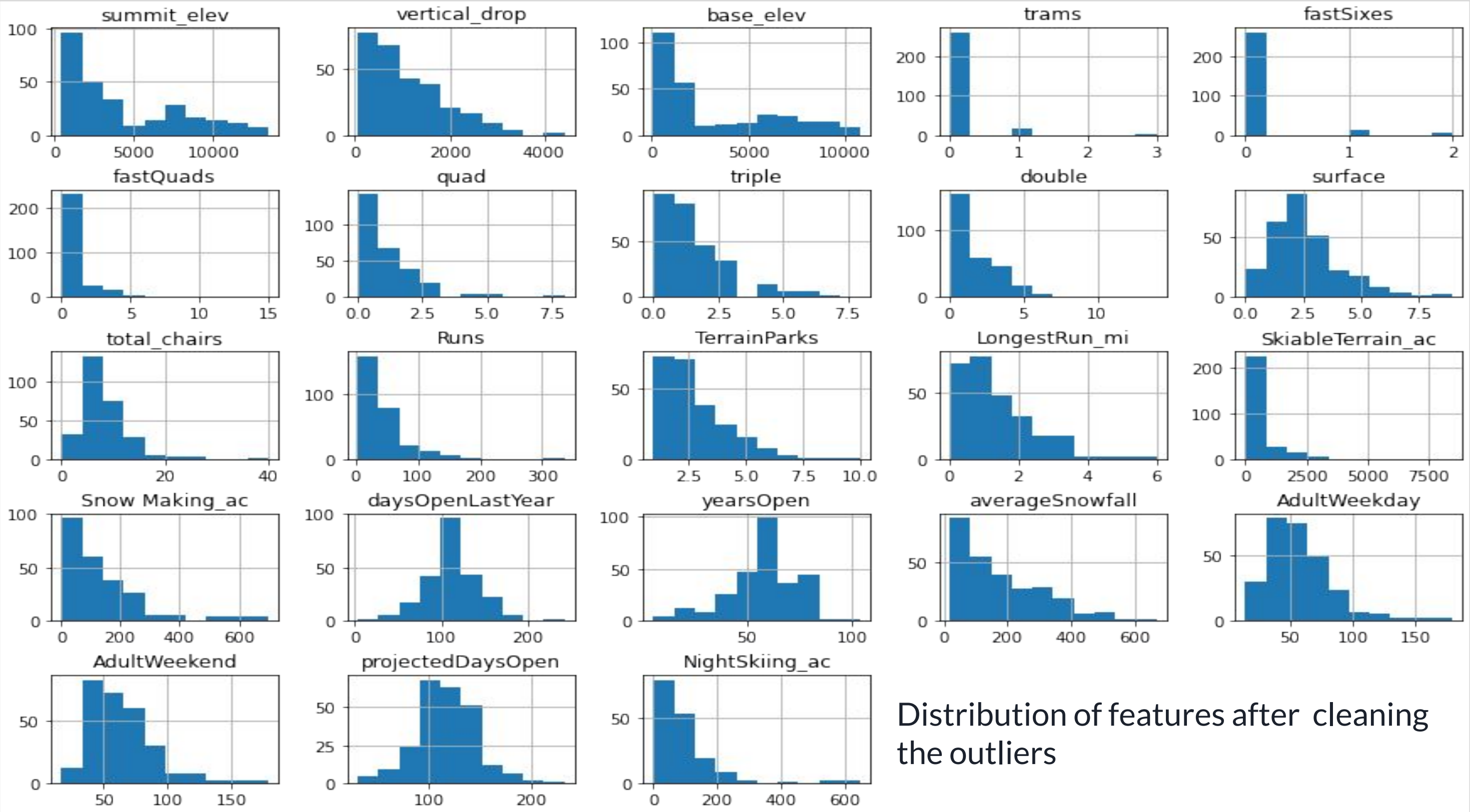
Target feature: Weekend ticket prices (‘AdultWeekend’)

Missing Values: feature ‘fastEight’ dropped for 50% missing values

Missing Values: Missing values in some rows were multiples of 4 (e.g., 4%, 8%, 12%, 16%, 20%)


Distribution of Ticket Prices (State)
Ticket
AdultWeekday
AdultWeekend
Price ($)
175
150
125
100
75
50
25
State
Alaska
Arizona
California
Colorado
Connecticut
Idaho
Illinois
Indiana
Iowa
Maine
Maryland
Massachusetts
Michigan
Minnesota
Missouri
Montana
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
Ohio
Oregon
Pennsylvania
Rhode Island
South Dakota
Tennessee
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming

Modeling Results and Analyses: Distribution of Features



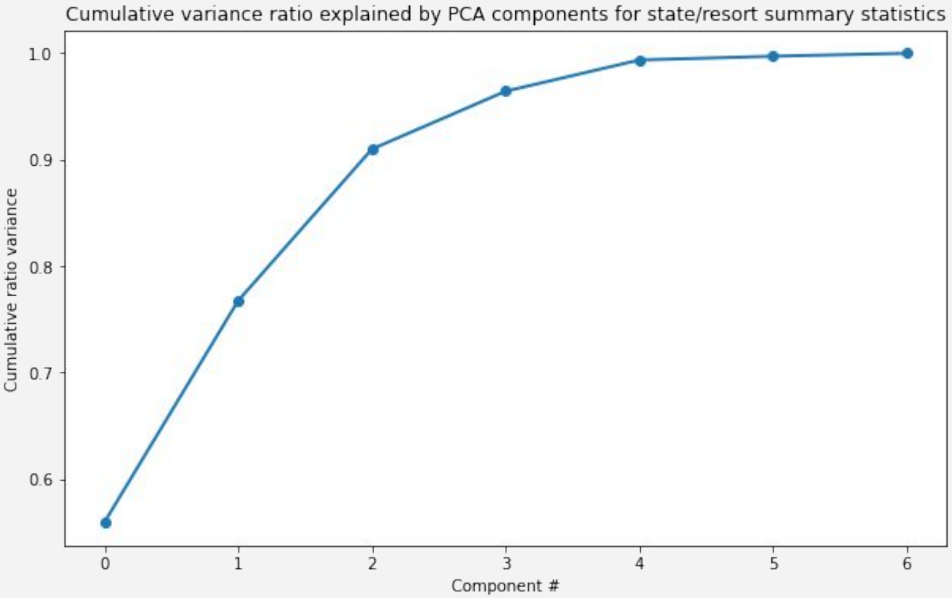
Distribution of features after cleaning the outliers

Modeling Results and Analyses: State Data, PCA,

Created a new dataframe: state_summary

- state population
- state area,
- number of resorts per state,
- total skiable area in the state,
- total number of days that resorts are open in the state,
- state total terrain parks, and state total night skiing area

Ran PCA: Two components explain 90% variation in the state_summary



Modeling Results and Analyses: ML Models

ML Model 1: Linear Regression

Model Metrics (MAE=Mean Absolute Error)

- MAE mean: 10.49
- MAE std: 1.62
- MAE for X_test: 14.10

ML Mode 2: Random Forest

Model Metrics: (MAE=Mean Absolute Error)

- MAE mean: 9.58
- MAE std: 1.38
- MAE for X_test: 9.5

Random Forest Model has better model metrics

- Lower MAE
- Lower Std Dev for MAE
- Lower MAE for X test

Tested Four Scenarios using Random Forest ML Model

Scenario 1: Close up to 10 of the least used runs. The number of runs is the only parameter varying.
Prediction: Closing runs lead to drops in ticket prices (see Figure 5).

Best Scenario

Scenario 2: In this scenario, Big Mountain is adding a run, increasing the vertical drop by 150 feet, and installing an additional chair lift.
Prediction: This scenario increases support for ticket price by $1.99 (revenue increase of $3,474,638).

Scenario 3: Same as Scenario 2 but adding 2 acres of snowmaking.
Prediction: This scenario increases support for ticket price by $1.99 (revenue increase of $3,474,638).

Scenario 4: This scenario calls for increasing the longest run by .2 miles and guaranteeing its snow coverage by adding 4 acres of snow-making capability.
Prediction: No difference whatsoever.

Summary and Conclusion

ML Models predicted that Scenario 2 is the best option

Scenario 2 supports increasing ticket prices by $1.99

Requires

- adding a run,
- increasing the vertical drop by 150 feet,
- installing an additional chair lift.

Scenario 2 brings minimal increase in operational costs

Can generate an additional $3,474,638 revenue annually