

AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

Prepared and Submitted by

NAME	ID
TARAFDER, BISHANATH	19-41827-3
AHAMED HASAN	20-41987-1

Course Name:Introduction To Data Science
Section:B

Project Title: Apply Web Scraping and Data Pre-processing

Submitted to

Dr. Akinul Islam Jony

Department of Computer Science

Faculty of Science and Technology, AIUB

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03-05-2023

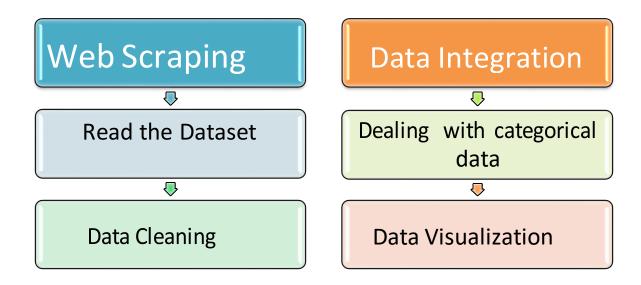
Project Outline:

Web scraping is an automatic method to obtain large amounts of data from websites. A spreadsheet or an API, for example. There are many techniques for web scraping. we have used r studio tool to scraping our data table. We used a IMDB websites for our Scrapping after that pre-processed the data.

Data pre-processing techniques are used when the data is inconsistent, which indicates that the data is not recorded in accordance with the restrictions on the column, noisy, which may contain a variety of mistakes or outliers, and incomplete, which indicates that some attribute value is missing. In our given dataset First, we tried to fix our missing values. After changing format, we have added a new column using another column value what had been given in our question condition. After adding column then we handled the categorical value to numerical value for our discretization part. At last, we tried to visualize these data.

Data Visualization is the approach used to offer patterns in the data using visual cues such as graphs, charts, maps, and many more. we have used scatter plot to represent our data visualization.

Project Solution Design:



After creating new project in RStudio read the .CSV file and then done all the data preprocessing systems.

Web Scraping:

```
library(rvest)
ipl_players_df = data.frame()
csk_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/58/IPL'
rcb_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/59/IPL
dc_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/61/IPL
mi_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/62/IPL'
kkr_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/63/IPL
rr_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/64/IPL
pbks_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/65/IPL
srh_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/255/IPL
lsg_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/966/IPL
gt_link = 'https://www.cricbuzz.com/api/html/series/5945/most-runs/3/971/IPL
 links = c(csk\_link, rcb\_link, dc\_link, mi\_link, kkr\_link, rr\_link, pbks\_link, srh\_link, lsg\_link, gt\_link) \\ teams = c('CSK', 'RCB', 'DC', 'MI', 'KKR', 'RR', 'PBKS', 'SRH', 'LSG', 'GT') 
for (link in links)
  page = read_html(link)
  table_body = html_nodes(page, 'tbody')
  table_rows = html_nodes(table_body, 'tr')
  player_name = html_nodes(table_rows, 'td:nth-child(2)')
  # player innings in 4th column
  player_innings = html_nodes(table_rows, 'td:nth-child(4)')
  # player runs in 5th column
  player_runs = html_nodes(table_rows, 'td:nth-child(5)')
  # player average in 6th column
  player_average = html_nodes(table_rows, 'td:nth-child(6)')
  # player strike rate in 7th column
  player_strike_rate = html_nodes(table_rows, 'td:nth-child(7)')
  # append the data to the data frame
  ipl_players_df = rbind(ipl_players_df, data.frame(
    team = teams[links == link],
    name = html_text(player_name),
    innings = html_text(player_innings),
    runs = html_text(player_runs),
    average = html_text(player_average),
    strike_rate = html_text(player_strike_rate)
  ))
```

This code is scrapes data from the most runs section of the IPL (Indian Premier League) website for each team and stores the data in a data frame.

It starts by creating a blank data frame called ipl_players_df. Then, it defines the links for each team's most runs section and stores them in a vector called links. It also defines the names of each team and stores them in a vector called teams.

Then, it starts a for loop that iterates through each link in the links vector. For each link, it reads the HTML content using the read_html() function from the rvest package. It then extracts the table body using the html_nodes() function and the 'tbody' selector. From the table body, it extracts the table rows using the html_nodes() function and the 'tr' selector.

For each row, it extracts the player name, innings, runs, average, and strike rate using the html_nodes() function and the appropriate nth-child selector. It then appends this data to the ipl_players_df data frame using the rbind() function and a new data frame created using the data.frame() function.

The final output of this code is a data frame containing the most runs data for each player on each team in the IPL.

team	> ip	ol_players_df					
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40 DC Kuldeep Yadav 7 21 21.00 72.41 41 MI Tilak Varma 8 248 41.33 152.15 42 MI Cameron Green 8 243 48.60 152.83 43 MI Ishan Kishan 8 211 26.38 128.66 44 MI Suryakumar Yadav 8 201 25.12 176.32 45 MI Rohit Sharma 8 184 23.00 132.37 46 MI Tim David 8 158 39.50 169.89 47 MI Nehal Wadhera 4 67 16.75 171.79 48 MI Piyush Chawla 2 23 23.00 127.78 49 MI Hrithik Shokeen 2 23 23.00 143.75 50 MI Arshad Khan 2 17 17.00 130.77		DC	Abishek Porel				106.45
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41 MI Tilak Varma 8 248 41.33 152.15 42 MI Cameron Green 8 243 48.60 152.83 43 MI Ishan Kishan 8 211 26.38 128.66 44 MI Suryakumar Yadav 8 201 25.12 176.32 45 MI Rohit Sharma 8 184 23.00 132.37 46 MI Tim David 8 158 39.50 169.89 47 MI Nehal Wadhera 4 67 16.75 171.79 48 MI Piyush Chawla 2 23 23.00 127.78 49 MI Hrithik Shokeen 2 23 23.00 143.75 50 MI Arshad Khan 2 17 17.00 130.77	40	DC		7	21		72.41
42 MI Cameron Green 8 243 48.60 152.83 43 MI Ishan Kishan 8 211 26.38 128.66 44 MI Suryakumar Yadav 8 201 25.12 176.32 45 MI Rohit Sharma 8 184 23.00 132.37 46 MI Tim David 8 158 39.50 169.89 47 MI Nehal wadhera 4 67 16.75 171.79 48 MI Piyush Chawla 2 23 23.00 127.78 49 MI Hrithik Shokeen 2 23 23.00 143.75 50 MI Arshad Khan 2 17 17.00 130.77	41	MI		8	248	41.33	152.15
43 MI Ishan Kishan 8 211 26.38 128.66 44 MI Suryakumar Yadav 8 201 25.12 176.32 45 MI Rohit Sharma 8 184 23.00 132.37 46 MI Tim David 8 158 39.50 169.89 47 MI Nehal Wadhera 4 67 16.75 171.79 48 MI Piyush Chawla 2 23 23.00 127.78 49 MI Hrithik Shokeen 2 23 23.00 143.75 50 MI Arshad Khan 2 17 17.00 130.77	42	MI					
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50 MI Arshad Khan 2 17 17.00 130.77							
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DI MI AFJUN TENGUTKAF I IS 13.00 144.44							
	ΣŢ	MT	Arjun Tendulkar	1	13	13.00	144.44

52	MI	Tristan Stubbs	1	5	5.00	50.00
53	MI	Jason Behrendorff	1	3	-	75.00
54	MI	Jofra Archer	1	1	-	50.00
55	KKR	Venkatesh Iyer	9	296	32.89	148.74
56	KKR	Rinku Singh	9	270	54.00	151.69
57	KKR	Nitish Rana	9	233	25.89	152.29
58 59	KKR KKR	Rahmanullah Gurbaz Jason Rov	6 3	183 160	30.50 53.33	145.24 170.21
60	KKR	Andre Russell	9	142	20.29	146.39
61	KKR	Shardul Thakur	6	101	20.29	183.64
62	KKR	N Jagadeesan	6	89	14.83	109.88
63	KKR	David Wiese	3	21	21.00	190.91
64	KKR	Umesh Yadav	5	19	9.50	105.56
65	KKR	Mandeep Singh	3	14	4.67	87.50
66	KKR	Sunil Narine	7	13	3.25	81.25
67	KKR	Litton Das	1	4	4.00	100.00
68	KKR	Anukul Roy	2	4	2.00	66.67
69	KKR	Varun Chakaravarthy	2	1	1.00	11.11
70 71	RR	Yashasvi Jaiswal Jos Buttler	9	428 289	47.56 32.11	159.70 138.94
72	RR RR	Sanju Samson	9	212	23.56	150.35
73	RR	Shimron Hetmyer	9	204	40.80	154.55
74	RR	Devdutt Padikkal	8	194	27.71	125.97
75	RR	Dhruv Jurel	8	132	26.40	191.30
76	RR	Ravichandran Ashwin	8	65	16.25	144.44
77	RR	Riyan Parag	5	54	13.50	112.50
78	RR	Jason Holder	3	12	6.00	109.09
79	RR	Abdul Basith	1	1	-	100.00
80	RR	Adam Zampa	1	1	1.00	100.00
81	PBKS	Shikhar Dhawan	6	262	65.50	148.86
82	PBKS	Prabhsimran Singh	9	210	23.33	153.28
83	PBKS	Sam Curran	9	192	27.43	143.28
84 85	PBKS	Jitesh Sharma Sikandar Raza	9	190 128	21.11	162.39 140.66
86	PBKS PBKS	Atharva Taide	6 5	112	25.60 22.40	140.88
87	PBKS	Matthew Short	5	90	18.00	136.36
88	PBKS	Shahrukh Khan	9	86	17.20	153.57
89	PBKS	Harpreet Singh Bhatia	3	76	25.33	128.81
90	PBKS	Liam Livingstone	4	75	18.75	138.89
91	PBKS	Bhanuka Rajapaksa	3	71	35.50	120.34
92	PBKS	Harpreet Brar	5	33	8.25	126.92
93	PBKS	Arshdeep Singh	2	2	-	100.00
94	PBKS	Nathan Ellis	2	1	0.50	14.29
95	PBKS	Mohit Rathee	1	1	-	50.00
96	SRH	Rahul Tripathi	8	170	24.29	114.86
97 98	SRH SRH	Mayank Agarwal Harry Brook	8	169 163	21.12 23.29	110.46 125.38
99	SRH	Heinrich Klaasen	5	153	51.00	182.14
100	SRH	Abhishek Sharma	6	139	23.17	156.18
101	SRH	Aiden Markram	7	132	22.00	138.95
102	SRH	Abdul Samad	4	90	45.00	120.00
103	SRH	Washington Sundar	5	60	15.00	100.00
104	SRH	Marco Jansen	3	32	32.00	103.23
105		Anmolpreet Singh	1	31	31.00	119.23
106		Adil Rashid	2	22	11.00	137.50
107		Umran Malik	2	19	19.00	237.50
108		Akeal Hosein	1	16		160.00
109 110		Glenn Phillips Bhuvneshwar Kumar	1	8 8	8.00 4.00	133.33 53.33
111		Kyle Mayers	9	297	33.00	158.82
112		KL Rahul	9	274	34.25	113.22
113		Marcus Stoinis	9	229	28.62	144.94
114		Nicholas Pooran	9	225	28.12	190.68
115	LSG	Ayush Badoni	8	132	18.86	132.00
116		Krunal Pandya	9	122	20.33	119.61
117		. Deepak Hooda	9	53	6.62	89.83
118		Krishnappa Gowtham	4	47	23.50	174.07
119		Amit Mishra	1	19	19.00	63.33
120 121		Naveen-ul-Haq Mark Wood	1 2	13 11	13.00 11.00	100.00 220.00
122		Ravi Bishnoi	4	11	11.00	78.57
123		Jaydev Unadkat	1	9	9.00	128.57
124		Yudhvir Singh Charak	2	1	0.50	50.00
125		Shubman Gill	9	339	37.67	140.66
126	GT	Hardik Pandya	8	213	30.43	117.03
127		Vijay Shankar	7	205	41.00	158.91
128		David Miller	8	180	45.00	147.54
129		Sai Sudharsan	5	176	44.00	123.94
130		Wriddhiman Saha Abhinav Manohar	9 5	151 112	16.78	123.77
131 132		Abninav manonar Rahul Tewatia	6	63	22.40 63.00	140.00 203.23
133		Rashid Khan	4	16	16.00	228.57
		Rasilia Kilali	-		_0.00	223.37

Data Integration:

```
#Data Integration
# Define the new data
new_data <- data.frame(
  team = c("CSK", "MI", "MI"),
  name = c("Mitchell Santner", "Behrendorff Jason Behrendorff", "Jofra Archer"),
  innings = c(2, 1, 1),
  runs = c(1, 3, 1),
  average = c(2.00, 3.00, 1.00),
  strike_rate = c(50.00, 75.00, 50.00)
)
# Bind the new data to the existing data frame
ipl_players_df <- rbind(ipl_players_df, new_data)</pre>
```

The code is performing data integration, which involves combining new data with an existing data frame called ipl_players_df.

The first step is to define the new data using the data.frame function.

The next step is to bind the new data to the existing data frame ipl_players_df. This is done using the rbind function, which stands for "row bind". The rbind function is used to concatenate rows of two or more data frames with the same column names. In this case, the new_data data frame is appended to the bottom of the ipl_players_df data frame. This results in a new ipl_players_df data frame with additional rows representing the performance of the three players in their respective matches.

Finally, the updated ipl_players_df data frame is assigned to the same variable name ipl_players_df to reflect the changes.

```
ipl_players_df
    team
                                    name innings runs average strike_rate
                           Devon Conwav
                                                  414
                                                          59.14
                                                                     144.25
     CSK
                        Ruturaj Gaikwad
Shivam Dube
     CSK
                                                   354
                                                                      145.68
                         Ajinkya Rahane
                               Moeen Ali
                                                   107
                                                          21.40
                                                                     146.58
                        Ravindra Jadeja
                                                          18.40
                                                                     143.75
     CSK
                                                                     136.07
     CSK
                          Ambati Rayudu
                                                    83
                                                          16.60
8
     CSK
                               MS Dhoni
                                                                      211.43
                                                    1.5
                                                          7.50
                              Ben Stokes
                                                                     107.14
     CSK
10
                       Mitchell Santner
                                                                       50.00
     CSK
                                                          58.25
                         Faf du Plessis
                                                   466
                                                                     159.59
     RCB
                             Virat Kohli
     RCB
                          Glenn Maxwell
     RCB
                         Dinesh Karthik
                                                         12.38
                                                                     133.78
     RCB
     RCB
                         Mahipal Lomror
                                                         15.60
                                                                     130.00
                          Shahbaz Ahmed
16
     RCB
                                                         10.50
                                                                     107.69
                           David Willev
                                                    35
                                                                     109.38
17
     RCB
                                                          8.75
                    Suyash Prabhudessai
18
                                                                     120.69
     RCB
                                                    35
                                                    25
19
                                                         12.50
                                                                       65.79
     RCB
                             Anui Rawat
                      Wanindu Hasaranga
20
                                                          10.50
                                                                      105.00
     RCB
21
                      Michael Bracewell
     RCB
                             Akash Deep
23
                      Vijaykumar Vyshak
                                                                      144.44
                          Harshal Patel
24
                                                                     100.00
25
26
     RCB
                            Karn Sharma
                                                          1.50
                                                                       60.00
                                                   308
                           David Warner
                                                          34.22
                                                                     118.46
27
                                                   238
      DC
                             Axar Patel
                                                          34.00
                                                                     133.71
28
                          Manish Pandey
                                                   133
                                                          19.00
      DC
                                                                     116.67
29
      DC
                         Mitchell Marsh
                                                          15.67
                                                                      130.56
30
                        Aman Hakim Khan
                                                          14.17
                                                                     119.72
                            Philip Salt
32
                          Sarfaraz Khan
                                                          13.25
                                                                       85.48
33
                          Rilee Rossouw
                                                    52
                                                          13.00
                                                                     133.33
34
35
                            Lalit Yadav
                                                         16.00
                                                                     114.29
      DC
                           Prithvi Shaw
                                                                     117.50
                                                         19.50
36
      DC
                                                    39
                                                                     144.44
                            Ripal Patel
37
      DC
                                                    37
                          Anrich Nortie
                                                         12.33
                                                                     132.14
38
      DC
                          Abishek Porel
                                                                     106.45
39
      DC
                             Priyam Garg
                          Kuldeep Yadav
41
                            Tilak Varma
                                                   248
42
                          Cameron Green
                                                   243
                                                          48.60
                                                                     152.83
43
                           Ishan Kishan
                                                   211
                                                          26.38
                                                                     128.66
44
                       Suryakumar Yadav
                                                   201
                                                          25.12
                                                                     176.32
45
                           Rohit Sharma
                                                   184
                                                          23.00
      МΤ
                                                                     132.37
46
                               Tim David
                                                   158
      ΜI
                                                          39.50
                                                                     169.89
                          Nehal Wadhera
47
                                                          16.75
      ΜI
                                                                     171.79
                                                          23.00
      ΜI
                          Piyush Chawla
                        Hrithik Shokeen
                                                                     130.77
50
                             Arshad Khan
                                                    17
                                                          17.00
                        Arjun Tendulkar
                                                          13.00
                                                                      144.44
```

52	MI	Tristan Stubbs	1	5	5.00	50.00
53	MI	Jason Behrendorff	1	3	-	75.00
54	MΙ	Jofra Archer	1	1	-	50.00
55	KKR	Venkatesh Iver	9	296	32.89	148.74
56		,	9	270	54.00	
	KKR	Rinku Singh				151.69
57	KKR	Nitish Rana	9	233	25.89	152.29
58	KKR	Rahmanullah Gurbaz	6	183	30.50	145.24
59		Jason Roy		160		170.21
	KKR	,	3		53.33	
60	KKR	Andre Russell	9	142	20.29	146.39
61	KKR	Shardul Thakur	6	101	20.20	183.64
62	KKR	N Jagadeesan	6	89	14.83	109.88
63	KKR	David Wiese	3	21	21.00	190.91
64	KKR	Umesh Yadav	5	19	9.50	105.56
-						
65	KKR	Mandeep Singh	3	14	4.67	87.50
66	KKR	Sunil Narine	7	13	3.25	81.25
67	KKR	Litton Das	1	4	4.00	100.00
68	KKR	Anukul Roy	2	4	2.00	66.67
69	KKR	Varun Chakaravarthy	2	1	1.00	11.11
70	RR	Yashasvi Jaiswaĺ	9	428	47.56	159.70
71	RR	Jos Buttler	9	289	32.11	138.94
72	RR	Sanju Samson	9	212	23.56	150.35
73	RR	Shimron Hetmyer	9	204	40.80	154.55
74	RR	Devdutt Padikkal	8	194	27.71	125.97
75	RR	Dhruv Jurel	8	132	26.40	191.30
76	RR	Ravichandran Ashwin	8	65	16.25	144.44
77	RR	Riyan Paraq	5	54	13.50	112.50
78	RR	Jason Holder	3	12	6.00	109.09
79	RR	Abdul Basith	1	1	-	100.00
80		Adam Zampa	1	1	1.00	100.00
	RR					
81	PBKS	Shikhar Dhawan	6	262	65.50	148.86
82	PBKS	Prabhsimran Singh	9	210	23.33	153.28
83		Sam Curran	9	192	27.43	143.28
	PBKS					
84	PBKS	Jitesh Sharma	9	190	21.11	162.39
85	PBKS	Sikandar Raza	6	128	25.60	140.66
86	PBKS	Atharva Taide	5	112	22.40	149.33
87	PBKS	Matthew Short	5	90	18.00	136.36
88	PBK5	Shahrukh Khan	9	86	17.20	153.57
89	PBKS	Harpreet Singh Bhatia	3	76	25.33	128.81
90	PBKS	Liam Livingstone	4	75	18.75	138.89
91	PBKS	Bhanuka Rajapaksa	3	71	35.50	120.34
92	PBKS	Harpreet Brar	5	33	8.25	126.92
93	PBKS	Arshdeep Singh	2	2	-	100.00
94	PBKS	Nathan Ellis	2	1	0.50	14.29
95	PBKS	Mohit Rathee	1	1	_	50.00
96	SRH	Rahul Tripathi	8	170	24.29	114.86
97	SRH	Mayank Agarwal	8	169	21.12	110.46
98	SRH	Harry Brook	8	163	23.29	125.38
99	SRH	Heinrich Klaasen	5	153	51.00	182.14
100	SRH	Abhishek Sharma	6	139	23.17	156.18
101	SRH	Aiden Markram	7	132	22.00	138.95
102	SRH		4	90		120.00
102		Abdul Samad			45.00	
103	SRH	Washington Sundar	5	60	15.00	100.00
104	SRH	Marco Jansen	3	32	32.00	103.23
105	CDU	Anmolpreet Singh	1	31	31.00	119.23
	SRH					
106	SRH	Adil Rashid	2	22	11.00	137.50
107	SRH	Umran Malik	2	19	19.00	237.50
108	SRH	Akeal Hosein	1	16	_	160.00
					0.00	
109		Glenn Phillips	1	8	8.00	133.33
110	SRH	Bhuvneshwar Kumar	3	8	4.00	53.33
111	LSG	Kyle Mayers	9	297	33.00	158.82
112		Ky re Mayers	9	274	34.25	113.22
113		Marcus Stoinis	9	229	28.62	144.94
114	LSG	Nicholas Pooran	9	225	28.12	190.68
115	LSG	Ayush Badoni	8	132	18.86	132.00
116		Krunal Pandya	9	122	20.33	119.61
117	LSG	Deepak Hooda	9	53	6.62	89.83
118	LSG	Krishnappa Gowtham	4	47	23.50	174.07
119		Amit Mishra	1	19	19.00	63.33
120		Naveen-ul-Haq	1	13	13.00	100.00
121	LSG	Mark Wood	2	11	11.00	220.00
122		Ravi Bishnoi	4	11	11.00	78.57
123		Jaydev Unadkat	1	9	9.00	128.57
124	LSG	Yudhvir Singh Charak	2	1	0.50	50.00
125		Shubman Gill	9	339	37.67	140.66
126		Hardik Pandya	8	213	30.43	117.03
127	GT	Vijay Shankar	7	205	41.00	158.91
128	GT	David Miller	8	180	45.00	147.54
129		Sai Sudharsan	5	176	44.00	123.94
130		Wriddhiman Saha	9	151	16.78	123.77
131	GT	Abhinav Manohar	5	112	22.40	140.00
132		Rahul Tewatia	6	63	63.00	203.23
		Rashid Khan				
133			4	16	16.00	228.57
134		Mitchell Santner	2	1	2	50
135	MI	Behrendorff Jason Behrendorff	1	3	3	75
136		Jofra Archer	1	1	1	50
	MI	JOH & ALCHEI	1	_	1	50
>						

preprocessing the data:

Data Cleaning:

Smooth noisy data

```
### Smooth noisy data
ipl_players_df$runs = as.numeric(gsub('[-]', NA, ipl_players_df$runs))
ipl_players_df$average = as.numeric(gsub('[-]', NA, ipl_players_df$average))
ipl_players_df$strike_rate = as.numeric(gsub('[-]', NA, ipl_players_df$strike_rate))
### Remove duplicates
ipl_players_df = ipl_players_df[!duplicated(ipl_players_df), ]
### Remove rows with NA values
ipl_players_df = na.omit(ipl_players_df)

### Remove rows with 0 runs
ipl_players_df = ipl_players_df[ipl_players_df$runs != 0, ]
## remove rows with 0 innings
ipl_players_df = ipl_players_df[ipl_players_df$innings != 0, ]
## remove rows with 0 average
ipl_players_df = ipl_players_df[ipl_players_df$average != 0, ]
```

These lines of code are cleaning the data by removing duplicates and rows with missing or zero values.

First, the code replaces any dash (-) characters in the "runs", "average", and "strike_rate" columns with NA values, and then converts the columns to numeric data types. This is done to ensure that these columns contain only numeric values and can be used for further analysis.

Next, the code removes duplicate rows from the data frame using the duplicated function. This function returns a logical vector indicating which rows are duplicated, and the ! operator negates the vector to select the non-duplicated rows.

Then, the code removes any rows with missing values using the na.omit function. This function removes any rows that contain missing values in any of the columns.

The code then removes any rows where the "runs" column has a value of 0, as these are likely to be incomplete or erroneous data. Similarly, it removes any rows where the "innings" or "average" columns have a value of 0, as these indicate that the player did not bat in any innings or did not score any runs on average. These rows are unlikely to be informative for analysis and can be safely removed.

• Handle missing data

```
## Handle missing data
### Replace missing values with mean
ipl_players_df$runs[is.na(ipl_players_df$runs)] = mean(ipl_players_df$runs, na.rm = TRUE)
ipl_players_df$average[is.na(ipl_players_df$average)] = mean(ipl_players_df$average, na.rm = TRUE)
ipl_players_df$strike_rate[is.na(ipl_players_df$strike_rate)] = mean(ipl_players_df$strike_rate, na.rm = TRUE)
```

This code is handling missing data in the ipl_players_df data frame.

In the first step, the code replaces the - characters in the runs, average, and strike_rate columns with NA values, and then converts those columns to numeric.

Next, the code removes any duplicate rows and any rows with NA values.

Then, the code removes any rows where the runs column is equal to 0, the innings column is equal to 0, or the average column is equal to 0.

Finally, the code handles any remaining missing values in the runs, average, and strike_rate columns by replacing them with the mean of the non-missing values in the respective columns, using the mean() function with the na.rm = TRUE argument to exclude any NA values from the calculation.

Data Munging

```
# Data Munging
## Create a new column for player type
ipl_players_df$type = NA|
```

ipl_players_df\$strike_rate = as.numeric(ipl_players_df\$strike_rate)

This code adds a new column named "type" to the IPL players data frame and initializes it with NA values.

```
## Assign player type based on average and strike rate

ipl_players_df$type[(ipl_players_df$average > 10) & (ipl_players_df$strike_rate < 100)] = 'Batsman'

ipl_players_df$type[(ipl_players_df$average > 35) & (ipl_players_df$strike_rate < 100)] = 'Bowler'

ipl_players_df$type[(ipl_players_df$average > 25) & (ipl_players_df$strike_rate > 140)] = 'Power Hitter'

ipl_players_df$type[(ipl_players_df$average > 25) & (ipl_players_df$average < 35) & (ipl_players_df$strike_rate > 130)] = 'Aggressive Batsman'

ipl_players_df$type[(ipl_players_df$average > 25) & (ipl_players_df$average < 35) & (ipl_players_df$strike_rate > 100) & (ipl_players_df$strike_rate < 130)] = 'Batting All-rounder'

ipl_players_df$type[(ipl_players_df$average < 25) & (ipl_players_df$strike_rate > 100) & (ipl_players_df$strike_rate < 130)] = 'Batting All-rounder'

ipl_players_df$type[(ipl_players_df$average < 25) & (ipl_players_df$strike_rate > 100) & (ipl_players_df$strike_rate < 130)] = 'Batting All-rounder'

ipl_players_df$type[(ipl_players_df$average < 25) & (ipl_players_df$strike_rate > 100) & (ipl_players_df$strike_rate < 130)] = 'Bowling All-rounder'

ipl_players_df$type[(ipl_players_df$average < 15) & (ipl_players_df$strike_rate < 100)] = 'Tailender'

### Convert runs, average and strike rate to numeric

ipl_players_df$runs = as.numeric(ipl_players_df$suerage)
```

This code assigns a player type to each player in the ipl_players_df dataframe based on their average and strike rate. The types are: "Batsman", "Bowler", "Power Hitter", "Aggressive Batsman", "Batting All-rounder", "Slogger", "Bowling All-rounder", and "Tailender". The code then converts the "runs", "average", and "strike rate" columns to numeric data type.

```
> ipl_players_df
    team
                                  name innings runs average strike_rate
                                                                                        type
                                                                                Power Hitter
1
     CSK
                                             9 414
                                                       59.14
                                                                 144.25
                          Devon Conway
2
                                             9 354
                                                       44.25
     CSK
                       Ruturaj Gaikwad
                                                                 145.68
                                                                                Power Hitter
3
     CSK
                           Shivam Dube
                                             8 264
                                                       33.00
                                                                 158.08 Aggressive Batsman
                                             6 224
                                                      44.80
     CSK
                        Ajinkya Rahane
                                                                 189.83
                                                                                Power Hitter
                             Moeen Ali
                                             7 107
                                                       21.40
                                                                  146.58
                                                                                     Slogger
```

Data Discretization:

```
## Create a new column for player performance

ipl_players_df$performance = 'Average'

## Assign player performance based on runs, average and strike rate

mean_runs = mean(ipl_players_df$runs)
mean_average = mean(ipl_players_df$average)
mean_strike_rate = mean(ipl_players_df$average)
mean_strike_rate = mean(ipl_players_df$strike_rate)

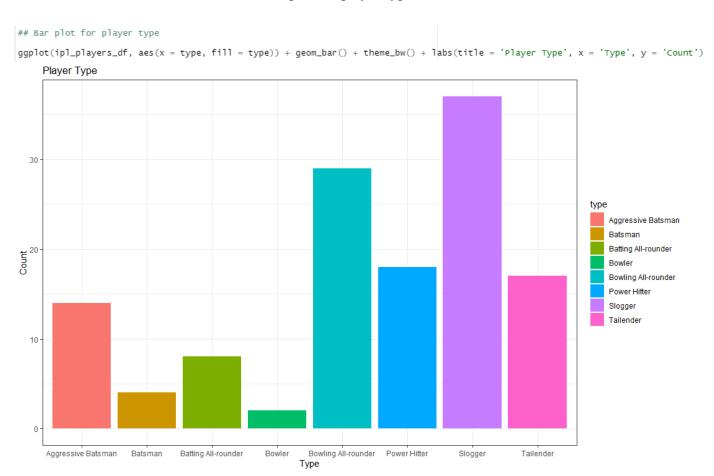
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average < mean_average % ipl_players_df$strike_rate < mean_strike_rate] = 'Inconsistent'
ipl_players_df$performance[ipl_players_df$runs < mean_runs % ipl_players_df$average < mean_average % ipl_players_df$strike_rate < mean_strike_rate] = 'Steady'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average < mean_average % ipl_players_df$strike_rate > mean_strike_rate] = 'Steady'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average < mean_average % ipl_players_df$strike_rate > mean_strike_rate] = 'Excellent'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average > mean_average % ipl_players_df$strike_rate < mean_strike_rate] = 'Cood'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average < mean_average & ipl_players_df$strike_rate < mean_strike_rate] = 'Average'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average < mean_average & ipl_players_df$strike_rate < mean_strike_rate'0.8] = 'Bad'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average < mean_average & ipl_players_df$strike_rate < mean_strike_rate'0.8] = 'Bad'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average > mean_average & ipl_players_df$strike_rate < mean_strike_rate'1.2] = 'Dominant
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average > mean_average & ipl_players_df$strike_rate < mean_strike_rate' > 'Solid'
ipl_players_df$performance[ipl_players_df$runs > mean_runs % ipl_players_df$average > mean_average & ip
```

This code creates a new column called "performance" in the dataframe "ipl_players_df" and assigns the value "Average" to all rows in that column. Then, it assigns a different performance level to each row based on the player's runs, average, and strike rate compared to the mean values of those statistics in the entire dataframe. For example, if a player's runs are greater than 1.2 times the mean runs and their average and strike rate are less than the mean average and mean strike rate, respectively, then their performance level is "Inconsistent". Similarly, there are different conditions for assigning other performance levels such as "Steady", "Impactful", "Excellent", "Good", "Poor", "Bad", "Dominant", "Solid", and "Consistent".

> ipl_players_df								
	team	name	innings	runs	average	strike_rate	type	performance
1	CSK	Devon Conway	9	414	59.14	144.25	Power Hitter	Excellent
2	CSK	Ruturaj Gaikwad	9	354	44.25	145.68	Power Hitter	Excellent
3	CSK	Shivam Dube	8	264	33.00	158.08	Aggressive Batsman	Dominant
4	CSK	Ajinkya Rahane	6	224	44.80	189.83	Power Hitter	Dominant
5	CSK	Moeen Ali	7	107	21.40	146.58	Slogger	Poor
128	GT	David Miller	8	180	45.00	147.54	Power Hitter	Excellent
129	GT	Sai Sudharsan	5	176	44.00	123.94	Batsman	solid
130	GT	Wriddhiman Saha	9	151	16.78	123.77	Bowling All-rounder	Average
131	GT	Abhinav Manohar	5	112	22.40	140.00	Slogger	Average
132	GT	Rahul Tewatia	6	63	63.00	203.23	Power Hitter	Consistent

Data Visualization:

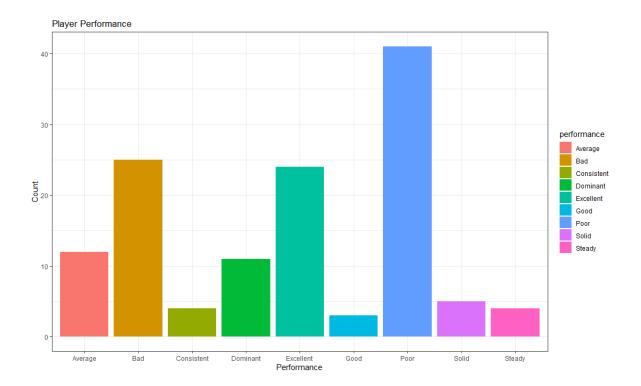
The below Bar plot for player type



The below Bar plot for player type

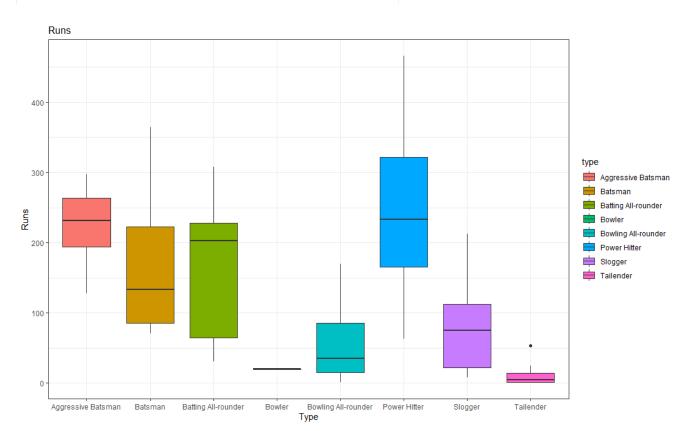
```
## Bar plot for player performance

ggplot(ipl_players_df, aes(x = performance, fill = performance)) + geom_bar() + theme_bw() + labs(title = 'Player Performance', x = 'Performance', y = 'Count')
```



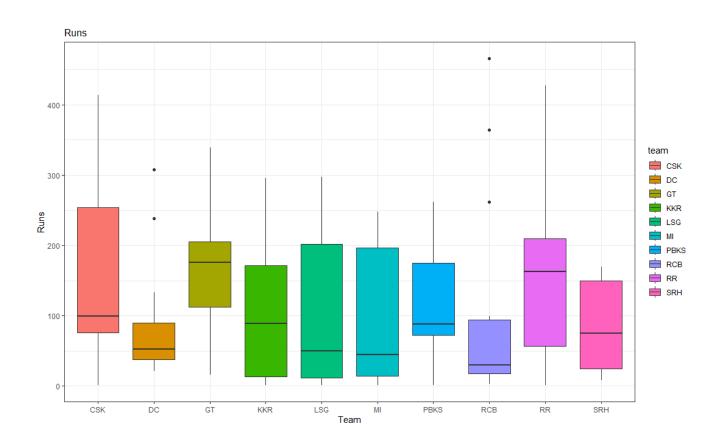
The below Box plot is made depending on the type(X-axis) and runs(Y-Axis)

Box plot for runs
ggplot(ipl_players_df, aes(x = type, y = runs, fill = type)) + geom_boxplot() + theme_bw() + labs(title = 'Runs', x = 'Type', y = 'Runs')



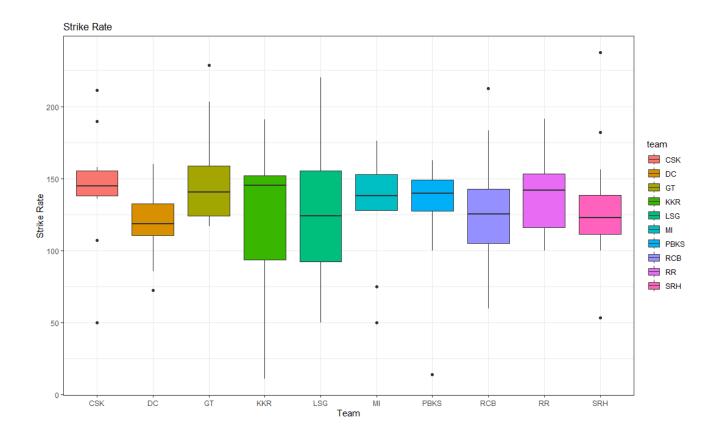
Measure the team performance by runs, strike rate, average, moving average and moving average of strike rate The below Box plot is made depending on the team(X-axis) and runs(Y-Axis)

```
## Measure the team performance by runs, strike rate, average, moving average and moving average of strike rate
### Runs
ggplot(ipl_players_df, aes(x = team, y = runs, fill = team)) + geom_boxplot() + theme_bw() + labs(title = 'Runs', x = 'Team', y = 'Runs')
```



The below Box plot is made depending on the team(X-axis) and strike_rate(Y-Axis)

```
### Strike Rate
|
ggplot(ipl_players_df, aes(x = team, y = strike_rate, fill = team)) + geom_boxplot() + theme_bw() + labs(title = 'Strike Rate', x = 'Team', y = 'Strike Rate')
```

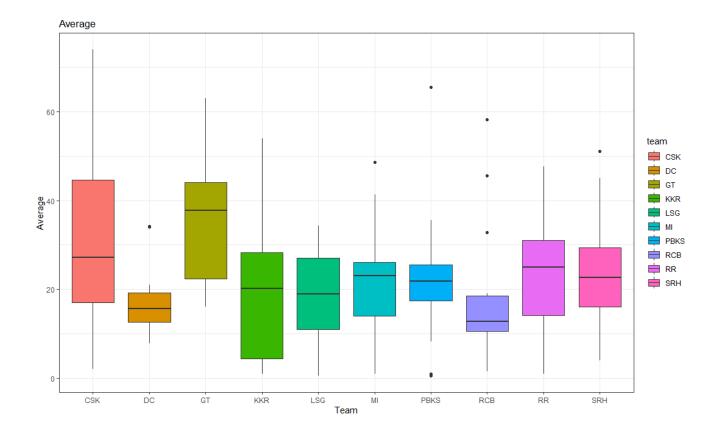


The below Box plot is made depending on the team(X-axis) and average(Y-Axis)

```
### Average

ggplot(ipl_players_df, aes(x = team, y = average, fill = team)) + geom_boxplot() + theme_bw() + labs(title = 'Average', x = 'Team', y = 'Average')

### Average
```



Discussion and Conclusion:

The project plays a vital role to learn how to web scrape and pre-process data. We learned about webscraping, cleaning, integration, reduction, transformation and discretization of data from a datset. I faced some kind of difficulties working with the datas using RStudio but It gives us a few knowledge how a data scientists work with datas. Now a days, every information is a data and we are surrounding by datas. so, its important to know how data can be scraped and processed.