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Research paper

Technologies and the prediction of spin bowlers in the game of cricket

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Abstract

Technologies plays an formidable role in any type of sports. In many games it plays the role of trainers for the players to enrich the skills for the competitiveness. It is replacing the umpires for the correct decision making to overcome human error. In the game of cricket, the spin bowling is very important and to study the different methods, efficiency, controlling mechanism, spinning action, direction and rotational speed of the ball. These things can be calculated based on using effective technological tools. In India the cricket highest body, Board of Control for Cricket in India (BCCI) have been using the database for selecting players for any tour-nament and various franchisers in the case of premier leagues in India and other countries.

Keywords: *Decision Making, IPL, Predictive Analytics, Spin Bowling, Technologies.*

1. Introduction

Cricket is one of the most popular game in the world played between two teams of 11 players each. There are three types of matches played in the game of cricket namely Test Match, One Day Match (ODI) and Twenty-Twenty overs (T-20) match. Test match played over 5 days with unlimited overs and teams each batting for two innings of unlimited overs in the given day but it is fixed 90 overs per day. One day match is a form of limited overs played between two teams in which each team faces fixed number overs, usually 50 overs, whereas T-20 played over a few hours with each team batting for a single innings of 20 overs. Indian Premier League (IPL) has an added advantage of earning income through the advertisements and sponsorships during the period of those few hours. Like IPL there are some leagues are happening in other countries such as Bangladesh Cricket League (BCL), Pakistan Cricket League (PCL) and West Indies, Caribbean (CPL) etc [1].

1) Bangladesh Cricket League(BCL): The Bangladesh Cricket League (BCL) was inaugurated in the 2012-13.The aim was to prepare players better for Test cricket and to raise the level of the nation's top first- class competition[10].
2) Pakistan Cricket League (PCL): Pakistan Super League is a Twenty20 cricket league, founded in Lahore on 9 September 2015 with five teams and now comprises six teams [13].
3) Caribbean Premier League (CPL): The Caribbean Premier League (abbreviated to CPL or CPLT20) held in the Caribbean. It was created in 2013. It is currently sponsored by Hero MotoCorp and is officially titled the Hero CPL [11].

2. Technologies used in cricket

There are different technologies being used in a cricket to give an accurate result without human intervention.

2.1 Spider camera

Spider camera is used to visualize fields horizontally and vertically during the play such as cricket and football. This camera records the entire game and relays it for people to view [8}.

Fig. 1: Spider Camera.

2.2. Stump cameras

The wickets or the stumps are now well equipped with high resolution cameras to give a proper view to the third umpire whenever required for the decision making process. When the stumps light up and it is disturbed, the method can be used estimate it whether it is out or not. The decision of the umpire crucial at this juncture because one out can change the course of the match. By using technique close run out and stumping decisions are Easy [8].

Fig. 2: Stump Camera.

2.3. Hot spot

Hot spot Technology is used to review if the ball had hit the bat or not. When the ball hits the bat the particular area of the bat is highlighted to let the umpire know that the ball has hit the bat or not. Hot Spot uses two infra-red cameras placed at either sides of the ground. These cameras sense and measure the heat generated by a collision, such as ball on pad, ballon bat, ball on ground or ball on glove. Using a subtraction technique, a series of black-and-white negative frames are generated into a computer, so precisely locating the balls point of contact [3].

Fig. 3: Hotspot Technology.

2.4. Snick-o-meter

A sensitive microphone is placed in one of the stumps, which can receive the sound when the ball hits the bat. The frequency model of the sound is used to give umpires to decide if the ball did or did not hit the bat. Unfortunately at this stage the umpires do not get the benefit of hearing snicko, though a Real-time Snickometer is being developed for the umpires to get benefited [3].

Fig. 4: Snick meter.

2.5. LED stumps and bails

In this technology as soon as the ball hits the stump and the bails gets dislodged, bails start blinking [12].

Fig. 5: LED Stumps and Bails.

2.6. Slow motion camera

This is mainly used to give a perfect frames to make correct decisions by accurately checking each frame [8].

Fig. 6: Slow Motion Camera.

2.7. Super sopper

This is used to dry the cricket field whenever the ground is in wet state because of rain. During the play, if at all any rain comes by using this machine drying the ground is comparatively faster [12].

Fig. 7: Super Sooper.

2.8. Radar gun

This technology is used to measure the speed of the ball by a radar. Th is gun consists of both a receiver and a transmitter. This gun gets the echo of the ball and then by using the principle of Doppler Shift, calculates the speed of the ball [14].

Fig. 8: Radar Gun.

2.9. Hawk eye

This computer system was first used in 2001 for showing the path of the cricket ball. It is a commonly used and necessary tool for cricket commentators to make sure the umpires decisions is right. It is also used as a part of the Decision Review System (DRS) to judge the Leg before Wicket (LBW) Decisions [3].

Fig. 9: Hawk Eye.

2.10. Ball spin RPM

Measure Revolutions per minute (RPM) of the ball by using the formula [12] .

Fig. 10: Ball Spin RPM.

2.11. Spin bowling machine

With the help of the spin bowling machine the players can practice and get familiarized with different spin bowling actions and can use them in the real game.

Today cricket is a standout amongst the most well-known recreations in India and abroad. In the game of cricket, batsman should be prepared playing diverse bowling actions to make his batting skills perfect. The machine is to give exact and reliable batting practice for players including proficient cricketers, new, inexperienced and club level cricketers. Proficient cricketers who can utilize it as a feature in their usual practice for improvising their batting skills as well as take out defects in their batting without the help of the bowler. Likewise it will be of much utilize at school, club and junior level where the bowling quality is less steady. In cricket a bowling machine empowers a batsman to practice (for the most part in the nets) and to prune particular skills through redundancy of the ball being played at a certain length, line and speed. It can likewise be utilized when there is nobody to bowl, or nobody of the coveted style or standard. There are various diverse kinds of bowling machines that are accessible to cricket mentors, each very unique in the manners in which they accomplish the required conveyance, however most permit the utilization of remote control, with the goal that a mentor can be more close to a batsman when the stroke is played. Following are the fundamental kinds of bowling machines are available [5].

2.11.1. Mechanical bowling machine

This kind of machine is the most widely recognized one. It is simple and well founded and in addition have the capacity to bowl a helpful range of deliveries. The primary instrument of the machine comprises of two heavy wheels, somewhere in the range of 30 and 50 cm in diameter across, fitted with strong elastic tires, each determined by its own electric engine. These are mounted in an edge with the end goal that the wheels are in a similar plane, around 7 cm separated (marginally not as much as the breadth of a cricket ball). A ball joint permits the machine an extensive variety of movements. The entire setting is mounted on a strong tripod or other frame with the goal that the plane of the wheels is generally at the stature that a bowler would discharge the ball. A chute delivers the ball between the wheels, ensuring the mentor's hands are safe. The engines are mostly controlled by a battery, and turn in inverse directions. A controller permits variety of the speed of each wheel, enabling the machine to be slow for less experienced batsmen, or when the engines are not running at a similar speed, swing or spin bowling can be recreated. These machines will work with any ball of generally the correct size and weight, for example, typical cricket balls or tennis balls. Be that as it may, they more often than not work best with their very own balls, which are made of hard plastic, and are canvassed in dimples. These dimples are to help with the swinging attributes when this sort of delivery is wanted [4].

Fig. 11: Mechanical Bowling Machine.

2.11.2. Pneumatic bowling machine

This design is fundamentally less regular than the mechanical kind and works utilizing a totally different principle. Most of the space in the machine is a hopper that contains the balls. At the base of the hopper, close to the front, is a rotor with space for six balls. The balls opening into the spaces on the rotor by gravity, which at that point brings them into the innards of the system. The rotor goes through a trap-door which the ball
opens with its weight, falling into a little chamber. A pump is utilized to give a stream of air into the chamber that the ball drops into. The wind current pushes the ball along the
chamber to elastic ring or gasket known as a "restrictor". The restrictor has an opening however it that is somewhat smaller than the ball, which the ball presses up against. This seals the gap, so pneumatic force develops in the chamber. At the point when the weight is great to the point that the restrictor can never again hold it, the ball blasts however, out of he principle body of the machine and into an outer tube, which guides it upwards and discharges it at the stature of a bowler's arm. Be that as it may, such a machine faces air spillage issue [7].

Fig. 12: Pneumatic Bowling Machine.

2.11.3. Programmable bowling machine

Programmable bowling machines are expected to overcome some of the restrictions of mechanical and pneumatic sorts of playing

machines, like their capacity to simulate just a single sort of delivery in a given arrangement; by quickly re-designing themselves to bowl diverse kinds of delivery quickly. A programmable bowling machine called ”Merlyn”, which its producers asserted could ”bowl any ball known to man”, got much open consideration when it was utilized by the English cricket group in the run-up to and amid the 2005 Ashes series. Originally a one- off, Merlyn was worked by Henry Pryor, a cricket mentor in Herefordshire Its mechanism has not been openly uncovered, however it is safe to expect it is substantially more unpredictable than alternate machines.

The machine, and in addition its mechanical capacities, has components of built in computer control. It is asserted that it can replicate an over from a specific bowler whenever the right information is fed to it. One of the more terrifying parts of the machine is that it gives no sign of the sort of ball it is going to bowl until the point that the ball has left the machine. This forces the batsmen to work on their intuitive batting, as opposed to attempting to second figure the bowler. An enhanced version is as of now being developed at Loughborough College, which will include visual input by demonstrating a portrayal of the bowler anticipated onto a screen. The ball will be discharged as the virtual bowler’s hand achieves the gap from which the ball is discharged [7].

Fig. 13: Programmable Bowling Machine.

3. Overview of technologies used

Artificial Intelligence (AI) is all about replacing works of humans by machines and the machine as to work based on the algorithms.

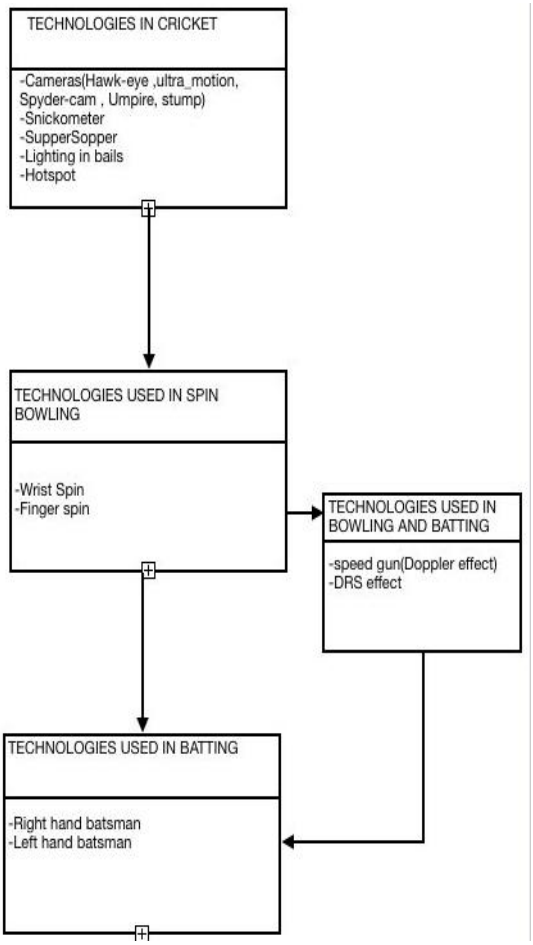

Fig. 14: Design.

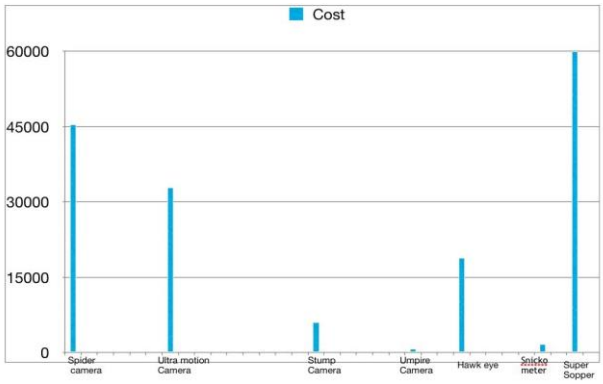

Fig. 15: Cost Efficiency.

Some of the technologies to reduce the work of the umpire and By going in this way future the decision is made by sensors and the umpires may be ruled out.

4. Calculation of strike rate and average for batsman

$$\text{Strike rate} = \frac{\text{Total No.Of Runs Scored}}{\text{Total No.Of balls Faced}} * 100$$

$$\text{Average} = \frac{\text{Total No.Of Runs Scored}}{\text{Total No.Of Matches Played}}$$

Fig. 16: Calculation of Strike Rate and Average.

5. Spin bowling

The arrangement of batsman based on the Opposite team and their capability
The scoring of a team is based the batsman and the bowler. Although both the Parties are important for a match, Bowlers role are more important to win the match [2].
Different bowling Actions:

1) Fast Bowling Action.
2) Fast-Medium Bowling Action and.
3) Spin Bowling Action.

Although the team has both fast and spin bowlers, the captain focuses more on spin bowlers ,since they are leading wicket takers.
There are two different types of spin bowlers.

a) Finger Spin
b) Wrist Spin

5.1. Finger spin

Finger spin (otherwise called off spin) is a sort of bowling in the game of cricket. It mention to the cricket method and particular hand movements related with imparting a specific direction of spin to the cricket ball. In spite of the fact that there are exceptions, finger spinners turn the ball not as much as wrist spinners [5]. In any case, on the grounds that the method is more straightforward and less demanding, finger spinners have a tendency to be more accurate.The name finger spin is really something of a misnomer, as the finger activity is anything but an imperative piece of the system for creating the spin on the ball. A finger spin delivery is released with the arm held in a completely supinated position, with the fingers on the outside of the ball (to one side for a right-handed bowler)[6]

Fig. 17: Finger Spin.

Two techniques in Finger spin

- Off break
- Left-arm Orthodox Spin

5.1.1. Off break

Right-handed with finger spin technique.
The ball from right side pitches on the ground and moves towards the off side [5].

5.1.2. Left-arm orthodox spin

Left-handed with finger spin technique. The ball from left side pitches on the ground and moves towards the leg side[5].

5.2. Wrist spin

Wrist spin is a sort of bowling in the game of cricket. It mention to the cricket procedure and particular hand movements related with imparting a specific direction of spin to the cricket ball. Wrist spin is bowled by releasing the ball from the back of the hand, the ball passes over the little finger [5]. Done by a right-handed bowler, this confers an anticlockwise rotation to the ball, as observed from the bowler's viewpoint; a left- handed wrist spinner pivots the ball clockwise. The name wrist spin is really something of a misnomer, as the wrist is definitely not an imperative piece of the system for creating the trademark turn on the ball. A wrist spin delivery is released with the arm held in a completely pronated position, with the fingers within the ball (to the left for a right-handed bowler).If this pronated position is kept up through the release, the fingers will normally cut down the side of the ball and create an anti-clockwise spin [6].

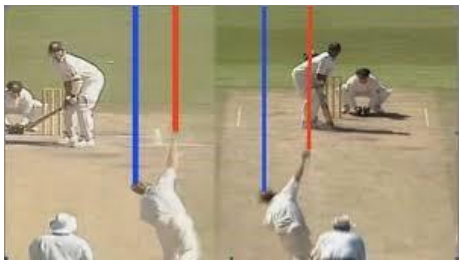

Fig. 18: Wrist Spin.

Despite the fact that the bio mechanical points of wrist spin are the equivalent for right and left hand bowlers, such bowlers are frequently discussed independently, as the direction in which the ball deviates as it bounces on the cricket pitch is unique: Right-handed wrist spin is more commonly known as leg spin. Left-handed wrist spin is more commonly known as left-arm unorthodox spin or left-arm chinaman. As same as Finger spin there are two techniques in wrist spin
Two techniques in Wrist spin

- Leg break
- Left-arm Unorthodox Spin

5.2.1. Leg break

Right-handed with wrist spin technique. The ball from right side pitches on the ground and moves towards the leg side [5].

5.2.2. Left-arm unorthodox spin

Right-handed with wrist spin technique. The ball from left side pitches on the ground and moves towards the off side [5].

6. Calculation of economy rate

$$Bowling\ Economy\ Rate = \frac{Runs\ Conceded\ Off\ Bowling}{Number\ of\ Overs\ Bowled}$$

$$True\ Economy\ Rate = \frac{Runs\ Conceded\ Off\ Bowling}{Number\ of\ Overs\ Bowled - Maiden\ Overs}$$

$$Independent\ Run\ Conceding\ Potential\ (IRCP) = \frac{Number\ of\ Runs\ Conceding\ Balls}{Total\ Number\ of\ Balls\ Bowled}\ x100$$

Fig. 19: Economy Rate.

7. Predictive analytics

Predictive analytics is a form of advanced analytics that uses both new and historical data to forecast activity, behaviour and trends. It involves applying statistical analysis techniques, analytical queries and automated machine learning algorithms to data sets to create predictive models that place a numerical value– or score – on the particular event happening [9].
Predictive Analytics of Spin bowlers

This paper deals with prediction of spin blowers for a team based on their previous performances using Decision Tree Classifier Algorithm. The spin bowlers are ranked based on the overs, runs, maidens and wickets of their previous performances.
This table contains the performances of the spin bowlers in the Indian Premier League (IPL). By comparing the data that is already present in the table with the data which is being fed into the algorithm, the spin bowlers are ranked. So this gives us a clear view of the bowlers' rank which is helpful for the team selection.

Player	Overs	Mdns	Runs
A Mishra	476.5	6	3525
PP Chawla	476.1	2	3673
Harbhajan Singh	518.2	5	3655
SP Narine	381.5	2	2498
R Ashwin	432.2	4	2909
RA Jadeja	361.5	0	2809
PP Ojha	316.3	1	2332
YS Chahal	248.3	2	1932
SK Trivedi	251	2	1904
M Muralitharan	254	1	1696
AR Patel	234.3	2	1765
SK Warne	199	1	1447
Shakib Al Hasan	210.3	1	1557
Imran Tahir	140	0	1180
KV Sharma	181.5	1	1412
SB Jakati	180.5	1	1451
A Kumble	160.5	1	1058

Fig. 20: List of Spin Bowlers.

For example, let us say there is new bowler (X) entering into IPL. By comparing X's data with the existing bowlers' data, the rank of X will be allotted.

8. Conclusion

This paper addresses the technology which is used in cricket and prediction of spin bowlers by ranking them into their respective categories. The technologies help the umpire to take accurate decision (run out, lbw etc) during the matches. The prediction of spin bowlers (because the spin bowlers are leading wicket takers in the world) will help the team to win the match. This work can be extended in future for prediction of fast bowlers, fast medium bowlers and batsmen to build the best team in order to win the matches.

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