

# Sports Navigator – A Framework for all Sports Intelligence using Machine Learning (Game Census)

Srinath R, NagaSwetha Devarakonda, Arun Biradar



**Abstract**— There are significant advances in the field of Machine Learning and Data analytics over the past few years and its use-cases has spread across various application areas starting from Transportation to Medical. Sports industry has been recently reaping the benefit of Machine Learning. People are looking to improve their games from all avenues. There is also a significant increase in the Interest in games among parents and kids. However, there is no one platform which creates a digital footprint of each player so a player can be tracked from his early participation in games till he starts playing professional games. We propose a platform which will collect data from all the videos played by players and create a digital footprint of each of the players and games. This paper particularly covers a game census with comparison between attacking team and opponent team.

**Keywords:** Game census, Machine Learning, Tagging.

## I. INTRODUCTION

The key is not the will to win. Everybody has that. It is the will to prepare to win that is important. Well, Game is not an individual’s talent; all the players’ performance is the one that determines the winner in a game. A decision is taken at a game collectively among two or more players. An individual’s performance, though has much significance, does not count much in a game; it is only the coordination and team spirit that leads the game.

Sports analytics is new trend topic and rapidly evolving area over decades. Sports analytics is collection of relevant, historical, statistics that when properly applied can provide a competitive advantage to a team or individual. There are numerous applications on sports analytics, epically on US professional sports leagues and for European football leagues. Machine learning for sports analytics has open a wide space for a player, team, Coaches and many other stake holders to increase their strengths and overcome their weakness correspondingly.

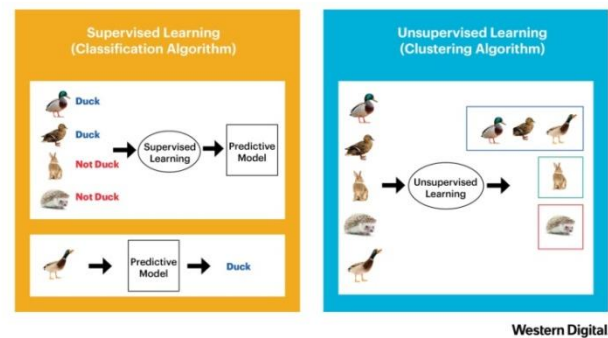
The statistical techniques are the majority contribution in this area and are still best. Now the trend is to apply new methodologies likes Machine Learning to Sports that has seen a tremendous growth. This has lead to numerous applications on Sports analytics.

Machine Learning is a branch of artificial intelligence, which may be defined as study of algorithms that make programs to improve automatically through experience.

Machine Learning consists of several cyclical steps to model training. Every step is repeated continuously to improve the model accuracy. There are generally two types of learning approaches: Supervised and Unsupervised

Learning. Supervised learning, a model is built by giving dataset with concrete concept. The second one, unsupervised learning, is used to discover structures within the data. The initial data is not necessarily labeled and the learning uses the clustering algorithms in order to group unlabelled data together.

Example as below:



Western Digital

**Fig 1. Supervised Learning (Classification/Regression) | Unsupervised Learning (Clustering) | Credits: Western Digital [3]**

## II. RELATED WORK

Rory [1], uses novel sport prediction framework through which ML is used as a learning strategy. The framework is focused on result prediction for team sports rather than individual sport. CRISP-DM framework is used as reference for the paper

Carson[2], used sports data mining approach, which discover interesting knowledge and predict outcomes of sports games such as college football. Combination of four different measures on the historical results of the games are used and used a approach to predict the outcomes based on the historical results of games.

Lotto[8], proposed a novel approach to measure players’ on-the-ball contributions from only passes using play-by-play event data collected during football games. The approach measures the expected impact of each pass on the scoreline.

Guiliang [10], The paper proposed a new approach to capturing game context by applying Deep Reinforcement Learning (DRL) to learn an action-value Q function from 3M play-by-play events in the National Hockey League (NHL). To assess a player’s overall performance, we introduce a novel Game Impact Metric (GIM) that aggregates the values of the player’s actions.

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### III. METHODOLOGY

There are many algorithm of Machine learning for sports analytics. We do propose a new simple and very efficient algorithm for player which is called as player recommender.

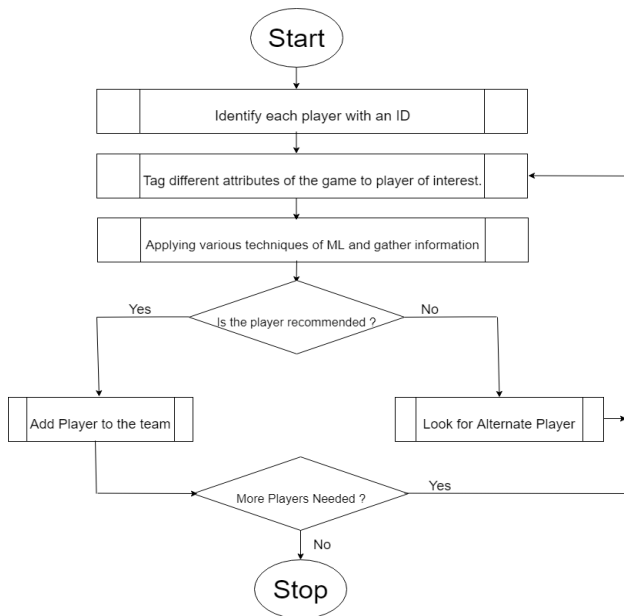


Fig 2. Player Recommender Flow Chart

We do have recommender system for coaches and also Clubs or owner of the team. This paper covers only the pre-processing part. The objective of the pre-processing is to tag the attributes for a particular Player, which in turn is used for analysis.

The list of attributes that are used to Tag the players are:

- **Kickoff** - game start, after a goal or start of second half
- **Pass** – This event occurs When player A passes the ball to Player B of the same team
- **Shot** – This event occurs when the player shoots the ball towards the Goal post.
- **Back post pass** – All passes which are targeting an attacking player close to the goal on the back post
- **Turn Over** - A Turnover is a game situation where the referee decides to switch the ball possession to the opponent team. This is done at Throw in or corners, where the player steps into the field before he kicks the ball or the ball is moving.
- **Successful Dribbling** - A player has the ball under control. A successful Dribbling occurs when an attacking player successful dribbles around a defender. The attacking team remains in ball possession.
- **Unsuccessful Dribbling** - a player has the ball under control. An unsuccessful Dribbling occurs when an attacking player intend to dribble a defender with skills and loose a dribbling against a defender, to the ball is out of play independently who is remaining in ball possession
- **Successful pass** - A successful Pass occur when a player has the intention to pass the ball and the ball goes in a direction of his team mates. The player passes the ball successful to one of his team mates anywhere on the field. The attacking team remains in ball possession.

- **Unsuccessful pass** - The player needs to be controlling the ball and have the intention to pass the ball to one of his teammates. An unsuccessful Pass occur when a player pass the ball unsuccessful to one of his team mates anywhere on the field. This occurs when the pass is intercepted by the other team, the pass is played out of reach of the player's teammate or the opponent team is intercepting the pass. The ball possession changes from the attacking team to the defending team.
- **Successful Tackle** - The player has the intention to tackle an attacking player and the attacking player tries to dribble around the defender. A successful Tackle occurs when a defending player successful stops a dribbling from an attacking player or kicks the ball to the side in depends from the ball possession.
- **Unsuccessful Tackle** - The player has the intention to tackle an attacking player and the attacking player tries to dribble around the defender. A unsuccessful Tackle occurs when a defending player can't stop a dribbling from an attacking player. The attacking team remains in ball possession.
- **Successful Interception** - A player have a chance to intercept a pass from the attacking team and have the intention to intercept. A successful Interception occurs when a defending player successful intercept a pass of the attacking team. The ball possession changes from the attacking team to the defending team.
- **Unsuccessful Interception** - A player have a chance to intercept a pass from the attacking team and have the intention to intercept. An unsuccessful Interception occurs when a defending player not successful intercept a pass of the attacking team. The attacking team remains in ball possession.
- **Player off** – This is the substitution of 1 or multiple players exiting the game to the site during the game. The player is not anymore part of the game.
- **Player on** – This is the substitution of 1 or multiple players entering the game from the site during the game. This includes the players starting the game. The player is now part of the game

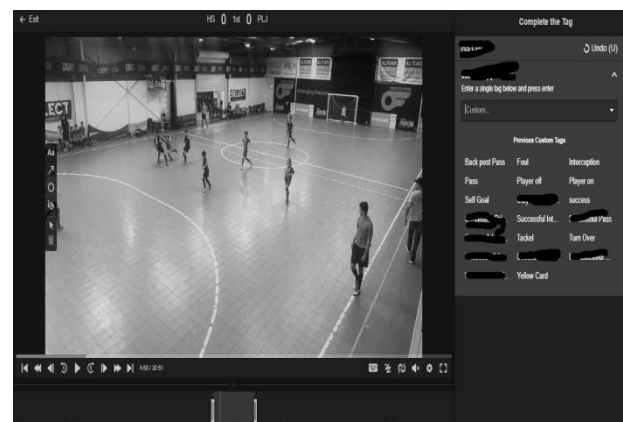


Fig 3. Tagging Attributes for each Player

**IV. GAME CENSUS**

Game census, the complete game is considered for collection of data instead of just a sample. The above discussed attributes are tagged for the both teams. The team which is of our interest is the attacking team and the other is the opponent team. The attributes for the attacking team are important for analysis; hence specific attributes are tagged for each player of the attacking team. But the attributed are also tagged for the opponent team where the identity of each player is not considered. Each player of the attacking team is identified by a unique identity which is a combination of characters (letters and digits), uniquely identifiable for the all seasons of game.

**Table- I: Team Representation**

1	Attacking Team	
2	Opponent Team	

**Table- II: Kick Statistics**

4	Corners	11
2	Free Kicks	1
11	Goal Kicks	12
24	Site Kicks	26

**Table- III: Shot Statistics**

33	Total Shots	20
8	Goal	1
4.13	Shot – Goal Ratio	20
14	Saved Shot	10
4	Blocked	3
7	Off Target	6
0	Goal Shot own half	0

**Table- IV: Pass Statistics**

89	Total Passes	83
66	Successful Pass	55
3	Back post Pass	0
20	Unsuccessful Pass	28
4	Goal Assist	0

**Table- V: Tackles Statistics**

9	Total Tackles	42
8	Successful Tackles	10
1	Unsuccessful Tackles	32

**Table- VI: Dribbling Statistics**

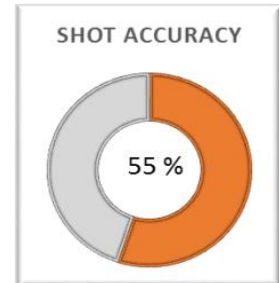
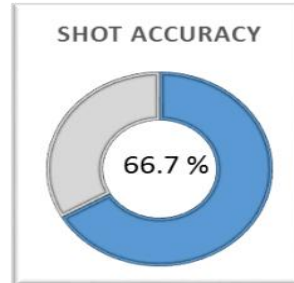
42	Total Dribbling	9
32	Successful Dribbling	1
10	Unsuccessful Dribbling	8

**Table- VII: Interception Statistics**

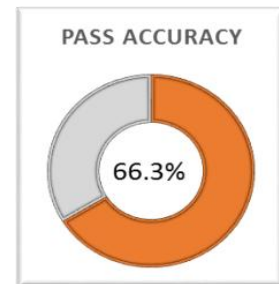
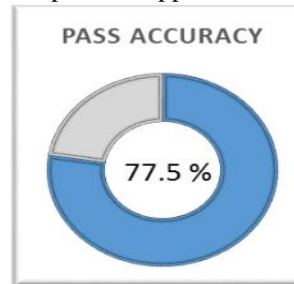
21	Total Interception	5
21	Successful Interception	5
1	Unsuccessful Interception	0

**V. RESULTS**

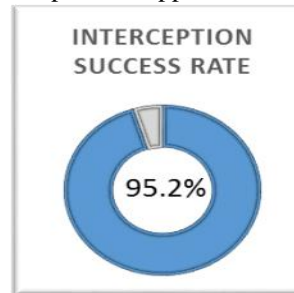
The Shot accuracy of attacking team is very good when compared to opponent team



The Pass accuracy of attacking team is very good when compared to opponent team



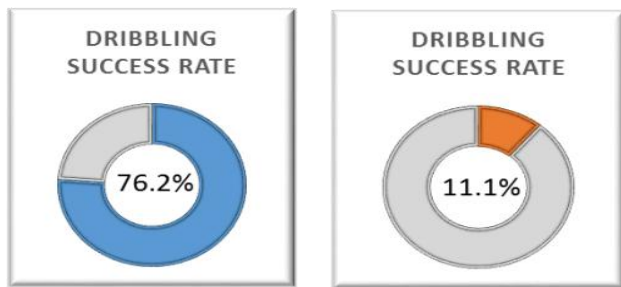
The Interception accuracy of attacking team is ok when compared to opponent team



The Tackling accuracy of attacking team is Excellent when compared to opponent team



The Dribbling accuracy of attacking team is Excellent when compared to opponent team



Overall the probability of success rate of attacking team is high when compared to opponent team.

## VI. OUTCOME

This technology will help to create a better digital forum for all (players, Coaches and Club) to improve their games.

### A. For Players

- Ability to track the development using statistical data or visual footage
- Etc...

### B. For Coaches

- Ability to track each player in terms of
  - performance in particular games against particular opposition
  - Identify areas of player or the team performance as a whole where they are Strong or weak.
  - to assist with training program design/modification to enhance player/team performance which can be used to assist with training program design/modification to enhance player/team performance and game preparation
- Customizable tags
- Etc...

### C. For Clubs

- Coaches, Technical Director and Support Staff can access to digital data also if required the data of each player over the course of time, which facilitate tracking of player development to assist with player education and adjustment of training sessions if required
- Etc...

## VII. CONCLUSION

Sports navigator is a digital platform that empowers Players, Coaches and Clubs to develop their individual players, teams and clubs to win. By comparing the attacking team with the opponent team, the ball possession of attacking team is high as tacking and dribbling success rate of attacking team is more that 75%. We conclude that the attacking team percentage of winning is very high compared to opponent team.

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