



Weapons of Best Production: Predicting the Optimal Pitch Arsenal Adjustment for Superior Stuff+

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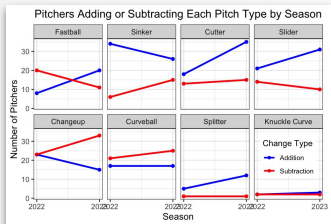
Introduction

Motivation:

- One way pitchers improve their performance is by changing their **pitching arsenal**: the types of pitches that a pitcher throws

Main Question:

- Can we create a pitch recommendation system that suggests with conviction which pitch a player should add and how effective it might be?



Data

- MLB Seasons: 2021, 2022, 2023
- Pitch data from **FanGraphs**
- Spin rate and release point data from **Baseball Savant**
- 5% pitch usage rate to eliminate any misclassification or one-off occurrences
- Stuff+** accounts for only the physical traits of a pitch: velocity, movement, spin rate, and release point

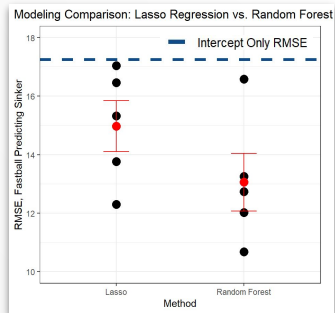
Methodology

- We used pitch characteristics to model Stuff+ values for pitches that a pitcher does not throw
- We decided to model the relationship between **pairs of pitches**
- Began by using fastball traits to predict sinker Stuff+

Two modeling strategies:

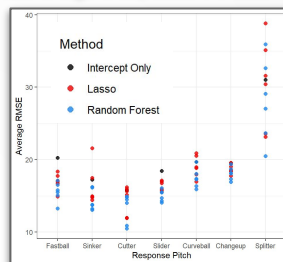
- Lasso Regression
- Random Forest Regression

We used **5-fold cross-validation** to compute average RMSEs for each pair of pitches (red points)



Results

The random forest model beats the basic intercept-only model and generally clears the lasso model



- We took the pairing with the smallest RMSE for each pitch and built our predictions
- Players can use these predictions to add an above-average pitch

Example: Ryan Pressly would have had a great changeup in 2021 and 2022. He added one in 2023, and it had a Stuff+ of 136, among the best in baseball

Predicting Changeup Stuff+ using Curveball Traits

Top Five Changeup Stuff+	Bottom Five Changeup Stuff+
1. Ryan Pressly (2021, 2022): 110.41, 109.76	1. Ross Detwiler (2021): 65.93
2. Justin Verlander (2023, 2022): 104.81	2. Grant Dayton (2021): 69.41
3. Tyler Glasnow (2023, 2021): 104.29, 101.75	3. Jimmy Hergert (2021): 71.66
4. Aaron Civale (2023, 2022): 103.57, 101.16	4. Robert Dugger (2021): 71.82
5. Keegan Thompson (2023): 101.02	5. Bryse Wilson (2023): 73.4

Players whose new changeups would be elite and those whose new changeups would be poor

Conclusion

- Within pairs of pitches, the random forest model is successful in predicting a realistic value for Stuff+
- The better performance of random forest indicates that interactions between pitch characteristics are important in modeling Stuff+

Limitations:

- Predictions do not take into account a pitcher's whole arsenal
- Inconsistencies between data sources in lumping certain pitch types together

Future Work:

- Generate predictions based off of multiple pitch types
- Examine how a pitch works in conjunction with other offerings
- Create an interactive tool that allow users to input their own pitch characteristics

Acknowledgements

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