

Profile Based Team Captain Recommendation System

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Abstract- The selection of a team captain is dependent on the performance, discipline of players in terms of various parameters in the concerned sports. In this paper we propose a new research task of captain recommendation system along with an approach for recommending a future team captain. The idea is to match profiles of all candidates of captaincy with an ideal captain profile and the one having the highest similarity can be recommended as a captain. We use principal component analysis for this purpose. A real world dataset of more than 76 Captain of different countries is taken from Cricinfo – the world's largest database for game of cricket having information about 50000 players from all over the world.

Keywords- Recommendation Systems, Prediction, Cricket

I. INTRODUCTION

The decision support systems (DSS) are such automated systems that are supposed to support decision making activities within an organization. Such systems provide great deal of help on several levels of management and help improving business operations. Decision support systems can totally be independent without any human involvement or they can be under supervision of some human or there can be some systems that are combination of both types. Such intelligent systems are need of the time and are becoming part of each organization of each domain of real world. Sports are a broad domain where different intelligent systems are being used for different objectives. For example, cricket is one the game where use of technology is superseding the human involved. The use of Hawk-eye, hot-spot and Decision Review System (DRS) has big impact on results of the game [1]. It has been reported that these technologies have proven their worth in making on-field decisions. However, technology is also helping cricket for taking off-field decisions. For example, use of bio-mechanical labs for checking action of bowlers to decide if they have a valid action. This technology also helps in improving playing techniques of batsmen. This work aims to bring this use of technology to a next level

where we plan to help decision makers to decide who should be the future captain of a team? Idea is to propose the team management possibly with a list of strong candidates with suggestion of the strongest candidate for captaincy. The basic idea is to build an ideal profile from existing captain's profiles and then suggest a future captain based on his similarity with the ideal profile. Major contribution of this paper include the formulation of a new research task (i.e. predicting a team captain using textual profiles), providing a data collection and performing experiments obtaining results of this task.

In any team game, it is always critical to choose a captain who is not only exemplary for the team members but also has the capability of managing team members well. However, it is not a very easy decision to make and is always prone to political and personal biasness, favoritism and poor insight of the game. The objective of this work is to predict the future captain of a team by finding its similarity with profile of previous captains. The purpose is not to choose a captain automatically when previous is relinquished but the objective is to provide a support to decision makers by providing them a list of promising players who based on their similarity with existing or previous captains can play the role of captain. For this purpose, we propose to build an ideal captain profile. The profile of a player is statistically matched with this ideal profile and player with the most similarity is predicted as a future captain. Block diagram of the system is shown in figure 1. In first step, Data collection is pre-processed and then profile of an ideal captain is created out of pre-processed data. Later on, a match is made between an ideal captain profile and candidate profile to predict whether that candidate can be chosen as a captain or not.

This method of determining a team captain involves a deep analysis of existing or previous captain profiles. These descriptive profiles (see figures 2 to 7) contain detailed information about the player from his demographic information to his understanding of the game and playing style. We strongly believe that these profiles contain enough information to help choose a team's captain. This method of suggesting a captain poses many challenges, for example:

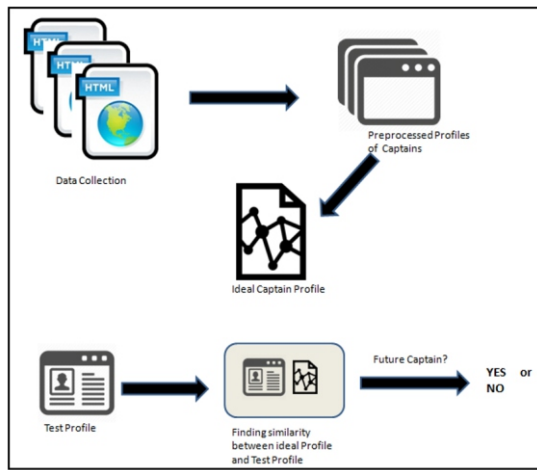


Figure 1: Figure describing the System

- To choose a set of keywords describing player of a profile,
- To create an ideal profile from a set of profiles,
- To find a way to match the profiles to select a future captain.

In the rest of the paper, we describe how we cope with these challenges. In next section, we discuss some related work. In section III, we provide some information about our data source and in section IV, we discuss our experiments and results. We end our paper with conclusion of our work.

II. RELATED WORK

Unfortunately, we have not found any similar kind of work in the literature i.e. a work on prediction of team's future captain. However, we discuss some works that are not exactly relevant to our work but can be discussed because somehow they use data mining techniques in sports field. It has been observed that most of the related work deals with selection and ranking of players [3, 4, 5, 6] while others have work on prediction of a team performance [7, 8, 9] and many others have attempted to improve the spirit of the game [10, 11, 12].

A. Selection and Ranking of Players

This category of related works deals with selection and ranking of players of a team according to their performances in previous games. [6] use PCA (Principal Component Analysis) for ranking captains of different teams by choosing some parameters like win-lose ratio and other on-field performances. [3] describes about the player performance of T20 cricket. The authors mainly focus on T20 cricket and normally when there are not enough matches played. The authors derived a new formula for such situations, their formula ranked the players either they are batsman or bowler. They measure the performance in case of small number of matches. According to the authors, if ordinary

measurement will be used in small number of matches, then we can't get fruitful results. [4] mainly focuses on batting performance using Moving Range Control Chart and Individual player ranking. They choose some top ranked players and after performing different types of calculations and analysis, they compare the performance of players. The work presented in [5] focuses on IPL Competition. The authors perform component analysis on sports data. Specially, the authors discuss the application of PC (Principal Components) in cricket players ranking. Faez Ahmed and co-authors [13] focus on player's selection in cricket by reducing the budget. They introduce a new scheme named "Novel Representation" and multi objective approach was also used based on NSGA-II algorithm. This new formulation is also introduced by the authors of this research. They suggest a multi criteria approach for team selection. The work method is simple and generic and can be easily implemented in other sports like baseball, soccer and like games. Dr. Parag Shah and co-authors [14] introduce a new formulation named "Pressure Index" for player's evaluation in terms of performance under pressure time. This new measure measures the pressure under which a batsman is playing. Gurshan Singh et. Al. [15, 16] ranks players by measuring their performances using fuzzy logic. [17] uses data mining technique to select player. Their association rule based analysis reveals the performance of Indian cricketers. They also suggest that this same methodology can be applied for cricket players from other teams.

B. Prediction of Team Performance

[7] proposed a system determined to predict the score of first innings of a match and a single batsman. They use linear regression technique for this purpose. [8] work on prediction of selected players for a particular match. This is applied for selection of bowlers as well as batsmen. They use several features like number of innings played, batting average, strike rate, etc for batsmen selection while number of innings, number of over, bowling average, etc for bowler selection. All these features are fed to several machine learning algorithms like Naive Bayes, Decision Tree, Random Forest and Support Vector Machines where Random Forest classifier gives the best performance for both bowlers and batsmen.

[9] proposed a Linear Regression based solution to predict the performance of a team based on the past performance of its players who have appeared most for the team. They compute features like home team, away team, stadium, toss winner, toss decision, home-team-weightage and away-team-weightage which are fed to a Random Forest Classifier to train the model and make a prediction on unseen matches.

C. Miscellaneous Work

Besides work on evaluation of performance of players

and prediction of game results, a lot of work exists for various tasks as defined by research community and in this sub-section we will discuss some noticeable attempts. A wide variety of works from injuries to political reviews can surprise anyone because of the scope of attention this game of cricket is getting in research. [18] focuses on “follow-on” decision in test cricket. They collected 391 test matches records from 1997 to 2007. They describe how different strategy about declaration of players varies from one innings to second. According to the authors, as matches' progress, their defined variable also increases from 44 percent to 80 percent at the end of third innings. Authors of [19] develop a model to predict the player performance as a function of certain characteristics related to the player, the team and the match series.

A linear model is proposed in this work with conclusion that a player's performance is significantly affected by his team rankings. Authors of [10] highlight the various region-wise injuries sustained in cricket along with their epidemiology, biomechanics, treatment, and prevention. The work in [11] criticizes the lack of projection female cricketers get in electronic and social media. They highlight the aspects where research in female participation cricket need to be explored. [12] discusses political aspects and related problems of cricket.

We have seen that current literature regarding cricket is very much diverse in their tasks however many people have worked on selection and ranking of players and our work can be considered in this category too.

III. CRICINFO – THE LARGEST CRICKETING DATABASE

Cricinfo is a collection of thousands of player's records about their bating and bowling. Our main focus is on the data that is provided in profiles of players (i.e. figure 7). This data is about the history, nature, player positive points and negative points like a little story of every player.

A. Cricinfo Player Profile

A player profile in *cricinfo* consists of 6 parts i.e. his bio-data, batting and fielding averages, bowling averages, career statistics, recent matches and profile.

Table 1: Background of the player

Full name Saqlain Mushtaq	
Born December 29, 1976, Lahore, Punjab	
Current age 42 years 300 days	
Major teams Ireland, Pakistan, Islamabad Cricket Association, Lahore Badshahs, Pakistan International Airlines, Surrey, Sussex	
Playing role Bowler	
Batting style Right-hand bat	
Bowling style Right-arm offbreak	

Profile of a player is general description about the player indicating his positive and negative points. It mostly contains adjectives and verbs about his style of batting or bowling and the way he perceives the game. Tables 1 to 6 describe complete profile of a Pakistan cricketer **Saqlain Mushtaq** as found on Cricinfo.

Table 2: Batting and Fielding averages of the player

	Mat	Inns	NO	Runs	HS	Ave	BF
Tests	49	78	14	927	101*	14.48	3603
ODIs	169	98	38	711	37*	11.85	1434
First-Class	194	263	59	3405	101*	16.69	
List A	323	182	67	1339	38*	11.64	
T20s	9	4	0	24	14	6.00	

Table 3: Bowling averages of the player

	Mat	Inns	Balls	Runs	Wkts	BBi	BBM
Tests	49	86	14070	6206	208	8/164	10/155
ODIs	169	165	8770	6275	288	5/20	169
First-Class	194		44634	19630	833	8/65	194
List A	323		16062	11261	478	5/20	5/20
T20s	9	9	210	265	14	3/24	9

Table 4: Career Statistics of the player

Test Debut	Pakistan v Sri Lanka at Peshawar, Sep 8-11, 1995
Last Test	Pakistan v India at Multan, Mar 28-Apr 1, 2004
ODI Debut	Pakistan v Sri Lanka at Gujranwala, Sep 29, 1995
Last ODI	Pakistan v South Africa at Faisalabad, Oct 7, 2003
First-Class Debut	1994/95
Last First-Class	Surrey v Hampshire at The Oval, Sep 9-12, 2008
List A Debut	1994/95
Last List A	Surrey v Essex at The Oval, May 11, 2008
T20 Debut	Hampshire v Surrey at Southampton, Jun 24, 2003
Last T20	Essex v Surrey at Chelmsford, Jun 20, 2008

Table 5: List of Recent matches played by the player

Bat & Bowl	Team	Opposition	Ground	Match Date
1/12	Arabians	v Leo Lions	Dubai (DSC)	13 Feb 2016
0/21	Arabians	v Sagittarius	Dubai (DSC)	11 Feb 2016
1/42	Arabians	v Sagittarius	Sharjah	5 Feb 2016
1/9	Arabians	v Commanders	Sharjah	3 Feb 2016
0/18	Arabians	v Leo Lions	Dubai (DSC)	30 Jan 2016

Table 6: Descriptive profile of the player

A trend-setter. Saqlain Mushtaq was perhaps the first offspinner to master the *doosra*, a delivery that spins away from the batsman even though it is delivered with an *offspinner's* action. Saqlain has a fast, short-stepping action with a halting delivery, and has a propensity to bowl no-balls, unusually for a bowler with such a short run. He is criticised for attempting too much variation and he often throws in the *doosra* the first time a batsman faces. Saqlain's international career got off to a splendid start - he was the fastest bowler to 100 one-day wickets, and his phenomenal control meant that he regularly bowled at the death. But his finest moment arguably came in a Test match, at Chennai in 1998-99, when his ten-for allowed Pakistan to sneak nerve-tingling 12-run win against India. However, his stock has fallen a long way since then, with Shoaib Malik, a better batsman than Saqlain, usurping the spinner's spot in the ODI line-up and Danish Kaneria becoming the frontline Test spinner. Saqlain did get an opportunity to have a go at the Indians again in the 2003-04 series, but unflattering figures of 1 for 204 at Multan meant that he was quickly consigned to the scrap heap. He was unable to force his way back ahead of Danish Kaneria and he was blighted by injury after a prolific time with Surrey. However, his career was given a lifeline in 2007 when he joined Mushtaq Ahmed at Sussex and there was even talk of him qualifying for England. That could remain a distant dream, after signing a contract with the unsanctioned Indian Cricket League. Indeed, his ICL contract forced Surrey to sever ties with him after the 2008 season, ending his 11-year relationship with The Oval.

It can be seen in table 6 that descriptive profile summarizes the player's style of playing in a very detailed manner. This profile contains nouns, adjectives, adverbs and verbs describing the player. This makes it an ideal entity for our use in ambition to predict future captain.

IV. EXPERIMENTS

A. Data Pre-Processing

We select profile of 76 captains (existing or previous) for building an ideal profile. Descriptive profiles of selected captains are tagged with parts-of-speeches. As described earlier that players profiles contain positive or negative words to describe their qualities and shortcomings.

In table 10, all gathered data of captain are summarized in the form of total words in the profile as well as positive words. We use the most trusted lexicon WordNet [2] to extract list of positive words from each profile. It is to be noted that we decided to not to use negative words because it is very obvious that generally we look for positive aspects of a player when looking for a team captain.

B. Building Ideal Profile

We have a collection of positive words for each previous captain to build an ideal profile of a captain. We use principal component analysis (PCA) [20] to create an ideal profile from this set of profiles. PCA has been used in research for prediction related tasks [21,22] and therefore can be considered a reliable

method. The words collected from different profiles are used as factors and we provide scores to each word according to number of occurrences a word in each profile. We have two choices for building an ideal profile using PCA:

Based on Eigenvalues

In this approach, only those factors are chosen that have eigenvalue greater than the value provided. Default value for eigenvalue is 1.

Fixed Number of Factors

In this approach, we can specify number of factors by ourselves. This is suitable, when number of factors returned by the PCA are less or greater than our expected results.

When we analyze our data using Eigenvalue, it provides too few components. Only 73 components returned by this approach, which doesn't cover the existing variables or generally speaking, it skips the number of players. As we have 76 players, when extraction is applied to the positive words of 76 players, we have to miss 9 players and only 67 players qualify on the components or factors returned by this approach. Therefore, we use second approach which is suitable for our analysis. We test with different number of factors:

- when 100 components extraction is used, it skips the players (captains),
- 150 components extraction is used, it repeats the same,
- we apply 250 components extraction which gives satisfied results and all captain are covered using this number.

After Putting all the data in SPSS and then by reducing terms according to the second approach, when number of fixed factors set to 250, following outcomes obtained by SPSS (figure 2).

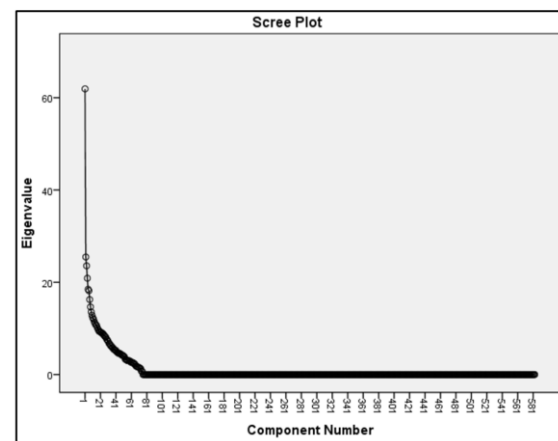


Figure 2: Plot between Eigen-value and Component numbers

C. Results

As each player or captain profile having different length, we have to equalize the number of positive words. For this, we used %age:

$$\text{Points} = \frac{\text{Positive Words in the Profile} \times 100}{\text{Total number of words in the profile}} \quad (1)$$

From the above tabular data, we can estimate threshold value. The maximum and minimum values found in captain's data are:

Table 7: Maximum and Minimum Values in Captains data

Minimum value	3.226
Maximum value	9.483

Hence, we decide to fix threshold value as same as minimum value i.e. 3.226. After building ideal profile and fixing a threshold value, now it's time to test our approach with non-captain data. For this purpose we select 15 random non-captain current players' profiles. After applying ideal profile to these non-captain players, we got the following point table (table 8) giving us the point of each player with relevant to the ideal profile.

Table 8: Player Data (Non-Captain)

Player Name	Total Words	Positive Words	Points
Hasan Raza	181	5	2.762
Azhar Ali	295	9	3.051
Umar Akmal	227	8	3.524
Pragyan Ojha	221	8	3.620
Steven Smith	474	18	3.797
Mohammad Amir	350	14	4.000
Kemar Andre Jamal Roach	182	8	4.396
Michael John Lumb	520	23	4.423
Usman Khawaja	185	9	4.865
Paul Adams	242	13	5.372
Balapuwaduge Ajantha Winslow Mendis	296	17	5.743
Hettige Don Rumesh Lahiru Thirimanne	213	13	6.103
Adam Voges	509	32	6.287
Sean Colin Williams	410	27	6.585
Rilee Roscoe Rossouw	105	9	8.571

These are the computed scores for non-captains players according to ideal profile matching. According to this data, players like Hasan Raza and Azhar Ali are less likely to be recommended for captains of the team. However, this data can only be confirmed when we compute data for the existing data to confirm the accuracy. Therefore, when we apply same on declared captains profile (see table 9), we get maximum of the

captains in the recommended domain of values confirming them as recommended captain, hence confirming the success of PCA.

V. CONCLUSIONS

We propose an approach for recommendation of team captain, a promising research task introduced in this paper. The basic idea behind this approach was to build an ideal profile based on previous or existing captain's profiles and the test if any candidate for captaincy relates to this idea profile to what extent. We use PCA for building ideal profile. We show that our profile successfully identify the captains. As part of our future work, we plan to use machine learning approach for the same purpose to identify some robust features for this task.

APPENDIX

Table 9: Captain Profiles Words with Positive Words in their Profiles

Sr #	Captain Name	Total Words in Profile	Positive Words in Profile
1	Mohammad Hafeez	309	15
2	Salman Butt	548	33
3	Waqar Younis Maitla	406	20
4	Saleem Malik	148	10
5	Sahibzada Mohammad Shahid Khan Afridi	354	14
6	Misbah-Ul-Haq Khan Niazi	347	14
7	Shoaib Malik	303	16
8	Wasim Akram	181	11
9	Syed Zaheer Abbas Kirmani	723	49
10	Intikhab Alam Khan	188	8
11	Saeed Anwar	189	16
12	Asif Iqbal Razvi	95	7
13	Imran Khan Niazi	308	20
14	Mohammad Javed Miandad Khan	585	34
15	Inzamam-Ul-Haq	682	22
16	Majid Jahangir Khan	168	10
17	Mohammad Moin Khan	180	9
18	Mushtaq Mohammad	137	9
19	Abdul Qadir Khan	144	10
20	Ramiz Hasan Raja	269	24
21	Rashid Latif	294	16
22	Mohammad Aamer Sohail Ali	151	9
23	Wasim Bari	359	29
24	Hanif Mohammad	134	7
25	Fazal Mahmood	471	20
26	Abdul Hafeez Kardar	422	28
27	Imtiaz Ahmed	116	11
28	David William Gregory	483	24
29	George Giffen	985	35
30	Clement Hill	906	45
31	Montague Alfred Noble	1598	68
32	Herbert Leslie Collins	266	15
33	Warren Bardsley	594	29
34	Victor York Richardson	309	12
35	Donald George Bradman	1025	53
36	Arthur Robert Morris	128	8
37	Raymond Russell Lindwall	983	54
38	Ian David Craig	186	11
39	Richard Benaud	175	11
40	Robert Neil Harvey	328	19
41	Ian Michael Chappell	131	8
42	Gregory Stephen Chappell	209	8

43	Allan Robert Border	266	9
44	Mark Anthony Taylor	182	14
45	Stephen Rodger Waugh	354	20
46	Adam Craig Gilchrist	570	26
47	Ricky Thomas Ponting	437	26
48	Michael John Clarke	354	33
49	Stephen Fleming	512	22
50	Arjuna Ranatunga	217	7
51	Muhammad Azharuddin	239	12
52	Ms Dhoni	585	28
53	Aarvinda De Silva	146	10
54	Hansie Cronje	2961	118
55	Brian Charles Lara	758	28
56	Sachin Tendulkar	554	29
57	Graeme Smith	448	28
58	Darren Sammy	511	19
59	Martin David Crowe	256	19
60	David Laud Houghton	124	8
61	Alistair Douglas Ross Campbell	325	26
62	Mahela Jayawardene	453	30
63	Kumar Sangakkara	425	25
64	Angelo Mathews	296	16
65	Mohammad Mushfiquir Rahim	433	17
66	Anil Kumble	507	24
67	Jimmy Adams	240	12
68	Graham Alan Gooch	314	11
69	Ian Botham	367	20
70	Clive Lloyd	1207	59
71	Andrew Strauss	593	22
72	Rahul Dravid	509	26
73	Sourav Ganguly	514	28
74	Alec Stewart	352	18
75	Stuart Broad	1025	45
76	Ab De Villiers	423	28

Table 10: Player Data (Captain's Profiles)

Captain Name	Positive Points	Total Words	Points
Inzamam-Ul-Haq	22	682	3.226
Arjuna Ranatunga	7	217	3.226
Allan Robert Border	9	266	3.383
Graham Alan Gooch	11	314	3.503
George Giffen	35	985	3.553
Brian Charles Lara	28	758	3.694
Andrew Strauss	22	593	3.710
Darren Sammy	19	511	3.718
Gregory Stephen Chappell	8	209	3.828
Victor York Richardson	12	309	3.883
Mohammad Mushfiquir Rahim	17	433	3.926
Sahibzada Mohammad Shahid Khan Afridi	14	354	3.955
Hansie Cronje	118	2961	3.985
Misbah-Ul-Haq Khan Niazi	14	347	4.035
Fazal Mahmood	20	471	4.246
Montague Alfred Noble	68	1598	4.255
Intikhab Alam Khan	8	188	4.255
Stephen Fleming	22	512	4.297
Stuart Broad	45	1025	4.390
Adam Craig Gilchrist	26	570	4.561
Anil Kumble	24	507	4.734
Ms Dhoni	28	585	4.786
Mohammad Hafeez	15	309	4.854
Warren Bardsley	29	594	4.882
Clive Lloyd	59	1207	4.888
Waqar Younis Maitla	20	406	4.926
Clement Hill	45	906	4.967
David William Gregory	24	483	4.969
Mohammad Moin Khan	9	180	5.000
Jimmy Adams	12	240	5.000
Muhammad Azharuddin	12	239	5.021
Rahul Dravid	26	509	5.108
Alec Stewart	18	352	5.114
Donald George Bradman	53	1025	5.171
Hanif Mohammad	7	134	5.224
Sachin Tendulkar	29	554	5.235
Shoaib Malik	16	303	5.281

Angelo Mathews	16	296	5.405
Rashid Latif	16	294	5.442
Sourav Ganguly	28	514	5.447
Ian Botham	20	367	5.450
Raymond Russell Lindwall	54	983	5.493
Herbert Leslie Collins	15	266	5.639
Stephen Rodger Waugh	20	354	5.650
Robert Neil Harvey	19	328	5.793
Mohammad Javed Miandad Khan	34	585	5.812
Kumar Sangakkara	25	425	5.882
Ian David Craig	11	186	5.914
Ricky Thomas Ponting	26	437	5.950
Majid Jahangir Khan	10	168	5.952
Mohammad Aamer Sohail Ali	9	151	5.960
Salman Butt	33	548	6.022
Wasim Akram	11	181	6.077
Ian Michael Chappell	8	131	6.107
Graeme Smith	28	448	6.250
Arthur Robert Morris	8	128	6.250
Richard Benaud	11	175	6.286
David Laud Houghton	8	124	6.452
Inran Khan Niazi	20	308	6.494
Mushtaq Mohammad	9	137	6.569
Ab De Villiers	28	423	6.619
Mahela Jayawardene	30	453	6.623
Abdul Hafeez Kardar	28	422	6.635
Saleem Malik	10	148	6.757
Syed Zaheer Abbas Kirmani	49	723	6.777
Aarvinda De Silva	10	146	6.849
Abdul Qadir Khan	10	144	6.944
Asif Iqbal Razvi	7	95	7.368
Martin David Crowe	19	256	7.422
Mark Anthony Taylor	14	182	7.692
Alistair Douglas Ross Campbell	26	325	8.000
Wasim Bari	29	359	8.078
Saeed Anwar	16	189	8.466
Ramiz Hasan Raja	24	269	8.922
Michael John Clarke	33	354	9.322
Imtiaz Ahmed	11	116	9.483

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