



The Art of Sequencing:

Utilizing Inter-Pitch Dynamics to Enhance Pitch Evaluation in Major League Baseball

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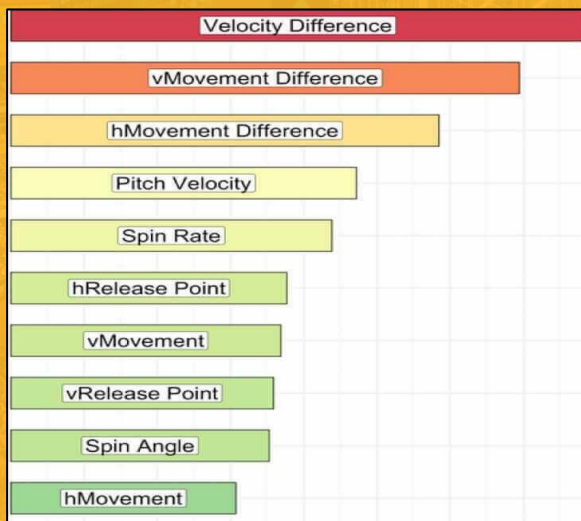
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Pitches Don't Exist in a Vacuum

- Art vs. Science
- Current Paradigm: Intra-Pitch
 - Stuff+*
 - trackman, rapsodo, pitch f/x
- Inter-Pitch dynamics
 - tunneling, deception
- Improvement in predicting effectiveness
 - xwOBA, RV/100

A Powerful Metric: Stuff+



- Max Bay & Eno Sarris
- Average = 100
- XGBoost Decision Trees
- Components:
 - Δ of Velocity
 - Δ of Movement
 - Pitch Velocity Spin

Data

- PyBaseball
- Fangraphs
 - Stuff+
- Statcast
 - Pitch Movement
 - Pitch Arsenal Stats

Modeling Intra-Pitch & Inter-Pitch

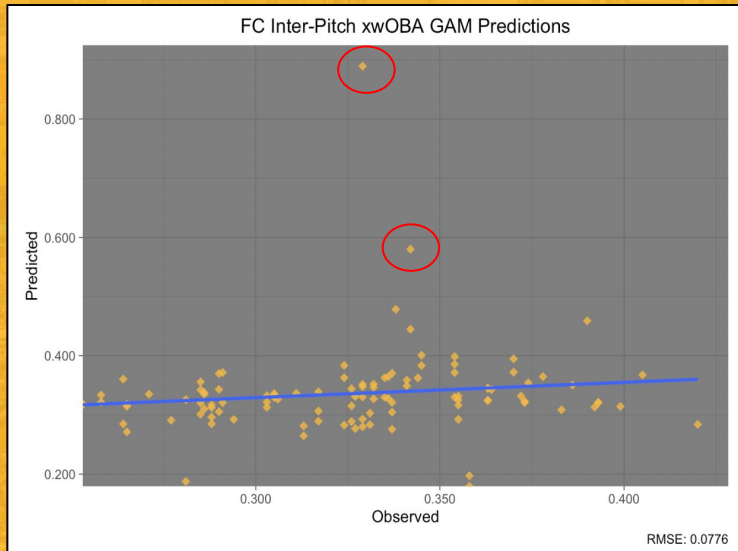
1. Intercept-only
2. Intra-Pitch
 - a. GAM w/ Stuff+ only
3. Inter-Pitch
 - a. GAM w/ Stuff+ & Inter-Pitch
 - b. Random Forest w/ Stuff+ & Inter-Pitch

Final: RMSE Comparisons

Modeling Interactions

Pitch	RMSE Intercept-Only	RMSE GAM Stuff+	RMSE GAM Stuff+ & Inter	RMSE RF Stuff+ & Inter
Changeup	0.0443	0.0421	0.0485	0.0424
Curveball	0.048	0.048	0.0496	0.0476
Cutter	0.0409	0.0389	0.0736***	0.0407
4-Seamer	0.052	0.0465	0.0494	0.0533
Sinker	0.042	0.0394	0.054	0.0413
Slider	0.0491	0.0532	0.0549	0.0481
Average	0.04605	0.04468	0.055	0.04556

Where Can We Improve?



- Rates of sequences data not used
 - FF-SL, FF-CU, CU-SL, SL-FC
- Outlier predictions, highly unrealistic
 - <- Cutters
- Model Selection - GAMs?
- Tuning, Monte Carlo

Discussion

- Central Idea: Inter-Pitch Dynamics
- Stuff+ is powerful
- Simple inter-pitch model was close
 - -0.00088 RMSE average difference
- Model Selection importance



Questions?

Pitch	Average xwOBA
Changeup	0.2832
Curveball	0.2633
Cutter	0.3235
4-Seamer	0.3448
Splitter	0.2406
Sinker	0.3431
Slider	0.2649
All Pitches	0.3100

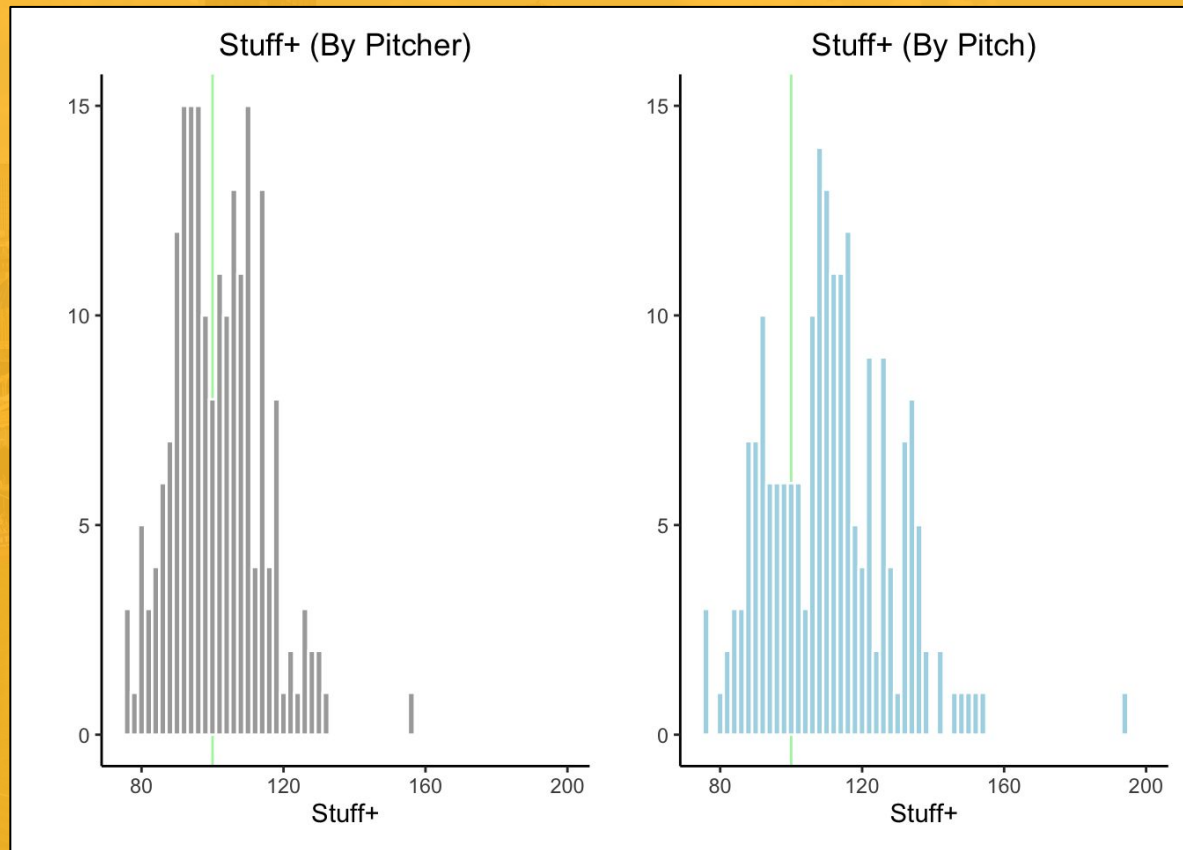


LEAGUE AVERAGES 2020 - 2022 (250+ Pitches)

Pitch	Horizontal	Vertical	Pitch Proportion	Spin Rate	Speed
4-Seamer	7.45	14.86	0.46	2285.29	93.93
Sinker	15.00	22.89	0.39	2127.16	93.21
Cutter	2.88	25.97	0.34	2380.57	88.97
Splitter	11.71	33.09	0.28	1459.77	86.37
Slider	6.42	36.28	0.34	2432.44	84.94
Changeup	14.03	32.27	0.26	1754.87	84.59
Curveball	9.45	53.35	0.26	2572.18	79.64

STUFF+

Fangraphs



Citations

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