Project Report
On
EPL Ranking System

Course: INFO 6205

Team Members:

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https://github.com/aayushjain92/INFO6205_Final_Project

Contents

Introduction

What is Ranking System?

Ranking system is an algorithm designed to evaluate the expression $P(X_i, X_j)$ where X_i, X_j are elements from a set of competing elements X and $P(X_i, X_j)$ is the probability that X_i would beat X_j if they met in a head to head matchup at neutral territory.

The application could be used to predict the rankings of the teams in a tournament and to get the likelihood of a team winning.

Aim of the Project

The 2019–20 Premier League is the 28th season of the Premier League, the top English professional football league, since its establishment in 1992. The League was started on 9 August 2019 but since March, the season has been affected by the 2020 coronavirus pandemic and the remaining matches have been postponed.

There are 20 clubs **in the Premier League**. During the course of a season (from August to May) each club **plays** the others **twice** (a **double** round-robin system), once at their home stadium and once at that of their opponents', for 38 games. Teams receive three points for a win and one point for a draw.

The Ranking System is an application designed to predict the outcome of the remaining matches that have been postponed and to predict the ranks of the clubs in this season.

Datasets used in the Project

The data has been published on the following website. It contains the entire history of EPL (English Premiere League) since 2000.

http://www.football-data.co.uk/englandm.php

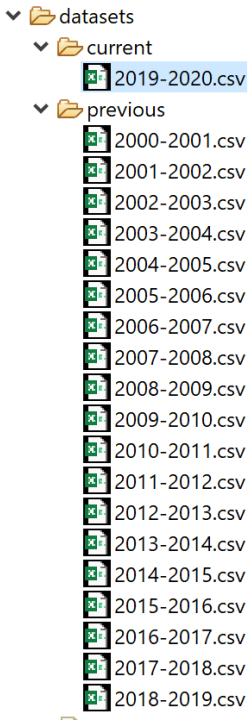


Fig: Sample screenshot of the data file

	Div	Date	HomeTeam	AwayTeam	FTHG	FTAG	FTR	HTHG	HTAG
2	E0	9/8/2019	Liverpool	Norwich	4	1	H	4	0
3	E0	10/8/2019	West Ham	Man City	0	5	A	0	1
4	E0	10/8/2019	Bournemouth	Sheffield United	1	1	D	0	0
5	E0	10/8/2019	Burnley	Southampton	3	0	H	0	0
6	E0	10/8/2019	Crystal Palace	Everton	0	0	D	0	0
7	E0	10/8/2019	Watford	Brighton	0	3	A	0	1
8	E0	10/8/2019	Tottenham	Aston Villa	3	1	H	0	1
9	E0	11/8/2019	Leicester	Wolves	0	0	D	0	0
10	E0	11/8/2019	Newcastle	Arsenal	0	1	A	0	0
11	E0	11/8/2019	Man United	Chelsea	4	0	H	1	0
12	E0	17/08/2019	Arsenal	Burnley	2	1	H	1	1
13	E0	17/08/2019	Aston Villa	Bournemouth	1	2	A	0	2

The historical data and the data of the current season has been separated into previous and current directories.

Following is the description of the columns used:

Div = League Division

Date = Match Date (dd/mm/yy)

Time = Time of match kick off

HomeTeam = Home Team

AwayTeam = Away Team

FTHG and HG = Full Time Home Team Goals

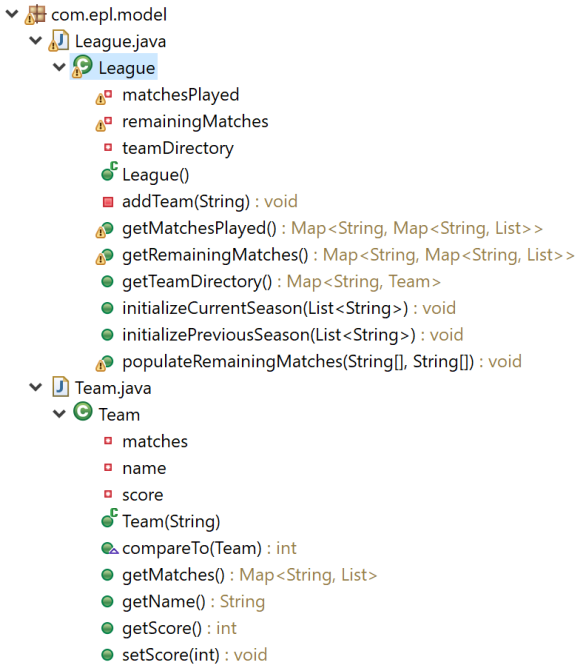
FTAG and AG = Full Time Away Team Goals

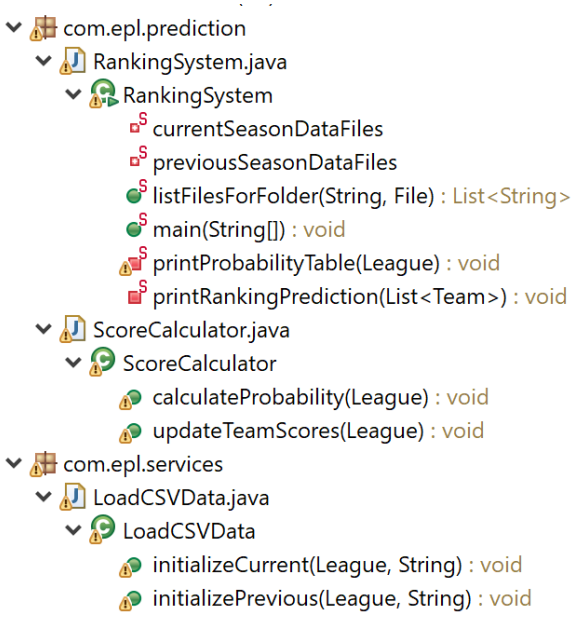
Implementation

Let's first get the overview of the code design:

Classes:

- com.epl.model
  - League.java
    - The business logic is using League and Team Model to store and process the data
    - League contains three member variables i.e. a team directory which has 20 participating teams this season; matchesPlayed variable which contains all the info about the matches that have already been played; remainingMatches variable which contains all the info about the matches in the history because these matches have been postponed and are going to be predicted on the historical data
  - Team.java
    - It contains the team related information and the most important one is Score.
- com.epl.prediction
  - Ranking System.java
    - It contains the main function
    - It also handles the printing functions to the console
  - ScoreCalculator.java
    - It contains the business logic and the merging of the Gaussian distributions to reach the most probable prediction
    - It uses the historical data to create a probability density function
- com.epl.services
  - LoadCSVData.java
    - It loads the data from the CSV files in the model





Data Structures

Java.util.Map Collection has been heavily used to enable faster lookup of the data. The first “key” points to the home team and the next “key” points to the away team, making sure to reach the linked list of goal differences in O(1) time.

For Example:

remainingMatches.get(“Arsenal”).get(“Liverpool”) will provide a list of goal differences between the two teams considering all the matches in the past since 2000.

```
public class League {

    private Map<String, Team> teamDirectory;

    private Map<String, Map<String, List>> matchesPlayed;

    private Map<String, Map<String, List>> remainingMatches;
```

Features:

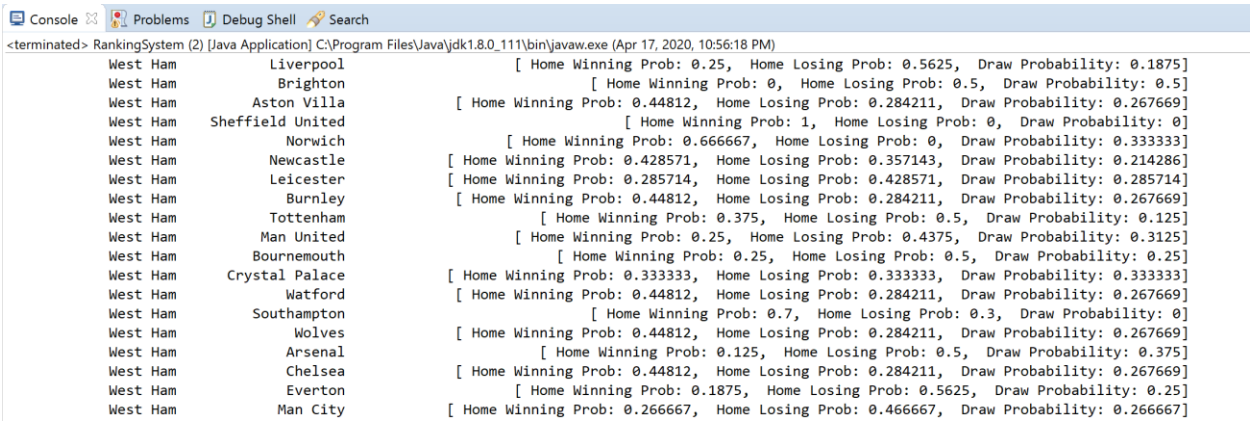
Home team advantage has been considered and accounted separately:

```
    public void calculateProbability(League league2019_20) {
        // TODO Auto-generated method stub
        Map<String, Map<String, List>> remainingMatches = league2019_20.getRemainingMatches();

        for (String homeTeam : remainingMatches.keySet()) {
            Map<String, List> rivals = remainingMatches.get(homeTeam);
            for (String awayTeam : rivals.keySet()) {
                int winFreq = 0, loseFreq = 0, drawFreq = 0;
                List<Integer> list = rivals.get(awayTeam);

                // calculating the frequency with the same team of winning, losing and drawing a
                // game
                for (Integer goalDifference : list) {
                    if (goalDifference > 0) {
                        ++winFreq;
                    } else if (goalDifference == 0) {
                        ++drawFreq;
                    } else if (goalDifference < 0) {
                        ++loseFreq;
                    }
                }
```

Output

```
Aston Villa          Liverpool                [ Home Winning Prob: 0.0625,  Home Losing Prob: 0.6875,  Draw Probability: 0.25]
Aston Villa    Sheffield United           [ Home Winning Prob: 0.44812,  Home Losing Prob: 0.284211,  Draw Probability: 0.267669]
Aston Villa            Norwich                  [ Home Winning Prob: 0.8,  Home Losing Prob: 0,  Draw Probability: 0.2]
Aston Villa           West Ham          [ Home Winning Prob: 0.538462,  Home Losing Prob: 0.153846,  Draw Probability: 0.307692]
Aston Villa          Newcastle              [ Home Winning Prob: 0.333333,  Home Losing Prob: 0.266667,  Draw Probability: 0.4]
Aston Villa          Leicester                  [ Home Winning Prob: 0.6,  Home Losing Prob: 0.2,  Draw Probability: 0.2]
Aston Villa            Burnley                  [ Home Winning Prob: 0.5,  Home Losing Prob: 0.5,  Draw Probability: 0]
Aston Villa          Tottenham              [ Home Winning Prob: 0.25,  Home Losing Prob: 0.4375,  Draw Probability: 0.3125]
Aston Villa         Man United           [ Home Winning Prob: 0.44812,  Home Losing Prob: 0.284211,  Draw Probability: 0.267669]
Aston Villa        Bournemouth                  [ Home Winning Prob: 0,  Home Losing Prob: 1,  Draw Probability: 0]
Aston Villa     Crystal Palace          [ Home Winning Prob: 0.44812,  Home Losing Prob: 0.284211,  Draw Probability: 0.267669]
Aston Villa        Southampton          [ Home Winning Prob: 0.333333,  Home Losing Prob: 0.333333,  Draw Probability: 0.333333]
Aston Villa            Watford                  [ Home Winning Prob: 0.5,  Home Losing Prob: 0.5,  Draw Probability: 0]
Aston Villa             Wolves          [ Home Winning Prob: 0.44812,  Home Losing Prob: 0.284211,  Draw Probability: 0.267669]
Aston Villa            Arsenal          [ Home Winning Prob: 0.44812,  Home Losing Prob: 0.284211,  Draw Probability: 0.267669]
Aston Villa            Chelsea          [ Home Winning Prob: 0.44812,  Home Losing Prob: 0.284211,  Draw Probability: 0.267669]
Aston Villa            Everton                  [ Home Winning Prob: 0.375,  Home Losing Prob: 0.25,  Draw Probability: 0.375]
Aston Villa           Man City              [ Home Winning Prob: 0.266667,  Home Losing Prob: 0.4,  Draw Probability: 0.333333]
```

The above output table shows the probabilities of Aston Villa (Home Team) winning, losing and drawing a match against different teams.



The above output table shows the probabilities of West Ham (Home Team) winning, losing and drawing a match against different teams.

```
================== RANKING PREDICTION ==================

                CLUB     SCORE
-------------------------------------------
           Liverpool       100
             Arsenal        85
           Man United       84
            Tottenham       81
              Chelsea       78
             Man City       75
              Everton       72
            Newcastle       59
      Sheffield United      52
           Southampton      51
                Wolves      51
             Leicester      50
        Crystal Palace      49
           Aston Villa      48
              West Ham      47
               Burnley      47
               Norwich      46
              Brighton      44
           Bournemouth      44
               Watford      42
```

The above output table displays the predicted ranking of the clubs participated this season. Liverpool ended up securing first rank whereas Brighton, Bournemouth, and Wartford are at the last positions.

References

https://en.wikipedia.org/wiki/Premier_League