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

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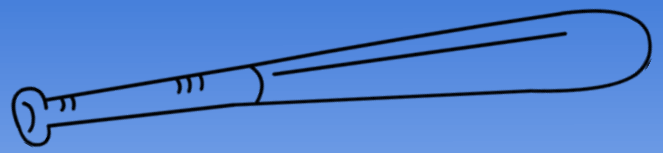


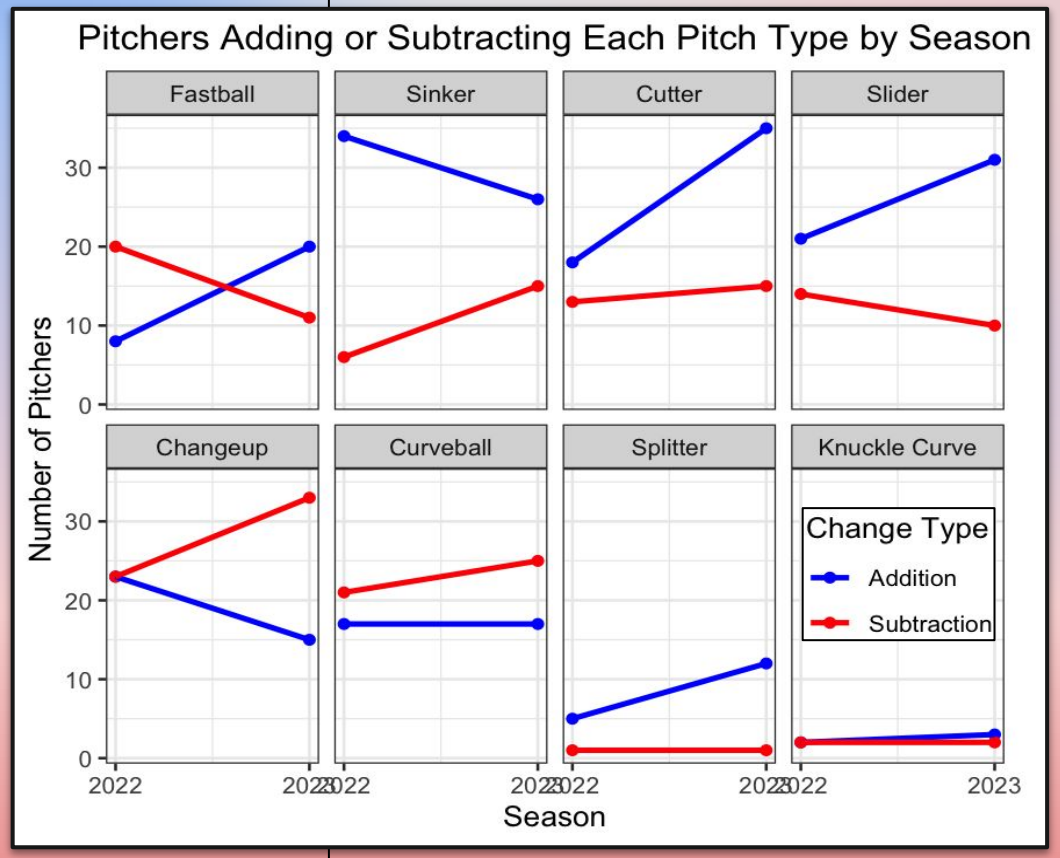
Introduction

Motivation:

- One way pitchers attempt to improve performance is by changing their **pitching arsenal**, i.e., the types of pitches they throw.

Main Question:

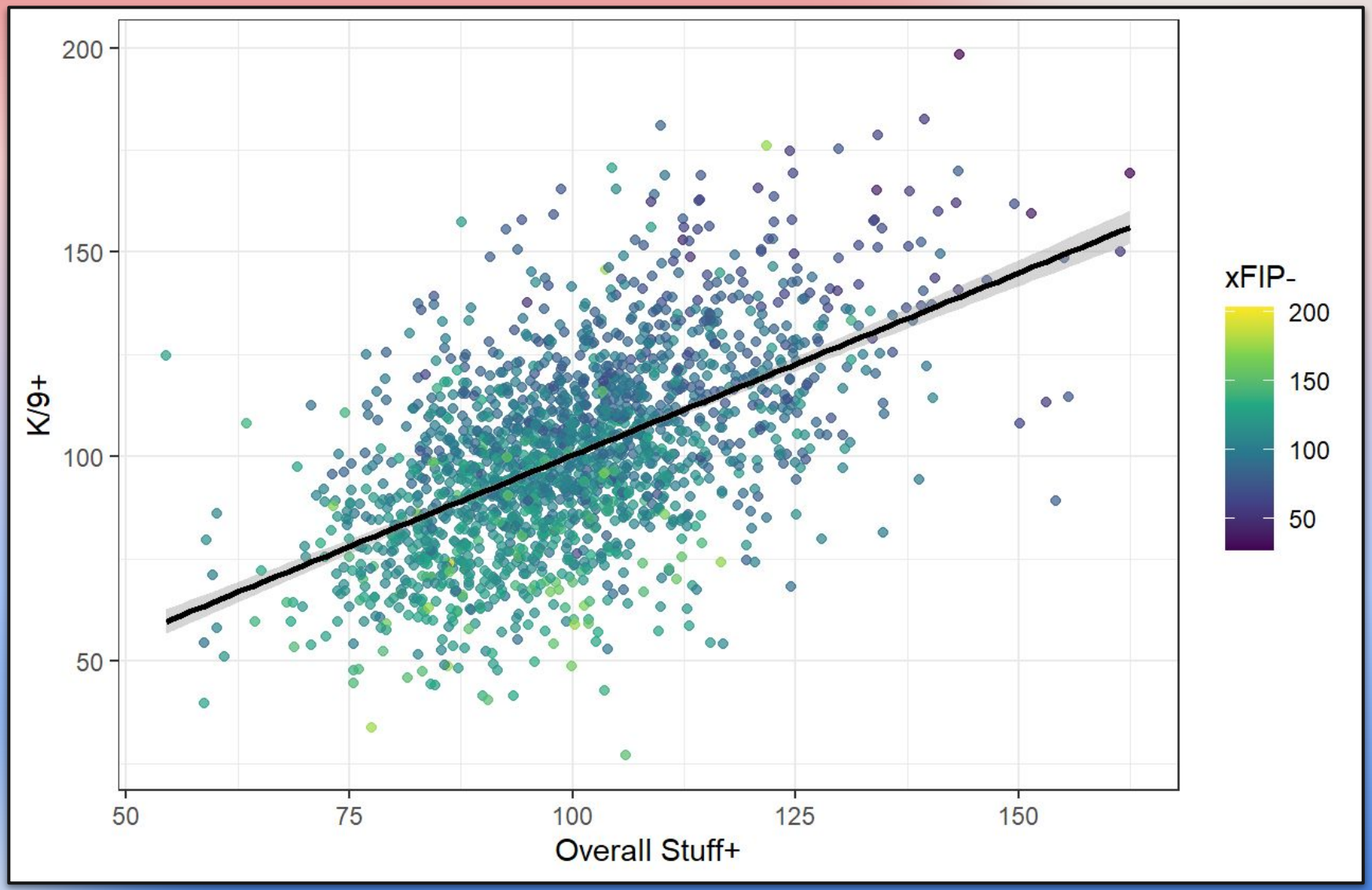
- Can we create a pitch recommendation system that suggests with conviction which pitch a player should add and how effective it might be?



Data

- MLB Seasons: 2021, 2022, 2023
- Pitch data from **FanGraphs**
- Spin rate and release point data from **Baseball Savant**
- 5% pitch usage cutoff to eliminate any misclassification or one-off occurrences
- **Stuff+** accounts for only the physical traits of a pitch:
    - Velocity
    - Horizontal and Vertical Movement
    - Spin Rate
    - Release Point

Stuff+ is a Useful Predictor for Performance



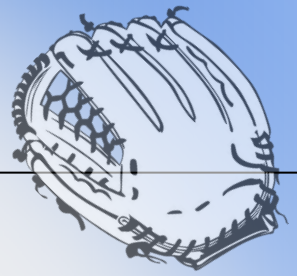
Methods

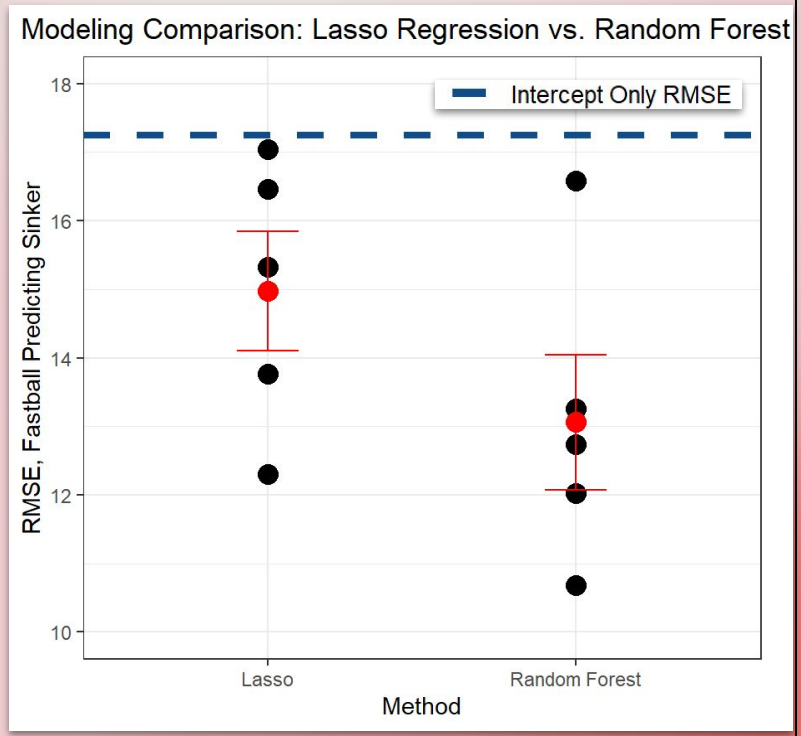
Approach to Modeling:

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

Two Modeling Strategies:

1. **Lasso Regression**
2. **Random Forest Regression**



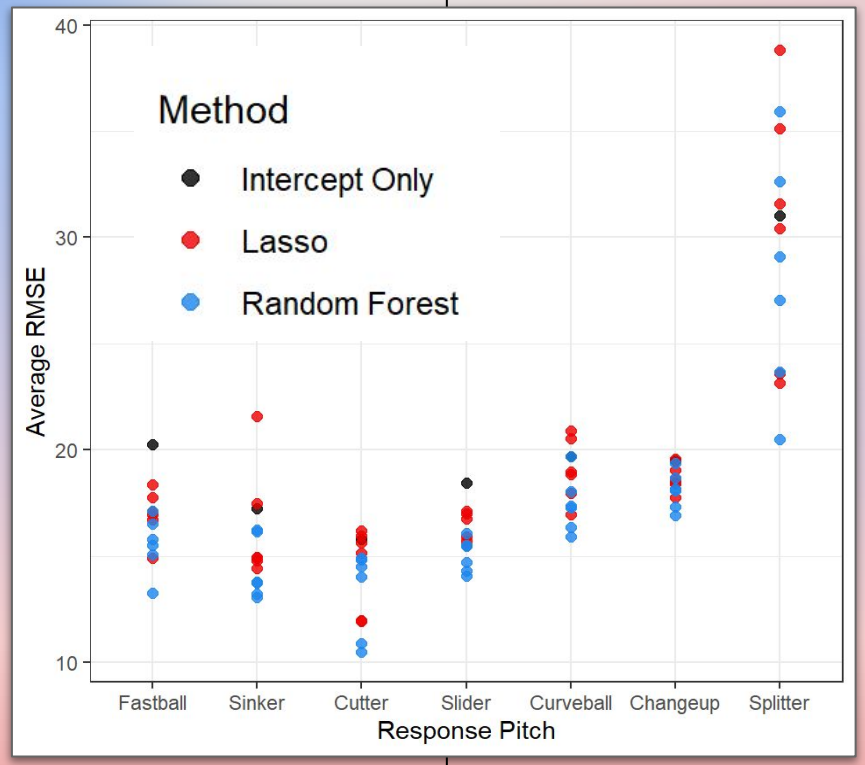


We used **5-fold cross-validation** to compute average RMSEs for each pair of pitches (red points)

Results

Which Model is the Winner?

- The random forest model beats the basic intercept-only model and generally clears the lasso model
- For each pitch type, the random forest process produces the lowest average RMSE.
- Tell us that the interactions within the predictor variables are significant



Applications

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

Example:

- Our model suggests that 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 Herget (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

Conclusions

- Constructed relatively reliable Stuff+ predictions that teams and players can utilize for a competitive advantage.
- Discovered which pitches are most useful for predicting others.
- Indicated important interactions between pitch traits through the model selection process.

Limitations

- Predictions do not take into account a pitcher's whole arsenal
- Inconsistencies between data sources in lumping certain pitch types together.
- Location and pitch sequencing also play roles in a pitch's success.

Future Work

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

Questions?

Works Cited

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