Untitled1

March 3, 2021

1 Data analysis for Indian Premier League

IPL is a professional Twenty20 cricket league founded by the Board of Control for Cricket in India (BCCI) in 2008.

The dataset that we use in this notebook is IPL (Indian Premier League) Dataset posted on Kaggle Datasets sourced from cricsheet. (https://www.kaggle.com/manasgarg/ipl/data)

The dataset consist of data about IPL matches played from the year 2008 to 2017. It uses two sets of data based from 2008 -2017; match-by-match and ball by ball statistics.

[3]:
```
import pandas as pd

df1 = pd.read_csv (r'matches.csv')
df1.head()
```

[3]:

	id	season	city	date	team1	team2	toss_winner	toss_decision	result	dl_applied	winner	win_by_runs	win_by_wickets	player_of_match	venue
0	1	2017	Hyderabad	05-04-2017	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	field	normal	0	Sunrisers Hyderabad	35	0	Yuvraj Singh	Rajiv Gandhi International Stadium, Uppal
1	2	2017	Pune	06-04-2017	Mumbai Indians	Rising Pune Supergiant	Rising Pune Supergiant	field	normal	0	Rising Pune Supergiant	0			
2	3	2017	Rajkot	07-04-2017	Gujarat Lions	Kolkata Knight Riders	Kolkata Knight Riders	field	normal	0	Kolkata Knight Riders	0			
3	4	2017	Indore	08-04-2017	Rising Pune Supergiant	Kings XI Punjab	Kings XI Punjab	field	normal	0	Kings XI Punjab	0			
4	5	2017	Bangalore	08-04-2017	Royal Challengers Bangalore	Delhi Daredevils	Royal Challengers Bangalore	bat	normal	0	Royal Challengers Bangalore	15			

```
1              7       SPD Smith    Maharashtra Cricket Association Stadium
2             10         CA Lynn     Saurashtra Cricket Association Stadium
3              6      GJ Maxwell                     Holkar Cricket Stadium
4              0       KM Jadhav                      M Chinnaswamy Stadium

          umpire1        umpire2  umpire3
0     AY Dandekar       NJ Llong      NaN
1  A Nand Kishore         S Ravi      NaN
2     Nitin Menon      CK Nandan      NaN
3    AK Chaudhary  C Shamshuddin      NaN
4             NaN            NaN      NaN
```

[4]:
```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 636 entries, 0 to 635
Data columns (total 18 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   id               636 non-null    int64
 1   season           636 non-null    int64
 2   city             629 non-null    object
 3   date             636 non-null    object
 4   team1            636 non-null    object
 5   team2            636 non-null    object
 6   toss_winner      636 non-null    object
 7   toss_decision    636 non-null    object
 8   result           636 non-null    object
 9   dl_applied       636 non-null    int64
 10  winner           633 non-null    object
 11  win_by_runs      636 non-null    int64
 12  win_by_wickets   636 non-null    int64
 13  player_of_match  633 non-null    object
 14  venue            636 non-null    object
 15  umpire1          635 non-null    object
 16  umpire2          635 non-null    object
 17  umpire3          0 non-null      float64
dtypes: float64(1), int64(5), object(12)
memory usage: 89.6+ KB
```

[5]:
```
df1.describe()
```

[5]:
```
                id       season  dl_applied  win_by_runs  win_by_wickets  \
count   636.000000   636.000000  636.000000   636.000000      636.000000
mean    318.500000  2012.490566    0.025157    13.682390        3.372642
std     183.741666     2.773026    0.156726    23.908877        3.420338
min       1.000000  2008.000000    0.000000     0.000000        0.000000
```

```
25%    159.750000  2010.000000    0.000000     0.000000        0.000000
50%    318.500000  2012.000000    0.000000     0.000000        4.000000
75%    477.250000  2015.000000    0.000000    20.000000        7.000000
max    636.000000  2017.000000    1.000000   146.000000       10.000000

       umpire3
count      0.0
mean       NaN
std        NaN
min        NaN
25%        NaN
50%        NaN
75%        NaN
max        NaN
```

[6]:
```
df1.head(2)
```

[6]:
```
   id  season       city        date                 team1  \
0   1    2017  Hyderabad  05-04-2017  Sunrisers Hyderabad
1   2    2017       Pune  06-04-2017       Mumbai Indians

                         team2                 toss_winner toss_decision  \
0  Royal Challengers Bangalore  Royal Challengers Bangalore         field
1       Rising Pune Supergiant       Rising Pune Supergiant         field

   result  dl_applied                winner  win_by_runs  win_by_wickets  \
0  normal           0     Sunrisers Hyderabad           35               0
1  normal           0  Rising Pune Supergiant            0               7

  player_of_match                                      venue         umpire1  \
0    Yuvraj Singh  Rajiv Gandhi International Stadium, Uppal     AY Dandekar
1       SPD Smith    Maharashtra Cricket Association Stadium  A Nand Kishore

    umpire2  umpire3
0  NJ Llong      NaN
1    S Ravi      NaN
```

2 How many matches we've got in the dataset?

[7]:
```
#matches,_=df1.shape
matches=df1['id'].max()
print("How many matches we've got in the dataset?\nAns:",matches)
```

```
How many matches we've got in the dataset?
Ans: 636
```

3 How many seasons we've got in the dataset?

[8]:
```
#no_of_seasons=len(set(df1.season))
no_of_seasons=len(df1['season'].unique())
print("How many seasons we've got in the dataset?\nAns:",no_of_seasons)
```

```
How many seasons we've got in the dataset?
Ans: 10
```

4 Which Team had won by maximum runs?

[48]:
```
# maximum_run_win=max(df1['win_by_runs'])
# for i in range(matches):
#     if df1.win_by_runs[i]==maximum_run_win:
#         print("Which Team had won by maximum runs?\nAns:",df1.winner[i],"won␣
 ↪by",maximum_run_win,"runs")

#df1.iloc[df1['win_by_runs'].idxmax()]
#idxmax will return the id of the maximumth value
#iloc takes an index value and returns the row.

df1.iloc[df1['win_by_runs'].idxmax()]['winner']
```

[48]:
```
'Mumbai Indians'
```

5 Which Team had won by maximum wicket?

[10]:
```
max_wicket_win=max(df1['win_by_wickets'])
for i in range(matches):
    if df1.win_by_wickets[i]==max_wicket_win:
        print("Which Team had won by maximum wickets?\nAns:",df1.winner[i],"won␣
 ↪by",max_wicket_win,"wickets\n")

# df1.iloc[df1['win_by_wickets'].idxmax()]['winner']
```

```
Which Team had won by maximum wickets?
Ans: Kolkata Knight Riders won by 10 wickets

Which Team had won by maximum wickets?
Ans: Kings XI Punjab won by 10 wickets

Which Team had won by maximum wickets?
Ans: Deccan Chargers won by 10 wickets

Which Team had won by maximum wickets?
```

```
Ans: Delhi Daredevils won by 10 wickets

Which Team had won by maximum wickets?
Ans: Royal Challengers Bangalore won by 10 wickets

Which Team had won by maximum wickets?
Ans: Rajasthan Royals won by 10 wickets

Which Team had won by maximum wickets?
Ans: Mumbai Indians won by 10 wickets

Which Team had won by maximum wickets?
Ans: Chennai Super Kings won by 10 wickets

Which Team had won by maximum wickets?
Ans: Royal Challengers Bangalore won by 10 wickets

Which Team had won by maximum wickets?
Ans: Sunrisers Hyderabad won by 10 wickets
```

6 Which Team had won by closest Margin (minimum runs)?

[49]:
```
# minimum_run_win=min(df1['win_by_runs']>0)
# for i in range(matches):
#     if df1.win_by_runs[i]==minimum_run_win:
#         print("Which Team had won by maximum runs?\nAns:",df1.winner[i],"won␣
 ↪by",minimum_run_win,"runs")

matches=df1
# matches.iloc[matches[matches['win_by_runs'].gt(0)].win_by_runs.
 ↪idxmin()]['winner']
```

[50]:
```
matches.iloc[matches[matches['win_by_runs'].ge(1)].win_by_runs.
 ↪idxmin()]['winner']
#matches[matches['win_by_runs'].gt(0)].win_by_runs.idxmin()
```

[50]:
```
'Mumbai Indians'
```

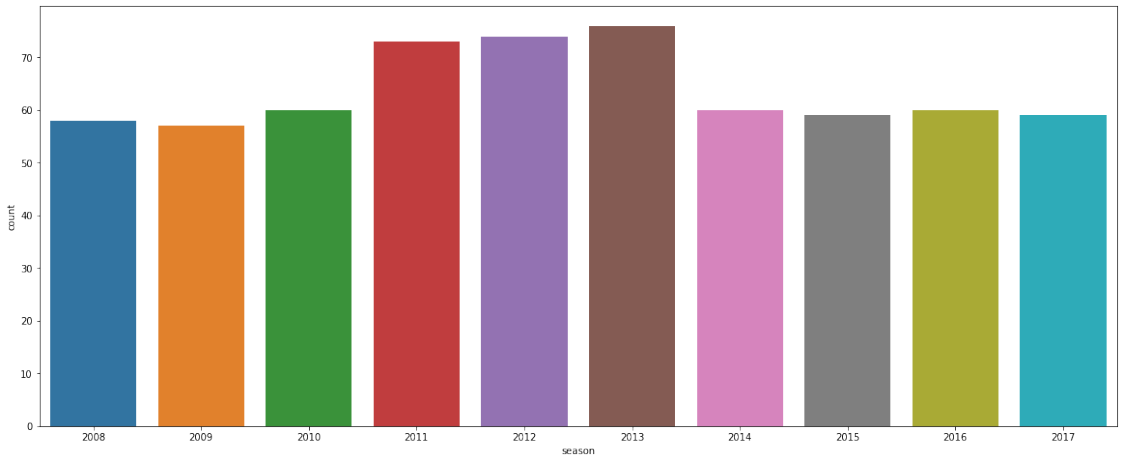
7 Which Team had won by minimum wicket?

[13]:
```
matches.iloc[matches[matches['win_by_wickets'].ge(1)].win_by_wickets.
 ↪idxmin()]['winner']
```

[13]:
```
'Kolkata Knight Riders'
```

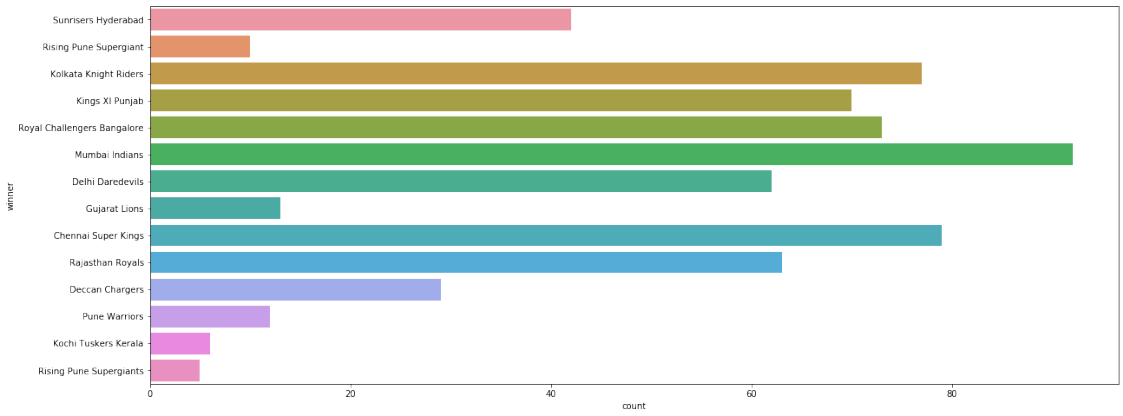
8 Which season had most number of matches?

[14]:
```
import matplotlib.pyplot as plt #visualization
import seaborn as sns #modern visualization
plt.rcParams['figure.figsize'] = (20, 8)

sns.countplot(x='season',data=matches)
#Show the counts of observations in each categorical bin using bars.
plt.show()
```



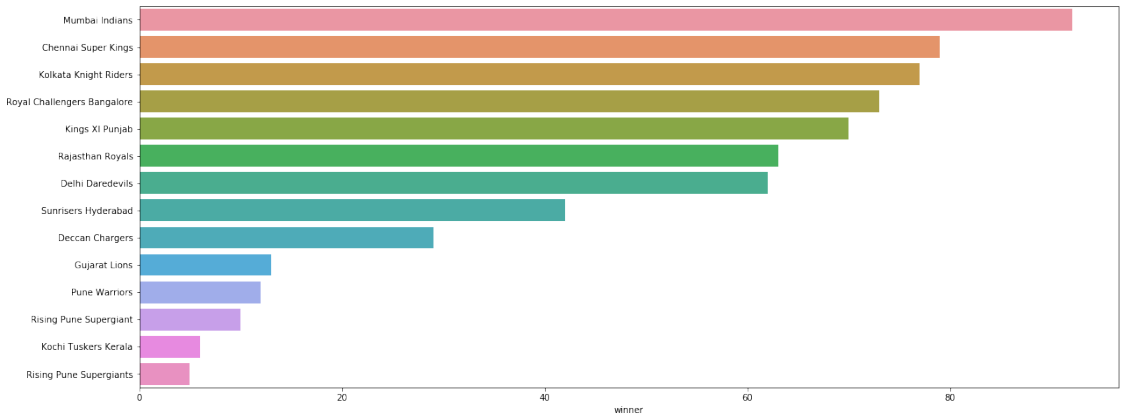
9 The most successful IPL Team

[15]:
```
sns.countplot(y='winner',data=matches)
#Show the counts of observations in each categorical bin using bars.
plt.show()
```



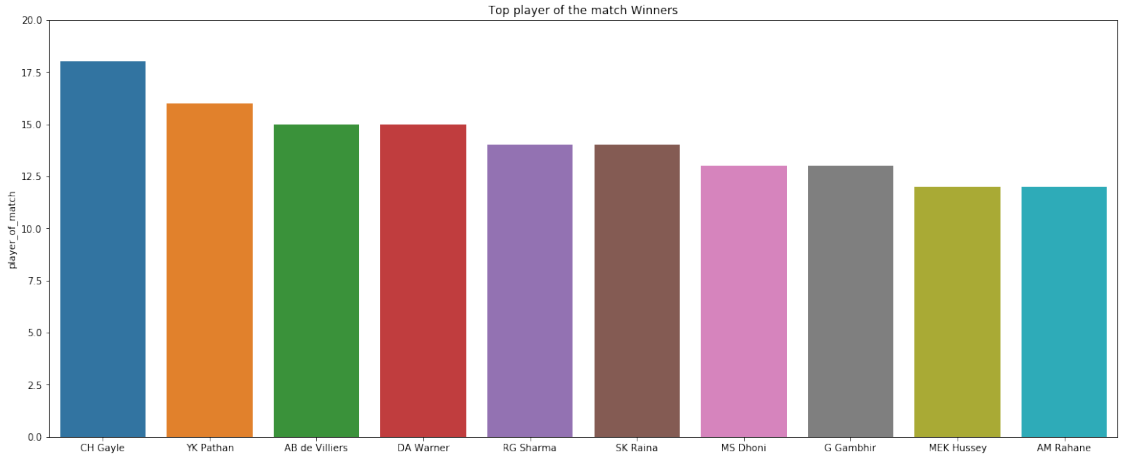
10 The most successful IPL Team (descending order)

[16]:
```
# sns.countplot(y='winner', data = matches)
# plt.show()
data = matches.winner.value_counts()
sns.barplot(y = data.index, x = data, orient='h');
```



11 Top player of the match Winners

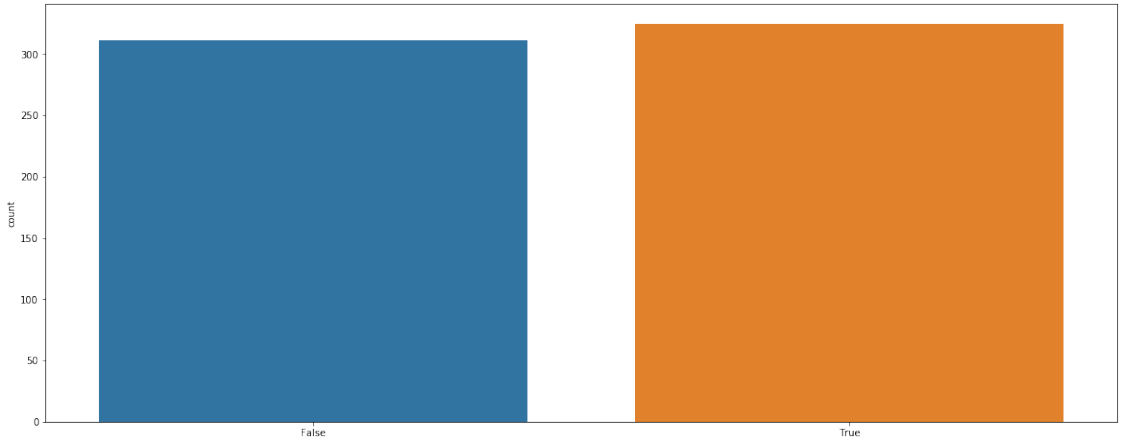
[17]:
```
top_players = matches.player_of_match.value_counts()[:10]
#sns.barplot(x="day", y="total_bill", datatop_playersps)
fig, ax = plt.subplots()
ax.set_ylim([0,20])
ax.set_ylabel("Count")
ax.set_title("Top player of the match Winners")
#top_players.plot.bar()
sns.barplot(x = top_players.index, y = top_players, orient='v');␣
 ↪#palette="Blues");
plt.show()
```



12 Has Toss-winning helped in Match-winning?

[18]:
```
# (df1[df1['toss_winner']==df1['winner']].count())/636
sns.countplot(df1['toss_winner']==df1['winner'])

ss = matches['toss_winner'] == matches['winner']
#print(ss)
print(ss.groupby(ss).size()/636)
```

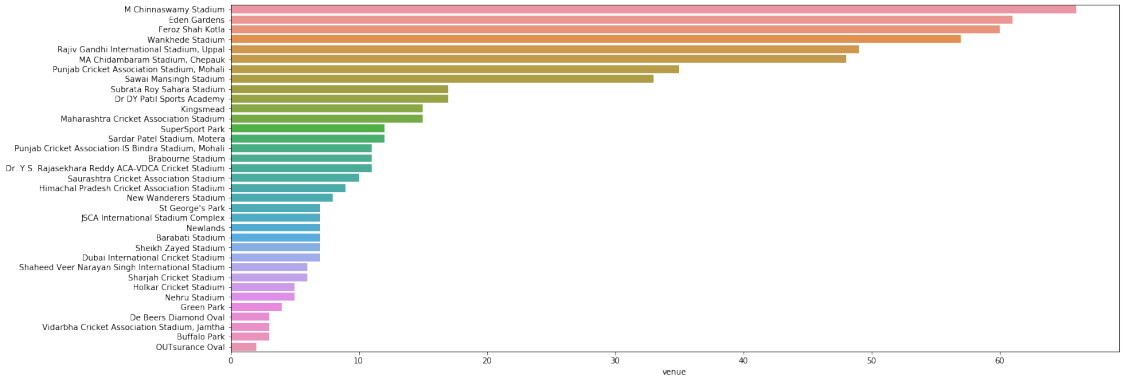
```
False    0.488994
True     0.511006
dtype: float64
```



13 Number of matches in each venue

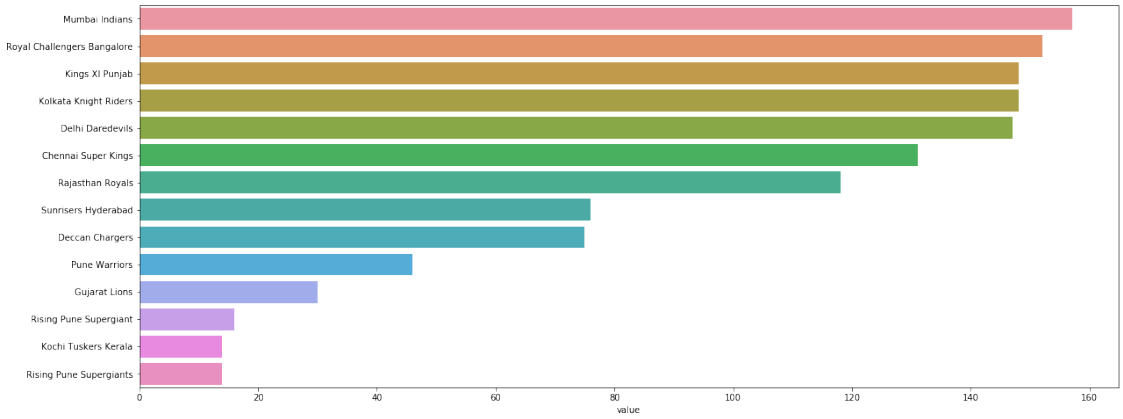
[19]:
```
#1.        Number of matches in each venue
data = matches.venue.value_counts()
print(data)
sns.barplot(y = data.index, x = data, orient='h');
```

```
M Chinnaswamy Stadium                                66
Eden Gardens                                         61
Feroz Shah Kotla                                     60
Wankhede Stadium                                     57
Rajiv Gandhi International Stadium, Uppal            49
MA Chidambaram Stadium, Chepauk                      48
Punjab Cricket Association Stadium, Mohali           35
Sawai Mansingh Stadium                               33
Subrata Roy Sahara Stadium                           17
Dr DY Patil Sports Academy                           17
Kingsmead                                            15
Maharashtra Cricket Association Stadium              15
SuperSport Park                                      12
Sardar Patel Stadium, Motera                         12
Punjab Cricket Association IS Bindra Stadium, Mohali 11
Brabourne Stadium                                    11
Dr. Y.S. Rajasekhara Reddy ACA-VDCA Cricket Stadium  11
Saurashtra Cricket Association Stadium               10
Himachal Pradesh Cricket Association Stadium          9
New Wanderers Stadium                                 8
St George's Park                                      7
JSCA International Stadium Complex                    7
Newlands                                              7
Barabati Stadium                                      7
Sheikh Zayed Stadium                                  7
Dubai International Cricket Stadium                   7
Shaheed Veer Narayan Singh International Stadium      6
Sharjah Cricket Stadium                               6
Holkar Cricket Stadium                                5
Nehru Stadium                                         5
Green Park                                            4
De Beers Diamond Oval                                 3
Vidarbha Cricket Association Stadium, Jamtha          3
Buffalo Park                                          3
OUTsurance Oval                                       2
Name: venue, dtype: int64
```



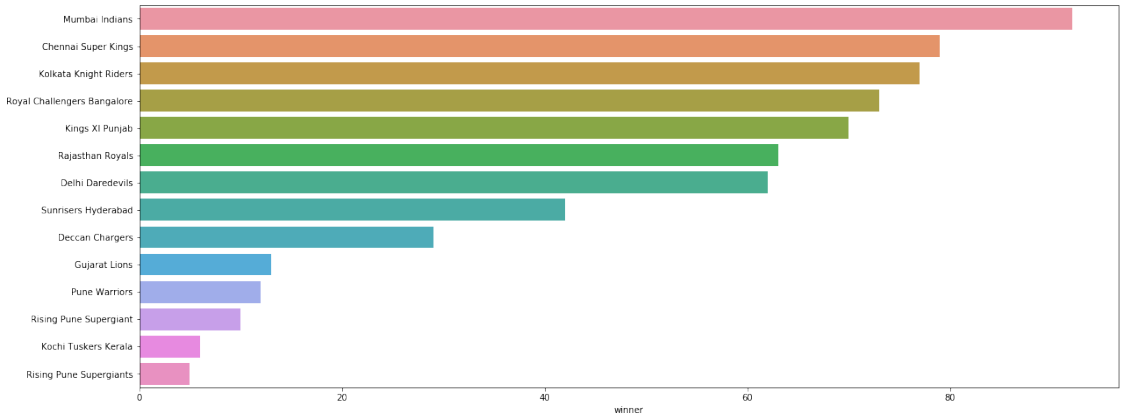
14 Number of matches played by each team

[20]:
```
temp_df = pd.melt(df1, id_vars=['id','season'], value_vars=['team1', 'team2'])
data = temp_df.value.value_counts()
sns.barplot(y = data.index, x = data, orient='h');
```



15 Number of wins per team

[21]:
```
#Number of wins per team
data=df1.winner.value_counts()
sns.barplot(y = data.index, x = data, orient='h');
```



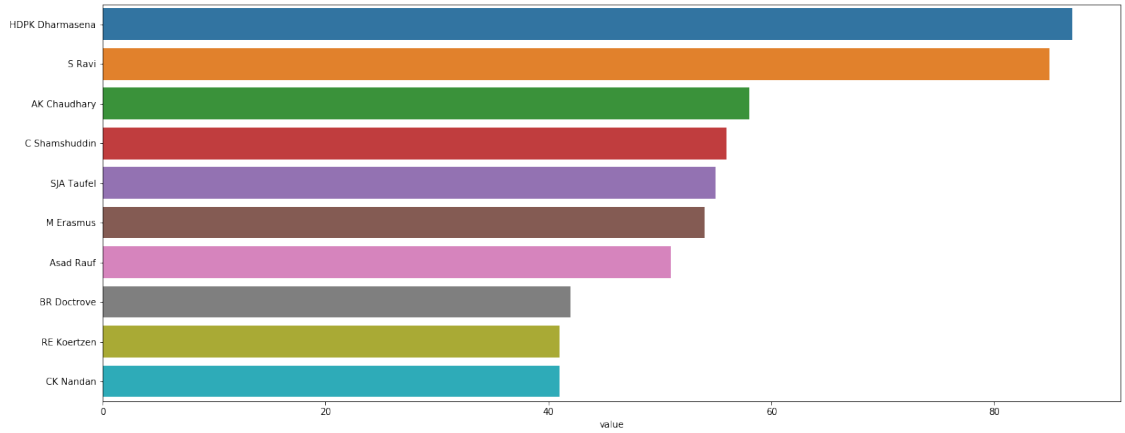
16 Champions each season

[22]:
```
#Champions each season

#DataFrame.drop_duplicates(subset=None, keep='first', inplace=False,␣
 ↪ignore_index=False)

temp_df = df1.drop_duplicates(subset=['season'], keep='last')[['season',␣
 ↪'winner']].reset_index(drop=True)
print((temp_df))
```

	season	winner
0	2017	Mumbai Indians
1	2008	Rajasthan Royals
2	2009	Deccan Chargers
3	2010	Chennai Super Kings
4	2011	Chennai Super Kings
5	2012	Kolkata Knight Riders
6	2013	Mumbai Indians
7	2014	Kolkata Knight Riders
8	2015	Mumbai Indians
9	2016	Sunrisers Hyderabad

17 Top Umpires

[23]:
```
temp_df = pd.melt(df1, value_vars=['umpire1', 'umpire2','umpire3'])
#print(temp_df)
data = (temp_df.value.value_counts())[:10]
sns.barplot(y = data.index, x = data, orient='h');
```



—> Batsman analysis

[24]:
```
import pandas as pd
import matplotlib.pyplot as plt #visualization
import seaborn as sns #modern visualization
score_df = pd.read_csv (r'deliveries.csv')
score_df.head()
```

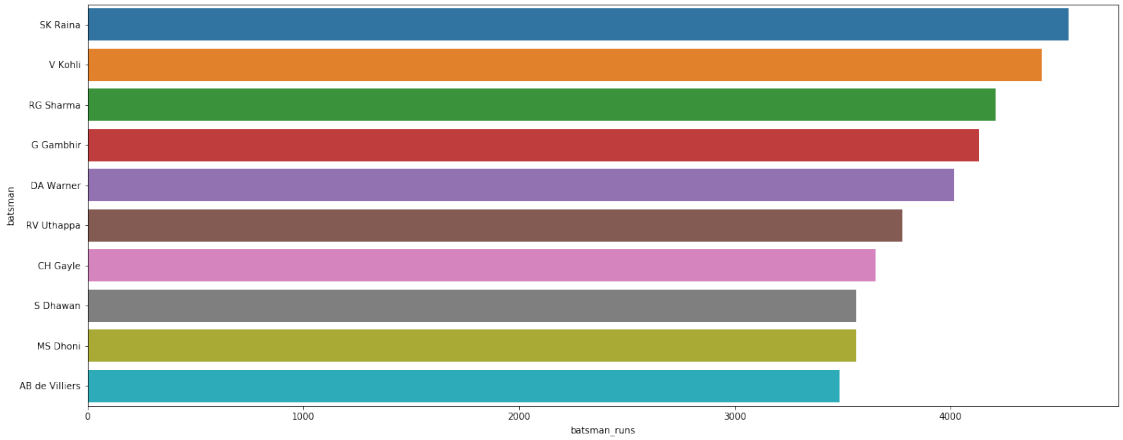
[24]:
```
   match_id  inning         batting_team                 bowling_team  over  \
0         1       1  Sunrisers Hyderabad  Royal Challengers Bangalore     1
1         1       1  Sunrisers Hyderabad  Royal Challengers Bangalore     1
2         1       1  Sunrisers Hyderabad  Royal Challengers Bangalore     1
3         1       1  Sunrisers Hyderabad  Royal Challengers Bangalore     1
4         1       1  Sunrisers Hyderabad  Royal Challengers Bangalore     1

   ball    batsman non_striker    bowler  is_super_over  ...  bye_runs  \
0     1  DA Warner    S Dhawan  TS Mills              0  ...         0
1     2  DA Warner    S Dhawan  TS Mills              0  ...         0
2     3  DA Warner    S Dhawan  TS Mills              0  ...         0
3     4  DA Warner    S Dhawan  TS Mills              0  ...         0
4     5  DA Warner    S Dhawan  TS Mills              0  ...         0

   legbye_runs  noball_runs  penalty_runs  batsman_runs  extra_runs  \
0            0            0             0             0           0
1            0            0             0             0           0
2            0            0             0             4           0
3            0            0             0             0           0
4            0            0             0             0           2

   total_runs  player_dismissed dismissal_kind fielder
0           0               NaN            NaN     NaN
1           0               NaN            NaN     NaN
```

```
2           4               NaN             NaN     NaN
3           0               NaN             NaN     NaN
4           2               NaN             NaN     NaN

[5 rows x 21 columns]
```

18 Which batsmen has scored maximum runs?

[26]:
```
temp_df = score_df.groupby('batsman')['batsman_runs'].agg('sum').reset_index().
 ↪sort_values(by='batsman_runs', ascending=False).reset_index(drop=True)

temp_df = temp_df.iloc[:10,:]
print(temp_df)

# labels = np.array(temp_df['batsman'])
# ind = np.arange(len(labels))
# width = 0.9
# fig, ax = plt.subplots()
# rects = ax.bar(ind, np.array(temp_df['batsman_runs']), width=width,␣
 ↪color='blue')
# ax.set_xticks(ind+((width)/2.))
# ax.set_xticklabels(labels, rotation='vertical')
# ax.set_ylabel("Count")
# ax.set_title("Top run scorers in IPL")
# autolabel(rects)
# plt.show()

plt.rcParams['figure.figsize'] = (20, 8)
g=sns.barplot(y = 'batsman', x = 'batsman_runs', data=temp_df);

# for index, row in score_df.iterrows():
#     g.text(row.name,row.batsman_runs, round(row.batsman_runs,2),␣
 ↪color='black', ha="center")
```

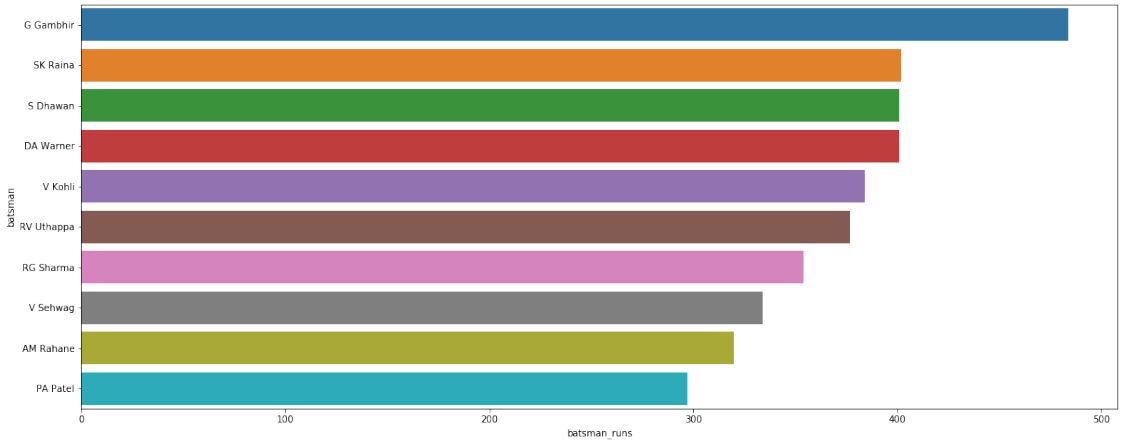
```
          batsman  batsman_runs
0        SK Raina          4548
1         V Kohli          4423
2       RG Sharma          4207
3       G Gambhir          4132
4       DA Warner          4014
5      RV Uthappa          3778
6        CH Gayle          3651
7        S Dhawan          3561
8        MS Dhoni          3560
9  AB de Villiers          3486
```



19 Players with more number of boundaries (Fours) in IPL.

[27]:
```
temp_df = score_df.groupby('batsman')['batsman_runs'].agg(lambda x: (x==4) .
 ↪sum()).reset_index().sort_values(by='batsman_runs', ascending=False).
 ↪reset_index(drop=True)
temp_df = temp_df.iloc[:10,:]
print(temp_df)

g=sns.barplot(y = 'batsman', x = 'batsman_runs', data=temp_df);
```

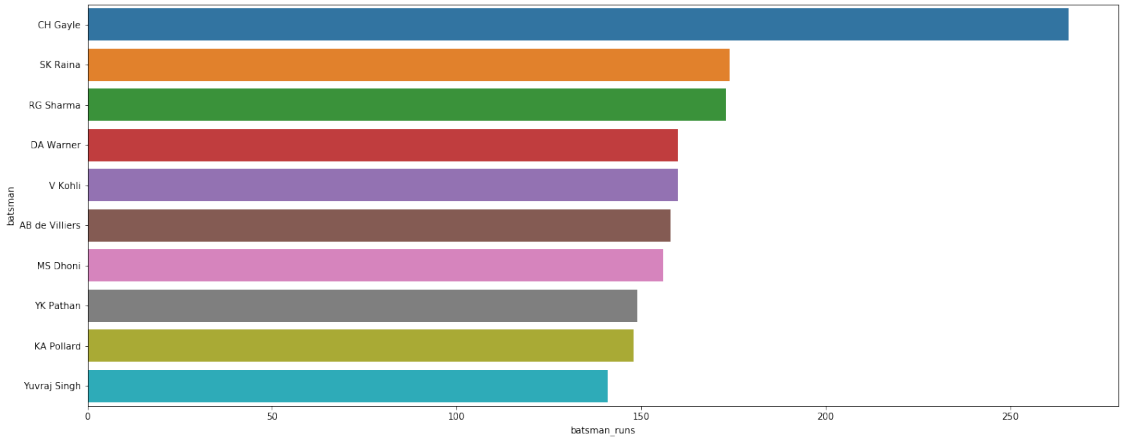
```
      batsman  batsman_runs
0   G Gambhir           484
1    SK Raina           402
2    S Dhawan           401
3   DA Warner           401
4     V Kohli           384
5  RV Uthappa           377
6   RG Sharma           354
7    V Sehwag           334
8   AM Rahane           320
9    PA Patel           297
```



20 Players with more number of boundaries (Sixes) in IPL.

[28]:
```
temp_df = score_df.groupby('batsman')['batsman_runs'].agg(lambda x: (x==6) .
 ↪sum()).reset_index().sort_values(by='batsman_runs', ascending=False).
 ↪reset_index(drop=True)
temp_df = temp_df.iloc[:10,:]
print(temp_df)

g=sns.barplot(y = 'batsman', x = 'batsman_runs', data=temp_df);
```

```
          batsman  batsman_runs
0        CH Gayle           266
1        SK Raina           174
2       RG Sharma           173
3       DA Warner           160
4         V Kohli           160
5  AB de Villiers           158
6        MS Dhoni           156
7       YK Pathan           149
8      KA Pollard           148
9    Yuvraj Singh           141
```



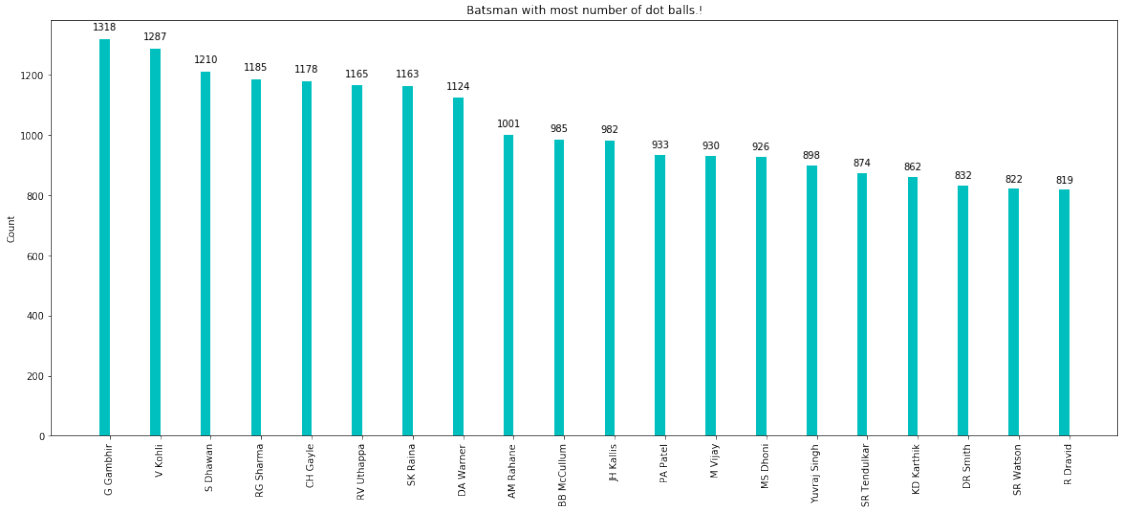
Helper function to write value above the bar in barplot.

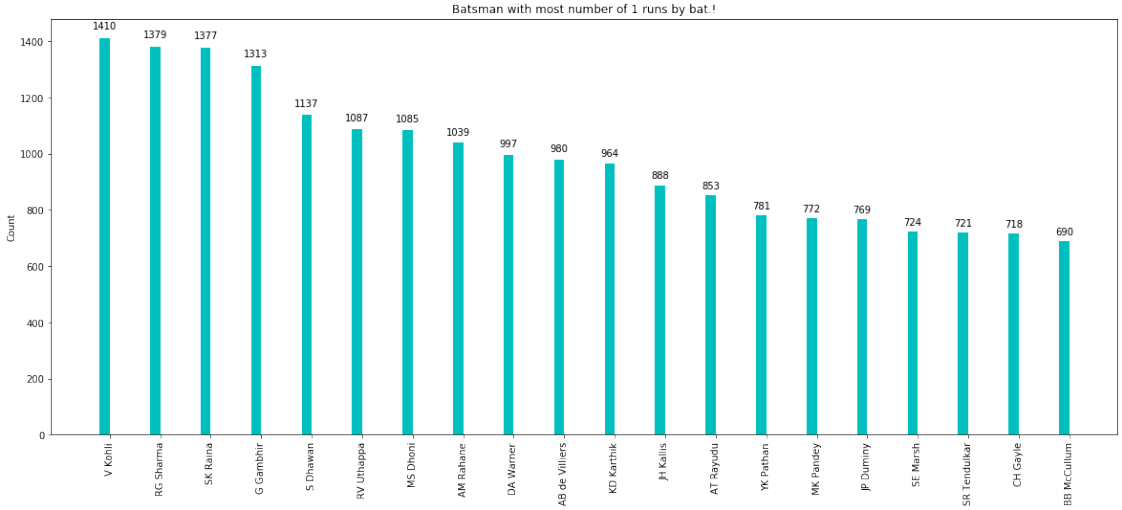
[29]:
```
def autolabel(rects):
    for rect in rects:
        height = rect.get_height()
        ax.text(rect.get_x() + rect.get_width()/2., 1.02*height,
                '%d' % int(height),
                ha='center', va='bottom')
```

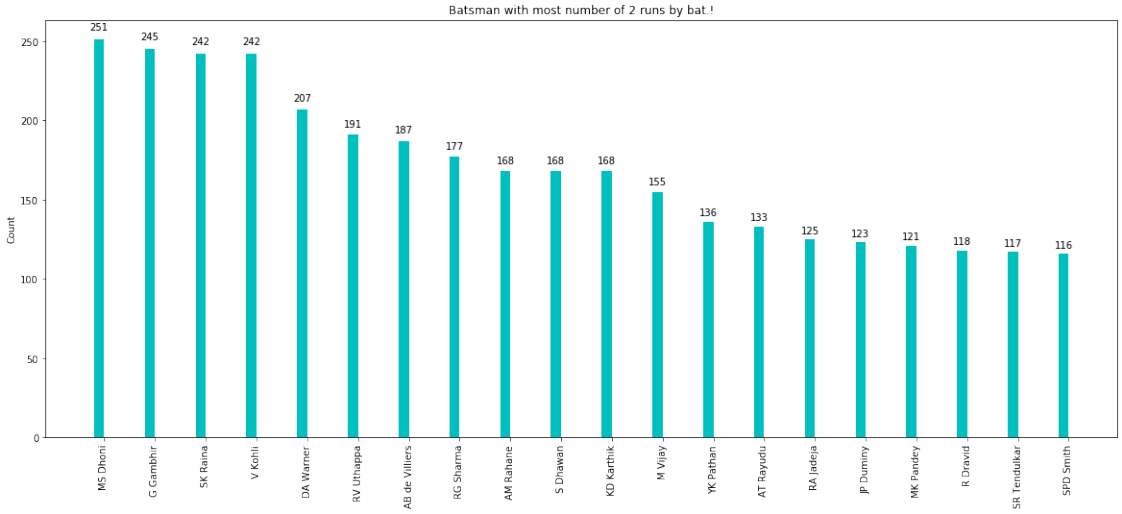
21 Batsmen played most number of dot balls, singles, doubles, triples, Fours, fives and Sixes.

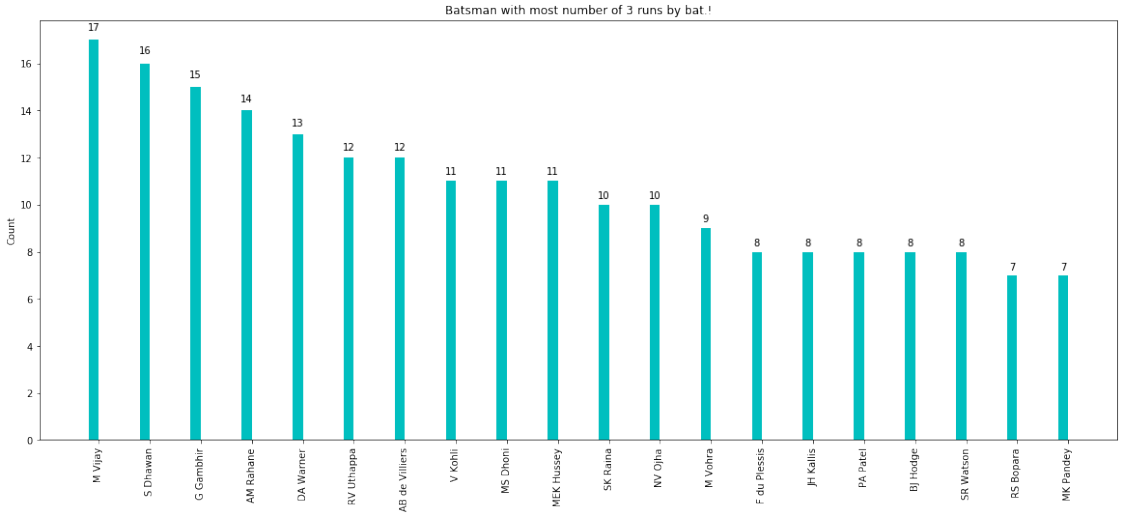
[30]:
```
for i in range(7):
    temp_df = score_df.groupby('batsman')['batsman_runs'].agg(lambda x: (x==i).
 ↪sum()).reset_index().sort_values(by='batsman_runs', ascending=False).
 ↪reset_index(drop=True)
    temp_df = temp_df.iloc[:20,:]

    labels = np.array(temp_df['batsman'])
    ind = np.arange(len(labels))
    width = 0.2

    fig, ax = plt.subplots()
    rects = ax.bar(ind, np.array(temp_df['batsman_runs']), width=width,␣
 ↪color='c')
    ax.set_xticks(ind+((width)/2.))
    ax.set_xticklabels(labels, rotation='vertical')
    ax.set_ylabel("Count")
    if i==0:
        ax.set_title("Batsman with most number of dot balls.!")
```

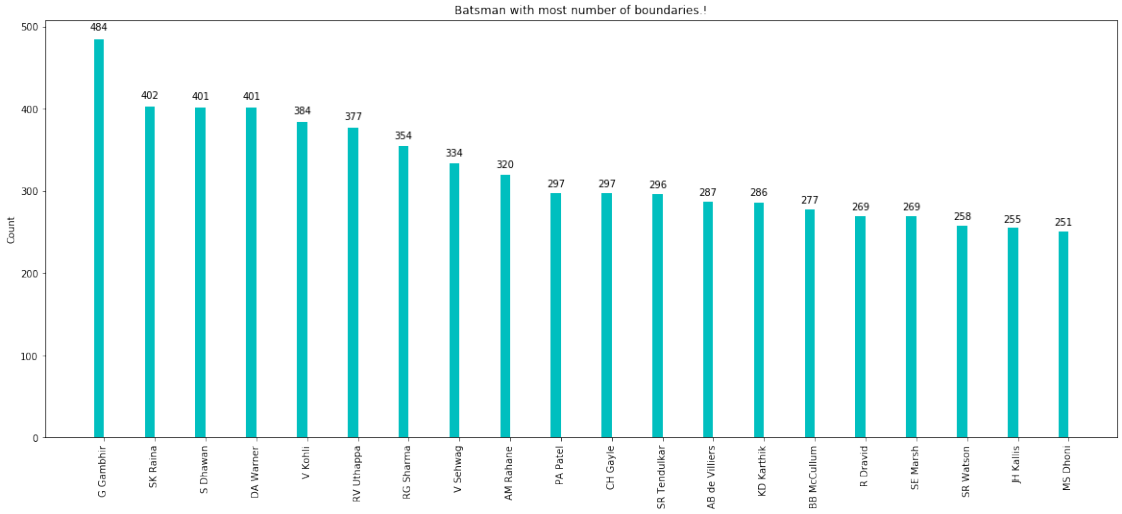
```
    elif i==4:
        ax.set_title("Batsman with most number of boundaries.!")
    else:
        ax.set_title("Batsman with most number of "+str(i)+" runs by bat.!")
    autolabel(rects)
    plt.show()
```

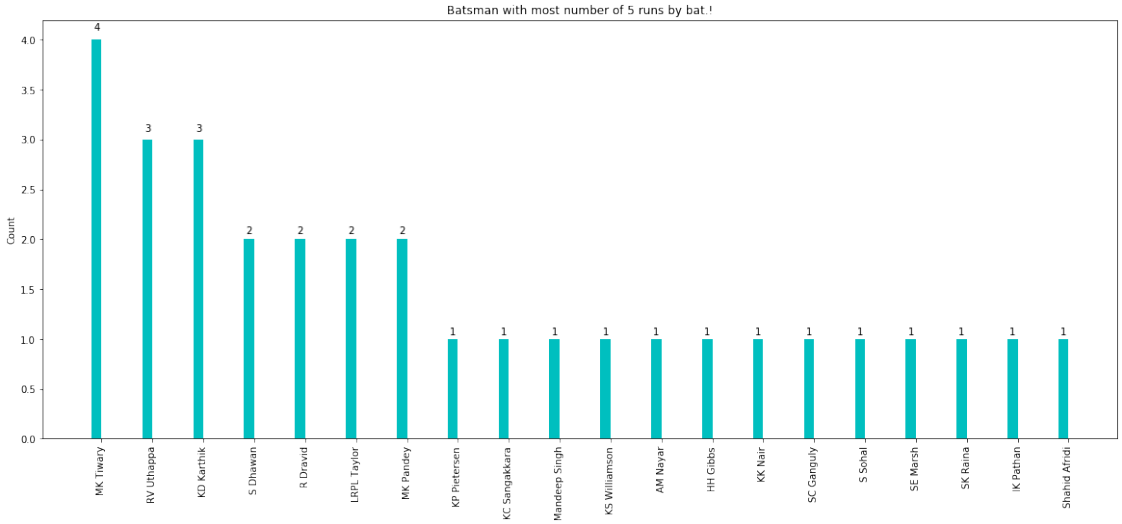


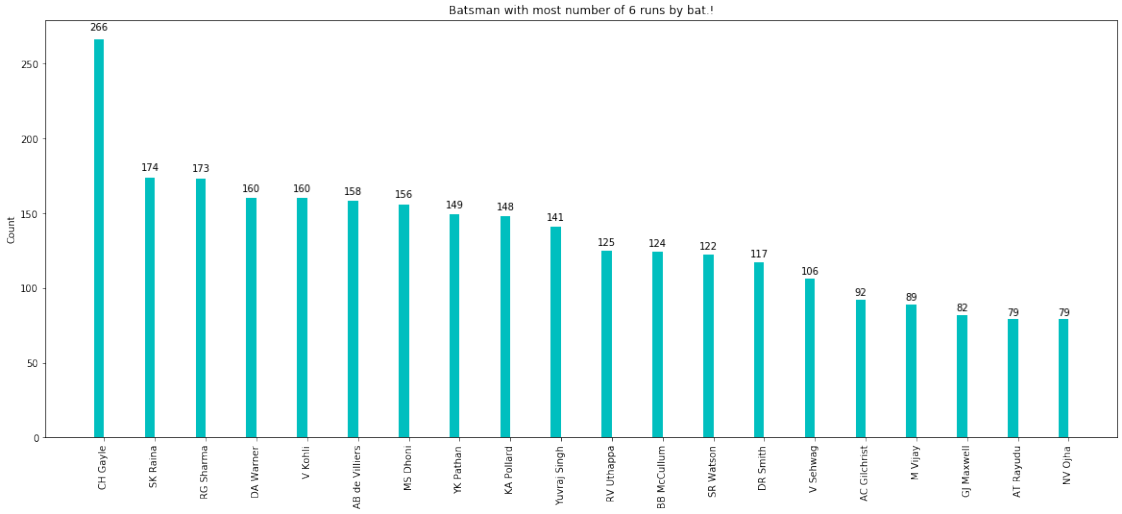



Batsman with most number of 2 runs by bat !
Count
MS Dhoni 251
G Gambhir 245
SK Raina 242
V Kohli 242
DA Warner 207
RV Uthappa 191
AB de Villiers 187
RG Sharma 177
AM Rahane 168
S Dhawan 168
KD Karthik 168
M Vijay 155
YK Pathan 136
AT Rayudu 133
RA Jadeja 125
JP Duminy 123
MK Pandey 121
R Dravid 118
SR Tendulkar 117
SPD Smith 116


Batsman with most number of 3 runs by bat !
Count
M Vijay 17
S Dhawan 16
G Gambhir 15
AM Rahane 14
DA Warner 13
RV Uthappa 12
AB de Villiers 12
V Kohli 11
MS Dhoni 11
MEK Hussey 11
SK Raina 10
NV Ojha 10
M Vohra 9
F du Plessis 8
JH Kallis 8
PA Patel 8
BJ Hodge 8
SR Watson 8
RS Bopara 7
MK Pandey 7

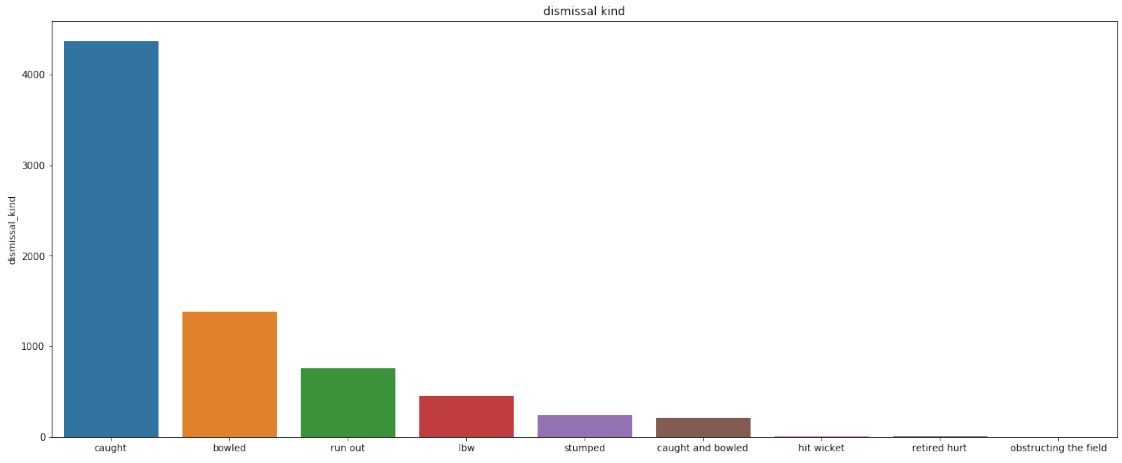

Batsman with most number of boundaries !
Count
0
100
200
300
400
500
484
402
401
401
384
377
354
334
320
297
297
296
287
286
277
269
269
258
255
251
G Gambhir
SK Raina
S Dhawan
DA Warner
V Kohli
RV Uthappa
RG Sharma
V Sehwag
AM Rahane
PA Patel
CH Gayle
SR Tendulkar
AB de Villiers
KD Karthik
BB McCullum
R Dravid
SE Marsh
SR Watson
JH Kallis
MS Dhoni


Batsman with most number of 5 runs by bat !
Count
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4
3
3
2
2
2
2
1
1
1
1
1
1
1
1
1
1
1
1
1
MK Tiwary
RV Uthappa
KD Karthik
S Dhawan
R Dravid
LRPL Taylor
MK Pandey
KP Pietersen
KC Sangakkara
Mandeep Singh
KS Williamson
AM Nayar
HH Gibbs
KK Nair
SC Ganguly
S Sohal
SE Marsh
SK Raina
IK Pathan
Shahid Afridi



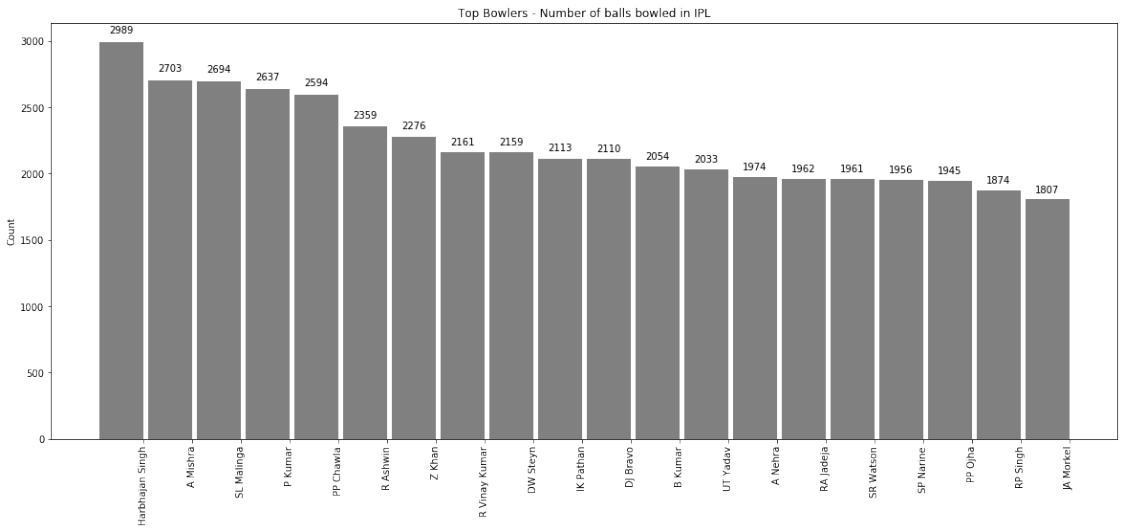
22 Most common dismissal types in IPL

[31]:
```
dismissal = score_df.dismissal_kind.value_counts()[:10]
#sns.barplot(x="day", y="total_bill", datatop_playersps)
fig, ax = plt.subplots()
#ax.set_ylim([0,20])
ax.set_ylabel("Count")
ax.set_title("dismissal kind")
#top_players.plot.bar()
sns.barplot(x = dismissal.index, y = dismissal, orient='v'); #palette="Blues");
plt.show()
```



23 Top Bowlers - By number of balls bowled in IPL

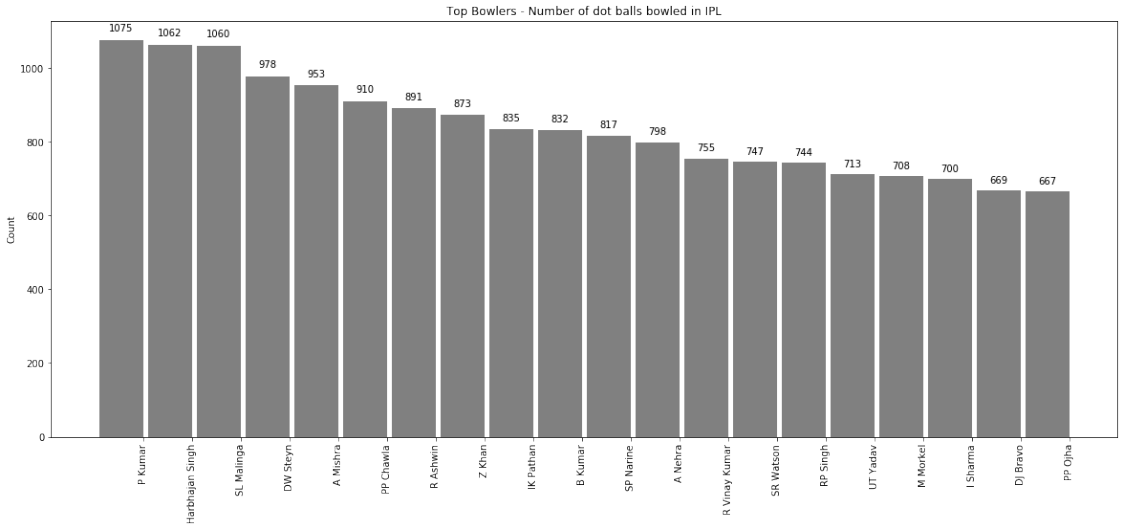
[32]:
```
temp_df = score_df.groupby('bowler')['ball'].agg('count').reset_index().
 ↪sort_values(by='ball', ascending=False).reset_index(drop=True)
temp_df = temp_df.iloc[:20,:]
#print(temp_df)

labels = np.array(temp_df['bowler'])
ind = np.arange(len(labels))
width = 0.9
fig, ax = plt.subplots()
rects = ax.bar(ind, np.array(temp_df['ball']), width=width, color='grey')
ax.set_xticks(ind+((width)/2.))
ax.set_xticklabels(labels, rotation='vertical')
ax.set_ylabel("Count")
ax.set_title("Top Bowlers - Number of balls bowled in IPL")
autolabel(rects)
plt.show()
```



24 Top Bowlers - By number of dot balls bowled in IPL

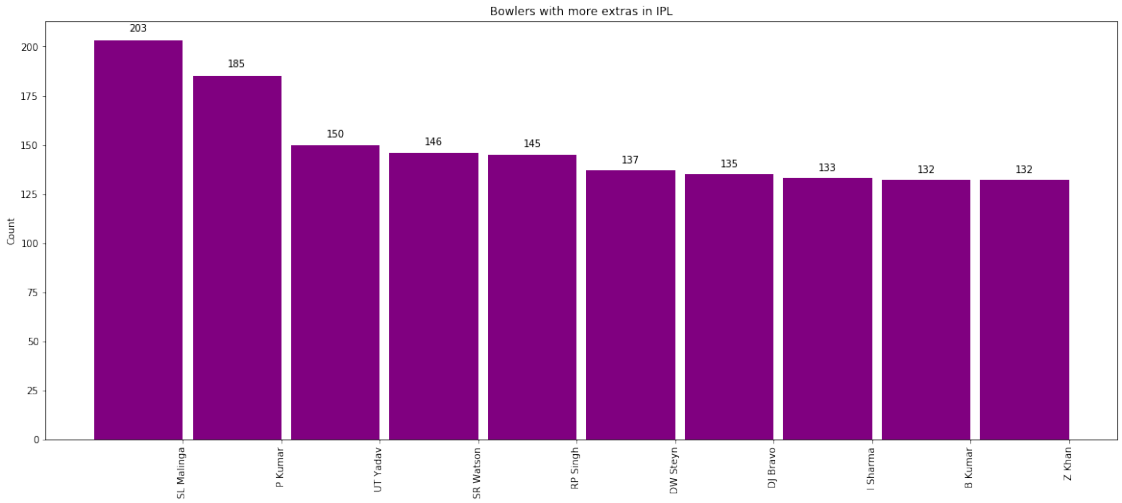
[33]:
```
temp_df = score_df.groupby('bowler')['total_runs'].agg(lambda x: (x==0).sum()).
 ↪reset_index().sort_values(by='total_runs', ascending=False).
 ↪reset_index(drop=True)
temp_df = temp_df.iloc[:20,:]

labels = np.array(temp_df['bowler'])
ind = np.arange(len(labels))
```

```
width = 0.9
fig, ax = plt.subplots()
rects = ax.bar(ind, np.array(temp_df['total_runs']), width=width, color='grey')
ax.set_xticks(ind+((width)/2.))
ax.set_xticklabels(labels, rotation='vertical')
ax.set_ylabel("Count")
ax.set_title("Top Bowlers - Number of dot balls bowled in IPL")
autolabel(rects)
plt.show()
```

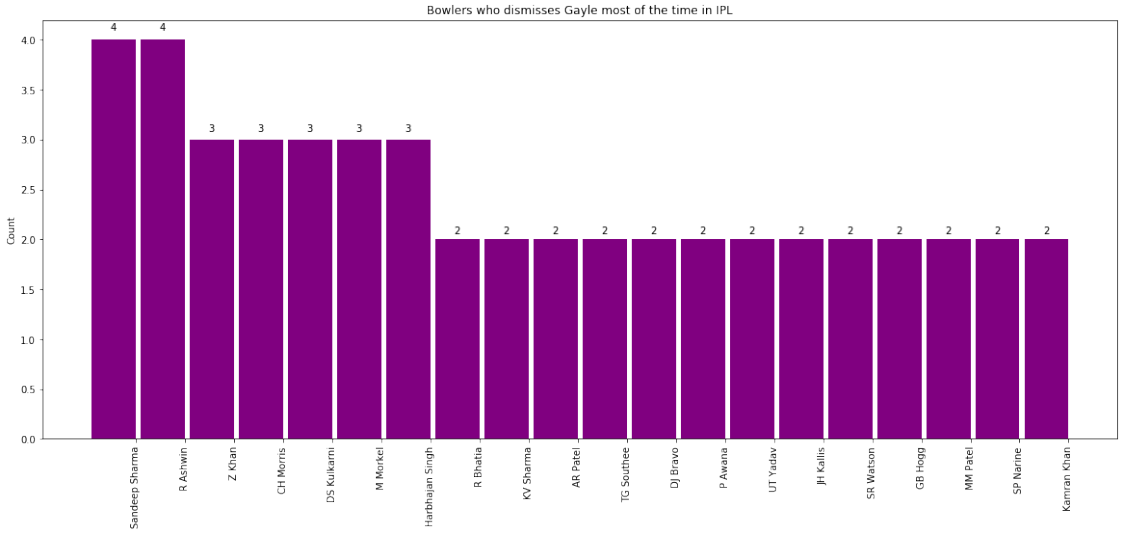


25 Bowlers who gave more extras in IPL

[34]:
```
temp_df = score_df.groupby('bowler')['extra_runs'].agg(lambda x: (x>0).sum()).
 ↪reset_index().sort_values(by='extra_runs', ascending=False).
 ↪reset_index(drop=True)
temp_df = temp_df.iloc[:10,:]

labels = np.array(temp_df['bowler'])
ind = np.arange(len(labels))
width = 0.9
fig, ax = plt.subplots()
rects = ax.bar(ind, np.array(temp_df['extra_runs']), width=width, color='purple')
ax.set_xticks(ind+((width)/2.))
ax.set_xticklabels(labels, rotation='vertical')
ax.set_ylabel("Count")
ax.set_title("Bowlers with more extras in IPL")
autolabel(rects)
plt.show()
```

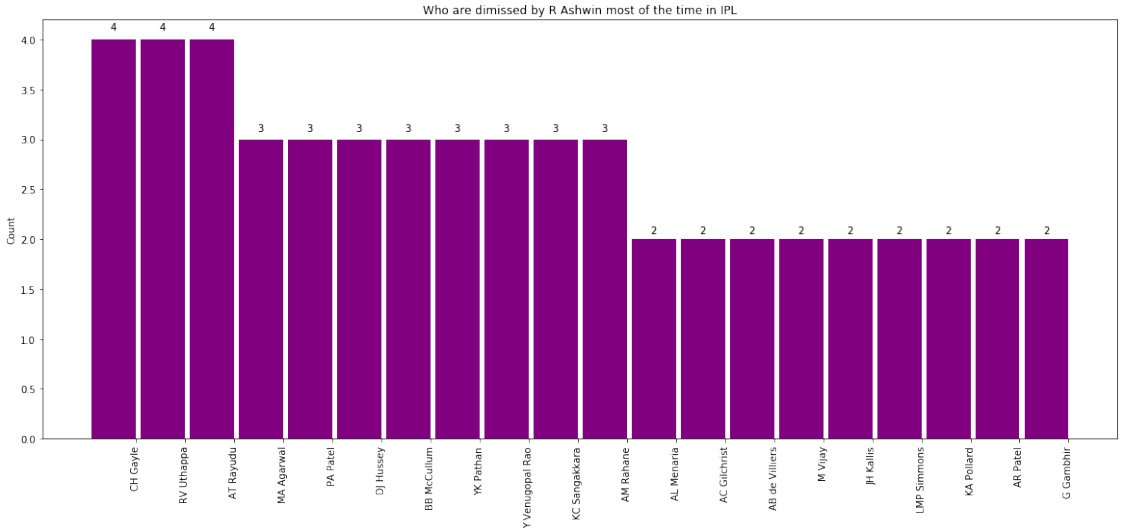


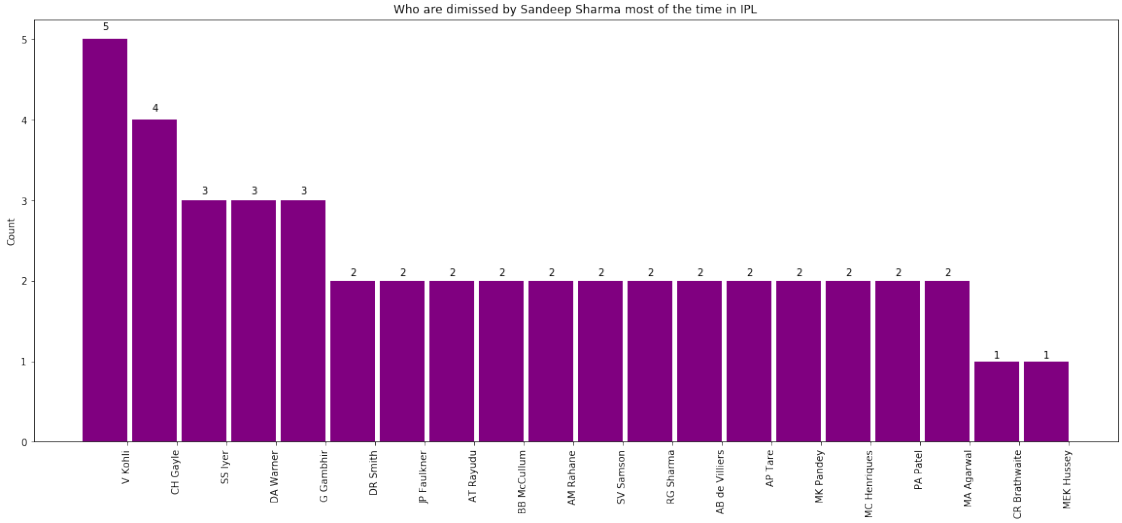
[35]:
```
temp_df = score_df.groupby('bowler')['player_dismissed'].\
agg(lambda x: (x=='CH Gayle').sum()).reset_index().
 ↪sort_values(by='player_dismissed', ascending=False).reset_index(drop=True)
temp_df = temp_df.iloc[:20,:]

labels = np.array(temp_df['bowler'])
ind = np.arange(len(labels))
width = 0.9
fig, ax = plt.subplots()
rects = ax.bar(ind, np.array(temp_df['player_dismissed']), width=width,␣
 ↪color='purple')
ax.set_xticks(ind+((width)/2.))
ax.set_xticklabels(labels, rotation='vertical')
ax.set_ylabel("Count")
ax.set_title("Bowlers who dismisses Gayle most of the time in IPL")
autolabel(rects)
plt.show()
```

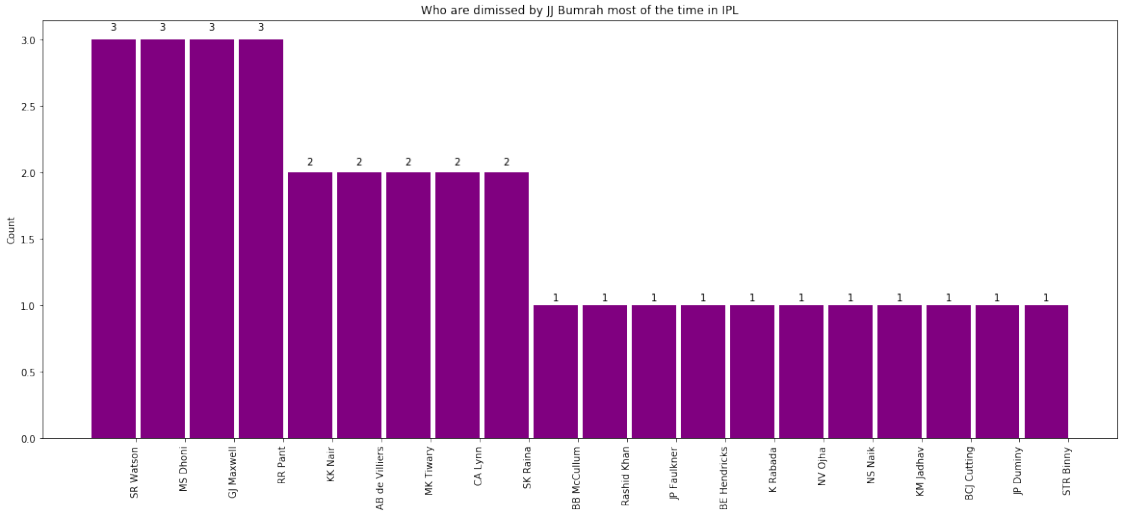


26 Which Bowler has dismissed which batsmen most of the time

[36]:
```
for i in ['R Ashwin','Sandeep Sharma','JJ Bumrah']:
    temp_df = score_df.groupby('player_dismissed')['bowler'].\
    agg(lambda x: (x==i).sum()).reset_index().sort_values(by='bowler',␣
 ↪ascending=False).reset_index(drop=True)
    temp_df = temp_df.iloc[:20,:]

    labels = np.array(temp_df['player_dismissed'])
    ind = np.arange(len(labels))
    width = 0.9
    fig, ax = plt.subplots()
    rects = ax.bar(ind, np.array(temp_df['bowler']), width=width, color='purple')

    ax.set_xticks(ind+((width)/2.))
    ax.set_xticklabels(labels, rotation='vertical')
    ax.set_ylabel("Count")
    ax.set_title("Who are dimissed by "+i+" most of the time in IPL")
    autolabel(rects)
    plt.show()
```


Who are dimissed by R Ashwin most of the time in IPL
Count
CH Gayle
RV Uthappa
AT Rayudu
MA Agarwal
PA Patel
DJ Hussey
BB McCullum
YK Pathan
Y Venugopal Rao
KC Sangakkara
AM Rahane
AL Menaria
AC Gilchrist
AB de Villiers
M Vijay
JH Kallis
LMP Simmons
KA Pollard
AR Patel
G Gambhir


Who are dimissed by Sandeep Sharma most of the time in IPL
Count
V Kohli
CH Gayle
SS Iyer
DA Warner
G Gambhir
DR Smith
JP Faulkner
AT Rayudu
BB McCullum
AM Rahane
SV Samson
RG Sharma
AB de Villiers
AP Tare
MK Pandey
MC Henriques
PA Patel
MA Agarwal
CR Brathwaite
MEK Hussey



27 Predictive Analysis of an IPL Match

1. Prediction using SVM Binary Classifier.
2. Since the output of winner prediction is a categorical value, the problem which we are trying to solve is a Classification problem.

Steps 1. Understand the dataset. 2. Clean the data. 3. Analyze the candidate columns to be Features. 4. Process the features as required by the model/algorithm. 5. Train the model/algorithm on training data. 6. Test the model/algorithm on testing data. 7. Tune the model/algorithm for higher accuracy.

[37]:
```
import pandas as pd
import matplotlib.pyplot as plt #visualization
import seaborn as sns #modern visualization
plt.rcParams['figure.figsize'] = (20, 8)


matches = pd.read_csv (r'matches.csv')
matches.head()
```

[37]:

	id	season	city	date	team1	team2	toss_winner	toss_decision
0	1	2017	Hyderabad	05-04-2017	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	field
1	2	2017	Pune	06-04-2017	Mumbai Indians			
2	3	2017	Rajkot	07-04-2017	Gujarat Lions			
3	4	2017	Indore	08-04-2017	Rising Pune Supergiant			
4	5	2017	Bangalore	08-04-2017	Royal Challengers Bangalore			

```
1       Rising Pune Supergiant       Rising Pune Supergiant         field
2        Kolkata Knight Riders        Kolkata Knight Riders         field
3              Kings XI Punjab              Kings XI Punjab         field
4             Delhi Daredevils  Royal Challengers Bangalore           bat

   result  dl_applied                       winner  win_by_runs  \
0  normal           0          Sunrisers Hyderabad           35
1  normal           0       Rising Pune Supergiant            0
2  normal           0        Kolkata Knight Riders            0
3  normal           0              Kings XI Punjab            0
4  normal           0  Royal Challengers Bangalore           15

   win_by_wickets player_of_match                                      venue  \
0               0    Yuvraj Singh  Rajiv Gandhi International Stadium, Uppal
1               7       SPD Smith    Maharashtra Cricket Association Stadium
2              10         CA Lynn     Saurashtra Cricket Association Stadium
3               6      GJ Maxwell                     Holkar Cricket Stadium
4               0       KM Jadhav                      M Chinnaswamy Stadium

          umpire1        umpire2  umpire3
0     AY Dandekar       NJ Llong      NaN
1  A Nand Kishore         S Ravi      NaN
2     Nitin Menon      CK Nandan      NaN
3    AK Chaudhary  C Shamshuddin      NaN
4             NaN            NaN      NaN
```

[2]:
```
#matches.isna().any()
null_columns=matches.isnull().sum()
#print(null_columns)
print(null_columns[null_columns > 0])
```

```
city                 7
winner               3
player_of_match      3
umpire1              1
umpire2              1
umpire3            636
dtype: int64
```

The data that we have, contains null values in several columns.There are several ways to handle the null values and among them, I will be using Imputation on column city. Imputation is a way to fill the missing values statistically.

[38]:
```
#imputing the values in column city based on venue
conditions = [matches["venue"] == "Rajiv Gandhi International Stadium, Uppal",\
              matches["venue"] == "Maharashtra Cricket Association Stadium",\
              matches["venue"] == "Saurashtra Cricket Association Stadium",\
              matches["venue"] == "Holkar Cricket Stadium",\
```

```
            matches["venue"] == "M Chinnaswamy Stadium",\
            matches["venue"] == "Wankhede Stadium",\
            matches["venue"] == "Eden Gardens",matches["venue"] == "Feroz Shah␣
↪Kotla",\
            matches["venue"] == "Punjab Cricket Association IS Bindra Stadium,␣
↪Mohali",\
            matches["venue"] == "Green Park",\
            matches["venue"] == "Punjab Cricket Association Stadium, Mohali",\
            matches["venue"] == "Dr DY Patil Sports Academy",\
            matches["venue"] == "Sawai Mansingh Stadium", \
            matches["venue"] == "MA Chidambaram Stadium, Chepauk",
            matches["venue"] == "Newlands", \
            matches["venue"] == "St George's Park",\
            matches["venue"] == "Kingsmead", \
            matches["venue"] == "SuperSport Park",
            matches["venue"] == "Buffalo Park", \
            matches["venue"] == "New Wanderers Stadium",\
            matches["venue"] == "De Beers Diamond Oval", \
            matches["venue"] == "OUTsurance Oval",\
            matches["venue"] == "Brabourne Stadium",\
            matches["venue"] == "Sardar Patel Stadium",\
            matches["venue"] == "Barabati Stadium", \
            matches["venue"] == "Vidarbha Cricket Association Stadium,␣
↪Jamtha",\
            matches["venue"] == "Himachal Pradesh Cricket Association␣
↪Stadium",\
            matches["venue"] == "Nehru Stadium",\
            matches["venue"] == "Dr. Y.S. Rajasekhara Reddy ACA-VDCA Cricket␣
↪Stadium",\
            matches["venue"] == "Subrata Roy Sahara Stadium",\
            matches["venue"] == "Shaheed Veer Narayan Singh International␣
↪Stadium",\
            matches["venue"] == "JSCA International Stadium Complex",\
            matches["venue"] == "Sheikh Zayed Stadium",\
            matches["venue"] == "Sharjah Cricket Stadium",\
            matches["venue"] == "Dubai International Cricket Stadium",\
            matches["venue"] == "M. A. Chidambaram Stadium",
            matches["venue"] == "Feroz Shah Kotla Ground",\
            matches["venue"] == "M. Chinnaswamy Stadium",\
            matches["venue"] == "Rajiv Gandhi Intl. Cricket Stadium" ,\
            matches["venue"] == "IS Bindra Stadium",
            matches["venue"] == "ACA-VDCA Stadium"]
```

```
values =␣
 ↪['Hyderabad','Mumbai','Rajkot',"Indore","Bengaluru","Mumbai","Kolkata","Delhi","Mohali","Kanp
 ↪Town","Port Elizabeth","Durban","Centurion",'Eastern␣
 ↪Cape','Johannesburg','Northern␣
 ↪Cape','Bloemfontein','Mumbai','Ahmedabad','Cuttack','Jamtha','Dharamshala','Chennai','Visakha
 ↪Dhabi','Sharjah','Dubai','Chennai','Delhi','Bengaluru','Hyderabad','Mohali','Visakhapatnam']

matches['city'] = np.where(matches['city'].isnull(),\
                           np.select(conditions, values),\
                           matches['city'])

null_columns=matches.isnull().sum()

print(null_columns[null_columns > 0])
```

```
winner               3
player_of_match      3
umpire1              1
umpire2              1
umpire3            636
dtype: int64
```

[40]:
```
#Removing records having null values in "winner" column
matches=matches[matches["winner"].notna()]
matches
```

[40]:

	id	season	city	date	team1
0	1	2017	Hyderabad	05-04-2017	Sunrisers Hyderabad
1	2	2017	Pune	06-04-2017	Mumbai Indians
2	3	2017	Rajkot	07-04-2017	Gujarat Lions
3	4	2017	Indore	08-04-2017	Rising Pune Supergiant
4	5	2017	Bangalore	08-04-2017	Royal Challengers Bangalore
..	...	...	...	...	...
631	632	2016	Raipur	22-05-2016	Delhi Daredevils
632	633	2016	Bangalore	24-05-2016	Gujarat Lions
633	634	2016	Delhi	25-05-2016	Sunrisers Hyderabad
634	635	2016	Delhi	27-05-2016	Gujarat Lions
635	636	2016	Bangalore	29-05-2016	Sunrisers Hyderabad

	team2	toss_winner	toss_decision
0	Royal Challengers Bangalore	Royal Challengers Bangalore	field
1	Rising Pune Supergiant	Rising Pune Supergiant	field
2	Kolkata Knight Riders	Kolkata Knight Riders	field
3	Kings XI Punjab	Kings XI Punjab	field
4	Delhi Daredevils	Royal Challengers Bangalore	bat
..	...	...	...
631	Royal Challengers Bangalore	Royal Challengers Bangalore	field

```
632  Royal Challengers Bangalore  Royal Challengers Bangalore         field
633        Kolkata Knight Riders        Kolkata Knight Riders         field
634          Sunrisers Hyderabad          Sunrisers Hyderabad         field
635  Royal Challengers Bangalore          Sunrisers Hyderabad           bat

     result  dl_applied                       winner  win_by_runs  \
0    normal           0          Sunrisers Hyderabad           35
1    normal           0       Rising Pune Supergiant            0
2    normal           0        Kolkata Knight Riders            0
3    normal           0              Kings XI Punjab            0
4    normal           0  Royal Challengers Bangalore           15
..      ...         ...                          ...          ...
631  normal           0  Royal Challengers Bangalore            0
632  normal           0  Royal Challengers Bangalore            0
633  normal           0          Sunrisers Hyderabad           22
634  normal           0          Sunrisers Hyderabad            0
635  normal           0          Sunrisers Hyderabad            8

     win_by_wickets player_of_match  \
0                 0    Yuvraj Singh
1                 7       SPD Smith
2                10         CA Lynn
3                 6      GJ Maxwell
4                 0       KM Jadhav
..              ...             ...
631               6         V Kohli
632               4  AB de Villiers
633               0    MC Henriques
634               4       DA Warner
635               0     BCJ Cutting

                                              venue          umpire1  \
0           Rajiv Gandhi International Stadium, Uppal      AY Dandekar
1             Maharashtra Cricket Association Stadium   A Nand Kishore
2              Saurashtra Cricket Association Stadium      Nitin Menon
3                                Holkar Cricket Stadium     AK Chaudhary
4                             M Chinnaswamy Stadium              NaN
..                                                 ...             ...
631  Shaheed Veer Narayan Singh International Stadium   A Nand Kishore
632                             M Chinnaswamy Stadium     AK Chaudhary
633                                  Feroz Shah Kotla        M Erasmus
634                                  Feroz Shah Kotla        M Erasmus
635                             M Chinnaswamy Stadium  HDPK Dharmasena

             umpire2  umpire3
0           NJ Llong      NaN
1             S Ravi      NaN
```

```
2          CK Nandan      NaN
3      C Shamshuddin      NaN
4                NaN      NaN
..               ...      ...
631     BNJ Oxenford      NaN
632  HDPK Dharmasena      NaN
633    C Shamshuddin      NaN
634        CK Nandan      NaN
635     BNJ Oxenford      NaN

[633 rows x 18 columns]
```

[41]:
```
null_columns=matches.isnull().sum()
print(null_columns[null_columns > 0])
```

```
umpire1      1
umpire2      1
umpire3    633
dtype: int64
```

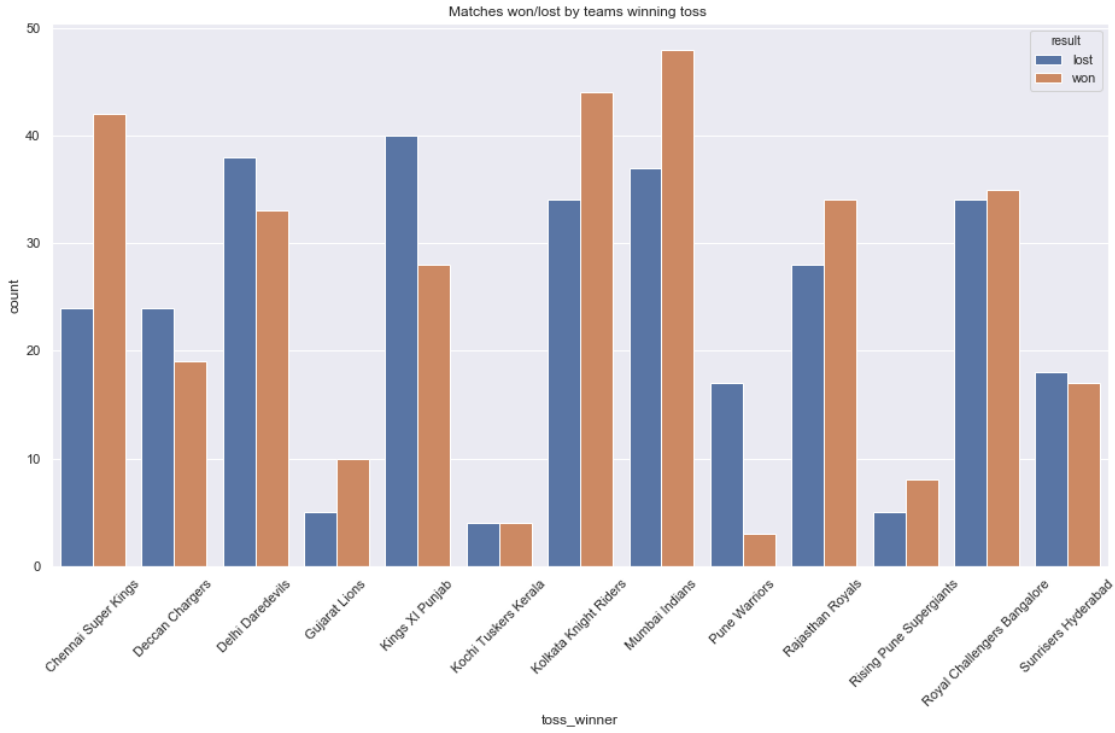
While playing around with the data, I found an interesting redundancy. Team Rising Pune SuperGiants were duplicated in columns team_1, team_2, winner, and toss_winner. Replacing these values with one value is the obvious thing to do next.

[42]:
```
#Replacing the Rising Pune Supergiant with Rising Pune Supergiants
matches["team2"]=matches["team2"].replace("Rising Pune Supergiant","Rising Pune␣
 ↪Supergiants")
matches["team1"]=matches["team1"].replace("Rising Pune Supergiant","Rising Pune␣
 ↪Supergiants")
matches["winner"]=matches["winner"].replace("Rising Pune Supergiant","Rising␣
 ↪Pune Supergiants")
matches["toss_winner"]=matches["toss_winner"].replace("Rising Pune␣
 ↪Supergiant","Rising Pune Supergiants")
```

[46]:
```
#Toss affecting the win dataframe
toss_win_result = matches.groupby(['toss_winner']).winner.value_counts().
 ↪reset_index(name="count")
#print(toss_win_result)
toss_win_result['result']=np.where(toss_win_result.winner==toss_win_result.
 ↪toss_winner,'won','lost')
#numpy.where(condition, x, y)
#print(toss_win_result)

toss_win_result_df = toss_win_result.groupby(['toss_winner','result'])['count'].
 ↪sum().reset_index()
print(toss_win_result_df)
#Visualization
```

```
plot = sns.barplot(x="toss_winner", y="count", hue="result",␣
 ↪data=toss_win_result_df)
plot.set_title('Matches won/lost by teams winning toss ')
plot.set_xticklabels(toss_win_result_df['toss_winner'].unique(),rotation=45)
plt.show()
```

	toss_winner	result	count
0	Chennai Super Kings	lost	24
1	Chennai Super Kings	won	42
2	Deccan Chargers	lost	24
3	Deccan Chargers	won	19
4	Delhi Daredevils	lost	38
5	Delhi Daredevils	won	33
6	Gujarat Lions	lost	5
7	Gujarat Lions	won	10
8	Kings XI Punjab	lost	40
9	Kings XI Punjab	won	28
10	Kochi Tuskers Kerala	lost	4
11	Kochi Tuskers Kerala	won	4
12	Kolkata Knight Riders	lost	34
13	Kolkata Knight Riders	won	44
14	Mumbai Indians	lost	37
15	Mumbai Indians	won	48
16	Pune Warriors	lost	17
17	Pune Warriors	won	3
18	Rajasthan Royals	lost	28
19	Rajasthan Royals	won	34
20	Rising Pune Supergiants	lost	5
21	Rising Pune Supergiants	won	8
22	Royal Challengers Bangalore	lost	34
23	Royal Challengers Bangalore	won	35
24	Sunrisers Hyderabad	lost	18
25	Sunrisers Hyderabad	won	17



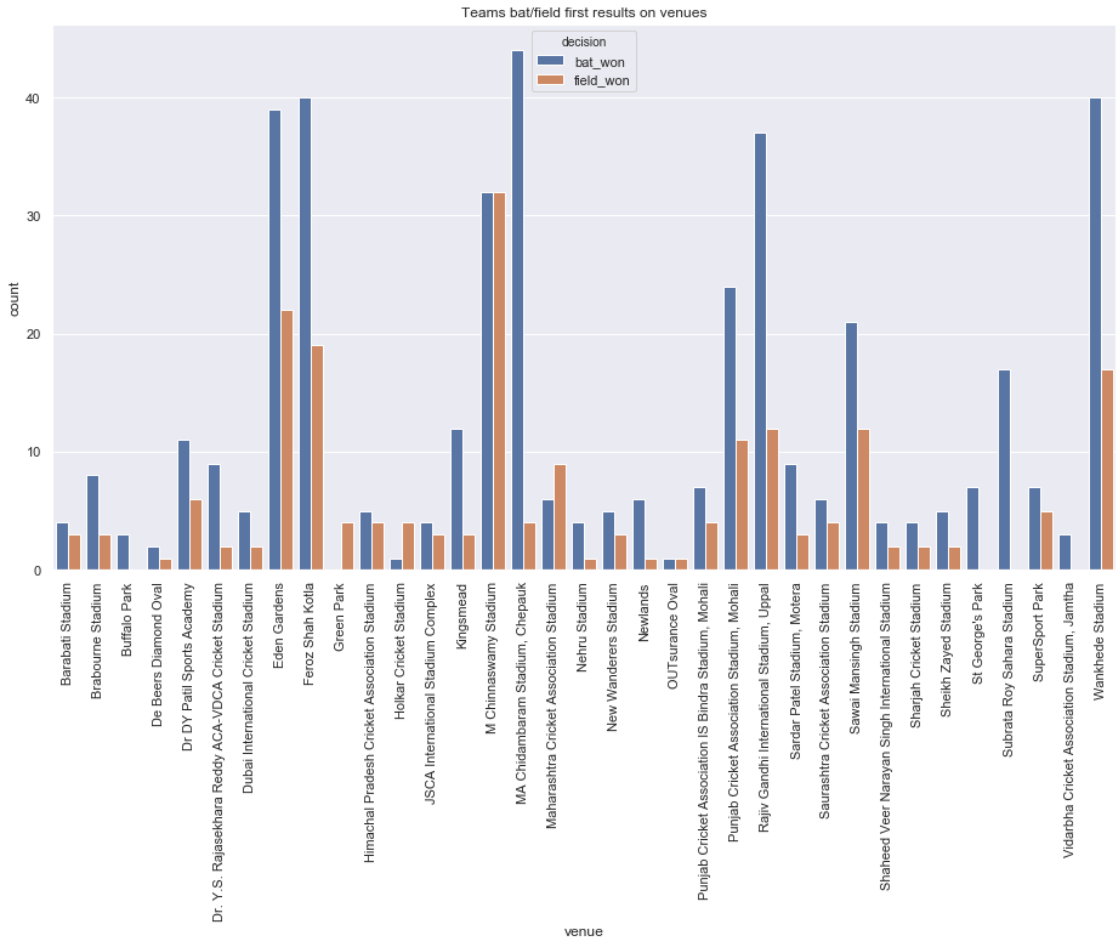
[44]:
```
#Winning stats of teams bat/field first by venues
venue_toss_decision_result=matches[["toss_winner","toss_decision","winner","venue"]]
#print(venue_toss_decision_result)


venue_toss_decision_result["decision"]=np.where((venue_toss_decision_result.
 ↪toss_winner == venue_toss_decision_result.winner) &␣
 ↪(venue_toss_decision_result.toss_decision=="field"),"field_won","bat_won")
#print(venue_toss_decision_result)

venue_result=venue_toss_decision_result.groupby(["venue"]).decision.
 ↪value_counts().reset_index(name="count")
print(venue_result)
#Visualization
sns.set(rc={'figure.figsize':(15.7,8.27)})
plot = sns.barplot(x="venue", y="count", hue="decision", data=venue_result)
plot.set_title('Teams bat/field first results on venues')
plot.set_xticklabels(venue_result['venue'].unique(),rotation=90)
#plt.tight_layout()
plt.show()
```

```
C:\Users\anika\anaconda3\lib\site-packages\ipykernel_launcher.py:6:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```

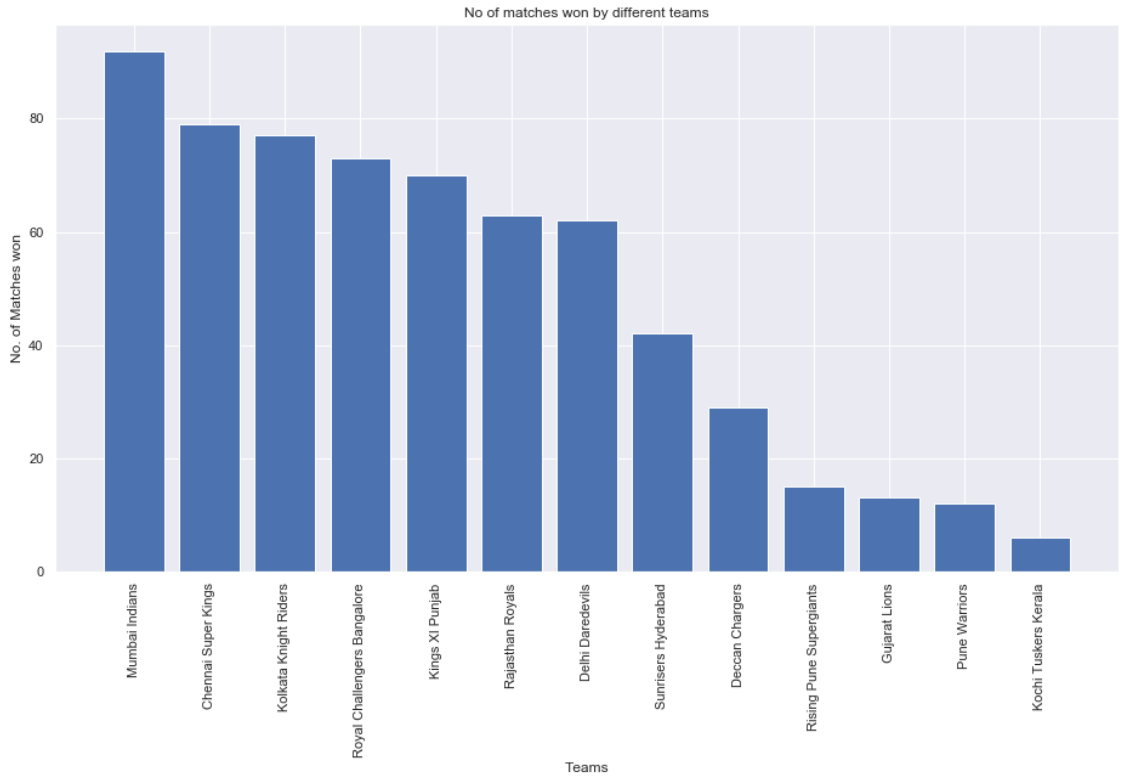
	venue	decision	count
0	Barabati Stadium	bat_won	4
1	Barabati Stadium	field_won	3
2	Brabourne Stadium	bat_won	8
3	Brabourne Stadium	field_won	3
4	Buffalo Park	bat_won	3
..	...	...	...
60	SuperSport Park	bat_won	7
61	SuperSport Park	field_won	5
62	Vidarbha Cricket Association Stadium, Jamtha	bat_won	3
63	Wankhede Stadium	bat_won	40
64	Wankhede Stadium	field_won	17

[65 rows x 3 columns]



[45]:
```
teams = list(set(matches.loc[:,'team1']))
matches_won = [len(matches.loc[matches['winner'] == i]) for i in teams]
test_list=(sorted(list(zip(matches_won,teams))))[::-1]
matches_won=[ i for i, _ in test_list ]
teams=[ i for _, i in test_list ]

plt.bar(np.arange(len(teams)), matches_won)
plt.xticks(np.arange(len(teams)), teams, rotation='vertical')
plt.ylabel('No. of Matches won')
plt.xlabel('Teams')
plt.title('No of matches won by different teams')
```

[45]:
```
Text(0.5, 1.0, 'No of matches won by different teams')
```



28 Data Preprocessing & Prediction

[10]:
```
from sklearn.preprocessing import LabelEncoder
#Encode target labels with value between 0 and n_classes-1.
#This transformer should be used to encode target values, i.e. y, and not the␣
 ↪input X.
```

For the columns to be able to assist the model in the prediction, the values should make some sense to the computers. Since they (still) don't have the ability to understand and draw inference from the text, we need to encode the strings to numeric categorical values.

[11]:
```
#encoder
encoder= LabelEncoder()
matches["team1"]=encoder.fit_transform(matches["team1"])
matches["team2"]=encoder.fit_transform(matches["team2"])
matches["winner"]=encoder.fit_transform(matches["winner"].astype(str)) ␣
 ↪#astype(str)) ??
matches["toss_winner"]=encoder.fit_transform(matches["toss_winner"])
matches["venue"]=encoder.fit_transform(matches["venue"])
```

Before we hop on to building models, an important observation has to be acknowledged. Columns like toss_winner, toss_decision, and winner might make sense to us, but what about the machines?

Let me elaborate. The values in toss_winner and winner include team names, but what is the relation of these variables with team_1 or team_2? The only thing common between them is that they would share the same value, but that is not enough to be logical. Also, toss_decision might be bat or field, but what team are they referring to? To tackle this problem, we will add new columns team1_win, team1_toss_win, and team1_bat for columns winner, toss_winner, and toss_decision such that they reflect the relationship with column team_1.

[12]:
```
#outcome variable as a probability of team1 winning
matches.loc[matches["winner"]==matches["team1"],"team1_win"]=1
matches.loc[matches["winner"]!=matches["team1"],"team1_win"]=0

matches.loc[matches["toss_winner"]==matches["team1"],"team1_toss_win"]=1
matches.loc[matches["toss_winner"]!=matches["team1"],"team1_toss_win"]=0
```

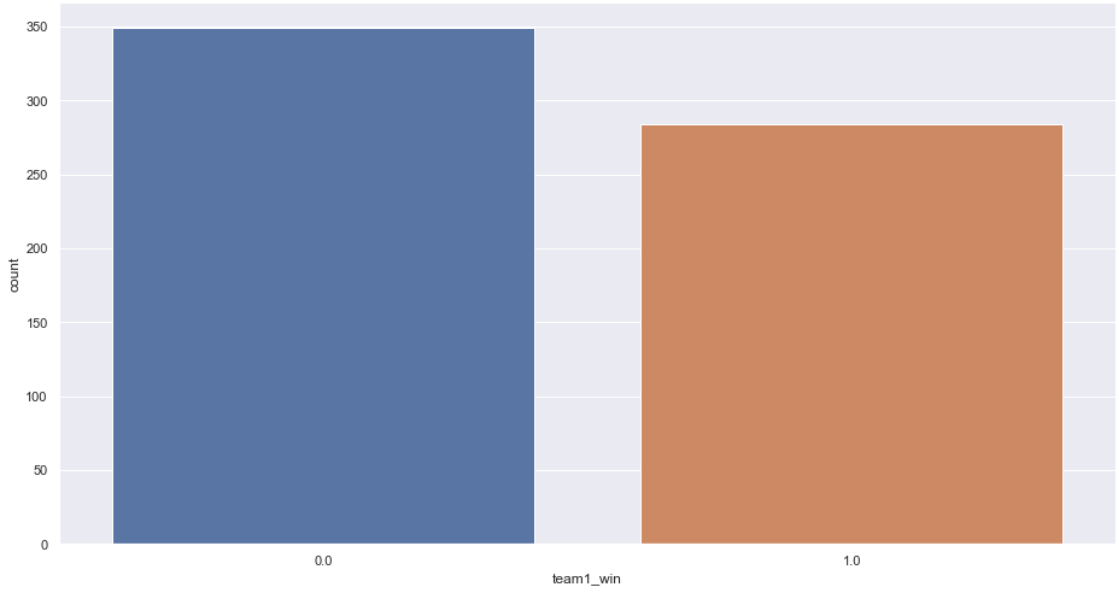
[13]:
```
matches["team1_bat"]=0
matches.loc[(matches["team1_toss_win"]==1) &␣
 ↪(matches["toss_decision"]=="bat"),"team1_bat"]=1
matches.head()
```

[13]:

	id	season	city	date	team1	team2	toss_winner	toss_decision	\
0	1	2017	Hyderabad	05-04-2017	12	11	11	field	
1	2	2017	Pune	06-04-2017	7	10	10	field	
2	3	2017	Rajkot	07-04-2017	3	6	6	field	
3	4	2017	Indore	08-04-2017	10	4	4	field	
4	5	2017	Bangalore	08-04-2017	11	2	11	bat	

```
   result  dl_applied  ...  win_by_runs  win_by_wickets  player_of_match  \
0  normal           0  ...           35               0     Yuvraj Singh
1  normal           0  ...            0               7        SPD Smith
2  normal           0  ...            0              10          CA Lynn
3  normal           0  ...            0               6       GJ Maxwell
4  normal           0  ...           15               0        KM Jadhav

  venue         umpire1        umpire2 umpire3  team1_win  team1_toss_win  \
0    23     AY Dandekar       NJ Llong     NaN        1.0             0.0
1    16  A Nand Kishore         S Ravi     NaN        0.0             0.0
2    25     Nitin Menon      CK Nandan     NaN        0.0             0.0
3    11    AK Chaudhary  C Shamshuddin     NaN        0.0             0.0
4    14             NaN            NaN     NaN        1.0             1.0

   team1_bat
0          0
1          0
2          0
3          0
4          1

[5 rows x 21 columns]
```

[14]:
```
#Checking for the distribution of the dataset
sns.countplot(x="team1_win",data=matches)
plt.show()
# sns.countplot(x="team1_toss_win",data=matches)
# plt.show()
# sns.countplot(x="team1_bat",data=matches)
# plt.show()
```



[15]:
```
prediction_df=matches[["team1","team2","team1_toss_win","team1_bat","team1_win","venue"]]
```

[16]:
```
prediction_df
```

[16]:

	team1	team2	team1_toss_win	team1_bat	team1_win	venue
0	12	11	0.0	0	1.0	23
1	7	10	0.0	0	0.0	16
2	3	6	0.0	0	0.0	25
3	10	4	0.0	0	0.0	11
4	11	2	1.0	1	1.0	14
..	...	...	...	...	...	...
631	2	11	0.0	0	0.0	27
632	3	11	0.0	0	0.0	14
633	12	6	0.0	0	1.0	8
634	3	12	0.0	0	0.0	8
635	12	11	1.0	1	1.0	14

[633 rows x 6 columns]

[17]:
```
#First, we will check the columns if any of them represent the same values as␣
 ↪other columns. For this, we need to create a correlation matrix to find out␣
 ↪the relationships between the column. If the absolute value of the correlation␣
 ↪between the columns is high enough, we can say that they represent similar␣
 ↪values.


#dropping higly correlated features
```

```
correlated_features = set()
correlation_matrix = prediction_df.drop('team1_win', axis=1).corr()
correlation_matrix


#Here, we see that team1_bat represents the same information as team1_toss_win.␣
↪Strange, right? It's just how the dataset was built, if team1 wins the toss␣
↪then they will always bat and if team2 wins the toss then they will always␣
↪field. So we removed the column team1_bat from our list of features.
```

[17]:

	team1	team2	team1_toss_win	team1_bat	venue
team1	1.000000	-0.098426	-0.087085	-0.087085	0.104659
team2	-0.098426	1.000000	-0.035555	-0.035555	0.077880
team1_toss_win	-0.087085	-0.035555	1.000000	1.000000	0.043885
team1_bat	-0.087085	-0.035555	1.000000	1.000000	0.043885
venue	0.104659	0.077880	0.043885	0.043885	1.000000

[18]:
```
for i in range(len(correlation_matrix.columns)):
    for j in range(i):
        if abs(correlation_matrix.iloc[i, j]) > 0.8:
            colname = correlation_matrix.columns[i]
            correlated_features.add(colname)
```

[19]:
```
prediction_df.drop(columns=correlated_features)
```

[19]:

	team1	team2	team1_toss_win	team1_win	venue
0	12	11	0.0	1.0	23
1	7	10	0.0	0.0	16
2	3	6	0.0	0.0	25
3	10	4	0.0	0.0	11
4	11	2	1.0	1.0	14
..	...	...	...	...	...
631	2	11	0.0	0.0	27
632	3	11	0.0	0.0	14
633	12	6	0.0	1.0	8
634	3	12	0.0	0.0	8
635	12	11	1.0	1.0	14

[633 rows x 5 columns]

[20]:
```
#feature selection
X = prediction_df.drop('team1_win', axis=1)
target = prediction_df['team1_win']
target=target.astype(int)
```

[21]:
```
# from sklearn.linear_model import LogisticRegression
```

```
# from sklearn.feature_selection import RFE          #---> Feature ranking with␣
 ↪recursive feature elimination.

# #Given an external estimator that assigns weights to features (e.g., the␣
 ↪coefficients of a linear model), the goal of recursive feature elimination␣
 ↪(RFE) is to select features by recursively considering smaller and smaller␣
 ↪sets of features. First, the estimator is trained on the initial set of␣
 ↪features and the importance of each feature is obtained either through any␣
 ↪specific attribute or callable. Then, the least important features are pruned␣
 ↪from current set of features. That procedure is recursively repeated on the␣
 ↪pruned set until the desired number of features to select is eventually␣
 ↪reached.

# logreg = LogisticRegression(solver='lbfgs')
# # print(logreg)
# rfe = RFE(logReg, 20)
# rfe = rfe.fit(X, target.values.ravel())
# #Checking for the features of they are important
# print(rfe.support_)
```

[22]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.feature_selection import RFE
logReg=LogisticRegression(solver='lbfgs')
print(logReg)
rfe = RFE(estimator=logReg, n_features_to_select=20)
print(rfe)
rfe = rfe.fit(X, target.values.ravel())
#Checking for the features of they are important
print(rfe.support_)
print(rfe.n_features_)
print(rfe.ranking_)
print(rfe.estimator_)
```

```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, l1_ratio=None, max_iter=100,
                   multi_class='auto', n_jobs=None, penalty='l2',
                   random_state=None, solver='lbfgs', tol=0.0001, verbose=0,
                   warm_start=False)
RFE(estimator=LogisticRegression(C=1.0, class_weight=None, dual=False,
                                 fit_intercept=True, intercept_scaling=1,
                                 l1_ratio=None, max_iter=100,
                                 multi_class='auto', n_jobs=None, penalty='l2',
                                 random_state=None, solver='lbfgs', tol=0.0001,
                                 verbose=0, warm_start=False),
    n_features_to_select=20, step=1, verbose=0)
[ True  True  True  True  True]
5
```

```
[1 1 1 1 1]
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, l1_ratio=None, max_iter=100,
                   multi_class='auto', n_jobs=None, penalty='l2',
                   random_state=None, solver='lbfgs', tol=0.0001, verbose=0,
                   warm_start=False)
```

[24]:
```
#Splitting the data into training and testing data and scaling it
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, target, test_size=0.2,␣
 ↪random_state=0)

#Standardize features by removing the mean and scaling to unit variance
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()

X_train = sc.fit_transform(X_train) #        Fit to data, then transform it.␣
 ↪Fits transformer to X and returns a transformed version of X.
X_test = sc.transform(X_test)  #        Perform standardization by centering and␣
 ↪scaling
```

[25]:
```
from sklearn.metrics import confusion_matrix, classification_report
#Logistic Regression
logreg = LogisticRegression()
logreg.fit(X_train, y_train)
y_pred = logreg.predict(X_test)
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
print('Accuracy of logistic regression classifier on test set: {:.4f}'.
 ↪format(logreg.score(X_test, y_test)))
```

```
[[69  0]
 [58  0]]
              precision    recall  f1-score   support

           0       0.54      1.00      0.70        69
           1       0.00      0.00      0.00        58

    accuracy                           0.54       127
   macro avg       0.27      0.50      0.35       127
weighted avg       0.30      0.54      0.38       127

Accuracy of logistic regression classifier on test set: 0.5433

C:\Users\anika\anaconda3\lib\site-
packages\sklearn\metrics\_classification.py:1272: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
```

```
  _warn_prf(average, modifier, msg_start, len(result))
```

[26]:
```
from sklearn.svm import SVC

#SVM
svm=SVC()
svm.fit(X_train,y_train)
svm.score(X_test,y_test)
y_pred = svm.predict(X_test)
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
print('Accuracy of SVM classifier on test set: {:.4f}'.format(svm.score(X_test,␣
 ↪y_test)))
```

```
[[62  7]
 [46 12]]
              precision    recall  f1-score   support

           0       0.57      0.90      0.70        69
           1       0.63      0.21      0.31        58

    accuracy                           0.58       127
   macro avg       0.60      0.55      0.51       127
weighted avg       0.60      0.58      0.52       127

Accuracy of SVM classifier on test set: 0.5827
```

[27]:
```
from sklearn.tree import DecisionTreeClassifier
#Decision Tree Classifier
dtree=DecisionTreeClassifier()
dtree.fit(X_train,y_train)
dtree.score(X_test,y_test)
y_pred = dtree.predict(X_test)
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
print('Accuracy of decision tree classifier on test set: {:.4f}'.format(dtree.
 ↪score(X_test, y_test)))
```

```
[[38 31]
 [27 31]]
              precision    recall  f1-score   support

           0       0.58      0.55      0.57        69
           1       0.50      0.53      0.52        58

    accuracy                           0.54       127
   macro avg       0.54      0.54      0.54       127
weighted avg       0.55      0.54      0.54       127
```

```
Accuracy of decision tree classifier on test set: 0.5433
```

[28]:
```
from sklearn.ensemble import RandomForestClassifier
#Random Forest Classifier
randomForest= RandomForestClassifier(n_estimators=100)
randomForest.fit(X_train,y_train)
randomForest.score(X_test,y_test)
y_pred = randomForest.predict(X_test)
print("Confusion matrix\n",confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
print('Accuracy of random forest classifier on test set: {:.4f}'.
 ↪format(randomForest.score(X_test, y_test)))
```

```
Confusion matrix
 [[38 31]
 [28 30]]
              precision    recall  f1-score   support

           0       0.58      0.55      0.56        69
           1       0.49      0.52      0.50        58

    accuracy                           0.54       127
   macro avg       0.53      0.53      0.53       127
weighted avg       0.54      0.54      0.54       127

Accuracy of random forest classifier on test set: 0.5354
```

It is evident from the results that SVM gives us a higher accuracy than other algorithms for this data distribution.