Project 3 - Milestone3

Title - IPL(Indian Premier League) Match Predictive Analysis

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Data Exploration

In [1]:
```
## Import required libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.feature_selection import RFE
from sklearn.preprocessing import StandardScaler
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import confusion_matrix, classification_report
```

In [2]:
```
## Load source dataset and create dataframe ipl_matches
ipl_matches=pd.read_csv("all_season_summary.csv")
```

In [3]:
```
## Check sample records from the dataframe head
ipl_matches.head()
```

Out[3]:

	season	id	name	short_name	description	home_team	away_team	toss_won	decision
0	2022	1304047	Chennai Super Kings v Kolkata Knight Riders	CSK v KKR	1st Match (N), Indian Premier League at Mumbai...	CSK	KKR	KKR	BOWL FIRST
1	2022	1304048	Delhi Capitals v Mumbai Indians	DC v MI	2nd Match (D/N), Indian Premier League at Mumb...	DC	MI	DC	BOWL FIRST
2	2022	1304049	Punjab Kings v Royal	PBKS v RCB	3rd Match (N), Indian Premier	PBKS	RCB	KXIP	BOWL FIRST

	season	id	name	short_name	description	home_team	away_team	toss_won	decision
			Challengers Bangalore		League at Navi M...				
3	2022	1304050	Gujarat Titans v Lucknow Super Giants	GT v LSG	4th Match (N), Indian Premier League at Mumbai...	GT	LSG	GT	BOWL FIRST
4	2022	1304051	Sunrisers Hyderabad v Rajasthan Royals	SRH v RR	5th Match (N), Indian Premier League at Pune, ...	SRH	RR	SRH	BOWL FIRST

5 rows × 45 columns

In [3]:
```python
ipl_matches.tail()
```

Out[3]:

	season	id	name	short_name	description	home_team	away_team	toss_won	decision
953	2008	336012	Royal Challengers Bangalore v Mumbai Indians	RCB v MI	55th match (D/N), Indian Premier League at Ben...	RCB	MI	MI	BOWL FIRST
954	2008	336019	Kings XI Punjab v Rajasthan Royals	KXIP v RR	56th match (N), Indian Premier League at Mohal...	KXIP	RR	RR	BOWL FIRST
955	2008	336038	Delhi Daredevils v Rajasthan Royals	DC v RR	1st Semi-Final (N), Indian Premier League at M...	DC	RR	DC	BOWL FIRST
956	2008	336039	Chennai Super Kings v Kings XI Punjab	CSK v KXIP	2nd Semi-Final (N), Indian Premier League at M...	CSK	KXIP	KXIP	BAT FIRST
957	2008	336040	Chennai Super Kings v Rajasthan Royals	CSK v RR	Final (N), Indian Premier League at Mumbai, Ju...	CSK	RR	RR	BOWL FIRST

5 rows × 45 columns

In [4]:
```
## check shape or size of the dataframe
ipl_matches.shape
```

Out[4]:
```
(958, 45)
```

In [5]:
```
## check info of the dataframe
ipl_matches.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 958 entries, 0 to 957
Data columns (total 45 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   season             958 non-null    int64  
 1   id                 958 non-null    int64  
 2   name               958 non-null    object 
 3   short_name         958 non-null    object 
 4   description        958 non-null    object 
 5   home_team          958 non-null    object 
 6   away_team          958 non-null    object 
 7   toss_won           958 non-null    object 
 8   decision           958 non-null    object 
 9   1st_inning_score   950 non-null    object 
 10  2nd_inning_score   948 non-null    object 
 11  home_score         950 non-null    object 
 12  away_score         948 non-null    object 
 13  winner             958 non-null    object 
 14  result             958 non-null    object 
 15  start_date         958 non-null    object 
 16  end_date           958 non-null    object 
 17  venue_id           958 non-null    int64  
 18  venue_name         958 non-null    object 
 19  home_captain       958 non-null    object 
 20  away_captain       958 non-null    object 
 21  pom                958 non-null    object 
 22  points             958 non-null    object 
 23  super_over         958 non-null    bool   
 24  home_overs         950 non-null    float64
 25  home_runs          950 non-null    float64
 26  home_wickets       950 non-null    float64
 27  home_boundaries    950 non-null    float64
 28  away_overs         948 non-null    float64
 29  away_runs          948 non-null    float64
 30  away_wickets       948 non-null    float64
 31  away_boundaries    948 non-null    float64
 32  highlights         936 non-null    object 
 33  home_key_batsman   950 non-null    object 
 34  home_key_bowler    937 non-null    object 
 35  home_playx1        958 non-null    object 
 36  away_playx1        958 non-null    object 
 37  away_key_batsman   948 non-null    object 
 38  away_key_bowler    939 non-null    object 
 39  match_days         958 non-null    object 
 40  umpire1            958 non-null    object 
 41  umpire2           958 non-null    object
 42  tv_umpire         958 non-null    object
 43  referee           958 non-null    object
 44  reserve_umpire    958 non-null    object
dtypes: bool(1), float64(8), int64(3), object(33)
memory usage: 330.4+ KB
```

EDA

In [6]:

```
## Remove any unwanted columns -- drop coluns

ipl_matches.drop(columns=["id","reserve_umpire","referee","tv_umpire","umpire2","umpire
                          "away_key_bowler","away_playx1","away_key_batsman","home_play
                          "home_key_batsman","highlights","away_boundaries","away_wicke
                         "away_overs","home_boundaries","home_wickets","home_runs","hom
                         "points","pom","away_captain","home_captain","start_date","end
                         "away_score","venue_id"],inplace=True)
ipl_matches.shape
```

Out[6]:

```
(958, 13)
```

In [7]:

```
## Check columns with null values
null_columns=ipl_matches.isnull().sum()
print(null_columns[null_columns > 0])
```

```
1st_inning_score     8
2nd_inning_score    10
dtype: int64
```

In [8]:

```
ipl_matches.head()
```

Out[8]:

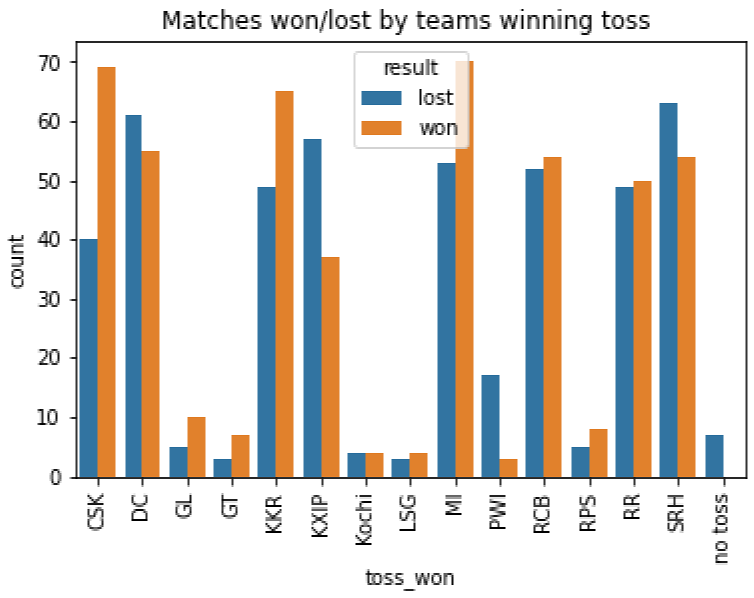
	season	name	short_name	description	home_team	away_team	toss_won	decision	1st_inning
0	2022	Chennai Super Kings v Kolkata Knight Riders	CSK v KKR	1st Match (N), Indian Premier League at Mumbai...	CSK	KKR	KKR	BOWL FIRST	
1	2022	Delhi Capitals v Mumbai Indians	DC v MI	2nd Match (D/N), Indian Premier League at Mumb...	DC	MI	DC	BOWL FIRST	
2	2022	Punjab Kings v Royal Challengers Bangalore	PBKS v RCB	3rd Match (N), Indian Premier League at Navi M...	PBKS	RCB	KXIP	BOWL FIRST	
3	2022	Gujarat Titans v Lucknow	GT v LSG	4th Match (N), Indian Premier	GT	LSG	GT	BOWL FIRST	

	season	name	short_name	description	home_team	away_team	toss_won	decision	1st_inning
		Super Giants		League at Mumbai...					
4	2022	Sunrisers Hyderabad v Rajasthan Royals	SRH v RR	5th Match (N), Indian Premier League at Pune, ...	SRH	RR	SRH	BOWL FIRST	

## Visualizations

In [9]:
```
## Checking stats for Toss affecting the win.
toss_won_df = ipl_matches.groupby(['toss_won']).winner.value_counts().reset_index(name=
toss_won_df['result']=np.where(toss_won_df.winner==toss_won_df.toss_won,'won','lost')
toss_won_result_df = toss_won_df.groupby(['toss_won','result'])['count'].sum().reset_in
```

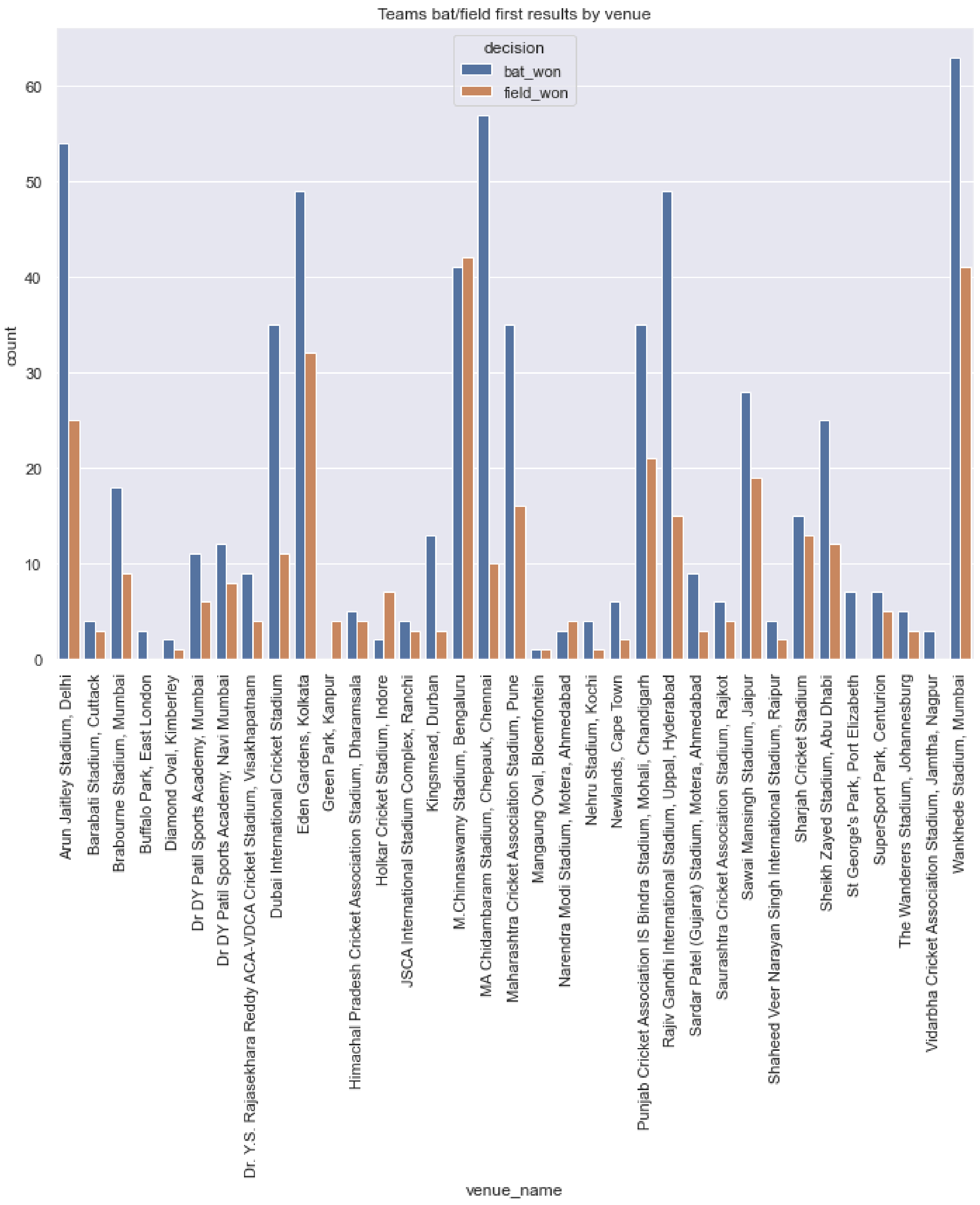
In [10]:
```
## Visualization
plot = sns.barplot(x="toss_won", y="count", hue="result", data=toss_won_result_df)
plot.set_title('Matches won/lost by teams winning toss ')
plot.set_xticklabels(toss_won_result_df['toss_won'].unique(),rotation=90)
plt.show()
```



In [11]:
```
## Checking Winning stats of teams by venue
venue_toss_decision_result=ipl_matches[["toss_won","decision","winner","venue_name"]]
venue_toss_decision_result["decision"]=np.where((venue_toss_decision_result.toss_won ==
venue_result=venue_toss_decision_result.groupby(["venue_name"]).decision.value_counts()
#Visualization
sns.set(rc={'figure.figsize':(11.7,8.27)})
plot = sns.barplot(x="venue_name", y="count", hue="decision", data=venue_result)
plot.set_title('Teams bat/field first results by venue')
plot.set_xticklabels(venue_result['venue_name'].unique(),rotation=90)
plt.show()
```

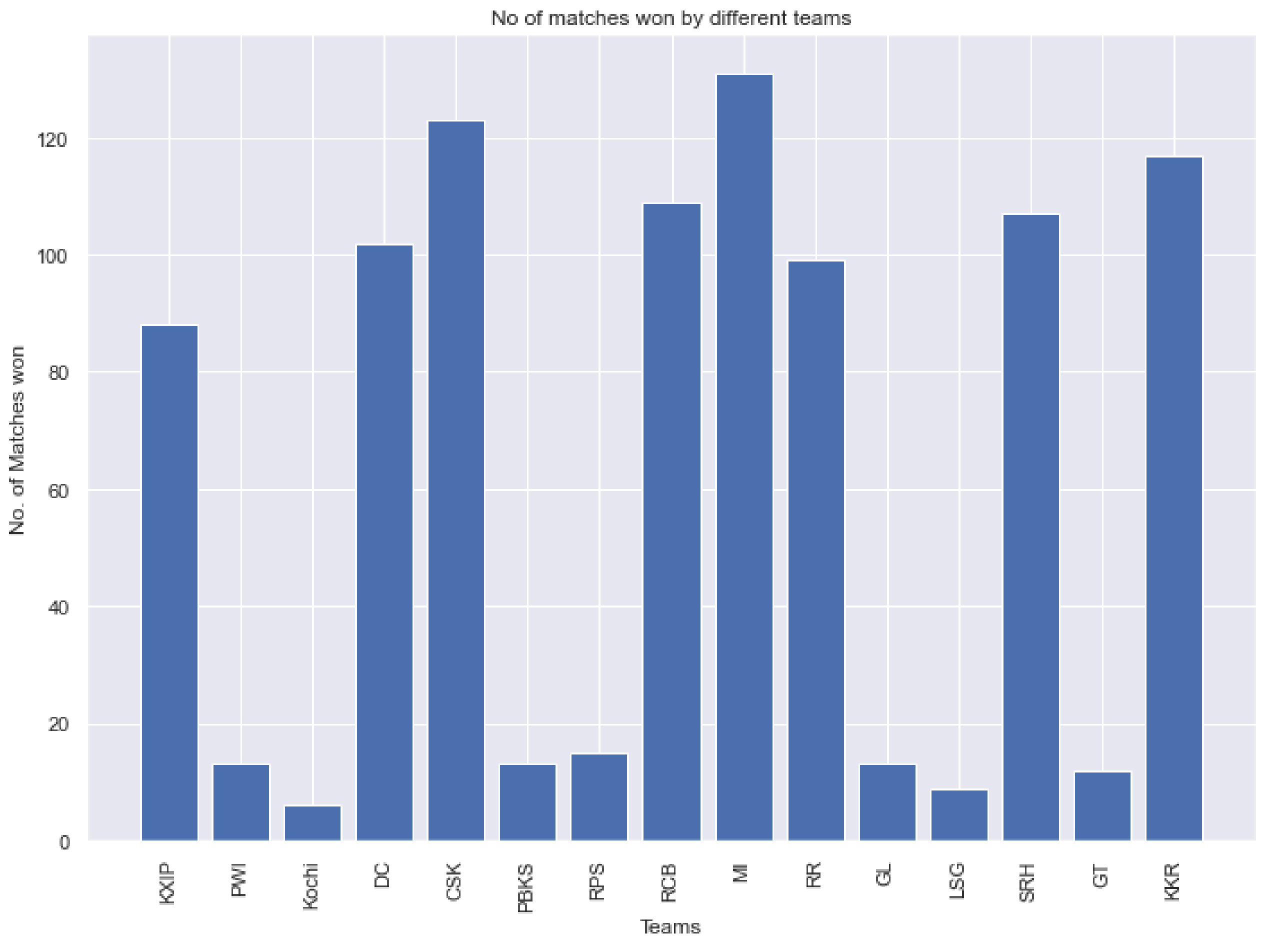
```
C:\Users\JAGADE~1\AppData\Local\Temp/ipykernel_34716/1309432646.py:3: SettingWithCopyWar
ning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  venue_toss_decision_result["decision"]=np.where((venue_toss_decision_result.toss_won =
= venue_toss_decision_result.winner) & (venue_toss_decision_result.decision=="BOWL FIRS
T"),"field_won","bat_won")
```



In [12]:
```
## Checking # of matches won by different teams
teams = list(set(ipl_matches.loc[:,'home_team']))
matches_won = [len(ipl_matches.loc[ipl_matches['winner'] == i]) for i in teams]
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')
```

Out[12]:
```
Text(0.5, 1.0, 'No of matches won by different teams')
```



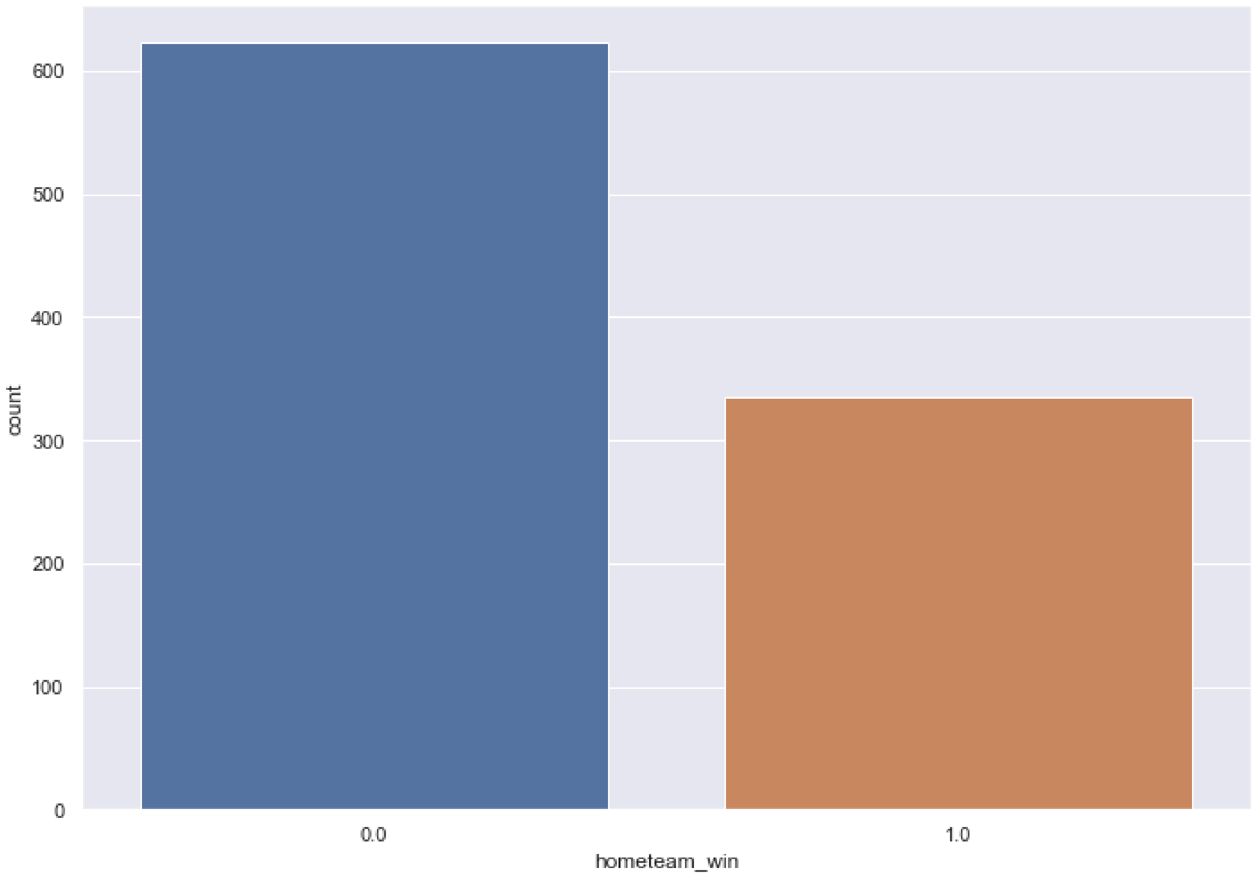
Prediction

In [12]:
```
## Encoding the numerical values
encoder= LabelEncoder()
ipl_matches["home_team"]=encoder.fit_transform(ipl_matches["home_team"])
ipl_matches["away_team"]=encoder.fit_transform(ipl_matches["away_team"])
ipl_matches["winner"]=encoder.fit_transform(ipl_matches["winner"].astype(str))
ipl_matches["toss_won"]=encoder.fit_transform(ipl_matches["toss_won"])
ipl_matches["venue_name"]=encoder.fit_transform(ipl_matches["venue_name"])
```

In [13]:
```
## outcome variable 'hometeam_win' as a probability of home_team winning the match
ipl_matches.loc[ipl_matches["winner"]==ipl_matches["home_team"],"hometeam_win"]=1
ipl_matches.loc[ipl_matches["winner"]!=ipl_matches["home_team"],"hometeam_win"]=0

## Checking the distribution of the dataset
```

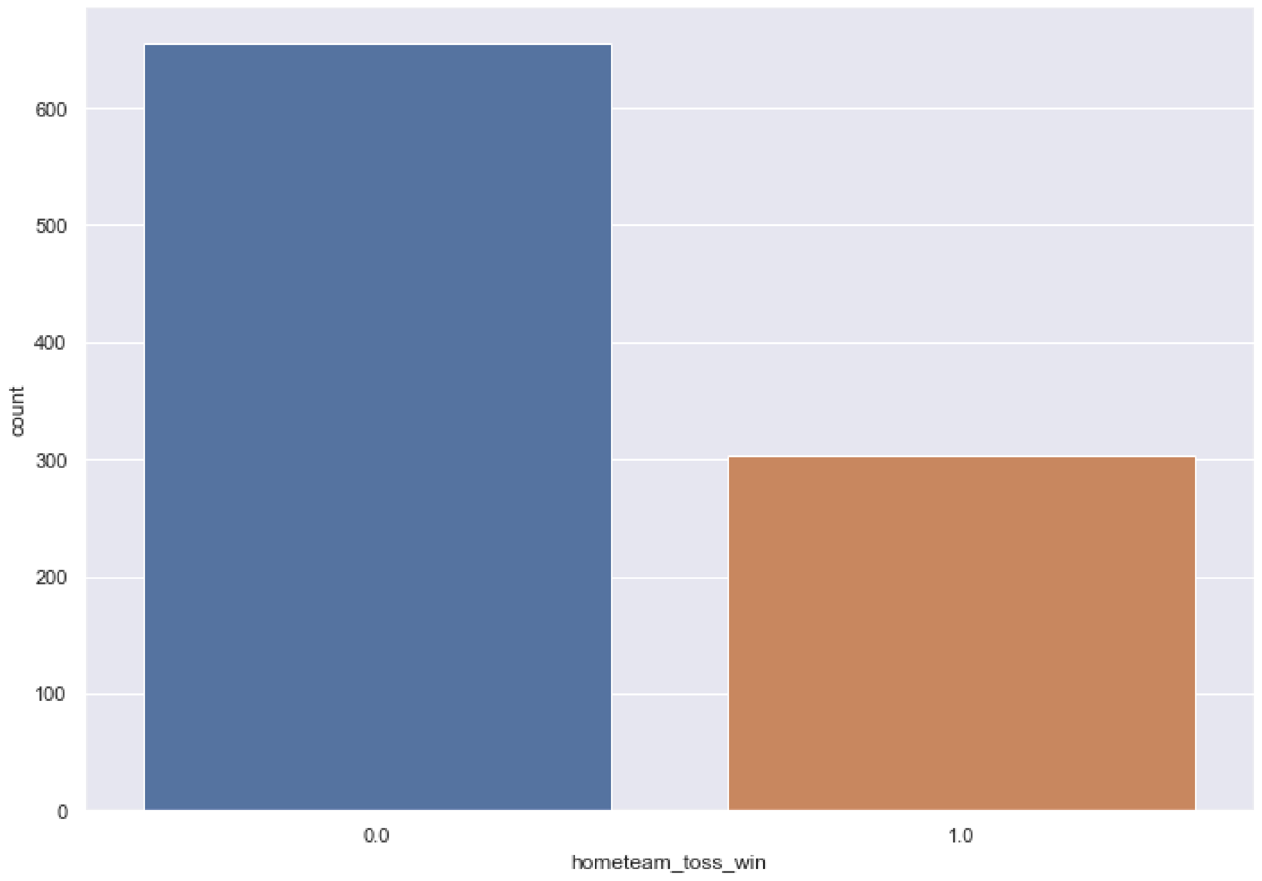
```
sns.countplot(x="hometeam_win",data=ipl_matches)
plt.show()
```



In [14]:

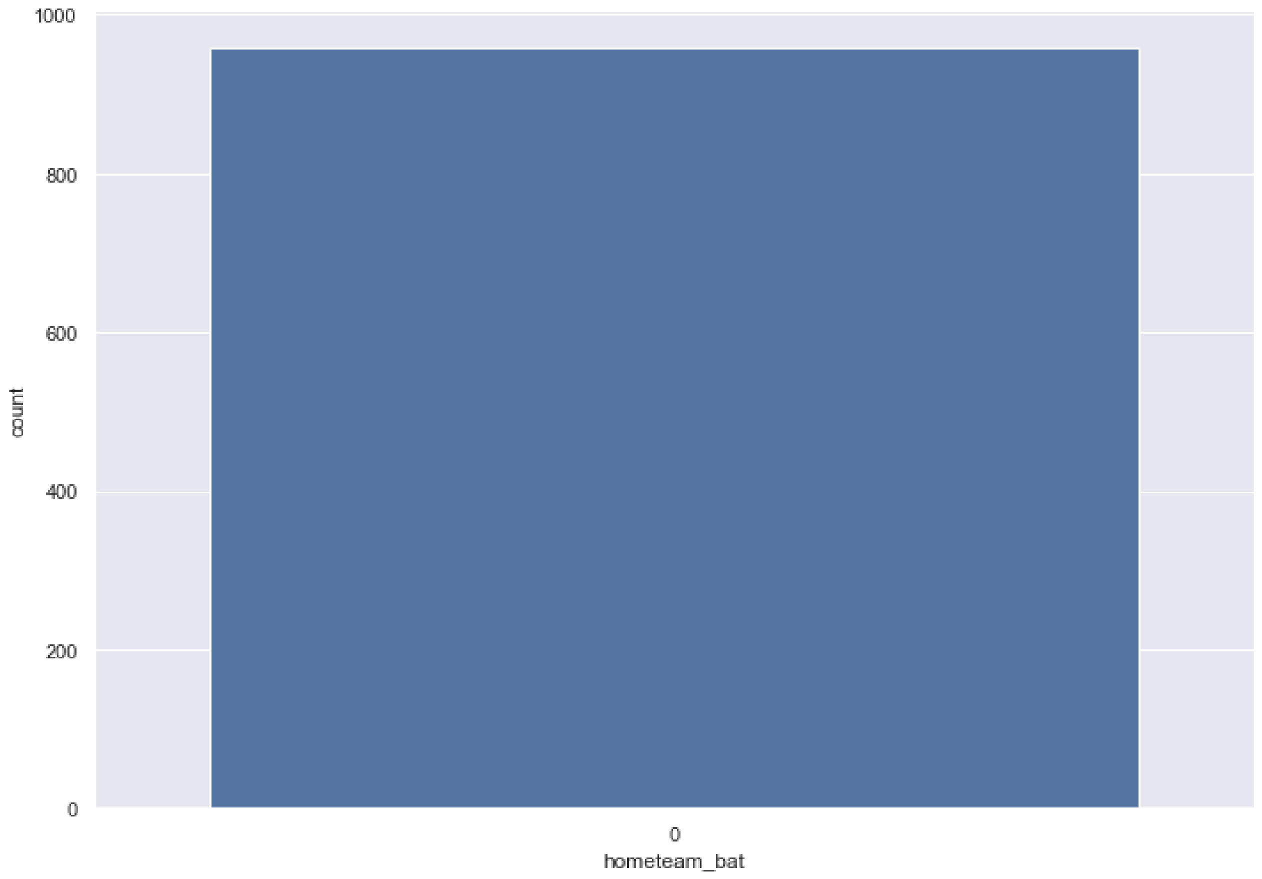
```
## outcome variable 'hometeam_toss_win' as a probability of home_team winning the toss
ipl_matches.loc[ipl_matches["toss_won"]==ipl_matches["home_team"],"hometeam_toss_win"]=
ipl_matches.loc[ipl_matches["toss_won"]!=ipl_matches["home_team"],"hometeam_toss_win"]=

## Checking the distribution of the dataset
sns.countplot(x="hometeam_toss_win",data=ipl_matches)
plt.show()
```



In [15]:
```
## outcome variable 'hometeam_bat' as a probability of home_team batting first
ipl_matches["hometeam_bat"]=0
ipl_matches.loc[(ipl_matches["hometeam_toss_win"]==1) & (ipl_matches["decision"]=="bat"

## Checking the distribution of the dataset
sns.countplot(x="hometeam_bat",data=ipl_matches)
plt.show()
```



In [16]:

```
## Create a prediction dataframe with all required and related features
prediction_df=ipl_matches[["home_team","away_team","hometeam_toss_win","hometeam_bat","
```

In [17]:

```
## Dropping higly correlated features
correlated_features = set()
correlation_matrix = prediction_df.drop('hometeam_win', axis=1).corr()
correlation_matrix
```

Out[17]:

	home_team	away_team	hometeam_toss_win	hometeam_bat	venue_name
home_team	1.000000	-0.142251	-0.423365	NaN	0.271405
away_team	-0.142251	1.000000	0.106037	NaN	-0.043951
hometeam_toss_win	-0.423365	0.106037	1.000000	NaN	-0.055695
hometeam_bat	NaN	NaN	NaN	NaN	NaN
venue_name	0.271405	-0.043951	-0.055695	NaN	1.000000

In [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)

prediction_df.drop(columns=correlated_features)
```

Out[18]:

	home_team	away_team	hometeam_toss_win	hometeam_bat	hometeam_win	venue_name
0	0	4	0.0	0	0.0	34
1	1	8	1.0	0	1.0	2
2	9	11	0.0	0	0.0	6
3	3	7	1.0	0	1.0	34
4	14	13	0.0	0	1.0	17
...	...	...	...	...	...	...
953	11	8	0.0	0	0.0	15
954	5	13	0.0	0	1.0	22
955	1	13	1.0	0	0.0	34
956	0	5	0.0	0	1.0	34
957	0	13	0.0	0	0.0	5

958 rows × 6 columns

In [19]:
```
## feature selection
X = prediction_df.drop('hometeam_win', axis=1)
target = prediction_df['hometeam_win']
target=target.astype(int)
```

Modeling

In [20]:
```
## Splitting the data into training and testing data and scaling it
X_train, X_test, y_train, y_test = train_test_split(X, target, test_size=0.2, random_st
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

In [21]:
```
## Apply 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.sc
```

```
[[95 29]
 [31 37]]
              precision    recall  f1-score   support

           0       0.75      0.77      0.76       124
           1       0.56      0.54      0.55        68

    accuracy                           0.69       192
   macro avg       0.66      0.66      0.66       192
weighted avg       0.69      0.69      0.69       192
```

```
Accuracy of logistic regression classifier on test set: 0.6875
```

In [22]:

```
## Apply 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)
```

```
[[79 45]
 [15 53]]
              precision    recall  f1-score   support

           0       0.84      0.64      0.72       124
           1       0.54      0.78      0.64        68

    accuracy                           0.69       192
   macro avg       0.69      0.71      0.68       192
weighted avg       0.73      0.69      0.69       192

Accuracy of SVM classifier on test set: 0.6875
```

In [23]:

```
## Apply 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_t
```

```
[[90 34]
 [32 36]]
              precision    recall  f1-score   support

           0       0.74      0.73      0.73       124
           1       0.51      0.53      0.52        68

    accuracy                           0.66       192
   macro avg       0.63      0.63      0.63       192
weighted avg       0.66      0.66      0.66       192

Accuracy of decision tree classifier on test set: 0.6562
```

In [24]:

```
## Apply 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.sc
```

```
Confusion matrix
 [[91 33]
 [29 39]]
              precision    recall  f1-score   support

           0       0.76      0.73      0.75       124
           1       0.54      0.57      0.56        68

    accuracy                           0.68       192
   macro avg       0.65      0.65      0.65       192
weighted avg       0.68      0.68      0.68       192

Accuracy of random forest classifier on test set: 0.6771
```

Observation: It is clear from the results that SVM has 68% of accuracy and Logistic Regression with 68% and Decision tree with 65% and Random forest with 67% of accuracy for this data distribution.

```
In [ ]:
```