



# Quantifying individual performance in Cricket – A network analysis of batsmen and bowlers



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## HIGHLIGHTS

- We construct a network of batsmen as well as bowlers in a team sport – Cricket.
- Social network analysis on the networks.
- Construction of gradient networks.
- PageRank Algorithm to evaluate player performance.
- Captures the consensus opinions on player's performance according to ICC ranking.

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## ABSTRACT

Quantifying individual performance in the game of Cricket is critical for team selection in International matches. The number of runs scored by batsmen and wickets taken by bowlers serves as a natural way of quantifying the performance of a cricketer. Traditionally the batsmen and bowlers are rated on their batting or bowling average respectively. However, in a game like Cricket it is always important the manner in which one scores the runs or claims a wicket. Scoring runs against a strong bowling line-up or delivering a brilliant performance against a team with a strong batting line-up deserves more credit. A player's average is not able to capture this aspect of the game. In this paper we present a refined method to quantify the 'quality' of runs scored by a batsman or wickets taken by a bowler. We explore the application of Social Network Analysis (SNA) to rate the players in a team performance. We generate a directed and weighted network of batsmen–bowlers using the player-vs-player information available for Test cricket and ODI cricket. Additionally we generate a network of batsmen and bowlers based on the dismissal record of batsmen in the history of cricket—Test (1877–2011) and ODI (1971–2011). Our results show that *M. Muralitharan* is the most successful bowler in the history of Cricket. Our approach could potentially be applied in domestic matches to judge a player's performance which in turn paves the way for a balanced team selection for International matches.

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## 1. Introduction

Tools of Social Network Analysis (SNA) have been a subject of interest for theoretical as well as empirical studies of social systems [1–3]. A social network is a collection of people or groups interacting with each other and displaying complex features [4]. Tools of SNA provide a quantitative understanding for the human interaction of collective behavior. Considerable research has been done on scientific collaboration networks [5–8], boards of directors, movie–actor collaboration networks [3] and citation networks [9–13]. The use of network analysis not only provides a global view of the

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system, it also shows the complete list of interactions. In the world of sports, individual players interact with each other and also with the players in the opponent team. It is therefore important to study the effect of interactions on performance of a player.

In recent years there has been an increase in studies of quantitative analysis of individual performance involving team sports. Time series analysis has been applied to football [14,15], baseball [16,17], basketball [18–20] and soccer [21,22]. Quantifying the individual performance or ‘quality’ of a player in any sport is a matter of great importance for the selection of team members in international competitions and is a topic of recent interest [23,24]. A lot of negotiations are involved in the process of team-selection [25]. Studies have focused on non-linear modeling techniques like neural networks to rate an individual’s performance. For example, neural network techniques were used to predict the performance of individual cricketer’s based on their past performance [25]. Earlier tools of neural networks were used to model performance and rank NCAA college football teams [26], predicting javelin flights [27] and to recognize patterns in Table Tennis and Rowing [28]. Again, a model-free approach was developed to extract the outcome of a soccer match [29]. It was also shown that the statistics of ball touches presents power-law tails and can be described by  $q$ -gamma distributions [30]. In recent years, the study of complex networks has attracted a lot of research interest [1]. The tools of complex network analysis have previously been applied to quantify individual brilliance in sports and also to rank the individuals based on their performance. For example, a network approach was developed to quantify the performance of individual players in soccer [31]. Network analysis tools have been applied to football [32] and Brazilian soccer players [33]. Successful and un-successful performances in water polo have been quantified using a network-based approach [34]. Head-to-head matchups between Major League Baseball pitchers and batters was studied as a bipartite network [35]. More recently a network-based approach was developed to rank US college football teams [36], tennis players [37] and cricket teams and captains [38].

The complex features of numerous social systems are embedded in the inherent connectivity among system components [1,34]. Social network analysis (SNA) provides insight about the pattern of interaction among players and how it affects the success of a team [39]. This article points out how topological relations between players help better the understanding of individuals who play for their teams and thus elucidate the individual importance and impact of a player. In this paper we apply the tools of network analysis to batsmen and bowlers in cricket and quantify the ‘quality’ of an individual player. The advantage of a network based approach is that it provides a different perspective for judging the excellence of a player.

We take the case of individual performance of batsmen and bowlers in International Cricket matches. Cricket is a game played in most of the Commonwealth countries. The International Cricket Council (ICC) is the governing body which controls the cricketing events around the globe. Although the ICC includes 120 member countries, only ten countries with ‘Test’ status – Australia, England, India, South Africa, New Zealand, West Indies, Bangladesh, Zimbabwe, Pakistan and Sri Lanka – play the game extensively. There are three versions of the game – ‘Test’, One Day International (ODI) and Twenty20 (T20) formats. Test cricket is the longest format of the game dating back to 1877. Usually it lasts for five days involving 30–35 hours. Shorter formats, lasting almost 8 h like ODI started in 1971 and during late 2000 ICC introduced the shortest format called T20 cricket which lasts approximately 3 h [40].

Batsmen and Bowlers in Cricket are traditionally ranked according to their batting and bowling average respectively. Judged by the batting average, Sir Donald Bradman (with an average of 99.94) is regarded as the greatest batsman of all times. The next best batting average of 60.9 is held by Graeme Pollock. Even though most of the records held by Bradman have been eclipsed by modern day batsmen like Sachin Tendulkar, Brian Lara, Graham Gooch, and Mohammad Yusuf, Bradman’s legacy still survives and generates debate among fans about his greatness relative to recent players like Sir Vivian Richards, Brian Lara or Sachin Tendulkar. The question that thus naturally arises is whether the batting average of batsmen (or the bowling average of bowlers) is the best measure for judging the worth of a batsman (or a bowler). It was shown that rankings based on averages suffer from two defects—(i) Consistency of scores across innings and (ii) Value of runs scored by the player [41]. However, one should also consider the quality of bowling as well. For example according to Bradman himself, the greatest innings he ever witnessed was that of McCabe’s innings of 187 at Sydney in 1932. The reason being it came against Douglas Jardine’s body-line attack, widely regarded as one of the fiercest bowling attacks. Similarly, runs scored against West Indian bowlers like Michael Holding, Joel Garner, Malcolm Marshall and Andy Roberts deserve more credit than runs scored against the low bowling attack of Bangladesh or Zimbabwe. On similar arguments the wicket of top-order batsman is valued more than the wicket of a lower-order batsman. If a bowler claims the wicket of Bradman, Lara, Richards or Tendulkar, he gets more credit than if he dismisses any lower-order batsman. Under the usual ranking scheme based on bowling average, *George Lohmann* of England has the lowest (best) bowling average (10.75) in Test cricket. However, bowlers like *George Lohmann* played under pitch conditions favoring fast bowlers. Hence, batting (or bowling) average does not serve as an efficient gauge for a batsman’s (or bowler’s) ability [42]. Against this background, we propose a network based approach to quantify the ‘quality’ of a batsman or bowler. The rest of the paper is presented as follows. In Section 2 we propose the methods of link formation among the batsmen and bowlers. In Section 3 we discuss the results and we conclude in Section 4.

## 2. Methodology

We obtain data from the cricinfo website [43]. The website contains the information of proceedings of all Test matches played since 1877 and all ODI matches from 1971 onwards. These include the runs scored by batsmen, wickets taken by

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