Peak Mountain Resort

Enhancing Safety, Optimizing Emergency Response & Ensuring Financial Sustainability

Data Miners

Executive Summary

Peak Mountain Resort is a top-tier all-season adventure destination known for its stunning alpine landscapes, thrilling outdoor experiences, and family-friendly activities.

Values:

1. Adventure: Delivering exhilarating outdoor experiences.
2. Safety: Prioritizing guest security and emergency response.
3. Sustainability: Protecting the natural beauty of the mountain.

Goal: To maintain its reputation as a premier mountain destination while ensuring financial sustainability, guest safety, and operational efficiency.

Challenges: Rising operational costs, seasonal safety concerns, high emergency response times.

Impact: Reduce costs without compromising safety; faster, more effective emergency handlin;, maintain Peak Mountain Resort’s leadership as a top destination.

Guiding Questions

1. How can the resort reduce ambulance wait times and improve triage, especially in its remote location?
2. Given tight budgets, where should the resort allocate resources first?
3. What cost-effective solutions can be proposed to balance the high price of maintaining multiple exhibitions, attractions, and advanced safety protocols?
4. What data-driven insights could help forecast future safety needs, reduce liability, and maintain stable revenue across all four seasons?
5. How should safety measures differ between winter, summer, spring, and autumn to address unique risks and weather conditions?

Methodology

Data Cleaning Process:

1. **Cleaning with Python and Excel:** Removed inconsistencies to ensure data integrity.
2. **Merging Datasets:**
   - Found unique customer IDs in both datasets.
   - Joined the two datasets using Customer ID as the key.
3. **Handling Date Column Issues:**
   - Identified and removed an incorrect date column to ensure accuracy.

Natural Language Processing: Gathered and cleaned text data, performed sentiment analysis using the VADER model to categorize reviews, extracted key aspects (e.g., safety, pricing, service) to identify discussion trends, and visualized findings with charts and word clouds.

Data Analysis Techniques:

1. **Exploratory Data Analysis:**
   - Visualized trends.
   - Identified key patterns affecting safety and operational efficiency.
2. **Multiple Regression Analysis:**
   - Explored the relationship between Injury Severity and Age, Skill Level, Response Time, Slope Difficulty.
   - Identified factors contributing most to rising costs.
3. **Correlation & Insights:**
   - Measured associations between Slope with Incident Costs.
   - Uncovered high-risk activities contributing to rising expenses.

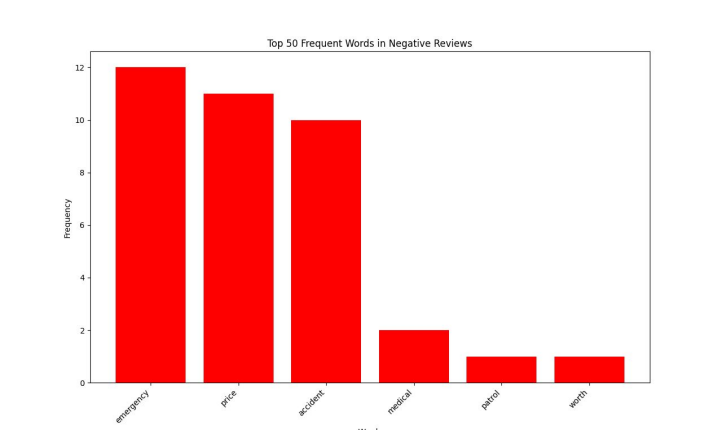
Natural Language Processing Methodology

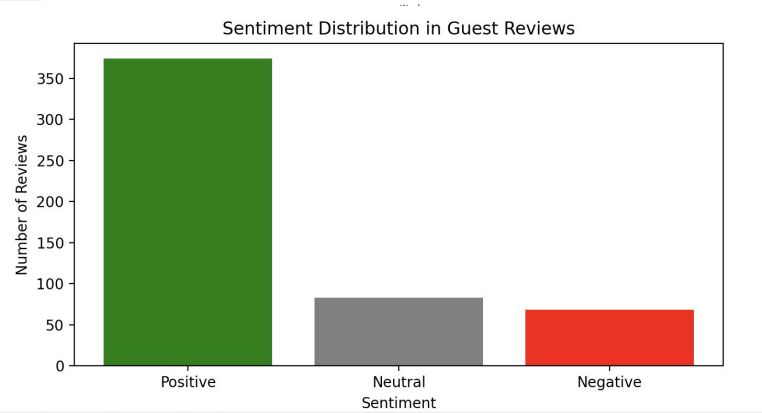
1. **Data Collection & Preprocessing:** Gathered the text data (reviews) and clean it by removing punctuation, and splitting into tokens.
2. **Sentiment Analysis:** Used VADER model to score the text and categorize each review as Positive, Neutral, or Negative.
3. **Aspect Extraction:** Identified specific keywords (e.g., safety, pricing, service) and count their occurrences (category) to understand which topics are most discussed.
4. **Visualization:** Summarized findings with charts and word clouds to see patterns in sentiment and topic frequency.

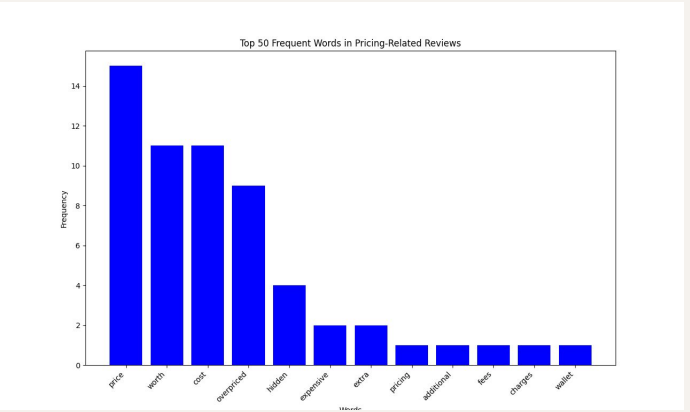
Code snippets

```
import matplotlib.pyplot as plt
import seaborn as sns

# 1Sentiment Distribution Analysis
plt.figure(figsize=(8, 4))
sns.countplot(x=df_reviews["sentiment"],
              palette={"Positive": "green", "Neutral": "gray",
"Negative": "red"})
plt.xlabel("Sentiment Category")
plt.ylabel("Number of Reviews")
plt.title("Sentiment Distribution in Guest Reviews")
plt.show()

# 2. Aspect-Based Sentiment Analysis (ABSA)
# Define categories for Safety, Pricing, and Service
safety_keywords = ["safe", "danger", "accident",
"injury", "medical", "rescue", "help", "hospital"]
pricing_keywords = ["expensive", "cheap",
"overpriced", "value", "cost", "money", "budget",
"price"]
service_keywords = ["staff", "customer", "friendly",
"rude", "helpful", "support", "service", "wait"]

# Count occurrences of keywords in each category
aspect_sentiments = {"Safety": 0, "Pricing": 0, "Service":
0}
for review in df_reviews["review"]:
    words = review.lower().split()
    if any(word in words for word in safety_keywords):
        aspect_sentiments["Safety"] += 1
    if any(word in words for word in pricing_keywords):
        aspect_sentiments["Pricing"] += 1
    if any(word in words for word in service_keywords):
        aspect_sentiments["Service"] += 1

# Plot the aspect analysis results
plt.figure(figsize=(8, 4))
plt.bar(aspect_sentiments.keys(),
aspect_sentiments.values(),
        color=["blue", "orange", "green"])
plt.xlabel("Aspect")
plt.ylabel("Number of Mentions")
plt.title("Aspect-Based Sentiment Analysis (ABSA)")
plt.show()
```

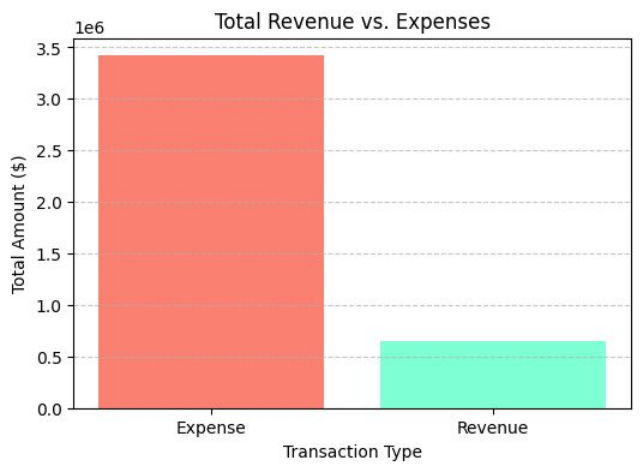
Natural Language Processing Trends



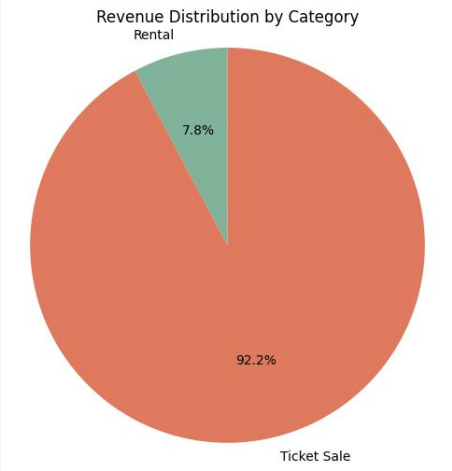




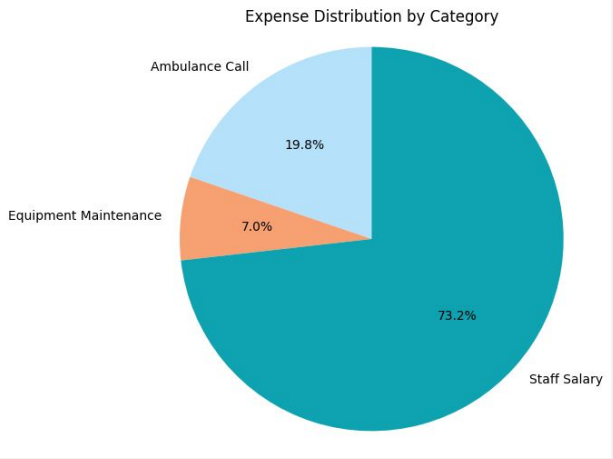
Transaction Breakdown



	Transaction_Type	Total_Amount
0	Expense	-3418853
1	Revenue	645000



	Category	Total_Amount
0	Rental	50210
1	Ticket Sale	594790



	Category	Total_Amount
0	Ambulance Call	675590
1	Equipment Maintenance	240142
2	Staff Salary	2503121

Key Takeaways

1. **Expenses Far Exceed Revenue:**
    - The resort has $3.42M in expenses but only $645K in revenue, indicating a significant financial gap.
2. **Revenue Composition is Limited:**
    - 92.2% of revenue comes from ticket sales, with only 7.8% from rentals, suggesting a need to diversify income streams.
3. **Majority of Expenses Come from Staff Salaries:**
    - 73.2% of costs are attributed to staff salaries, making it the largest cost driver.
    - Ambulance calls (19.8%) and equipment maintenance (7%) also contribute significantly.

IMPLICATION(S):

1. Cost-cutting strategies should focus on optimizing staff salaries and emergency response expenses without compromising guest safety.

Seasonal Revenue

Season		Summer	Winter	Grand Total
Transaction_Typ	Category	Amount (Sum)		
▼ Expense	Ambulance Call	-333947	-341643	-675590
	Equipment Mair	-123703	-116439	-240142
	Staff Salary	-1287403	-1215718	-2503121
Expense Total		-1745053	-1673800	-3418853
▼ Revenue	Rental	15810	34400	50210
	Ticket Sale	134020	460770	594790
Revenue Total		149830	495170	645000
Grand Total		-1595223	-1178630	-2773853

Key Takeaways

1. **Revenue Is Heavily Seasonal:**
   - Summer ticket sales ($134K) vs. Winter ticket sales ($460K).
   - Total summer revenue covers <10% of expenses.
2. **Summer Operations Are Running at a Large Deficit:**
   - Summer net loss: -$1.59M vs. Winter net loss: -$1.18M.
   - Imbalance between staffing levels and guest demand.

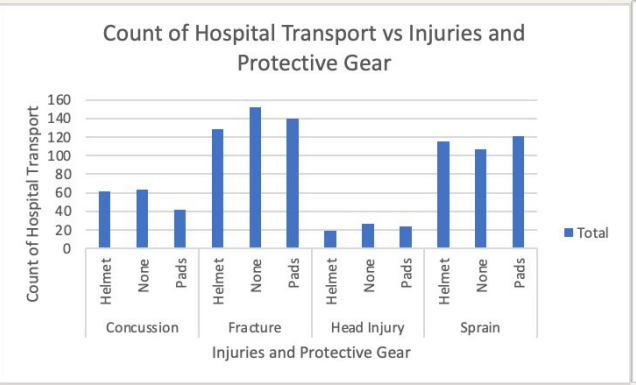
IMPLICATIONS:

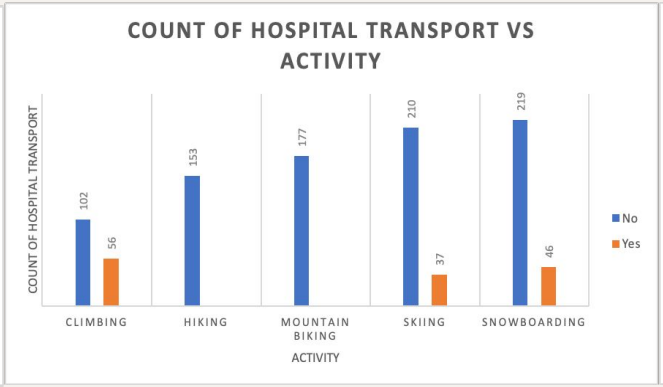
1. Summer staffing costs appear excessive given low visitor numbers.
2. Winter revenue sustains resort finances, highlighting seasonal dependency.
3. Need for better alignment of workforce size with seasonal demand.

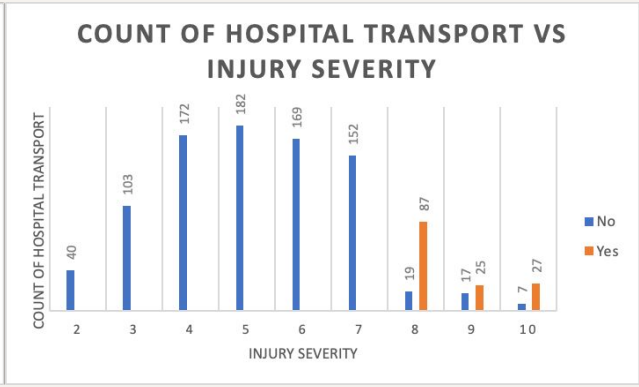
Possible Alternatives 1

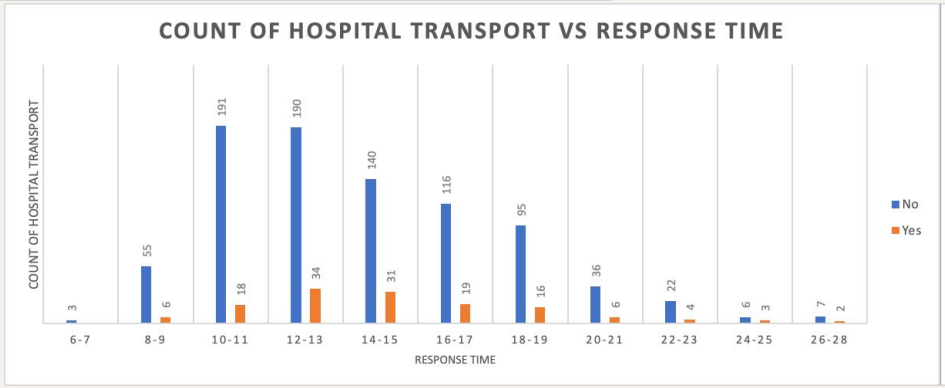
1. **Optimize Seasonal Staffing**
   - Reduce full-time summer staff, shift toward seasonal/part-time roles, and cross-train staff.
   - Implement dynamic staffing models based on real-time visitor demand.
2. **Boost Summer Revenue**
   - Expand summer attractions (festivals, guided tours, adventure packages).
   - Introduce VIP & premium experiences to attract higher-spending visitors.
   - Bundled Activity Passes: Discounted multi-activity passes that incentivize visitors to try multiple experiences.
   - Dynamic Pricing on Lodging & Activities: Offer early booking discounts, weekday promotions, and special pricing for groups.
3. **Improve Operational Efficiency**
   - Automate guest services (online check-in, digital concierge, online equipment check).
   - Activity queue management can be streamlined with an automated ticket/pass check system. A virtual “take-a-number” system via a pager can be implemented —guests get notifications when it’s their turn.

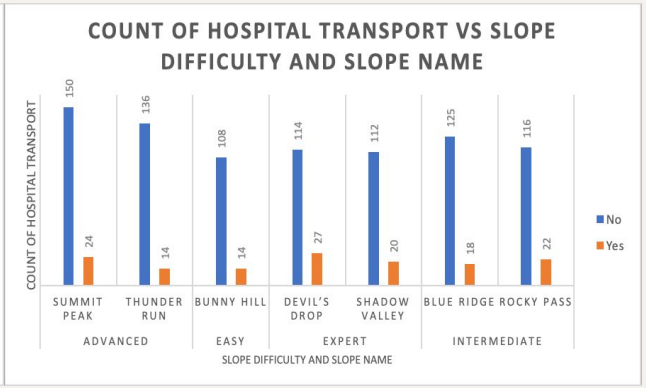
Factors Causing Hospital Transport











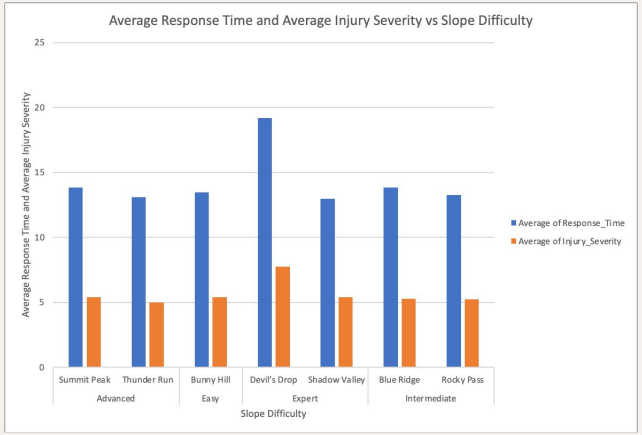
Key Takeaways

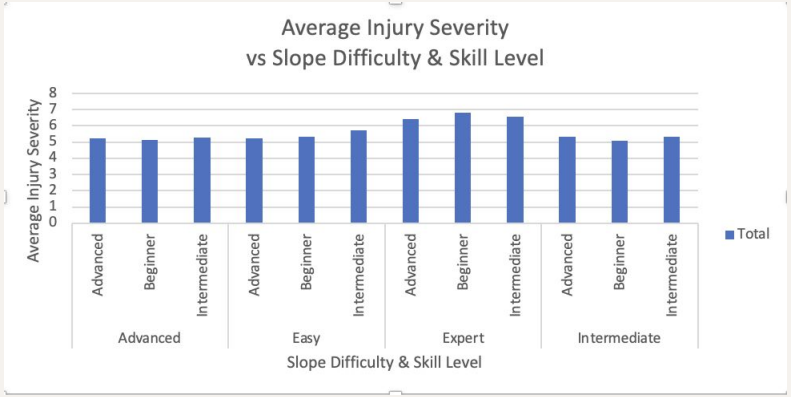
1. **Fractures and Sprains Are the Most Common Injuries Requiring Transport**
    - Protective gear (helmets and pads) does not eliminate the need for hospital transport.
2. **Mountain Biking, Skiing, and Snowboarding Have the Most Incidents**
    - Climbing has the highest number of hospital transports (even with significantly fewer incidents), followed by snowboarding and skiing.
3. **Response Time Peaks Between 10-14 Minutes**
    - Most hospital transports occur when response times range between 10-14 minutes.
    - Faster response times (6-9 minutes) are less common, suggesting logistical challenges or delays in reaching certain accident locations.
4. **Higher Injury Severity Leads to More Hospital Transports**
    - No transports occur at severity levels below 8, likely because mild cases are be treated on-site.

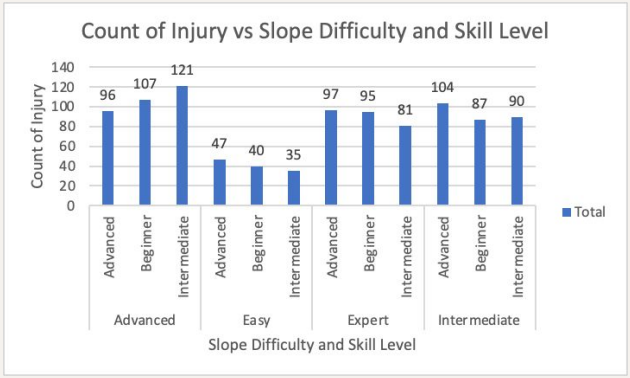
IMPLICATIONS:

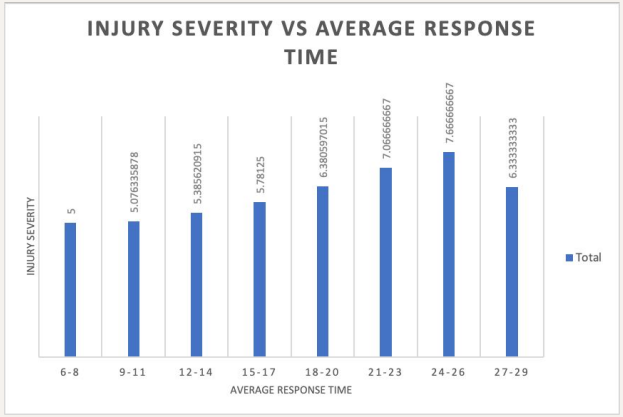
1. Preventative measures, such as better protective gear usage, enhanced safety education on slopes, and skill-appropriate slope selection, could reduce injuries.
2. Quicker emergency response times (under 10 minutes) might improve patient outcomes.
3. More injury prevention efforts should focus on climbing biking, skiing, and snowboarding.

Factors Driving Injury Severity









Key Takeaways

1. **Longer response times correlate with higher injury severity.**
    - Injury severity is around 5 for response times below 17 minutes, but it increases to 7+ when response times exceed 20 minutes.
    - This suggests that faster medical response can help reduce injury severity.
2. **Response times appear relatively consistent across different slopes, but Devil's Drop has a longer response time (and severity).**
    - This could be due to challenging terrain making rescues harder.
3. **Injury severity tends to be slightly higher on Expert slopes, especially for beginners.**
    - This suggests that inexperience, combined with challenging terrain, may increase injury severity.
    - However, across all slope difficulties, injury severity remains fairly consistent across skill levels.
4. **Injury count tends to be higher on Advanced slopes, especially for beginners and intermediates.**

IMPLICATIONS:

1. Target areas with longer response times and higher severity, such as Devil's Drop and expert slopes, by adding more patrollers and improving access.
2. Implement specialized training, pre-slope assessments, and on-slope monitoring for beginners to enhance safety on expert slopes.

Regression Analysis on Injury Severity

```
Call:
lm(formula = Injury_Severity ~ Age + Skill_Level + Response_Time +
    Slope_Difficulty, data = merged_data)

Residuals:
     Min       1Q   Median       3Q      Max
-1.59914 -0.32572 -0.03797  0.43856  1.25793

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                6.809697   0.160087  42.537   <2e-16 ***
Age                        0.001034   0.002169   0.477   0.6339
Skill_LevelBeginner        0.043024   0.070095   0.614   0.5397
Skill_LevelIntermediate    0.140273   0.070556   1.988   0.0475 *
Response_Time              0.091052   0.008151  11.170   <2e-16 ***
Slope_DifficultyEasy       0.096365   0.111423   0.865   0.3877
Slope_DifficultyExpert     0.848408   0.083519  10.158   <2e-16 ***
Slope_DifficultyIntermediate 0.141241   0.078500   1.799   0.0728 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.5494 on 384 degrees of freedom
Multiple R-squared:  0.5637,    Adjusted R-squared:  0.5557
F-statistic: 70.88 on 7 and 384 DF,  p-value: < 2.2e-16
```

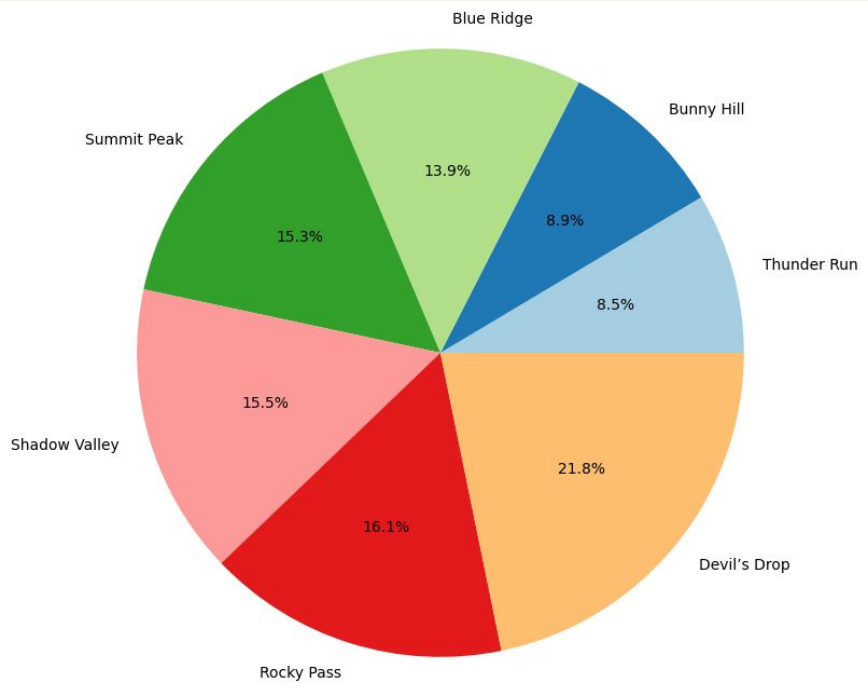
Significant Predictors of Injury Severity:

1. Response Time ($p < 2e\text{-}16$): Higher response time is strongly correlated with increased injury severity.
2. Slope Difficulty (Expert) ($p < 2e\text{-}16$): Expert slopes have a significantly higher impact on injury severity.
3. Skill Level (Intermediate) ($p = 0.0475$): Intermediate skill level shows a minor but significant effect.

Regression Stats:

1. $R^2 = 56.37\%$ (Moderate model fit)
2. F-statistic: 70.88 ($p < 2.2e\text{-}16$) (Model is statistically significant)

Correlation of Slope with Incident Costs



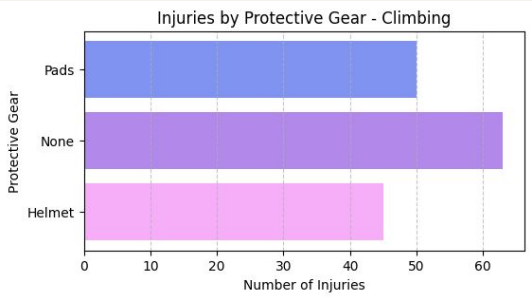
Key Takeaways

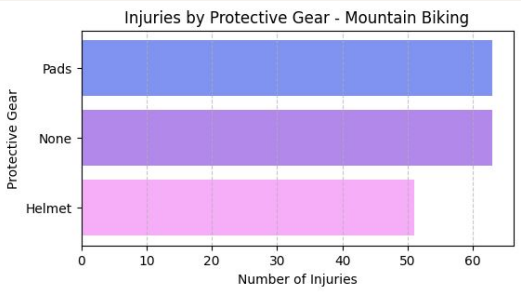
1. Devil's Drop incurs the highest expenses, followed by Rocky Pass and Shadow Valley.
2. These slopes are classified as Expert and Advanced difficulty levels.

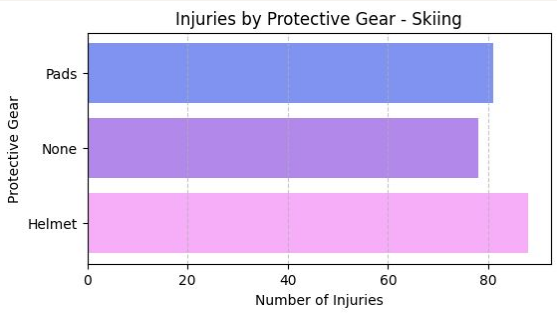
Possible Alternatives 2:

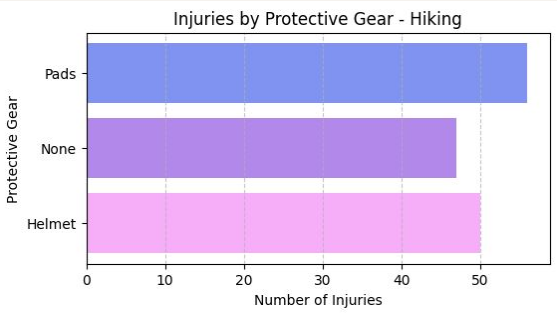
1. Enhanced Safety Measures: Install warning signs, safety nets, and improve slope maintenance.
2. Mandatory Safety Briefings: Require expert skiers to review risks before accessing high-difficulty slopes.
3. Incentivize Safer Routes: Promote alternative routes for less experienced skiers to reduce high-cost injuries.

Analyzing Protective Gear Usage and Incident Trends









Key Takeaways

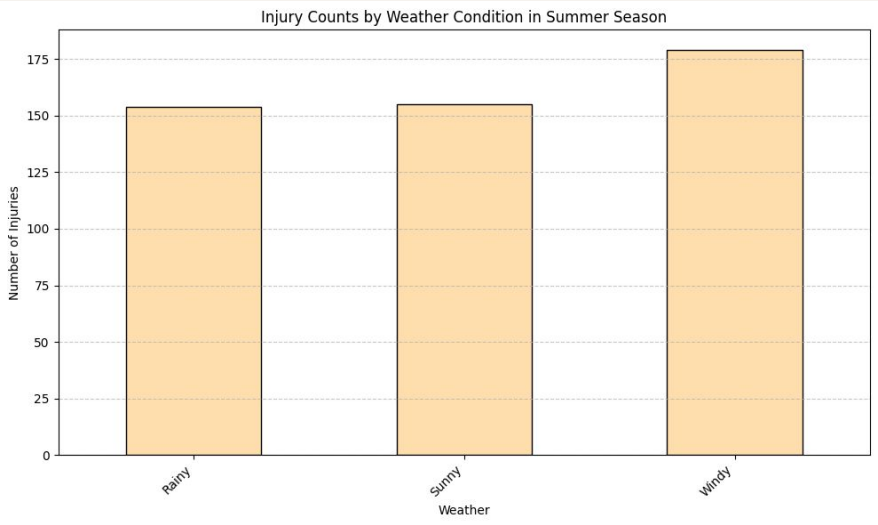
Analysis:

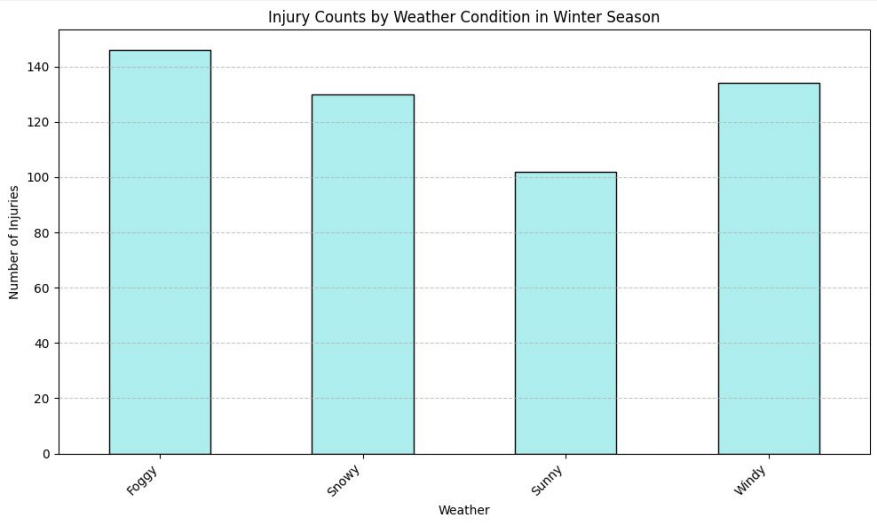
1. Protective Gear Usage and Incident Counts are not correlated.
2. Climbing and Snowboarding show significant incidents without helmets and pads.
3. Skiing and Hiking have many incidents despite helmet use.

Possible Alternatives 3:

1. **Mandatory Gear:** Require helmets & pads for Climbing and Snowboarding.
2. **Improved Protective Equipment:** Invest in additional higher-quality helmets, pads, and back protectors for skiing and Hiking.
3. **Enhanced Safety Compliance:** Implement gear rental tracking & enforce proper equipment use.
4. **Risk Acknowledgment Waivers:** Require waivers before high-risk activities for legal protection.

Seasonal Trends in Injury Counts Based on Weather Conditions





Key Takeaways

1. **Summer Season:**
    - Windy conditions have the highest injury counts, followed closely by rainy and sunny weather.
    - No drastic differences between weather types, suggesting injuries are relatively consistent across conditions in summer.
2. **Winter Season:**
    - Foggy conditions show the highest injury counts, indicating reduced visibility may be a major risk factor.
    - Windy and snowy conditions also contribute significantly to injuries, but sunny weather has the lowest injury counts.

Possible Alternatives 4:

1. **Mandatory Gear:** Mandate Avalanche beacons for high-risk areas in winter.
2. **Patrolls:** Increase patrolls when it is foggy and windy to guide guests, and decrease when it is sunny.
3. **Improved Visibility Aids:** Waterproof signage, lighting, and fog alerts.
4. **Preventative Training:** Educating visitors on weather-related risks & mandatory signing of waivers.
5. **Emergency Communication Systems:** Radio alerts for hikers and bikers about weather shifts.

Final Recommendation 1 : Cost Saving Measures

Seasonal Staffing Adjustments

1. **Winter Weather Analysis + Recommendations**
    - **Foggy (146 incidents):** Limited visibility raises injury risks. Boost ski patrol, emergency, and medical teams.
    - **Snowy (130 incidents):** Avalanche and injury hazards require extra caution. Increase patrols, deploy avalanche teams, and ensure snow clearance.
    - **Sunny (102 incidents):** Lower risk, but beginner slopes may need attention. Maintain regular staffing with focused support on beginner areas and lift operations.
    - **Windy (134 incidents):** Increased accident severity on high altitudes. Enhance patrols and rescue readiness on upper slopes.
2. **Summer Analysis + Recommendations**
    - **Rainy (154 incidents):** Slippery trails heighten hiking and equipment-related risks. Increase medical staff and trail patrols to check weather hazards with emphasis on safety gear checks.
    - **Sunny (155 incidents):** High guest volume, especially for hiking and climbing necessitates crowd and safety management. Adjust staffing for crowd control and monitor challenging terrains.
    - **Windy (179 incidents):** Elevated risks in zip-lining and climbing activities can lead to equipment failures. Reinforce patrols and rescue teams, especially for high-altitude or exposed activities.

Final Recommendation 1 : Cost Saving Measures

3. **Transition Periods**
    - **Spring**
        - **Conditions:** Unpredictable weather with temperature swings and snowmelt, leading to wet trails and landslide risks.
        - **Recommendations:** Rotate flexible schedules; focus on trail monitoring and medical support for hiking/biking incidents.
    - **Autumn**
        - **Conditions:** Lower overall risk, but early snow and slippery leaves can trigger accidents.
        - **Recommendations:** Monitor equipment and adjust patrol levels to match reduced traffic while ensuring hazard coverage.

4. **Dynamic Staffing & Cross-Training Model**
    - **Predictive Forecasting:** Use historical weather data and incident trends to predict high-risk days.
    - **Dynamic Scheduling:** Adjust staff levels in real-time based on forecasted conditions.
    - **Cross-Training:** Equip staff with multiple skills (e.g., paramedic, ski patrol) to allow flexible, efficient responses.
    - **Automated Alerts:** Implement weather alerts and real-time incident tracking to trigger staffing adjustments.

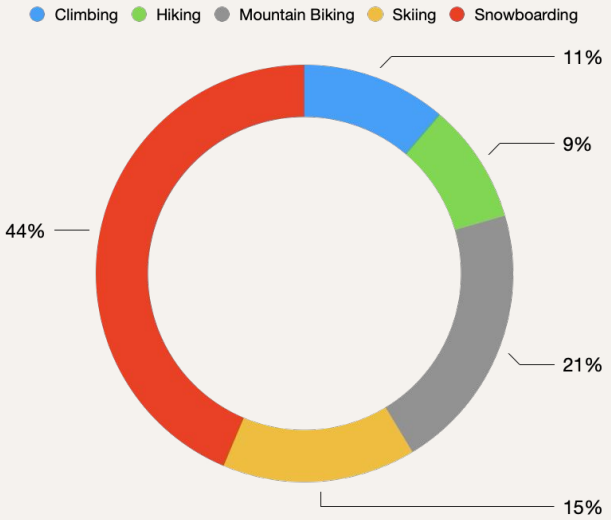
Final Recommendation 2: Increasing Sales

1. **Maximize Rental & Safety Gear Sales:**
    - Bundle gear rentals (helmets, knee pads, wrist guards) with lift tickets.
    - Offer premium gear options for added safety & comfort.
    - Require protective gear for high-risk activities (Climbing, Snowboarding, Mountain Biking).
    - **Potential Revenue Impact:** Higher rental sales + improved safety = fewer costly injuries.
2. **Dynamic Pricing for Tickets & Passes**
    - Peak Pricing: Charge more on weekends, holidays, and peak ski seasons.
    - Off-Peak Discounts: Encourage midweek visits with lower rates.
    - Season Pass Upsell: Offer discounted season passes to frequent visitors.
    - **Potential Revenue Impact:** Maximizing ticket prices during high-demand periods can increase per-visitor revenue
3. **Improve Guest Spending with Add-On Experiences:**
    - Guided Adventure Packages: Charge for expert-led skiing, hiking, and climbing tours.
    - Après-Ski & Wellness Services: Expand spa, dining, and entertainment offerings.
    - Photography & Video Packages: Offer professional action shots of guests on slopes & trails.
    - **Potential Revenue Impact:** Higher per-guest spend through premium experiences.

Per-Ticket Cost Analysis: Forecasting Revenue Impact

Activity	Amount (Average)
Climbing	1754
Hiking	864.285714285714
Mountain Biking	1583
Skiing	1184
Snowboarding	2287.33333333333
Grand Total	1634.04255319149

Activity	Amount (Average)
Climbing	122.142857142857
Hiking	191.5
Mountain Biking	180.454545454545
Skiing	91.8181818181818
Snowboarding	193.125
Grand Total	161



Final Recommendation 3: Increasing revenue

1. **Monetize Training & Safety Courses:**
    - Beginner Lessons: Make first-time ski/snowboard lessons (at an extra fee).
    - Mountain Safety Workshops: Sell guided courses on avalanche preparedness, hiking survival, and injury prevention.
    - **Potential Revenue Impact:** Fewer accidents + extra revenue from training fees.
2. **Partner with Sponsors & Local Businesses:**
    - Brand Sponsorships: Partner with outdoor brands (e.g., ski gear companies, energy drinks) for sponsored events.
    - **Potential Revenue Impact:** New revenue streams from sponsorships and partnerships.
3. **Expand Year-Round Events & Attractions:**
    - Attract visitors with food, and adventure sports competitions.
    - Corporate Retreats & Team-Building Packages: Market the resort as a business getaway destination.
    - **Potential Revenue Impact:** More off-season visitors = stable revenue year-round.

Impact of Revenue Strategies

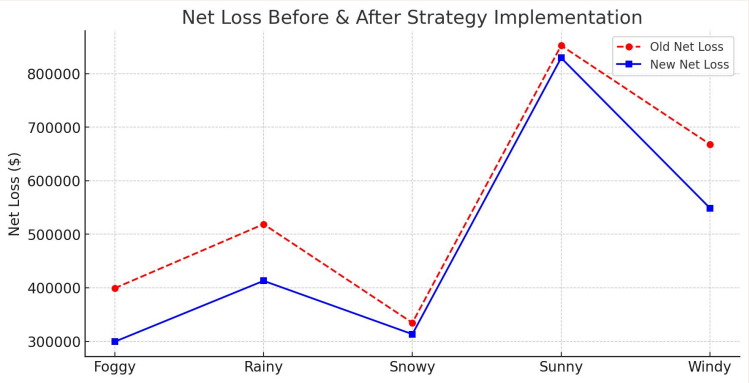
Financial Model Results:

After implementing pricing adjustments, new revenue streams, and cost reductions, the model shows:

1. **Revenue Increase:**
   - 15% ticket & rental price hike on peak days (Sunny, Snowy, Windy).
2. **Expense Reduction:**
   - 10% cost reduction on high-loss days (Foggy, Rainy, Windy) by cutting excess staff & adjusting operations.

Biggest Gains:

1. Monetizing Rainy & Foggy days reduced losses significantly.
2. Peak pricing increased revenue without major cost changes.



Thank You