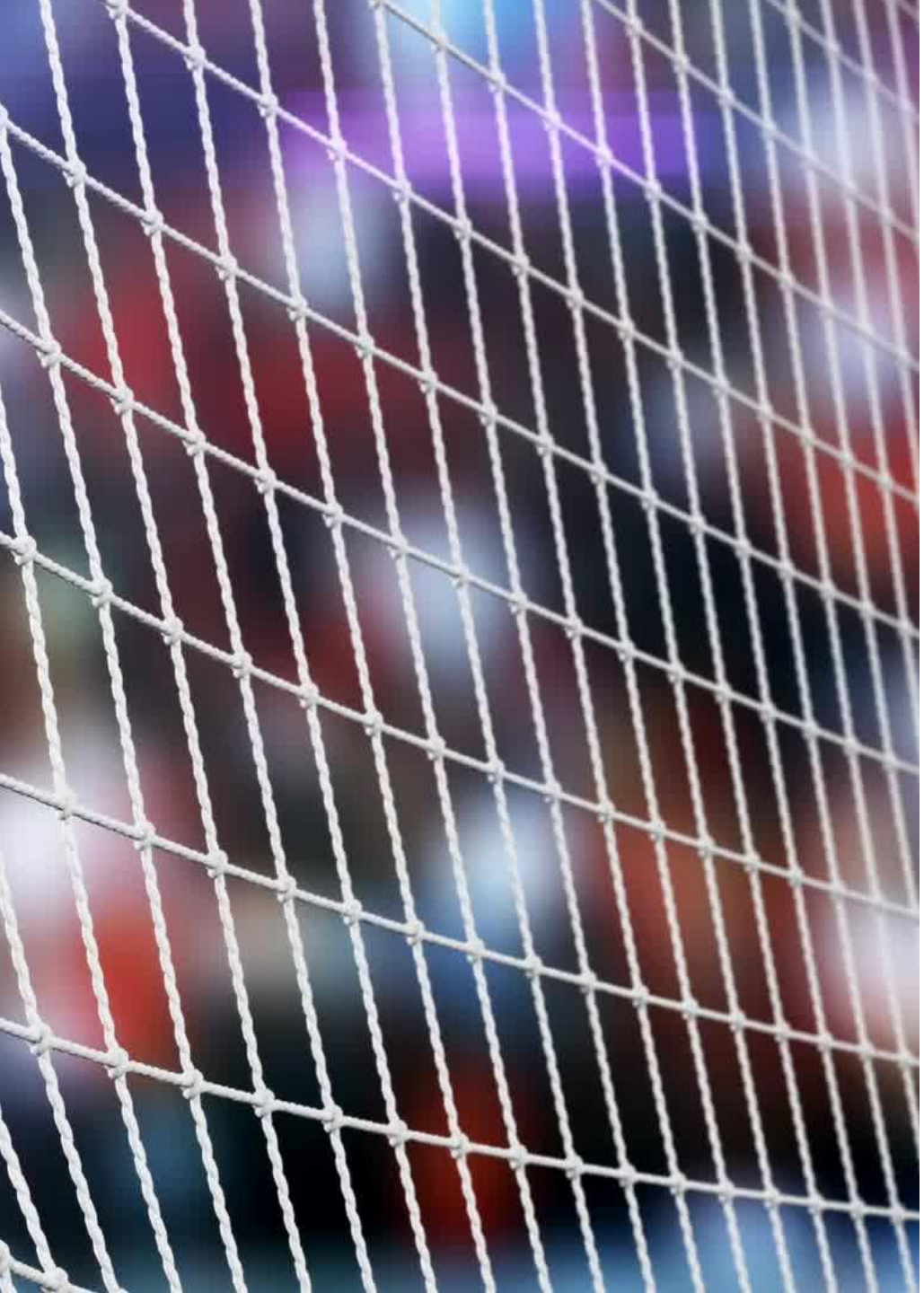

SOCCER RATINGS

Data mining and machine learning

Giuseppe Martino

INTRODUCTION

Soccer Ratings

- *Soccer Ratings* is an application intended to evaluate players performances in a match, assigning them a **rating** from 1 to 5 giving as input some statistical data
- The application is also able to help a coach suggesting a team's **best formation** for the next match based on the ratings given to each player in the last 5 matches.
- Newspapers and sports magazines are used to evaluate the performances of footballers after a match assigning them a rating
- Different criteria may be used by each evaluator to decide whether a footballer has played well or not

DATASET

- 50652 instances and 63 attributes
- 789 different matches across 4 different competitions between 2016 and 2018
- Ratings are taken from 6 different sport magazines and specialized websites

competition	date	match	team	pos	pos_role	player	rater	original_rating	goals	assists	shots_ontarget	shots_offtarget	shotsblocked
Bundesliga 2017-18	04/11/2017	Augsburg - Bayer Leverkusen, 1 - 1	Bayer Leverkusen	MF	AML	Julian Brandt	Kicker	4.0	0	0	0	0	0
Bundesliga 2017-18	04/11/2017	Augsburg - Bayer Leverkusen, 1 - 1	Bayer Leverkusen	MF	AML	Julian Brandt	WhoScored	6.71	0	0	0	0	0
Bundesliga 2017-18	04/11/2017	Augsburg - Bayer Leverkusen, 1 - 1	Bayer Leverkusen	MF	AML	Julian Brandt	Bild	4.0	0	0	0	0	0
Bundesliga 2017-18	04/11/2017	Augsburg - Bayer Leverkusen, 1 - 1	Bayer Leverkusen	MF	AMC	Kai Havertz	Kicker	3.0	0	0	0	1	0
Bundesliga 2017-18	04/11/2017	Augsburg - Bayer Leverkusen, 1 - 1	Bayer Leverkusen	MF	AMC	Kai Havertz	WhoScored	7.98	0	0	0	1	0

⋮

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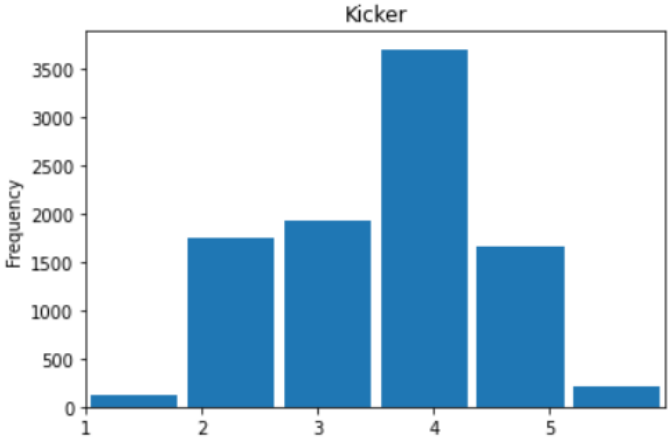
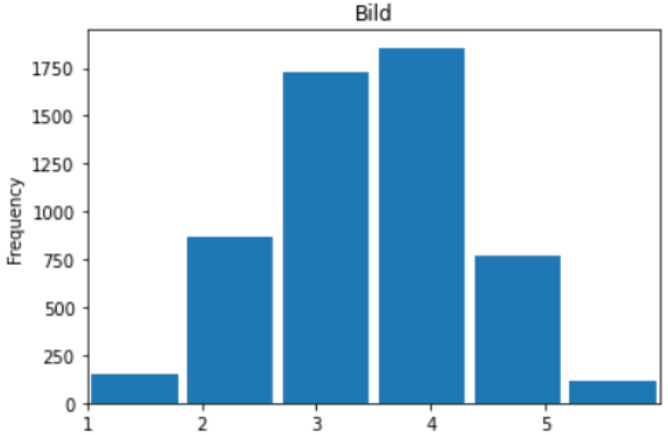
Pre processing

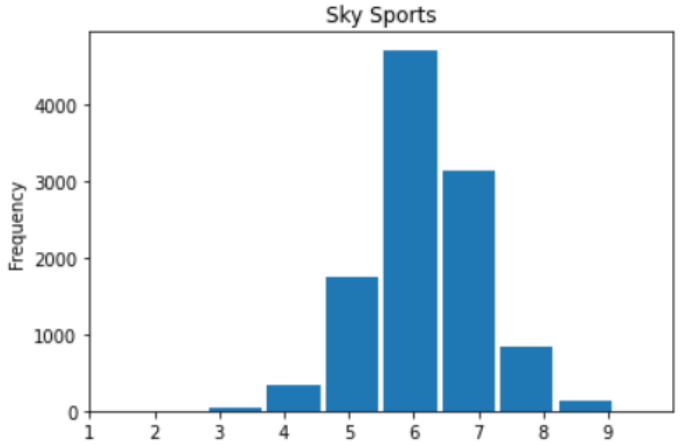
Ratings distribution for each magazine



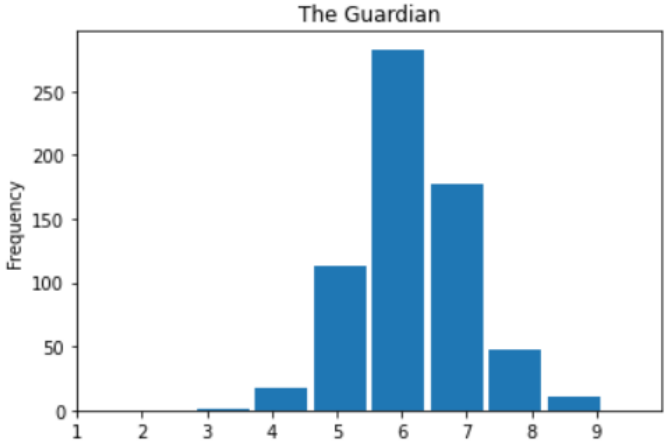
- 1 to 6 scale in 0.5-size steps
- descending order of goodness of performance
- rating is discrete



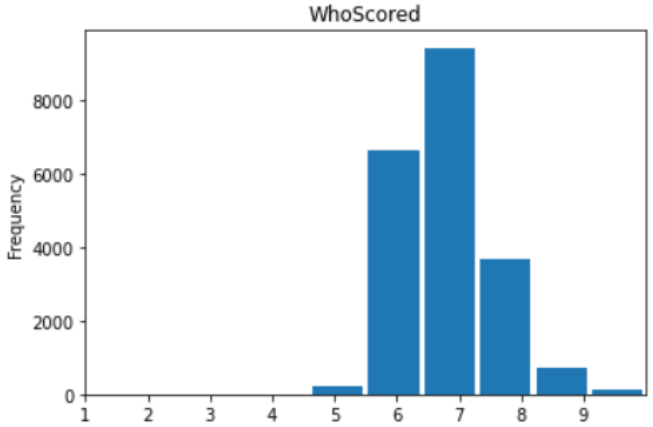
- 1 to 6 scale
- descending order of goodness of performance
- rating is discrete



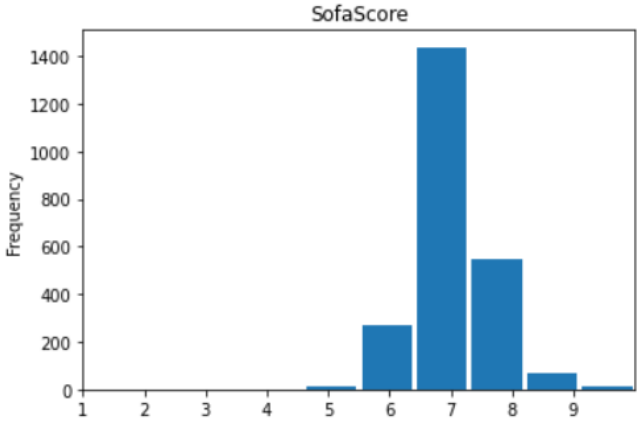
- 1 to 10 scale
- ascending order of goodness of performance
- rating is discrete



- 1 to 10 scale
- ascending order of goodness of performance
- rating is discrete



- 1 to 10 scale
- ascending order of goodness of performance
- rating is continuous



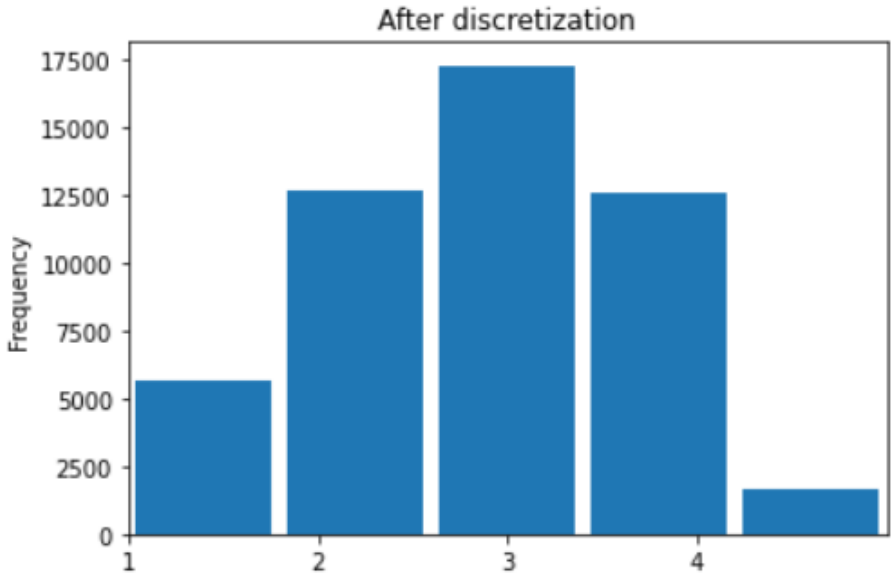
- 1 to 10 scale
- ascending order of goodness of performance
- rating is continuous

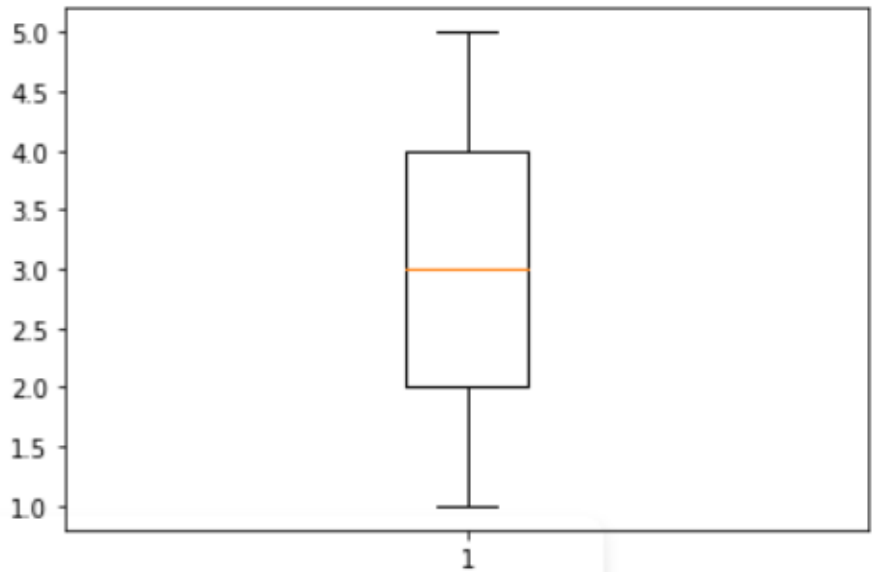
Pre processing

- Where necessary the ratings have been changed to be in an ascending scale

- **Discretization** into 5 bins for each rater using a **clustering approach**
  - sklearn function *KBinsDiscretizer* (n_bins = 5, strategy = ‘kmeans’) has been used

Classes distribution of the whole dataset after the discretization:





Pre processing

Conversion of categorical data:
- ***One-hot encoding***

pos_AMF	pos_DF	pos_DMF	pos_FW	pos_GK	pos_MF
1	0	0	0	0	0
0	0	0	1	0	0
0	0	0	1	0	0
1	0	0	0	0	0
0	0	0	1	0	0

Position original attribute:

GK (Goalkeeper) → GK (Goalkeeper)

DR (Defender Right)
DC (Defender Center)
DL (Defender Left)
→ DF (Defender)

DMR (Difensive Midfielder Right)
DML (Difensive Midfielder Left)
→ DMF (Defensive Midfielder)

MR (Midfielder Right)
ML (Midfielder Left)
→ MF (Central MF)

AMR (Attacking Midfielder Right)
AMC (Attacking Midfielder Center)
AML (Attacking Midfielder Left)
→ AMF (Attackig MF)

FR (Foreward Right)
FC (Foreward Center)
FL (Foreward Left)
→ FW (Foreward)

Pre processing

Dealing with missing values

team	pos_role	player	rater
Romania	DC	Dragos Grigore	Kicker
Romania	DC	Dragos Grigore	WhoScored
Romania	DC	Dragos Grigore	SofaScore
France	Sub	Anthony Martial	WhoScored

The player substituted another one during the game

- Creation of a new binary attribute called '**starter**'

- 'Sub' does not correspond to a role: lack of information about the player's role.
- Treated as a **missing value**
  - Using the mode calculated on the other instances of the same player where position information was present.
  - Some have been filled by hand
  - Some were deleted in case it was not possible to establish the role

Pre processing

Removing irrelevant attributes

- competition
- date
- match
- rater
- team

Pre processing

Removing duplicates and inconsistencies

Since there are several ratings for each performance, assigned by different newspapers, there are 2 situations:

- Agreement across different raters ⟶ duplicated instances
- Disagreement across different raters ⟶ instances with all attributes equal except class (rating)

win	lost	is_home_team	minutesPlayed	game_duration	starter	rating
0	1	0	90	90	1	3.0
0	1	0	90	90	1	2.0

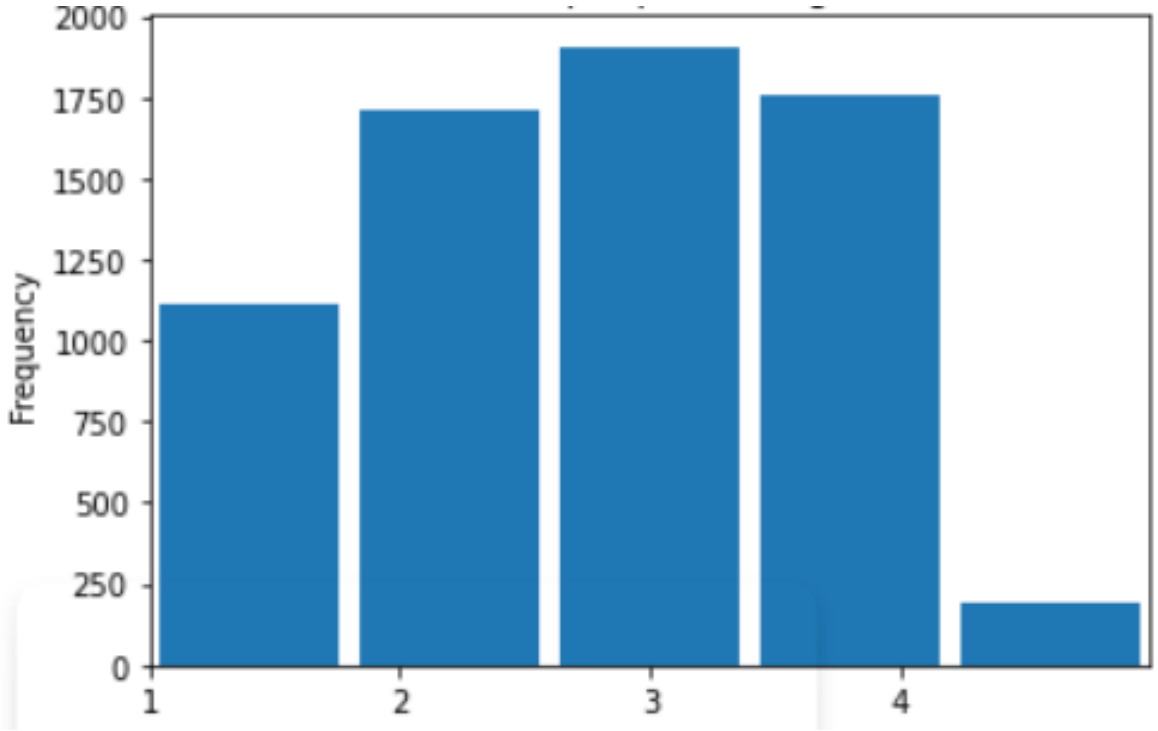
Pre processing

Normalization

Z-score normalization when algorithms that need feature scaling were tested

- function *StandardScaler* from scikit-learn

After pre processing



- 6676 instances
- 60 attributes

Classes are **imbalanced!**

Classification

Evaluation metrics:

- Focus mainly on **macro averaged mean absolute error** (provided in the *imbalanced-learn* python library), most suitable for **ordinal classification** problems where the target values are **imbalanced** [1]

Given the imbalanced class, performances of classifiers were tested also after having applied over-sampling techniques for rebalancing (***SMOTE*** and ***RandomOverSampler).***

The models have been tested on both the full dataset and also on the reduced subspace expressed by the **feature selection** step.
Tried methods for feature selection from both scikit-learn and weka

- *SelectKBest*
- *SelectFromModel*
- *CfsSubsetEval + BestFirst*

[1] S. Baccianella, A. Esuli, F. Sebastiani, Evaluation measures for ordinal regression, in: Proceedings of the Ninth International Conference on Intelligent Systems Design and Applications, ISDA'09, 2009, pp. 283–287

Tested models

- KNN
- Support Vector Machine
- XGBClassifier
- Random Forest
- Logistic Regression
- OrdinalClassifier (implementation of the approach proposed in [2] specifically for ordinal classification)

All the classifiers have been evaluated with a ***10-fold cross validation*** and for each one was performed the hyperparameters tuning using the ***GridSearchCV*** algorithm

[2] Frank, E., Hall, M.: A simple approach to ordinal classification. Technical Report 01/05, Department of Computer Science, University of Waikato (2001)

Results

	Attribute selection	Num. features selected	Resampling	Macro avg MAE	Avg Precision	Avg Recall	Avg F1 score	Avg Accuracy	Prediction Time
Logistic Regression	SelectFromModel	30	RandomOversampler	**0.305**	0.637	0.704	0.657	0.653	0.023
Logistic Regression	None	59	RandomOversampler	0.306	0.643	0.704	0.663	0.66	0.021
SVM	None	59	SMOTE	0.311	0.651	0.702	0.669	0.663	0.201
SVM	SelectFromModel	30	SMOTE	0.313	0.652	0.699	0.667	0.657	0.216
Logistic Regression	None	59	None	0.314	0.728	0.694	**0.706**	0.684	0.025
SVM	None	59	None	0.316	0.724	0.693	0.705	0.68	0.251
Logistic Regression	SelectFromModel	30	None	0.317	0.72	0.691	0.702	0.678	0.021
SVM	SelectFromModel	30	None	0.324	0.723	0.685	0.7	0.678	0.188
XGBClassifier	SelectFromModel	30	SMOTE	0.341	0.712	0.672	0.686	0.656	0.154
XGBClassifier	None	59	RandomOversampler	0.342	0.686	0.673	0.676	0.652	0.031
XGBClassifier	CfsSubsetEval + BestFirst	**11**	None	0.348	0.611	0.671	0.633	0.601	0.02
Logistic Regression	SelectKBest	35	None	0.35	0.718	0.667	0.686	0.658	0.021
OrdinalClassifier + DecisionTree	CfsSubsetEval + BestFirst	11	None	0.358	0.532	0.663	0.553	0.541	0.007
Random Forest	None	59	RandomOversampler	0.365	0.704	0.649	0.669	0.651	0.048
KNN	CfsSubsetEval + BestFirst	11	None	0.371	0.575	0.654	0.602	0.578	0.292

STATISTICAL SIGNIFICANCE

Student's t-test on macro-avg MAE and F1 score

α = 0.05

Chosen model for the application: *Logistic Regression* ("SelectFromModel without resampling" version)

	Macro avg MAE		F1 score	
Logistic regression w/o attribute selection	**0.314**		0.706	
–		*p* = 0.718		*p* = 0.388
Logistic regression Attr. Selection = *SelectfromModel*	0.317		**0.702**	
Logistic regression *SelectfromModel + Resampling*	**0.305**		0.657	
–		*p* = 0.065		*p* = 0.001
Logistic regression Attr. Selection = *SelectfromModel*	0.317		**0.702**	
XGBClassifier Attr. Selection = *CfssubsetEval + BestFirst*	0.348		0.633	
–		*p* = 0.02		*p* = 1.23e-05
Logistic regression Attr. Selection = *SelectfromModel*	**0.317**		**0.702**	

The application

Functional requirements

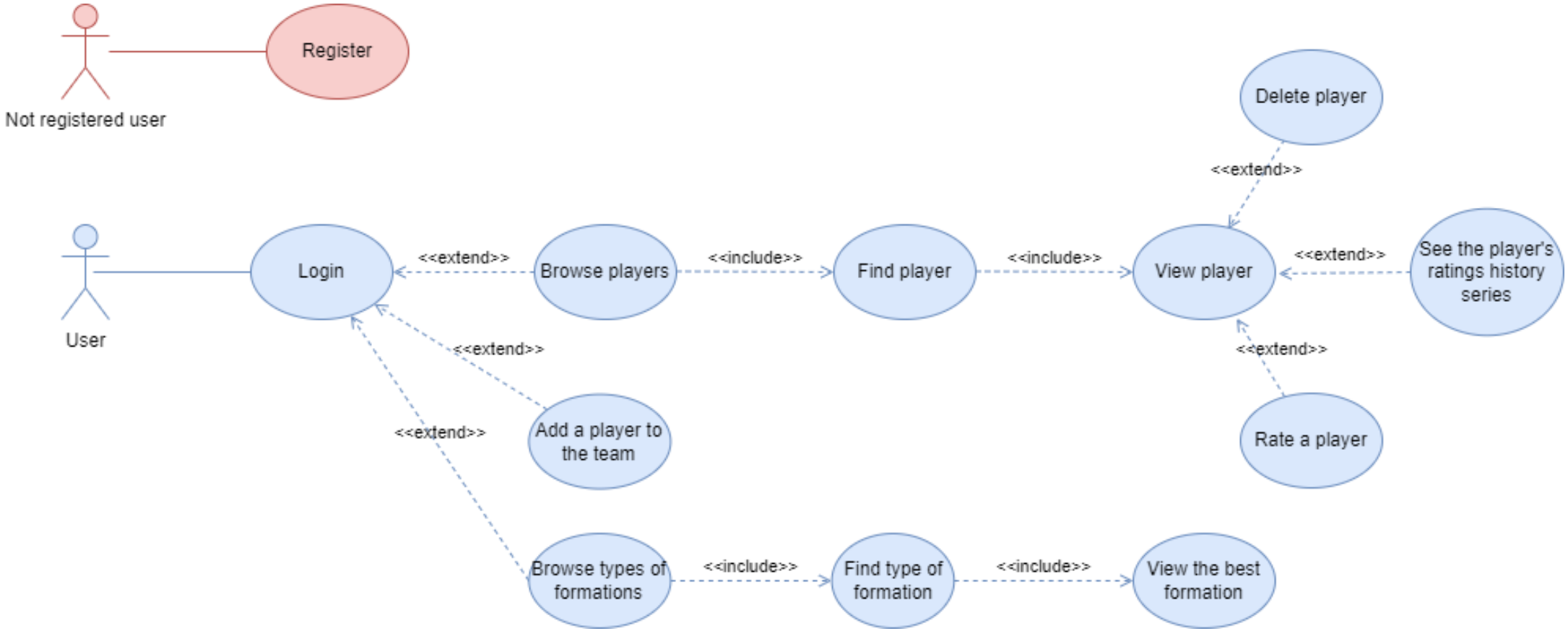
A User can:

- Login
- Create his own team and modify it, adding new player or removing others
- Rate a player entering statistical information about a player's performance in a match
- See the best formation for the next match suggested by the application
- See the trend of the performances of a player

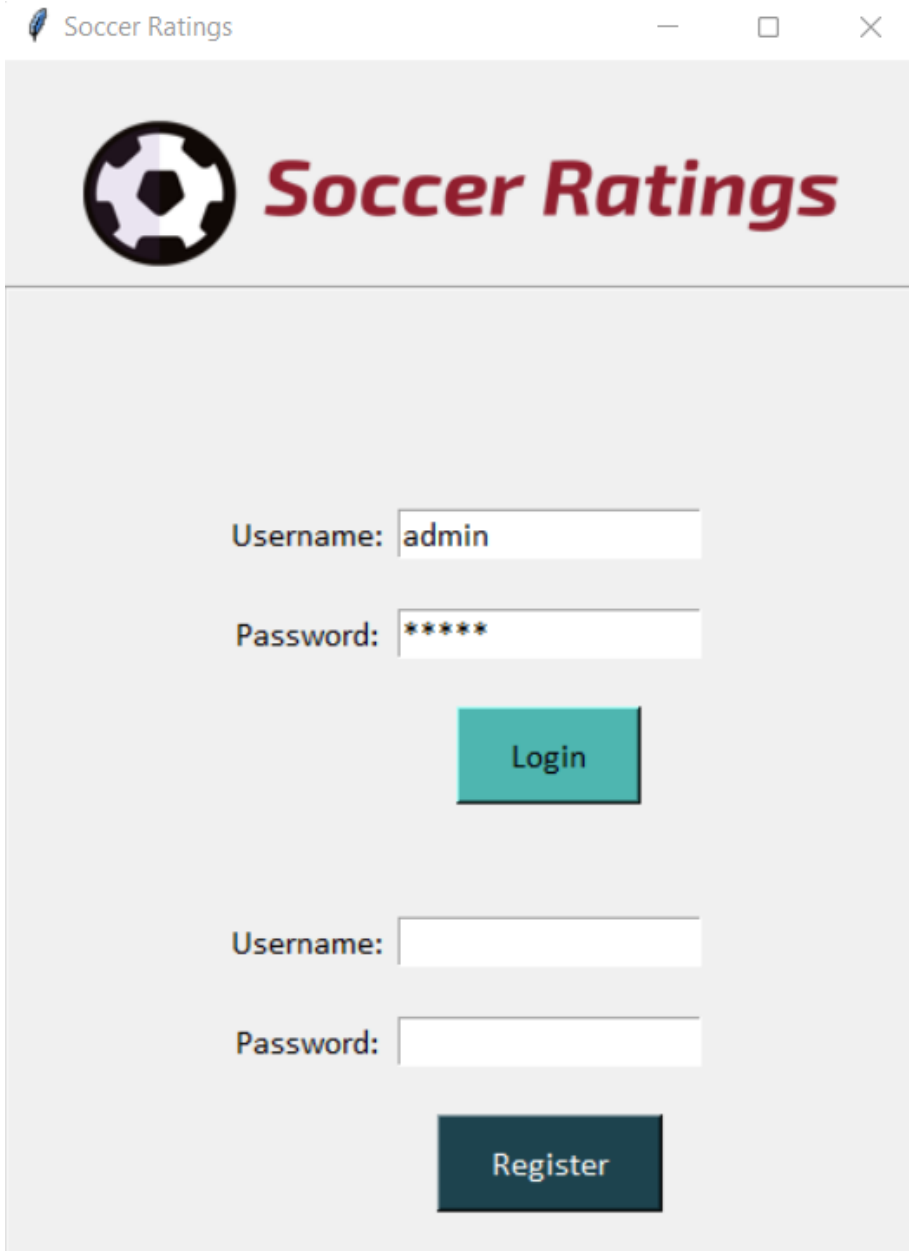
Non-functional requirements

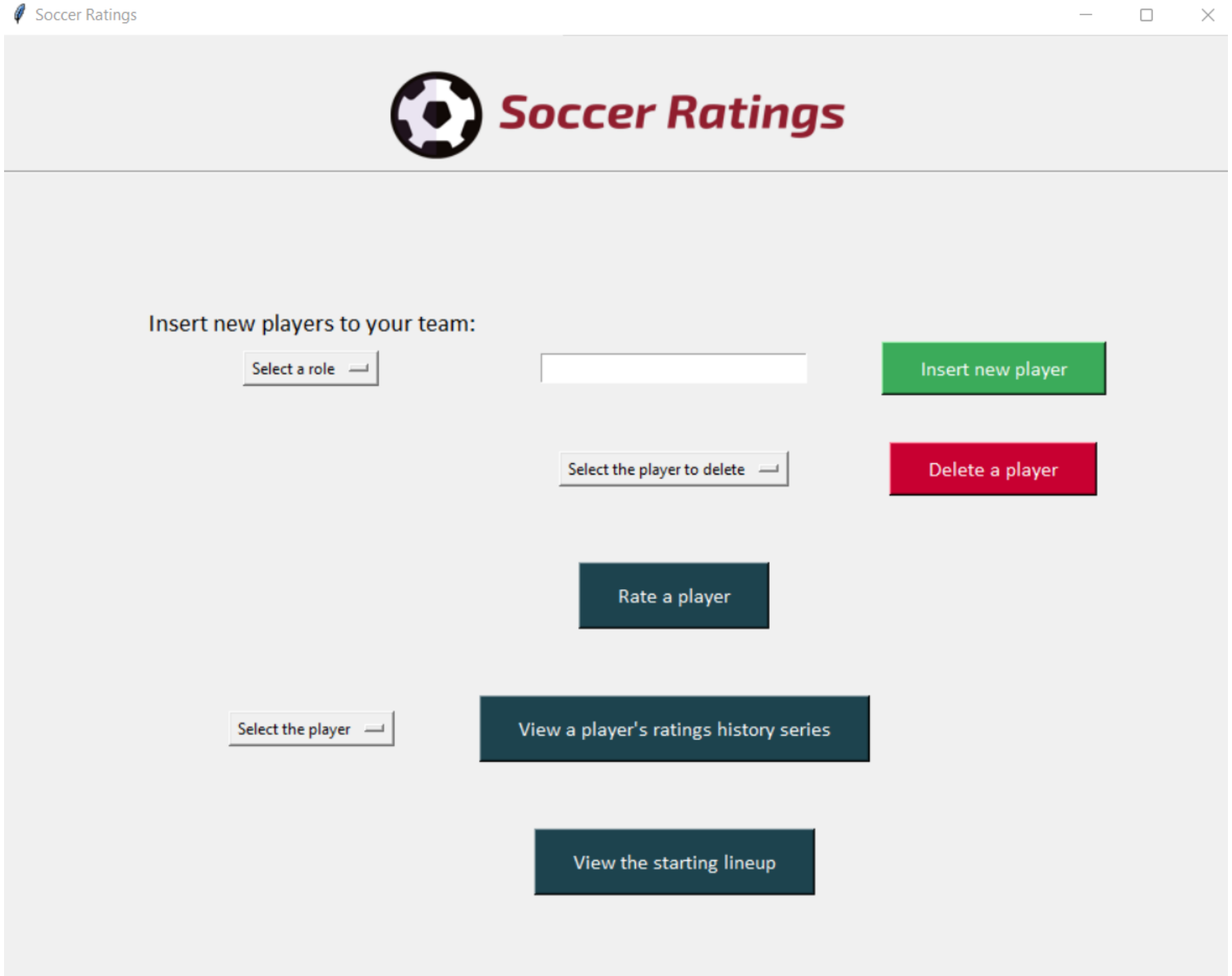
- The application must be user-friendly and easy to use through a clear user interface.
- The application must provide fast responses to users requests

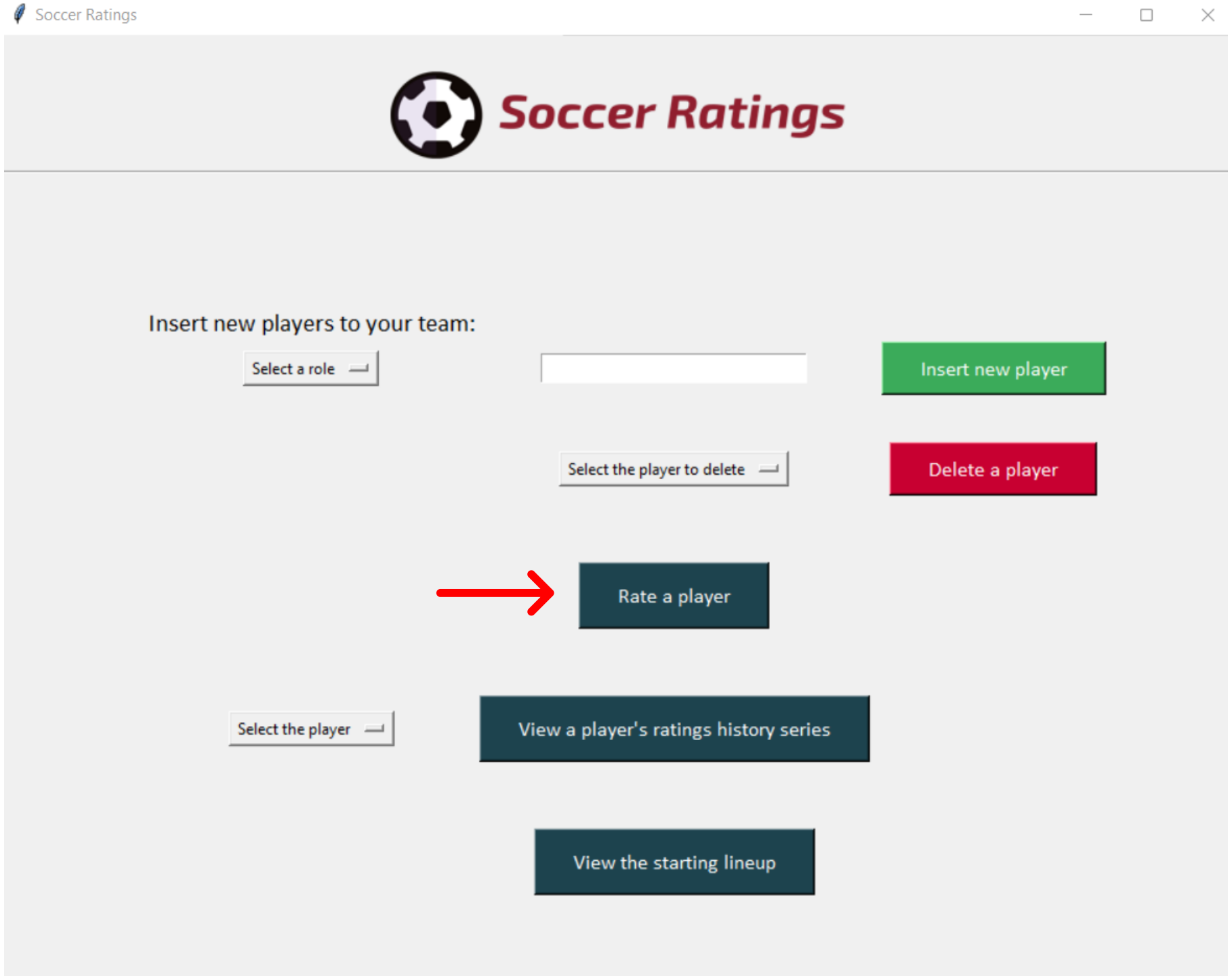
UML Use case diagram



Login/registration




Soccer Ratings
Soccer Ratings
Insert new players to your team:
Select a role
Insert new player
Select the player to delete
Delete a player
Rate a player
Select the player
View a player's ratings history series
View the starting lineup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View the starting lineup

Soccer Ratings

Soccer Ratings

Select the player

Soccer Ratings

Soccer Ratings

Marco Verratti

Select the date of the match

4/11/22

Goals

Assists

Key passes

Dribblings

Touches

Accurated passes

Accurated crosses

Accurated long passes

Stopped shots

Ground duels won

Aerials won

Possession lost

Clearances

Interceptions

Tackles

Shots on target

Own goals

actions in which player is involved

total actions of team

Red Cards

Win

actions which end with a shot where player is involved

Soccer Ratings

Marco Verratti

Accurated long passes
3

Stopped shots
1

Ground duels won
10

Aerials won
3

Possession lost
7

Clearances
1

Interceptions
2

Tackles
1

Shots on target
0

Own goals
0

actions in which player is involved
10

total actions of team
100

Rating result

The rating is 4

OK

☐ Red Cards

☐ Yellow Cards

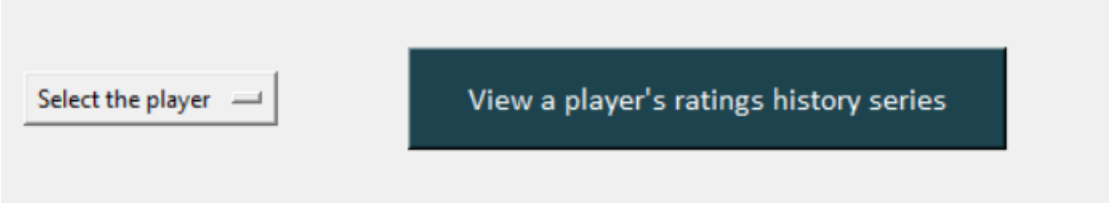
☑ Win

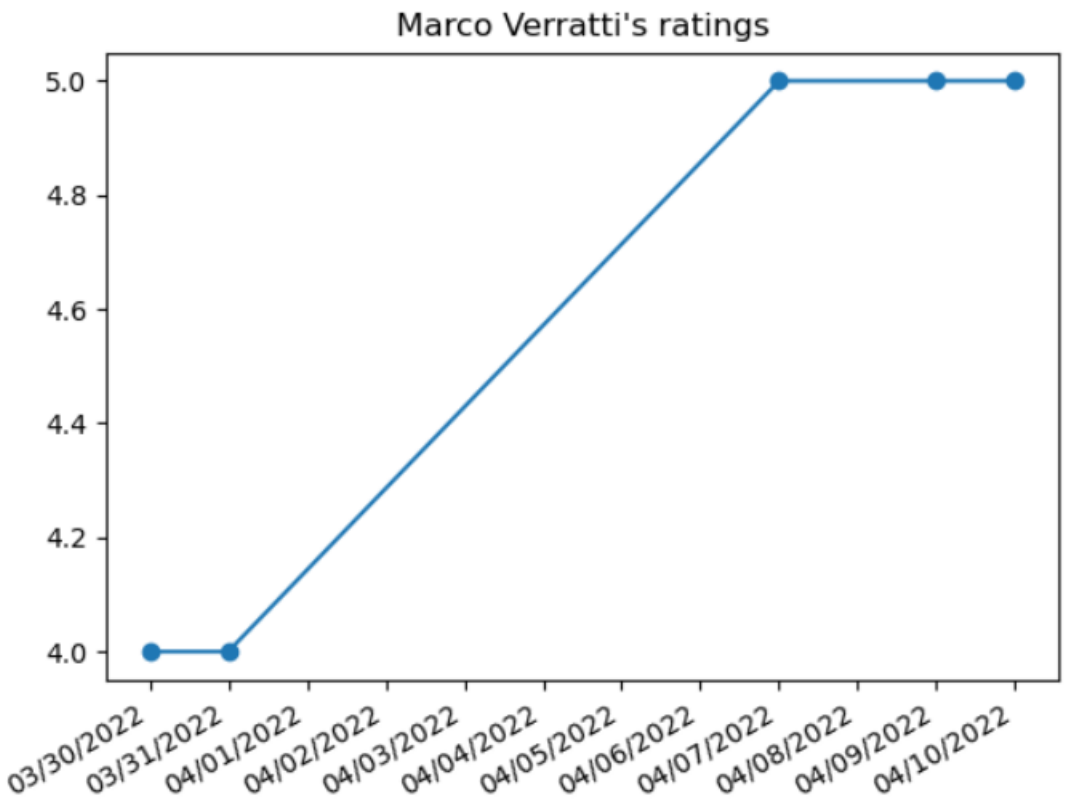
☐ Lost

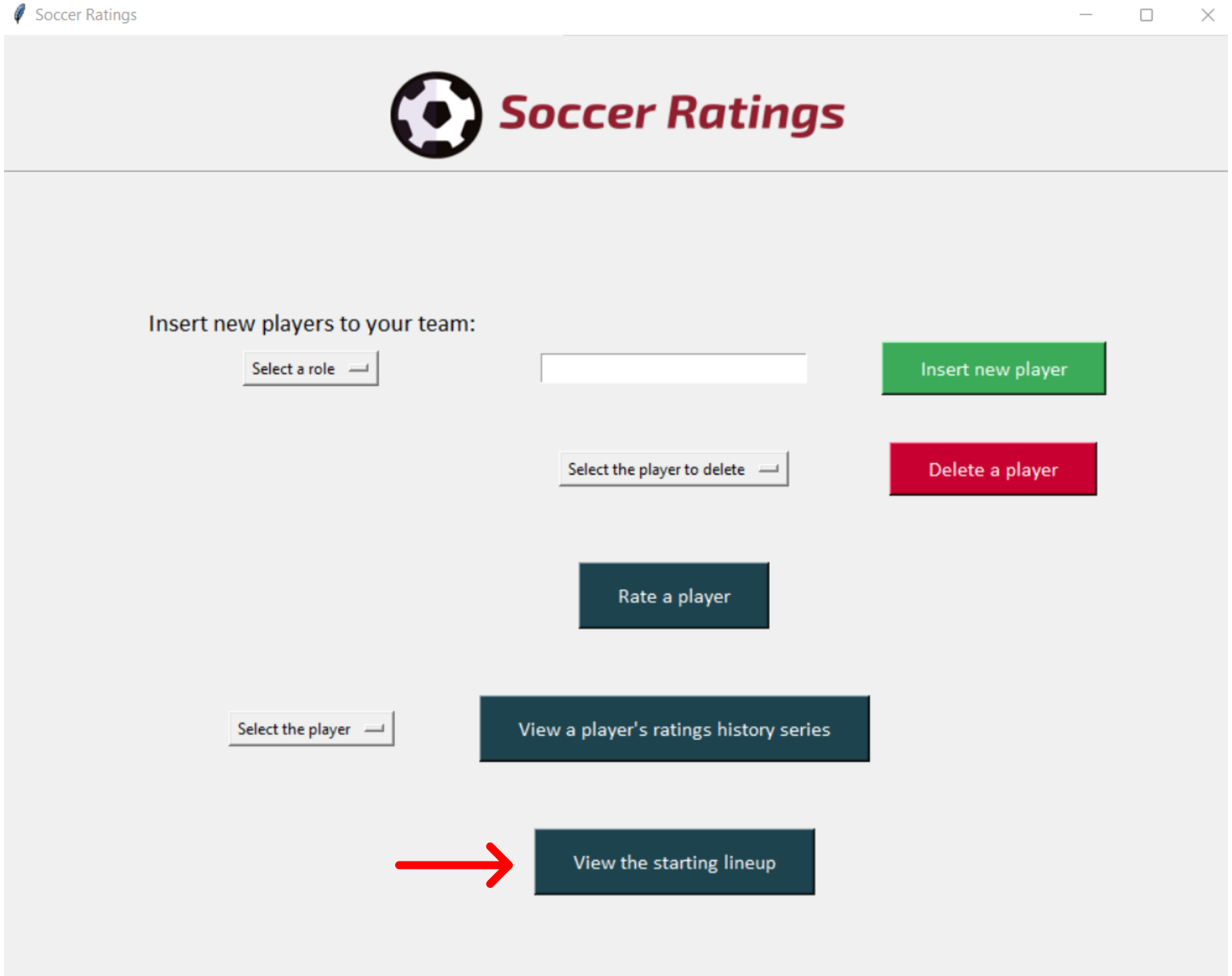
☑ Starter

actions which end with a shot where player is involved
0

Compute the rating


Select the player
View a player's ratings history series


Marco Verratti's ratings
5.0
4.8
4.6
4.4
4.2
4.0
03/30/2022
03/31/2022
04/01/2022
04/02/2022
04/03/2022
04/04/2022
04/05/2022
04/06/2022
04/07/2022
04/08/2022
04/09/2022
04/10/2022


Soccer Ratings
Soccer Ratings
Insert new players to your team:
Select a role
Insert new player
Select the player to delete
Delete a player
Rate a player
Select the player
View a player's ratings history series
View the starting lineup

Soccer Ratings

Soccer Ratings

Select the type of formation

Soccer Ratings

Soccer Ratings

4-4-2