Characterizing Playing Styles for Ice Hockey Players

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Loosing a key player

- Loosing key players is a challenge all teams face.
- In a thin market players are often hard to replace.
- For example, Färjestad lost one of their best defenders Carl Dahlström
- This challenge is one thing our paper will address
Introduction
Motivation and objective

- Identifying player skills and styles
- Scouting
- Roster creation
- Objective: Characterize playing styles
Methodology
Data

**Event data**
Data from AHL, SHL, HockeyAllsvenskan

**Seasons used**
21/22, 22/23, and half of 23/24

**Players**
Only players with more than 200 minutes on ice
## Playing style

- A player's playing style is defined by a player vector.
- A player vector has 13 skill features for defenders and 18 for forwards.
- Each skill is evaluated by the frequency of 2-7 actions.

<table>
<thead>
<tr>
<th>Skills</th>
<th>Defenders</th>
<th>Forwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passing</td>
<td></td>
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</tr>
<tr>
<td>Skating</td>
<td></td>
<td>Skating</td>
</tr>
<tr>
<td>Shooting</td>
<td></td>
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</tr>
<tr>
<td>Defensive Stickwork</td>
<td></td>
<td>Powerplay Playmaking</td>
</tr>
<tr>
<td>Puck Moving</td>
<td></td>
<td>Powerplay Slot Engagement</td>
</tr>
<tr>
<td>Point Producing</td>
<td></td>
<td>Powerplay Scoring</td>
</tr>
<tr>
<td>Powerplay Playmaking</td>
<td></td>
<td>Defensive Puck Control</td>
</tr>
<tr>
<td>Powerplay Scoring</td>
<td></td>
<td>Defensive Zone Play</td>
</tr>
<tr>
<td>Physical Play</td>
<td></td>
<td>Defensive Positioning</td>
</tr>
<tr>
<td>Slot Defense</td>
<td></td>
<td>Slot Defense</td>
</tr>
<tr>
<td>Stay at Home</td>
<td></td>
<td>Penalty Killing</td>
</tr>
<tr>
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<td></td>
<td>Slot Engagement</td>
</tr>
<tr>
<td>Penalty Killing Slot Defense</td>
<td></td>
<td>Heavy Game</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forechecking</td>
</tr>
</tbody>
</table>
# Construction of player vectors

**Defenders Passing Vector:**

<table>
<thead>
<tr>
<th>Outlet pass</th>
<th>Stretch pass</th>
<th>NZ pass</th>
<th>Pass for 1-timer</th>
<th>OZ pass</th>
<th>Assist</th>
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<tbody>
<tr>
<td>115</td>
<td>98</td>
<td>127</td>
<td>23</td>
<td>75</td>
<td>16</td>
</tr>
</tbody>
</table>
Construction of player vectors

Normalization:

1. Normalize by ice time
   \[
   \frac{\text{Action Frequency}}{\text{Time on ice}} \times 60
   \]

2. Standardize by applying MinMax Scaler

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<td>0.85</td>
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Construction of player vectors

Dimensionality reduction:

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Player Vector:

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<th>Skating</th>
<th>Shooting</th>
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<tbody>
<tr>
<td>0.87</td>
<td>0.63</td>
<td>0.47</td>
</tr>
</tbody>
</table>

NMF
Clustering

- Fuzzy C-Means.
- Each player can belong to more than one player type.
- Each cluster explains a typical player for the specific player type.
- Previous work used hard clustering.
- Five player types each for defenders and forwards.
Results
Defenders skill distribution

- Skill distribution across the defensive skills
- Broad range of skill levels among the players
- Some skills have more consistent values
- Special teams
- Outliers
Forwards skill distribution

- Skill distribution among the forwards
- Broad level of skill in all the skills
- Some skills values are more evenly distributed
- Numerous outliers indicating variability
Defender Player Types

Cluster D1 (91 players)
- S Forsmark (SHL)
- H Skinner (AHL)
- W Wallander (SHL/AHL)
- J Andersson (SHL)
- H Gabrielson (HA)
- A Brandhanmar (HA)
- H Stuf (HA)
- C.J. Lerby (SHL/HA)
- Q Smeirman (AHL)
- J Brok (AHL)

Cluster D2 (229 players)
- H Murey (AHL)
- T Smith (AHL)
- T Niemelä (AHL)
- A Lindelöf (HA)
- J Lägdesil (SHL)
- A Knaiz (AHL)
- J Pudas (SHL)

Cluster D3 (188 players)
- J Nyberg (SHL)
- A Söderberg (HA)
- K Lowe (SHL)
- P Tischle (AHL)
- V Pulli (AHL)
- J Lundegård (SHL)
- J Heens (SHL/HA)

Cluster D4 (128 players)
- B Pachal (AHL)
- A Strand (AHL)
- D Samorukov (AHL)
- I Soloyov (AHL)
- G Brisebois (AHL)
- M Kekkonen (AHL)
- W Aamot (AHL)
- D Helsson (AHL)

Cluster D5 (142 players)
- E Trong (AHL)
- M Björk (AHL/SHL)
- K Johansson (HA)
- J Jansso (H)
- O Nilsson (SHL)
- S Santini (AHL)

5 best skills
3 lowest skills
Forward
Player Types

Cluster F1
(302 players)
T Barron (AHL)
M Westfall (SHL)
N Caamano (AHL)
N Jones (AHL)
M Marushev (AHL)
M O’Leary (AHL)
B Maxwell (SHL)
T Kaspi (AHL)
J Labate (AHL)

Cluster F2
(359 players)
L Larsson (SHL)
O Sillinger (AHL)
R Elie (SHL)
A Ritchy (AHL)
J Kellman (SHL)
J Lauko (AHL)
A Poganski (AHL)
G Moireles (AHL)
P Carlsson (SHL)
E Desnoyers (AHL)

Cluster F3
(255 players)
J Grönhagen (HA)
F Nilsson (SHL)
F Barklund (HA)
J Devane (AHL)
R Clune (AHL)
R Muzik (SHL)
O Pettersson (SHL)
J Joshun (AHL)
K Gabriel (AHL)
J McKinnon (AHL)

Cluster F4
(243 players)
R Damiani (AHL)
S Walker (AHL)
N Todd (AHL)
R Marenis (HA)
A Beckman (AHL)
C Conacher (AHL)
A Andreoff (AHL)
J Dean (AHL)
B McCartney (AHL)
S Wright (AHL)

Cluster F5
(250 players)
M Strömwall (AHL/SHL)
O Palve (SHL)
M Ruohomaa (SHL)
D Holloway (AHL)
D Tomasek (SHL)
J Looke (SHL/HA)
A Petersson (SHL)
A Louis (AHL)
M Modigs (HA)
L Bristedt (SHL)

- 5 best skills
- 3 lowest skills
Finding replacement for Carl Dahlström

<table>
<thead>
<tr>
<th>Players</th>
<th>Similarity to C. Dahlström</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fredrik Claesson</td>
<td>89 %</td>
</tr>
<tr>
<td>Casey Fitzgerald</td>
<td>88 %</td>
</tr>
<tr>
<td>Brandon Scanlin</td>
<td>88 %</td>
</tr>
<tr>
<td>Steven Santini</td>
<td>87 %</td>
</tr>
<tr>
<td>Austin Strand</td>
<td>87 %</td>
</tr>
<tr>
<td>Filip Windlert</td>
<td>87 %</td>
</tr>
<tr>
<td>Didrik Strömberg</td>
<td>86 %</td>
</tr>
</tbody>
</table>
Conclusion

Represented playing styles for ice hockey defenders and forwards

Constructed numerical vectors based on skill sets that represented an ice hockey player’s playing style

Derived player types for ice hockey defenders and forwards

With the use of fuzzy clustering, we defined five player types each for defenders and forwards together with typical skill levels and players for these player types.
Future work

**New representation of player similarities**
As future work, we will define a new similarity between players based on their membership values to the playing style clusters.

**Investigate other clustering methods**
Other clustering methods will be investigated such as Gaussian Mixture Models.
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