Power Play Danger Index

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Power Play Structure Index

- Hockey-Graphs article by Matt Cane:

  "Measuring Measuring the Importance of Structure on the Power Play" from February 2017

- Measuring distance from average shot location by shot

- *Player Structure = (Σ distance of shot to player's average shot location) / (# of shots for player)*

- *Team Structure Index = (Σ # of shots for player * Player Structure) / (Σ # of shots for each player)*

Shortcomings Structure Index

▶ Shots taken from dangerous spots?

→ Expected Goals (xG)

▶ How much space when taking the shot?

→ Tracking Data

Expected Goals Model

- Feature set:
  - Shot type
  - Coordinates x and y, distance to goal
  - Angle to the goal
  - Shot type, x and y previous two events
  - Time, angle and distance to goal differences between last two events
  - Strength state
- XG Boost classifier with grid search
- K-fold split training

xG Index

▶ Intermediate step to Danger Index

▶ *Player xG Index = Σ(xG – average xG) / (# of shots for player)*

▶ *Team xG Index = Σ(Σ # of shots for player * Player xG Index) / (Σ # of shots for each player)*

Power Play Danger Index

▶ Combination of xG index and structure index divided through 100

▶ Weighting of 100:1 decided through predictability of final value

▶ Player Danger Index = Player xG Index – (Player Structure Index \ 100)

▶ Team Danger Index = (Σ (Σ shots * Player xG Index) \ Σ shots) – (Σ(Σ shots * Player Structure Index) \ Σ shots * 100)

	player_name	powerplay_shots	player_structure_index	player_xg_index	player_danger_index
0	Michelle Karvinen	5	25.057538	0.458524	0.207949
1	Petra Nieminen	4	11.870287	0.087543	-0.031160
2	Elisa Holopainen	8	5.536409	0.022472	-0.032892
3	Megan Keller	3	8.152026	0.001273	-0.080247
4	Alina Muller	3	7.983230	-0.002158	-0.081990
5	Nina Pirogova	3	8.449289	-0.002375	-0.086868
6	Phoebe Staenz	4	18.535490	0.086245	-0.099110
7	Minnamari Tuominen	11	11.420921	-0.008016	-0.122225
8	Anna Shokhina	6	13.013396	0.004158	-0.125975
9	Jenni Hiirikoski	6	16.487716	0.021960	-0.142918
10	Angelina Goncharenko	4	15.291697	0.002551	-0.150366
11	Nelli Laitinen	5	12.887208	-0.021772	-0.150644
12	Alex Carpenter	7	14.083180	-0.035821	-0.176653
13	Lara Stalder	8	20.802099	-0.012026	-0.220047
14	Cayla Barnes	7	20.129781	-0.027182	-0.228480
15	Hilary Knight	3	22.522477	-0.019212	-0.244436

Results Olympics

	team_name	team_powerplay_shots	team_structure_index	team_xg_index	team_danger_index
0	Olympic (Women) - Canada	10	5.597423	0.006171	-0.049803
1	Olympic (Women) - Finland	47	11.908058	0.054605	-0.064476
2	Olympic (Women) - Olympic Athletes from Russia	19	10.004744	-0.001040	-0.101088
3	Olympic (Women) - Switzerland	19	14.717957	0.014504	-0.132676
4	Olympic (Women) - United States	29	13.515063	-0.013816	-0.148967

Results Olympics

Results NWHL

	player_name	powerplay_shots	player_structure_index	player_xg_index	player_danger_index
0	Maddie Elia	14	21.222111	0.174958	-0.037263
1	Lisa Chesson	11	13.237344	0.044381	-0.087992
2	McKenna Brand	11	14.794510	0.008566	-0.139379
3	Sarah Edney	12	24.572584	0.065145	-0.180581
4	Blake Bolden	20	37.623356	0.124484	-0.251749
5	Janine Weber	11	29.967278	0.009370	-0.290302
6	Kaleigh Fratkin	18	38.743484	0.035790	-0.351645
7	Kourtney Kunichika	10	31.114997	-0.041633	-0.352783
8	Lee Stecklein	13	39.640133	0.032564	-0.363837
9	Corinne Buie	19	39.531574	-0.033937	-0.429253
10	Hilary Knight	11	67.200032	0.225076	-0.446924
11	Kiira Dosdall	17	46.851499	-0.016028	-0.484543
12	Amanda Boulier	16	57.642336	0.080282	-0.496141
13	Kelsey Koelzer	17	50.285723	0.005044	-0.497813
14	Alexa Gruschow	11	49.119960	-0.017035	-0.508235
15	Kendall Coyne Schofield	12	52.345932	0.000356	-0.523103
16	Shiann Darkangelo	13	61.884529	0.090738	-0.528107
17	Megan Bozek	22	50.916701	-0.036305	-0.545472
18	Jenny Ryan	24	62.182648	0.063699	-0.558127
19	Hayley Scamurra	21	67.177022	0.112911	-0.558859
20	Shannon Doyle	12	52.511859	-0.038583	-0.563701
21	Miye D'Oench	16	54.916169	-0.062207	-0.611369
22	Cydney Roesler	13	58.900490	-0.031705	-0.620710
23	Brianna Decker	14	56.325093	-0.058113	-0.621364
24	Courtney Burke	34	63.932069	-0.000948	-0.640269
25	Hannah Brandt	15	62.095971	-0.031793	-0.652753
26	Dana Trivigno	12	64.961195	-0.071930	-0.721542
27	Rebecca Russo	32	68.770245	-0.054042	-0.741744
28	Madison Packer	23	74.829596	-0.008326	-0.756622
29	Kelly Babstock	18	80.733484	0.009537	-0.797798
30	Haley Skarupa	18	80.495019	-0.010741	-0.815692

Results NWHL

	team_name	team_powerplay_shots	team_structure_index	team_xg_index	team_danger_index
0	BUF	211	41.138518	0.034365	-0.377021
1	BOS	139	42.525810	0.028676	-0.396583
2	MIN	61	51.262730	0.000487	-0.512140
3	CTW	187	56.373976	-0.007410	-0.571150
4	MET	244	60.693947	-0.005457	-0.612397

Evaluation Danger Index

- Nothing "beats" xG
- Puts some context into Cane's structure index but makes it more complicated
- Kept things similar but maybe not optimal
- Difficult to draw meaningful conclusions from very limited data (a general whky problem)

Tracking Data: Creating Space

- Started using the BDC tracking data to find out who is good with creating space

- Calculated nearest defender for events and the difference between events

- Very favourable of backwards passes to the blue line (defeats purpose)

- xG weighting helped a little bit

- Still needs refinements

Tracking Data: Keeping Structure

▶ Trying to get back to topic of PP structure

▶ Calculated differences to AVG position

▶ Like difference to AVG shot in Cane's structure index

▶ Extremes caused by small samples for most players

Conclusion

▶ Able to add a bit more context to powerplay structure index

▶ Able to see who is just structured and who is structured in dangerous positions

▶ Should the approach be changed from an index to more of a model?

▶ Tracking data helps to add more context but "can't live on its own"

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- To Meghan Chayka, Shirley Mills, Alison Lukan, Michael Schuckers and everyone else involved for putting on the Big Data Cup

- To Mr. Bucket for the Data cleaning for BDC and ultimately this project

- Everyone in the Net Growth Pod Discord for putting up with my questions and keep the motivation high

JSM2022

▶ I'm going over the pond to D.C. to attend JSM this summer

▶ My main goal is to network with people I only know via the internet so anyone who wants to meetup please DM on Twitter @imkeller_5