International Journal of Physical Education, Health and Social Science (IJPEHSS)
www.ijpehss.org
Peer Reviewed, Indexed and UGC Approved Journal (48531)
ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02

PERFORMANCE EVALUATION OF CRICKETERS THROUGH FUZZY INFERENCE SYSTEM (FIS)

Dr. Mahesh Singh Dhapola, Assistant Professor
Mr. Debabrata Sarkar, Research Scholar
Department of Physical Education, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh
Dr. Gaurav Pant, Assistant Professor
Department of Physical Education, B.V.D.U., Pune, Maharashtra

ABSTRACT
Cricket is a bat-and-ball game played between two teams of 11 players each on a field at the center of which is a rectangular 22 yard long pitch.Each team takes its turn to bat, attempting to score runs, while the other team fields. The main objective of any team is to win the match. The result of a match is a win when one side scores more runs than the opposing side and all the innings of the team that has fewer runs have been completed. The performance evaluation in cricket is very critical issue in this game.Performance of players directly affects team`s and their ranking internationally. Hence, the success or failure of any team lies in the skills and abilities of the players that comprise the team.This paper proposed a new tool based on Fuzzy Inference System (FIS) to evaluate the performance of a cricket player. FIS is a process to formulate the mapping from given input to an output using fuzzy logic. Various new parameters are used in this tool which can make affect on the performances of players and can improve the quality of performance evaluation in cricket. This tool will be useful to make the ranking of players and for the selection of players based on performances.
Keywords: Cricket Players, Pitch, Ranking, Fuzzy Logic, Fuzzy Inference System and Performance Evaluation

INTRODUCTION
Cricket is one the most viewed sport now-a-days. Endearing in cricket rest on on numerousaspectslike home ground advantage, performances in the past matches, involvement of the players, performance at the preciseplace, performance against the exact team and the present formof the squad and the player. In the recent past lot of research has been done which processes the player performance and forecasts the engaging percentage of winning the game. The chief types of cricket matches are Test cricket (5 day`s; each day 90 Over), One day cricket (50 Over per Innings) and Twenty-20 (20 Over per Innings) cricket. The ICC is responsible for the organization and governance of cricket's major international tournaments. ICC is also responsible for the calculation of ranking of players, which depends on their performance. The ranking is calculated separately for test matches, ODIs and T20s, and also for batsman, bowler and all-rounder.
Performance of players is very crucial part of this game. Performance is evaluated on the foundation of some parameters such as total runs scored by batsman, strike rate and averages, wickets taken by a bowler, economy rate and bowling averages.But the rules for calculating the ranking are very vague and crisp, and therefore, the actual performance of player is not visible. The assessment of a player's performance is essential for given reasons:

- For international ranking of players.
- For team selections.
- To determine "Man of Match" and "Man of Series"
- To improve the playing techniques of players.

There are so many traditional tools used to evaluate the performance of players. Hansford and Kimber (1993) proposed a nonparametric approach based on runs scored for assessing batting performance.

Lemmer [2002] proposed a measure for assessing the performance of bowlers based on the three traditional performance statistics. Barr and Kantor [2004] proposed a measure based on the strike rate and batting average, and another one was defined by Lemmer (2002).

Askin and Sodhi (1994) have presented a novel method for organizing teams in concurrent engineering. They developed five different criteria for team formation and discussed team training, leadership, and computer support issues.

Zakarian and Kusiak (1999) proposed an analytical model for the selection of multi-functional teams. They used the analytic hierarchy process and the quality function deployment method to prioritize ''team membership'' based on customer requirements and product specifications.

Braha (2002) has proposed a team-building approach based on task partitioning by specifying task dependencies and partitioning the tasks among a number of teams. Chen and Lin (2004) proposed a team member model for the formation of a multi-functional team in concurrent engineering. They used the analytic hierarchy process and Myers–Briggs type indicators to model team member characteristics.

In the software development field, Gronau, Froming, Schmid, and Russbu ¨ldt (2006) developed an algorithm to propose a team composition for a specific task by analyzing the knowledge and skills of the employees.

In the project management field, Durmusoglu and Kulak (2008) proposed a team building process using axiomatic design principles. They proposed to establish teams by identifying the needed skills and preparing a skill development procedure to ensure maximum utilization of team members' talents. Feng, Jiang, Fan, and Fu (2010) proposed a member selection method in cross functional teams where both the individual performance of the candidates and the collaborative performance between candidates were considered. Fuzzy set theory has also been used in the team member selection and Hence, in this research work, we will propose fuzzy based cricket player performance evaluator, that will evaluate the performance of a player using fuzzy logic.

Fuzzy Logic was initiated in 1965 by Zadeh in his first paper on Fuzzy Sets, professor for computer science at the University of California in Berkeley.Fuzzy logic is a superset of Boolean logic that is used to handle the concept of partial truth values that ranges in degree between 0 and 1. It is a problem solving methodology which can be applied in developing both linear and non-linear systems for embedded control. Fuzzy logic helps to draw conclusions from vague or ambiguous information. Fuzzy systems typically employ rules to translate vague terms, such as skill or comfort, into system outputs.

METHODOLOGY

There are two types of fuzzy inference systems that can be implemented in the Fuzzy Logic Toolbox:

Mamdani-type: It was proposed in 1975 by EbrahimMamdani as an attempt to control a steam engine and boiler combination by synthesizing a set of linguistic control rules obtained from experienced human operators. And Sugeno-type. Mamdani-type inference, as defined for the toolbox, expects the output membership functions to be fuzzy sets. After the aggregation process, there is a fuzzy set for each output variable that needs defuzzification.

Sugeno-type: It is very similar to the Mamdani method. Sugeno made a change only to a rule consequent. He used a mathematical function of the input variable instead of a fuzzy set. The format of the Sugeno-style fuzzy rule is:IF X is A AND Y is B then Z is f(x, y)

Whereas x, y and z are linguistic variables; A and B are fuzzy sets on universe of discourses x and y respectively; and f(x, y) is a mathematical function. A FCM (Fuzzy Cognitive Maps) consists of factors (concepts / nodes) which represent the important elements of the mapped system. The directed lines labeled with fuzzy values show the strength of the causal conditions between the factors. A fuzzy cognitive map is a model of system structure.

ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02

Fuzzy inference System (FIS) is the process of formulating the mapping from a given input to an output using fuzzy logic (Guillaume, 2001). The mapping then provides a basis from which decisions can be made. FIS contains three steps: -

a) Fuzzification
b) Inference and
c) Defuzzification.

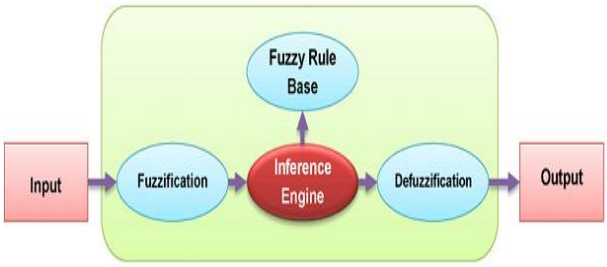


Fig. 1: Different phase of Fuzzy inference System (FIS)

I/O Components used in Fuzzy Based Cricket Player Evaluation Tool

In our fuzzy system, the researcher has taken eight parameters as linguistic variables that affect the ranking or performance of a cricket player. The parameters taken for the system are: RunsScored, BallsFaced, StrikeRate, Out, Fours, Sixes, TeamStrength and TeamAgainst Strength. We have taken Ranking as an output parameter. All these input variables affect the ranking of a player.

On the basis of the description of input, output variables, constructed 96 rules. Below mention some rules are:

Rule 1: If (runsScored is High) and (balls Faced is Low) and (strikeRate is High) and (out is No) and (fours is High) and (sixes is Med) and (teamStrength is High) and (teamAgainstStrength is High) then (ranking is very High) (0.75).

Rule 2: If (runsScored is High) and (ballsFaced is Low) and (strikeRate is High) and (out is No) and (fours is High) and (sixes is Med) and (team Strength is High) and (teamAgainstStrength is High) then (ranking is High) (0.25).

Rule 3: If (runsScored is High) and (balls Faced is Med) and (strikeRate is High) and (out is No) and (fours is High) and (sixes is Low) and (team Strength is High) and (teamAgainstStrength is High) then (ranking is Very High) (0.75).

Rule 4: If (runsScored is High) and (balls Faced is Med) and (strikeRate is High) and (out is No) and (fours is High) and(sixes is Low) and (team Strength is High) and (teamAgainstStrength is High) then (ranking is High) (0.25).

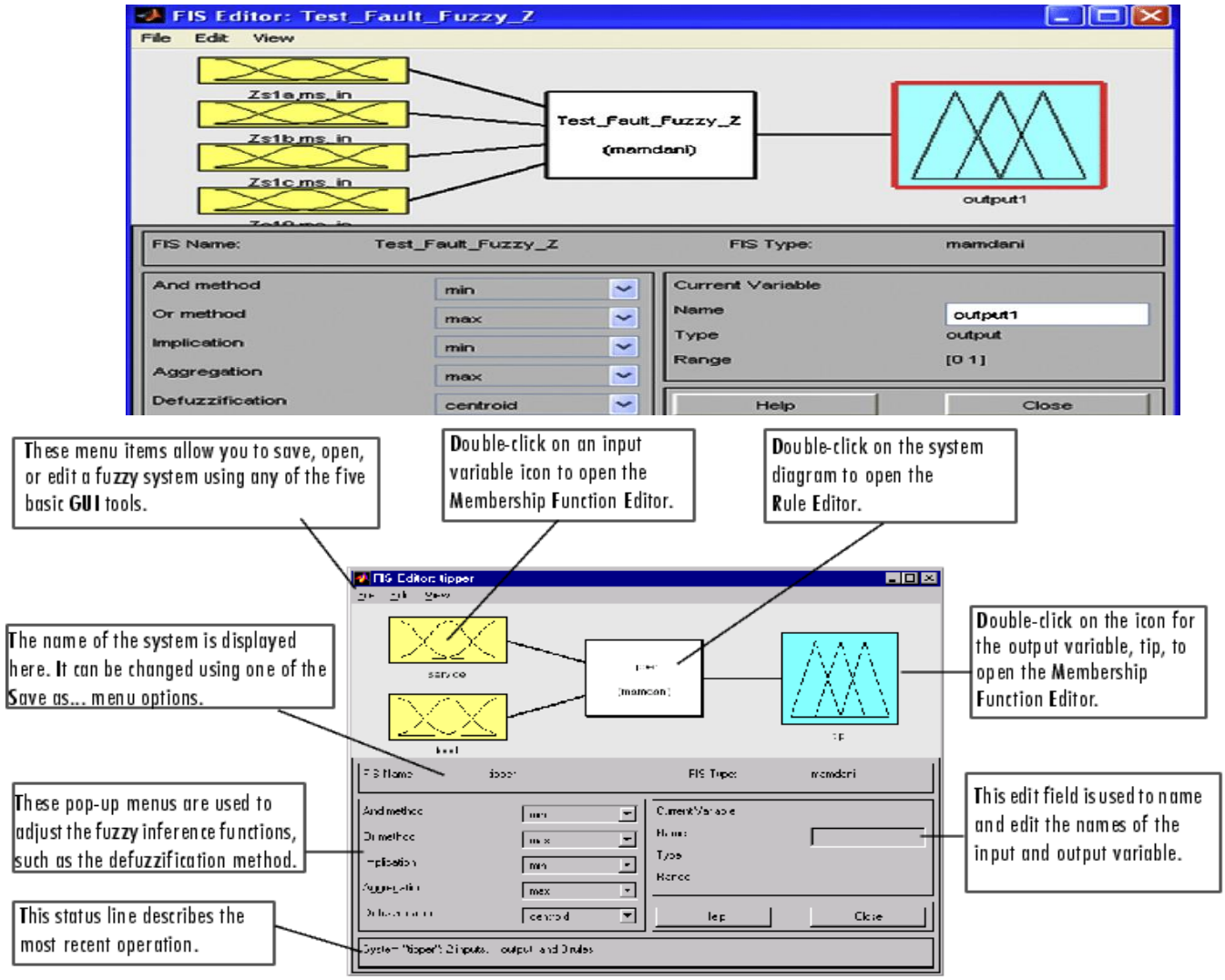
Rule 48: If (match is High) and (Wickets is Low) and (TS is High) and (OT is Low) and (Pitch conditions is High) and (SR is Low) and (ST is Low) and (economy rate is low) then (performance is Low)

Rule 95: If (runs Scored is Low) and (balls Faced is High) and (strikeRate is Low) and (out is Yes) and (fours is Low) and (sixes is Low) and (teamStrength is Low) and (teamAgainstStrength is Low) then (ranking is Very Low) (0.75).

Rule 96: If (runs Scored is Low) and (balls Faced is High) and (strikeRate is Low) and (out is Yes) and (fours is Low) and (sixes is Low) and (teamStrength is Low) and (teamAgainstStrength is Low) then (ranking is Low) (0.25).

ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02

FIS Editor: Bellow we will show you use of various tools like wise open, save, edit etc.



Fuzzy logic tool box
Fig. Eight Input and one output parameters

ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02

Formula of Input Membership Functions

$$f(x;a,b,c)=\begin{Bmatrix}0, & x\le a\\ \frac{x-a}{b-a}, & a\le x\le b\\ \frac{c-x}{c-b}, & b\le x\le c\\ 0, & c\le x\end{Bmatrix}$$

zmf: Z-shaped built-in membership function (zmf) is used to define the variable Low. The weight is calculated by the following formula:

$$f(x;0,0.5)=\begin{Bmatrix}1, x\le 0\\ 1-2\left(\frac{x-0}{0.5-0}\right)^2, 0\le x\le \frac{0+0.5}{2}\\ 2\left(\frac{x-0.5}{0.5-0}\right)^2, \frac{0+0.5}{2}\le x\le 0.5\\ 0, x\ge 0.5\end{Bmatrix}$$

gaussmf: Gaussian curve built-in membership function is used to define the variable Med. The weight is calculated by the following formula:

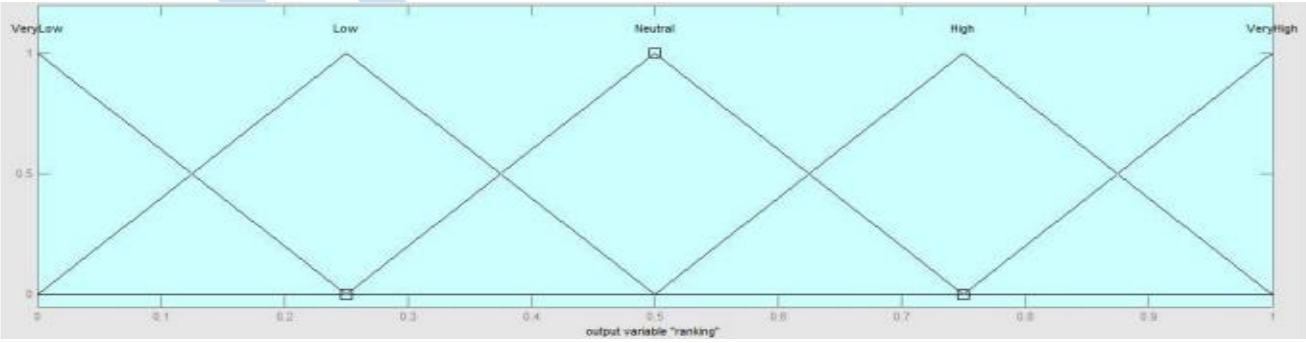
$$f(x;0.2123,0.5)=e^{\frac{-(x-0.5)^2}{2(0.2123)^2}}$$

smf: S-shaped built-in membership function is defined for variable High. The weight is calculated by the following formula

$$f(x;0.5,1)=\begin{Bmatrix}0, x\le 0.5\\ 2\left(\frac{x-0.5}{1-0.5}\right)^2, 0.5\le x\le \frac{0.5+1}{2}\\ 1-2\left(\frac{x-1}{1-0.5}\right)^2, \frac{0.5+1}{2}\le x\le 1\\ 1, x\ge 1\end{Bmatrix}$$

Output Membership Function

Performance is taken as an output variable which has five levels: Very Low, Low, Neutral, High and Very High. All these five levels are defined by the membership function.



ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02

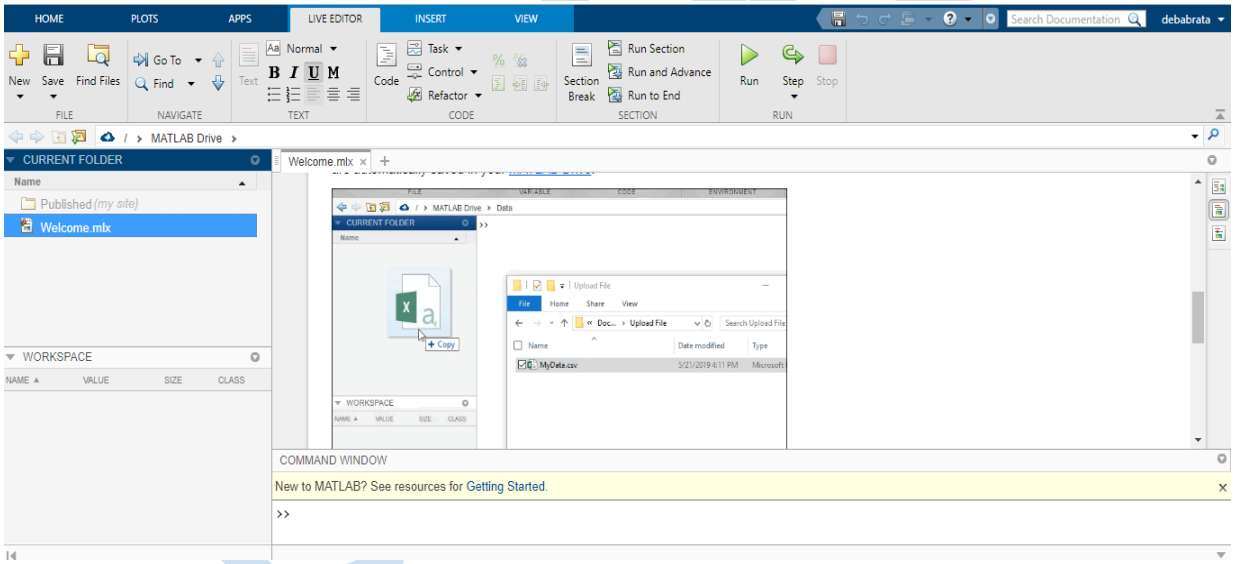
Triangular-shaped built-in membership function is defined for the variable ranking. The weight is calculated by the following formula:

Paramters	a	b	c
Very Low	-0.25	0	0.25
Low	0	0.25	0.5
Neutral	0.25	0.5	0.75
High	0.5	0.75	1
Very High	0.75	1	1.25

Fig. Shows the values of a, b & c for all five variables

RESULT ANALYSIS

To calculate the performance of a cricket player by using the cricket player performance evaluator (MATLAB), we took four different hypothetical scenarios.



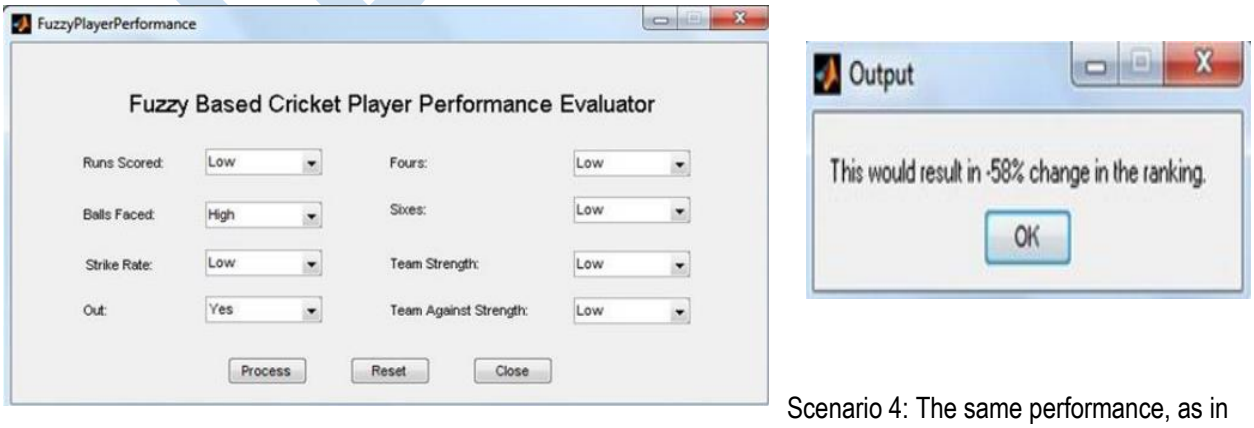
Scenario 1:

A player belonging to a high rated team plays against a high rated team. He scores high amount of runs in low amount of balls. Hence, he has a high strike rate. He struck high number of fours and sixes, and remained not out in the match. All these parameters are entered into the performance evaluator developed in MATLAB. The output of this scenario shows that it affects his ranking by 64%

ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02

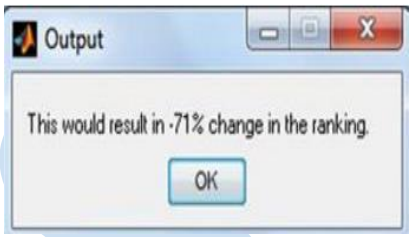
Scenario 2: The same performance, as mentioned in scenario 1, is made by a player belonging to a low strength team. The parameters entered are shown in Figure, The output shows that it also impact his ranking by 84.

Scenario 3: A player belonging to a weak team plays against a weak team &scores low amount of runs facing low balls, resulting in low strike rate. He also struck low number of fours and sixes before getting out. The parameters entered are shown in Figure.The output shows that his ranking must be affected by -58%, as shown in Figure.



Scenario 4: The same performance, as in scenario 3, is given by a player of a strong team. The parameters entered are shown in below Figure.The output shows that his bad performance must affect his ranking by -71%.

ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02



CONCLUSION

Fuzzy logic provides effective techniques for the representation of uncertainty and is therefore often used for the handling of vague conditions in a variety of application areas. In the field of sport, Zadeh's proposal is being applied in the analysis and classification of sport-specific executions such as in cricket player`s ranking.
In club cricket team owner follow player rating and ranking through analyzer; who analysis player performance during auction. Here FIS input most valuable part. The present paper suggests the design of fuzzy logic techniques for the evaluation of performances in cricket such as batting, bowling; overall performance.

RECOMMENDATION

The Fuzzy system of performance evaluation can also be implemented in other sports like Atheletes,football, hockey and ice-hockey where a player's performance is calculated on the basis of goals scored. In future, the proposed methodology can be applied to evaluating a Team ranking, student and teacher's performance.
The system getting developed based on the Cricket information is similar to the one expected by Accenture.The monitoring of testing artifact rate or debugging rate is similar to monitoring the run rate. The study also suggests that the deliverables plan to be rechecked are similar to their commendations generated by the system like that of "run rate needs to be improvedto achieve the far-fetched target".

REFERENCES

https://www.tutorialspoint.com/fuzzy_logic/fuzzy_logic_inference_system.htm
A fuzzy inference system with application to player selection andteam formation in multi-player sports- MadjidTavana, FarshadAzizi, FarzadAzizi, Majid Behzadian.
www.elsevier.com/locate/smr
Lemmer H.H. (2002). The combined bowling rate as a measure of bowling performance in cricket. South African Journal of Research in Sports, Physical Education and Rec-reation 24(2), 37-44.
(18) (PDF) Measuring Fielding Performance in Cricket.
MeenakshiG.,"Multi Source Feedback Based Performance Appraisal System using Fuzzy Logic Decision Support System", International Journal on Soft Computing (IJSC) Vol. 3, No. 1, 2012.
Barr G.D., Kantor B.S. (2004). A criterion for comparing and selecting batsmen in limited overs cricket. The Journal of the Operational Research Society 55(12), 1266-1274(18) (PDF) Measuring Fielding Performance in Cricket.

ISSN: 2278 – 716X
Vol. 8, Issue 1, (2019)
Impact Factor 5.02

Bhosale G. A., Kulkarni R. V.,"Role of Fuzzy Techniques in Performance Appraisal of Teaching Staff", International Journal of Latest Trends in Engineering and Technology, 2013.
http://www.ijecbs.com
http://internationaljournalofresearch.org/
Mendel, J. M. 1995. Fuzzy logic systems for engineering: atutorial. In Proceedings of the IEEE. Vol. 83. No. 3, March 1995.
Fuzzy Logic based Cricket Player Performance Evaluator-Gursharan Singh, Nitin Bhatia,Sawtantar Singh.
http://www.cse.iitm.ac.in/~nehamay/Neha_files/CricketMatch_Report.pdf.