

Analyzing Elo Ratings for NCAA Men's Division 1 Hockey

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Background

- 64 Men's Division 1 hockey teams.
- Weekly rankings via "expert vote" system. by US College Hockey Online.
- Rankings use no formal quantitative. calculation/analysis.

Elo Rating

- New teams historically set at 1500.
- Continuously updates after every match.
- Uses an expected outcome parameter based on players pre-game rating.
- Uses an "update" factor, k , to scale how much rating increases/decreases for wins/losses.

$$expected_{Home} = \frac{1}{1 + 10^{\frac{Away - (Home + homeAdvantage)}{400}}}$$

$$rating_{post} = rating_{pre} + k(scoreMultiplier(goalDiff)(outcome - expectedOutcome))$$

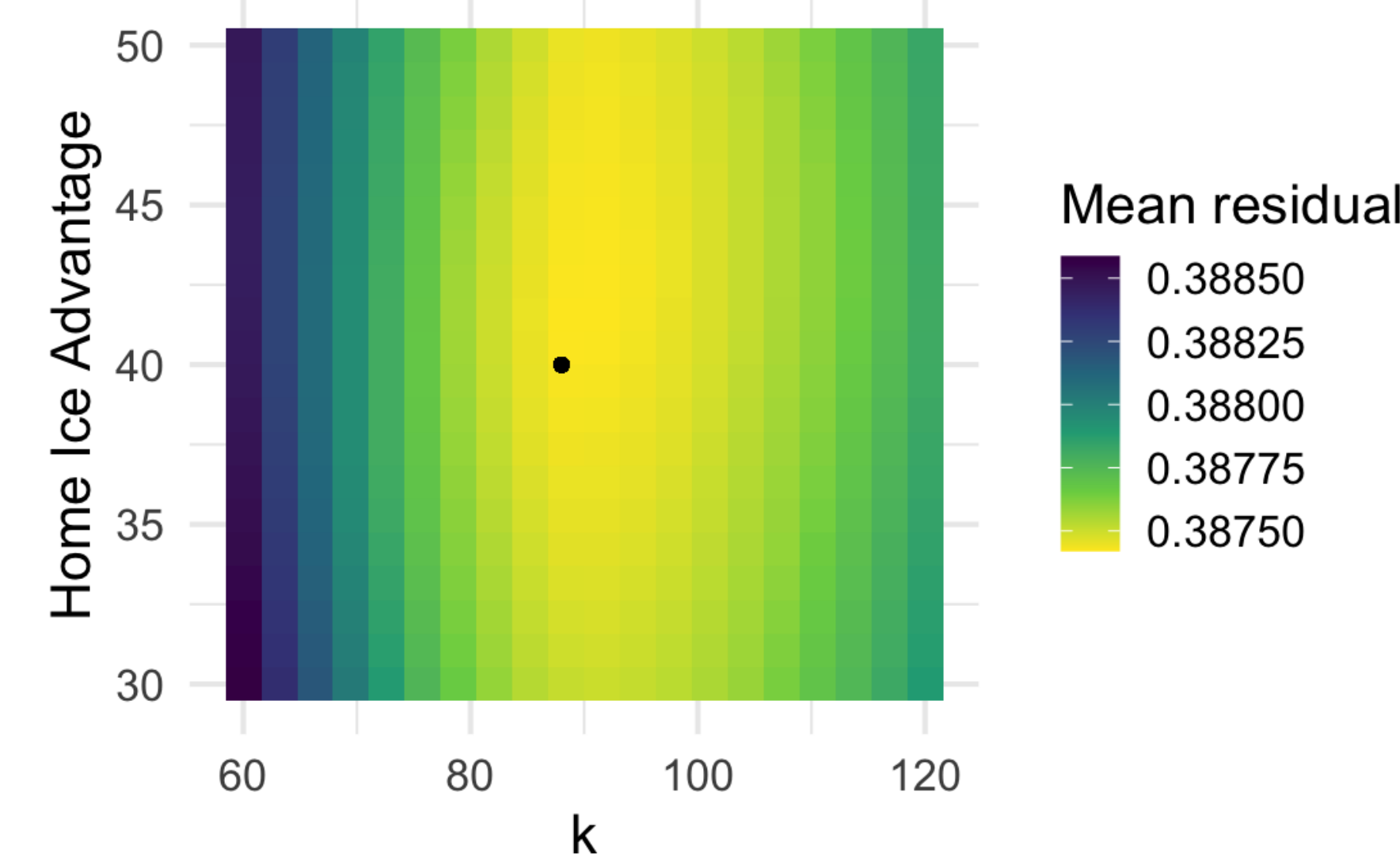
Goal:

- Use a modified Elo rating system to rank Men's Division 1 Hockey.
- Optimize update factor, k , for NCAA Men's Division 1 Hockey.
- Account for home ice advantage.
- Account for blowouts and closely contested games using goal differential.

Optimizing Parameters

- Grid search to find combination of k , d , and home ice advantage that yields the lowest mean difference between expected outcome and actual outcome.

Optimization of k and Home Ice Advantage



k is optimized at 88, home ice advantage at 40, and goal differential factor of $0.6686 * \log(abs(score_diff)) + 0.8048$

Example

- Michigan State vs Lake Superior State, October 4th, 2024:
- Michigan State wins 2 – 1.
- Michigan State new Elo rating = 1870.956.

$$expected_{MSU} = \frac{1}{1 + 10^{\frac{1515.695 - (1862.486 + 40)}{400}}}$$

$$expected_{MSU} = 0.903$$

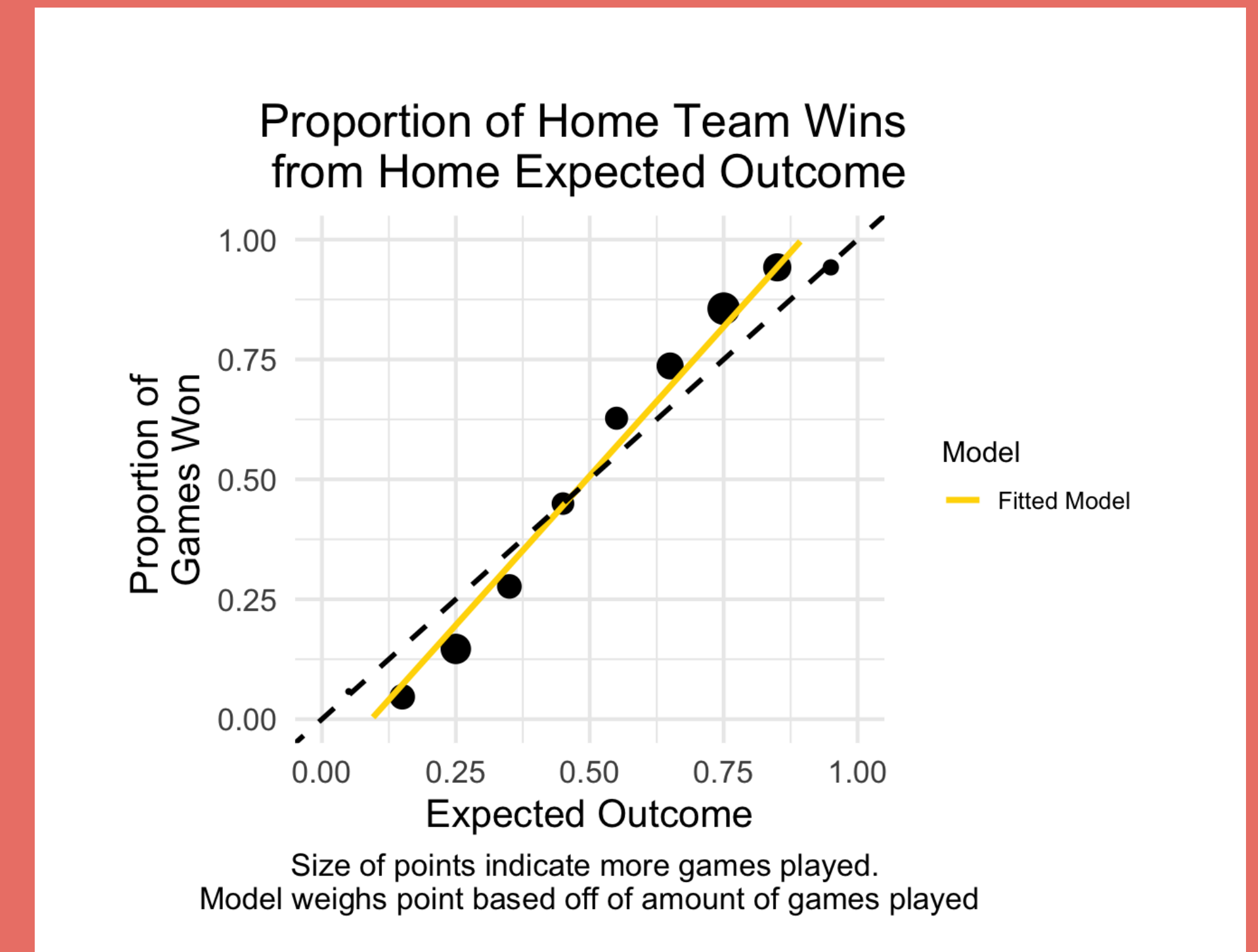
$$rating_{MSU} = 1862.486 + 88(((0.669 \log_e 1) + 0.805)(1 - 0.903))$$

$$rating_{MSU} = 1870.956$$

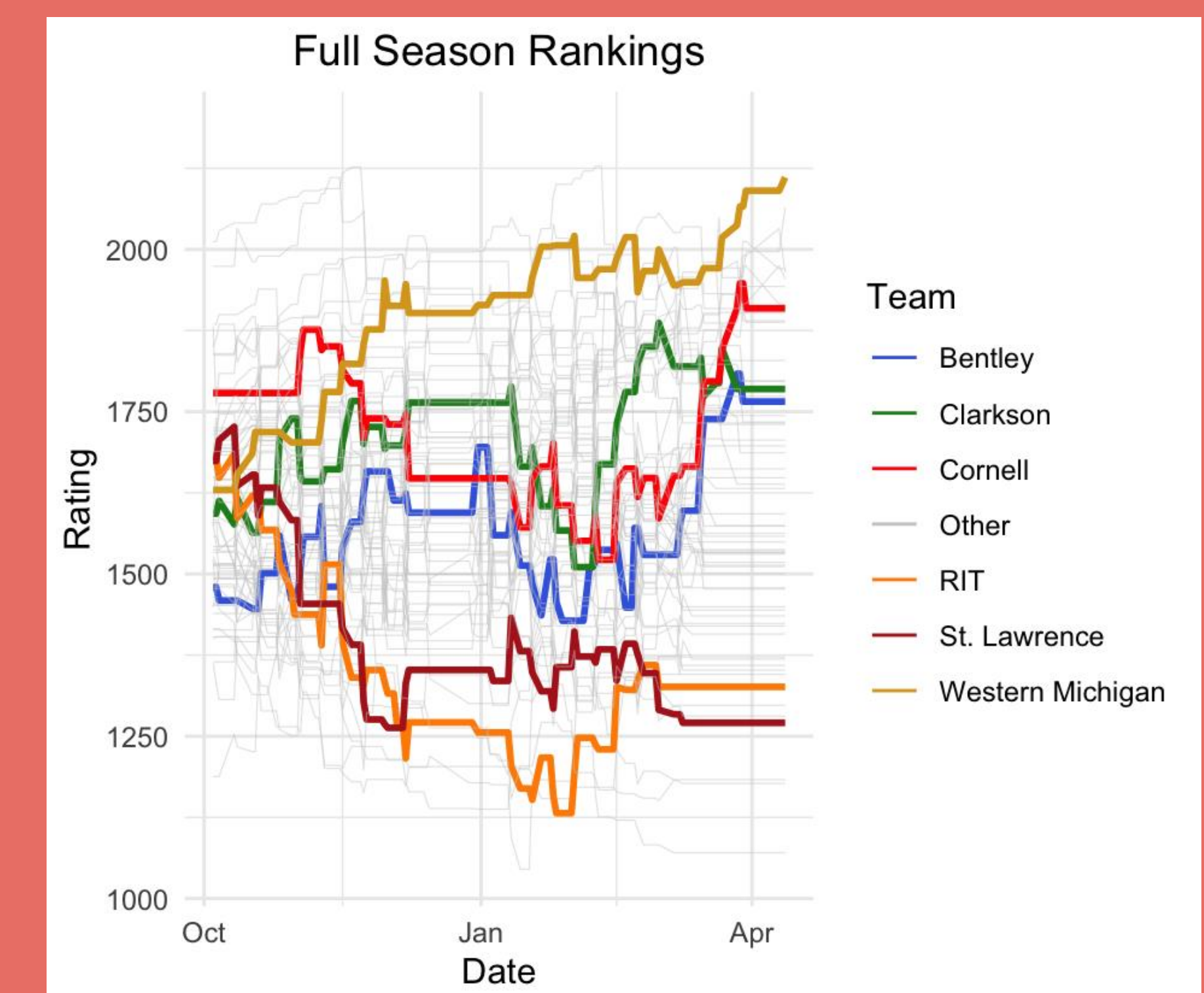
$$|residual| = |1 - 0.903|$$

$$|residual| = 0.097$$

Findings



- Expected slope to be equal to 1, shown by dashed line



- Rankings of all 64 NCAA Division 1 Men's Ice Hockey teams. Select teams Highlighted.

Acknowledgements

- College Hockey News. (2024). *Men's Division I Hockey Schedule – 2023–2024 Season*. <https://www.collegehockeynews.com/schedules/>
- College Hockey News. (2025). *Men's Division I Hockey Schedule – 2024–2025 Season*. <https://www.collegehockeynews.com/schedules/>
- Silver, N. (n.d.). *How our NHL predictions work*. FiveThirtyEight. <https://fivethirtyeight.com/methodology/how-our-nhl-predictions-work/>