

5 HOCKEY PLAYERS SELECTION

by **Team Purple**

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Rotman ? Choose **5** Ice Players to form a Team.

Req.



1. Excellent Goal Scorers ≥ 3



3. Faceoff Specialist ≥ 2



2. Excellent Passers ≥ 3



4. Takeaway Specialist ≥ 1

5. Passers are familiar with the shooting specialist



Evaluation Model

1. Calculate an Evaluation Score

	Player	Evaluation Score
0	Abbie Ives	0.078313
1	Allie Olnowich	0.096814
2	Allie Thunstrom	0.156591
3	Alyson Matteau	0.247391
4	Alyssa Wohlfeiler	0.278318
...
121	Tori Howran	0.214387
122	Tori Sullivan	0.099713
123	Victoria Hanson	0.108013
124	Whitney Dove	0.277014
125	Winny Brodt-Brown	0.219885

Factors:

- **Score & Goal:**
"# Goals", "# Shots", "Scoring Rate(%)"
- **Success:**
"# succesful passes", "# unsuccesful passes"
"Success Pass Rate"
- **Faceoff:**
"# faceoff wins"
- **Takeaway:**
"# takeaway wins"
- **Penalty:**
"# penalty take", "# penalty give"

Equally weighting ~

* Evaluation Score is used to find players who excel in all areas.

Rotman

Evaluation Model

Rotman

2. Rank Choose

Finally Choose Top 30% in Goals & Shot Field

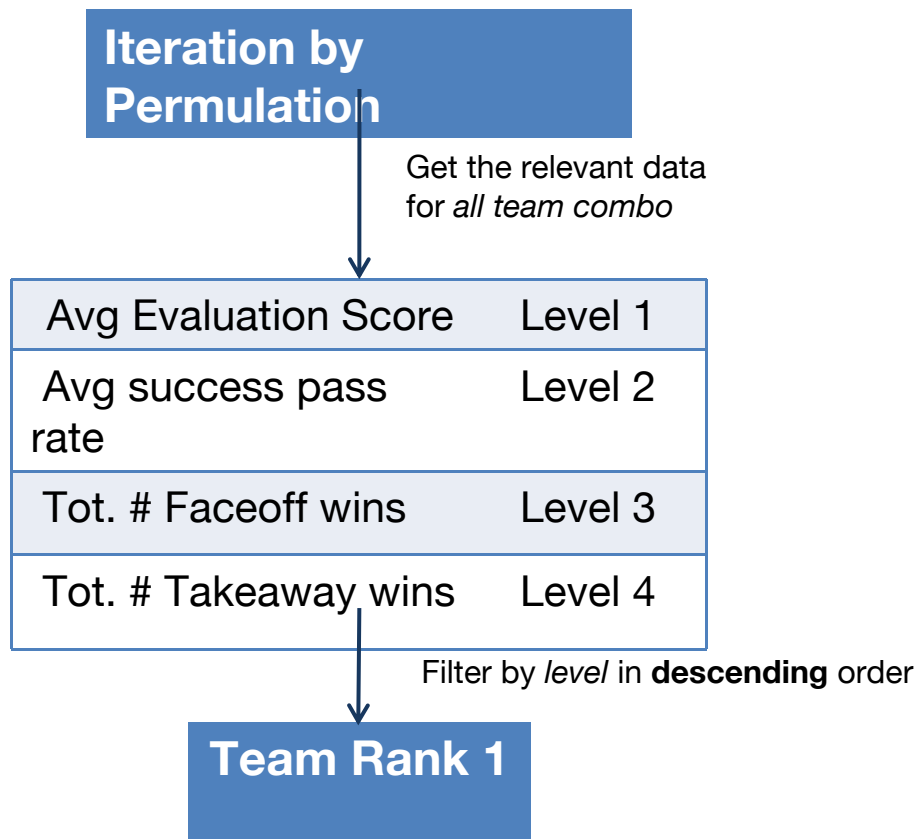
Record !

				Player	# succesful passes	# unsuccesful passes	Success Pass Rate	# Goals	# Shots	Scoring Rate(%)	# faceoff wins	# takeaway wins	# penalty take	# penalty give	Evaluation Score	Record !				
Player	# succesful passes	unsuc p		87	Mikyla Grant-Mentis	0.427386	0.488889	0.524324	1.0	0.890909	0.255102	0.240506	0.655172	0.6	0.000000	0.508229	# way wins	# penalty take	# penalty give	Evaluation Score
87	Mikyla Grant-Mentis	0.427386	0.488889	116	Taylor Woods	0.647303	0.511111	0.637438	0.8	0.763636	0.238095	0.025316	0.482759	1.0	0.222222	0.488344	3448	0.0	0.000000	0.126210
44	Jillian Dempsey	0.327801	0.400000	44	Jillian Dempsey	0.327801	0.400000	0.503448	0.6	0.436364	0.312500	0.886076	0.758621	0.0	0.222222	0.400259	1483	0.0	0.000000	0.108013
98	Samantha Davis	0.489627	0.533333	76	Mallory Souliotis	0.721992	0.933333	0.481081	0.6	0.581818	0.234375	0.000000	0.758621	0.0	0.444444	0.386678	3000	0.0	0.000000	0.103734
61	Leila Kilduff	0.190871	0.222222	98	Samantha Davis	0.489627	0.533333	0.540120	0.8	0.618182	0.294118	0.063291	0.620690	0.2	0.444444	0.371492	3000	0.0	0.000000	0.103573
91	Nina Rodgers	0.199170	0.188889	61	Leila Kilduff	0.190871	0.222222	0.522388	0.4	0.090909	1.000000	0.000000	0.517241	0.0	0.000000	0.294363	3000	0.0	0.000000	0.100000
58	Kristin Lewicki	0.336100	0.433333	91	Nina Rodgers	0.199170	0.188889	0.587879	0.4	0.309091	0.294118	0.012658	0.448276	0.6	0.111111	0.292897	3000	0.0	0.000000	0.097654
36	Haley Mack	0.253112	0.311111	58	Kristin Lewicki	0.336100	0.433333	0.484298	0.4	0.381818	0.238095	0.012658	0.586207	0.0	0.111111	0.276140	3000	0.0	0.000000	0.091371
9	Autumn MacDougall	0.290456	0.533333	50	Katelynn Russ	0.161826	0.333333	0.314286	0.4	0.472727	0.192308	0.075949	0.379310	0.4	0.000000	0.272974	3000	0.0	0.000000	0.090300
82	Meaghan Rickard	0.116183	0.222222	14	Brooke Boquist	0.290456	0.344444	0.513725	0.4	0.490909	0.185185	0.025316	0.103448	0.4	0.222222	0.253126	3000	0.0	0.000000	0.083929
8	Audra Richards	0.107884	0.222222	36	Haley Mack	0.253112	0.311111	0.502222	0.4	0.236364	0.384615	0.075949	0.137931	0.2	0.111111	0.239019	3000	0.0	0.000000	0.081756
• There are 10 players				69	Mackenzie MacNeil	0.190871	0.355556	0.351899	0.4	0.472727	0.192308	0.012658	0.517241	0.0	0.111111	0.238215	passes" and "Success Pass Rate"			
				9	Autumn MacDougall	0.290456	0.533333	0.354622	0.6	0.327273	0.416667	0.000000	0.241379	0.0	0.444444	0.231929				

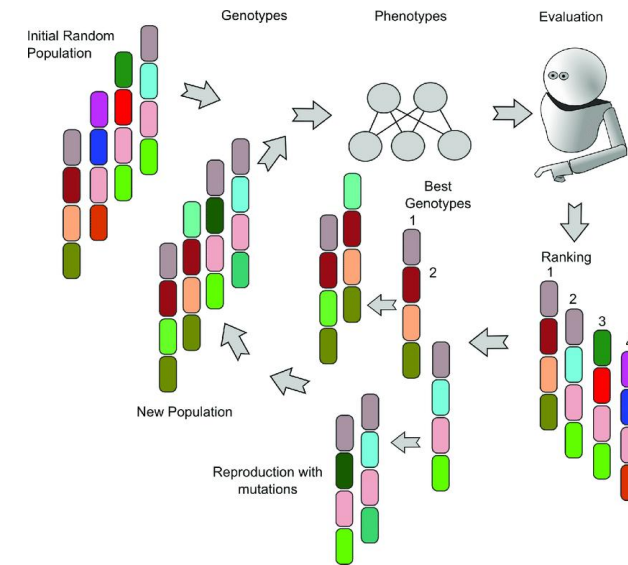
Evulation Model

3. Model Construction - 2 Methods

I. Team Combo



II. Genetic Algorithm

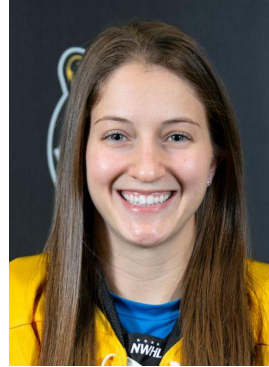


Pros:

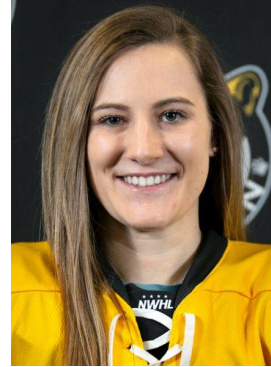
1. Consider *multiple* evaluation metrics and constraints.
2. Powerful search capabilities.
3. Find optimal solutions quickly and flexibly.

4. Result (Combo VS. Genetic Algorithm)

1



Jillian Dempsey



Mallory Souliotis



Mikyla Grant-Mentis



Samantha Davis



Taylor Woods

2



Jillian Dempsey



Audra Richards



Autumn MacDougall



Brooke Boquist



Haley Mack

Result Test and Support

**RECOMMEND
THIS TEAM !**

Info of Team 1 (Combo) Jillian Dempsey, Mallory Souliotis, Mikyla Grant-Mentis, Samantha Davis, Taylor Woods

- Covering the entire significant field in all areas.

Team stats in total

goal:19

Lowest Score Rate: 9.375%

pass:635

takeaway:95

faceoff:96

Beat 97.62% players

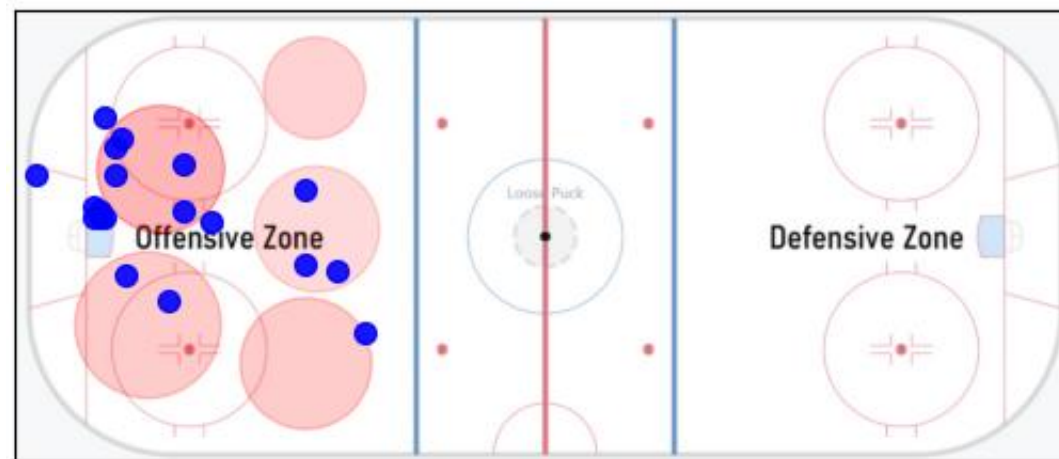
Beat 83.33% players

Beat 90.48% players

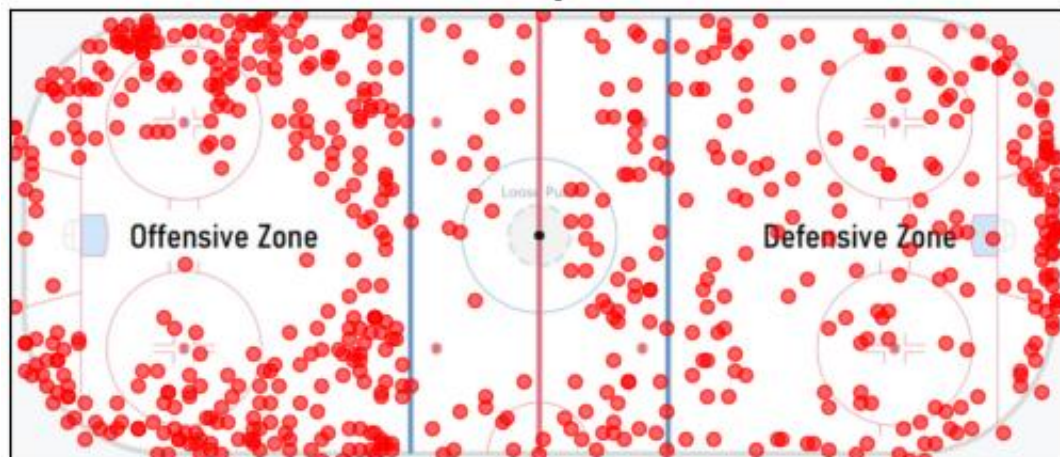
Beat 89.68% players

Beat 88.89% players

Shot area and Goal



Play



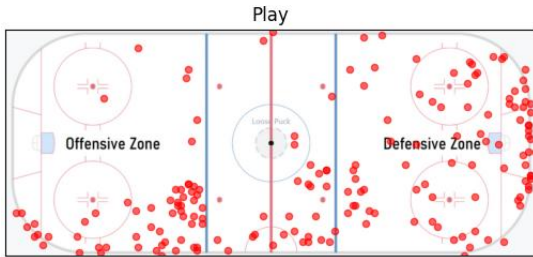
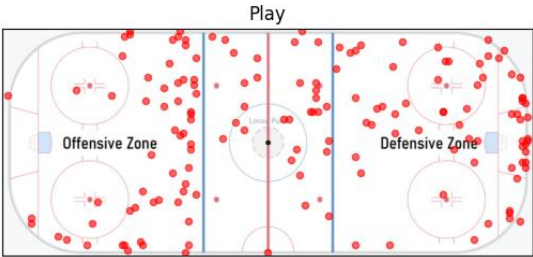
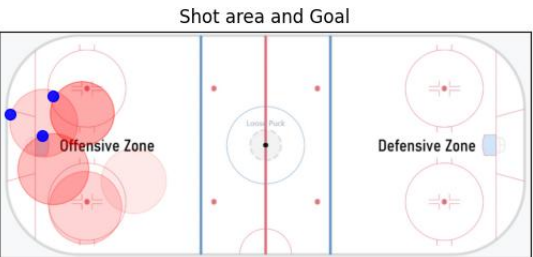
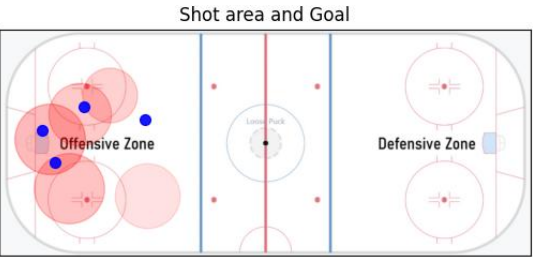
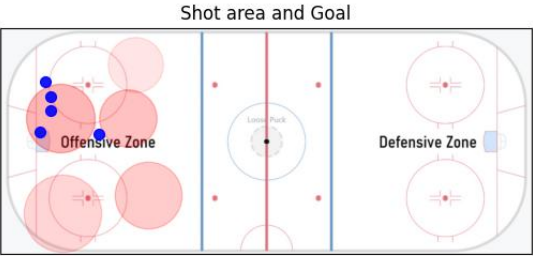
Takeaway



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Subdivision of specialized fields

Excellent goal scorers (Goal / Shots)	Excellent Passer (Complete / Incomplete)	Faceoff Specialist #	Takeaway Specialist #
Mikyla Grant-Mentis 5 / 49	Taylor Woods 157 / 46	Jillian Dempsey 70	Mallory Souliotis 22
Samantha Davis 4 / 34	Mallory Souliotis 175 / 84	Mikyla Grant-Mentis 19	
Jillian Dempsey 3 / 24			



Tacit understanding in Team Combo

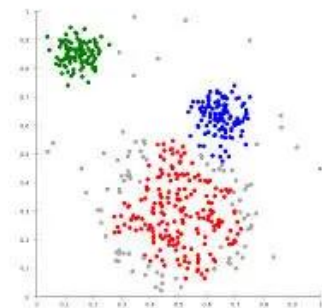
Req. Passers are familiar with the shooting specialists

- The players in Team Combo come from two different team:

Mallory Souliotis	Boston Pride
Jillian Dempsey	Boston Pride
Samantha Davis	Boston Pride
Mikyla Grant-Mentis	Toronto Six
Taylor Woods	Toronto Six



Players were familiar with their teammates, but what about the other team’s players?



- Using clustering to group all players into different groups. Players in the same group with similar attributes

Pass to teammates

Taylor Woods (group 4)	Mallory Souliotis (group 4)
Mikyla Grant-Mentis (group 6)	Kaleigh Fratkin (group 1)
Lindsay Eastwood (group 4)	Tori Sullivan (group 0)
Sarah Steele (group 7)	Samantha Davis (group 6)

Taylor Woods -> Samantha Davis, Mallory Souliotis
Mallory Souliotis -> Mikyla Grant-Mentis

Get pass from teammates

Mikyla Grant-Mentis(group 6)	Samantha Davis (group 6)	Jillian Dempsey (group 5)
Taytum Clairmont (group 3)	Tereza Vanisova (group 5)	McKenna Brand (group 6)
Amy Curlew (group 0)	Kaleigh Fratkin (group 1)	Christina Putigna (group 6)
Taylor Woods (group 4)	Taylor Turnquist (group 1)	Kaleigh Fratkin (group 1)

Mikyla Grant-Mentis -> Mallory Souliotis
Jillian Dempsey -> Mikyla Grant-Mentis

Thank you for watching our presentation today!
We are confident that this team will achieve great success and become a top-tier ice hockey team.

Your support and feedback are valuable for us.
If you have any questions or feedback, please feel free to reach out.

Thank you !

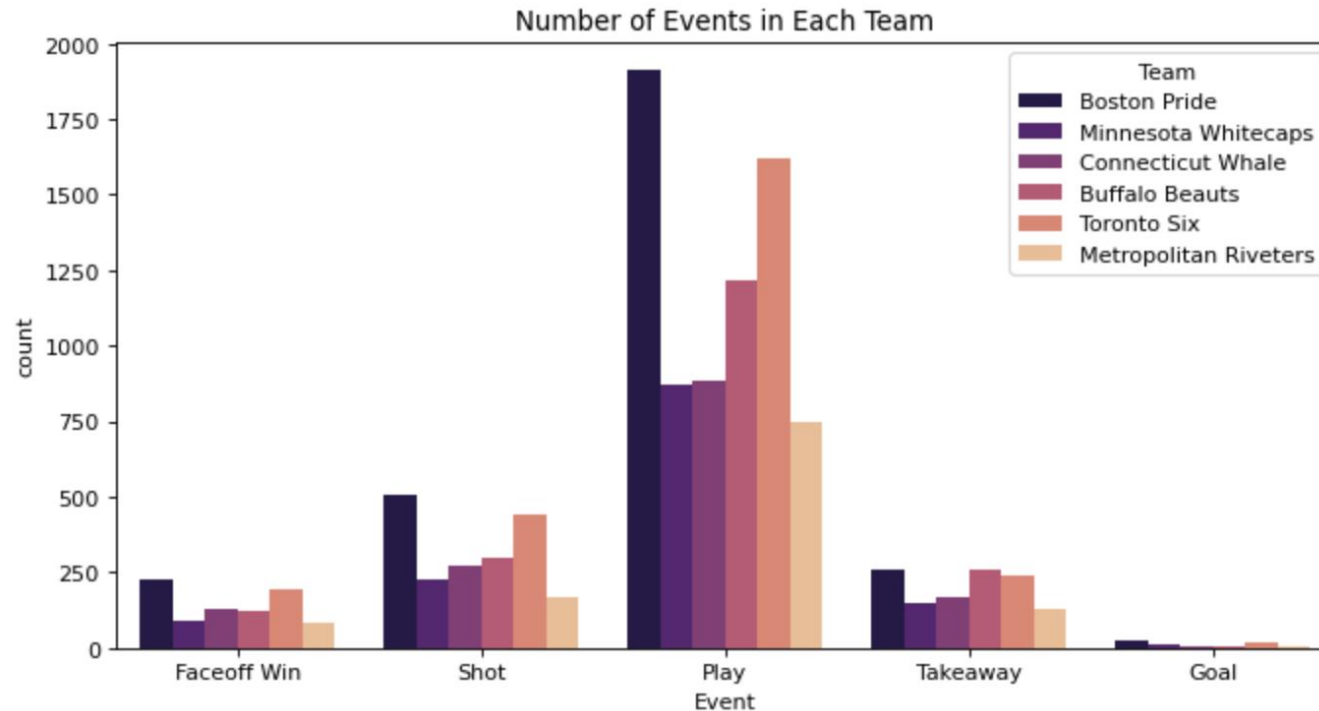
----- from Team Purple



Appendix

This part includes some assumptions, graphs, texts, codes, logistical ideas, explanations and other information that we think are important and would like to be considered in addition to the overall presentation.

Basic Data Visualization



Interpretation:

We do a basic data visualization (also can be considered as the EDA part) before we conducted deep-dive analysis, and the result is the picture shown above.

This graph illustrates the statistics of 'goals', 'shots', 'faceoff wins', and 'takeaways' for different teams. It is evident that both the **Boston Pride** and the **Toronto Six** have the highest number of data records in all aspects. They also exhibit strong offensive and defensive performances compared to other teams. Therefore, in the future player selection, we will be inclined to consider players from these two teams.

Weight Definition Part

1. Evaluation Score Calculation Part

- The left picture shows how we define weights for each indicator. However, It should also be noted that, since we are not experts in hockey, we **assumed** that the weighting of each factor was equal weighting (except for penalty give we set it as a negative indicator), and this weighting also meets the requirements of our selection of players *excel in all area*.

```
# Define Indicator Weights
weight1 = {
    '# succesful passes': 0.1,
    '# unsuccessful passes': 0.1,
    'Success Pass Rate': 0.1,
    '# Goals' : 0.1,
    '# Shots' : 0.1,
    'Scoring Rate(%)' : 0.1,
    '# faceoff wins' : 0.1,
    '# takeaway wins' : 0.1,
    '# penalty take': 0.1,
    '# penalty give': -0.1
}
```

2. Top Rank Players in 2 Fields Selected Part

- This code below is about choosing the top 30%, 30%, 10%, 10% players in 4 different fields ('# Goals', 'Scoring Rate(%)', '# succesful passes', 'Success Pass Rate'). We choose factors from Goals and Pass filed since we need to meet the question requirement that to achieve more goals. In addition, we set this top percentage since the question ask us to select at least 3 excellent goal scorers and at least 2 excellent passers. However, the client can change both the factors and the top percentages by themselves easily based on some proffessional suggestions and business needs in the future.

```
factors = ['# Goals', 'Scoring Rate(%)', '# succesful passes', 'Success Pass Rate']
top_percentages = [0.3, 0.3, 0.1, 0.1]
```

Weight Definition Part

3. Genetic Algorithm Factors' Weight Part

```
    return num_success_pass, faceoff_specialists, takeaway_specialists, evaluation_score  
  
# Optimization objective is maximization  
creator.create("FitnessMax", base.Fitness, weights=(0.3, 0.2, 0.2, 0.3))  
creator.create("Individual", list, fitness=creator.FitnessMax)
```

- This code is related to how we define factors' weight in the genetic algorithm model. We set a little difference among these 4 b/c we think evaluation score and pass rate are more important to select players in this question. However, ss we the same before, clients can change them based on their needs in the future.



Model Evaluation Part

In order to choose players more accurately for the client, we evaluate the data of top players who rank simultaneously as **Top20%** and **Top30%** in **Goals** Field separately, and eventually choose Top30% as our final range after comparison between these 2 ranges. The result of players in choosing different ranges by using 2 different methods are shown below.



Team Combo Result:

- **Top 30%:** Jillian Dempsey, Mallory Souliotis, Mikyla Grant-Mentis, Samantha Davis, Taylor Woods
- **Top 20%:** Jillian Dempsey, Leila Kilduff, Mikyla Grant-Mentis, Samantha Davis, Nina Rodgers,

Genetic Algorithm Result:

- **Top30%:** Audra Richards, AutumnMacDougall, Brooke Boquist, Haley Mack, Jillian Dempsey
- **Top20%:** Audra Richards, Autumn MacDougall, Haley Mack, Kristin Lewicki, Jillian Dempsey

Result for team choosing

Rotman

Why we choose Genetic Algorithm ?

- Since the player selection problem usually involves multiple evaluation metrics and constraints, such as scoring ability, passing skills, and face-to-face matchup ability, the genetic algorithm is able to take these metrics and conditions into account to find the combination of players that perform best overall and meet the conditions.
- Besides, the advantage of genetic algorithm in player selection problem is that it can find the optimal solution from a large number of candidate solutions through continuous iteration and evolution. It gradually improves and optimizes player combinations by simulating the process of natural evolution, using crossover, mutation and selection operations. So we also consider here the genetic algorithm as a method of player selection.
- We don't consider the direction of the goal here because we are already selecting the player team from the part of players with the best data in the Goal&Shot.

Info of Team 2 (Genetic Algorithm)

Audra Richards, Autumn MacDougall, Haley Mack, Jillian Dempsey, Brooke Boquist

- Covering the entire significant field in all areas.

Team stats in total

goal: 12

Lowest Score Rate: 7.40%

pass: 311

takeaway: 41

faceoff: 80

Beat 94.44% players

Beat 77.78% players

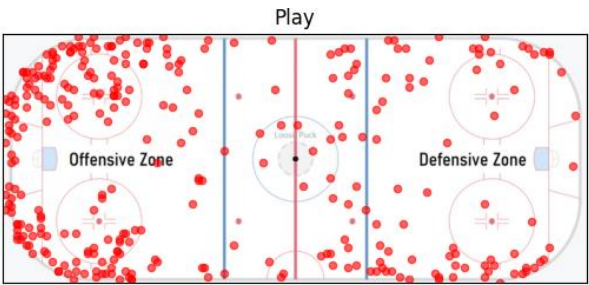
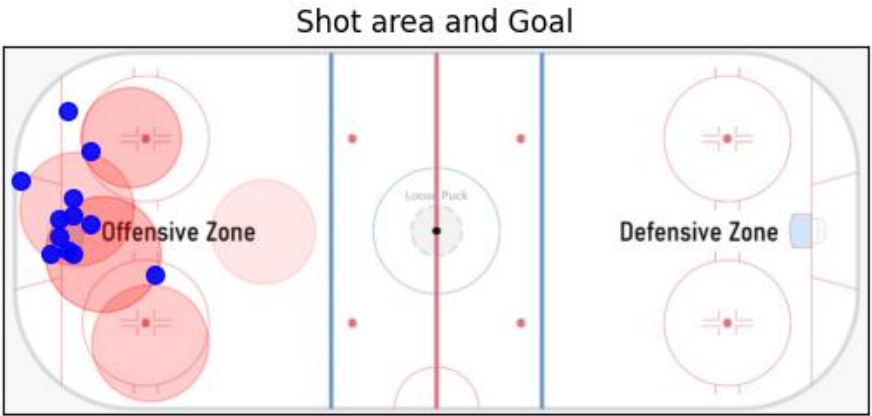
Beat 60.90% players

Beat 50.00% players

Beat 85.71% players

Subdivision of specialized fields

Excellent goal scorers (Goal / Shots)	Excellent Passer (Complete / Incomplete)	Faceoff Specialist	Takeaway Specialist
Autumn MacDougall 3 / 18	Jillian Dempsey 80 / 36	Jillian Dempsey 70	Jillian Dempsey 22
Audra Richards 2 / 14	Brooke Boquist 71 / 31	Haley Mack 6	
Haley Mack 2 / 13			



Why We Do Not Choose Team 2

The Genetic Algorithm is a good model to choose select players, and the info of Team 2 do shows good from the stats and position perspective as the former slide displays. The players' record for goals beat more than 94.44% other players in the team, which highly meet the question's *target - to gain more goals*. But there are several reasons that we do not choose Team 2 as recommended.

1. Firstly, we believe that the players from Team 2 have a relatively **low number of shot and goal records**, so Audra Richards, Autumn MacDougall, and Haley Mack who act as scorers in Team 2 does not outperform the goal scorers from Team 1. Although it could be due to the weaker performance of the team where these scorers belong, based on this dataset, we still prefer to select Team 1, which has shown better performance in all areas.
2. Additionally, while Team 2 has the talented passer Jillian Dempsey, who can also serve as a faceoff and takeaway specialist, it may be unreasonable to **rely too heavily on a single individual** for multiple roles.

Conclusion: We cannot deny that Genetic Algorithm is an excellent approach for solving the problem of selecting the optimal team. However, in this particular problem, where our dataset has limited data and infomation(e.g., only 126 players' data), genetic algorithm may not be able to produce the optimal results. Nevertheless, we still recommend clients to consider using genetic algorithm in the future when they have a sufficiently large dataset and info, as it can be an effective method for selecting desired and high-performing players.