Problem Chosen	2020 MCM/ICM Summary Sheet	Team Control Number
D		2001535

Analyze and Optimize Huskies Scoring

According to the requirements of Huskies' coach, we will explore how the interactions among the players on the field impacts their success? How to balance the performance between individuals and team?

For problem 1, we give four indicators. First indicators is the value of H, the second is PezzliScore, the third is Shooting Accuracy and the fourth is Passing Accuracy. The main factors to determine the value of H is total amount of passes of each match which mainly depends on individuals' ability and the distribution of players. The indicator PezzliScore is used to measure offensive and defensive efficiency which mainly depends on both teamwork and individuals. The indicator Shooting Accuracy is used to measure the accuracy of shots which mainly depends on individuals. The indicator Passing Accuracy is used to measure the accuracy of passes which mainly depends on individuals and teamwork. For Huskies, the value of H was 5.414474. We further explored and found that there was also certain positive correlation between H and the scores of each match. For Huskies, the value of PezzliScore was 1.185345, a higher PezzliScore means higher efficiency of offense and defense. But we found that there was not much relevance between the performance of Huskies and PezzliScore. Based on the data we collected and analyzed, we found that the value of Shooting Accuracy and Passing Accuracy were both related to the outcome of the match that they had consistent variation trend; When the value of Shooting Accuracy and Passing Accuracy are high the probability of win is high.

For problem 2, we gave three factors that we have mentioned: Team Chemistry, Distribution of Players and Individuals Ability. We analyzed impact of the four indicators to three factors and the AHP method was used to weigh the weight of three factors in Huskies' success. We can then balance the importance of individuals' performance and team performance.

Besides, by analyzing 38 games, we also found that home and away games would also have a certain impact on the outcome of the game. The Huskies' winning percentage at home is significantly higher than the Huskies' winning percentage on away. But according to the rules of the game, every two teams must play two games between home and away. Although playing at home and away has a big impact on the Huskies team, Huskies can't just choose to play at home. Therefore, the impact of home and away on the game cannot be quantified.

We finally wrote a suggestion about how to improve their team on individuals and team for Huskies and pointed out how to weigh the weight between individuals performance and team performance.

Keywords: PezzliScore, Shooting Accuracy, Passing Accuracy, TeamChemistry, Individual, The Distribution of Players

CONTENTS

1 Restatement of Problem

1.1 Background

A football team is a community of individuals. The team can reasonably use the outstanding ability of individuals to coordinate different work and finally achieve a goal. Teamwork can often accomplish tasks that individuals cannot complete. Each team member can promote the completion of tasks from different perspectives according to their own abilities. Competitive team sports are the concentrated embodiment of teamwork. Team members not only need to improve their ability, but also need to coordinate with other team members. The success of a team depends on how its members perform. This article looks at the Huskies' interactions during the game to find out what factors are driving the team to score and to identify strategies to improve Huskies scoring.

1.2 Problem Analysis

The data analysis of the full events of the Huskies team members can be analyzed to determine which variables can play a certain role in the Huskies team's victory. It can be assumed that the score function of football is $y = f(x_1, x_2 ... x_n)$, $x_1, x_2 ... x_n$ are the factors that affect Huskies team's score. When Huskies's scoring function value is greater than the opponent's scoring function value, then the Huskies team can win. Therefore, we started to analyze Huskies match data, quantified Huskies team full events, analyzed the relationship between events, found the relationship between various influencing factors, and obtained the score function.

2 Assumptions

1. the coaching team of each team is homogeneous, the time and money invested in training of each team is consistent, and each team is united.
2. Both fans like their favorite teams equally.
3. The result of the previous match has no influence on the result of the current match. No matter what the situation is, every team can withstand the pressure.
4. Each team does not adopt the most suitable tactics, that is, the team does not know the most suitable tactics.

3 Notation

Here we list the symbols and notations used in this paper, as shown in Table1.All of them will be defined later in the following sections.

Table 1. Notation

Symbol	Description
w	total passing volume
μ_p	mean players' passing volume
σ_p	variance of players' passing volume
μ_z	mean zones' passing volume
σ_z	variance of zones' passing volume
H	combination of above measures
$PezzliScore$	relative goal rate
g_i	win goals of match i
s_i	the total number of shots of match i
ε_i	shooting accuracy of match i
p_i	success passes of match i
P_i	total attempts of pass of match i
τ_i	passing accuracy of a match i

4 The Value of H

The team layout assigns different functions to each team member. Passing is the foundation of football. We will analyze the passing behavior of the players and look for the impact of passing on the game. We analyze a total of five indicators from the two aspects of the player's passes and the distribution of the passes on the court. Then we aggregated this set of indicators to get a new indicator H, which represents the passing behavior of the entire team.

4.1 Number of Passes

4.1.1 Average number of passes per game

The Huskies pass count for each Huskies player in each game is calculated and then the total number of passes is added up, divided by the number of matches

$$w = \frac{1}{38}\sum_{j=1}^{38}\sum_{j=1}^{30} P_{ij} \tag{1}$$

w is the average number of passes per game, P_{ij} is the number of passes made by the i-th player in the j-th game.

4.1.2 The average number of passes by players in each game

Then calculate the average number of passes per game divided by the number of Huskies players:

$$\mu_p = \frac{w}{30} = 469.1333333333333 \tag{2}$$

4.1.3 σ_p standard deviation of μ_p

The existence of heterogeneity means that there is a gap in passing ability between players. The standard deviation σ_p of the average number of passes per player in each match describes the deviation of the players' passing ability. So we use σ_p to describe heterogeneity, and σ_p is positively related to heterogeneity. The larger the value of σ_p, the greater the gap between the player's passing ability and the higher the heterogeneity.

Bring $\mu_p = 469.1333333333333$ into the formula

$$\sigma_p = \sqrt{\frac{1}{38\times 30}\sum_{j=1}^{38}\sum_{i=1}^{30}(P_{ij} - \mu_p)^2} \tag{3}$$

Inferred σ_p =406.5799097207162

4.2 Distribution of Passes on the Court

We already have passing data (including Huskies) from multiple teams. The distribution of passes over the zones of the pitch is another key aspect of a team's passing behavior. To capture this aspect we build a zone passing network, where nodes are zones of the pitch and an edge (z_1, z_2) represents all the passes performed by any player from zone z_1 to zone z_2. (1) The average number of times each ball passes through area i (i = 1,2,3 ... 100) is μ_Z .(2) The variance σ_Z of the amount of passes managed by zones of the pitch during the game.

A high σ_Z means a coexistence of “hot” zones with high passing activity and “cold” zones with low pass activity during the game. Low values of σ_Z indicates a more uniform distribution of the passing activity across the zones of the pitch.[1]

We first divide the standard 65*110(m) football field into 100 standard rectangles of 10*10, so each rectangle is 11m long and 6.5m wide. The plane rectangular coordinates established in the data. So in this coordinate, each unit of the X-axis represents 110/100 = 1.1 (m), and each unit of the Y-axis represents 65/100 = 0.65(m). For the sake of calculation, we still use the coordinate system that the data USES, but make sure that each unit is not actually 1m. The next values we're going to calculate for x and y are for each of these little rectangular areas.

Next we number each rectangle, from 1 to 100. The Huskies team played a total of 38 games, the following calculates the sum of μ_Z and σ_Z in 38 games (n represents the nth game) $\sum_{n=1}^{38}\mu_n$ and $\sum_{n=1}^{38}\sigma_n$, we can divide the sum of μ_Z and σ_Z by the number of games to get the average and standard deviation. We now extract and store the passing data of each team through matlab, then, the total number of passes in the j-th small rectangle (the 11th rectangular position (2,1)) of the i-th team is calculated by writing a program in matlab, and a matrix of the number of passes of each team can be obtained.

Below we calculate the relevant parameters of the Huskies team:

Mean total passes $\sum_{n=1}^{38}\mu_n$

$$\sum_{n=1}^{38}\mu_n = \frac{1}{100}\sum_{i=1,j=1}^{100} x_{ij} \tag{4}$$

Since $\sum_{i=1,j=1}^{100} x_{ij}$ can be obtained directly during statistics, no double calculation is needed.

The standard deviation of the number of passes in 100 rectangles is $\sum_{n=1}^{38}\sigma_n$.

$$\sum_{n=1}^{38}\sigma_n = \sqrt{\frac{1}{100}\sum_{i=1,j=1}^{100}(x_{ij}-\mu_z)^2} \tag{5}$$

Because there is the following relationship:

$$\mu_z = \frac{1}{38}\sum_{n=1}^{38}\mu_n, \tag{6}$$

$$\sigma_z = \frac{1}{38}\sum_{n=1}^{38}\sigma_n \tag{7}$$

It can be calculated: $\mu_z = 3.695526, \sigma_z = 2.102232$.

4.3 Team Passing Ability

Through the in-depth analysis of the passing behavior above, we obtained five indicators. Each indicator represents a different aspect of passing behavior. The five indicators are summarized to obtain a new indicator H. We use this metric to describe the team's overall passing behavior. The higher the H, the better the team's passing ability.

$$H = \frac{5}{1/w + 1/\mu_p + 1/\sigma_p + 1/\mu_z + 1/\sigma_z} \tag{8}$$

Based on the calculation of 38 games, we can get the H value of Huskies, $H = 5.414474$. Similarly, we can get the corresponding values and rankings of other teams.

Table 2. Teams and their corresponding passing abilities H and rankings

Team	Opp2	Opp16	Opp3	Opp9	Opp5
H	12.9364	11.15499	9.642247	9.347293	8.808208
Rank	1	2	3	4	5
Team	Opp13	Opp4	Opp14	Opp15	Opp11
H	8.670058	8.440733	8.059042	7.905766	7.546362
Rank	6	7	8	9	10
Team	Opp18	Opp17	Opp12	Opp6	Opp10
H	7.284351	7.052105	7.039602	6.372014	6.116956
Rank	11	12	13	14	15
Team	Opp19	Opp7	Opp8	Huskies	Opp1
H	5.794085	5.710213	5.686003	5.414474	4.802566
Rank	16	17	18	19	20

Because the other teams have 2 games and the data is too small, they cannot perform well in the overall level of those teams.

4.4 Analysis of Huskies' passes

Next, we counted 13 Huskies wins, 10 draws and 15 lost passes. In this process, we counted all the teams The data is weighted, and an average pass distribution matrix is finally obtained, and the corresponding contour model is drawn according to this matrix.

The above three pictures show that the color changes from warm color to cool color, and the amount of passing is decreasing in the contour region.

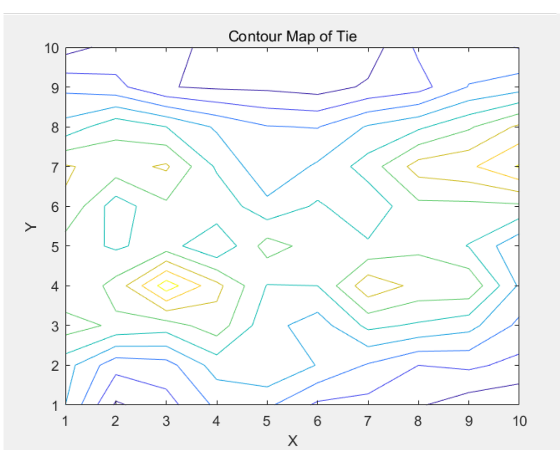

Figure 1. Contour model of average pass distribution in Tie

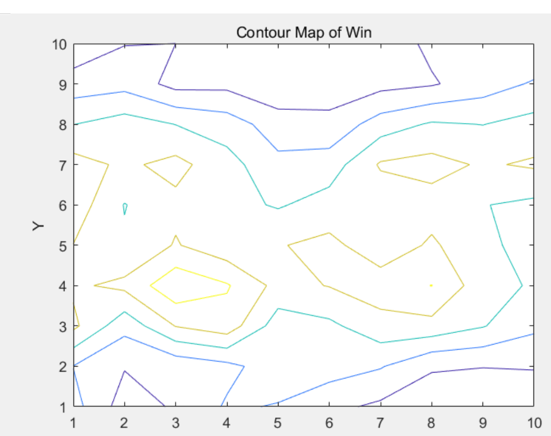

Figure 2. Contour model of average pass distribution in Win

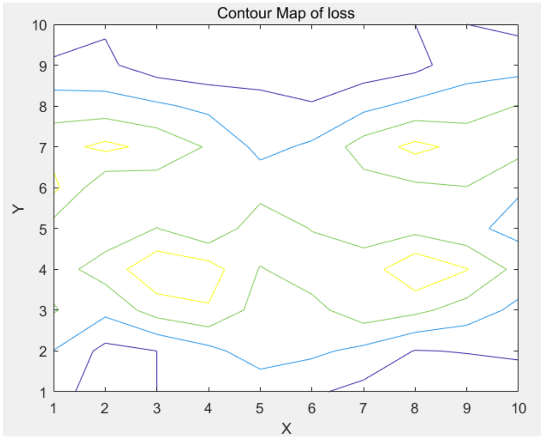

Figure 3. Contour model of average pass distribution in Loss

Comparing the three images above, we can find that the contour distribution under the winning field is the most discrete and uniform, which means that σ_z is the smallest in the winning field. The larger σ_z is, the more concentrated the pass is, and it is not easy to win.

4. 5 Points Per Game

The basis of goals when passing, we guess the passing behavior will affect the score of the game. In order to explore the relationship between H and the average score, we calculated the team's average score and ranking and compared it with the team's passing ability value and ranking.

Assume that Huskies's game conforms to the football game points rule, that is, the team that wins each game gets 3 points, the team that loses does not score, and the team that draws each scores one point.

Add up the scores of each team to get the total score of each team. Divide the total score by the number of entries to get the average score of each team, and rank according to the average score of each team.

Table 3. Teams and their average points and rankings

Team	Opp4	Opp5	Opp9	Opp11	Opp2
Average Score	3	3	3	3	2
Rank	1	1	1	1	5
Team	Opp3	Opp13	Opp6	Opp7	Opp10
Average Score	2	2	1.5	1.5	1.5
Rank	5	5	8	8	8
Team	Opp14	Huskies	Opp16	Opp19	Opp8
Average Score	1.5	1.29	1	1	0.5

Rank	8	12	13	13	15
Team	Opp12	Opp18	Opp1	Opp15	Opp17
Average Score	0.5	0.5	0	0	0
Rank	15	15	18	18	18

According to Tables 2 and 3, we can find that in addition to some teams having large differences in H-value rankings and score rankings, on the whole, the larger the H, the higher the score. Further we look for the relationship between the average score and H.

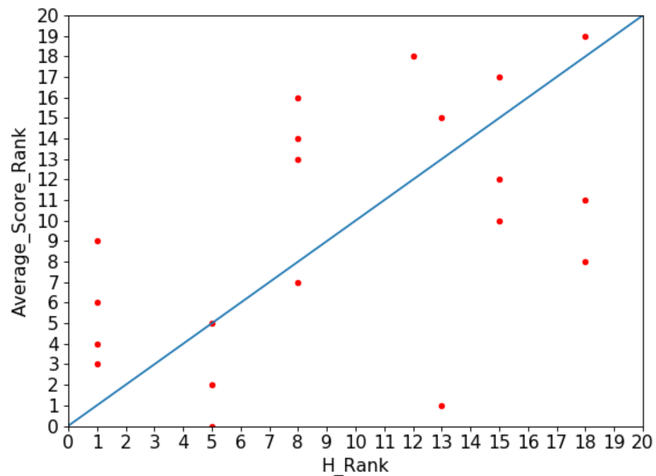

Figure 4. Relationship between average score and H

It can be seen from Fig. 4 that the average score per game is proportional to H. The same reason: the other teams have 2 games and the data is too small, they cannot perform well in the overall level of those teams.

5 Shooting Accuracy

We chose to use the accuracy of shots to describe the impact of individuals on scoring. The higher the accuracy of the shot, the higher the probability of scoring on each attempt,in other words, the closer the probability of success to the number of shots. On the other hand, the lower the accuracy of the shot, the more shots a player may need to score, which affects the outcome of the match.[2]

Define average shooting accuracy

$$\varepsilon_i = \frac{g_i}{s_i} \tag{9}$$

ε_i means shooting accuracy of match i, g_i means win goals of match i, s_i means the total number of shots of match i.

Based on 38 games, we collected the data and calculated it. After removing some points with large deviations, Huskies and opponents' scoring accuracy line chart was obtained. Where, FIG. 5 and FIG. 6 represent the number of matches and the vertical coordinate represent the shooting accuracy.

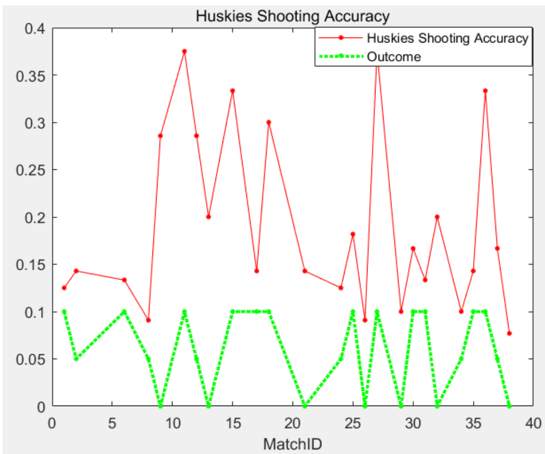

Figure 5. Huskies Shooting Accuracy

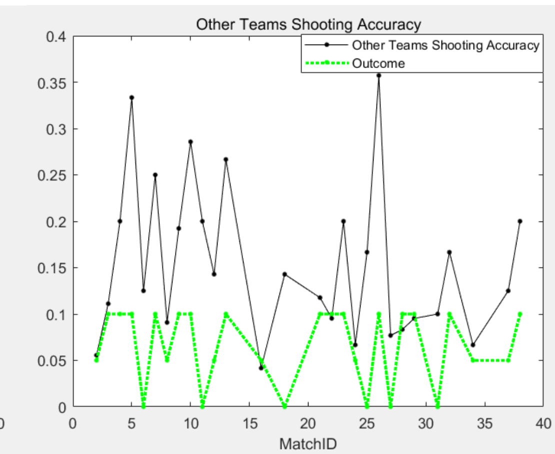

Figure 6. Other Teams Shooting Accuracy

In order to clearly and intuitively observe the relationship between shooting accuracy and match results, we use the value 0.1 for Win,0.05 for Tie, and 0 for Loss, and draw the graph together. Note here that Huskies outcome is opposite to outcome of opponent.

The red line represents the shooting accuracy of each match, the green line represents the result of the match.

After removing the deviation point, we can see that the shooting accuracy of each team is basically stable between [0.05,0.35], and more concentrated in [0.1,0.3].

Through observation, we found that the variation trend of shooting accuracy was consistent with that of winning situation. When the shooting accuracy is higher, the probability of winning the game is higher; when the shooting accuracy is lower, the probability of losing the game is higher. So it can be judged that the shooting accuracy has a great impact on the result of the game.

6 PezzliScore

The team score goals also need to consider the offensive and defensive capabilities of the two sides. We use *PezzliScore* (team) to measure the impact of the choice of offensive and defensive tactics on the outcome of the game. The team's high *PezzliScore* (team) score means that the team has efficient attack and defense, that is, it only needs a few attempts to score, while the opponent needs many attempts to score. On the other hand, when a team is ineffective both offensively and defensively, *PezzliScore* scores low: it takes many attempts to score, while the opponent only needs a few shots to score.[1]

The Huskies' 38 games were analyzed as a whole. See Opponent1 ~ Opponent19 as a whole, and calculate the overall OpponentScore, Opponent_shot sum, as 19 team consists of the average. Then calculate the sum of OwnScore, Huskies_shot. By looking at the *PezzliScore* formula, we can see that the *PezzliScore* values of the 19 teams and the *PezzliScore* values of the Huskies are the reciprocal of each other.

Put the data into the formula

$$PezzaliScore(team) = \frac{OwnScore}{Huskies\_shot} * \frac{Opponent\_shot}{OpponentScore} \tag{10}$$

Get $PezzliScore = 1.185345$.

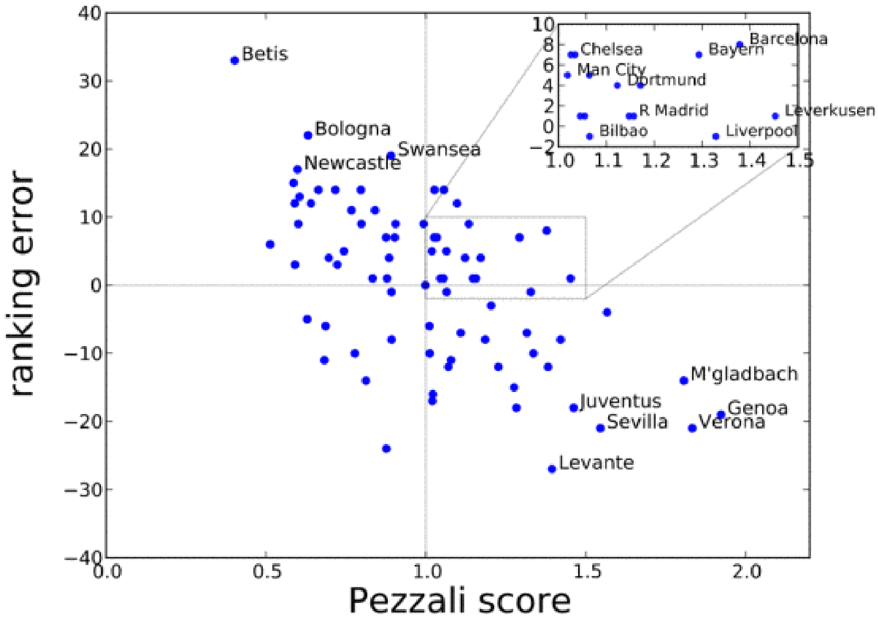

Figure 7. Distribution of *PezzliScore* and range error

As shown in **Figure 7**[1], in the case of $PezzliScore =$ 1.185345, the error range of the ranking is [-20,8]. Because Huskies teams have a lower H value, Huskies should be more aggressive than defensive teams with a higher H rating. They take advantage of their passing and their defensive strategy is effective, so they don't allow opponents to score easily. The Huskies' $PezzliScore >$, 1, shows that its scoring rate is high compared to the 19-team average. But Huskies rank relatively low in scoring (12th) and H (18th), so Huskies should pass more, improve H, switch from defense to offense, and thus improve attempt_shot, increasing the number of field goals without changing the goal rate.

7 Passing Accuracy

After analyzing the shooting accuracy, we began to analyze the passing accuracy. We chose to study the effect of passing accuracy on teamwork. The higher the accuracy of the pass, the higher the probability that a pass will be successfully received between players and the lower the probability that the opponent will seize the pass.[2]

Define passing accuracy：

$$\tau_i = \frac{p_i}{P_i} \tag{11}$$

τ_i passing accuracy of match i, p_i success passes of match i, P_i total attempts of pass of match i.

Based on Huskies' 38 games, we obtained the scatter chart of Huskies' shooting accuracy per game and the scatter chart of opponents' shooting accuracy per game by analyzing the data.

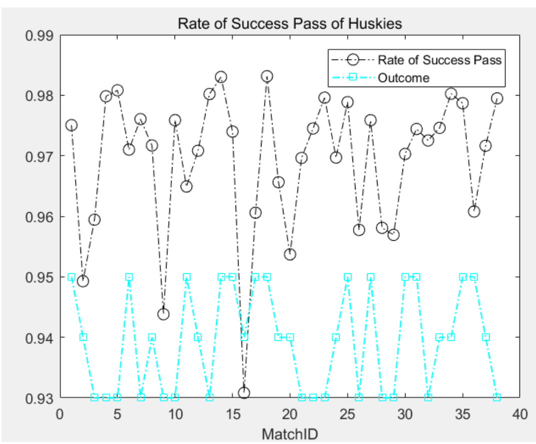

Figure 8. Rate of Success Pass of Huskies

Figure 9. Rate of Success Pass of Other Teams

We can see that the passing accuracy of each team on goal is basically stable between [0.93,0.99], and more concentrated in [0.96,0.99]. In order to clearly and intuitively observe the relationship between shooting accuracy and match results, we use the value 0.95 for Win,0.94 for Tie and 0.93 for Loss, and draw the graph together. Similarly, we need to pay attention here: Huskies outcome is opposite to outcome of opponent.

Through observation, we find that the variation trend of passing accuracy is basically consistent with that of winning situation. When the passing accuracy is high, the probability of winning the game is high; when the passing accuracy is low, the probability of winning the game is small. So it can be judged that passing accuracy has a great impact on the outcome of the game.

Here because passing accuracy and the quality of the players themselves have a certain relationship, so here passing accuracy for individual factors also have a certain significance.

8 Other Factors that Affect Victory

By analyzing Huskies' home and away games, we found that home and away also had an impact on Huskies' winning percentage. The Huskies are less likely to lose at home than away.

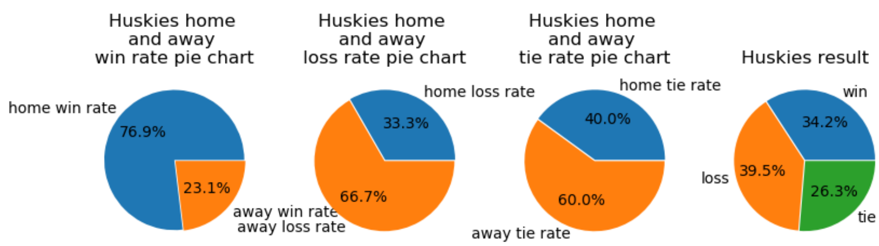

Figure 10. Pie chart of Huskies match results analysis

Second, we calculate the Huskies' H value at home and away. The horizontal axis represents the team Numbers (Huskies and 19 opponents) and the vertical axis represents the H value. The red line represents the Huskies' H value for all games, the blue line represents the Huskies' H value for away games, and the black line represents the Huskies' H value for home games.

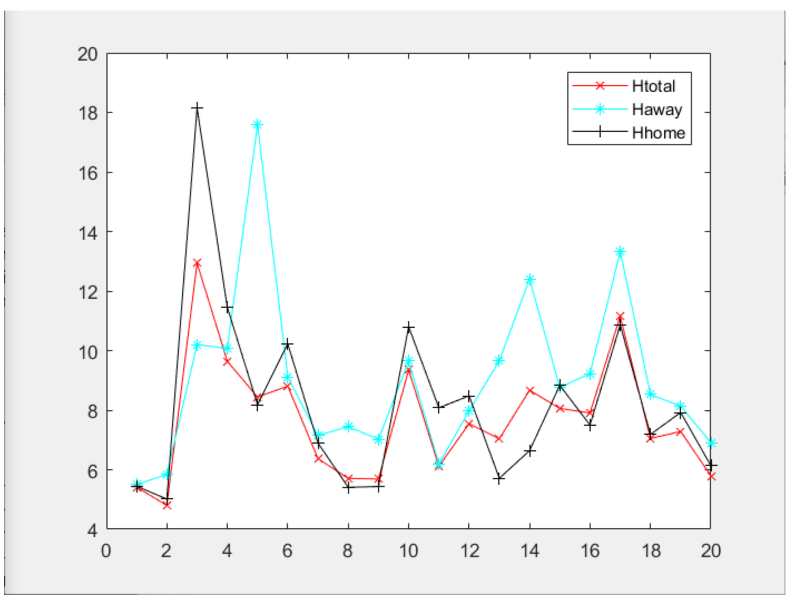

Figure 11. Huskies H -value at home and away

The Huskies' overall H -value is higher at home than away. Huskies is home away from Opponents in the away situation. According to the figure, it can be seen that when each team is at home, the H value is usually higher than that at the away. It can be seen from the graph that the H value of each team is usually higher when they are at home than when they are away.

Combining the two graphs, we can see that each team has a higher winning percentage at home than away, and each team has a higher winning percentage at home than away. It is inferred that home and away affect winning percentage by influencing H . But because the team will face home and away games, this is an unchangeable fact, so it is not for home and away quantitative analysis.

9 Comprehensive Analysis and Judgement

For the above four factors we use AHP to term weight of every indicators and the factors. We create comparison matrixes of every factors and indicators and we then check their consistency to judge whether they are consistent enough to be used. And finally we can calculate every final factor’s weight to make decision.

9.1 Stratification

We have analyzed four factors separately before:

(1) The value of H is mainly related to μ_z and δ_z which depends on the quantity of passes and the distribution of players.

(2) For the value of PezzliScore we mainly consider the significance for offensive and defensive efficiency. It’s related to both individuals and team chemistry.

(3) Shooting Accuracy is the mean of every match which is mainly about individuals.

(4) Passing Accuracy is the mean of every match which is mainly about both individuals and team chemistry.

We will base on the Huskies situation in detail to weigh the proportion of each factor for Huskies and further determine the direction of the improvements of Huskies.

9.2 Comparison Matrixes

To determine the impact of each layer on the upper layer and calculate the weight, we compare them one by one by permutation and combination, and we take the scale from 1 to 9.

Table 4. Scale and Meaning

Scale	Meaning
1	Indicates that the two factors are of equal importance
3	The former is slightly more important than the latter
5	The former is obviously more important than the latter
7	The former is more important than the latter
9	The former is extremely more important than the latter
2，4，6，8	Represents the intermediate value of the above adjacent judgments
reciprocal	If the ratio of the importance of factor i to factor j is a_{ij}， then the ratio of the importance of factor j to factor i is $a_{ji} = 1/a_{ij}$

We use a_{ij} to represent the importance of i to j, then we have $a_{ij} = \frac{1}{a_{ji}}$.

We can build comparison matrix

$$A = (a_{ij})_{n\times n} = \begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{pmatrix} \tag{12}$$

According to the degree of importance of four indicators analyzed above and the situation of Huskies, we build comparison matrix of each factors and indicators.

For example, We consider that it's slightly more important to A1 than A3 so the value of a_{13} is 3. We get table as follows:

Z	A1	A2	A3	A4
A1	1	4	3	7
A2	1/5	1	1	5
A3	1/3	1	1	5
A4	1/7	1/5	1/5	1

A1	B1	B2	B3
B1	1	2	1/8
B2	1/2	1	1/9
B3	8	9	1

A2	B1	B2	B3
B1	1	1/3	1/5
B2	3	1	1/2
B3	5	2	1

A3	B1	B2	B3
B1	1	3	5
B2	1/3	1	2
B3	1/5	1/2	1

A4	B1	B2	B3
B1	1	1/2	7
B2	2	7	9
B3	1/7	1/9	1

And we get the matrixes:

$$Z = \begin{pmatrix} 1 & 4 & 3 & 7 \\ 1/5 & 1 & 1 & 5 \\ 1/3 & 1 & 1 & 5 \\ 1/7 & 1/5 & 1/5 & 1 \end{pmatrix} \tag{13}$$

$$A_1 = \begin{pmatrix} 1 & 2 & 1/8 \\ 1/2 & 1 & 1/9 \\ 8 & 9 & 1 \end{pmatrix} \tag{14}$$

$$A_2 = \begin{pmatrix} 1 & 1/3 & 1/5 \\ 3 & 1 & 1/2 \\ 5 & 2 & 1 \end{pmatrix} \tag{15}$$

$$A_3 = \begin{pmatrix} 1 & 3 & 5 \\ 1/3 & 1 & 2 \\ 1/5 & 1/2 & 1 \end{pmatrix} \tag{16}$$

$$A_4 = \begin{pmatrix} 1 & 1/2 & 7 \\ 2 & 1 & 9 \\ 1/7 & 1/9 & 1 \end{pmatrix} \tag{17}$$

9.3 Check for Consistency

We can’t use the matrixes above directly which is because the matrix may not consistent enough to be used so we check for their consistency as follows.

We define an index of consistency as

$$CI_i = \frac{\lambda_i - n_i}{n_i - 1} \tag{18}$$

λ_i is the maximum eigenvalue of matrix i (i=1 for Z, i=2 for A1, …), n_i is the dimension of matrix i, we can also get the normalized eigenvector ω_i of matrix i.

We define random consistency index RI_{n_i} and we get RI_{n_i} as follows:

Order	1	2	3	4	5	6	7	8
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41

Order	9	10	11	12	13	14	15	
RI	1.46	0.49	0.52	1.54	1.56	1.58	1.59	

Ordinarily, when the consistency

$$CR_i = \frac{CI_i}{RI_{n_i}} < 0.1, \tag{19}$$

We consider the inconsistency degree of the matrix to be within the allowable range. Through matlab program, we check the inconsistency degree of each matrix and calculate the weight vector of each matrix.

We first get $\begin{cases} CI_1 = 0.0254 \\ CI_2 = 0.0184 \\ CI_3 = 0.0018 \\ CI_4 = 0.0018 \\ CI_5 = 0.0109 \end{cases}$ while $RI_{n=3} = 0.52$ and $RI_{n=4} = 0.89$

so we can get $\begin{cases} CR_1 = 0.0285 \\ CR_2 = 0.0355 \\ CR_3 = 0.0036 \\ CR_4 = 0.0036 \\ CR_5 = 0.0209 \end{cases}$, we find that $CR_i \ll 0.1$, so they all pass the test.

At the same time, we get each normalized eigenvectors of each λ_i:

$\omega_1 = \{0.5519, 0.1877, 0.2076, 0.0529\}$, $\omega_2 = \{0.124, 0.0753, 0.8004\}$,

$\omega_3 = \{0.1096, 0.3092, 0.5813\}$, $\omega_3 = \{0.1096, 0.3092, 0.5813\}$,

$\omega_5 = \{0.3468, 0.5955, 0.0577\}$;

We finally get the weight of each factors in layer B: $\{0.3849, 0.1940, 0.3919\}$;

Let the total order of m factors $A_1, A_2, \cdots, A_m$ in layer A to target Z be $a_1, a_2, \cdots a_m$, we make the test of consistency of overall ranking levels, define CR as

$$CR = \frac{a_1 CI_1 + a_2 CI_2 + \cdots + a_m CI_m}{a_1 RI_1 + a_2 RI_2 + \cdots + a_m RI_m}, \tag{20}$$

and we get $CR = 0.0202 \ll 1$, pass, the decision can be used.

9.4 Analysis of Final Weight

Through the calculations above, we get the weight of Individual(B1) is 0.3849 while the TeamChemistry(B2) is 0.1940 and the DistributionOfPlayer(B3) is 0.3919.

We can see the importance of three factors above to Huskies is respectively 0.3849, 0.1940 and 0.3919 which means DistributionOfPlayer(B3) is the most important for Huskies while DistributionOfPlayer (B1) is slightly less important and TeamChemistry (B2) is the last one.

10 Conclusion

We analyzed Huskies' performance in 38 matches against 19 other teams and the performance of 20 teams including Huskies. It is divided into the following points:

- H value analysis of the whole team: 5 parameters are w, μ_p, σ_p, μ_z, σ_z.

Among them, the decisive factors for the value of H are the values of μ_z and σ_z; the value of μ_z depends on the number of passes of the team, which is mainly used to describe the parameters of individual ability and team cooperation; and σ_z depends on the distribution and position of players.

- *PezzliScore*

A high *PezzliScore* (team) means the team has an efficient attack and defense, meaning it only needs a few attempts to score, while the opponent needs many attempts to score. And we found by calculation that Huskies have a higher *PezzliScore* but a lower Rank, so *PezzliScore* is less important to Huskies.

We compare the number of points scored in each game to the number of shots scored in each game. Based on the comparative analysis of the changes, we can observe the relationship between them and the trend of victory.

- Passing accuracy

We compare the number of successful passes per game to the total number of passes per game, and from a comparative analysis of the variation we can observe the relationship between it and the winning trend.

- Other factor

In addition to the above points, we have also observed the influence of home and away on the change of H value. However, as the team will face the situation of home and away, this is an unchangeable fact, so we do not conduct quantitative analysis for home and away.

11 Advantages and Disadvantages

11.1 Advantages

Our model analyzes Huskies' specific situation, and through quantitative and observational analysis combined with Huskies' and other teams' data of 38 matches, it can determine the influence correlation of each factor on Huskies, and finally calculate the importance weight of each overall factor to Huskies.

11.2 Disadvantages

We did not have a good quantitative analysis, but through a part of the observation means to obtain the overall trend, there is a certain error.

12 Suggestions for Huskies

First, Huskiness has a low H value, a low scoring per game ranking, and a shooting accuracy greater than the average of 19 teams. Huskies should adjust their tactics and adopt a more aggressive approach, increasing the number of attempts and thus the number of successful shots, while keeping the accuracy of their shots constant.

On the other hand, based on the final weighting analysis, we suggest that Huskies should focus on improving the layout of their players and the distribution of their formations during the match, and adopt a more concentrated stance. Secondly, it is necessary to improve the individual quality of the players and improve the passing accuracy and shooting accuracy of each player. Try to score as many goals as possible with a limited number of shots. Finally, it is to improve the cooperation between each team member, improve the success rate of passing.

13 Reference

[1] Cintia, P., Giannotti, F., Pappalardo, L., Pedreschi, D., & Malvaldi, M. (2015). The harsh rule of the goals: Data-driven performance indicators for football teams. 2015 IEEE International Conference on Data Science and Advanced Analytics (DSAA), 1-10, 7344823.

[2] Duch J., Waitzman J.S., Amaral L.A.N. (2010). Quantifying the performance of individual players in a team activity. PLoS ONE, 5: e10937.

[3] McCaffrey, James (June 2005). "Test Run: The Analytic Hierarchy Process". MSDN Magazine. Retrieved 2007-08-21.

[4] Saaty, Thomas L. Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process (1994). Pittsburgh: RWS. ISBN 0-9620317-6-3. "A thorough exposition of the theoretical aspects of AHP."

[5]https://en.wikipedia.org/wiki/Analytic_hierarchy_process

[6]https://wiki.mbalib.com/wiki/%E5%B1%82%E6%AC%A1%E5%88%86%E6%9E%90%E6%B3%95

[7]Eric Matthes 2015.Python Crash Course A Hands-On, Project-Based Introduction to Programming. The USA:No Starch Press.560

[8] T. Taki, J.I. Hasegawa, "Visualization of dominant region in team games and its application to teamwork analysis", Computer Graphics International 2000. Proceedings. IEEE, pp. 227-235, 2000.

[9] J. Gudmundsson, T. Wolle, "Towards automated football analysis: Algorithms and data structures", Proc. 10th Australasian Conf on Mathematics and Computers in Sport, 2010.