Not all goals areequally importanta study for the NHL

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#### Niklas (and many others) dream of:



First try



A bit easier ...



## Outline

- Motivation
- Methods and Results
- Conclusion

#### **Performance metrics - traditional**

RANK	SPELARE	NR	LAG		POS	GP	G	Α	TP	PIM	GWG	PPG	SOG	HITS	BKS	+	-	+/-	TOI/GP
1	Ryan Lasch	81	👰 FI	rölunda	F	37	10	25	35	16	3	2	66	9	2	23	31	-8	19:02
2	Joakim Lindström	10	🐞 si	kellefteå	F	38	13	21	34	14	3	4	132	4	8	29	25	4	17:15
3	Derek Roy	9	🤯 Li	inköping	F	39	5	29	34	22	0	2	74	4	20	29	20	9	17:15

- *Offensive:* G: goals, A: assists, TP: points, GWG: game winning goals, PPG: powerplay goals, SOG: Shots on goal
- *Defensive:* HITS: hits, BKS: blocked shots
- +/-: plus-minus
- PIM: penalty minutes
- *Time:* GP: games played, TOI: time on ice

## **Performance metrics - advanced**

- Corsi: shots
- xG (Expected Goals): assigns a value to each shot, based on the likelihood of the shot resulting in a goal.

 These metrics have made it into the ice hockey discourse

## **Performance metrics - advanced**

Critique on advanced metrics: context

Some new approaches:

- Using Markov games
- THOR (Total Hockey Rating)

Our goal:

#### Metrics that

- Are variants on traditional metrics
- □ Are easy to understand for practitioners
- Take into account context
- Are related to the importance of goals

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## Data

- Play-by-play data from Sportlogiq
- Seasons (only regular season)
  - □ In paper: 2013-2014
  - □ Later in the talk: 2007-2008 to 2013-2014

## Goal frequency per minute



# Game Points Importance Value for a goal

Game points for NHL: 2pts for win, 1pt for tie and loss after overtime, 0pts for loss in regulation time.

# Game Points Importance Value for a goal

Outcome in regulation time: win, tie, loss

Context:
<time, goal differential, manpower differential>

$$P(outcome \mid context) = \frac{Occ(context \mid outcome)}{Occ(context)}$$

## Game Points Importance Value for a goal in a context

Change of probability of winning the game by scoring the goal

context = contextBG

$$GPIV(context) = 2 * [P(win \mid contextAG) - P(win \mid contextBG)] + 1 * [P(tie \mid contextAG) - P(tie \mid contextBG)]$$

Change of probability of the game ending in a tie by scoring the goal

## **GPIV vs Goal Differential**



## **GPIV vs Manpower Differential**



## Cumulative Distribution Function for GPIV



### New metrics

 Traditional metrics:
 Goal contributes 1 directly (Goals, +/-) or indirectly (Assists)

Variants of Goals, Assists, Points, +/-: Goal contributes with its context-based GPIV

## Top 10 players for GPIV-P

P-Rank	GPIV-P-Rank	Rank-diff	Player	Position	P	GPIV-P
2-3	1	1	Sidney Crosby	С	69	25.734
6-7	2	4	Alex Ovechkin	R	64	25.085
4	3	1	Joe Pavelski	С	67	23.467
1	4	-3	Tyler Seguin	С	70	22.259
5	5	0	Phil Kessel	R	66	22.006
6-7	6	0	Ryan Getzlaf	С	64	21.366
2-3	7	-5	Corey Perry	R	69	20.803
20-22	8	12	Blake Wheeler	R	51	20.295
20-22	9	11	Anze Kopitar	С	51	19.812
23-24	10	13	Eric Staal	С	50	19.791

## Rank changes P, G, A



## **Some new results**

■ Not in paper.

#### **Correlations for 7 seasons**



Season

#### Goals vs GPIV-Goals















#### Assists vs GPIV-Assists







12-13









#### **Points vs GPIV-Points**















100 0









#### +/- vs GPIV-+/-



10-11

11-12

12-13





13-14



**Plus-minus** 

#### Trends for some players



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## Conclusions

- Introduced variants of traditional metrics that take the importance of goals into account
- Strong correlation for G, A, P between new and traditional metrics
- Pass the eye test

## **Future Work**

- Deeper analysis over different seasons
- Use GPIV in Markov model-based approach for performance evaluation as a reward function in a Q-learning algorithm

### Thanks

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For the results on multiple seasons (not in paper)