# Guided Capstone Project Report: Big Mountain Resort

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## Problem Statement

Big Mountain Resort needs a data-driven pricing strategy to optimize Big Mountain Resort’s ticket pricingand compensate for $1.54M in new operating costs from recent chair lift investments while maintaining market competitiveness. This analysis uses competitor data and predictive modeling to identify optimal ticket pricing and evaluate facility investment scenarios for revenue optimization.

## Data Wrangling

Analyzed 330 ski resorts across 27 features, cleaning to 277 resorts with 25 variables after removing high-missing columns (fastEight, NightSkiing\_ac) and correcting data entry errors. Selected weekend adult ticket prices as target variable (range: $39-$91, mean: $61) due to fewer missing values than weekday pricing.

## A collage of graphs AI-generated content may be incorrect.3. Exploratory Data Analysis (EDA)

## Analysis of 277 ski resorts revealed that resort-level features drive pricing more than geographic location, with strong correlations between ticket prices and runs (0.76), fast quads (0.73), vertical drop (0.71), and snow making area (0.70). PCA showed that most variance in state-level features is explained by overall ski infrastructure and resort density.

## No clear state-level pricing patterns emerged, indicating that facility quality matters more than regional market dynamics. Counterintuitively, higher chair-to-run ratios correlate with lower prices, suggesting different business models between exclusive and mass-market resorts. Big Mountain ranks in the top quartile for most facility metrics but prices below the model-predicted optimal level (figure 1), indicating untapped pricing potential.

## 4. Model Preprocessing & Feature Engineering

## Data preprocessing used train-test splits and multiple imputation strategies with nearly identical results. Engineered features added context but did not outperform original resort-level features. Key predictive features include vertical drop, snow making coverage, chairlift capacity (total and fast quads), and number of runs, though feature importance rankings differed between linear regression and Random Forest models.

## 5. Algorithms & Model Evaluation

## The Random Forest approach outperformed linear regression models. Cross-validation and hyperparameter optimization (testing 10-1000 trees) ensured reliable model performance, with the Random Forest model performing optimally with 69 trees and median imputation. The final approach prioritized simplicity—no feature scaling was necessary due to its tree-based robustness—while maintaining high predictive accuracy. We reviewed four scenarios for feature improvements and cutting costs: (1) run closures, (2) facility expansion with and without additional snow making

## 6. Winning Model & Scenario Modeling

The Random Forest model achieved superior performance with 75% accuracy vs 60% for linear models and 19% better precision ($9.54 vs $11.79 MAE).

A graph with green and red squares

AI-generated content may be incorrect.Four operational scenarios were evaluated for business impact (**figure 2)**. **Run closures** show tiered revenue losses from minimal ($0-$720K for 1-2 runs) to major ($2.21M-$3.17M for 6+ runs), requiring cost-benefit analysis against operational savings. **Facility expansion** (additional run, 150ft vertical drop, chair lift) delivers the strongest ROI with $1.93M annual profit after operating costs, representing 125% return on investment. **Snow making enhancements** provide no additional pricing support beyond base facility expansion. **Longest run extensions** show zero pricing impact and are not recommended. The analysis supports facility expansion while suggesting cautious evaluation of run closures based on actual operational cost savings.

**7. Pricing Recommendation**

Our predictive model suggests Big Mountain could support a ticket price of $95.87, representing an 18% increase from the current $81.00 price. This translates to approximately **26M in additional annual revenue potential**, based on 350,000 annual visitors. The recommendation falls within our model's expected prediction uncertainty (MAE: $10.39), providing statistical confidence in the pricing analysis. We recommend validation before full implementation through a phased strategy: (1) small incremental price increases with demand monitoring, (2) price sensitivity testing, and (3) monitoring competitor responses and customer satisfaction.

## 8. Conclusion

Big Mountain Resort faced the challenge of optimizing pricing strategy to offset $1.54M in new chair lift operating costs while maintaining competitive market position. Our competitive analysis and predictive modeling identified significant revenue opportunities through strategic pricing optimization ($81 to $95.87 per ticket) and facility expansion scenarios. Combined, these data-driven recommendations support a potential annual profit increase of **$27.95 million**, demonstrating substantial untapped value in Big Mountain's current operations and facilities.

## 9. Future Scope of Work

Suggest improvements or expansions for future analysis.

Future analysis should address key data limitations and enhance model robustness. Priority areas include collecting customer price sensitivity data to validate demand response assumptions, gathering operational cost breakdowns for accurate run closure ROI calculations, and implementing dynamic pricing models that account for seasonal demand variations. Advanced modeling could incorporate competitor response scenarios, customer satisfaction metrics correlation with pricing, and real-time market monitoring systems. Additionally, developing self-service analytical tools (Excel dashboards or Jupyter templates) would enable ongoing scenario testing without data science team dependency, while A/B testing frameworks could validate pricing recommendations through controlled market experiments.