

Research and Comprehensive Evaluation College Coaching Legends

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Abstract. This paper studies the problem of who are the top five coaches in the world. We choose the Winning rate, the Contribution rate and the cycle of the honors to evaluate each coach, then we select the time from 1913 to 2013 to be a century. After standardizing the metrics by using the Coefficient of Variation Method, we use the Weighted Arithmetic Mean of Comprehensive Evaluation to get the final scores of each metrics for basketball, according to the scores, we get the top five coaches in a century. At last, we take the gender and timeline into account, and get the final results.

1. Model 1:Coach Evaluation Model Regardless Of The Gender

1.1 Selection of the metrics

In order to truly achieve evaluating goals, we should uphold the following principles during the modeling process^[1-2].

(1) The model should reflect the objectivity and fairness.

(2) Index selection should reflect the comprehensiveness, representativeness and factuality.

(3) The comprehensive evaluation system of the coach should be feasible and maneuverable, that is, our model should be simple to operate, in time to analyze and easy to manage.

According to the evaluation for sports, we make the procedure of the evaluation system. We use questionnaires^[3] on the internet to get the final scores of each metrics evaluated on the net. The following is the results.

Table 1: the scores of five metrics by objective evaluation

Metric	A	B	C	D	E
Score	7.5877	7.9324	7.9726	6.0064	5.0743

In the Table 1, a represents winning rate, B represents stability, C represents professionalism, D represents Coach of the Year, E represents Coach of the Year on the net. We can get from the table 1 that people pay more attention to the winning rate, stability and professionalism, and less attention to the honor of the Coach of the Year and the Coach of the Year on the net.

1.2 Data standardization[4]

We suppose that there are i evaluation objects, and j evaluation metrics, the original value of every metric is x_{ij} , for positive metrics, general standardization includes linear normalization algorithm and nonlinear normalization algorithm. The Dispersion is belong to the nonlinear normalization algorithm, the computing formula is

$$y_{ij} = x_{ij} / \sqrt{\sum_{i=1}^n x_{ij}^2} \quad (1)$$

In the equation, the y_{ij} is the value that is standardized, \bar{x}_{ij} represents the average value of every metric.

1.3 Determine the weight by the coefficient of variation method

Coefficient of Variation Method directly uses the information included by the all metrics, and get the weight of the metrics through computation, which is a king of objective weight defining. The

basic work is: in the evaluation system, the metrics of large difference in values can better reflect the gap of the evaluation. Because the dimensions of every metrics in the evaluation system are different, we can't compare them directly. In order to eliminate the influence of different dimension, we have to use variation coefficient to measure the value of every metrics. The variation coefficient formula is as follows:

$$V_i = \sigma_i / \bar{x}_i (i = 1, 2, \dots, n) \quad (2)$$

In the equation, V_i is the variation coefficient for the metric of i , or the coefficient of standard deviation. σ_i is the standard deviation for the metric of i . \bar{x}_i is the average number for the metric of i .

The formula for the weight of every metrics is

$$W_i = V_i / \sum_{i=1}^n V_i \quad (3)$$

1.4 Weighted arithmetic mean of comprehensive evaluation

When using comprehensive evaluation, if the weight of every metrics are equal, we can choose the simple average method directly. The basic formula for computing of the *Weighted Arithmetic Mean of Comprehensive Evaluation* is as follows:

$$f = \sum_{i=1}^n x_i W_i / \sum_{i=1}^n W_i \quad (4)$$

In the formula, n is the number of the metrics; x_i is the relative value for the metric of i under the same measurement, and let x_i be a sequence, where $i = 1, 2, 3, \dots, n$; W_i is the weight of the every metrics, that is, $W_1 + W_2 + \dots + W_n = 100\%$, similarly, let W_i be a sequence.

The feature of the approach is that independence of every metrics, linear compensation among every metrics, and the evaluation result reflects the functionality of each for all metrics.

Similarly, we take some coaches as examples to describe the Weighted Arithmetic Mean of Comprehensive Evaluation. The following is the final scores of the three coaches.

Table 2: final scores of the three coaches

Name	A1	B1	C1	Final Scores
Mike Krzyzewski	0.1052	0.1135	0.0022	0.0208290
Herb Magee	0.0984	0.0943	0.0047	0.0203500
Jim Boeheim	0.1027	0.1149	0.1178	0.0117686

Here, we let the $A1_w$, $A2_w$, $A3_w$ denotes the weight of the Winning Rate, the Contribution Rate and the Cycle of the Honor respectively.

We take the Mike Krzyzewski for example, the final scores for Mike Krzyzewski can be calculated in the following formula.

$$F_M = A1 \times A1_w + A2 \times A2_w + A3 \times A3_w = 0.0208290$$

Then we can deal with the rest of the scores of every coach in the same method.

1.5 The best all time college coach in the model 1

First, we standardize the metrics, and get the weight of every metrics by using the Coefficient of Variation Method, and finally get the final scores of every coach by using the Weighted Arithmetic Mean of Comprehensive Evaluation. The following is the coaches in the top eight and we summarize the top five coaches in the Table 3.

Table 3: the top five coaches in the model 1

Rank	1	2	3	4	5
Gender	male	male	male	male	female
Name	John Wooden	Mike Krzyzewski	Dean Smith	Denny Crum	Pat Summitt

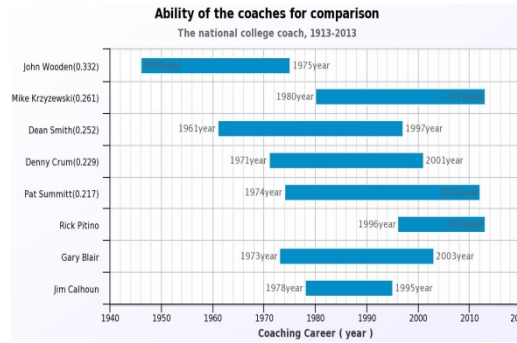


Figure 1: the best all time coach in the model 1

In the Fig.1, the blue bar represents the coaching time of the coach, the abscissa denotes the teaching time and the ordinate denotes the final scores of the coach. The higher of the blue bar, the higher the coach's rank is.

2. Model 2: Coach Evaluation Model For All Genders

Regardless of the male coaches and the female coaches, they all have the potential and the ability to train a best team, so we think they can have the same level of personal ability, what we should consider about is the gender of the team the coach coached, therefore, we should find a way to equal the men's team to the women's team.

We choose to get the *balance factor* in order to compare them directly. Here, we define four variables, they are $N_w, N_M, \bar{N}_w, \bar{N}_M$, the N_w and N_M represents the total winning number of the women's team and the men's team, similarly, the \bar{N}_w and \bar{N}_M represents the average winning number of the women's team and the men's team. On account for the difference of the physical quality between men and women, we can give the computation of the balance factor,

$$\text{balancefactor} = \bar{N}_M / \bar{N}_w \quad (5)$$

Since the women's teams are generally in bad situation in comparison with the men's teams. So the balance factor must be larger than one. When dealing with the data, if we meet the data for the women's team, we all let the data multiplied by the balance factor, so that we can regard the women's team as the men's team.

After the discussion of the balance factor, we use the model 1 to solve the problem, and get the following diagram.

Table 4: the top five in the model 2

Rank	1	2	3	4	5
Gender	male	male	male	male	male
Name	John Wooden	Mike Lightfoot	Dean Smith	Denny Crum	Roy Williams

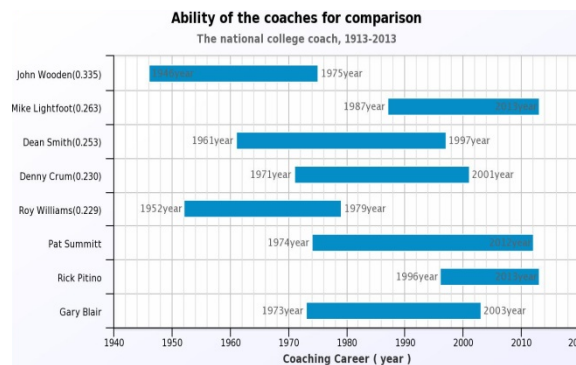


Figure 2: the best all time coach in the model 2

3. Model 3: Coach Evaluation Model For All Genders And Timeline

With the times past by requirement and development, the understanding of the meaning of the sports is more comprehensively and profoundly, the ability of the coaches are better. In order to reflect the positive influence of the timeline, here, we define another *time factor*, and the time factor can be expressed by the *growth membership function*, to reflect the experience brought with the time going by, we use the integral form of the growth membership function, then it can be described as follows:

$$F_T = \begin{cases} 0, & x < a \\ \int_{a1}^{b1} \frac{x-a}{b-a} dx, & a \leq x \leq b \\ 1, & x > b \end{cases} \quad (6)$$

Here, the a represents the year of the 1913, the b represents the year of the 2013, and the $a1$ and $b1$ represents the start and the teaching time.

The final results in model 3. The following is the diagram of the best all time coach

Table 5: the top five coaches in the model 3

Rank	1	2	3	4	5
Gender	male	male	male	male	male
Name	John Wooden	Mike Krzyzewski	Dean Smith	Pat Summitt	Mike Lightfoot

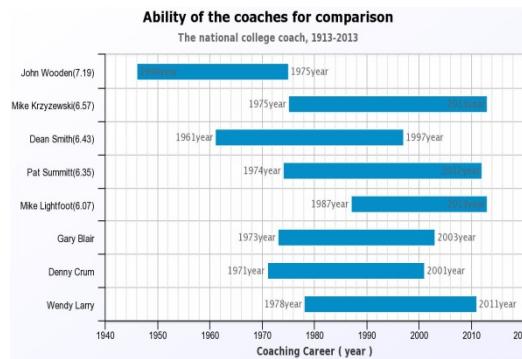


Figure 3: the best all time coach in model 3

4. Conclusions

It can be seen from Table 5 that the top five coaches evaluated in our paper are John Wooden, Mike Krzyzewski, Dean Smith, Pat Summitt, Mike Lightfoot. The results are accepted by most people, because the result is related to the reality, our result is justified in the top 10 basketball coaches.

Reference

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