

(Hockey II)



Produced by Dr. Mario | UNC STOR 390



Analyzing Goaltenders

- Classic Metrics for Goaltenders
 - Wins (W)
 - Goals Against Average (GAA)
 - Save Proportion (SVP) ← Considered Optimal
- Binary Categorization

$$\Phi_i = \begin{cases} 1 & \text{if shot } i \text{ is saved,} \\ 0 & \text{if shot } i \text{ is not saved.} \end{cases}$$





Analyzing Goaltenders

- Key Predictors
 - Opponent Strength (s)
 - EV (Even Strength)
 - PP (Power Play)
 - PK (Penalty Kill)
 - Type of Shot (w)
 - Backhand
 - Deflection
 - Slap
 - Snap
 - Tip-In
 - Wrap-Around
 - Wrist
 - Distance from Center Ice (d)
 - Angle from Center Ice (θ)





Analyzing Goaltenders

- Available Data
 - NHL'S Real Time Scoring System
 - Measurement Error Exists
 - Error in Location Detection
 - R Library *nhlscrapr*
- Metric 1: Wins
 - Assumes Winning Associated with Goalie Skill
 - Winning is Team-Dependent





Analyzing Goaltenders

- Metric 2: Goals Against Average
 - Like ERA of Baseball
 - Average Number of Goals Allowed Per 60 Minutes

$$GAA = 60 \left[\frac{n - \sum_{i=1}^n \Phi_i}{T} \right]$$

Number of Shots

Time Played

- Function of SVP, n, and T

$$GAA = 60 \left[\frac{n}{T} (1 - SVP) \right]$$

- Out of Goalie's Control





Analyzing Goaltenders

- **Metric 3: Save Proportion**
 - Estimates Probability Shot Gets in Goal

$$SVP = \frac{\sum_{i=1}^n \Phi_i}{n}$$

- Moderately Has Been Increasing Over Time
- Different Based on State

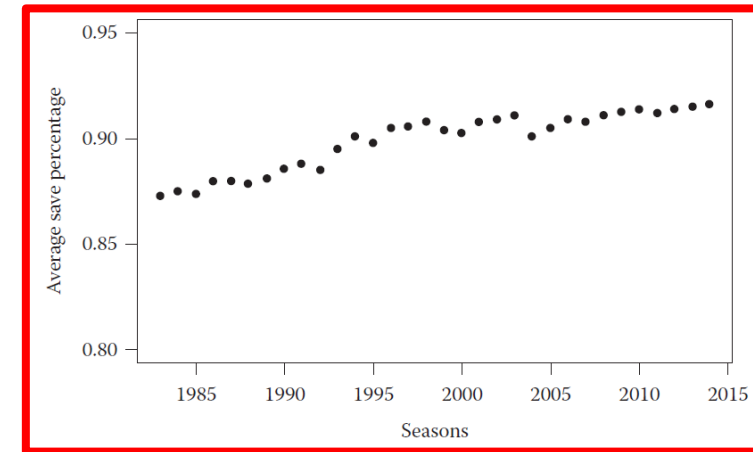
$$\mathbf{z}_u = (x, y, d, \theta, w, s, \dots)^T \text{ where } u = 1, \dots, \mathcal{U}$$

- Decomposed Into Weighted Average

$$SVP = \sum_{u=1}^{\mathcal{U}} G(u) S(u)$$

Probability Goalie
Saves in State

Probability of Facing
Certain State





Analyzing Goaltenders

- Reliability of SVP

Correlation between a Goalie's SVP in 1 Year and Their SVP in Subsequent Years Given a Number of Shots Faced in Each Season

Seasons	More than 500 Shots		More than 750 Shots	
	Correlation	J	Correlation	J
2009/2010 v 2010/2011	0.186	34	0.120	22
2010/2011 v 2011/2012	0.018	37	−0.038	28
2011/2012 v 2012/2013	0.060	20	0.909	8





Analyzing Goalenders

- Adjusted SVP
 - Motivation
 - Account for Shot Difficulty
 - Better Prediction of Future Goalkeeper Success
 - First Version by Ryder (2004)
 - Save Proportion Relative to What Average Goalie's Save Proportion Would Be Given the Shots Faced by the Goalie

$$\text{aSVP}_{\bar{G}} = \sum_{u=1}^{\mathcal{U}} \bar{G}(u) S(u).$$

↑
Probability an Average
Goalie Saves in State

- Compare to SVP





Analyzing Goaltenders

- Adjusted SVP
 - Second Version by War-On-Ice.com (2014)
 - Save Proportion Relative to An Average Goalie's Shot Quality

$$\text{aSVP}_{\bar{S}} = \sum_{u=1}^U G(u) \bar{S}(u)$$

↑
Probability an Average
Goalie Faces the State

- Goalies Are Compared Using Same Shot Distribution
- Compare to SVP





Analyzing Goaltenders

- Shot Probability Models
 - Goal: Estimate Probability a Shot Results in a Goal
 - Purpose: Estimate Components of Adjusted SVP

$$G(u) \quad \bar{G}(u)$$

Two red arrows point from the text "Adjusted SVP" in the previous block to the terms $G(u)$ and $\bar{G}(u)$ in this equation.

- Methods: Logistic Regression
- Developed by Many Researchers
- Defense Independent Goalie Rating

$$\begin{aligned} DIGR_j &= \sum_{u=1}^{\mathcal{U}} \tilde{G}_j(u) \bar{S}(u) \\ &= \sum_{u=1}^{\mathcal{U}} \left[\alpha(u) G_j(u) + (1 - \alpha(u)) \bar{G}(u) \right] \bar{S}(u). \end{aligned}$$

$$\alpha(u) = \frac{n_u}{n_u + n^\dagger}$$

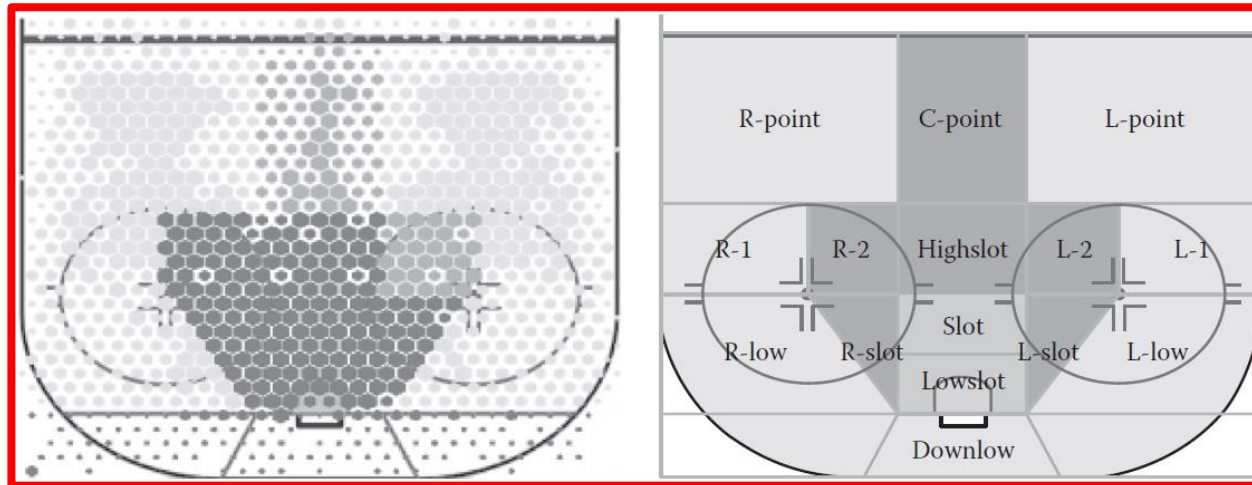
n_u is the number of shots faced by goalie $j, j = 1, \dots, J$ of shot type w at strength s
 n^\dagger is a “shrinkage” constant





Analyzing Goaltenders

- Shot Probability Models
 - Incorporation of (x,y) Location Relative to Center



- Authors Modified Original DIGR
 - Treated Rebounds/Rush Shots as Separate Types
 - Used Adjusted Shot Location Based on Rink
 - Modified Shrinkage Constant for Prediction Accuracy





Analyzing Goaltenders

- Shot Probability Models
 - Results of Author's DIGR

Correlation between a Goalie's DIGR in 1 Year and Their DIGR in Subsequent Years

Seasons	More than 500 Shots		More than 750 Shots	
	Correlation	J	Correlation	J
2009/2010 v 2010/2011	0.237	34	0.393	22
2010/2011 v 2011/2012	0.647	37	0.665	28
2011/2012 v 2012/2013	-0.174	15	0.677	6

Top 10 Goalies Ranked by DIGR for 2010–2011 NHL Season Using $n^{\dagger} = 1000$

Goalie	DIGR(aSVP)	SVP	n
T. Thomas	0.9314	0.9499	1416
S. Clemmensen	0.9308	0.9216	638
N. Backstrom	0.9305	0.9301	1202
J. Reimer	0.9301	0.9330	880
K. Lehtonen	0.9295	0.9290	1522
A. Niemi	0.9295	0.9310	1333
J. Quick	0.9295	0.9243	1255
S. Varlomov	0.9288	0.9370	571
M. Kiprusoff	0.9281	0.9172	1438
P. Rinne	0.9279	0.9364	1462



Final Inspiration

I went to a fight
the other night, and a
hockey game broke out.

-Rodney Dangerfield