

Design and Implementation of TOPSIS and AHP Coach ranking System

Chenxiang Zhang

Suzhou Industrial Park Institute of Services Outsourcing, Suzhou 215123, China

Keywords: evaluating best coach, three-level metrics, time line horizon, AHP with TOPSIS

Abstract. We build a elaborate model for finding the best all time coach or coaches in a more subjective and equitable way. We put emphasis on the establishment of three-level metrics, influence of time line horizon, selection of assessment method and application of all sports. Considering the universality of the model, we creatively propose a three-level metrics system. Primary metrics can be used to evaluate coaches in every sport, which helps us form our excellent coaches' database. Middle metrics are determined by the kind of sports. Meanwhile it can test whether our database is reasonable. Advanced metrics are related to special awards or honors. We study influence of time line horizon through the development of sports and the number of teams and calculate time-dependent weights. According to the calculations, we make adjustments to some metrics value. Based on our former work, we get the final coach rankings by combining AHP with TOPSIS.

Introduction

Everyone has a set of criteria of the best coach in mind. In order to find the "best all time college coach" in a fair and equitable way which can be accepted by most people, we will tackle with three subproblems. Which metrics can be used to evaluate a coach's achievements? How does the time line horizon influence assessment of a coach?

What method should we use to find the best coach or coaches, and how to find? We set five primary metrics to form our excellent coaches' database. Using AHP, we get every metrics' weights which can be applied in latter algorithm. Based on the former work, we utilize TOPSIS ranking coaches of top five.

Assumptions

In this paper, we discuss coaches whose information was recorded by NCAA. When a sport has been developed to a certain scale, NCAA may have the whole records about this sport. Before this, the coaches can be neglected. Some coaches may coach in many fields; we choose the longest coach experience he ever worked on as his records. Our goal is to select the greatest coaches in every field. He must be single-minded All-round talent has little effect on final result[1].

We presume our data and information about coaches downloaded from internet is reliable. We cannot exclude the possibilities that records of some coaches are lost, but we think the data is relatively comprehensive.

Step one: Establishment of three-level metrics

In the last century, sports developed rapidly in American. At the same time, each sport event emerged large number of excellent coaches. In consideration of the huge quantity of the coaches and the diversification of the honor the coaches won, it's unreasonable to choose the best coach just by using some plain metrics, such as win-lose percentage. But there are some basic requirements for the excellent coaches in spite of the difference of the sport event. Hence, we creatively propose a three-level Metrics.

Level One: Primary Metrics

An excellent coach should meet the Primary Requests which are the minimum standards that an excellent coach should be equipped. To select the excellent coaches, we set five metrics and establish a database.

Coaching Time. Generally, an old coach usually better than a younger one in that the more games he guide the more experience he owns. In other words, a coach of 30 years is better than a coach of 10 years in most cases.

Victories. A great coach not only possesses rich experience but also win a certain number of games as his (her) record to support his reputation and skill.

Winning Percentage. This metrics can direct reflect a coach's teaching level. Beyond the influence of a team's economic strength and the attention the college pay, a great coach's win-loss percentage should be higher relatively. In turn, teams who get good result may get sponsored by schools or local government. This is may start virtuous circle.

Highest Honor. It's crucial for a great coach to get highest honor in his field. Gaining the highest honor can bring the coach more attentions and approvals.

Media Influence. Besides admirable skills, a super coach should have a lot of fans and supporters. There are many activities of vote to select the best coach on the internet. Of course, the results are not absolute[2].

Level Two: Middle Metrics

Due to the particularity of a certain sport event, some sport events have special metrics. Let's take basketball for examples.

SRS (Simple Rating System). SRS is denominated in points above/below average, where zero is average. Non- Division games are excluded from the ratings.

Highest Victories in One Season. In a coach's career, (s) he may experience lots of season games. This metric tell us about the best achievement (s) he ever made.

Fastest to Milestone wins. This metric is the win-lose percentage when a coach first reaches 50 victories. It's used for head coaches with at least half their seasons at Division I.

AP Final (Final AP Poll Ranking). AP Final is ranking in final AP poll (poll taken before the conclusion of the NCAA tournament).

Level Three: Advanced Metrics. There are no special rules for the advanced metrics.

These metrics are mainly some special title or award by the media. It will be helpful to rank in step 3.

Selection of Coaches. By using the primarily metrics, we can select some outstanding coaches form the NCAA coaches record and form our database. Here are the basic factors that a outstanding basketball coach should be equipped with:

At least win a championship during the coach's coaching career. Coaching time is no less than 10 years. The win-loss percentage is not less than 50%. The victories should be higher than 1.5 times average victories of all the coaches. No bad review form media. At least 15 coaches in every sport event database (if not satisfied, the above conditions can be adjusted). The result of selection of basketball shows in Table 1.

Table 1 Selection of the Basketball Coaches

coach	From	To	Yrs	G	W	L	W-L%	GREG	CTRN	NCAA	FF	NC
Phog Allen	1906	1956	48	978	719	259	0.735	24	0	4	3	1
Jim Boeheim	1977	2014	28	1256	942	314	0.75	11	5	30	4	1
Jim Calhoun	1973	2012	20	1259	877	382	0.697	16	12	23	4	3
Denny Crum	1972	2001	30	970	675	295	10696	15	11	23	6	2
John Calipari	1989	2014	22	756	585	171	0.774	14	11	14	4	1
Hank Iba	1930	1970	40	1085	752	333	10.693	15	0	8	4	2
Mike Krzyzewski	1976	2014	39	1277	975	302	0.764	12	13	29	22	4
Bob Knight	1966	2008	42	1273	899	374	0.706	11	0	28	5	3
Lute Olson	1974	2007	34	1061	776	285	0.731	13	4	28	5	1
Adolph Rupp	1931	1972	41	1066	876	190	0.822	28	13	20	6	4
Dean Smith	1962	1997	36	1133	879	254	0.776	17	13	27	11	2
Bill Self	1994	2014	21	693	524	169	0.756	15	7	15	2	1
Jerry Tarkanian	1970	2002	30	963	761	202	0.79	18	8	18	4	1
Roy Williams	1989	2014	26	902	715	187	0.793	15	6	23	7	2
John Wooden	1947	1975	29	826	664	162	0.804	16	0	16	12	10
Bob Knight	1965	2008	42	1273	899	374	0.706	11	0	28	5	3

Step Two: Ranking of the Excellent Coaches

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)[Hwang and Yoon 1981] is a multi-criteria decision analysis method and based on the concept that the chosen alternative should have the shortest geometric distance from the positive ideal solution and the longest geometric distance from the negative ideal solution[3].

The key of TOSIS is determining the weight of each index more accurately. In order to get more accurate weights, we use the Analytic Hierarchy Process (AHP)[Saaty 1982].

The weight of each index is obtained by AHP calculation as follows Table 2:

Table 2 AHP-derived weights

Factors	Yrs	W	W-L%	CREG	CTRN	FF	NC
Weights	0.0049	0.0049	0.13	0.2	0.13	0.16	0.27

Then, we test the consistency of the preferences for this instance of the AHP. For good consistency: we get the principal eigenvalue and and . Our decision methods are perfectly accepted by consistency. Now we can calculate the index weight according to the AHP which can be used in the TOPSIS. Here we can tell the result of the college basketball coach rankings. Result shows in Table 3:

Table 3 Rankings of college basketball coaches

Names	John Wooden	Adolph Rupp	Mike	Dean Smith	Jim	Denny	Bob Knight	Roy
Rankings	1	2	3	4	5	6	7	8
Index	0.75	0.44	0.43	0.33	0.3	0.24	0.22	0.21
Names	John Calipari	Jerry	Phog Allen	Bill Self	Hank Iba	Lute Olson	Jim Boeheim	
Rankings	9	10	11	12	13	14	15	
Index	0.19	0.17	0.17	0.13	0.13	0.12	0.11	

References

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