

THIS ISN'T A STRETCH: QUANTIFYING BALL ACQUISITION PROFICIENCY TO EVALUATE FIELDERS ON ASSISTED PUT-OUTS

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PRESENTATION OUTLINE

INTRODUCTION

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METHODS &
ALGORITHMS

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CONCLUSION

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BACKGROUND

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OVERVIEW &
SUMMARY OF
FINDINGS

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FUTURE STEPS

6

Behind every
great
infielder is a
first basemen
willing to
stretch the
limits.

Investigate the potential for credit assignment on collaborative plays between fielders to convert qualitative remarks into quantitative assessments



DECOMPOSING DEFENSIVE TOUCHES



Acquiring a Batted Ball



Throwing an Acquired Ball



Acquiring a Thrown Ball

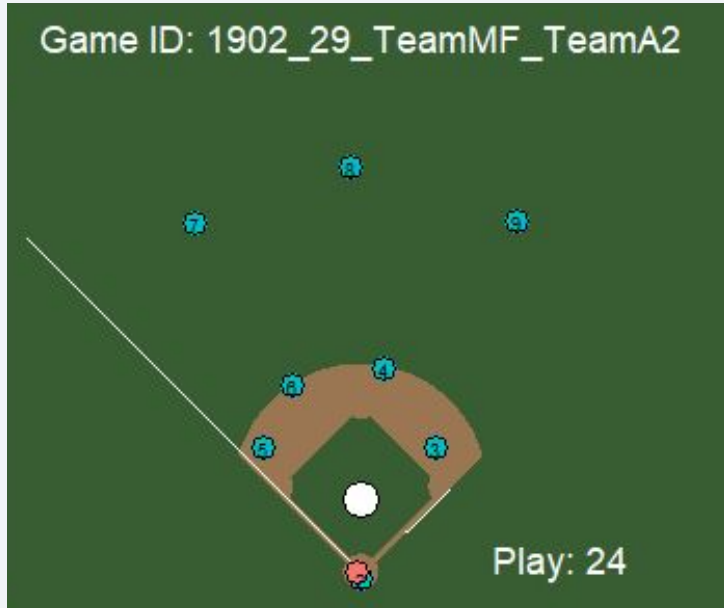
Over 80% of a first baseman's defensive touches come from catching a thrown ball

Player Position	Batted Ball Acquisition	Thrown Ball	Thrown Ball Acquisition
Center Fielder	61.44%	37.38%	1.18%
First Baseman	13.46%	4.65%	81.89%
Left Fielder	59.67%	39.84%	0.49%
Right Fielder	60.86%	38.74%	0.41%
Second Baseman	31.03%	30.51%	38.46%
Shortstop	29.95%	29.08%	40.97%
Third Baseman	44.59%	33.16%	22.24%

Our Goal:

Quantify a first baseman's
catching ability on
assisted put-out attempts.

HELPER FUNCTIONS

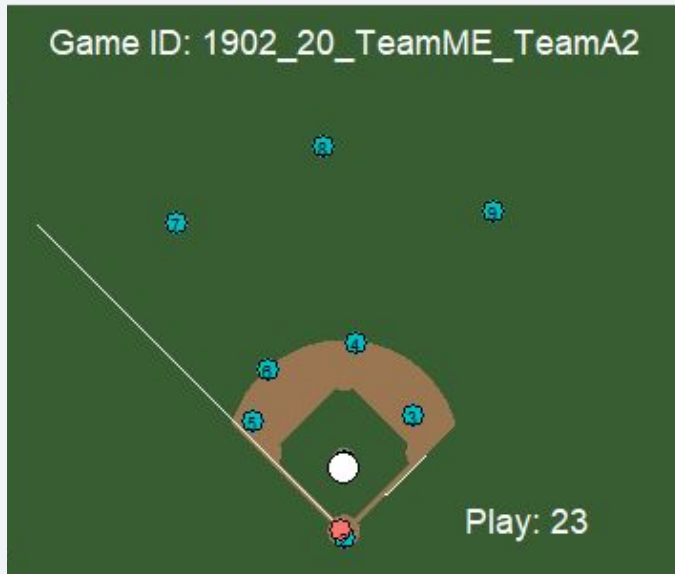


```
play_by_play("1902_29_TeamMF_TeamA2", 24)
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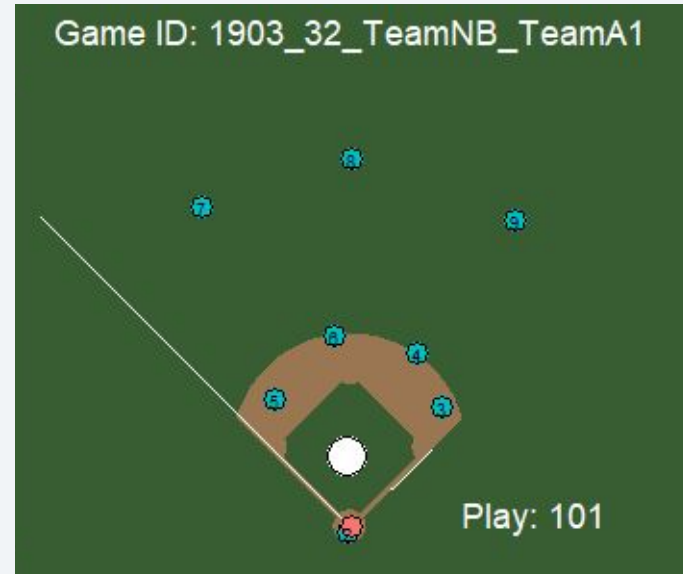
"Pitch thrown by pitcher, ball hit into play by batter, ball bounce, ball acquired by second baseman, ball thrown by second baseman, ball acquired by first baseman, end of play."

DATA CLEANING

Filtering plays by **intention** to expand the dataset

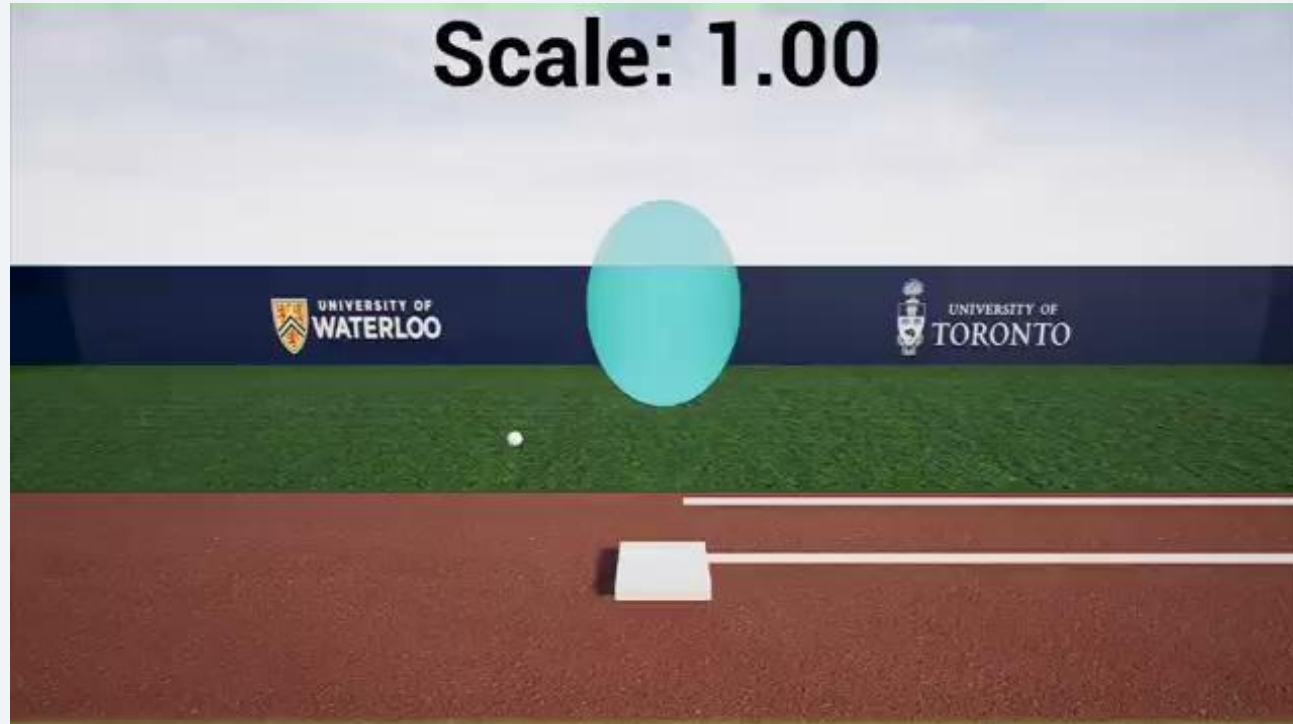


Included: Throw to first base
not caught by first baseman



Not Included: Throw to first
base caught by pitcher

METHODS AND ALGORITHMS



MODELLING CATCH DIFFICULTY

Goal: Estimate how challenging it is for a first baseman to catch an incoming throw



VISUALIZING xCR

- xCR is lower for throws further away from first base
- Throws that take the first basemen into the path of the runner have an especially low xCR



kDE plot of xCR for ~20000 simulated throws (no bounce, fixed x coordinate)

ILLUSTRATION

“That’s why the Diamondbacks had so few errors this year. Christian Walker **saved a lot of them** for his infielders” - Dave Flemming



Parameter	Estimated Value
Ellipsoid	7.6
Ellipsoid x	3
Ellipsoid y	7
Ellipsoid z	0.6
Bounce	1
Estimated xCR	0.57

Video courtesy of [mlb.com](https://www.mlb.com)

QUANTIFYING CATCH PROFICIENCY

Goal: Distinguish first basemen who excel at catching incoming throws from those who don't

Solution: Derive each player's Catches Above Average (CAA) from xCR

Example:

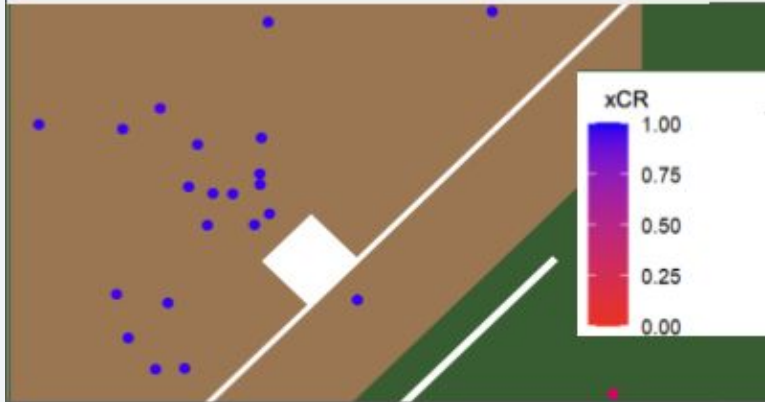
Throw	Outcome	xCR	Diff	CAA
Throw 1	1	0.99	+0.01	-0.55
Throw 2	0	0.65	-0.65	
Throw 3	1	0.91	+0.09	

The diagram illustrates the calculation of Catches Above Average (CAA) from xCR. It shows a sequence of operations: an arrow points from the 'Throw' column to the 'Outcome' column, followed by a subtraction sign, then an equals sign, and finally a summation symbol (Σ) leading to the 'CAA' column. The 'Diff' column contains the results of the subtraction (Outcome - xCR) for each throw.

PLAYER COMPARISON WITH CAA

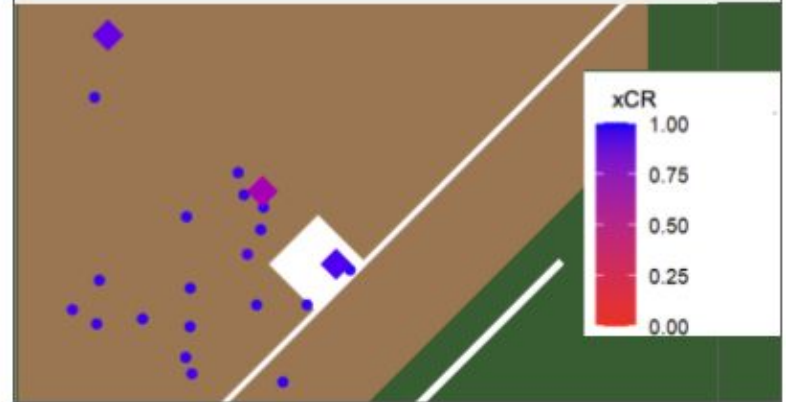
Highly Ranked Player

CAA: +1.16

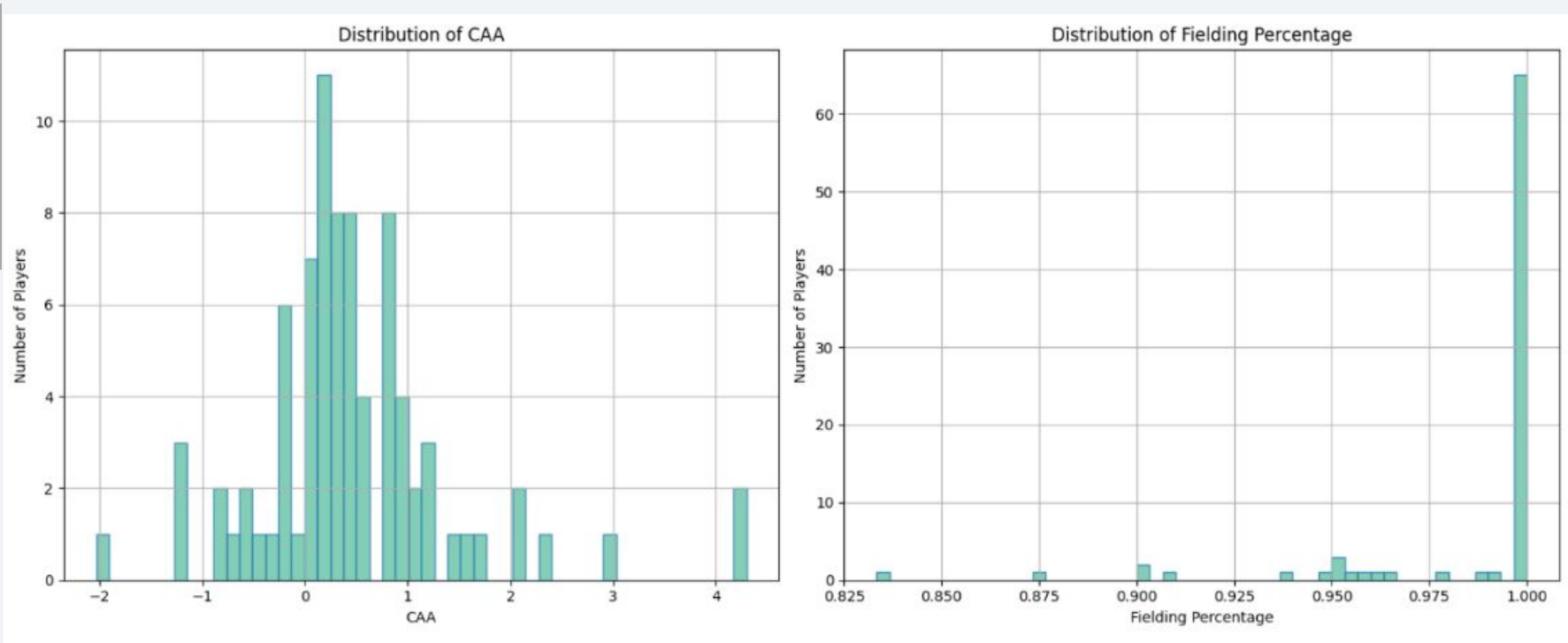


Lowest Ranked Player

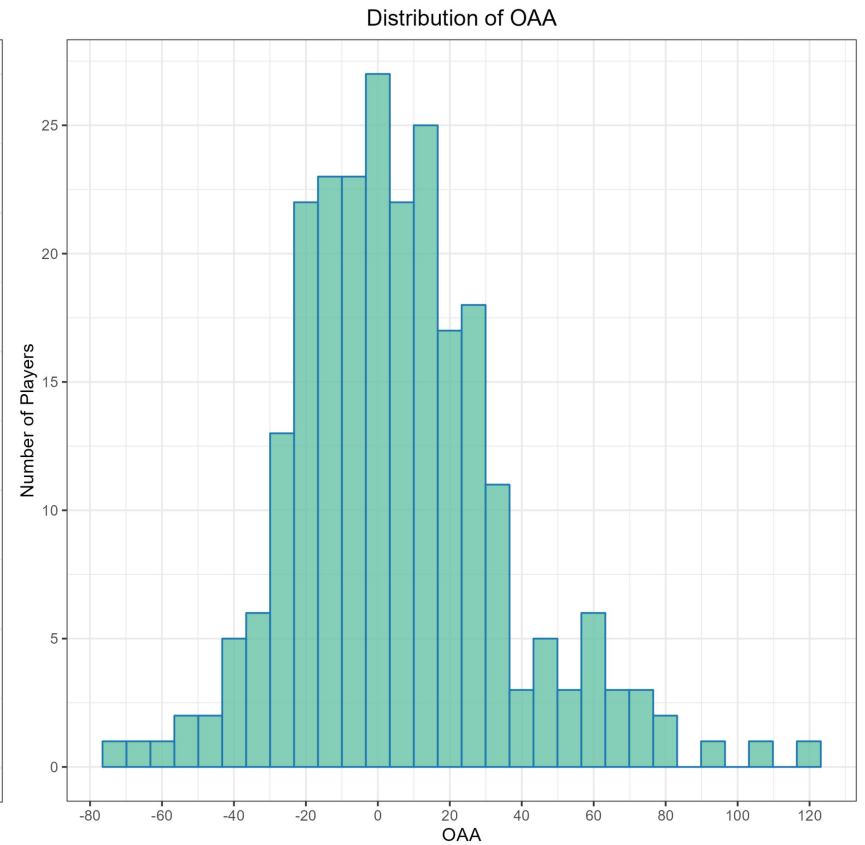
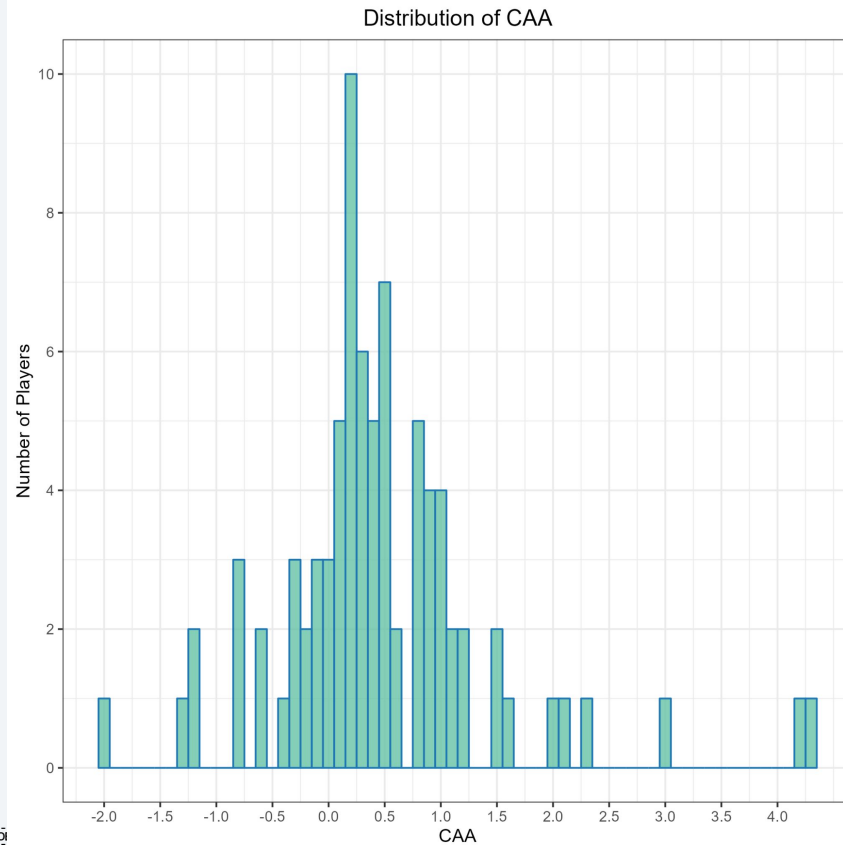
CAA: -2.03



EVALUATING THE DISCRIMINATORY POWER OF CAA



EVALUATING THE DISCRIMINATORY POWER OF CAA



FUTURE STEPS

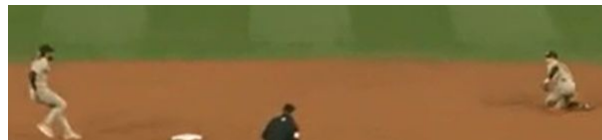
1

Incorporating Player Mechanics



2

Accounting For Player Movement



3

Quantifying Trust Between Fielders



Takeaway:

CAA can be
immediately applied
to player evaluation

THANK YOU FOR YOUR ATTENTION



[GITHUB PAGE](#)

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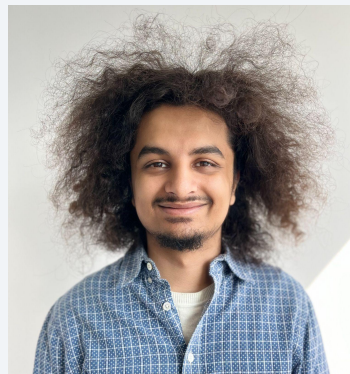
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APPENDIX

A **geometric interpretation** of catch difficulty

$$R_{\alpha} = \begin{bmatrix} \cos(\alpha) & -\sin(\alpha) \\ \sin(\alpha) & \cos(\alpha) \end{bmatrix}$$

$$\left(\frac{x}{\alpha}\right)^2 + \left(\frac{y}{\alpha}\right)^2 + \left(\frac{z-4}{\frac{4}{3}\alpha}\right)^2 \leq 1$$