Assignment #4: The Bradley Terry Model

Introduction and Methodology

This report looks to analyze and estimate the true team ability levels of NHL teams during the currently ongoing 2023-2024 NHL Season using the Bradley-Terry Model, a linear regression model which considers a team's strength of schedule and margin of victory to estimate relative true talent.

To make this analysis, I extracted the previous results of the 2023-2024 NHL season from hockey-reference.com, getting the results of each game as well as the current standings as of writing(February 7th, 2024).

Results and Analysis

Top Teams

Based on the Bradley-Terry Model, I found the top 5 teams in true-talent in the NHL.

Team	B-T Coefficient
Vancouver Canucks	1.82759
Boston Bruins	1.48814
Winnipeg Jets	1.45492
Edmonton Oilers	1.43547
Dallas Stars	1.38676

Unsurprisingly, we see the Canucks, Bruins, and Stars, all of whom are top five in record in the NHL right now. However, we also see the Jets, who are currently 8th overall, and the Oilers, who are currently 10th overall sit at 3rd and 4th, respectively. While these teams do not have the very best record, they are ranked highly because of their difficult schedules, meaning that their true record may not be the best depiction of their actual ability.

Another interesting note is that despite the fact that four of the five top teams come from the Western Conference, the average B-T Strengths of teams in the Western Conference(**0.7652**) is relatively similar to the strengths of Eastern Conference teams(**0.7569**), implying that the Western Conference is much more spread out in terms of skill, with more teams at the top or bottom, with very little parity, but the Eastern Conference is much more balanced in skill, with more parity overall.

Predicting Games

Additionally, we can also estimate score-differentials for teams by taking the difference between the two teams relative strengths and accounting for home-field advantage. For example, we look to predict the score differential between an upcoming game between the San Jose Sharks and the Nashville Predators in San Jose, occurring on February 24th.

Using the Sharks relative strength($\beta = -\mathbf{0.8678}$), the Predators relative strength($\beta = \mathbf{0.6875}$, as well as home field advantage($\beta = \mathbf{0.1737}$), we can predict that the Predators will win by $0.6875 - (-0.8678 + 0.1737) = \mathbf{1.3817\ goals}$.

This result is not too surprising considering that the Predators have a slightly above average record of 26 - 23 while the Sharks have one of the very worst records in the NHL of 14 - 32, meaning that even with home-field advantage, the Sharks should not be expected to win.

Comparison with Actual Standings

We also compare the Bradley-Terry Rankings with the actual NHL Rankings using two parallel coordinates plots, one for each conference.
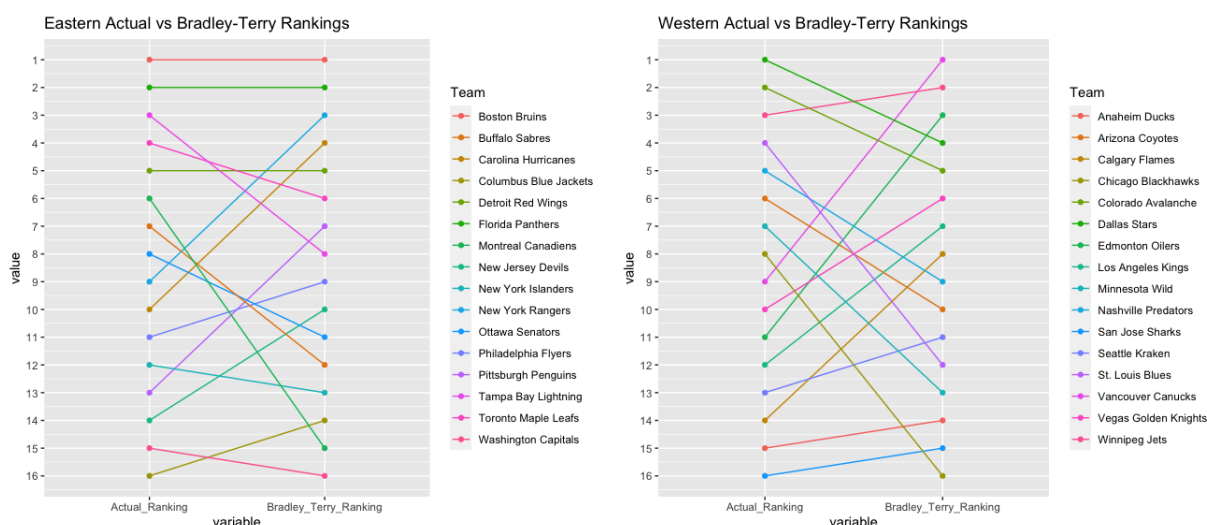
While there are some notable exceptions in the Eastern Conference, like the Montreal Canadiens falling from 6th to 15th in the Bradley-Terry Rankings, suggesting that the Canadiens have been playing a relatively easy schedule and inflating their record, most teams in the East stay within three to four spots of each other, implying that Eastern team's true ability is represented well by their records, with few teams having a very easy or difficult schedule which could inflate or deflate their record.

On the other hand, the plot for the Western Conference is much more scattered, with multiple teams moving many places up and down when comparing with the Bradley-Terry Ranking, implying that many Western teams' have very easy or very difficult schedules, leading to an inflation or deflation of their record when compared to their true ability level.

Conclusion

This report looked to use to Bradley-Terry Model to estimate the true ability of NHL teams. Looking at the top teams, there were some outliers of teams who have strong records with difficult schedules. Additionally, I found that the West there was more change in rankings by the West than the East, suggesting that the West had more varying schedule strengths.