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2016
Mathematical Contest in Modeling (MCM/ICM) Summary Sheet

Cream of The Crop—Looking for The Best All Time College Coach

Summary

After mathematically analyzing the question of selecting the "best all time college coach", our modeling group would like to present our conclusions, strategies, and recommendations.

In the model of subjective judgement, we use the grey relational analysis model based on entropy weight method. We have defined correlation degree and determined the weights of their significance. By searching and selecting needed data, we obtained the final amount of evaluation of each coach in a certain sport. Finally, we compared the evaluation amounts and listed top five coaches, which is accordant with widely accepted result. Further work of the first model, we ought to gather more data and set more evaluation factors. Only in this way, can we rank coaches in a more fairly way.

In the model of objective judgement, we adopt the analytic hierarchy process to calculate the evaluation indexes. The algorithm offers us a convenient way to evaluate the excellence of certain coach, without any need for detailed information. After constructing the hierarchy and pairwise comparing the criteria with respect to the goal, we can obtain an rough ranking list, which need a mass of adjustment later. Through adjustment of proportion coefficient, we finally gain satisfactory results. This method can be applied to any time period and any ranking field, because of its good applicability.

Taking the subjectivity of ranking of the coaches into account, we will combine the results of the two models above in a certain proportion. The final results have quantities of bias because of the evaluation of individual things shall be avoided to the extent feasible. After testing a variety of real data, we believe that the model is reliable. Furthermore, by slightly adjusting the coefficients, we can apply this model into various ranking field of sports.

Keywords: AHP; GRAP; Dual Model Fusion; Perfect Time-applicability;

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November 27, 2016

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1 Introduction

In sports, a coach is a person involved in the direction, instruction and training of the operations of a sports team or of individual sportspeople. In college,a coach may also be a teacher.For most athletes involved, their coach is an influential element of the competitive experience. The Sport in America survey found that coaches are a leading positive^[1] influence on today's youth. Respondents were asked to rate the overall influence of a variety of groups on young people. Across all major demographic groups, coaches rank as the number one positive influence on youth today.

At their best, coaches can help their players improve their skills, perform to their best ability, develop strong character, and gain confidence. That is, they can maximize the positive value of sport, and they can enhance the intrinsic motivation to play sport. The intrinsic values of sport and the experience of mastery are more likely to generate fair play and good sportsmanship.

Therefore, it is necessary to build a model to evaluate the performance and achievement of coaches,In particular, the college coaches. Thus, it would be much easier for us to honor the best all time college coach . Moreover,coaches listed would be the good role models to emulate for the other coaches.

2 Problem Restatement and Analysis

On the one hand,according to the given question,we are required to build a comprehensive,hierarchical,have wide range of application and well time-applicability model to look for the "best all time college coach" male or female for the previous century.

On the other hand,we need to write an article using plain language for readers of this Sports Illustrated magazine,which should explain our selection criteria and the aspects of judgement.

Having considered about all the requirements above, our goal is to construct a comprehensive evaluation model to select the best college coach statistically ,meanwhile, gain further analysis and answers for the problem.

3 Basic Assumptions

- Evaluation of the coach's coaching level, we take the coach's official games as the main part of the standard (taking MCAA data as the standard).A variety of friendly, warm-up match will not be considered.
- Evaluation of the popularity of the coach, only consider Google search volume, the proportion of negative search volume will be included in consideration.Assuming Google clicks can reflect the prestige of coaches.
- It is assumed that the rules of sports competitions do not change with time, and the intensity of competition does not change with time too.
- Only using the data of Division one.

- Assuming that the data we have chosen is true and reliable.
- Assuming that coaches do not interact with each other.
- Assuming the existing six evaluation indicators have been able to assess the level of the coach.

Under the basic assumptions, the analytic hierarchy process method and the multiplex model can be designed later.

4 Symbol Description

In the section, we define some symbols when constructing the model as follows.

Table 1: Symbols Definition

Symbols	Definition
$X =$	Objective judgement matrix
n, m	The number of coaches and judgement elements
E_1, E_2, \dots, E_k	The information entropy of each index
W_j	The weight of each index
X_0	Reference data column
$\Delta_i(j)$	The absolute difference
a, b	The intermediate variables
y_i	Correlation coefficient
r_i	Correlation degree
CI	Coincidence indicator
C	Coincidence ratio
W	Corresponding feature vector
A	Subjective judgement matrix
λ_{max}	maximum eigenvalue of A
S	The final score
P_t	The strength of competition
α	Subjective coefficient
β	Objective coefficient

5 Model Preparation

Taking the evaluation of a coach into account , we need to analyze this problem from the objective aspect and subjective aspect. However, there is no suitable single model to analyze these two aspects at the same time, so we need to establish an evaluation model combined with subjective and objective. After consulting the relevant information and choosing , we use the Analytic Hierarchy Process (AHP) model to evaluate the

coaches from the subjective aspect, and the grey relational analysis model based on entropy weight method is used to evaluate the coaches objectively. Finally, we integrate the results of the two models to obtain the final results.

5.1 The Analytic Hierarchy Process

The Analytic Hierarchy Process has unique advantages when important elements of the decision are difficult to quantify or compare.

Decision situations to which the AHP can be applied include:

- Choice—The selection of one alternative from a given set of alternatives, usually where there are multiple decision criteria involved.
- Ranking—Putting a set of alternatives in order from most to least desirable.
- Prioritization—Determining the relative merit of members of a set of alternatives, as opposed to selecting a single one or merely ranking them.
- Resource allocation—Apportioning resources among a set of alternatives.
- Quality management—Dealing with the multidimensional aspects of quality and quality improvement.

In this problem, we use AHP to rank college coaches subjectively. Procedure for using the AHP can be summarized as:

- Model the problem as a hierarchy containing the decision goal, the alternatives for reaching it, and the criteria for evaluating the alternatives.
- Establish priorities among the elements of the hierarchy by making a series of judgments based on pairwise comparisons of the elements.
- Synthesize these judgments to yield a set of overall priorities for the hierarchy.
- Check the consistency of the judgments.
- Come to a final decision based on the results of this process.

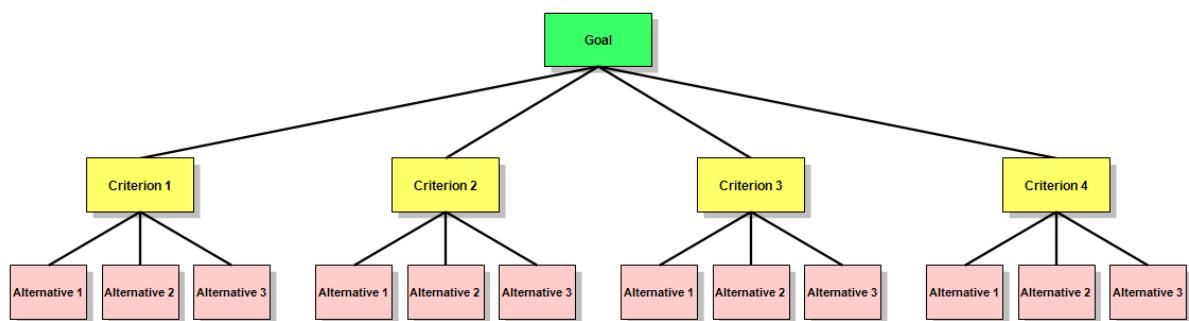


Figure 1: A simple AHP hierarchy

5.2 Grey relational analysis model based on weighted entropy

Grey relational analysis uses a specific concept of information. It defines situations with no information as black, and those with perfect information as white. However, neither of these idealized situations ever occurs in real world problems. In fact, situations between these extremes are described as being grey, hazy or fuzzy. Therefore, a grey system means that a system in which part of information is known and part of information is unknown. With this definition, information quantity and quality form a continuum from a total lack of information to complete information ? from black through grey to white. Since uncertainty always exists, one is always somewhere in the middle, somewhere between the extremes, somewhere in the grey area.

Grey analysis then comes to a clear set of statements about system solutions. At one extreme, no solution can be defined for a system with no information. At the other extreme, a system with perfect information has a unique solution. In the middle, grey systems will give a variety of available solutions. Grey analysis does not attempt to find the best solution, but does provide techniques for determining a good solution, an appropriate solution for real world problems.

In order to improve the low evaluation precision that the grey relational analysis method has been, the entropy theory was integrated to establish a new model. We use grey relational analysis model based on weighted entropy to judge the coaches' objective aspect.

6 Model Establishment

6.1 Objective Judgment Model—Using GRAP

Because the analytic hierarchy process is influenced by the subjective factors, we use the grey relational model based on the entropy weight method to judge at the same time, and the results obtained by the two models are aggregated according to a certain weight.

We assume there have n coaches and m aspects of judgement, which formed the evaluation matrix. According to the assumptions, we have

$$X = (x_{ij})_{n \times m} \quad (1)$$

where the matrix X has been carried out after the standardized data.

In order to using the matrix above to solve, we have to figure out the information entropy of each index:

$$E_j = -\ln n^{-1} \sum_{i=1}^n p_{ij} \ln p_{ij} \quad (2)$$

Where

$$p_{ij} = x_{ij} / \sum_{i=1}^n x_{ij} \quad (3)$$

if $p_{ij} = 0$, then define

$$\lim_{p_{ij} \rightarrow 0} p_{ij} \ln p_{ij} = 0 \quad (4)$$

Whose solutions are E_1, E_2, \dots, E_k . The weight of each index is calculated by the information entropy:

$$W_j = \frac{1 - E_i}{k - \sum E_i} \quad (i = 1, 2, \dots, k) \quad (5)$$

Considering the limitations of the grey relational model, we combine the grey relational model with the information entropy to construct the grey relational model based on entropy weight method. In this model, we constitute a reference data column with the optimal value of each column:

$$X_0 = (X_0(1), X_0(2), \dots, X_0(n)) \quad (6)$$

Calculate the absolute difference between the target sequence and the reference sequence corresponding element of each evaluated object, which is

$$\Delta_i(j) = |X_i(j) - X_0(j)| \quad j = 1, 2, \dots, n \quad (7)$$

Where $X_0(j)$ represents the reference data of j^{th} measurement criterion.

Using the data of Division one, we find the intermediate variables:

$$a = \min_{1 \leq i \leq n} \min_{1 \leq j \leq n} \{\Delta_i(j)\} \quad (8)$$

$$b = \max_{1 \leq i \leq n} \max_{1 \leq j \leq n} \{\Delta_i(j)\} \quad (9)$$

Calculated correlation coefficient:

$$y_i = \frac{a + b\rho}{\Delta_i(j) + b\rho} \quad (10)$$

So that we can obtain the correlation degree:

$$r_i = \sum_{j=1}^m W_j y_i(j) \quad (i = 1, 2, \dots, n) \quad (11)$$

According to the correlation degree, we can calculate the final score and evaluate the coach. The results are followed:

6.2 Subjective Judgment Model—Using AHP

In an AHP hierarchy for college coach evolution, the goal might be to choose the best college coach or coaches (past or present) from among either male or female coaches in football, baseball and basketball. The selection criteria might be decided by considering prestige, individual accolades, winning rate, times of competition, times of winning champions and coaching time. Take those elements as six criterions. For this question, the alternatives might be those coaches.

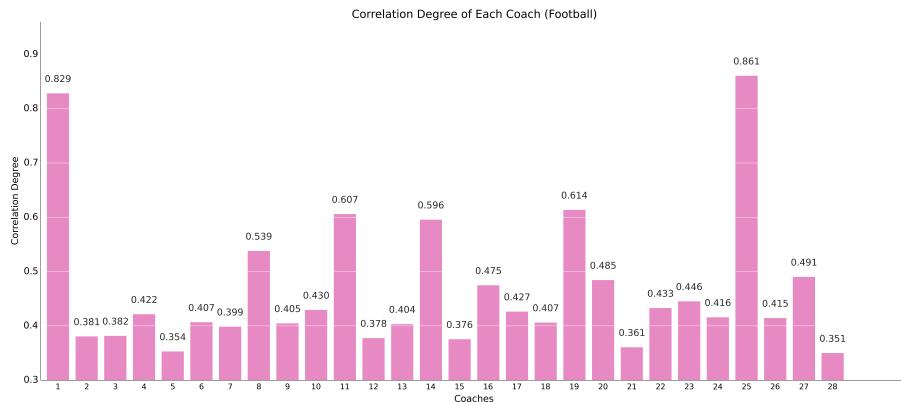


Figure 2: Correlation Degree of Each Coach(Football)

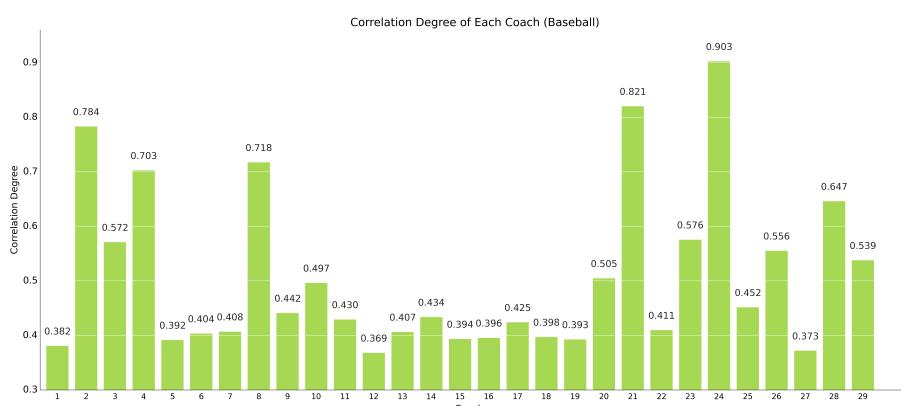


Figure 3: Correlation Degree of Each Coach(Baseball)

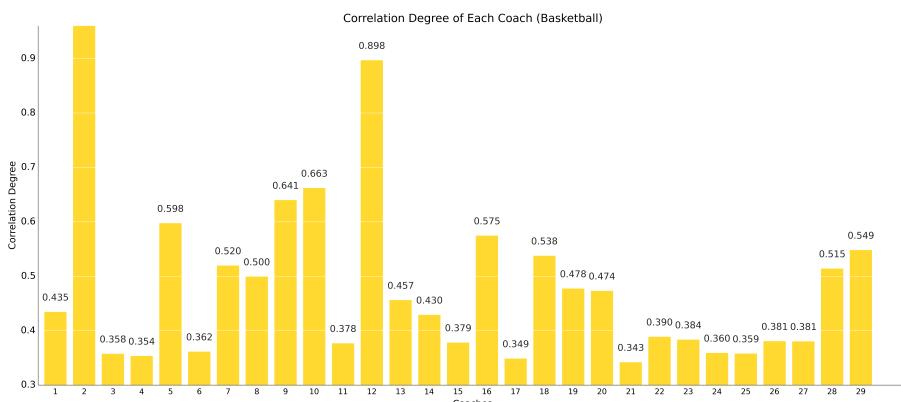


Figure 4: Correlation Degree of Each Coach(Basketball)

6.2.1 Constructing the Hierarchy

As we build our judging hierarchy, the next step, we should investigate the values or measurements of the different elements that make it up.

For the winning rate, times of competition, times of winning champions and coaching time, we can measure their importance through finding specific data. Because teams'

participation in various sports leagues can best represent the level of coaching a team, we surf the MCAA's official website to gain the data as a standard to evaluate the elements. As for personal honor and prestige, we can't find the right data to measure. There are a thousand Hamlets in a thousand people's eyes, fans? evaluation of the coach will be interfered by the idea of the general public and some misleading informations..At this time, we can not take a quantitative way to measure him. Taking this factor into account, we use the number of Google searches to roughly measure the popularity of the coach. And the appropriate ratio is selected to be included in the analysis model of the whole hierarchy.

6.2.2 Pairwise comparing the criteria with respect to the goal

To incorporate their judgments about the various elements in the hierarchy, decision makers compare the elements two by two. Right now, let's see which items are compared. Our example will begin with the six criteria in the second row of the hierarchy, though we could begin elsewhere if we wanted to. The criteria will be compared as to how important they are to the decision makers, with respect to the goal. Each pair of items in this row will be compared; there are a total of fifteen pairs . You can use the diagram below to see these pairs clearly.

Things change a bit when we get to the alternatives row. Here, the candidates in each group of alternatives are compared pair-by-pair with respect to the covering criterion of the group, which is the node directly above them in the hierarchy. What we are doing here is evaluating the models under consideration with respect to winning rate, then with respect to times of competition, then times of winning champions, coaching time, prestige, and individual accolades. Because there are n coaches in the group of alternatives, there will be $\binom{n}{2}$ comparisons for each of the eight covering criteria.

6.2.3 Making the decision

On the basis of the last chapter, we construct the judgment matrix. Assuming a certain layer has n factors,

$$X = x_1, x_2, \dots, x_n \quad (12)$$

To compare the upper layer of a certain criterion, we have to determine the proportion relative to a certain criterion. we define a_{ij} to measure the comparison results of the i^{th} factor relative to the j^{th} factor, and we have:

$$a_{ij} = \frac{1}{a_{ji}} \quad (13)$$

$$A = (a_{ij})_{n \times m} = \begin{vmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{vmatrix} \quad (14)$$

Where $n = 6$. Meanwhile, the judgment matrix is obtained with the scale of 1 – 9 as fol-

lows:

$$\begin{vmatrix} 1 & 3 & 5 & 5 & 7 & 9 \\ \frac{1}{3} & 1 & 3 & 3 & 5 & 7 \\ \frac{1}{5} & \frac{1}{3} & 1 & 3 & 3 & 5 \\ \frac{1}{5} & \frac{1}{5} & \frac{1}{3} & 1 & 3 & 5 \\ \frac{1}{7} & \frac{1}{5} & \frac{1}{5} & \frac{1}{3} & 1 & 3 \\ \frac{1}{9} & \frac{1}{7} & \frac{1}{5} & \frac{1}{5} & \frac{1}{3} & 1 \end{vmatrix} \quad (15)$$

We define maximum eigenvalue of A is λ_{max} , the corresponding feature vector is W_0 . We can obtain W after inputting normalized feature vector, which is the weight vector.

$$W = \frac{\lambda_{max} - n}{n - 1} \quad (16)$$

Calculating the coincidence indicator:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (17)$$

Calculating the coincidence ratio:

$$CR = \frac{CI}{RI} \quad (18)$$

When $n = 6$, the result of RI is 1.24. After bringing data into model, we obtain $CR = 0.050262$. The result of CR is smaller than 0.1, therefore, the consistency of judgment matrix is acceptable.

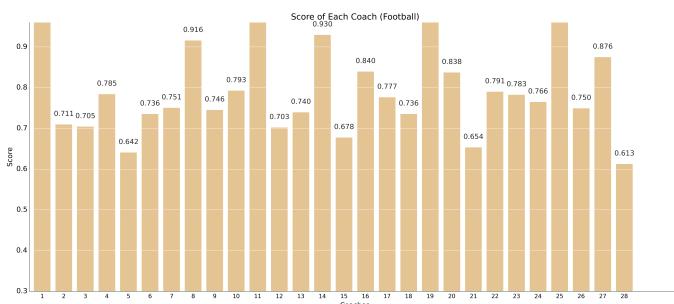


Figure 5: Evaluation Value of Each Coach(Football)

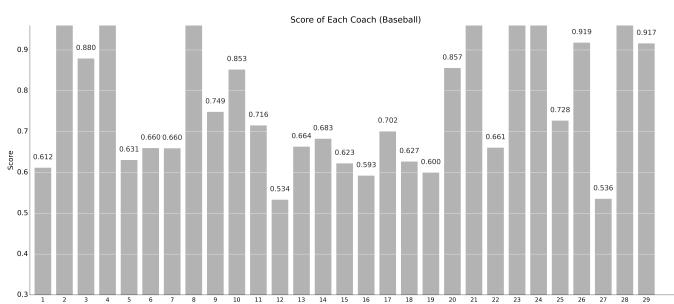


Figure 6: Evaluation Value of Each Coach(Baseball)

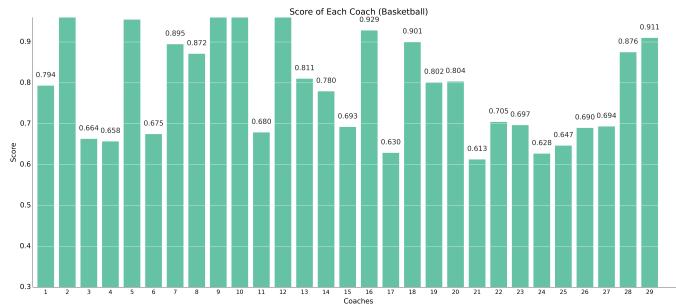


Figure 7: Evaluation Value of Each Coach(Basketball)

6.3 The Influence of other Factors

6.3.1 Time Influence

Any kind of sport is constantly developing. The number of participants should increase at first and then tends to be stable, it can be considered that the trend follows the logistic growth curve, the strength of the competition can also be reflected by the curve.

We define P_t as the strength of competition, P_t has to take mean value standardization. S is the Integrated score of coaches. S' is the final score of coaches.

$$S' = P_t S \quad (19)$$

Time factor is too complex, in order to simplify the model, we have not taken it into account.

6.3.2 Sex Influence

Considering the gender-specific sports have different ways of competitive, we find that the influence of sex is very small. So in this question, we would ignore it.

7 Solving the Model

Because the analytic hierarchy process is influenced by the subjective factors, we use the grey relational model based on the entropy weight method to judge at the same time, and the results obtained by the two models are aggregated according to a certain weight.

We define the final score is S , and the scale coefficients are α (subjective coefficient) and β (objective coefficient). According to the models we have already built, we can obtain that:

$$S = \alpha r + \beta W \quad (20)$$

Where α is taking 0.4 and β is taking 0.6.

After taking the data we solve above into calculating, we can gain the final result as follows:

Table 2: Top 5 Coaches of Football

No.1	No.2	No.3	No.4	No.5
Ron Schipper Hope	Larry Kehres Mount Union	Mike Kelly Manchester	Tom Osborne Hastings	Fielding Yost West Virginia

Table 3: Top 5 Coaches of Baseball

No.1	No.2	No.3	No.4	No.5
Gene Stephenson Wichita St.	Mike Martin Florida St.	Don Schaly Marietta	Cliff Gustafson Texas	Frank Vieira New Haven

Table 4: Top 5 Coaches of Basketball

No.1	No.2	No.3	No.4	No.5
Adolph Rupp Kentucky	Dean Smith North Carolina	Jerry Tarkanian Fresno St.	Dave Robbins Virginia Union	John Wooden UCLA

This result is in good agreement with the objective evaluation model, which is compared with the model we have constructed. So the choice of ratio coefficient is very scientific.

8 Strengths and Weaknesses

8.1 Strengths

Our model effectively achieves all of the goals we set initially. It is fast and can handle large quantities data of coaches performance, but also have the flexibility we desired. Though we did not test all kinds of ball games and all the college coaches, we showed that our model optimizes state districts for any of a number of variables. Our model can rank the coaches from past to current, it has wide range of application and good time applicability. As well, our method is robust.

8.2 Weaknesses

Weakness of the model included assumptions made for simplicity that likely do not hold. And some special data can't be found, and it makes that we have to do some proper assumption before the solution of our models. For instance, we can't find the data of the coaches' popularity, so we take Google search volume as an alternative. A more abundant data resource can guarantee a better result in our models.

9 the Article for Sports Illustrated

Cream of The Crop—Looking for The Best All Time College Coach

Measurement implies difference. When you measure, you take the difference between the starting point and the finishing point. Then you can see the difference change . Difference is not necessarily of value. It has to be put into context to see what it means. It needs to be measured against some other coaches to provide the context, and then it can be evaluated.Evaluation adds meaning to measurement.

Different people have different measurement standards. People born to be biased to their own preference. People may prefer those teams, which are related to him. If I live in New York City, the New York Yankees might be my favorite team. However, ranking isn't always follow our own hearts. After reference to various data about college coaches from MACC, we can put forward an undisputed ranking. Here are the top 5 greatest college coaches over the course of sports history in football, baseball and basketball as follows:

Table 5: Top 5 Coaches

No.1	No.2	No.3	No.4	No.5
Football				
Ron Schipper Hope	Larry Kehres Mount Union	Mike Kelly Manchester	Tom Osborne Hastings	Fielding Yost West Virginia
Baseball				
Gene Stephenson Wichita St.	Mike Martin Florida St.	Don Schaly Marietta	Cliff Gustafson Texas	Frank Vieira New Haven
Basketball				
Adolph Rupp Kentucky	Dean Smith North Carolina	Jerry Tarkanian Fresno St.	Dave Robbins Virginia Union	John Wooden UCLA

Ron Schipper , the highest ranking coach.who had 36 years coaching experience. During his coaching life,he won 3 national championships.The win-loss record is 287-67 and winning-percentage is 0.808,the highest in NCAA.Take various factors into consideration ,there is no doubt that Ron was the greatest college football coach.We appreciate this honorable coach,he not only help his own team became the most shining team in NCAA,but also promote the development of Football.

College sports are various,the number of coaches is enormous.The method we took is balance the factors of subjectivity and objectivity.If you have interest in our way to evaluate your own favorite coach ,please contact us.Whether you have enough data or not ,our model would always get the your own answer.

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Appendices

Appendix A The Data of Objective Judgement Model

Here are the final score of coaches we calculated in our model as follow.

Table A1:The Result of Football Coach Ranking

Final Rank	Coach Name	Score
1	25. Ron Schipper (Hope 1952	0.861323
2	1. Larry Kehres (Mount Union 1971	0.828949
3	19. Mike Kelly (Manchester 1970	0.61444
4	11. Tom Osborne (Hastings 1959	0.606615
5	14. Fielding Yost (West Virginia 1895	0.596344
6	8. Jake Gaither (Knoxville 1927	0.538745
7	27. Chuck Broyles (Pittsburg St. 1970	0.490908
8	20. Henry A. Kean (Fisk 1920	0.485191
9	16. Bob Neyland (Army 1916	0.47542
10	23. Jock Sutherland (Pittsburgh 1918	0.44586
11	22. *Joe Fincham (Ohio 1988	0.433482
12	10. Barry Switzer (Arkansas 1960	0.430033
13	17. Bud Wilkinson (Minnesota 1937	0.427063
14	4. Bob Reade (Cornell College 1954	0.422136
15	24. *Pete Fredenburg (Texas St. 1970	0.416481
16	26. Bob Devaney (Alma 1939	0.415111
17	6. Dick Farley (Boston U. 1968	0.407455
18	18. Chuck Klausing (Slippery Rock 1948	0.406921
19	9. Dave Maurer (Denison 1954	0.405277
20	13. Don Coryell (Washington 1950	0.403988
21	7. George Woodruff (Yale 1889	0.399163
22	3. Frank Leahy (Notre Dame 1931	0.382276
23	2. Knute Rockne (Notre Dame 1914	0.381243

Table A1:The Result of Football Coach Ranking

Final Rank	Coach Name	Score
24	12. *Urban Meyer (Cincinnati 1986	0.378251
25	15 Percy Haughton (Harvard 1899	0.376209
26	21. *Mike Sirianni (Mount Union 1994	0.361356
27	29. Sid Gillman (Ohio St. 1934	0.355325
28	5. Doyt Perry (Bowling Green 1932	0.353612
29	28. Biggie Munn (Minnesota 1932	0.350625

Table A2:The Result of Baseball Coach Ranking

Final Rank	Coach Name	Score
1	24. *Gene Stephenson (Wichita St. 1978-10	0.90323638
2	21. *Mike Martin (Florida St. 1980-10	0.821028243
3	2. Don Schaly (Marietta 1964-03	0.783913293
4	8. Frank Vieira (New Haven 1963-06	0.717971261
5	4. Cliff Gustafson (Texas 1968-96	0.703452693
6	28. Ron Fraser (Miami [FL] 1963-92	0.646819868
7	23. *Mike Fox (N.C. Wesleyan 1983-94, 96-98,	0.576177312
8	3. John Barry (Holy Cross 1921-60	0.571706219
9	26. *Bob Babb (Johns Hopkins 1980-10	0.555972193
10	29. G ary Ward (Oklahoma St. 1978-96,	0.538544621
11	20. Frank Sanctet (Arizona 1950-72	0.505388576
12	10. Chuck Anderson (Fla. Southern 1967,	0.4969309
13	30. W.J. Disch (Texas 1911-39	0.481050838
14	25. Bob Wren (Ohio 1949-72	0.452256656
15	9. *Mike Kinnison (Delta St. 1997-10	0.441752081
16	14. G eorge Huff (Illinois 1896-19	0.434465608
17	11. Dennis Denning (St. Thomas [MN] 1995-09	0.429926877
18	17. Bobby Winkles (Arizona St. 1959-71	0.424797585
19	22. Chase Riddle (Troy 1979-90	0.410533337
20	7. Russ Tiedmann (Wis.-Oshkosh 1975-88	0.407563437
21	13. *Joe Urso (Tampa 2001-10	0.407090652
22	6. *Joe Brown (SUNY Cortland 2000-10	0.404193028
23	18. *James Vilade (Dallas 1998-01,	0.397783307
24	16. H arry Carlson (Springfield 1924,	0.396234266
25	15. *Doug Fleetwood (Salisbury 2001-10	0.394269781
26	19. Carleton Wood (St. Bonaventure 1951,	0.39328301
27	5. Mark Walsh (Aurora 1993-02	0.392276822
28	1. Robert Henry Lee (Southern U. 1949-60	0.381618164
29	27. G eorge Jacobs (Villanova 1933-43	0.372694559
30	12. William Spaulding (Western Mich. 1911-21	0.368779134

Table A3:The Result of Basketball Coach Ranking

Final Rank	Coach Name	Score
1	2. Adolph Rupp Kentucky 1931-52, 54-72	0.995112
2	12. Dean Smith North Carolina 1962-97	0.897544
3	10. Jerry Tarkanian Long Beach St.1969-73, UNLV 74-92	0.662902
4	9. Dave Robbins Virginia Union 1979-2008	0.640727
5	5. John Wooden Indiana St. 1947-48,UCLA 49-75	0.598213
6	16. Steve Moore Muhlenberg 1982-87,Wooster 88-2010*	0.575382
7	29. Dean Nicholson Central Wash. 1965-90	0.548798
8	18. Bo Ryan Wis.-Platteville 1985-99,Wisconsin 02-10*	0.538454
9	7. Roy Williams Kansas 1989-2003,North Carolina 04-10*	0.52028
10	28. Ron Niekamp Findlay 1986-2010*	0.514847
11	8. John KresseCol. of Charleston 1980-2002	0.500042
12	19. Frank M. Keaney Rhode Island 1921-48	0.478122
13	20. George Keogan Allegheny 19, Notre Dame 24-43#	0.473997
14	13. Ed AdamsN.C. Central 1937,Texas Southern 50-58	0.457006
15	1. Clair Bee Rider 1929-31,Long Island 32-43, 46-51	0.435227
16	14. Bruce PearlSouthern Ind.1993-2001, Tennessee 06-10*	0.429834
17	30. Harry Sheehy (Williams 1975) Williams 1984-2000	0.392285
18	22. Mike Jones 1989-2002, 07-08	0.389534
19	23. Lucas Mitchell AlabamaNorfolk St. 79-81	0.384299
20	26. Jim Borcherding (Wartburg 1962)Augustana (IL) 1970-84	0.381434
21	27. Mike DunlapCal Lutheran 1990-94, Metro St. 98-2006	0.381194
22	15. Charles Christian Norfolk St. 1974-78, 82-90	0.378824
23	11. Francis Schmidt Tulsa 1916-17, 19-22,Arkansas 24-29,	0.377533
24	6. Mark Few (Oregon 1987) Gonzaga 2000-10*	0.362184
25	24. Harry Fisher Columbia07-16, Army 07, 22-23, 25	0.359765
26	25. Ed Green (Clarion 1964) Roanoke 1978-89	0.358666
27	3. Walter Bucky HarrisPhiladelphia U. 1954-65, 67	0.358211
28	4. Dolph Stanley (Beloit 1946-57	0.354311
29	17. Jack Ramsay (St. Joseph??s 1949) St. Joseph??s 1956-66	0.349427
30	21. Vic Bubas (North Carolina St. 1951) Duke 1960-69	0.342712

Appendix B The Data of Subjective Judgement Model

Table A4:The Result of Football Coach Ranking

Final Rank	Coach Name	Evaluation Value
1	1. Larry Kehres (Mount Union 1971	1.12755
2	25. Ron Schipper (Hope 1952	1.108272
3	11. Tom Osborne (Hastings 1959	0.997158
4	19. Mike Kelly (Manchester 1970	0.993665
5	14. Fielding Yost (West Virginia 1895	0.930321
6	8. Jake Gaither (Knoxville 1927	0.91647

Table A4:The Result of Football Coach Ranking

Final Rank	Coach Name	Evaluation Value
7	27. Chuck Broyles (Pittsburg St. 1970	0.875636
8	16. Bob Neyland (Army 1916	0.84018
9	20. Henry A. Kean (Fisk 1920	0.837924
10	10. Barry Switzer (Arkansas 1960	0.793259
11	22. *Joe Fincham (Ohio 1988	0.790624
12	4. Bob Reade (Cornell College 1954	0.784771
13	23. Jock Sutherland (Pittsburgh 1918	0.783374
14	17. Bud Wilkinson (Minnesota 1937	0.777045
15	24. *Pete Fredenburg (Texas St. 1970	0.765534
16	7. George Woodruff (Yale 1889	0.751132
17	26. Bob Devaney (Alma 1939	0.750005
18	9. Dave Maurer (Denison 1954	0.74595
19	13. Don Coryell (Washington 1950	0.740235
20	6. Dick Farley (Boston U. 1968	0.736036
21	18. Chuck Klausing (Slippery Rock 1948	0.736011
22	2. Knute Rockne (Notre Dame 1914	0.710502
23	3. Frank Leahy (Notre Dame 1931	0.705068
24	12. *Urban Meyer (Cincinnati 1986	0.702866
25	15 Percy Haughton (Harvard 1899	0.678282
26	21. *Mike Sirianni (Mount Union 1994	0.654123
27	5. Doyt Perry (Bowling Green 1932	0.641562
28	29. Sid Gillman (Ohio St. 1934	0.629187
29	28. Biggie Munn (Minnesota 1932	0.61327

Table A5:The Result of Baseball Coach Ranking

Final Rank	Coach Name	Evaluation Value
1	24. *Gene Stephenson (Wichita St. 1978-10	1.228556
2	21. *Mike Martin (Florida St. 1980-10	1.183313
3	2. Don Schaly (Marietta 1964-03	1.153538
4	4. Cliff Gustafson (Texas 1968-96	1.098829
5	8. Frank Vieira (New Haven 1963-06	1.065278
6	28. Ron Fraser (Miami [FL] 1963-92	1.047706
7	23. *Mike Fox (N.C. Wesleyan 1983-94, 96-98,	0.964883
8	26. *Bob Babb (Johns Hopkins 1980-10	0.918692
9	29. Gary Ward (Oklahoma St. 1978-96,	0.91678
10	3. John Barry (Holy Cross 1921-60	0.879881
11	20. Frank Sanctet (Arizona 1950-72	0.856509
12	10. Chuck Anderson (Fla. Southern 1967,	0.852685
13	30. W.J. Disch (Texas 1911-39	0.766118
14	9. *Mike Kinnison (Delta St. 1997-10	0.749163
15	25. Bob Wren (Ohio 1949-72	0.727642
16	11. Dennis Denning (St. Thomas [MN] 1995-09	0.715938

Table A5:The Result of Baseball Coach Ranking

Final Rank	Coach Name	Evaluation Value
17	17. Bobby Winkles (Arizona St. 1959-71	0.701791
18	14. George Huff (Illinois 1896-19	0.683349
19	13. *Joe Urso (Tampa 2001-10	0.663881
20	22. Chase Riddle (Troy 1979-90	0.661495
21	6. *Joe Brown (SUNY Cortland 2000-10	0.660434
22	7. Russ Tiedmann (Wis.-Oshkosh 1975-88	0.65988
23	5. Mark Walsh (Aurora 1993-02	0.631117
24	18. *James Vilade (Dallas 1998-01,	0.627339
25	15. *Doug Fleetwood (Salisbury 2001-10	0.622995
26	1. Robert Henry Lee (Southern U. 1949-60	0.612291
27	19. Carleton Wood (St. Bonaventure 1951,	0.600229
28	16. Harry Carlson (Springfield 1924,	0.592802
29	27. George Jacobs (Villanova 1933-43	0.536152
30	12. William Spaulding (Western Mich. 1911-21	0.533849

Table A6:The Result of Basketball Coach Ranking

Final Rank	Coach Name	Evaluation Value
1	2. Adolph Rupp (Kansas 1923) Kentucky 1931-52, 54-72	1.122933
2	12. Dean Smith (Kansas 1953) North Carolina 1962-97	1.100008
3	10. Jerry Tarkanian UNLV 74-92, Fresno St. 96-2002	0.996622
4	9. Dave Robbins Virginia Union 1979-2008	0.983505
5	5. John Wooden Indiana St. 1947-48, UCLA 49-75	0.955703
6	16. Steve Moore Muhlenberg 1982-87, Wooster 88-2010*	0.929097
7	29. Dean Nicholson Central Wash. 1965-90	0.910848
8	18. Bo Ryan Milwaukee 2000-01, Wisconsin 02-10*	0.900834
9	7. Roy Williams Kansas 1989-2003, North Carolina 04-10*	0.895349
10	28. Ron Niekamp Findlay 1986-2010*	0.875743
11	8. John Kresse Col. of Charleston 1980-2002	0.872021
12	13. Ed Adams Tuskegee 38-49, Texas Southern 50-58	0.811021
13	20. George Keogan (Minnesota) Wis.-Superior 1913-14	0.804024
14	19. Frank M. Keaney (Bates 1911) Rhode Island 1921-48	0.802093
15	1. Clair Bee (Clair Bee Rider 1929-31, 46-51	0.794039
16	14. Bruce Pearl Tennessee 06-10*	0.780112
17	30. Harry Sheehy Williams 1984-2000	0.705595
18	22. Mike Jones 1975) Mississippi Col. 1989-2002, 07-08	0.705137
19	23. Lucas Mitchell Alabama St. 1964-67, Norfolk St. 79-81	0.697322
20	27. Mike Dunlap Cal Lutheran 1990-94, Metro St. 98-2006	0.694085
21	15. Charles Christian Norfolk St. 1974-78, 82-90	0.69285
22	26. Jim Borcherding Augustana (IL) 1970-84	0.690489
23	11. Francis Schmidt Tulsa 1916-17, TCU 30-34	0.67958
24	6. Mark Few (Oregon 1987) Gonzaga 2000-10*	0.675407
25	3. Walter Bucky Harris Philadelphia U. 1954-65, 67	0.663652

Table A6:The Result of Basketball Coach Ranking

Final Rank	Coach Name	Evaluation Value
26	4. Dolph Stanley Beloit 1946-57	0.657502
27	25. Ed Green (Clarion 1964) Roanoke 1978-89	0.647179
28	17. Jack Ramsay St. Joseph??s 1956-66	0.629524
29	24. Harry Fisher Fordham 1905, Army 07, 22-23, 25	0.627561
30	21. Vic Bubas (North Carolina St. 1951) Duke 1960-69	0.61328