Ranking Cricket Teams through Runs and Wickets

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Abstract. Teams are ranked to show their authority over each other. The International Cricket Council (ICC) ranks the cricket teams using an ad-hoc points system entirely based on the winning and losing of matches. In this paper, adoptions of PageRank and h-index are proposed for ranking teams to overcome the weakness of ICC ad-hoc point system. The intuition is to get more points for a team winning from a stronger team than winning from a weaker team by considering the number of runs and wickets also in addition to just winning and losing matches. The results show that proposed ranking methods provide quite promising insights of one day and test team rankings.

Keywords: indexing, ranking, cricket teams, runs and wickets

1 Introduction

Sports ratings are performed for showing the standings of different teams and players by analyzing the results of competitions or matches. The team with the highest points is usually ranked number 1. Traditional sports rankings are based on win, loss or tie ratios or polls which are subjective rating of the teams, such as, ICC cricket rankings are based on many ad-hoc rules [14]. Borooah and Mangan [2], criticized that current point system based ranking schemes are opaque, so the methods used by ICC for rankings of cricket teams and players still needs to be investigated properly to provide better ranking methods.

State-of-the-art indexing and ranking algorithms such as h-index [8] and PageRank [12] can be adopted to rank cricket teams. The number of runs and wickets from which matches are won can be thought of as citations. The intuition is that the more the average number of runs or wickets from which matches are won by a team the higher the team-index (our proposed method) he has. PageRank is an iterative algorithm [12] which was used to rank web pages on the basis of inlinks and the importance of those pages that are providing those inlinks. The nodes in a graph can be taken as teams and the links between them are the matches played between them. If a team A wins from another team B, team B will provide an inlink to team A. In this way a directed graph is built which can be used to rank teams by considering graph weightage in addition the simply considering the number of won or lost matches.

We propose Team-index (t-index) T-index considers only the number of runs and wickets from which matches are won, while the strength and weakness of the teams from which a team wins is ignored. Consequently, to consider the strength and weakness of teams from which a team wins we propose TeamRank (TR) which is an adoption of PageRank [12]. The intuition is that the more a team wins matches from the stronger teams the higher it will be ranked, while it ignores the number of runs and wickets from which matches are won. Consequently, we propose weighted TeamRank (WTR) which also considers the weight of number of runs and wickets from which as teams. The results and discussions prove that our proposed methods are useful and should be used to rank cricket teams.

The contributions in this work are as follows, (1) proposal of graph and non-graph weightage based ranking algorithms for cricket teams ranking, (2) addition of number of runs and wickets instead of simply using match won or lost information and (3) hybridization of non-graph weightage and graph weightage based ranking algorithms to provide a unified solution.

2 Cricket Teams Ranking

In this section, before describing our proposed (1) Team-Index, (2) Simple Team Rank, (3) Weighted Team Rank, and (4) Unified Weighted Team Rank methods, we briefly introduce related ICC ranking method [14] for ranking cricket teams.

2.1 ICC Cricket Teams Ranking System

The international governing body of cricket is international Cricket Council (ICC). ICC awards championship trophies to the teams with highest ratings in both ODI and test matches. Test cricket matches can last up to five days with each day broken into three sections punctuated by lunch and tea breaks. ODI cricket matches are the faster alternative, typically completed in one day, and with a maximum of 50 over's permitted per team. An "over" is defined as a set of six balls bowled consecutively. The ICC employs ratings formulas for both leagues to determine a champion [14].

2.1.1 Test Matches

- i. Add one point to a team for winning a match, after a series between two teams; add a half-point to both teams for drawing a match. Add a bonus point to the team that won the series; add a half-point to each team if the series ended in a draw.
- ii. Multiply the team's series result by 50 points more than the opponent's rating, if the ratings gap between the two teams was less than 40 points at the start of the series. Then add that total to the opponent's series result multiplied by 50 points less than the opponent's rating.
- iii. Multiply the stronger team's series result by 10 points more than their own rating (if the ratings gap was equal to or more than 40 points), then add that total to the opponent's series result multiplied by 90 points less than the team's own rating. The weaker team multiplies its series result by 90 points

more than their own rating, and then adds that total to the opponent's series result multiplied by 10 points less than the team's rating.

- iv. Add the new point's totals to the team's points total before the series began. Remove points from matches that no longer fall within the past three years. Update the number of matches by adding one more than the number of games in a series. For example, if a series lasted two matches, you would add three matches to the total.
- v. Divide the updated points total by the updated match total. This represents the team's rating, and comparisons of ratings will yield the team's ranking [14].

2.1.2 ODI Matches

- i. Add one point to a team for winning the match, after a series between two teams, and a half-point to each team for a draw.
- ii. Score 50 points more than the opponent's rating for the winner if the gap between the two teams at the outset of the match was less than 40 points. Score 50 points fewer than the opponent's rating. In case of a tie, each team scores the opponent's rating.
- iii. Score 10 points more than the stronger team's rating in a win or 90 points fewer than its rating in a loss (if the gap between teams' ratings was more than or equal to 40 points). The weaker team scores 90 points more than its rating for a win or 10 points fewer than its rating for a loss. For ties, the stronger team scores 40 points fewer than its rating and the weaker team scores 40 points more than its rating.
- iv. Add the new point totals to the existing point total for each team before the series started. Update the match numbers, as well. Throw out all points and matches that no longer fall within the last three years.
- v. Divide the new points total by the new matches' total. This will provide the rating for each team, and ratings comparisons will order the teams into rankings [14].

2.2 Team-Index (T-Index)

Our first proposed method T-index is an adoption of h-index [8]. In T-index like hindex teams are referred to as author's and papers as number of runs and wickets from which matches are won by the team. The idea is that if a team wins matches from more number of runs and wickets the higher the t-index the team will have.

We take an example of a team A which played 15 matches in total from which 7 matches are won by runs and 8 matches are won by wickets. Here, it is necessary to mention that in cricket game one team bat first and score runs while other team bowls. So in case team batting first wins it wins from runs while in case team batting second wins it wins from wickets. This is why teams can win from runs and wickets both in different matches. Table 1(a) and Table 1(b) for team A are used to calculate its T-index as follows.

 Table 1(a). Matches won from wickets

Table 1(b). Matches won from runs

T1		T2	
No. of Matches	No. of Wickets	No. of Matches	No. of Runs
1	10	1	138
2	9	2	99
3	8	3	86
4	8	4	84
5	7	5	52
6	2	6	6
7	3	7	5
8	1	Total	470
Total	48	·	

$$T - \text{index} = \frac{\sqrt{T1 + T2}}{2} = \frac{\sqrt{3.46 + 10.83}}{2}$$

$$= \frac{14.88}{2} = 7.14$$
(1)

T1 =
$$\frac{\sqrt{\text{Total no. of wickets}}}{2} = \frac{\sqrt{48}}{2} = \frac{6.928}{2} = 3.46$$

T2 = $\frac{\sqrt{\text{Total no. of runs}}}{2} = \frac{\sqrt{470}}{2} = \frac{21.68}{2} = 10.83$

2.3 TeamRank (TR)

Our second proposed method TR is an adoption of page rank algorithm. PageRank [12] is considered as one of the most important graph based page ranking algorithms on the web. TR of a team should be high if the team wins many matches from other teams and those teams are strong (those teams also had won many matches). TR is calculated by using the following formula.

$$TR(A) = \frac{1 - d}{N} + d\left[\frac{TR(T_i)}{CT_i} + \dots + \frac{TR(T_n)}{CT_n}\right]$$
(2)

Where, TR(A) is the TeamRank of Team A, $TR(T_i)$ is the TeamRank of Teams T_i which link (lose matches) to Team A, CT_i is the number of outlinks (matches lost) by team T_i , d is a damping factor which can be set between 0 and 1, and N is total number of teams. Here inlinks refer to the matches won say a team has won 10 matches then inlinks will be 10 and outlinks refer to the matches lost from another team say a team lost 14 matches then outlinks will be 14.

2.4 Weighted Team Rank (WTR)

Our third proposed method is a weight based enhancement in TR. Assigns larger rank values to stronger teams instead of dividing the rank value of a team evenly among it's outlink matches. Instead of only considering the number of matches we do in TR we also consider the number of runs and wickets from which the matches are lost. The idea is that if a team lost matches from more runs and wickets will contribute less to the rank of the team being ranked.

An example is provided to show how the parameter of runs and wickets impact the ranking of teams. Suppose we have two teams A and B with same number of lost matches 10. If the sum of the runs from which team A lost those 10 matches is 200 and sum of the wickets is 30 and the sum of the runs from which team B lost those matches is 100 and sum of the wickets is 15. It will have different rank scores of teams. As in the following example we can see that when both Team A and B has lost same number of matches they have same scores 0.1 while contributing to some other teams from which they have lost matches. But when runs and wickets are considered we can see that Team A has rank score of 0.056 while Team B has rank score 0.061 which is higher as compared to Team A. We can see that team has lost matches from more runs or wickets is 30 while Team B, as Team A's lost matches runs sum is 200 and sum of wickets is 30 while Team B is lost matches runs sum is 100 and sum of wickets it contributes less score to the team from which the team has lost matches. WTR is calculated by using Eq. 3.

Table 2 (a): Team Rank scores contribution when runs and wickets are ignored

Team A
 Team B

$$\frac{1}{10} = 0.1$$
 $\frac{1}{10} = 0.1$

Table 1	2 (b):	Team Rank	scores contribut	ion when runs a	and wickets are	considered
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Team A	Team B	
$\frac{1}{\frac{60(10)+20(200)+20(30)}{60+200+30}} = 0.056$	$\frac{1}{\frac{60(10)+20(100)+20(15)}{60+100+15}} = 0.061$	
$WTR(A) = \frac{1-d}{N} + \frac{1-d}{$	$d\sum \frac{WTR(T_i)}{WC(T_i)}$	(3)

Where, WTR(A) is the weighted TeamRank of Team A, $WTR(T_i)$ is the TeamRank of Teams T_i which have lost matches to Team A, $WC(T_i)$ is the number of outlinks (matches lost) by team T_i , in order to calculate $WC(T_i)$ (weighted outlinks) we use weighted arithmetic mean formula given in Eq. 4. One can try different weights for matches, runs and wickets such as (50(matches), 25(runs), 25(wickets)) or (40(matches), 30(runs), 30(wickets)). We used 60% weigtage for match result as it is important to win or lose as compared to number of runs or wickets whose weightage is 20% and 20%, respectively used in this work.

$$Weighted \ Outlinks = \frac{60(matches) + 20(runs) + 20(wickets)}{matches + runs + wickets}$$
(4)

2.5 Unified Weighted Team Rank (UWTR)

Our proposed fourth method UWTR is hybridization of t-index and WTR methods. UWTR combines the power of a team in terms of winning number of matches in terms of runs and wickets without considering graph weightage (t-index) and power of a team in terms of the power of the teams from which those matches are won with considering graph weightage. UWTR is calculated by using Eq. 5, where, WT_j is the T-index of the team for which we are calculating the rank and $\sum_{t=1}^{N} WT_i$ is the sum of t-index of all teams.

$$UWTR = \frac{1-d}{N} \left(\frac{WT_j}{\sum_{t=1}^N WT_i} \right) + d \sum \frac{WTR(T_i)}{WC(T_i)}$$
(5)

3 Experimental

3.1 Dataset

The dataset for experiments is taken from the cricinfo web site [15] from 2000 to March 2012 and ICC cricket rankings point system of ODI and test matches is taken as existing method. There are ten teams which has been given the test status by ICC. Teams are categorized into strong and weak teams on the basis of opinions about their performance. Strong teams are Australia, India, Pakistan, South Africa, Sri Lanka, West Indies, England, New Zealand and weak teams are Zimbabwe, Bangladesh.

Here it is necessary to mention that there exists no Gold Standard dataset with which the ranking results of existing and our proposed methods can be compared to find accuracy in terms of precision, recall or f-measure. Consequently, the results of our proposed methods are subjectively compared with the existing ICC rankings to show their effectiveness. The subjective discussions are performed with the help of several cricket team players of our university.

3.2 Results and Discussions

3.2.1 One Day International Matches

One day international team's rankings are provided in Table 3. T-index is used to rank teams by considering the number of runs and wickets from which the teams have won matches. The top 3 teams ranked by ICC ranking are Australia, South Africa and India, respectively. The top ranked team for t-index is also Australia with clear difference of score in comparison to other teams at number 2 and 3, which is same as ICC cricket ranking. While the second team ranked is South Africa and third team is

Sri Lanka which is not same as ICC rankings. The Indian team is ranked 5th by t-index due to winning from less number of runs and wickets from other teams as compared to Sri Lanka which have won matches from more wickets and runs as compared to India so is ranked 3rd.

Australia again stands first by our second method TR, which is same position given in ICC rankings. But by point system India is ranked 3rd while by TR method India is ranked at number 2nd. By analyzing data we have found that Indian team has won more matches against strong teams like Australia, Pakistan, South Africa and Sri Lanka as compared to South Africa. So the inlinks weights by winning from stronger teams are more for India as compared to South Africa. Pakistan and Sri Lanka are also ranked higher by TR as compared to South Africa due to their most winnings from stronger teams.

By applying our proposed third WTR method we got different results as from simple team rank method. By this method South Africa ranked first, Sri Lanka is second and Australia is ranked third because we are calculating weight-age of each team against other team by considering number of runs and wickets from which matches are won. South Africa has won more matches from weaker teams resulted in winning matches from large number of runs and wickets so is ranked number one.

As unified team rank is the combination of two techniques which are team index and weighted team rank, for ODI matches Australia hold first position, South Africa and Sri Lanka on second and third and so on. One can see that rankings provided by t-index and UWTR are same for all teams which shows that considering runs and wickets are both useful though similar results are obtained when graph based strength or weakness of teams is considered. For our proposed all methods England team is ranked 6th or 7th due to winning from less runs and wickets.

			IC					
			TEAM	MATCH	POINTS	RATING		
		1	Australia	49	6030	123		
		2	South Africa	30	3549	118		
		3	India	55	6409	117		
		4	England	40	4469	112		
		5	Sri Lanka	55	6111	111		
		6	Pakistan	48	4989	104		
		7	New Zealand	31	2667	86		
		8	West Indies	33	2814	85		
		9	Bangladesh	36	2408	67		
		10	Zimbabwe	33	1511	46		
TEAM INDEX		TI	TEAM RANK		WEIGHTED TEAM RANK		UNIFIED TEAM RANK	
Australia	3.80789	Austral	ia 0.13385	7 South	n Africa	0.0512701	Australia	0.00630054
South Africa	3.53553	India	0.12169	4 Sri	Lanka	0.0512691	South Africa	0.00586111
Sri Lanka	3.53550	Pakista	n 0.11942	2 Aus	tralia	0.0512602	Sri Lanka	0.00586098
Pakistan	3.4641	Sri Lan	ka 0.11424	l Iı	ndia	0.0512553	Pakistan	0.00573821
India	3.3541	South Afi	rica 0.11073	3 New 2	Zealand	0.0512466	India	0.00556624
New Zealand	3.08221	New Zeal	and 0.0981	En	gland	0.0512424	New Zealand	0.00512497
England	2.95804	Englan	d 0.094605	53 Pal	cistan	0.051204	England	0.00492394
West Indies	2.78388	West Ind	lies 0.08172	3 West	Indies	0.0511923	West Indies	0.00463663
Bangladesh	2.17945	Zimbab	we 0.063681	2 Bang	gladesh	0.0509535	Bangladesh	0.00363257
Zimbabwe	2.12132	Banglade	esh 0.061944	13 Zim	babwe	0.0508243	Zimbabwe	0.00352188

Table 3. Teams Ranking W.R.T ODIS

3.2.2 Test Matches

Test teams rankings are provided in Table 4. Test match is played for five days in which each team can play two innings. The teams can win from wickets and runs and sometime even one innings plus some wickets or runs. T-index is used to rank test teams by considering the number of runs and wickets from which the teams have won matches. The top 3 teams ranked by ICC ranking are England, South Africa and Australia, respectively. The top ranked teams for t-index are Australia, England and Sri Lanka in which Australia with clear difference of score in comparison to teams at 2nd and 3rd number, which is different from ICC cricket rankings in which England is ranked number 1. The south African team is ranked 6th by t-index due to winning from less number of runs and wickets from other teams as compared to South Africa so is ranked 3rd.

Table 4. Teams Ranking W.R.T Tests

			ICC RANKING - TEST MATCH						
			TEAM	I MA	тсн	POINTS	RATING	-	
		1	Englan	d	48	5614	117	-	
		2	South Afi	rica	32	3709	116		
		3	Austral	ia -	46	5153	112		
		4	India		46	5103	111		
		5	Pakista	n	35	3781	108		
		6	Sri Lanl	ka	38	3780	99		
		7	West Ind	lies	38	3212	85		
		8	New Zeak	and	28	2366	85		
		9	Banglade	esh	18	135	8		
TEAM INDEX		TEAMRANK			WEI	WEIGHTED TEAM RANK		UNIFIED TEAM RANK	
Australia	3.7081	Au	Istralia	0.158223]	India	0.0515155	Australia	0.00692822
England	3.31662	E	ngland	0.136533	E	ngland	0.0515	England	0.0062163
Sri Lanka	3.20156	Sou	h Africa	0.122923	Aı	ustralia	0.0514915	Sri Lanka	0.00598051
Pakistan	3	1	India	0.11662	Sout	th Africa	0.0514199	Pakistan	0.0056282
India	2.95804	Sri	Lanka	0.0968203	Pa	akistan	0.0514129	India	0.00556456
South Africa	2.95804	Pa	kistan	0.0959763	New	/Zealand	0.0513838	South Africa	0.00555422
New Zealand	2.69258	New	Zealand	0.08725	Sri	i Lanka	0.0513102	New Zealand	0.00506361
West Indies	2.34521	We	st Indies	0.0746774	We	st Indies	0.0511389	West Indies	0.00440602
Zimbabwe	1.65831	Zin	nbabwe	0.0587397	Zin	nbabwe	0.0503121	Zimbabwe	0.00305885
Bangladesh	1.5	Bar	gladesh	0.0522367	Bar	ngladesh	0.0502923	Bangladesh	0.00276505

Australia again stands first by our second method TR, which is different from ICC rankings in which England is ranked first. But by point system South Africa is ranked 2nd while by TR method South Africa is ranked at number 6 and Sri Lanka is ranked at number 3. The data analysis explains that Sri Lanka team has won more matches against strong teams like Australia, India, Pakistan and South Africa as compared to South Africa. Even Indian and Pakistani team is ranked higher due to winning matches from strong teams. So the in link weights by winning from stronger teams are more for Australia and Sri Lanka as compared to South Africa.

By applying our proposed third WTR method we got different results as from simple team rank method and WTR results for ODI matches. By this method India is ranked first, England is ranked second and Australia is ranked third because we are calculating weight-age of each team against other team by considering number of runs and wickets from which matches are won. India has won more matches from weaker teams resulted in winning matches from large number of runs and wickets so is ranked number one.

As unified team rank is the combination of two techniques which are team index and weighted team rank for test matches. Australia holds first position, England and Sri Lanka on second and third, respectively and so on. One can see that rankings provided by t-index and UWTR are same for all teams which shows that considering runs and wickets are both useful though similar results are obtained when graph based strength or weakness of teams is considered. For our proposed all methods Australian team is ranked number one for both ODI and Test matches due to winning from more runs and wickets as well as from stronger teams. The results for WTR method are a bit different though in which other teams are ranked on top.

4 Related Work

H-Index [8] and G-index [6] was proposed for scientist's productivity indexing in coauthor networks. Both h-index and g-index ignored number of years in which the scientist has published papers, so Burrell [4] proposed m-quotient by including career length in existing indexing h-index.

PageRank [12] was first used for ranking web pages. It provides query independent importance of web pages. Consequently, for results dependent on query based importance topic-sensitive PageRank is proposed [7]. The main idea was to rank web pages on the basis of same topic web pages linking to them and their importance on that topic. The problem of treating all links equally when rank scores are being calculated is raised and Weighted PageRank Algorithm was proposed [13]. It takes both inlinks and outlinks importance into account and distributes rank scores based on the popularity of web pages and showed better performance. Bundit et al., [10] highlighted the time factor importance in order to find authoritative web pages and proposed Time-Weighted PageRank. PageRank was applied to many domains other than ranking of web pages, such as; a Personalized PageRank [9] is proposed to analyze protein interaction networks.

A few social network analysis researchers' interest is also attracted by crickets' popularity. Bailey and Clarke [1], investigated the inefficiencies occurred in market in player head to head betting for 2003 cricket world cup. Bracewell and Ruggiero [3] have shown interest in performance monitoring of an individual batsman's performance in different matches by using a parametric control chart. Duchet al., [5] have used social network analysis based network approach which is applied for quantifying individual soccer players performance. An initial effort is made to apply PageRank [12] to teams and captains ranking in cricket [11]. Unfortunately, they have not considered h-index based researcher productivity methods for ranking cricket teams and also ignored the number of runs and wickets parameters for both graph and non-graph based weightage methods.

5 Conclusions

This work concludes that number of runs and wickets from which team wins are important and affect teams ranking. The weightage factor is also important when two teams' wins similar number of matched from similar kind of opponents. The hybridization of h-index and PageRank based methods for ranking cricket teams is also effective as it considers graph, non graph weightage as well as number of runs and wickets for both. Similar methods can be applied to T20 matches.

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