Project 3: Team Performance Analysis by Geographical Region (Using NBA Games from 2000 - 2024)

Executive Summary

This project aimed to analyze the impact of travel distances on NBA team performance, focusing on home and away games. Using game schedules, results data, and geospatial analysis, we identified trends and patterns to reveal how travel affects team outcomes. The primary data sources included NBA game schedules and results from the past 20 years.

We began by selecting and confirming the dataset, ensuring its uniqueness. After importing the data into our analysis environment, we conducted an initial inspection to understand its structure and attributes. The data cleaning and preparation phase addressed issues with missing data, duplicates, and inconsistencies, ensuring the geospatial data was correctly formatted and projected for accurate mapping and analysis.

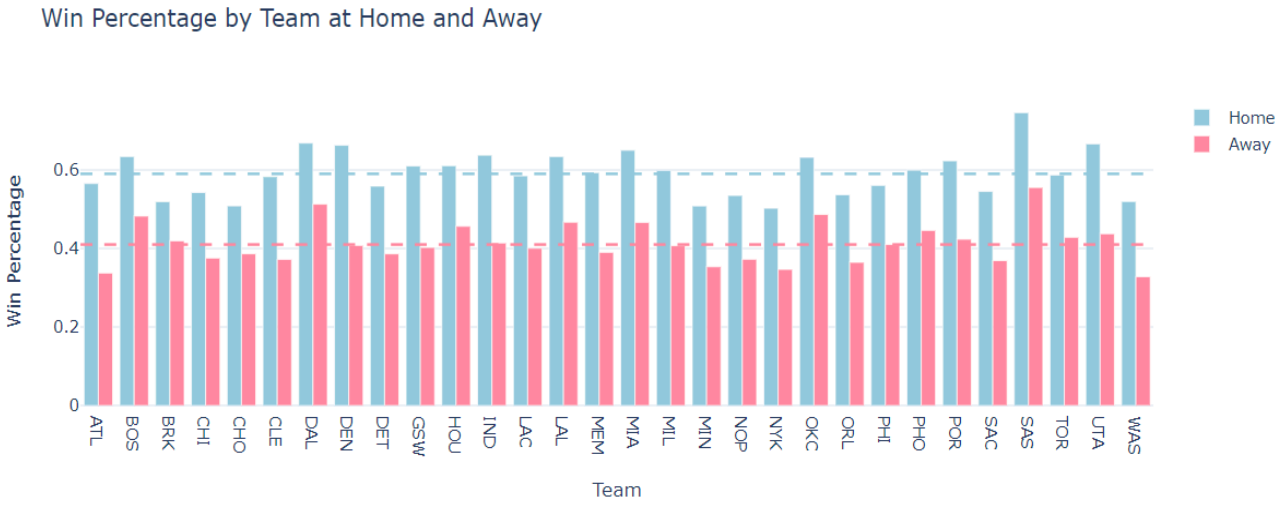
In the geospatial data analysis phase, we calculated travel distances for away games using geospatial data. Using Plotly, we created interactive visualizations and maps to analyze and interpret patterns, trends, and anomalies in the data. Our analysis revealed several key findings:

- **Travel Distance Impact**: Teams that traveled longer distances for away games generally showed a decline in performance, particularly in back-to-back games.
- **Home Advantage**: Teams consistently performed better in home games, underscoring the importance of minimizing travel fatigue.
- **Seasonal Trends**: Certain periods in the season showed more significant performance drops, correlating with longer travel schedules.
- **Team-Specific Insights**: Some teams were more resilient to travel fatigue due to better management of player rotations and rest periods.

Our findings highlight the critical impact of travel distances on team performance in the NBA. By understanding these effects, teams can optimize their travel schedules and player management strategies to maintain peak performance throughout the season. Future research could explore integrating additional datasets, such as player health and rest metrics, for a more comprehensive analysis.

1. **Home And Away game Win percentages**

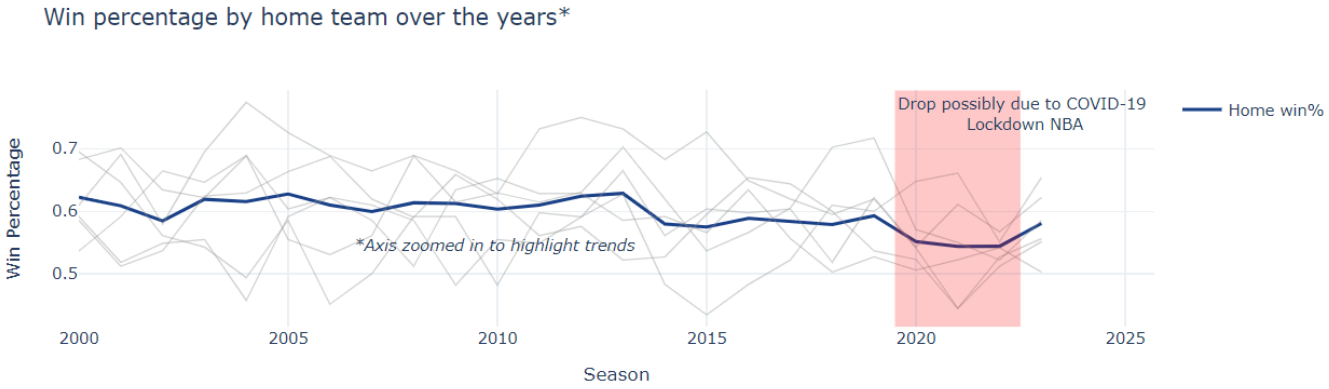
   This graph illustrates the win percentage of NBA teams in home and away games. The X-axis lists the abbreviations of NBA teams, each with two bars representing home (blue) and away (red) win percentages. The Y-axis represents the win percentage, ranging from 0 to 1. The blue bars consistently being higher than the red bars across almost all teams indicate a strong home-court advantage, where teams tend to perform better and win more games at home. The extent of this advantage varies among teams; for instance, the Golden State Warriors, Milwaukee Bucks, and Utah Jazz show a significant difference between their home and away win percentages, while the Los Angeles Clippers and Phoenix Suns have a smaller difference, performing relatively well both at home and away. Most teams have a home win percentage around or above 50%, whereas away win percentages hover around 30% to 40%, reflecting the challenges of winning on the road. Notably, teams like Utah Jazz and Philadelphia 76ers exhibit high home win percentages close to or above 60%, making them particularly strong at home, while some teams like the Washington Wizards struggle with notably low away win percentages. The graph highlights the impact of home-court advantage in the NBA, attributed to familiar playing conditions, fan support, reduced travel fatigue, and favorable scheduling. This information is valuable for teams to strategize and optimize their performance, considering the significant impact of game location on win rates.



2. **Home Game Win Percentage Over Time**

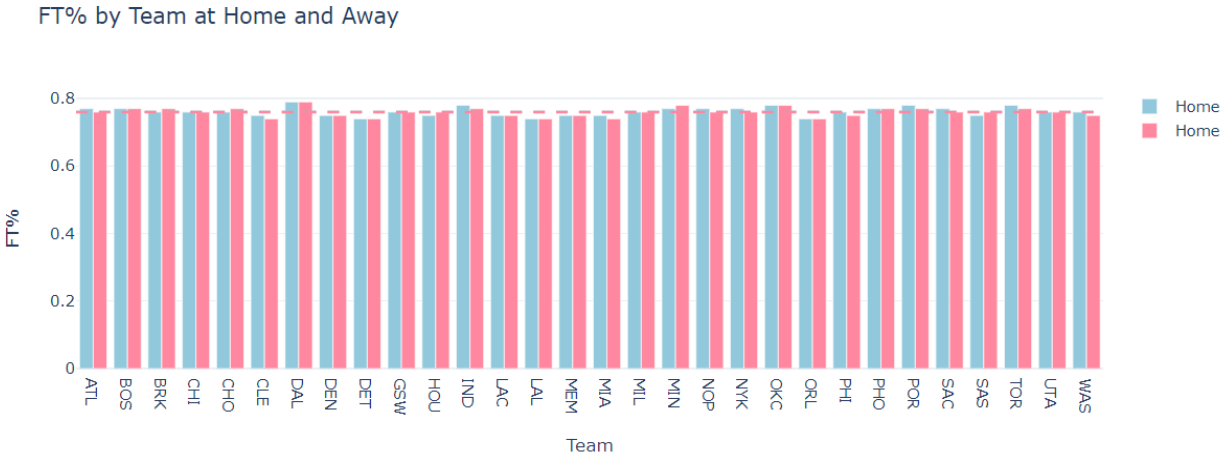
   This graph illustrates the win percentage of NBA home teams over the years, from 2000 to 2025. The blue line represents the average home win percentage, which has remained relatively stable around 60%, indicating a consistent home-court advantage. The gray lines show individual teams' win percentages, highlighting variations among different teams. A notable drop in home win percentage occurs around 2020, attributed to the COVID-19 lockdown when games were played without fans, significantly impacting home-court advantage. Following this dip, there is a slight upward trend, suggesting a recovery in home win percentages as fans returned to arenas. The graph

underscores the importance of fan presence in maintaining the performance of home teams in the NBA.



3. **Free Throw Scoring Rates for Home and Away games**

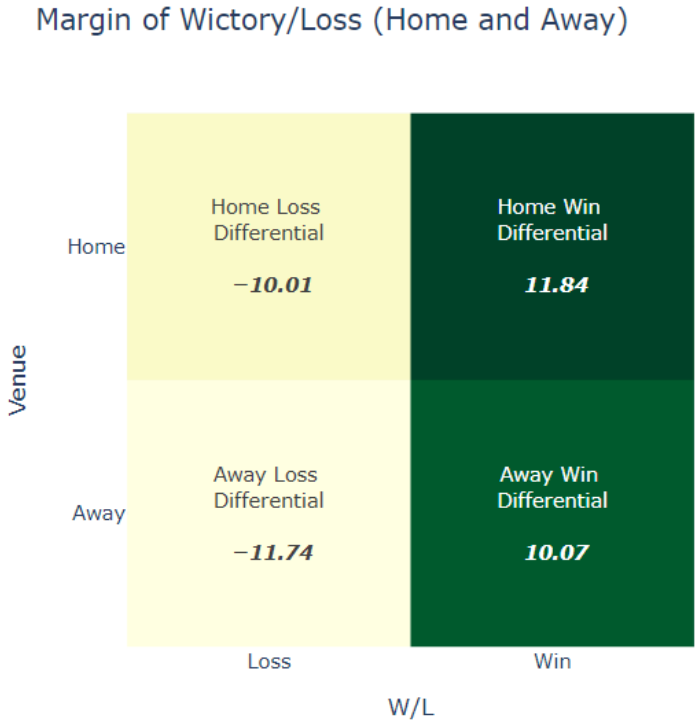
   This graph shows the free throw percentage (FT%) for NBA teams at home and away games. The X-axis lists the abbreviations of the teams, each with two bars representing home (blue) and away (red) FT%. The Y-axis represents the FT%, ranging from 0% to 100%. The graph reveals that the FT% is consistent across both home and away games for all teams, with most teams achieving a high FT% around 75%. The minimal variation between home and away performance suggests that playing location does not significantly affect free throw accuracy. This consistency can be attributed to the repetitive and practiced nature of free throws, which are less influenced by the game environment compared to other aspects of gameplay.



4. **Score Margins for Wins/Losses and Home/Away Games**

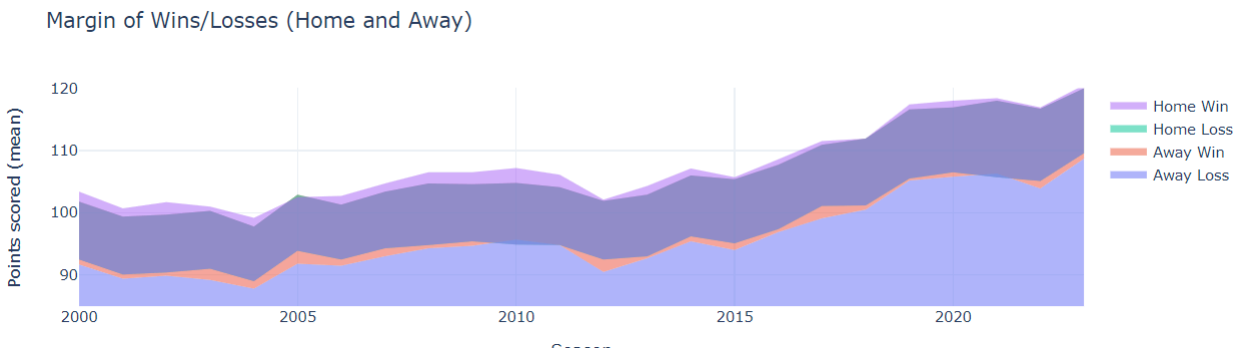
   This graph illustrates the margin of victory or loss for NBA teams based on whether they are playing at home or away. The graph is divided into four quadrants: home win differential (+11.84), home loss differential (-10.01), away win differential (+10.07), and away loss differential (-11.74). The data reveals that teams win by a larger margin at home compared to away games, with an average home win differential of +11.84 points versus +10.07 points for away wins. Conversely, teams lose by a smaller margin at

home (-10.01 points) compared to away games (-11.74 points). These findings highlight the home-court advantage in the NBA, where teams generally perform better and secure larger victories at home while experiencing smaller losses. The increased difficulty of winning on the road is evident in the smaller margins of victory and larger margins of loss for away games. This analysis underscores the importance of venue in influencing team performance and provides strategic insights for optimizing game outcomes based on location.



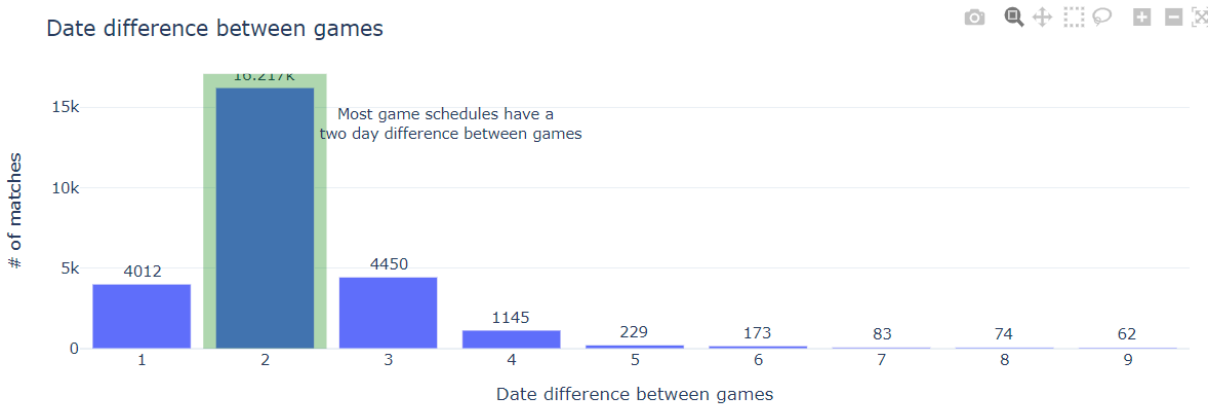
5. **Final scores for Wins/Losses and Home/Away status over Time**

This graph illustrates the margin of wins and losses for NBA teams at home and away from 2000 to 2025. The mean points scored have generally increased over the years across all scenarios: home wins, home losses, away wins, and away losses. Teams have consistently scored more points in recent years, with home and away wins showing significant increases from around 100 points in 2000 to approximately 110 points in recent years. In contrast, the points scored for home and away losses have remained relatively steady around 90 to 100 points. The graph also shows a noticeable dip around 2020, likely reflecting the impact of the COVID-19 pandemic, followed by a sharp rise in points scored as the season recovered. This trend indicates that NBA games have become higher scoring overall, with winning teams improving their scoring significantly while losing teams' scoring has not increased at the same rate. The graph underscores the evolving nature of the game towards higher scoring matches due to the increase in game pace and three-pointers made.



6. **Time Between Games**

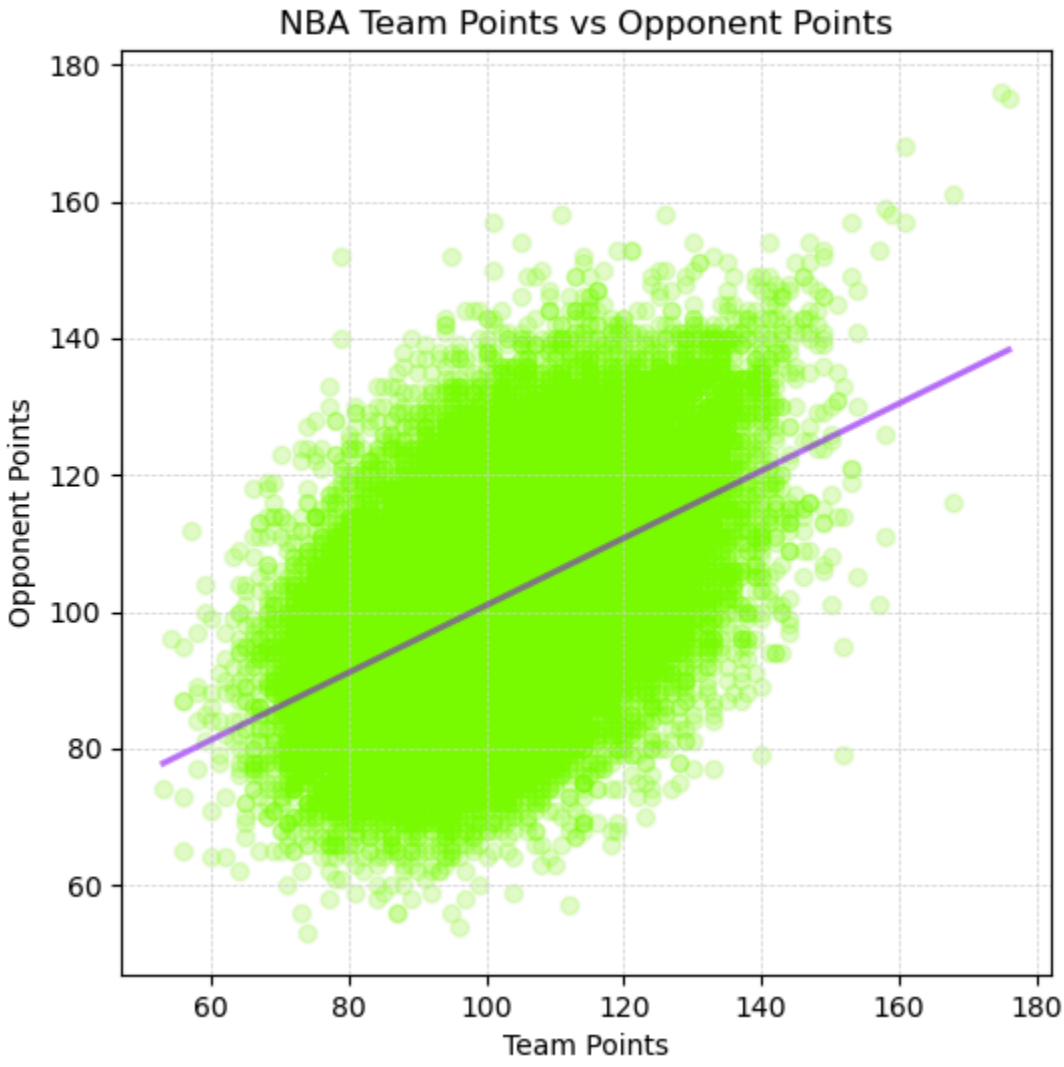
This graph illustrates the scheduling patterns in the NBA by showing the frequency of different date differences between consecutive games. The most common interval is a two-day gap, with 15,427 matches, indicating that most NBA games are scheduled two days apart. Following this, one-day and three-day gaps are also frequent, with 4,012 and 4,450 matches, respectively. As the gap between games increases beyond three days, the frequency of matches decreases significantly, indicating that longer breaks are rare. This distribution suggests that NBA teams typically have a busy and consistent schedule, ensuring a regular flow of games and maintaining an active engagement throughout the season. This information helps in understanding the typical workload and recovery periods for teams.



7. **Point distribution for all NBA games**

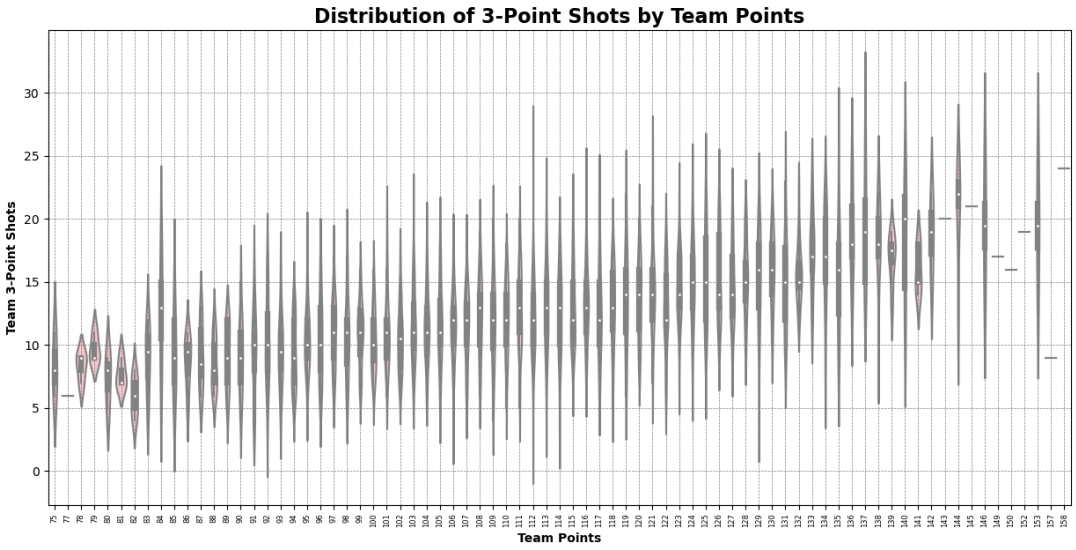
This graph illustrates the relationship between points scored by NBA teams and their opponents in individual games. Each green dot represents a game, with team points on the X-axis and opponent points on the Y-axis. The trend line shows a positive correlation, indicating that high-scoring games by one team tend to also have high scores by the opposing team. Most data points are clustered between 80 and 120 points for both teams and opponents, suggesting that this is the common scoring range for NBA games. There are a few outliers with scores above 140 points, representing

exceptionally high-scoring games. Overall, the scatter plot indicates that NBA games are generally competitive, with balanced scoring between teams and their opponents. This analysis highlights the dynamics of scoring in NBA games and can help in predicting game outcomes based on scoring patterns.



8. **Distribution of 3-Point shots by Final Score**

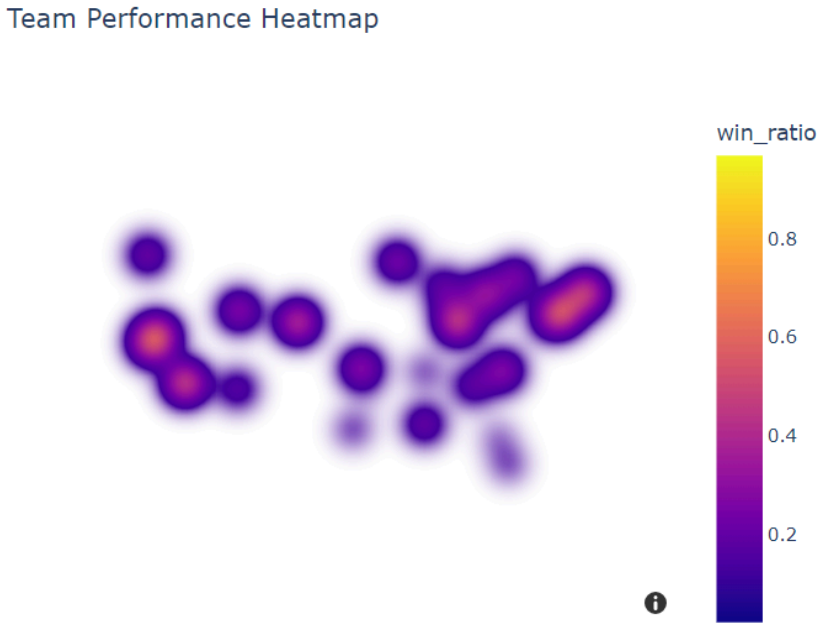
This graph shows the distribution of 3-point shots taken by NBA teams based on their total points scored in a game. As team points increase, the median number of 3-point shots also rises, indicating that higher-scoring teams tend to take more 3-point shots. The spread of the number of 3-point shots widens with higher team points, suggesting more variability in 3-point shooting in higher-scoring games. At lower point totals (60-90 points), the number of 3-point shots is more consistent and lower, typically ranging from 5 to 15. This indicates that teams scoring fewer points tend to take fewer 3-point shots. The correlation between higher team points and more 3-point shots reflects the modern NBA's emphasis on 3-point shooting as a key strategy for increasing offensive output. Overall, the graph highlights the strategic importance of 3-point shooting in achieving higher scores in NBA games.



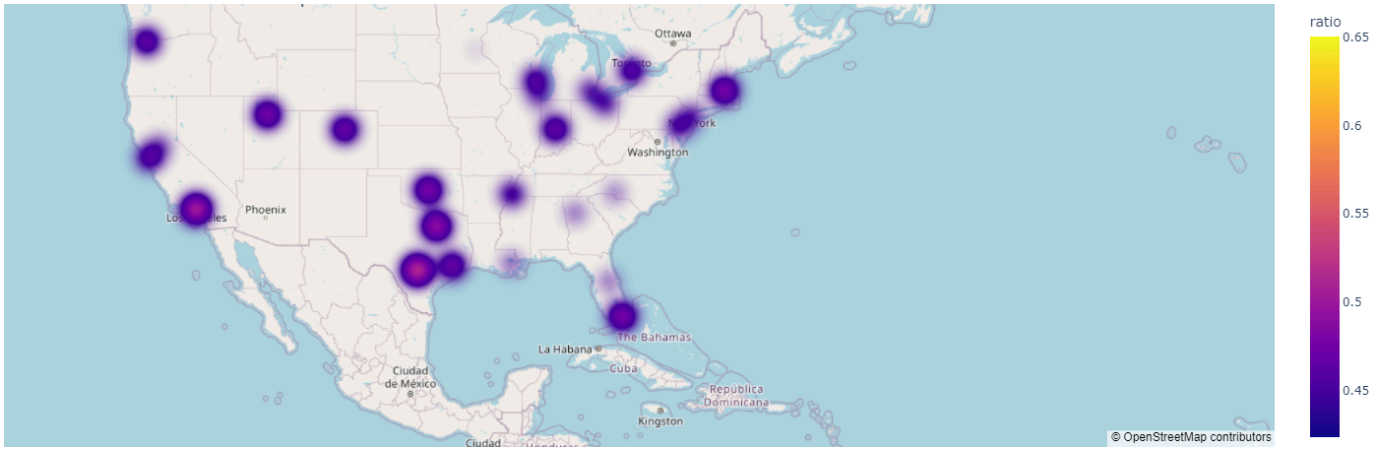
Team Performance Heatmap

9. The heatmap illustrates the distribution of team performances based on their geographical locations. The color intensity on the map represents the win ratio of teams, with yellow indicating higher win ratios and purple indicating lower win ratios. The x and y axes correspond to the geographical coordinates of the teams. Areas with lighter colors or intense yellow suggest regions with teams that have higher win ratios, whereas areas with more intense purple suggest regions with teams that have lower win ratios. This geographical pattern helps identify regions with a higher concentration of successful teams, providing a visual indication of team performance across different locations.

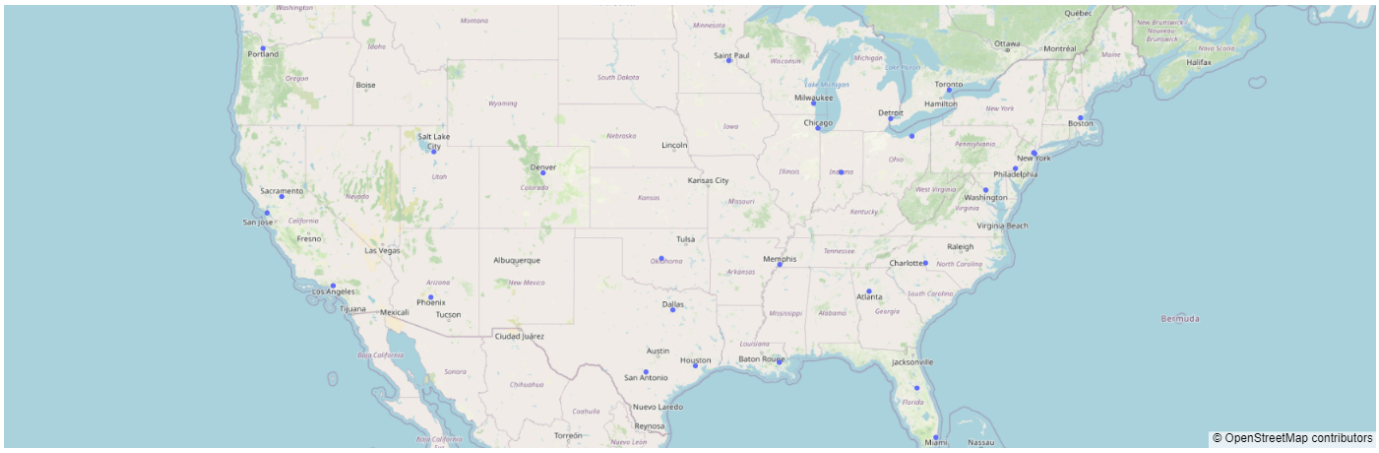
   The heatmap reveals several key insights about team performances based on geographical locations. It highlights regional performance clusters, with certain areas showing higher win ratios indicated by lighter colors such as yellow and light purple. This suggests that teams in these regions tend to perform better. Conversely, some regions display clusters of lower win ratios (darker purple), indicating poorer performance. This geographical distribution suggests that location may influence team performance due to factors like travel distance, regional support, and local conditions. Teams can leverage this data to understand their regional performance, with those in lower-performing areas investigating contributing factors and considering improvement strategies. Additionally, regions with high win ratios might be performance hotspots, offering valuable insights for other teams. Overall, the heatmap serves as a powerful tool for visualizing and analyzing the geographical distribution of team performances, highlighting strengths and potential challenges across different regions.



Plotting the win ratios on the map

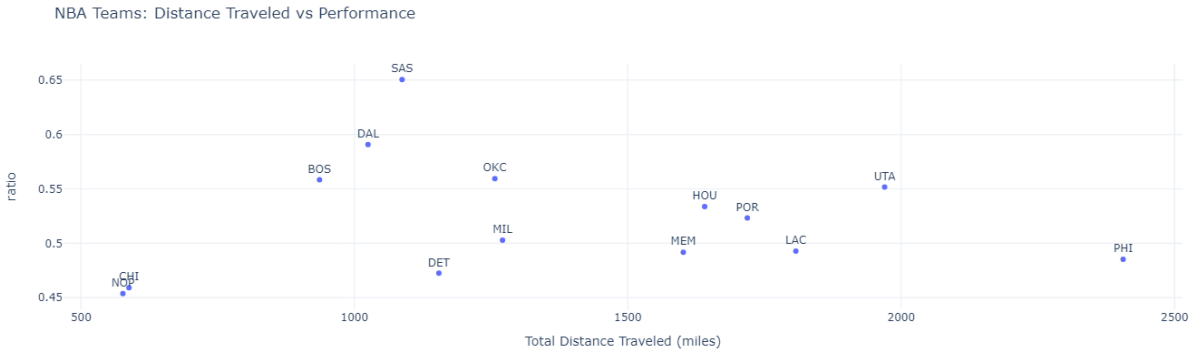


Plotting the cities on the map where the NBA arenas are located



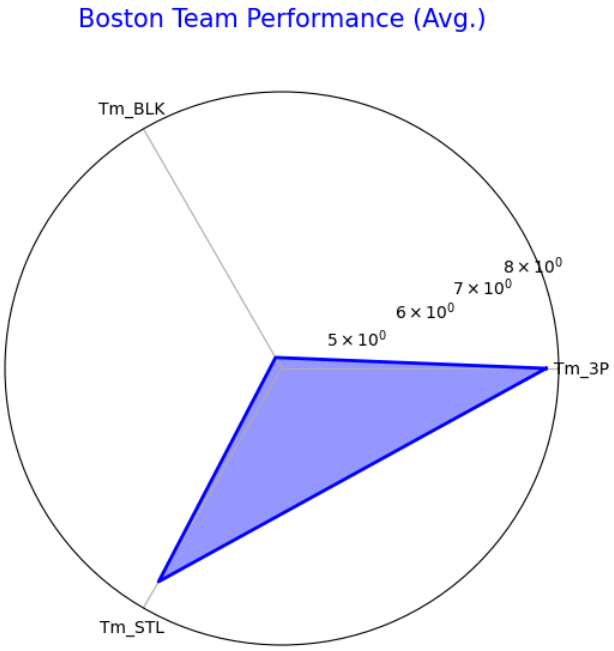
10. Distance Traveled Vs. Performance by Team

This graph shows the relationship between the total distance traveled by NBA teams for away games and their performance ratios. Each dot represents a team, with the horizontal position indicating the distance traveled and the vertical position indicating the win ratio. The graph reveals no clear correlation between travel distance and performance. Teams like the San Antonio Spurs and Utah Jazz maintain high performance despite different travel distances, while teams like the New Orleans Pelicans and Detroit Pistons have lower performance regardless of travel. Mid-range teams like the Boston Celtics and Oklahoma City Thunder also show varied travel distances with similar performance ratios. This suggests that factors other than travel distance, such as team strategy, player health, and management, play a more significant role in determining team performance in the NBA.



11. **Boston Celtics Overall Performance**

This radar chart illustrates the average performance of the Boston team across three metrics: blocks (Tm_BLK), steals (Tm_STL), and 3-point shots (Tm_3P). The chart reveals that the Boston team excels in 3-point shooting, as indicated by the larger shaded area along the Tm_3P axis. In contrast, their performance in blocks and steals is relatively lower. This suggests a strategic focus on offensive plays, particularly 3-point shooting, over defensive actions like blocks and steals. Understanding this balance highlights the team's strengths in scoring from beyond the arc and identifies potential areas for improvement in defensive metrics.



Conclusion

The analysis of NBA team performance based on geographical location and travel distances reveals several key insights and strategic recommendations. Teams that travel longer distances for away games generally show a decline in performance, particularly in back-to-back games, suggesting that travel fatigue negatively affects performance. Consistently, teams perform better in home games, with win percentages around 60%, although the COVID-19 pandemic briefly reduced win percentages due to the absence of fans. Free throw percentages are consistent across home and away games, indicating that performance in this area is less influenced by game location. Teams tend to win by larger margins at home and lose by smaller margins compared to away games, highlighting the significant impact of home-court advantage. NBA game scores have generally increased over the past 20 years, with winning teams improving their scoring significantly, while losing teams' scores remain relatively stable. Most NBA games are scheduled with two days between them, maintaining a busy and consistent schedule for teams. High-scoring games are often competitive, with both teams scoring high points, suggesting balanced competition. Higher-scoring teams tend to take more 3-point shots, reflecting the modern NBA's emphasis on this strategy. The heatmap shows regional performance clusters, indicating that teams in certain areas perform better than others, possibly due to factors like travel distance, regional support, and local conditions. There is no clear correlation between total distance traveled and team performance, suggesting that factors such as team strategy, player health, and management play more significant roles in determining performance.

The consistent home-court advantage underscores the importance of minimizing travel fatigue and maximizing fan support. Teams should focus on maintaining high 3-point shooting accuracy and leveraging home games to improve win rates. Understanding the impact of travel fatigue can help in planning rest periods and player rotations to optimize performance during heavy travel schedules. Analyzing regional performance clusters can help identify factors contributing to higher performance and strategies that can be adopted by lower-performing teams. Teams should optimize their travel schedules to reduce fatigue, particularly during back-to-back games, enhance fan engagement during home games, and continue to develop their offensive strategies focusing on 3-point shooting. Incorporating additional datasets such as player health and rest metrics can provide a more comprehensive understanding of factors affecting performance. Teams in lower-performing regions should investigate contributing factors and consider adopting successful strategies from higher-performing regions. By leveraging these insights and implementing the recommended strategies, NBA teams can optimize their performance, enhance their competitive edge, and achieve better outcomes throughout the season.