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**2014 Mathematical Contest in Modeling (MCM) Summary Sheet**

## **People's Choice of Best Coach**

### **Summary**

With the soaring popularity of college sports, the role of coaches has become increasingly significant in that they can positively affect the teams' performance. Our goal is to build a model to choose the top five *best* college coaches in three sports and adjust our model to suit various scenarios such as different sports, time line horizons and genders.

We determine the choice of factors in our assessment by doing research, reviewing literatures and analyzing the criteria of the past "best coaches" ranks. The design of our basic model is based on the Analytic Hierarchy Process (AHP), which defines the ratio of each factor in the evaluation. To fully consider the importance of each factor, we design a questionnaire and conduct a survey via emails, phones and text messages. We obtain a sample of 400 participants, including 118 professionals and 282 nonprofessionals. We generate the importance rank (from the most to the least important) as "Number of Championships", "Number of Wins and Win-loss Percentage", "Contribution to the Team" and "Years of Coaching".

In our model adjustment, we take two scenarios into account, including different time line horizons and different genders. We apply the Analytic Hierarchy Process (AHP) to balance different time line horizons. Our model is equally applicable for both genders. By applying the adjusted AHP Model, we rank the Top5 coaches in three sports (basketball, football and baseball).

Finally, we design an Artificial Neural Network Model. We analyze the present data of the top coaches to predict the future achievement of coaches. In other words, the model can be used to predict the potential "future best coaches".

In conclusion, our models can cover most traits of a good coach and perform well in reliability, universality and creativity.

**Key Words:** Analytic Hierarchy Process (AHP), Questionnaire Survey, Artificial Neural Network

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## Introduction

College sports gained its popularity throughout the last century. Nowadays, people run wild for the latest rankings of sports teams in the fields of basketball, football, baseball, etc. Meanwhile, coaches are rather influential in that they can positively affect athletes' performance, behavior, psychological and emotional well-being [Horn, 2002]. The search of the "best all time college coach", as a result, has become a head-scratching puzzlement for sports magazines such as *Sports Illustrated*.

Our goal is to find the best coaches in different college sports based on the assessment which involves various factors. Further requirements are to generalize our model to suit different scenarios, including genders, all possible sports and different time lines. We simply conclude our work as follows:

1. Find the most significant factors to determine the best coaches
2. Design a model based on these factors to evaluate the candidates
3. Screen out the best coaches and generalize our model

Many researches have been done to seek metrics for coach assessment. Feltz et al.[1999] constructed a conceptual model of coach efficacy, which was defined as the extent to which coaches believe that they have the capacity to influence the learning and performance of their athletes [Kavussanu et al., 2008] consisting of four dimensions: motivation, game strategy, technique, and character building [Feltz et al., 1999]. In addition, Feltz proposed various sources which may influence coach efficacy, including perceived team ability, social support, career winning percentage and years as a collegiate coach [Myers et al., 2003; Feltz et al., 1999]. Along with her colleagues, Feltz designed a Coach Efficacy Scale to measure the construct [Myers et al., 2003]. A number of researches [Boardley, Kavussanu&Ring, 2008; Kavussanu et al., 2008; Myers et al., 2003] that followed designed questionnaires based on the scale and analyzed the participants' results to discover the important factors. The questionnaire survey is obviously infeasible for us.

In spite of the widely-used Coach Efficacy Model, other approaches to the assessment of coach competency [Cushion, 2003; Myers et al., 2006] have also been conducted. All the researches are of partial help, but they still differ from ours due to the fact that most of the factors they propose aim at evaluating whether a coach is qualified or not. In other words, their researches are based on a more general scenario while we are looking for *the best* coach, the candidates of which definitely meet the common coach efficacy and competency standards.

A good choice of the best coach has to reflect the public taste and gain social approval. Information on Wikipedia and NCAA.com and the result of the past ranks shows the most important determining factors as "years of coaching", "number of wins", "number of championships" and "win-loss percentage". Since our sample of more than 3,000 coaches in each field is gigantic, a screening process is needed to narrow down the number of coaches to a computable extent. Combining the above factors with empirical knowledge, we develop two rounds of screening to screen out the best coaches (we use the data of college basketball coaches as an example):

Round 1 (Preliminary Screening): We apply the number of wins to screen out a small range of coaches (55 in total for basketball). In addition, we use the “win-loss percentage” factor for further assessment and get a sample of 47 coaches.

Round 2 (Further Screening): We detail the factors in Round 1 to more aspects. To measure the proportion of each factor, we apply the *Analytic Hierarchy Process* (AHP) to our model. We design a questionnaire and conduct a survey via emails, phones and text messages in the first two days to determine the importance rank of the factors. We synthesize the opinions of our 396 participants (including 116 professionals and 280 nonprofessionals) and the criteria of sportswriters (via online search) in the past ranks to get a universally acknowledged result. We further calculate the ratio of each factor and compute a score for each judge based on the ratios and their original data.

We modify our model to suit scenarios of different time line horizons, coaches crossing the time line, different sports and different genders. In addition, we design a model based on *Artificial Neural Network* to predict the potential “future best coaches”.

## Definitions and General Assumptions

### Definitions

**Years of coaching:** Total years as the *chief coach* of one or more college basketball teams that participate in regular competitions in their own conference.

**Number of wins:** The number of games a team (the coach is in charge of) has won including regular seasons, tournaments, national championships, etc...

**Number of championships:** Consisting of the number of championships a team has won in different levels of competitions (levels are the same as above).

**Win-loss percentage:** The ratio of “number of wins” to the “total number of games”.

**Divisions (I, II and III):** The levels of intercollegiate athletics sanctioned by the National Collegiate Athletic Association. Division I is the highest level, and D-I schools include “the major collegiate athletic powers, with larger budgets, more elaborate facilities, and more athletic scholarships than Divisions II and III as well as many smaller schools committed to the highest level of intercollegiate competition”(Wikipedia).

**Contribution to the team:** According to the NBA’s Coach of the Year Award (Wikipedia) and our own comprehension, “contribution” means “making great achievement for a relatively untalented team”. We use the ratio of “team’s average win-loss percentage during the coach’s charge” to “team’s average win-loss percentage under the previous coach’s charge” to measure the “Contribution” factor.

## Assumptions

1. The objects of our study are college coaches in the USA.
2. All the samples employed by the model can cover the entire extreme situations, e.g. the coaching age, win-loss percentage (excluding the coaches who have less than two-year' experience)
3. For those who coach in two or more sports simultaneously, we ignore the interactional effects among them.

## Model Development

### Preliminary Work

We adopt the data of college men's basketball coaches in NCAA to design our basic Model (NCAA is quite representative due to its broad popularity and there are lots of data available). Since our sample has a massive amount of 3,500 coaches, narrowing it down to a computable range has become a major problem for us to solve.

We conduct a preliminary screening process to select the potential "best coaches". According to the sportswriters who ranked the Top10 and Top100 all time coaches on Bleacherreport.com, "the number of wins" is a crucial factor to determine whether a coach has the chance of becoming "the best". Luckily, we find a "List of college men's basketball coaches with 600 wins" on Wikipedia with the top ones highly resembling the Top10 list. The list is therefore proved to be reasonable in reflecting the greatness of coaches, and we propose it as the smaller sample with 55 coaches in total.

After further analysis on the data of past top-ranked coaches (data resources: Sports-reference.com, NCAA.com), we find that the "win-loss percentage" is also closely related to the rankings. In terms of this, we define a reasonable standard of 60 percent and screen out the ineligible coaches. This gives us a final sample of 47 figures, which we bring to the next round.

The preliminary work plays a vital role in our model. We cannot analyze all the data in two days. So we take merely 47 coaches into consideration. According to our previous analysis, it is reasonable.

### Model 1:*Analytic Hierarchy Process (AHP) Model*

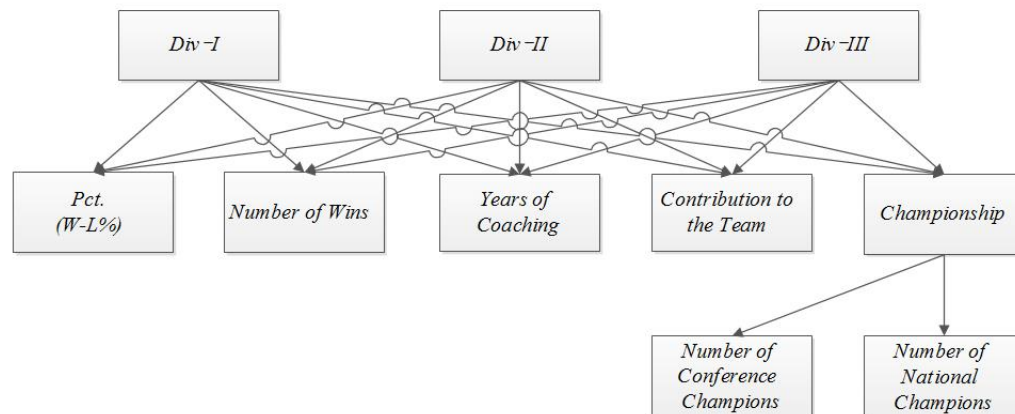
We analyze the sports commentators' criteria when judging the best coaches. There are four factors which appear frequently in the comments on the Top100 judges on Bleacherreport.com. They are: "the number of championships (including tournament and national championships)", "the number of wins", "win-loss percentage" and "years of coaching". And these factors could also be found in many other ranking websites among all sports (e.g. Orlandosentinel.com for football and Mademan.com for baseball). In addition, we discover the criterion of judging NBA's Coach of the Year (Wikipedia) is "making the greatest possible achievement for the least talented team", which means the coach's "contribution to the team" is also crucial. Adding this to our criteria, we work out a total of five factors to judge a coach and screen out the best coaches.

Although the variables all partly reflect the greatness of a coach, apparently they are not equally important, which means we need to define the relative weights of the factors according to their importance in our judgment. Fortunately, we discover the *Analytic Hierarchy Process* (AHP), which “provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions” (Wikipedia) and can be fairly instructive in our work.

Considering the above, we apply the AHP to our model. Our working process is stated as follows.

### Step 1: Model the hierarchy of the problem

In this step, we need to explore the aspects of the problem at levels from general to detailed (Wikipedia). As for basketball, the general level involves the division that a team joins, which reflects the basic level of the team. As for the detailed level, we consider the five factors that we proposed above. We build our hierarchy which is shown in **Figure 1**.



**Figure 1.** Hierarchy of the factors in NCAA.

### Step 2: Evaluate the hierarchy--A questionnaire survey

Now that the hierarchy has been constructed, our next step is to analyze it through a series of *pairwise comparisons* that derive numerical scales of measurement for the nodes (AHP, Wikipedia). Surely the results of our comparisons cannot reflect the opinions of the public. To avoid using the one-sided opinion, we intend to obtain resources from both sports-professionals and non-professionals. We believe that in this way, our rank of importance can not only become professional enough but also meet the public taste, which guarantees the reliability and the universality of our result.

The participants of our study consists of three kinds of people: professional sportswriters (mostly experts in sports rankings), other sports professionals (amateurs in sports rankings but experts in sports, including college P.E. teachers, college sports coaches, sports professors, athletes and other employees in the sports field) and non-professional sports enthusiasts (complete amateurs).

To define the importance rank of the five factors, we design a questionnaire by using a rating scale known as 5-point Rating Scale and conduct a survey among the

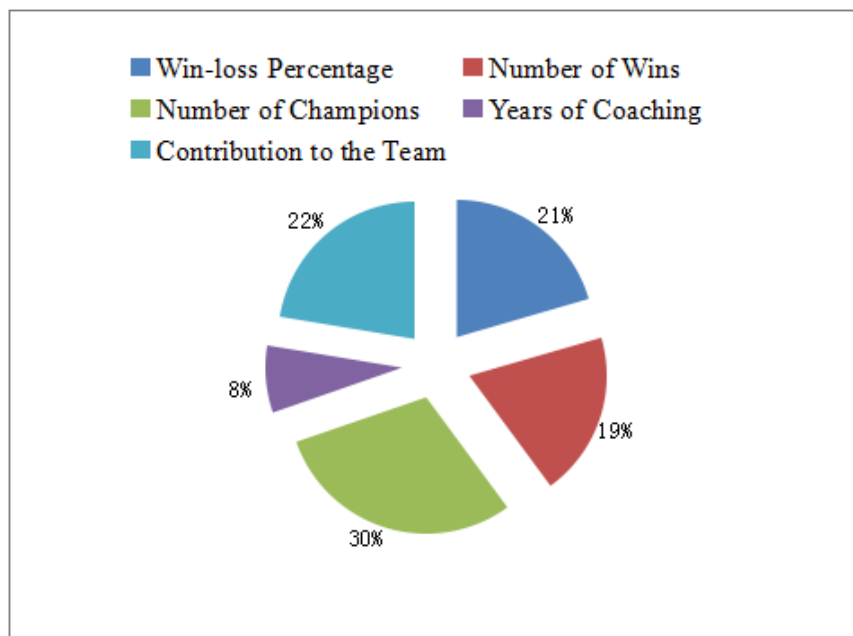
“other sports professionals” and “sports enthusiasts” groups. The number of participants in these two groups is 400 in total, 118 (professionals) and 282 (nonprofessionals) respectively. We simply ask them to rank the variables from the most to the least important. We assign each ranking place with a score from 1 to 5. Each first-place rank is worth 5 points; each second-place rank is worth 4 points and so on. We then calculate the ratio of each factor.

As for the “sportswriters” group, we analyze the criteria of judging each of the Top100 coaches. We calculate the number of occurrence of the five factors in the 100 comments and get the frequency-of-occurrence of each factor, which we denote as the ratio in the importance rank.

We synthesize the opinions of the three groups and get the final importance rank. The result is shown in **Table 1** and **Figure 2**.

**Table 1.**  
The ratio of factors in the importance rank.

	Win-loss Percentage	Number of wins	Number of Championships	Years of Coaching	Contribution to the Team
Nonprofessionals	0.232	0.175	0.209	0.108	0.276
Professionals	0.213	0.170	0.217	0.124	0.276
Sportswriters	0.199	0.213	0.360	0.044	0.184

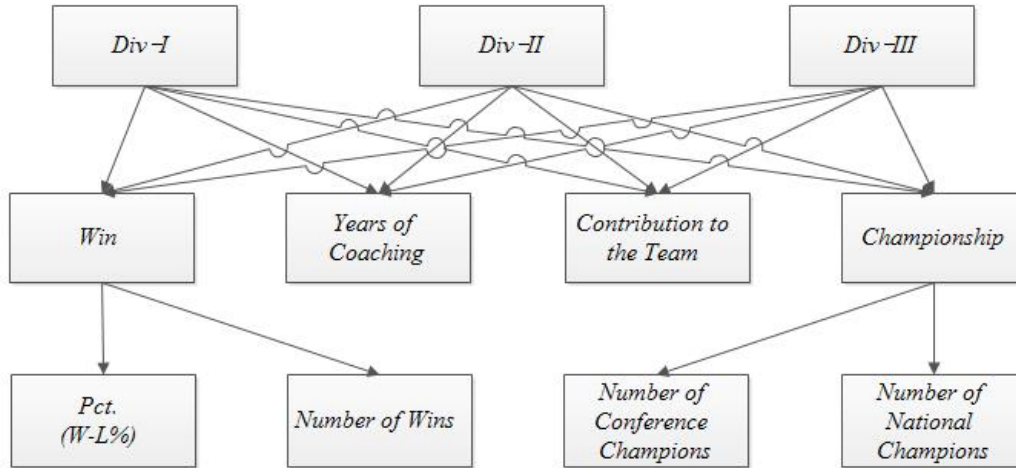


**Figure 2.** Synthesized ratio of factors in the importance rank.

As is clearly shown in **Figure 2**, we can easily rank the importance of factors (from most to least important) as “Number of Championships”, “Win-loss Percentage”, “Contribution to the Team”, “Number of Wins” and “Years of

Coaching”. Many professionals believe that the two factors of “Number of Wins” and “Win-loss Percentage” are closely related. To simplify our work, we merge these two factors into the “Win” factor. With the merging of two factors, we modify our rank as “Number of Championships”, “Win”, “Contribution to the Team” and “Years of Coaching”.

We propose an adjusted Hierarchy shown as **Figure 3**.



**Figure 3.** Adjusted Hierarchy of the factors in NCAA.

Now that we have worked out the importance rank, we need to make *pairwise comparisons* mentioned above. We propose a judging matrix to quantify the pairwise relative importance shown as **Table 2**.

**Table 2.**  
General judging matrix.

$C_k$	$P_1$	$P_2$	$P_3$	$P_4$
$P_1$	$b_{11}$	$b_{12}$	$b_{13}$	$b_{14}$
$P_2$	$b_{21}$	$b_{22}$	$b_{23}$	$b_{24}$
$P_3$	$b_{31}$	$b_{32}$	$b_{33}$	$b_{34}$
$P_4$	$b_{41}$	$b_{42}$	$b_{43}$	$b_{44}$

Where  $b_i$  usually gets its value from 1, 2, 3...9 and their reciprocals (1, 1/2, 1/3...1/9). Their meanings are stated as follows:

If  $b_{ij}=1$ , then  $P_i$  and  $P_j$  are of equal importance;

If  $b_{ij}=3$ , then  $P_i$  is slightly important when compared to  $P_j$ ;

If  $b_{ij}=5$ , then  $P_i$  is obviously important when compared to  $P_j$ ;



If  $b_{ij}=7$ , then  $P_i$  is greatly important when compared to  $P_j$ ;

If  $b_{ij}=9$ , then  $P_i$  is absolutely important when compared to  $P_j$ .

By applying this, we propose two judging matrices concerning different Divisions and the four factors shown in **Table 3** and **Table 4**.

**Table 3.**  
Division judging matrix.

	Division I	Division II	Division III
Division I	1	3	5
Division II	1/3	1	3
Division III	1/5	1/3	1

**Table 4.**  
Four-factor judging matrix.

	Wins	Champions	Contribution	Years of Coaching
Wins	1	1/3	3	5
Champions	3	1	5	7
Contribution	1/3	1/5	1	3
Years of Coaching	1/5	1/7	1/3	1

### Step 3: Establish priorities

From the last step, we get two matrices for the calculation of priorities. There are several methods, among which we choose the Power Method. The priorities are shown in **Table 5**:

**Table 5.**  
Priorities of each factor.

		Division I	Division II	Division III
Wins	Win-Lose Percentage	0.084	0.034	0.014
	Number Of Wins	0.084	0.034	0.014
Champions	National Championship	0.314	0.128	0.052
	Conference Championship	0.045	0.018	0.007
Years of coaching		0.035	0.014	0.006
Contribution		0.075	0.030	0.012

## Step 4: Calculate the final score for coaches

We process the data by using a unification method. Take the “years of coaching” as an example. For a coach, we calculate the ratio of “his years of coaching” to the “maximum years of coaching”. Other items observe the same rule.

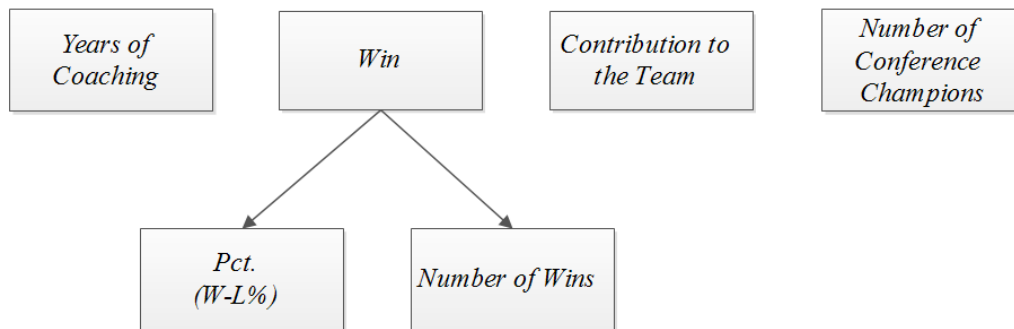
By applying the priorities calculated in Step 3 and the data of coaches, we can calculate a score for each coach based on the following formula:

$$Score = \sum data \times priorities$$

## Model 1 Adjustment

### Different Time Line Horizons

For college men’s basketball, we define “the Foundation of NCAA” as the time boundary. We analyze the data of coaches before the boundary to examine whether the factors and the priorities we propose are still suitable. We discover that there were no National Championships back at that time. This means while the main factors are still functioning, we need to adjust the sub-factors and their priorities to cater to the change of time line horizon. Therefore, we adjust the hierarchy and present it in **Figure 4**.

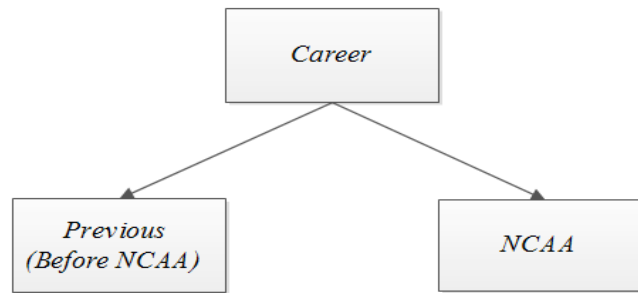


**Figure 4.** Hierarchy of factors before the establishment of NCAA.

The following process of AHP remains the same. Therefore, the only adjustment to our model is the change of sub-factors due to different competition systems in different times.

### Assess Coaches Crossing the Time Line

In our calculation of the coaches’ scores, the data we import all date from the establishment of NCAA. This is rather unfair for those prominent coaches who cross the time line and whose achievement in the period before NCAA has been ignored. In order not to rule out these great coaches by accident and also to guarantee the robustness of our model, we propose another AHP model to solve this problem. We show the hierarchy in **Figure 5**.



**Figure 5.** Hierarchy of another AHP model.

## Assess Coaches with Bonus

For those outstanding coaches who have already gained public approval, we add bonus to their scores. The bonus includes honors such as Coach of the Year Award and Hall of Fame, AP Poll and Coaches Poll.

## Model 1 Application

### Basketball

We process the data using a unification method. Take the “years of coaching” as an example. For a coach, we calculate the ratio of “his years of coaching” to the “maximum years of coaching”. Other items observe the same rule.

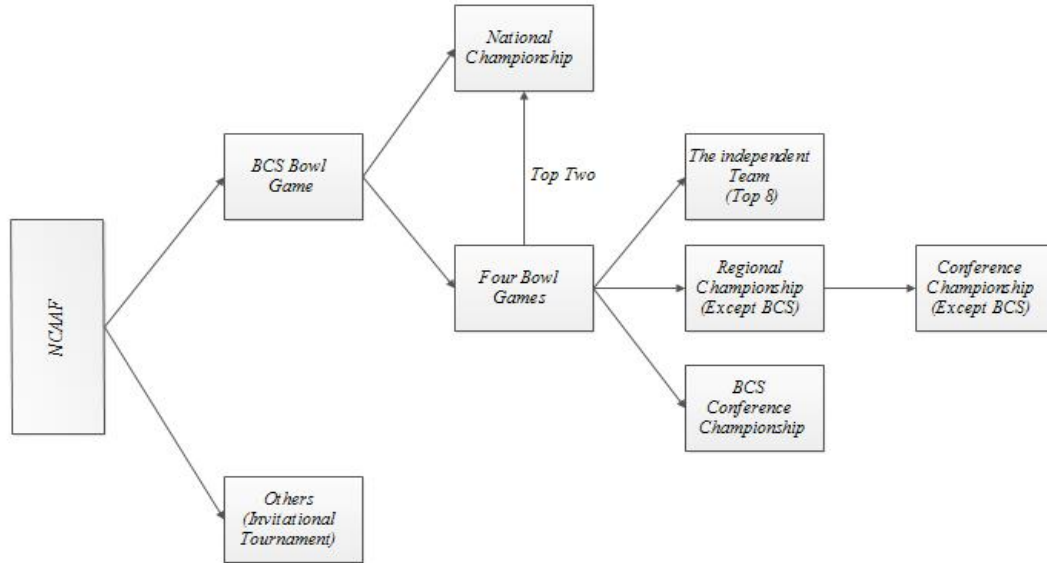
We import the data of 47 coaches in the sample and calculate the score of each coach. We convert the score to the Hundred Mark System and get a list of the Top5 coaches shown in **Table 6**.

**Table 6.**  
Top5 best men’s basketball coaches of NCAA.

Rank	Name	Score
1	John Wooden	100
2	Adolph Rupp	99
3	Mike Krzyzewski	83
4	Jim Boeheim	82
5	Dean Smith	80

### Football

For different sports, the competition system is different, so there might be great difference in the levels of competitions. Taking basketball as an example, there are roughly two levels of competitions: National and Conference. However, as for football, the situation is more complicated, so we analyze the levels and present it in **Figure 6**.



**Figure 6.** Football competition levels in NCAA.

There are roughly three levels of competitions: National (Four Bowl Games included), Regional and Conference. The level differences only affect the sub-factors under the “Number of Championships”. We simply adjust the sub-factors by adding the “Number of Regional Championships” and calculate the score observing the same AHP process in the Model 1. The Top5 coaches are shown in **Table 7**.

**Table 7.**  
Top5 Best Football Coaches of NCAA.

Rank	Name	Score
1	Paul “Baul” Bryant	100
2	Bobby Bowden	93
3	Woody Hayes	84
4	Tom Osborne	83
5	Joe Paterno	81

## Baseball

For baseball, the competition system is similar to that of Basketball, with three Divisions and two levels of competitions. We calculate the score of baseball coaches and show the Top5 in **Table 8**.

**Table 8.**  
Top5 Best Baseball Coaches of NCAA.

Rank	Name	Score
1	Don Schaly	100
2	Raoul “Rod” Dedeaux	89
3	Augie Garrido	56
4	Gordie Gillespie	52
5	Cliff Gustafson	50

## Different Genders

There are only two women sports in NCAA: basketball and soccer. For women's basketball, the factors and the priorities are the same as that of men's. As a result, we simply calculate the score of women's basketball coaches by observing the same process as men's basketball coaches. The Top5 coaches are shown in **Table 9**.

**Table 9.**  
Top5 Best Women's Basketball Coaches of NCAA.

Rank	Name	Score
1	Pat Summitt	100
2	Geno Auriemma	99
3	Tara VanDerveer	71
4	Jody Conradt	59
5	Sylvia Hatchell	52

We conclude that the gender difference has no distinct influence on our model due to the fact that all the factors we selected for coach assessment are equivalent for both genders.

## Model 2: *Artificial Neural Network Model*

According to the result of our model, the “best coaches” usually have great priority in the “years of coaching” and “number of championships” factors. Although this situation meets the public recognition, this seems unfair for those “genius coaches” with relatively fewer years of coaching and outstanding performance, and we might degrade these coaches in our coach assessment model. Therefore, we apply the *Artificial Neural Network Model* to solve this problem. Neural Network performs well in handling multifactor conditions and fuzzy information. Our goal is to predict the potential level a coach can reach in the future via the data which reflect his performance in the first five years of his coaching experience.

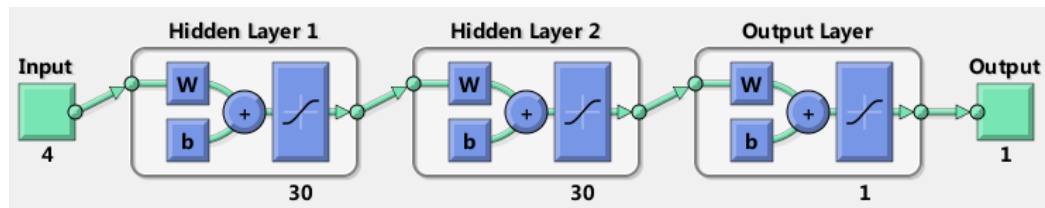
We apply top 10 men's basketball coaches' data in our Model 2 and analyze their “teams' average win-loss percentage in the first five years”, “teams' average win-loss percentage in the previous five years”, “teams' number of different championships (national, conference tournament and conference regular) in the first five years”, “teams' total win-loss percentage in the first five years”. Taking these factors into account, we calculate the “comparative win-loss percentage” and “comparative improvement percentage” of the first five years using the following formulas:

$$\text{Comparative } W - L \text{ Pct.} = \frac{\text{Avg. } W - L \text{ Pct. (First five years)}}{\text{Avg. } W - L \text{ Pct. (Total)}}$$

$$\text{Comparative Improvement Pct} = \frac{\text{Avg. } W - L \text{ Pct. (First five years)}}{\text{Avg. } W - L \text{ Pct. (Five years before the coach)}}$$

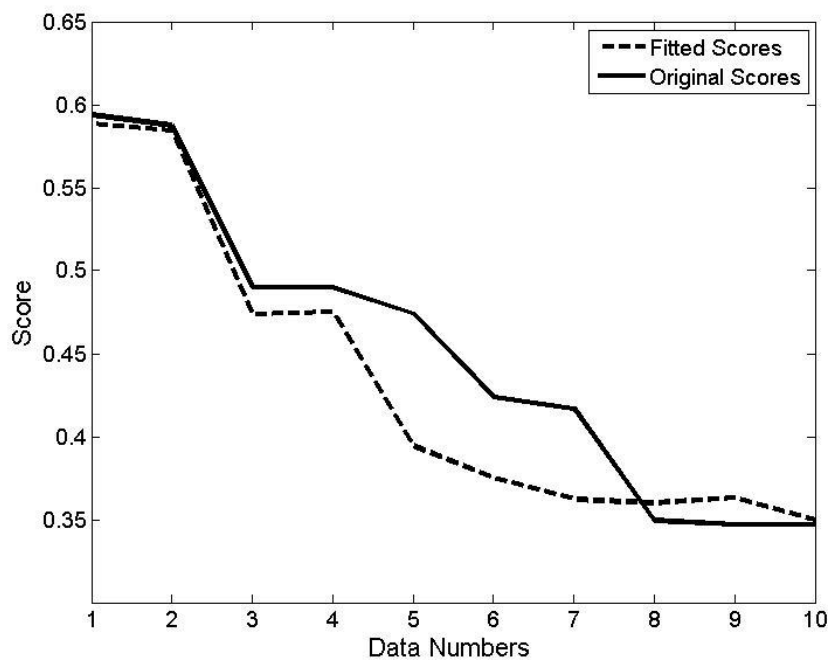
We incorporate their “comparative win-loss percentage”, “comparative improvement percentage”, “number of conference championships”, “number of national championships” data into the Original Matrix and their final scores in the

Model 1 into the Object Matrix. By applying the two matrices, we propose a neural network with two hidden layers and supervise its learning. The topological graph of our neural network is shown in **Figure 7**.



**Figure 7.** Topological graph of neural network.

The training result is shown in **Figure 8**.



**Figure 8.** Training result of the neural network.

The figure indicates that our neural network can make predictions to some extent but the accuracy of predictions is relatively low, due to the small scale of our 10-individual sample and the convergence of data. We assume that the accuracy of our predictions will increase significantly if our sample is sufficient.

## Result and Analysis

We screen out the Top5 coaches from each of the three sports, including basketball, football and baseball. Our final result is shown in **Table 10**.

**Table 10.**  
List of Best Top5 coaches in three sports.

Basketball			Football			Baseball		
Rank	Name	Score	Rank	Name	Score	Rank	Name	Score
1	John Wooden	100	1	Paul “Baul” Bryant	100	1	Don Schaly	100
2	Adolph Rupp	99	2	Bobby Bowden	93	2	Raoul “Rod” Dedeaux	89
3	Mike Krzyzewski	83	3	Woody Hayes	84	3	Augie Garrido	56
4	Jim Boeheim	82	4	Tom Osborne	83	4	Gordie Gillespie	52
5	Dean Smith	80	5	Joe Paterno	81	5	Cliff Gustafson	50

We make a comparison between our rank and the past ranks on different sites and show our result in **Table 11**.

**Table 11.**  
Comparison between our rank and the past ranks on different sites.

Sites (.com)	go	wiki. answer	wiki. answer	wiki. answer	craveonline	greatest -players	ranker	top5
John Wooden	1	-	-	-	1	1	1	1
Adolph Rupp	7	5	3	3	-	2	4	5
Mike Krzyzewski	3	1	9	9	3	6	2	2
Jim Boeheim	14	2	12	12	-	15	11	-
Dean Smith	2	4	2	2	5	4	3	3

The result of the comparison suggests the reliability and the accuracy of our rank.

## Conclusion

We analyze the criteria in the past “best coaches” ranks to obtain the important factors for our assessment. To define the relative weights of the nodes according to their importance in our judgment, we apply the *Analytic Hierarchy Process* (AHP) to our model. We conduct a survey among 400 professional and unprofessional participants using questionnaires to define the importance rank of the factors we propose. After calculating the priority of each factor, we compute a score for each coach and generate the “best coaches” rank. We apply the model to college men’s basketball and get the Top5 best coaches. The results are satisfactory.

We modify our model to suit the scenarios of different time line horizons, coaches crossing the time line, different sports and different genders. These scenarios require an adjustment of the sub-factors and do not require great changes of our model.

In addition, we design a model based on *Artificial Neural Network* to assess the “genius coaches” and predict the potential “future best coaches”.

## Strengths and Weaknesses

### Strengths

1. Reliability: We obtained the opinions of both sports-professionals (sportswriters included) and nonprofessionals using questionnaires and synthesis to get a general opinion of the importance rank of the factors. Therefore, the reliability of our result is guaranteed.
2. Universality: Our model worked well (with a minor adjustment to the sub-factors to cater to the situation’s demand) under different circumstances, including different time line horizons, sports and genders.
3. Creativity: The methods we used in our study include the *Analytic Hierarchy Process* (AHP), questionnaire survey and the *Artificial Neural Network*, all of which are rather creative.

### Weaknesses

Small sample: In the assessment we conducted, the number of coaches was rather limited due to the complexity of data analysis. As a result, the accuracy of our final Top5 rank did not meet our expectations. (e.g. Jim Boeheim in the List of Top5 Best Men’s Basketball Coaches in NCAA) Nevertheless, we believe that given a larger sample, there will definitely be a great increase in accuracy.

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## **Data:**

### **Top 100 college basketball coaches:**

<http://bleacherreport.com/articles/901148-the-100-greatest-coaches-in-college-basketball-history>

### **Top 10 college basketball coaches:**

<http://bleacherreport.com/articles/1341064-10-greatest-coaches-in-ncaa-basketball-history>

### **Data of basketball, football and baseball coaches:**

<http://web1.ncaa.org/stats/StatsSrv/careercoach>

<http://www.sports-reference.com/cbb/coaches/hank-iba-1.html>

<http://www.baseball-reference.com/>

[http://en.wikipedia.org/wiki/NCAA\\_Division\\_I\\_college\\_baseball\\_team\\_statistics](http://en.wikipedia.org/wiki/NCAA_Division_I_college_baseball_team_statistics)

### **College Basketball Coaches with 600 Wins:**

[http://en.wikipedia.org/wiki/List\\_of\\_college\\_men%27s\\_basketball\\_coaches\\_with\\_600\\_wins](http://en.wikipedia.org/wiki/List_of_college_men%27s_basketball_coaches_with_600_wins)

## **Definitions:**

### **Artificial Neural Network (Wikipedia):**

[http://en.wikipedia.org/wiki/Artificial\\_neural\\_network](http://en.wikipedia.org/wiki/Artificial_neural_network)

### **NBA Coach of the Year Award**

[http://en.wikipedia.org/wiki/NBA\\_Coach\\_of\\_the\\_Year\\_Award](http://en.wikipedia.org/wiki/NBA_Coach_of_the_Year_Award)

## Article for *Sports Illustrated*

With the soaring popularity of college sports, the role of coaches has become increasingly significant in that they can positively affect the teams' performance. Our team has been asked to build a model to choose the top five *best* college coaches in three sports and adjust our model to suit various scenarios such as different sports, time line horizons and genders. By doing research and literary reviewing, we discover various scoring systems and ranks, but there existed a lot of problems in these systems: some of them lay too much emphasis on the coaching experience, making the scores of "Veteran Coaches" much higher than that of "Rookie Coaches; others partially focus on one or more aspects (e.g. number of championships). Comparing to these scoring systems, our model can cover most of the traits of a good coach.

To make a full consideration of the factors in assessing a good coach and their importance, we do a questionnaire survey via emails, phones and text messages. We obtain a sample of 400 participants. This includes 118 professionals and 282 nonprofessionals (we contact sports experts via phones and text messages). We generate the importance rank (from most to least important) as: "Number of Championships", "Number of Wins and Win-loss Percentage", "Contribution to the Team" and "Years of Coaching". We explain these factors as follows:

**No.1:** "Number of Championships" in our importance rank is a crucial factor in the evaluation of a coach. Different sports have different types of championships. Take basketball as an example, the "Number of Championships" consists of "Number of National Champions" and "Number of Conference Champions". Apparently these two sub-factors are not of equal importance, and we take this into consideration in our model-designing process.

**No.2:** "Number of Wins" and "Win-loss Percentage"--it is hard to define which is more important in assessing a good coach. To reach a balance between the "Veteran Coaches" (with a large "Number of Wins") and "Rookie Coaches" (with a large "Win-loss Percentage"), we suppose that these two factors are of equal importance.

**No.3:** "Contribution to the Team" includes leading a team to move to an upper Division (e.g. football coach Eddie Robinson moved to Division I in 1977) and to significantly-improved performances.

**No.4:** We also take the "Years of Coaching" into consideration. After all, as an old saying goes, "the older, the wiser".

Apart from these factors, we propose many other factors such as the assessment of coaches who go across two time periods, because there were no such events like National Championships before the establishment of NCAA. In addition, we propose the converting of scores in different Divisions so that we can make an overall consideration of All-Division coaches.

For those outstanding coaches who have already gained public approval, we add bonus to their scores. The bonus includes honors such as Coach of the Year Award and Hall of Fame.

Finally, we design a model to predict the future achievement of coaches by employing the statistical analysis of the present data of the top coaches.

By applying our model, we rank the Top5 best coaches in three different sports (basketball, football and baseball). The Top5 college men's basketball coaches are:

- 1. John Wooden:** Wooden's team won an unprecedented 10 national championships in his 27 years as the Bruins' head coach, which promised him the first place.
- 2. Adolph Rupp:** With a super high win-loss percentage, 4 national championships and 41 tournament champions, Rupp has got himself the second place.
- 3. Mike Krzyzewski:** His third place owes to the perfect performance in every aspect.
- 4. Jim Boeheim:** His performance is similar to Krzyzewski's (with fewer national champions), except his poor contribution to his team (resulting in his lower ranking).
- 5. Dean Smith:** Poor contribution to the team limits his chance of becoming the best.

The Top5 college football coaches are:

- 1. Paul "Bear" Bryant:** Highly experienced in coaching, great number of wins and national champions (6 in total), outstanding number of bowl champions and conference champions.
- 2. Bobby Bowden:** 44 years of coaching experience, in spite of 2 national champions, he won 21 bowl champions, which promised him the second place
- 3. Woody Hayes:** Poor number of wins is a drawback for Hayes, but his five national champions result in the third place.
- 4. Joe Paterno:** 46 years of coaching and great number of wins get him No.4.
- 5. Tom Osborne:** Despite an average performance in all aspects, the outstanding win-loss percentage of 0.836 wins him the fifth place.

The Top5 college baseball coaches are:

- 1. Don Schaly:** Outstanding number of wins, win-loss percentage and conference champions make up for the lack of national champions and wins him No.1.
- 2. Raoul "Rod" Dedeaux:** Upper intermediate years of coaching, number of wins and win-loss percentage along with great priority in the number of champions (compared to Schaly) gets him No.2.
- 3. Augie Garrido:** In spite of fewer conference champions, Garrido performs well in all other aspects and therefore ranks third.
- 4. Gordie Gillespie:** Greatest number of wins along with average performance in all other aspects ranks him forth.
- 5. Cliff Gustafson:** Great performance in all aspects apart from fewer years of coaching wins him the fifth place.

## Appendix

### Questionnaire on Judging a Coach

Dear friend,

*This questionnaire is desired to figure out your opinion on judging whether a coach is qualified or not according to your consideration of ranking in the order of importance, i.e. from the most important to the least important.*

1. The Number of Championships (including tournament and national championships)
2. The Number of Wins
3. Win-Loss Percentage
4. Years of Coaching
5. Contribution to the Team

Your order of importance: \_\_\_\_\_

Thank you for your cooperation!