

Comparing NHL Players' Shots and Goals by Algorithmically Decomposing Shot Intensity Surfaces

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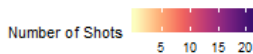
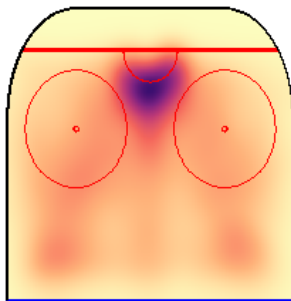
Collaborators: Charmaine Dean and Douglas Woolford

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Carleton University
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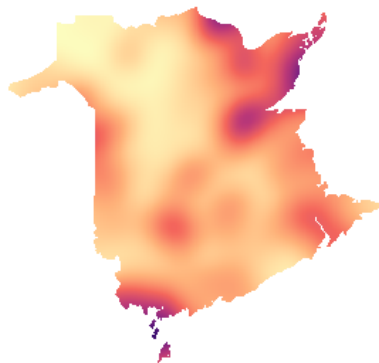
Introduction

A Song of Ice Hockey and Forest Fire

Flames versus Leafs



Fires versus Leaves



Outline

- Describe the NMF-LGCP algorithm in general.
- Apply it to NHL shot data.
- Use these estimates to describe shot efficiency (with a twist).

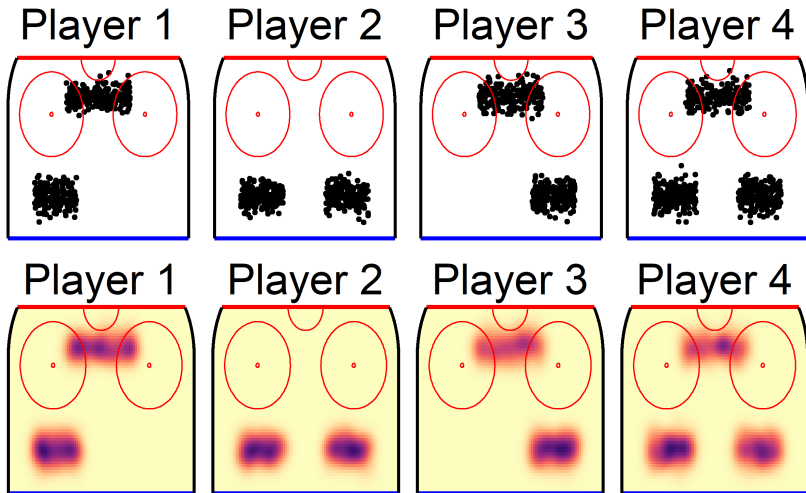
Image Recognition and Spatial Estimates

Idea: Convert one big matrix into two smaller matrices

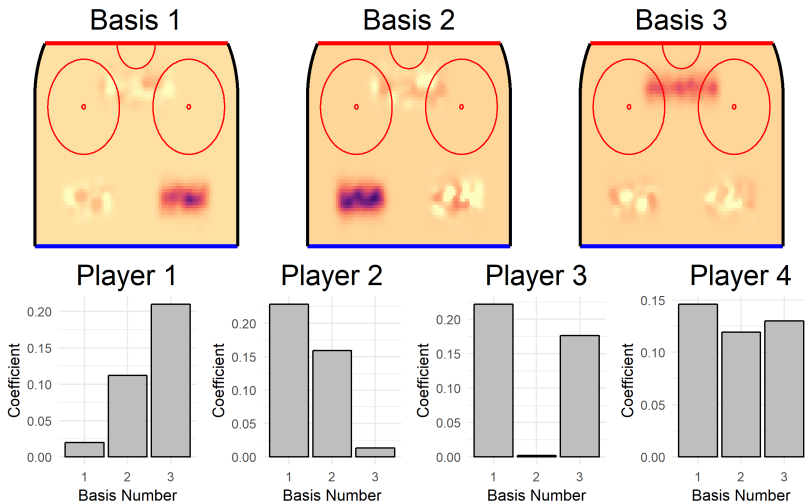
$$X \approx WH$$

- X is a giant collection of images
 - In this case, LGCP estimates of the shot locations.
- W defines the “bases”
 - Building blocks for all images
 - Must choose the number of bases
- H defines the “coefficients”
 - How much each image uses each building block

Dummy Data and Estimates



Dummy Bases and Coefficients

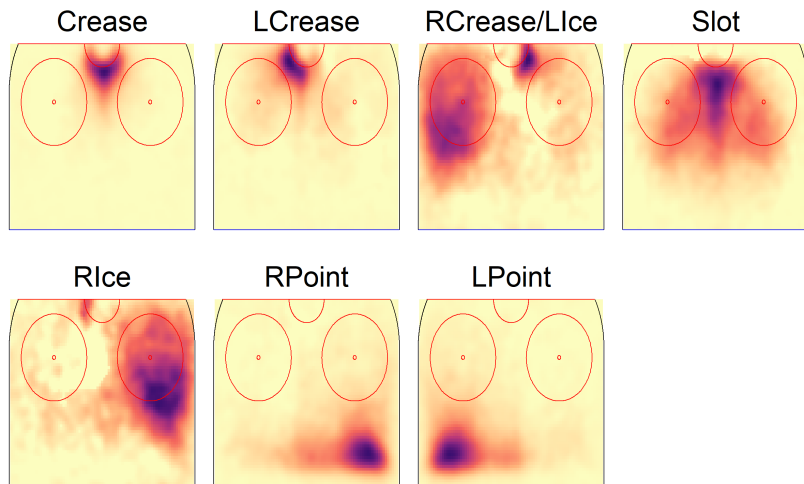


NHL Shot Location Data

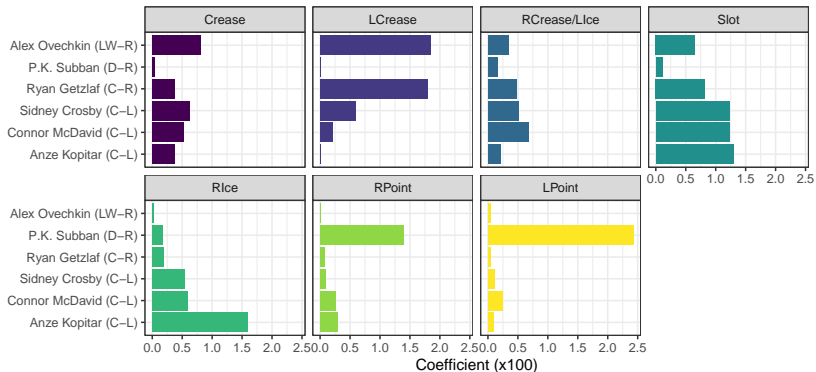
- Scraped from <https://statsapi.web.nhl.com/api/v1/...>
 - Incomplete version available from a Kaggle data set.
 - Always check robots.txt before scraping.
- Only looked at players with > 500 shots.
- Removed rebounds.
 - Focused on shot choice, not opportunity.

In all, 510,847 shots and goals from 466 players.

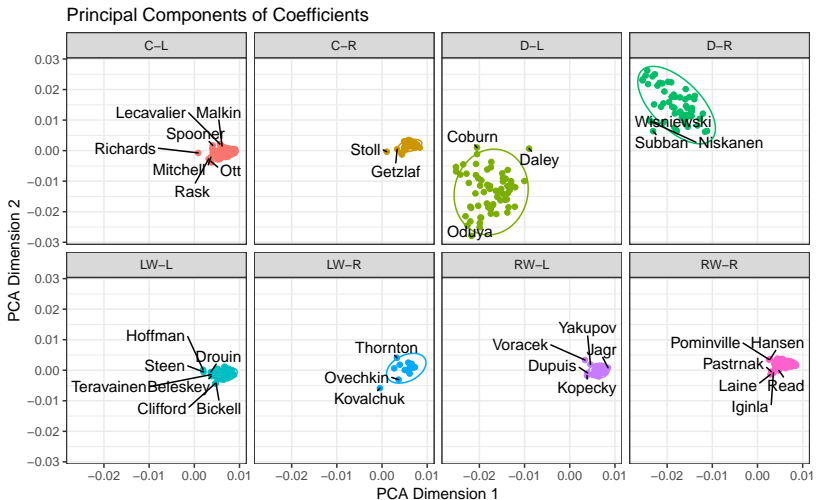
Estimated Bases for NHL Data



Some Select Players



Basis Results - Outliers



Shot Quality

Basketball versus Hockey

For players who played at least half of the 2017-2018 season:

Basketball

- WORST 3-point percentage: 29.8% (Russell Westbrook)

Hockey

- BEST shooting percentage: 23.5% (Alexander Kerfoot)

Hockey just doesn't have enough goals per player!

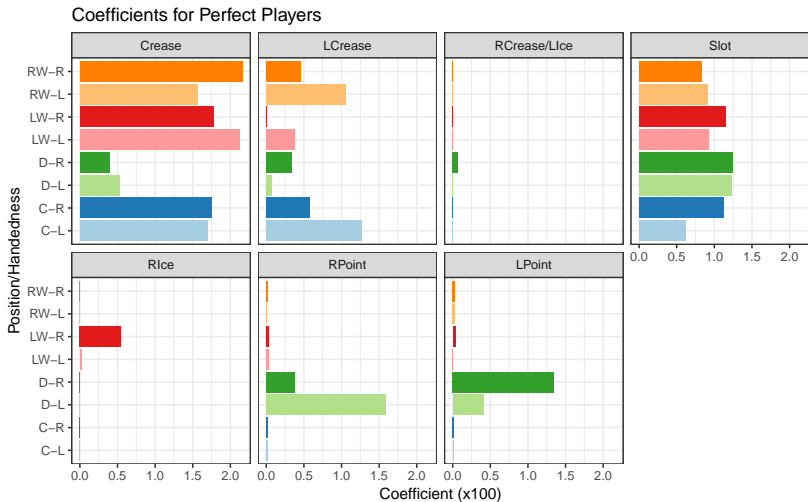
Workaround: Perfect Players

“Perfect Player”: A player that scores with every shot.

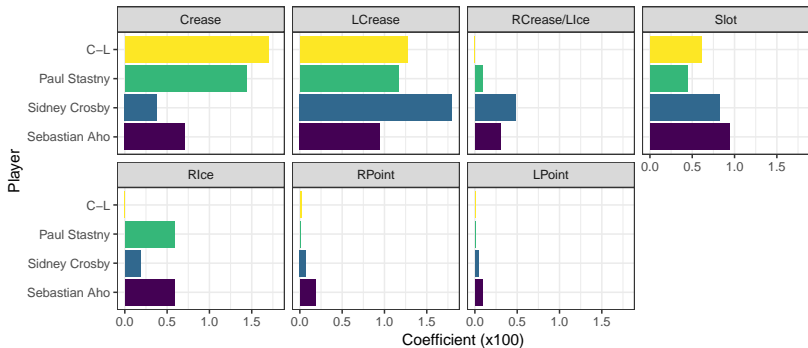
Treat all goals by left-handed centres as if they're from one player.

Shot quality: difference from perfect player.

Coefficients for the Perfect Players



Comparing Stastny, Crosby, and Aho to the Perfect Player

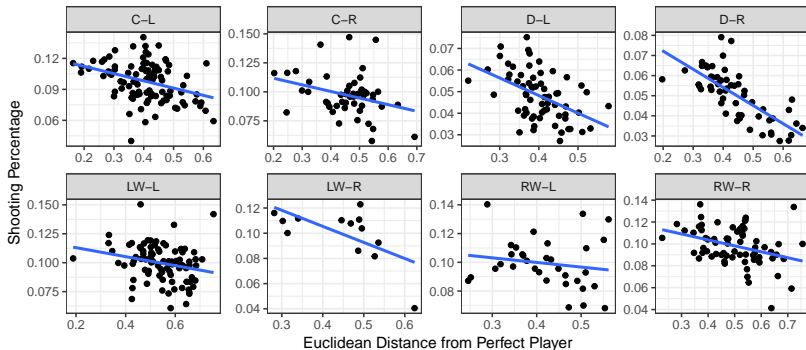


- Stastny: Follows the Perfect Player, “Could stand to shoot the puck more.” - EliteProspects.com
- Crosby: Shoots from wherever, but scores.
- Aho: “Very good passer.” - EliteProspects.com

Euclidean distance as shot quality

Players "closest" to the perfect player have better shooting percentage

Blue line is the linear trend.



Recall: estimates were normalized to **not** include the number of shots or goals.

Conclusions

- Bases provide good foundations for heuristic advice.
 - E.g. “Shoot more when you’re at the point, less from the faceoff circle.”
- Coefficients simplify the comparison of player shooting strategy.
- Perfect players give us a measure of quality when we don’t have enough data.
- Playing like a perfect player does not mean you’ll always score.

Acknowledgements

