Inside The Wallabies: A Statistical Game Analysis

Adhok, Katti (N10548394)
IFN704 Assessment 3

Preface

I have loved sports ever since I was a kid, both as a player and as an audience. As an onlooker, I have always been fascinated by highly skilled and competent individuals and their elegant execution of impossible feats. This fascination has carried over into my personal sporting life on the fields of cricket and soccer. I have participated in a variety of competitive levels in the game of soccer and though I have never played or watched rugby prior to this study, I took this opportunity to learn this noble game of rugby and develop my knowledge and understanding of the game. This journey has brought me to not only explore and appreciate the game but also apply scientific and statistical analysis to the game. With this study, I aim to provide a methodology for translating rugby statistics into actionable insights for any of the involved stakeholders like coaches, players, or any other interested individuals. An appendix at the end of this report contains all the metadata and the codes written to facilitate reproducibility.

I wish to acknowledge and thank the Queensland University of Technology and the unit coordinators of IFN704 Dimitri Perrin and David Lovell for providing me an opportunity to research the game of rugby. Their knowledgeable and expert guidance throughout the semester has been pivotal in this work. It has been a wonderful opportunity to learn from them.

I would also like to extend my appreciation to Brendon Sheilds of Rugbycology for giving us the resources to make the study possible.

Executive Summary

Rugby union performance analysis is rapidly evolving all around the world as a result of the sport's emerging professionalism. Coaches, journalists, managers, and players are clamoring for a more precise analysis of the game with the help of advancements in technologies throughout the world. In recent times, the technical capabilities and aspects of a high definition video, superior computational systems, and video analysis software have facilitated the increase in demand for the performance analysis of teams and players likewise. Consequently, this study concentrates on the analysis of a variety of performance indicators relating to frameworks and tactics of the game played out by the Australian national rugby union team from 7th June 2021 to 20th March 2022. The dataset consists a total of 14 games played by the wallabies and is sequential in nature, meaning, it includes passages or sequences of rows that denotes the activity of the ball. Each sequence is regarded as the basic unit of observation for the analysis and the order of these sequences is crucial.

Python programming language was mostly utilized for wrangling and mining the data for valuable information. Also, the Apriori algorithm was utilized to derive all the frequent actions performed from the game sequences. The accuracy of the data has not been questioned and no distinct method is put in place for its validation.

Introduction

The novel game of rugby union is said to have originated in 1823 in England [1]. The World Rugby [2] henceforth referred to as IRB, the international regulatory board for rugby union characterizes rugby as a fast-paced sport that spans for 80-minute and consists of a mixture of intensive individual and team-specific performance. There are 15 players on each team, with eight forwards and seven backs. Every match is overseen by a referee, who is solely responsible for enforcing the IRB's rules for each game. The main objective of the game is to score as many points as possible by carrying, passing, kicking, and placing the ball past the opposing goal-line while adhering to the laws and ethos of the game. The forwards' primary responsibility is to contend for ball possession, whereas the backs try to receive the ball from forwards and progress downfield with winning runs and score points. The phrase 'open play' denotes every phase of the game in which the ball is passed or kicked amongst teammates and both sides compete for possession. The team in possession of the ball attempts to get the ball to players in a position that can make aggressive movement upfield towards the opposition goal line during open play. Table 1 lists all the methods by which a team can score points along with a brief discussion of how each scoring method works [2].

Scoring Method	Points	Description
Try	5	A try is scored when the team with ball possession grounds the ball in the opposition's in-goal area.
Conversion	2	Following a try, the same team can try to add two more points by kicking the ball over the goal but between posts from the same spot as the try was scored.
Penalty	3	Once a penalty is awarded, the ball is kicked in between upright goal posts and over the crossbar.
Drop-Kick	3	The ball is dropped to the ground and kicked on the half-volley in open play.

Table 1: Scoring methods in Rugby Union

The sections that follow explain situations that occur throughout rugby union matches. It is critical to understand the types of variables that are described in the novel and unique dataset that captures the count of all the actions performed in a specific sequence of the game.

1.1 Field Zones

a. Own 22: The zone on a field from the goal line to the 22-meter line of the attacking team.
b. Own 50: The zone on a field from the goal line to the halfway line of the attacking team.

c. Opponent 50: The zone on a field from the halfway line to the goal line of the defending team.
d. Opponent 22: The zone on a field from the 22-meter line to the goal line of the defending team.

1.2 Platform

a. Restart: Restart kicks are used to start the game after a goal is scored or a touchdown happens [2].
b. Scrum: A scrum's objective is to begin to play following a minor infraction or halt. Eight players on each team interlock with the opposing eight players. Both the teams battle for ball possession and try to pass it out to the rear of the scrum with their foot [2].
c. Lineout: The line-out occurs when the ball has exited the field of play. Each team falls in line a meter apart, anywhere between 5 to 15 meters from the touchline. An opposing player from the team that last handled the ball tosses it in between the two teams and both the teams fight to regain the possession [2].
d. Penalty: Penalties are granted to the non-offending team in light of violations of the various rules that are applicable to the rugby union [2].
e. Free-Kick: Free-kicks too are granted to the non-offending team in light of violations of rules that are applicable to the rugby union [2].
f. Turnover: Act of winning the ball possession as a defending team in an effort to make a counter-attack [2].
g. Kick-Return: Kick-Return is a move that happens following a kickoff. One team kicks the ball into its opponent's half at the start of each half. kick returns are significant as they dictate where the receiving team will begin their attack.

1.3 Ruck

A ruck is simply a battle for possession after a player has grounded the ball as a result of a tackle from the opposition. The tackled player and the tackling player should release the ball at once in the interest of each other's safety. Players from one team bind with each other and face the opponent team and try to win or maintain ball possession by using their feet [2].

1.4 Pass

The transfer of the ball from one player of a team to another player of the same team.

1.5 Clear

To kick the ball upfield to alleviate the pressure from the attacking team and gain upfield ground.

1.6 Contest

To apply pressure on the opponents with a kick upfield. This may or may not result in reclaiming the ball possession.

Hughes and Bartlett [3] explain that the performance indicator is a measure or group of variables that aims to define some element of performance and, to be effective, should be related to successful performance or result. For use in sport performance analysis, four types of performance

indicators have been proposed: match classification indicators, tactical indicators, technical indications, and biomechanical indicators [3]. Few key performance indicators from the dataset are identified and attempted to analyze key performance indicators. An apriori algorithm is also implemented to query frequent itemsets from the data.

Literature Review

Rugby research has also used temporal motion analysis, which analyses the movement intensity of players in location and time and is intended at providing information for coaches to enable higher specificity in training prescription. One such research done by Bloomfield et al. [4] was created for dynamic movement sports, and it features several kinds of motion-based, categories-based, intensity levels-based, and another special instantaneous movement a time-motion analysis.

Another analysis area in rugby is used to quantify essential game structures to determine the impact of legal changes on the game done by Quarrie [5] in which the IRB's 1994 "use it or lose it" regulation has been analyzed.

Many analysis has been conducted in rugby research to make comparisons between eras of the game. Because of the rising professionalism of the game, coaches' requirements for analytical help, and developments in performance analysis technology, game analysis within rugby union organizations is developing. Rugby research has concentrated on a variety of performance measures associated with game structures and tactical features.

Findings

Firstly, three data sources were combined for the statistical analysis of the wallabies team. All the data were relatively “clean” and the preprocessing of the data is minimal in nature. A total of 27 dates were recorded in the dataset, starting from 07/07/2021 to 20/03/2022.

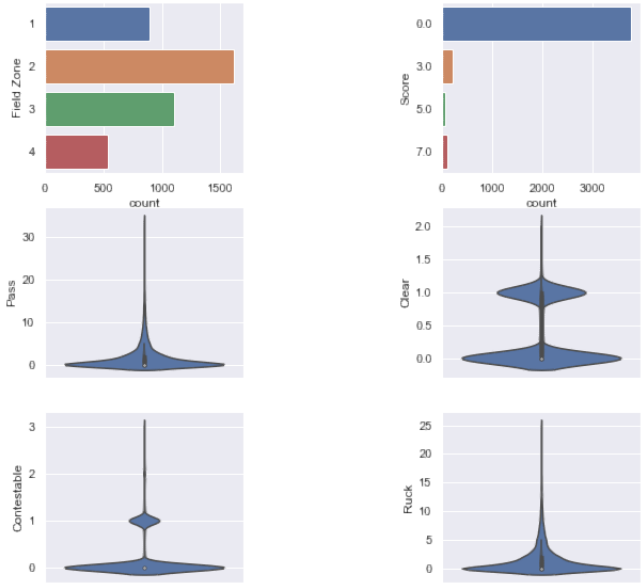

Figure 1: Count data of all the matches

From the count data that is shown above, we can observe that most of the sequences of the game played by all the teams are in field zone 2, followed by field zone 3. The score count plot reflects that most of the sequences of all the games played by the team result in no score and as true to the game of rugby, scoring points is relatively difficult. No further analysis has been conducted on all the teams as the aim of this study is to analyze and investigate the wallabies' nature of the gameplay. The following section entails the match-specific insights and performance indicators of the wallabies team.

1. Match location statistics

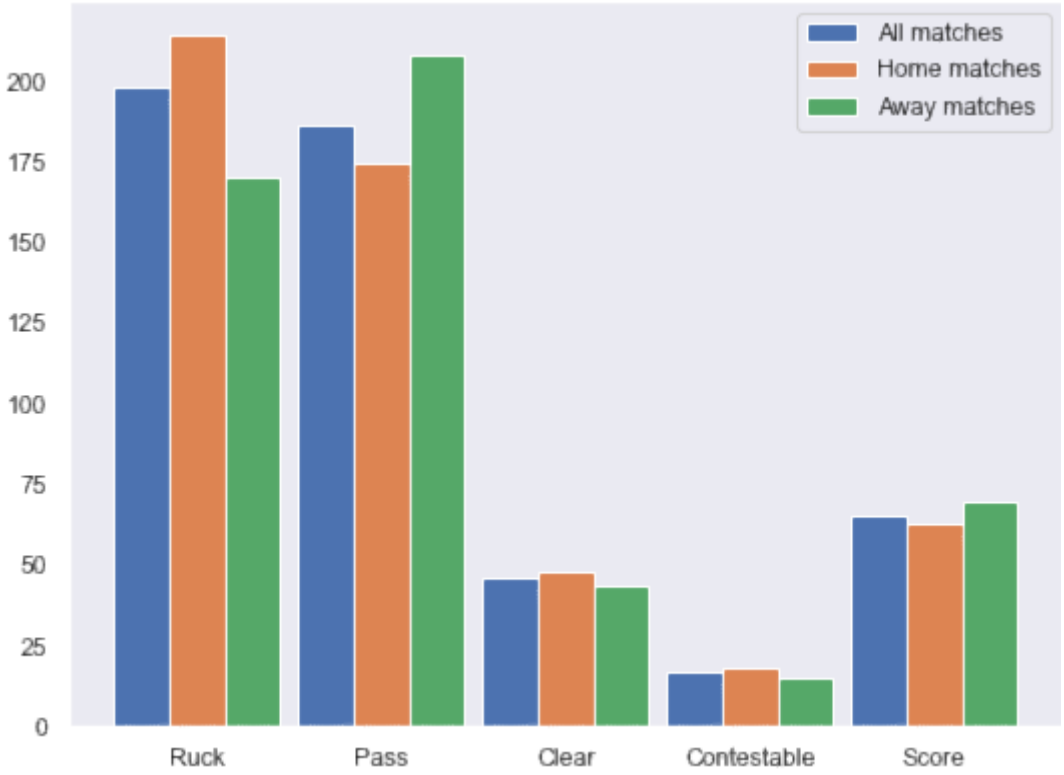

Figure 2: Frequency of events by match location

All the matches played by wallabies including home games and away games are investigated and plotted as shown in figure 2. From figure 2, we can observe that wallabies perform significantly more rucks when they play at home games, and on the contrary, they pass the ball more when playing in away matches. Defensive maneuvers like clearing and contesting for the ball are almost similar irrespective of the game location. Unintuvitely, the wallabies team scores slightly more points whilst playing away games.

2. The flow of game sequences

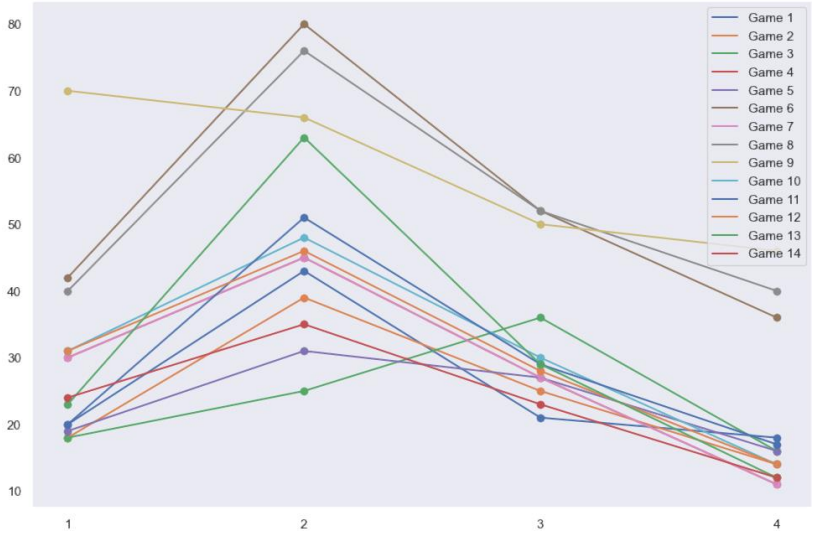

Figure 3: Flow of game sequences with respect to field position

All the game sequences from the wallabies team were bought together according to the game played. These games are analyzed chronologically from the first game recorded to the last game recorded in the data. A general trend that can be seen in figure 3 is that wallabies play more sequences of plays in field zone 2 as compared to field zone 1 but as the attack builds up and wallabies advance into the opponent's half, the sequences of play drastically reduce. Wallabies have the least amount of play sequences in the opponent's 22m. This gives an overall idea of the attack strength and aggressiveness of the wallabies team.

3. Starting field position for scoring sequences

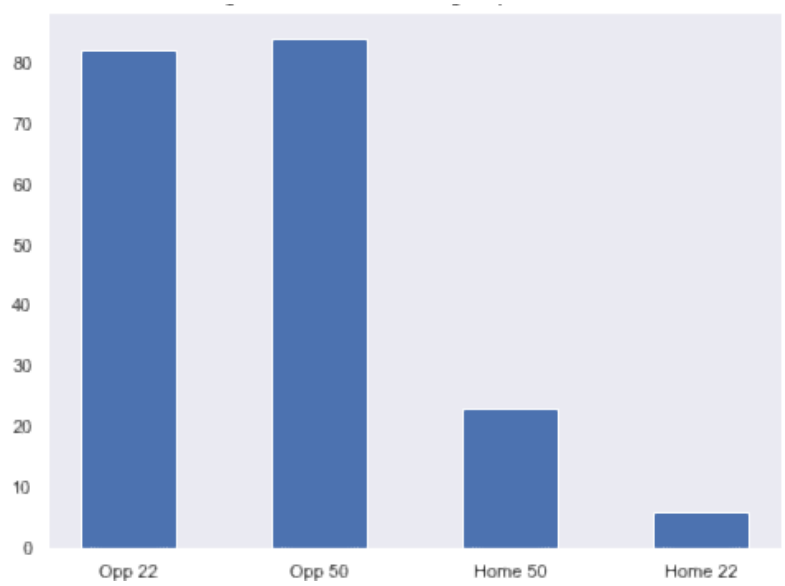

Figure 4: Starting field position for scoring sequences

Figure 4 helps us to identify the starting field zones of the wallabies team that leads to scoring points. Wallabies tend to build up the play and score points when they start the play from the

opponent-50 and the opponent-22 zones. As intuitive as it is, plays are rather difficult to develop and score when they start from the wallabies' own- 22 field zone.

4. Kicks per match

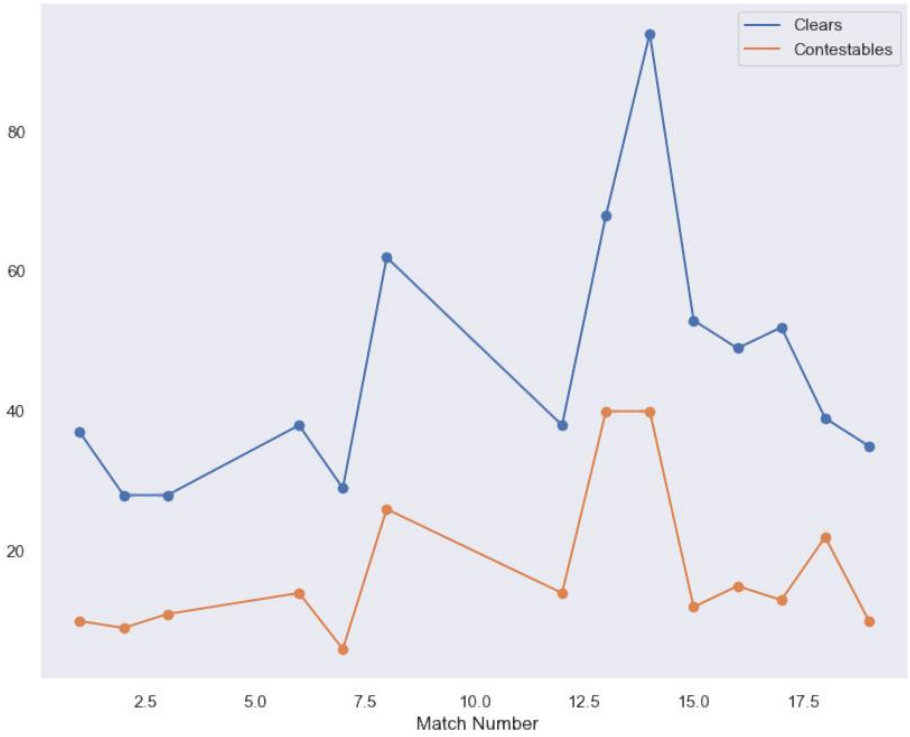

Figure 5: Kick type per game of wallabies

Kicks are an integral part of the rugby team's success. According to Quarrie [6], the match analysis data taken from the professional tournaments provided by the IRB indicate that goal kicks account for between 40% and 60% of points scored in rugby matches. Hence it becomes important to analyze the kick type. Figure 5 attempts to collectively summarise the kicks taken by wallabies. More often, wallabies commit to clearing the ball than attempting to perform a contestable kick. Though, both the kick types help in the wallabies' defense, committing to a contestable kick is more favorable for ball possession.

5. Dynamic Plays

Wheeler et al. [7] discuss how the increase in ruck frequency implies that the defending side has more chances to reclaim possession of the ball in general play. As a result, all the game sequences with rucks, pass, and clear or contestable actions from the wallabies game sequences are analyzed as a performance indicator.

Match Day	Number of Dynamic Plays
1	13
2	15
3	11
6	17
7	8
8	14
12	17
13	20
14	30
15	15
16	12
17	20
18	20
19	16

Table 1: Dynamic play by the wallabies

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Appendix