DATA MINING PROJECT

STEAM DATA ANALYSIS AND PREDICTION

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Project Group Number-10

Group Members:

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Introduction:

Steam is an internet based digital distribution platform developed by Valve Corporation. It offers DRM, Multiplayer Gaming and Social Networking. According to the recent statistics, there are over 125 million active steam accounts. Along with that, it has 781 million registered Video Games, out of which 37% have never even been played, and nearly 2/3rd's of them haven't even been launched. So, currently steam only has around 4,500 games available for Windows, iOS and Linux. Along with 400 million pieces of user generated data. Surveys from 2013 suggest that 75% of the video games bought online are bought through Steam alone.

Abstract:

The purpose of this project is to predict the date and time and to suggest video games to a user, when a particular user logs in, based on the aspects like the type of video games he/she plays, age, location, steam rank etc. on the steam community website (https://steamcommunity.com). Steam is a digital distribution platform developed by Valve Corporation, available on Windows, Os X and Linux. Basically, it is the PC gaming platform. This project can be deployed in the fields of marketing research, enabling the developers to develop a video game which is best suited to a group of people. It can also be used to design a suggestion filter using which, a user can receive a list of suggested video games based on his/her user data.

The primary goal of the research is to obtain the user data from several steam accounts (Just considering the public data available on steam profiles), which is bound to take most of the time of the project. The steam data includes

→ Game (One out of the six, which we considered)

→ Location (Country)

→Steam Level (Numeric)

→Number of Badges (Numeric)

→Number of Games/ Products owned (Numeric)

→Number of Groups the user is in (Numeric)

→Friends of the User (Numeric)

This data can be mined to obtain the patterns between the player profile - online activity and preferred Video Games. If everything goes as planned, it will be highly likely to predict the Video game, which a new player will choose, based on his/her profile data.

Overview:

The sole purpose of this project is to analyze the steam data (age, location and game) of several steam accounts, and predict a Video Game for the user based on his/her age and location. However, this project could be even more accurate if we had considered a few more attributes like 'Friend's List', 'Number of Games' etc. This project can also be deployed in a far greater scope, and can be used to suggest friends to a user based on the games he/she has played.

Goal of the Research:

The purpose of the research is to analyze the steam data (location, Player's steam level, badges, number of games owned, groups, friends, and most played video game) of several steam accounts, and predict a Video Game for the user based on his/her data.

This research can also be deployed in a far greater scope, and can be used to suggest friends to a user based on the games played.

Expected Contributions Of This Research:

→Can be used to suggest a Video game to a completely new user.

→Can predict the when a pre-existing user, usually logs in. (Can be extended to new users)

→Can be used to suggest video games to users depending on their video game list.

→Suggest friends to a user, based on the games in common to them.

→Can be employed the development team to advertise games, based on the user's favorite genre. (There's no point advertising an Action RPG game to a user to only play First-Person-Shooter-Games).

→Can be used to predict the location of the user based on the preferred language, games played, and login frequency.

→Predict a user's favorite genre by simply taking into account, the wish list and the list of owned games.

Code and Application:

Once we had the data, all that remained was to train and test the data using weka. We have used several algorithms to pick the best one to train the machine with. All these algorithms which we have used left us with an accuracy which averages around 50%. Before we can strike away the project saying that the accuracy is too low, we need to keep in our minds about the Redundancy.(i.e., it is not necessary for a teenager from USA, to play a certain video game). We have decided to go by J48 algorithm to visualize the tree, and train our machine, for convenience and accuracy purposes.

Project Management:

TEAM MEMBER	ROLES AND SKILLS	CONTRIBUTION
Mounica Poreddy(999991539) and Siri Chandhana Banala(999991460)	Data collection	Development of data sets and input data
Mohammed Shakeer Bandrevu(999991619) and Javeed Shaik(999991512)	Weka development	Usage of WEKA in the process of development of the project
Javeed Shaik(999991512) and Yasmeen Kowsar Shaik(999991463)	Coding	Development of prediction process
Yasmeen Kowsar Shaik(999991463) and Mohammed Shakeer Bandrevu(999991619)	Testing the data and code	Testing
Siri Chandhana Banala(999991460) and Mounica Poreddy(999991539)	Reporting	Final reporting

Team Contributions:

DELIVERABLE DATE	CONTRIBUTION	RESPONSIBLE TEAM MEMBER	CHECKPOINT RESULT
03/22/2016	Project Proposal	Mohammed Shakeer Bandrevu	Submission of Group Project Proposal.
04/11/2016	Collection of datasets	Mounica Poreddy, Siri Chandhana Banala	Collection of data from data source.
04/18/2016	Selecting Algorithm, Training the machine, and Testing	Javeed Shaik, Yasmeed Kowsar Shaik.	J48 Algorithm Selected to run the code.
04/25/2016	Testing	Mohammed Shakeer Bandrevu, Yasmeen Kowsar Shaik.	Execution has been tested.
05/01/2016	Reporting	Siri Chandhana Banala and Mounica Poreddy	Reporting the final data and result.

Methodology:

Step 1: Collecting the data

This can be done manually or through web scraping. We collected the data from at least 50 to 100 public accounts. This is easy, yet time consuming, as several steam accounts don't disclose their info.

→Data Collection had to be done manually as Valve has denied Steam API key, which is required to access their data. (We needed a premium account to receive API key.)

→We have still managed to collect data from over 3200 public steam accounts (out of 75 million).

→We considered only a limited number of games to save time.

→We finally were able to gather data from over 3200 steam accounts.

→Tried to be as diverse as possible, but we knew that, not all countries have equal number of players.

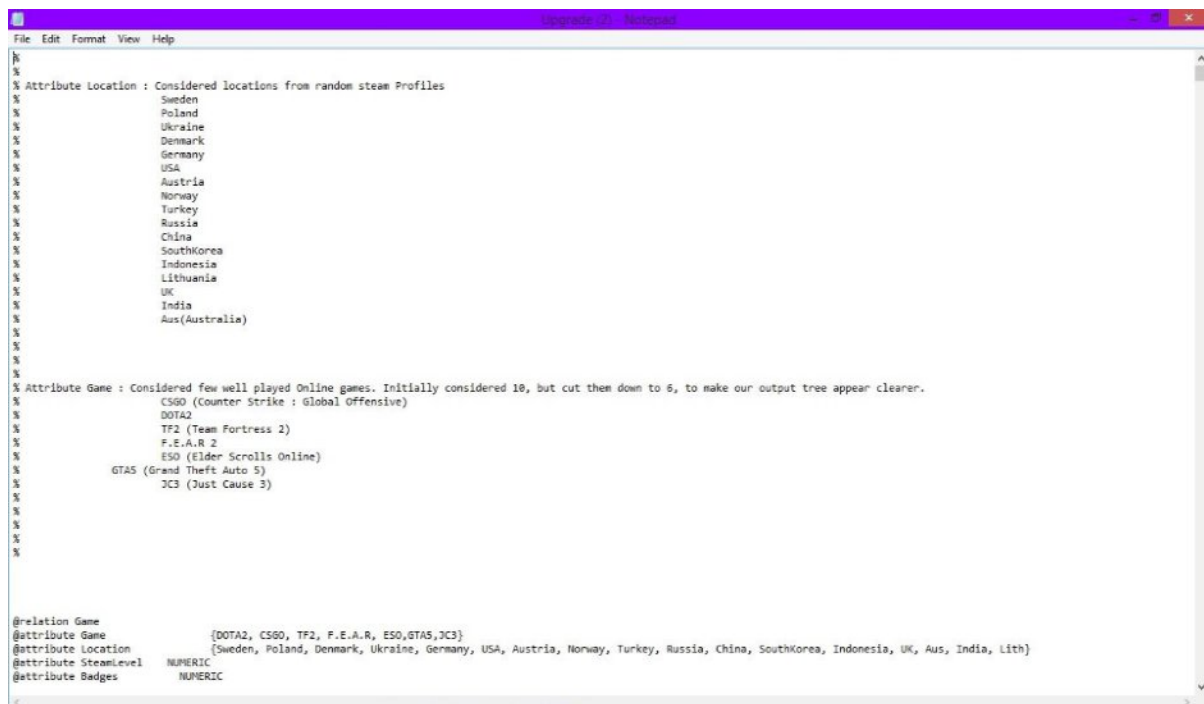→Limited the number of games, as we could not have considered all the 6500 games by entering instances manually.

Challenges Faced While Collecting the Data:

→While collecting data, we noticed that a few of the steam profiles had at least one of the required attributes hidden, which left us with 2 choices: We either had to set it as a missing value, or move on to the next steam profile.

→Not many had their Location hidden, which easily made us set it missing value, rather than skipping the account.

→Given our limited time, it was highly unlikely for us to collect a lot of data, which might've actually greatly improved the accuracy.

→We planned on grabbing data from at least 20,000 steam accounts (out of 75 million), if we had the API key. Anything more than that much of data wouldn't have been practical, given our limited processing speed. (Researchers from a website named Arstechnica had to scrape Steam for 80,000-90,000 steam accounts every day, for about 2 months just to find out the least played games on steam). Now, working on such a huge database, without limited resources, can prove to be really hard, at the moment.

```
Upgrade (2) - Notepad
File  Edit  Format  View  Help


@data
CSGO, Sweden, 31, 19, 96, 3, 95
CSGO, Poland, 25, 11, 58, 5, 68
CSGO, Sweden, 65, 25, 98, 11, 105
CSGO, Germany, 96, 38, 56, 10, 67
CSGO, USA, 13, 6, 14, 3, 25
CSGO, Germany, 15, 3, 12, 2, 12
CSGO, USA, 65, 32, 56, 15, 36
CSGO, Germany, 35, 12, 24, 3, 30
CSGO, USA, 54, 13, 26, 3, 35
CSGO, USA, 35, 11, 23, 2, 24
CSGO, USA, 78, 21, 86, 14, 96
CSGO, USA, 56, 21, 65, 9, 87
CSGO, Germany, 35, 15, 41, 6, 65
CSGO, Poland, 62, 14, 56, 9, 54
CSGO, Austria, 1, 0, 2, 0, 0
CSGO, China, 1, 0, 3, 0, 0
CSGO, Indonesia, 12, 6, 23, 1, 35
CSGO, Sweden, 26, 15, 35, 14, 72
CSGO, Sweden, 35, 30, 65, 12, 91
CSGO, Turkey, 60, 50, 21, 15, 99
CSGO, Turkey, 17, 10,54,9,122
CSGO, Turkey, 28, 11, 45, 8, 102
CSGO, Sweden, 7, 5, 21, 5, 33
CSGO, USA, 17, 15, 35, 15, 49
CSGO, China, 51, 23, 56, 15, 89
CSGO, Russia, 56, 15, 58, 2, 56
CSGO, USA, 68, 31, 65, 10, 156
CSGO, Russia, 15, 6, 26, 25, 45
CSGO, UK, 1, 0, 1, 0, 1
CSGO, Austria, 1, 0, 3, 1, 5
CSGO, UK, 25, 14, 45, 17, 89
CSGO, Turkey, 35, 28, 200, 14, 90
CSGO, Austria, 50, 110, 56, 30, 121
CSGO, Poland, 8, 6, 33, 5, 13
CSGO, Indonesia, 6, 3, 46, 21, 37
CSGO, Poland,11,7,37,6,32
CSGO, USA,23,17,53,7,53
CSGO, Austria,10,4,2,5,37
CSGO, USA,4,3,5,3,14
CSGO, USA,10,3,7,1,19
CSGO, Germany,9,7,26,3,24
CSGO, Germany,33,26,82,10,94
```

Pre-Processing:

→This stage has given us broad view upon our survey, which is quite interesting.
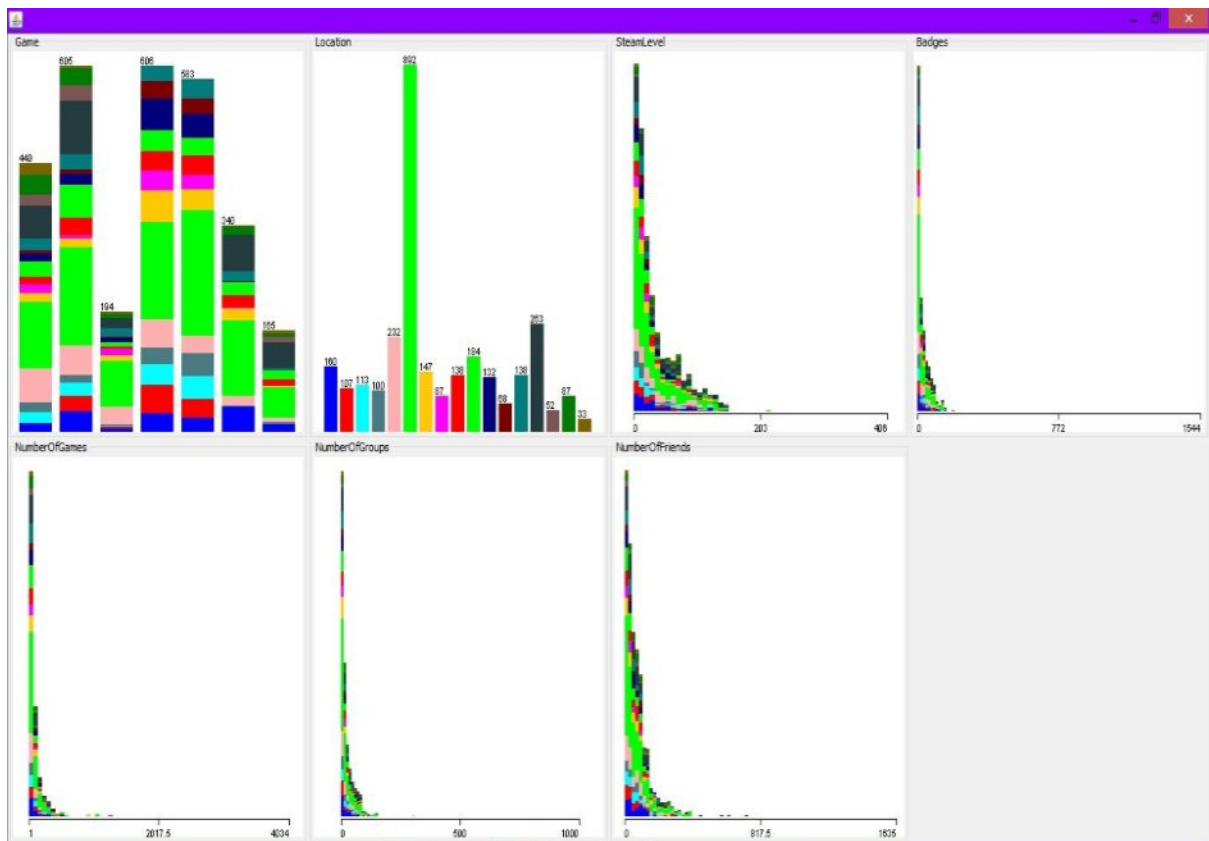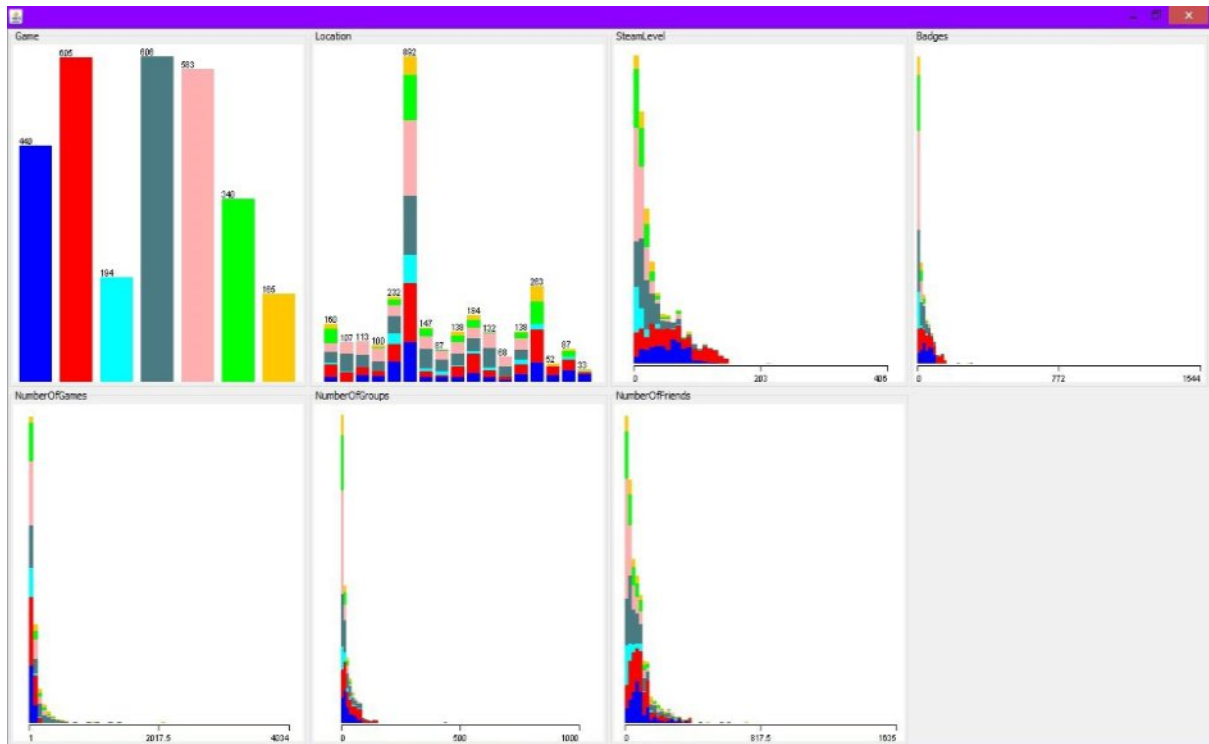
Step 2: Training the Machine:

→Once we had the data, all that remained was to train and test the data using weka.

→We have used several algorithms to pick the best one to train the machine with.

→Random Forest Algorithm left us with an whooping 98.54% accuracy, while J48 tree algorithm gave us 87.7%.

J48 ('Game' as label):

```
Classifier output
=== Evaluation on training set ===
=== Summary ===

Correctly Classified Instances        2839              87.7047 %
Incorrectly Classified Instances       398              12.2953 %
Kappa statistic                          0.8553
Mean absolute error                      0.0458
Root mean squared error                  0.1512
Relative absolute error                 21.4901 %
Root relative squared error             46.3121 %
Total Number of Instances             3237

=== Detailed Accuracy By Class ===
```

	TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
	0.964	0.014	0.916	0.964	0.939	0.997	DOTA2
	0.954	0.024	0.9	0.954	0.926	0.994	CSGO
	0.675	0.012	0.789	0.675	0.728	0.983	TF2
	0.899	0.034	0.858	0.899	0.878	0.987	F.E.A.R
	0.906	0.028	0.879	0.906	0.892	0.991	ESO
	0.744	0.017	0.835	0.744	0.787	0.982	GTA5
	0.673	0.007	0.841	0.673	0.747	0.988	JC3
	0.888	0.009	0.912	0.888	0.9	0.995	L4D
Weighted Avg.	0.877	0.021	0.875	0.877	0.875	0.991	

```
=== Confusion Matrix ===

   a   b   c   d   e   f   g   h   <-- classified as
 424  16   0   0   0   0   0   0 |   a = DOTA2
  23 577   0   1   2   2   0   0 |   b = CSGO
   0   5 131  35   8  11   0   4 |   c = TF2
   4  18  10 545  15   7   3   4 |   d = F.E.A.R
   1   5   6  32 528   7   2   2 |   e = ESO
   6   9  11  11  31 253  10   9 |   f = GTA5
   4   3   4   6  12  18 111   7 |   g = JC3
```

J48 ('Location' as Label):

Classifier output
=== Summary ===

Correctly Classified Instances   2717   83.9617 %
Incorrectly Classified Instances   519   16.0383 %
Kappa statistic   0.8133
Mean absolute error   0.0257
Root mean squared error   0.1134
Relative absolute error   25.125 %
Root relative squared error   50.1333 %
Total Number of Instances   3236
Ignored Class Unknown Instances   1

=== Detailed Accuracy By Class ===

              TP Rate   FP Rate   Precision   Recall   F-Measure   ROC Area   Class
                0.78   0.012   0.801   0.78   0.79   0.991   Sweden
                0.888   0.005   0.848   0.888   0.868   0.998   Poland
                0.867   0.004   0.875   0.867   0.871   0.998   Denmark
                0.79   0.008   0.76   0.79   0.775   0.995   Ukraine
                0.82   0.01   0.866   0.82   0.842   0.993   Germany
                0.941   0.087   0.824   0.941   0.879   0.978   USA
                0.845   0.01   0.796   0.845   0.82   0.995   Austria
                0.822   0.009   0.791   0.822   0.806   0.995   Norway
                0.638   0.006   0.836   0.638   0.724   0.986   Turkey
                0.791   0.012   0.846   0.791   0.818   0.99   Russia
                0.781   0.005   0.87   0.781   0.823   0.996   China
                0.735   0.003   0.82   0.735   0.775   0.998   SouthKorea
                0.754   0.005   0.877   0.754   0.811   0.996   Indonesia
                0.837   0.012   0.878   0.837   0.857   0.994   UK
                0.788   0.001   0.953   0.788   0.863   0.999   Aus
                0.701   0.001   0.953   0.701   0.808   0.998   India
                0.841   0.001   0.925   0.841   0.881   0.999   Lith
Weighted Avg.   0.84   0.032   0.842   0.84   0.838   0.989

=== Confusion Matrix ===

J48 ('Location' as label continued):

Classifier output
                0.845   0.01   0.796   0.845   0.82   0.995   Austria
                0.822   0.009   0.791   0.822   0.806   0.995   Norway
                0.638   0.006   0.836   0.638   0.724   0.986   Turkey
                0.791   0.012   0.846   0.791   0.818   0.99   Russia
                0.781   0.005   0.87   0.781   0.823   0.996   China
                0.735   0.003   0.82   0.735   0.775   0.998   SouthKorea
                0.754   0.005   0.877   0.754   0.811   0.996   Indonesia
                0.837   0.012   0.878   0.837   0.857   0.994   UK
                0.788   0.001   0.953   0.788   0.863   0.999   Aus
                0.701   0.001   0.953   0.701   0.808   0.998   India
                0.841   0.001   0.925   0.841   0.881   0.999   Lith
Weighted Avg.   0.84   0.032   0.842   0.84   0.838   0.989

=== Confusion Matrix ===

   a   b   c   d   e   f   g   h   i   j   k   l   m   n   o   p   q   <-- classified as
 145   0   0   0   2 25   0   3   2   1   1   1   1   4   0   0   1 | a = Sweden
   1   95   0   2   0   6   0   0   0   2   0   0   0   1   0   0   0 | b = Poland
   1   0 98   0   0   9   1   1   1   0   1   0   1   0   0   0   0 | c = Denmark
   1   0   0 79   0 12   2   0   1   0   3   2   0   0   0   0   0 | d = Ukraine
   5   2   2   2 200 19   1   1   0   3   2   0   0   6   0   1   0 | e = Germany
   4   5   6   3   9 925   7   2   1   6   1   2   3   8   1   0   0 | f = USA
   3   0   1   1   2   9 125   2   3   1   0   0   1   0   0   0   0 | g = Austria
   2   2   0   0   3 11   2 106   0   1   0   1   0   1   0   0   0 | h = Norway
   3   0   2   4   2 24   5   4 97   2   2   0   0   6   0   1   0 | i = Turkey
   3   0   1   4   4 24   2   7   2 193   1   0   1   2   0   0   0 | j = Russia
   1   4   0   3   1 12   2   1   1   3 107   1   1   0   0   0   0 | k = China
   2   1   0   2   0   3   2   1   0   3   2 50   2   0   0   0   0 | l = SouthKorea
   1   1   2   1   2   9   4   1   1   7   2   3 107   1   0   0   0 | m = Indonesia
   7   1   0   2   2 19   2   3   5   3   1   1   2 251   0   0   1 | n = UK
   1   1   0   1   1   2   0   0   1   1   0   0   0   3 41   0   0 | o = Aus
   1   0   0   0   3 10   2   2   0   2   0   0   2   3   0 61   1 | p = India
   0   0   0   0   0   3   0   0   1   0   0   0   1   0   1   1 37 | q = Lith

Random Forest ('Game' as Label):

```
Classifier output

Correctly Classified Instances         3190               98.548  %
Incorrectly Classified Instances         47                1.452  %
Kappa statistic                           0.983
Mean absolute error                       0.0401
Root mean squared error                   0.0921
Relative absolute error                  18.8225 %
Root relative squared error              28.1908 %
Total Number of Instances              3237

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall   F-Measure   ROC Area   Class
               0.959     0.001     0.995       0.959    0.977       1          DOTA2
               0.997     0.007     0.971       0.997    0.984       1          CSGO
               0.866     0         1           0.866    0.928       0.999      TF2
               1         0.01      0.959       1        0.979       0.999      F.E.A.R
               1         0         1           1        1           1          ESO
               0.997     0         1           0.997    0.999       1          GTA5
               1         0         0.994       1        0.997       1          JC3
               1         0         1           1        1           1          L4D
Weighted Avg.  0.985     0.003     0.986       0.985    0.985       1

=== Confusion Matrix ===

   a   b   c   d   e   f   g   h   <-- classified as
 422  18   0   0   0   0   0   0 |   a = DOTA2
   2 603   0   0   0   0   0   0 |   b = CSGO
   0   0 168  26   0   0   0   0 |   c = TF2
   0   0   0 606   0   0   0   0 |   d = F.E.A.R
   0   0   0   0 583   0   0   0 |   e = ESO
   0   0   0   0   0 339   1   0 |   f = GTA5
   0   0   0   0   0   0 165   0 |   g = JC3
   0   0   0   0   0   0   0 304 |   h = L4D
```

Random Forest ('Location' as Label):

```
Classifier output

=== Evaluation on training set ===
=== Summary ===

Correctly Classified Instances         3182               98.3313 %
Incorrectly Classified Instances         54                1.6687 %
Kappa statistic                           0.9808
Mean absolute error                       0.0232
Root mean squared error                   0.0677
Relative absolute error                  22.635  %
Root relative squared error              29.9358 %
Total Number of Instances              3236
Ignored Class Unknown Instances                            1

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall   F-Measure   ROC Area   Class
               0.957     0.002     0.967       0.957    0.962       1          Sweden
               1         0         1           1        1           1          Poland
               1         0         1           1        1           1          Denmark
               0.95      0         1           0.95     0.974       1          Ukraine
               0.984     0.001     0.988       0.984    0.986       1          Germany
               0.996     0.005     0.989       0.996    0.992       1          USA
               0.993     0         0.993       0.993    0.993       1          Austria
               0.984     0.003     0.934       0.984    0.958       1          Norway
               0.934     0.001     0.979       0.934    0.956       1          Turkey
               0.971     0.001     0.988       0.971    0.979       1          Russia
               1         0.001     0.986       1        0.993       1          China
               0.971     0         1           0.971    0.985       1          SouthKorea
               0.979     0.001     0.986       0.979    0.982       1          Indonesia
               0.977     0.003     0.967       0.977    0.972       1          UK
               1         0         1           1        1           1          Aus
               0.989     0         0.989       0.989    0.989       1          India
               1         0.001     0.936       1        0.967       1          Lith
Weighted Avg.  0.983     0.002     0.983       0.983    0.983       1
```

Random Forest ('Location' as Label Continued):

```
Classifier output
                0.993      0           0.993     0.993     0.993     1        Austria
                0.984      0.003       0.934     0.984     0.958     1        Norway
                0.934      0.001       0.979     0.934     0.956     1        Turkey
                0.971      0.001       0.988     0.971     0.979     1        Russia
                1          0.001       0.986     1         0.993     1        China
                0.971      0           1         0.971     0.985     1        SouthKorea
                0.979      0.001       0.986     0.979     0.982     1        Indonesia
                0.977      0.003       0.967     0.977     0.972     1        UK
                1          0           1         1         1         1        Aus
                0.989      0           0.989     0.989     0.989     1        India
                1          0.001       0.936     1         0.967     1        Lith
Weighted Avg.   0.983      0.002       0.983     0.983     0.983     1

=== Confusion Matrix ===

    a    b    c    d    e    f    g    h    i    j    k    l    m    n    o    p    q    <-- classified as
  178    0    0    0    0    0    1    2    0    1    0    0    0    3    0    0    1 |    a = Sweden
    0  107    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0 |    b = Poland
    0    0  113    0    0    0    0    0    0    0    0    0    0    0    0    0    0 |    c = Denmark
    0    0    0   95    0    0    0    0    0    3    0    2    0    0    0    0    0 |    d = Ukraine
    0    0    0    0  240    2    0    0    0    0    0    0    0    2    0    0    0 |    e = Germany
    1    0    0    0    1  979    0    1    0    1    0    0    0    0    0    0    0 |    f = USA
    0    0    0    0    0    1  147    0    0    0    0    0    0    0    0    0    0 |    g = Austria
    2    0    0    0    0    0    0  127    0    0    0    0    0    0    0    0    0 |    h = Norway
    0    0    0    0    0    3    0    2  142    1    0    0    0    2    0    1    1 |    i = Turkey
    0    0    0    0    2    0    0    3    0  237    0    0    0    2    0    0    0 |    j = Russia
    0    0    0    0    0    0    0    0    0    0  137    0    0    0    0    0    0 |    k = China
    0    0    0    0    0    0    0    0    0    0    0   66    2    0    0    0    0 |    l = SouthKorea
    1    0    0    0    0    0    0    0    0    0    0    0  139    1    0    0    1 |    m = Indonesia
    2    0    0    0    0    4    0    1    0    0    0    0    0  293    0    0    0 |    n = UK
    0    0    0    0    0    0    0    0    0    0    0    0    0    0   52    0    0 |    o = Aus
    0    0    0    0    0    1    0    0    0    0    0    0    0    0    0   86    0 |    p = India
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   44 |    q = Lith
```

Visualizing the Tree:

We tried to visualize how the trained machine is thinking, by looking at its tree. And, we got a really complicated response from the machine. Just to show everyone how complicated the tree is, I have scaled the tree to fit to the screen and selected the least possible font.

J48 tree for label 'Game:
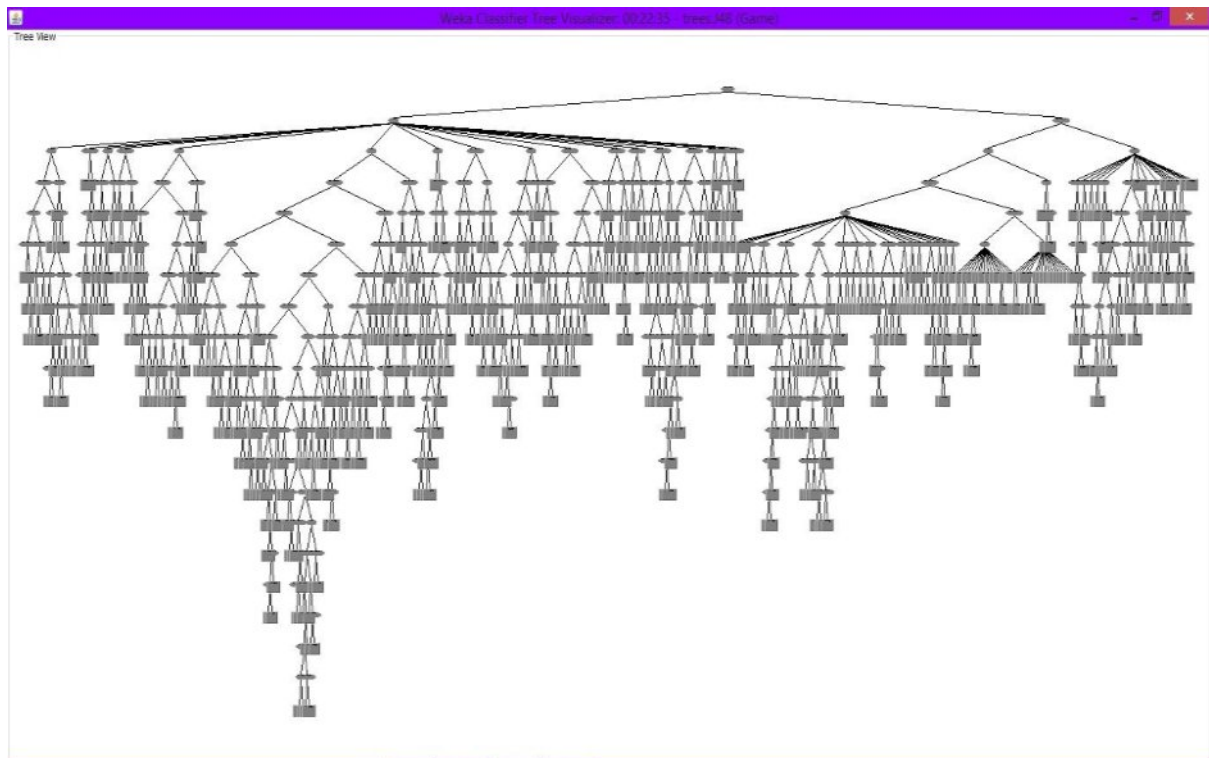
J48 tree for label 'Location:
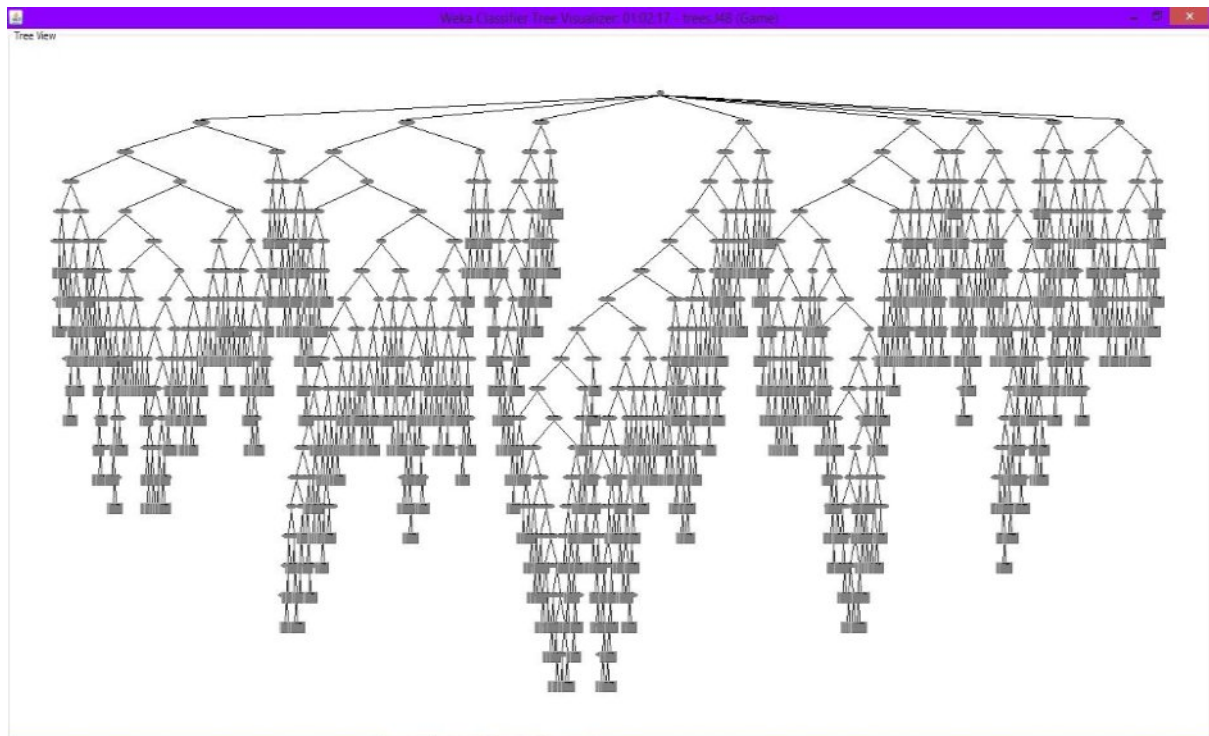
Step 3: Prediction:

So, we now had a trained machine. We must now predict a Game for a user, based on the attributes which we have considered. For this to happen, we must enter a new instance in the Arff file, which contains the user's data, but the 'Game' attribute of that instance must be left as a missing value (?)

For, example we want to predict a Game for a user from UK, whose, Steam Lvl=12,Badges=20,games=5,groups=3,and number of friends = 80.


```
L4D,Sweden,10,3,13,9,27,2
L4D,Norway,8,5,51,7,24
L4D,USA,14,12,18,1,52
L4D,USA,18,14,31,161,101
L4D,UK,11,8,26,4,24
?,UK,12,20,5,3,80
```

After running a suitable Algorithm, right click on the result list and click on 'View Classifier Errors'
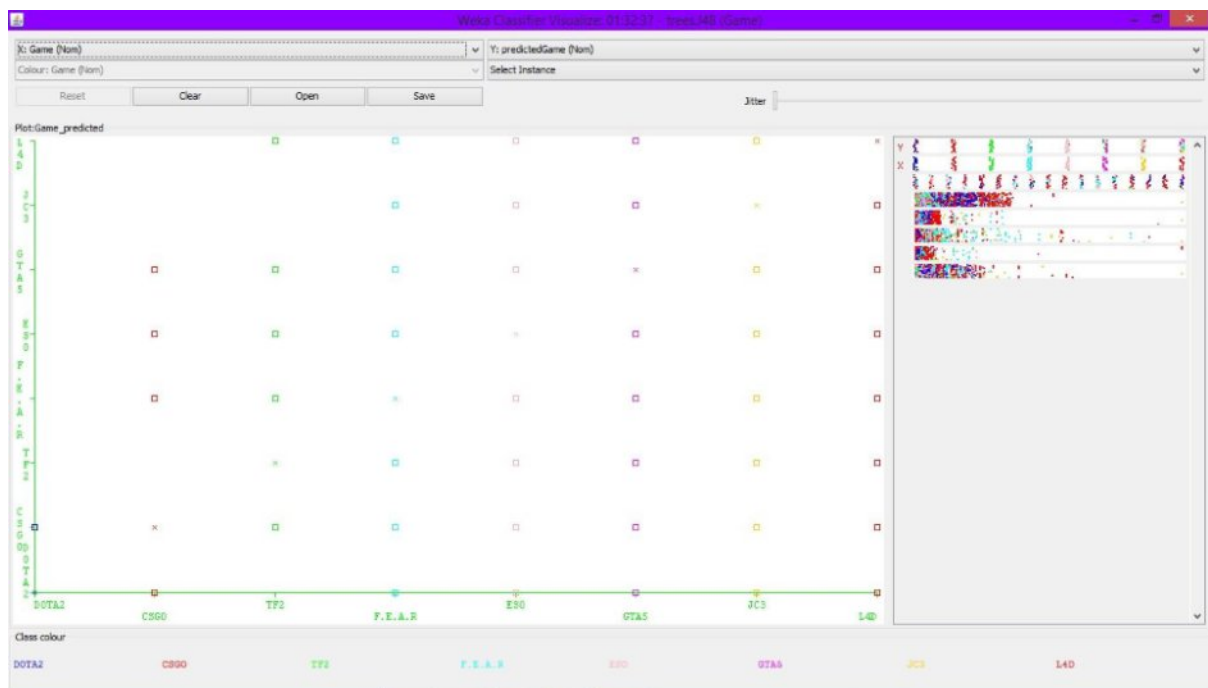
Save the Output file to a location (The output will be saved in the form of an ARFF file).
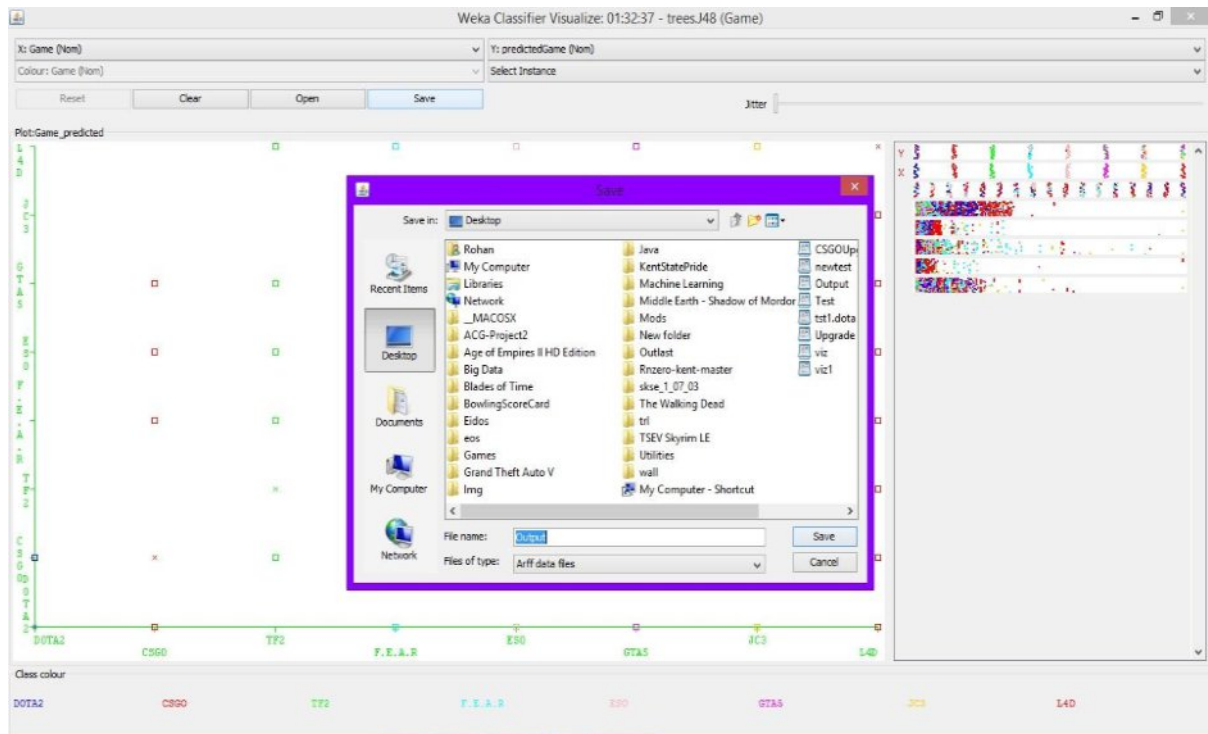
Open the output file using Word.(Notepad will not be clear). We notice that we have a new attribute called 'predicted Game' now, which is generated by weka.

```
@relation Game_predicted

@attribute predictedGame
{DOTA2,CSGO,TF2,F.E.A.R,ESO,GTA5,JC3,L4D}
@attribute Game {DOTA2,CSGO,TF2,F.E.A.R,ESO,GTA5,JC3,L4D}
@attribute Location
{Sweden,Poland,Denmark,Ukraine,Germany,USA,Austria,Norway,Turkey,
Russia,China,SouthKorea,Indonesia,UK,Aus,India,Lith}
@attribute SteamLevel numeric
@attribute Badges numeric
@attribute NumberOfGames numeric
@attribute NumberOfGroups numeric
@attribute NumberOfFriends numeric

@data
CSGO,CSGO,Sweden,31,19,96,3,95
CSGO,CSGO,Poland,25,11,58,5,68
CSGO,CSGO,Sweden,65,25,98,11,105
CSGO,CSGO,Germany,96,38,56,10,67
CSGO,CSGO,USA,13,6,14,3,25
CSGO,CSGO,Germany,15,3,12,2,12
```

Prediction: Scroll down to the place where we left the missing value to view the prediction.

```
L4D,L4D,USA,40,76,176,124,62
L4D,L4D,Sweden,10,3,13,9,27
L4D,L4D,Norway,8,5,51,7,24
L4D,L4D,USA,14,12,18,1,52
L4D,L4D,USA,18,14,31,161,101
L4D,L4D,UK,11,8,26,4,24
L4D,?,UK,12,20,5,3,80
```

Result:

As we can see from the above slide, weka has predicted that, a user from UK, with a steam level of 12, possessing 20 badges, owns 5 games, is a part of 3 groups, and has 80 people as friends, will most probably play *Left for Dead 2*(L4D). Similarly, we can use the same method to predict the location of a user, in case he/she decides to hide it from us.

Further Data Analysis with Label 'Game':

On further analysis, we noticed that 'Number of Badges' is the attribute which had the least correlation with the label 'Game'. Removing both 'Badges' and 'Location' did not affect the accuracy much. The loss in accuracy wasn't more than 0.3%, even when both of these attributes were removed.

Further Data Analysis with Label 'Location':

The Attribute 'Steam Level' and had negligible influence on the accuracy when we consider the label 'Location'.(accuracy drop < 1%). Attribute 'Badges' had low relation with 'Location' too (accuracy drop < 1%). There was no significant drop in accuracy when both 'Badges' and 'Steam Level' were removed. 'Number of Games' attributes alone, had a huge impact on the prediction, because removing this attribute, reduced the accuracy but almost 4%.

What can be done to refine the data?

→We can clearly eliminate the attribute 'Badges' as it did not have much correlation with both the labels (Game & Location).

→The attribute 'Steam Level' can be removed too.

→Removing attributes might make the data lighter, but it also makes it less accurate at the same time.

Possibilities:

→This research is basically, just an idea how a game can be predicted and sent as a suggestion to the user, by the steam application, by just taking into the account, the user's steam data.

→(This is subjected to perspective) -> If a user decides to hide his/her location for some reason, but yet, we use this trained machine to predict the user's location (since, we will be correct 98% of the time), can be considered as violation of privacy.

Code:

```
%
%
% Attribute Location : Considered locations from random steam
Profiles
%             Sweden
%             Poland
%             Ukraine
%             Denmark
%             Germany
%             USA
%             Austria
%             Norway
%             Turkey
%             Russia
%             China
%             SouthKorea
%             Indonesia
%             Lithuania
%             UK
%             Aus
%
%
%
%
```

```
@relation Game
@attribute Game             {DOTA2, CSGO, TF2, F.E.A.R, ESO,GTA5}
@attribute Location         {Sweden, Poland, Denmark, Ukraine,
Germany, USA, Austria, Norway, Turkey, Russia, China, SouthKorea,
Indonesia, UK, Aus, India, Lith}
@attribute SteamLevel    NUMERIC
@attribute Badges           NUMERIC
@attribute NumberOfGames      NUMERIC
@attribute NumberOfGroups       NUMERIC
@attribute NumberOfFriends       NUMERIC



@data
CSGO, Sweden, 31, 19, 96, 3, 95
CSGO, Poland, 25, 11, 58, 5, 68
CSGO, Sweden, 65, 25, 98, 11, 105
CSGO, Germany, 96, 38, 56, 10, 67
CSGO, USA, 13, 6, 14, 3, 25
CSGO, Germany, 15, 3, 12, 2, 12
CSGO, USA, 65, 32, 56, 15, 36
CSGO, Germany, 35, 12, 24, 3, 30
CSGO, USA, 54, 13, 26, 3, 35
CSGO, USA, 35, 11, 23, 2, 24
CSGO, USA, 78, 21, 86, 14, 96
CSGO, USA, 56, 21, 65, 9, 87
CSGO, Germany, 35, 15, 41, 6, 65
CSGO, Poland, 62, 14, 56, 9, 54
CSGO, Austria, 1, 0, 2, 0, 0
CSGO, China, 1, 0, 3, 0, 0
CSGO, Indonesia, 12, 6, 23, 1, 35
CSGO, Sweden, 26, 15, 35, 14, 72
CSGO, Sweden, 35, 30, 65, 12, 91
CSGO, Turkey, 60, 50, 21, 15, 99
CSGO, Turkey, 17, 10,54,9,122
CSGO, Turkey, 28, 11, 45, 8, 102
CSGO, Sweden, 7, 5, 21, 5, 33
```

```
CSGO, USA, 17, 15, 35, 15, 49
CSGO, China, 51, 23, 56, 15, 89
CSGO, Russia, 56, 15, 58, 2, 56
CSGO, USA, 68, 31, 65, 10, 156
CSGO, Russia, 15, 6, 26, 25, 45
CSGO, UK, 1, 0, 1, 0, 1
CSGO, Austria, 1, 0, 3, 1, 5
CSGO, UK, 25, 14, 45, 17, 89
CSGO, Turkey, 35, 28, 200, 14, 90
CSGO, Austria, 50, 110, 56, 30, 121
CSGO, Poland, 8, 6, 33, 5, 13
CSGO, Indonesia, 6, 3, 46, 21, 37
CSGO, Poland,11,7,37,6,32
CSGO, USA,23,17,53,7,53
CSGO, Austria,10,4,2,5,37
CSGO, USA,4,3,5,3,14
CSGO, USA,10,3,7,1,19
CSGO, Germany,9,7,26,3,24
CSGO, Germany,33,26,82,10,94
CSGO, USA,70,69,127,12,398
CSGO, Ukraine,15,15,39,25,76
CSGO, Russia,13,6,17,3,37
CSGO, Russia,1,1,4,1,9
CSGO, SouthKorea,70,67,123,56,373
CSGO, USA,44,52,126,1,21
CSGO, Russia,1,1,1,2,19
CSGO, Germany,25,20,95,6,62
CSGO, Germany,28,41,154,34,126
CSGO, USA,20,13,22,19,149
CSGO, USA,6,4,14,19,27
CSGO, USA,7,3,1,12,132
CSGO, UK,33,24,97,12,145
CSGO, UK,40,47,352,37,51
CSGO, Aus,6,6,16,1,4
CSGO, Ukraine,4,3,3,15,83
CSGO, USA,4,4,8,5,45
CSGO, Russia,21,21,89,24,111
CSGO, UK,11,4,3,11,77
CSGO, Sweden,8,4,16,18,98
CSGO, Indonesia,10,5,53,9,19
CSGO, USA,70,69,127,12,398
CSGO, Ukraine,15,15,39,25,76
CSGO, UK,8,5,103,13,67
CSGO, USA,31,18,11,36,221
CSGO, Indonesia,3,3,1,35,89
CSGO, Sweden,6,4,38,7,87
CSGO, Poland,5,3,12,6,28
CSGO, Turkey,2,2,1,11,101
CSGO, UK,3,2,5,26,57
CSGO, Denmark,3,3,3,2,18
CSGO, Ukraine,2,2,1,11,101
CSGO, Turkey,17,10,54,9,122
CSGO, Turkey,28,11,45,8,102
CSGO, Sweden,7,5,21,5,33
CSGO, USA,70,69,127,12,398
CSGO, Ukraine,15,15,39,25,76
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CSGO, USA,17,15,35,15,49
CSGO, China,51,23,56,15,89
CSGO, Russia,56,15,58,2,56
CSGO, USA,68,31,65,10,156
CSGO, Russia,15,6,26,25,45
CSGO, UK,1,0,1,0,1
CSGO, Austria,1,0,3,1,5
CSGO, UK,25,14,45,17,89
CSGO, Turkey,35,28,200,14,90
CSGO, Austria,50,110,56,30,121
CSGO, Poland,8,6,33,5,13
CSGO, Indonesia,6,3,46,21,37
CSGO, Poland,11,7,37,6,32
CSGO, USA,23,17,53,7,53
CSGO, Austria,10,4,2,5,37
CSGO, USA,4,3,5,3,14
CSGO, USA,10,3,7,1,19
CSGO, Germany,9,7,26,3,24
CSGO, China,51,23,56,15,89
CSGO, Russia,56,15,58,2,56
CSGO, USA,68,31,65,10,156
CSGO, Russia,15,6,26,25,45
CSGO, Germany,33,26,82,10,94
CSGO, USA,70,69,127,12,398
CSGO, Ukraine,15,15,39,25,76
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CSGO, Russia,1,1,4,1,9
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CSGO, Russia,1,1,1,2,19
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CSGO, Germany,28,41,154,34,126
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CSGO, UK,40,47,352,37,51
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CSGO, USA,44,52,126,1,21
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CSGO, Ukraine,4,3,3,15,83
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CSGO, Poland,5,3,12,6,28
CSGO, Turkey,2,2,1,11,101
CSGO, UK,3,2,5,26,57
CSGO, Denmark,3,3,3,2,18
CSGO, Ukraine,2,2,1,11,101
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CSGO, Russia,72, 48, 65, 21, 36
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CSGO, UK,98, 46, 7, 75, 30
CSGO, USA,77, 45, 58, 46, 31
CSGO, India,48, 8, 29, 7, 51
CSGO, Russia,47, 9, 56, 57, 34
CSGO, Sweden,47, 18, 74, 31, 33
CSGO, UK,11, 7, 41, 33, 52
CSGO, Russia,58, 35, 8, 66, 37
CSGO, UK,10, 30, 72, 40, 35
CSGO, Aus,45, 20, 49, 25, 63
CSGO, UK,71, 32, 18, 17, 51
CSGO, USA,37, 63, 51, 76, 22
CSGO, USA,49, 17, 11, 33, 30
CSGO, India,40, 38, 53, 15, 54
CSGO, Germany,50, 59, 47, 18, 79
CSGO, USA,47, 20, 5, 63, 78
CSGO, India,40, 61, 69, 13, 70
CSGO, Germany,11, 70, 63, 62, 26
CSGO, UK, 40, 30, 50, 64, 32
CSGO, USA, 56, 46, 29, 60, 13
CSGO, Germany, 71, 45, 37, 75, 43
CSGO, USA, 17, 10, 15, 5, 36
CSGO, Aus, 30, 24, 43, 74, 3
CSGO, Norway, 98, 70, 69, 59, 79
CSGO, Denmark, 24, 54, 73, 29, 25
CSGO, Ukraine, 38, 44, 43, 62, 51
CSGO, Germany, 79, 38, 55, 15, 12
CSGO, USA, 78, 50, 43, 14, 60
CSGO, Germany, 94, 51, 43, 17, 9
CSGO, UK, 60, 79, 29, 19, 42
CSGO, USA, 37, 13, 62, 47, 43
CSGO, UK, 89, 61, 55, 10, 11
CSGO, Aus, 103, 60, 18, 69, 36
CSGO, Norway,99, 76, 73, 72, 68
CSGO, USA, 57, 14, 12, 54, 50
CSGO, India,69, 68, 35, 2, 56
CSGO, Germany, 74, 41, 40, 74, 22
CSGO, USA, 141, 79, 69, 50, 60
CSGO, UK, 105, 79, 55, 25, 24
CSGO, Russia, 31, 32, 59, 56, 78
CSGO, Russia, 92, 35, 8, 73, 76
CSGO, Germany,35, 6, 32, 3, 22
CSGO, India, 31, 17, 58, 16, 72
CSGO, Turkey, 30, 18, 28, 27, 74
CSGO, Sweden, 48, 37, 67, 9, 60
CSGO, Indonesia, 79, 69, 43, 59, 41
CSGO, Germany, 49, 43, 30, 75, 62
CSGO, Turkey, 79, 56, 72, 46, 69
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CSGO, Indonesia, 15, 67, 12, 49, 44
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CSGO, Aus, 28, 14, 41, 79, 43
CSGO, UK, 30, 40, 76, 43, 68
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CSGO, Ukraine, 76, 50, 58, 67, 73
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CSGO, India, 73, 31, 49, 20, 10
CSGO, Russia, 70, 9, 41, 4, 35
CSGO, Sweden, 12, 31, 21, 73, 79
CSGO, USA, 71, 28, 14, 77, 25
CSGO, Poland, 65, 44, 60, 37, 64
CSGO, China, 95, 50, 9, 55, 5
CSGO, India, 31, 17, 58, 16, 72
CSGO, Turkey, 30, 18, 28, 27, 74
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CSGO, India, 70, 19, 26, 18, 56
CSGO, Russia, 46, 25, 62, 59, 26
CSGO, Aus, 16, 36, 76, 45, 13
CSGO, USA, 54, 45, 11, 36, 57
CSGO, Russia, 20, 36, 32, 33, 73
CSGO, India, 59, 68, 77, 39, 58
CSGO, USA, 58, 35, 24, 68, 51
CSGO, UK, 11, 47, 68, 15, 27
CSGO, Russia, 51, 25, 28, 2, 33
CSGO, Poland, 10, 48, 47, 19, 59
CSGO, Germany, 12, 58, 50, 55, 70
CSGO, Ukraine, 57, 74, 41, 24, 75
CSGO, USA, 33, 67, 64, 35, 11
CSGO, India, 31, 17, 58, 16, 72
CSGO, Turkey, 30, 18, 28, 27, 74
CSGO, Germany, 40, 14, 9, 64, 18
CSGO, USA, 19, 43, 41, 51, 61
CSGO, Germany, 60, 42, 34, 17, 46
CSGO, UK, 67, 51, 46, 59, 30
CSGO, USA, 15, 6, 25, 17, 50
CSGO, UK, 40, 76, 77, 6, 33
CSGO, Aus, 52, 54, 4, 30, 26
CSGO, Norway, 70, 31, 51, 10, 24
CSGO, USA, 98, 68, 77, 75, 105
CSGO, Russia, 55, 26, 5, 72, 44
CSGO, Germany, 21, 49, 47, 15, 40
CSGO, USA, 76, 26, 69, 65, 51
CSGO, India, 31, 17, 58, 16, 72
CSGO, Turkey, 30, 18, 28, 27, 74
CSGO, UK, 30, 17, 50, 10, 60
CSGO, Russia, 59, 68, 31, 14, 15
CSGO, Russia, 13, 11, 58, 54, 33
CSGO, Germany, 100, 64, 18, 52, 99
CSGO, UK, 76, 69, 41, 13, 77
CSGO, Turkey, 42, 50, 63, 65, 60
CSGO, Sweden, 41, 55, 72, 8, 27
CSGO, Indonesia, 50, 55, 1, 76, 26
CSGO, Germany, 102, 66, 98, 71, 156
CSGO, Turkey, 45, 33, 31, 42, 85
CSGO, Germany, 60, 32, 54, 9, 35
CSGO, Indonesia,63, 76, 71, 12, 14
CSGO, USA,16, 7, 49, 15, 64
CSGO, India, 31, 17, 58, 16, 72
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CSGO, Turkey, 30, 18, 28, 27, 74
CSGO, Aus,33, 36, 34, 30, 75
CSGO, UK, 10, 28, 60, 41, 71
CSGO, Ukraine, 4, 33, 13, 46, 73
CSGO, Denmark, 59, 39, 30, 3, 11
CSGO, USA, 18, 68, 32, 1, 53
CSGO, India, 31, 17, 58, 16, 72
CSGO, Turkey, 30, 18, 28, 27, 74
CSGO, Russia, 28, 49, 64, 13, 23
CSGO, Sweden, 30, 45, 21, 13, 65
CSGO, USA, 75, 48, 29, 71, 19
CSGO, Poland, 62, 36, 4, 48, 41
CSGO, China, 33, 25, 5, 55, 40
DOTA2, USA, 46, 35, 38, 57, 66
DOTA2, Russia, 38, 21, 8, 57, 83
DOTA2, UK, 54, 4, 87, 64, 25
DOTA2, USA, 18, 13, 89, 19, 93
DOTA2, Germany, 3, 20, 61, 32, 90
DOTA2, USA, 34, 46, 67, 27, 92
DOTA2, India, 66, 72, 29, 3, 91
DOTA2, Lith, 60, 52, 54, 34, 15
DOTA2, Aus, 93, 76, 57, 55, 17
DOTA2, Denmark, 15, 42, 33, 64, 57
DOTA2, Germany, 106, 75, 64, 54, 140
DOTA2, Russia, 82, 20, 70, 37, 23
DOTA2, USA, 87, 45, 76, 33, 181
DOTA2, UK, 38, 58, 35, 32, 72
DOTA2, Aus, 92, 37, 15, 59, 39
DOTA2, India, 54, 61, 35, 64, 57
DOTA2, USA, 21, 41, 82, 53, 52
DOTA2, Lith, 32, 80, 28, 78, 75
DOTA2, China, 49, 83, 22, 28, 106
DOTA2, Indonesia, 13, 89, 67, 36, 85
DOTA2, Denmark, 78, 51, 19, 30, 81
DOTA2, USA, 48, 14, 17, 68, 22
DOTA2, Ukraine, 51, 43, 3, 7, 22
DOTA2, Austria, 94, 75, 31, 4, 95
DOTA2, Denmark, 60, 35, 81, 45, 62
DOTA2, USA, 37, 53, 85, 43, 72
DOTA2, UK, 91, 74, 80, 63, 138
DOTA2, India, 73, 60, 34, 56, 65
DOTA2, USA, 8, 79, 48, 6, 14
DOTA2, Russia, 15, 16, 8, 44, 11
DOTA2, Germany, 66, 82, 55, 8, 76
DOTA2, USA, 15, 61, 59, 49, 20
DOTA2, UK, 49, 51, 39, 52, 28
DOTA2, Russia, 14, 3, 13, 21, 44
DOTA2, UK, 42, 82, 28, 68, 44
DOTA2, USA, 81, 55, 49, 47, 64
DOTA2, India, 107, 61, 65, 18, 91
DOTA2, Norway, 76, 39, 27, 12, 32
DOTA2, Denmark, 108, 65, 17, 35, 77
DOTA2, Sweden, 52, 35, 13, 5, 25
DOTA2, India, 78, 87, 52, 6, 51
DOTA2, Russia, 70, 72, 6, 20, 95
DOTA2, USA, 49, 90, 74, 45, 59
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DOTA2, USA, 91, 54, 35, 66, 79
DOTA2, USA, 89, 90, 24, 38, 83
DOTA2, Denmark, 21, 20, 22, 10, 44
DOTA2, Indonesia, 29, 18, 50, 12, 64
DOTA2, Germany, 86, 95, 67, 12, 35
DOTA2, Turkey, 63, 20, 8, 19, 77
DOTA2, Germany, 64, 49, 51, 22, 67
DOTA2, Germany, 64, 44, 47, 14, 46
DOTA2, Turkey, 73, 26, 94, 17, 36
DOTA2, India, 26, 8, 56, 18, 45
DOTA2, USA, 33, 88, 49, 21, 78
DOTA2, UK, 41, 55, 5, 12, 64
DOTA2, India, 68, 54, 93, 42, 90
DOTA2, Turkey, 87, 94, 29, 13, 60
DOTA2, UK, 63, 78, 95, 28, 92
DOTA2, Ukraine, 79, 17, 10, 23, 43
DOTA2, Norway, 50, 49, 10, 18, 65
DOTA2, Germany, 60, 78, 64, 8, 73
DOTA2, Sweden, 92, 25, 79, 32, 77
DOTA2, USA, 65, 78, 46, 18, 80
DOTA2, India, 45, 8, 20, 49, 33
DOTA2, Germany, 48, 37, 69, 12, 28
DOTA2, Lith, 13, 10, 47, 5, 45
DOTA2, USA, 65, 63, 72, 2, 15
DOTA2, USA, 50, 3, 48, 16, 82
DOTA2, USA, 29, 74, 9, 5, 31
DOTA2, UK, 72, 74, 95, 12, 30
DOTA2, Sweden, 58, 62, 43, 11, 71
DOTA2, Norway, 15, 30, 8, 21, 93
DOTA2, USA, 30, 91, 70, 15, 4
DOTA2, UK, 59, 54, 51, 26, 81
DOTA2, UK, 75, 71, 22, 31, 34
DOTA2, Germany, 31, 4, 66, 22, 29
DOTA2, USA, 66, 84, 58, 12, 93
DOTA2, USA, 48, 36, 79, 14, 15
DOTA2, Indonesia, 31, 30, 36, 5, 89
DOTA2, China, 63, 77, 34, 9, 76
DOTA2, Indonesia, 62, 27, 12, 6, 85
DOTA2, India, 83, 45, 4, 57, 40
DOTA2, Russia, 48, 82, 46, 66, 94
DOTA2, Germany, 21, 81, 9, 6, 8
DOTA2, Germany, 41, 40, 19, 50, 65
DOTA2, Denmark, 22, 32, 36, 21, 52
DOTA2, USA, 71, 83, 15, 81, 21
DOTA2, UK, 52, 30, 58, 18, 45
DOTA2, Lith, 28, 47, 49, 4, 36
DOTA2, USA, 22, 71, 51, 41, 144
DOTA2, USA, 28, 39, 79, 83, 186
DOTA2, USA, 11, 80, 75, 16, 8
DOTA2, USA, 25, 7, 41, 80, 90
DOTA2, USA, 84, 30, 33, 61, 82
DOTA2, UK, 33, 61, 26, 78, 21
DOTA2, UK, 9, 7, 18, 74, 92
DOTA2, India, 87, 82, 70, 35, 15
DOTA2, Germany, 83, 17, 75, 8, 13
DOTA2, Germany, 64, 61, 26, 7, 60
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DOTA2, Indonesia, 81, 94, 14, 24, 61
DOTA2, Russia, 33, 87, 83, 22, 58
DOTA2, Germany, 90, 39, 85, 19, 72
DOTA2, Russia, 31, 6, 51, 34, 277
DOTA2, India, 72, 37, 64, 14, 79
DOTA2, China, 42, 60, 20, 8, 56
DOTA2, Denmark, 42, 61, 71, 48, 91
DOTA2, Sweden, 57, 59, 49, 75, 84
DOTA2, USA, 68, 72, 36, 65, 126
DOTA2, UK, 28, 47, 86, 8, 53
DOTA2, Lith, 35, 38, 5, 6, 81
DOTA2, Germany, 49, 38, 7, 18, 13
DOTA2, Germany, 47, 48, 14, 59, 22
DOTA2, USA, 118, 92, 51, 5, 35
DOTA2, USA, 61, 44, 27, 15, 108
DOTA2, UK, 82, 65, 95, 68, 288
DOTA2, Lith, 61, 84, 60, 89, 94
DOTA2, Germany, 48, 18, 60, 28, 91
DOTA2, USA, 116, 95, 78, 28, 131
DOTA2, UK, 70, 86, 56, 6, 129
DOTA2, Lith, 37, 20, 45, 51, 76
DOTA2, Germany, 101, 71, 13, 54, 195
DOTA2, USA, 15, 27, 9, 8, 68
DOTA2, UK, 48, 40, 71, 39, 37
DOTA2, Indonesia, 51, 43, 61, 32, 53
DOTA2, USA, 19, 6, 39, 18, 89
DOTA2, China, 34, 40, 15, 14, 62
DOTA2, Norway, 30, 27, 28, 10, 106
DOTA2, SouthKorea, 82, 54, 81, 15, 135
DOTA2, Ukraine, 106, 75, 88, 17, 278
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DOTA2, India, 87, 11, 36, 15, 122
DOTA2, Ukraine, 53, 80, 3, 17, 90
DOTA2, Norway, 16, 15, 85, 19, 145
DOTA2, USA, 92, 91, 7, 17, 138
DOTA2, India, 60, 41, 49, 28, 105
DOTA2, USA, 63, 44, 56, 5, 48
DOTA2, Lith, 51, 40, 90, 13, 68
DOTA2, Germany, 41, 15, 38, 72, 85
DOTA2, Indonesia, 52, 79, 49, 11, 41
DOTA2, Germany, 40, 35, 77, 19, 121
DOTA2, Russia, 129, 84, 38, 45, 174
DOTA2, Denmark, 11, 35, 81, 14, 53
DOTA2, Sweden, 41, 69, 28, 36, 104
DOTA2, UK, 91, 42, 47, 18, 66
DOTA2, Turkey, 90, 64, 28, 17, 124
DOTA2, Austria, 66, 43, 17, 17, 144
DOTA2, Aus, 75, 55, 31, 87, 66
DOTA2, Norway, 72, 76, 6, 5, 55
DOTA2, Aus, 89, 13, 32, 8, 78
DOTA2, Turkey, 12, 28, 9, 7, 45
DOTA2, USA, 42, 35, 14, 32, 37
DOTA2, USA, 14, 26, 6, 38, 145
DOTA2, USA, 25, 32, 14, 24, 89
DOTA2, Austria, 72, 69, 65, 9, 61
DOTA2, Aus, 61, 62, 15, 18, 136
```

```
DOTA2, UK, 86, 89, 36, 30, 229
DOTA2, Germany, 62, 69, 85, 28, 290
DOTA2, USA, 76, 50, 18, 22, 91
DOTA2, Austria, 46, 25, 35, 6, 79
DOTA2, Germany, 40, 47, 86, 17, 51
DOTA2, USA, 99, 87, 80, 10, 131
DOTA2, Indonesia, 60, 54, 49, 25, 198
DOTA2, Russia, 74, 39, 76, 23, 56
DOTA2, USA, 19, 28, 35, 9, 42
DOTA2, Austria, 69, 84, 53, 32, 56
DOTA2, Aus, 60, 65, 71, 14, 79
DOTA2, India, 75, 74, 68, 8, 136
DOTA2, Indonesia, 34, 19, 31, 21, 82
DOTA2, USA, 18, 32, 66, 16, 121
DOTA2, USA, 68, 92, 13, 13, 90
DOTA2, India, 74, 63, 21, 26, 235
DOTA2, USA, 99, 93, 29, 45, 336
DOTA2, UK, 45, 36, 26, 8, 64
DOTA2, Austria, 79, 34, 72, 41, 57
DOTA2, Aus, 52, 15, 24, 16, 123
DOTA2, Germany, 23, 20, 43, 6, 114
DOTA2, Indonesia, 69, 33, 82, 26, 79
DOTA2, India, 60, 69, 78, 5, 162
DOTA2, China,  54, 15, 26, 23, 136
DOTA2, Ukraine, 61, 49, 26, 41, 190
DOTA2, Turkey, 70, 75, 18, 27, 89
DOTA2, USA, 60, 42, 54, 29, 326
DOTA2, USA, 84, 75, 16, 69, 362
DOTA2, USA, 87, 95, 83, 14, 371
DOTA2, China, 15, 56, 88, 20, 92
DOTA2, USA, 78, 70, 19, 22, 90
DOTA2, UK, 45, 83, 56, 28, 48
DOTA2, UK, 40, 66, 8, 14, 37
DOTA2, USA, 51, 31, 10, 19, 188
DOTA2, USA, 75, 70, 81, 18, 310
DOTA2, UK, 65, 68, 87, 51, 192
DOTA2, Ukraine, 26, 38, 19, 16, 179
DOTA2, Aus, 22, 11, 27, 7, 89
DOTA2, Germany, 27, 22, 15, 8, 135
DOTA2, Lith, 73, 66, 29, 17, 135
DOTA2, Denmark, 8, 9, 15, 4, 71
DOTA2, Russia, 41, 34, 14, 29, 168
DOTA2, Sweden, 29, 24, 8, 14, 148
DOTA2, Norway, 16, 12, 19, 6, 85
DOTA2, USA, 82, 75, 45, 28, 264
DOTA2, Germany, 31, 36, 14, 13, 38
DOTA2, Sweden, 78, 61, 14, 8, 65
DOTA2, UK, 63, 16, 4, 4, 47
DOTA2, USA, 90, 94, 18, 11, 258
DOTA2, Lith, 73, 65, 10, 5, 89
DOTA2, Ukraine,  56, 37, 74, 9, 186
DOTA2, Austria, 46, 64, 31, 11, 79
DOTA2, Germany, 120, 101, 90, 35, 320
DOTA2, UK, 48, 40, 50, 12, 75
DOTA2, Germany, 79, 55, 60, 27, 232
ESO,USA,45,72,177,5,468
```

```
ESO,USA,73,75,714,20,56
ESO,Sweden,14,12,11,10,106
ESO,Poland,31,26,216,6,43
ESO,Ukraine,83,299,1246,24,320
ESO,Denmark,5,3,52,1,27
ESO,Germany,4,3,3,5,1
ESO,USA,8,5,55,10,10
ESO,Austria,105,137,277,90,69
ESO,USA,12,9,92,2,5
ESO,Norway,19,21,199,15,31
ESO,USA,15,11,86,33,105
ESO,Turkey,13,1,69,2,9
ESO,Russia,33,27,200,3,70
ESO,Austria,6,3,18,1,14
ESO,China,22,22,50,17,83
ESO,Germany,12,10,165,4,12
ESO,USA,17,15,254,2,25
ESO,SouthKorea,51,50,88,87,192
ESO,Indonesia,31,25,224,93,199
ESO,USA,15,13,57,4,18
ESO,USA,17,16,66,4,98
ESO,Sweden,12,9,6,3,10
ESO,Poland,26,25,439,72,62
ESO,Poland,37,24,161,10,169
ESO,Ukraine,5,3,57,5,4
ESO,Denmark,14,12,252,31,129
ESO,Germany,26,27,105,12,216
ESO,USA,6,4,73,1,16
ESO,USA,21,11,205,61,20
ESO,Austria,21,23,44,4,49
ESO,Norway,2,2,2,4,10
ESO,USA,17,18,97,7,81
ESO,Turkey,21,17,66,6,51
ESO,Russia,3,2,13,8,13
ESO,China,10,7,155,6,79
ESO,SouthKorea,10,6,130,16,52
ESO,Indonesia,13,9,22,13,35
ESO,USA,6,4,16,2,26
ESO,USA,3,2,36,4,61
ESO,China,7,5,73,10,38
ESO,Norway,11,9,18,17,17
ESO,USA,5,3,46,10,9
ESO,Sweden,10,8,61,35,110
ESO,Norway,9,4,26,20,17
ESO,USA,15,14,75,15,30
ESO,USA,5,5,14,6,2
ESO,Germany,1,1,5,2,1
ESO,Denmark,6,5,28,14,112
ESO,Russia,3,3,7,5,1
ESO,SouthKorea,2,3,4,6,1
ESO,Indonesia,21,21,61,9,31
ESO,USA,20,15,5,3,94
ESO,USA,13,11,89,7,15
ESO,Turkey,72,74,207,72,137
ESO,Austria,5,4,45,7,34
ESO,USA,6,3,44,2,17
```

```
ESO,Denmark,53,40,79,45,7
ESO,Germany,25,22,93,12,257
ESO,Poland,13,8,22,4,44
ESO,SouthKorea,24,29,68,3,105
ESO,Ukraine,4,3,37,5,4
ESO,USA,12,8,39,74,70
ESO,USA,10,7,29,2,10
ESO,USA,1,15,513,1,2
ESO,Denmark,13,13,78,1,6
ESO,USA,4,4,26,1,5
ESO,USA,2,3,5,1,2
ESO,USA,5,3,63,10,15
ESO,USA,12,8,52,10,2
ESO,USA,28,22,238,2,46
ESO,Norway,6,3,66,4,36
ESO,Turkey,31,16,91,72,17
ESO,USA,12,8,293,13,22
ESO,Austria,9,4,90,1,14
ESO,China,15,16,106,5,49
ESO,Indonesia,6,4,37,1,6
ESO,USA,7,3,22,1,1
ESO,USA,12,8,14,2,11
ESO,USA,6,4,26,2,12
ESO,USA,7,4,89,7,34
ESO,Turkey,7,5,16,6,65
ESO,USA,13,12,177,5,18
ESO,USA,17,8,221,3,14
ESO,Russia,5,4,8,1,3
ESO,China,8,5,15,1,17
ESO,USA,6,3,45,2,9
ESO,SouthKorea,4,4,12,6,5
ESO,Indonesia,3,2,11,10,1
ESO,USA,8,4,192,15,22
ESO,Germany,14,11,33,7,64
ESO,Denmark,12,7,359,6,160
ESO,China,3,3,5,1,42
ESO,Denmark,21,17,260,87,200
ESO,Ukraine,2,2,4,1,2
ESO,USA,15,16,109,18,74
ESO,USA,8,6,97,10,15
ESO,China,4,3,12,2,7
ESO,USA,10,5,37,1,16
ESO,Denmark,2,14,47,4,21
ESO,Germany,27,25,59,1,18
ESO,USA,5,3,47,6,4
ESO,Poland,2,2,3,1,5
ESO,Austria,20,16,82,19,68
ESO,USA,11,7,109,13,81
ESO,Ukraine,10,7,161,2,14
ESO,Austria,3,2,25,5,8
ESO,Indonesia,35,51,279,5,103
ESO,Russia,4,3,3,1,6
ESO,USA,0,5,36,2,43
ESO,China,4,2,28,4,20
ESO,USA,6,3,55,7,35
ESO,Sweden,52,105,2484,66,107
```

```
ESO,Denmark,23,20,207,20,81
ESO,USA,9,5,75,1,6
ESO,Indonesia,6,5,23,5,37
ESO,USA,12,4,64,4,37
ESO,Indonesia,20,14,31,1,41
ESO,SouthKorea,4,3,17,45,200
ESO,USA,42,25,239,16,276
ESO,USA,11,8,102,13,80
ESO,Russia,12,12,53,3,7
ESO,USA,7,4,93,10,32
ESO,Ukraine,1,1,9,1,8
ESO,USA,212,440,1567,21,69
ESO,USA,10,4,87,2,8
ESO,USA,12,9,129,12,30
ESO,USA,2,2,19,10,22
ESO,USA,5,3,55,1,28
ESO,USA,10,6,49,27,43
ESO,USA,6,4,29,5,28
ESO,USA,2,2,26,5,11
ESO,Ukraine,13,14,30,59,189
ESO,USA,1,2,7,5,6
ESO,Sweden,20,11,18,9,112
ESO,USA,5,4,20,3,7
ESO,Denmark,34,50,292,50,45
ESO,Sweden,10,5,19,10,20
ESO,Germany,47,42,71,19,93
ESO,Poland,21,19,52,37,285
ESO,China,7,3,7,4,24
ESO,Ukraine,3,3,23,10,7
ESO,Austria,2,2,6,1,11
ESO,USA,5,4,18,4,15
ESO,Denmark,70,69,134,2,18
ESO,USA,11,94,10,4,37
ESO,Indonesia,11,6,7,55,109
ESO,USA,3,2,68,2,11
ESO,USA,2,2,9,1,3
ESO,Poland,11,6,39,4,65
ESO,Germany,1,1,16,1,1
ESO,USA,14,11,90,1,14
ESO,Sweden,7,5,40,8,111
ESO,Ukraine,6,3,57,3,24
ESO,Ukraine,7,5,71,2,51
ESO,USA,5,4,63,5,16
ESO,SouthKorea,7,3,319,10,8
ESO,Russia,31,25,99,9,60
ESO,Turkey,71,71,123,24,93
ESO,USA,5,4,27,41,98
ESO,Norway,20,18,46,31,129
ESO,USA,5,4,25,4,16
ESO,Austria,3,3,7,4,39
ESO,Russia,19,17,71,2,42
ESO,Turkey,14,9,250,11,56
ESO,SouthKorea,22,23,50,5,37
ESO,China,15,10,41,12,28
ESO,Indonesia,22,23,50,5,37
ESO,Poland,5,2,27,5,3
```

```
ESO,Germany,5,3,18,2,13
ESO,Russia,17,11,666,37,98
ESO,Turkey,3,3,23,4,8
ESO,Denmark,5,4,21,1,14
ESO,Austria,19,17,79,15,33
ESO,Ukraine,3,2,35,1,12
ESO,China,3,2,35,1,12
ESO,Sweden,27,20,121,500,318
ESO,USA,8,4,113,6,21
ESO,Austria,20,20,97,3,31
ESO,Poland,9,6,28,5,292
ESO,Sweden,33,21,141,6,33
ESO,USA,10,7,47,3,10
ESO,USA,61,82,224,26,92
ESO,USA,10,7,71,6,42
ESO,USA,5,4,11,11,20
ESO,Norway,10,5,30,17,45
ESO,Denmark,4,4,7,1,29,
ESO,USA,4,3,9,6,31
ESO,USA,75,94,196,2,55
ESO,Austria,2,2,3,1,3
ESO,Turkey,6,4,68,5,11
ESO,USA,12,5,380,2,4
ESO,Ukraine,18,16,113,3,28
ESO,USA,16,18,111,1,20
ESO,China,3,2,43,1,1
ESO,Indonesia,2,3,2,5,10
ESO,Ukraine,34,31,155,8,46
ESO,Poland,4,2,26,5,6
ESO,USA,3,3,17,10,18
ESO,USA,6,4,53,10,7
F.E.A.R,Sweden,80,122,2393,36,635
F.E.A.R,Germany,74,88,135,101,287
F.E.A.R,Poland,32,31,852,60,122
F.E.A.R,Ukraine,23,29,316,14,52
F.E.A.R,Austria,27,29,119,8,75
F.E.A.R,Denmark,33,34,383,23,220
F.E.A.R,USA,19,14,213,10,44
F.E.A.R,USA,16,12,49,13,66
F.E.A.R,Norway,120,504,1252,97,106
F.E.A.R,Poland,53,90,343,23,32
F.E.A.R,Turkey,26,16,322,72,67
F.E.A.R,Russia,32,22,64,33,30
F.E.A.R,China,51,33,319,151,223
F.E.A.R,SouthKorea,13,9,410,2,19
F.E.A.R,USA,22,22,553,12,146
F.E.A.R,USA,24,31,171,14,248
F.E.A.R,Poland,25,31,171,14,248
F.E.A.R,Poland,22,14,131,133,57
F.E.A.R,Indonesia,40,53,309,4,44
F.E.A.R,USA,12,9,50,4,35
F.E.A.R,Sweden,10,3,486,3,5
F.E.A.R,Ukraine,14,11,131,1,9
F.E.A.R,Germany,17,11,155,21,101
F.E.A.R,Austria,40,52,78,25,35
F.E.A.R,Denmark,18,13,65,1,24
```

```
F.E.A.R,Turkey,32,31,468,3,19
F.E.A.R,Austria,7,4,114,3,4
F.E.A.R,Norway,20,17,440,17,26
F.E.A.R,Turkey,27,35,144,14,109
F.E.A.R,Denmark,46,35,144,14,109
F.E.A.R,Russia,24,19,514,346,389
F.E.A.R,China,52,49,162,63,19
F.E.A.R,SouthKorea,18,13,158,13,99
F.E.A.R,Sweden,33,36,317,14,62
F.E.A.R,USA,10,4,113,1,22
F.E.A.R,USA,39,50,227,16,84
F.E.A.R,Indonesia,16,10,607,3,37
F.E.A.R,Austria,24,18,210,17,154
F.E.A.R,Austria,115,108,1600,20,47
F.E.A.R,China,16,9,256,35,145
F.E.A.R,USA,24,25,412,32,99
F.E.A.R,USA,8,3,175,1,5
F.E.A.R,Germany,53,69,892,37,101
F.E.A.R,Norway,10,4,252,15,20
F.E.A.R,USA,43,44,292,18,53
F.E.A.R,USA,19,21,247,3,47
F.E.A.R,Turkey,19,7,1373,19,41
F.E.A.R,USA,52,42,159,7,32
F.E.A.R,China,30,24,443,15,211
F.E.A.R,SouthKorea,13,9,430,42,88
F.E.A.R,Russia,32,28,58,13,110
F.E.A.R,Ukraine,31,31,176,6,32
F.E.A.R,USA,12,7,178,161,295
F.E.A.R,Poland,10,6,51,10,78
F.E.A.R,Denmark,20,20,406,9,8
F.E.A.R,China,3,2,41,6,5
F.E.A.R,Russia,20,17,268,150,217
F.E.A.R,Austria,16,15,102,1,43
F.E.A.R,USA,30,36,278,26,98
F.E.A.R,Germany,28,20,215,7,90
F.E.A.R,Austria,30,34,182,7,27
F.E.A.R,SouthKorea,45,25,111,4,118
F.E.A.R,Poland,7,3,196,2,14
F.E.A.R,China,50,69,154,3,49
F.E.A.R,Sweden,6,16,15,38,147
F.E.A.R,USA,37,29,135,22,174
F.E.A.R,Indonesia,10,5,230,10,32
F.E.A.R,Indonesia,14,10,57,15,195
F.E.A.R,USA,21,20,99,4,68
F.E.A.R,Germany,20,15,396,1,187
F.E.A.R,Austria,34,57,446,2,25
F.E.A.R,Norway,76,75,314,12,185
F.E.A.R,China,37,37,82,21,49
F.E.A.R,Denmark,64,132,1419,20,35
F.E.A.R,Poland,44,61,158,24,12
F.E.A.R,Germany,43,61,1145,5,13
F.E.A.R,Austria,17,14,87,1,45
F.E.A.R,USA,27,25,598,10,92
F.E.A.R,USA,22,16,234,73,176
F.E.A.R,Turkey,42,71,465,30,41
F.E.A.R,China,33,34,75,19,60
```

```
F.E.A.R,Russia,53,39,172,10,22
F.E.A.R,SouthKorea,33,32,781,393,33
F.E.A.R,China,14,10,181,6,37
F.E.A.R,Austria,35,39,912,18,151
F.E.A.R,Germany,42,45,914,48,190
F.E.A.R,USA,24,24,163,44,32
F.E.A.R,USA,9,3,235,3,2
F.E.A.R,Turkey,10,6,34,6,8
F.E.A.R,USA,6,3,67,5,69
F.E.A.R,Russia,13,13,91,5,6
F.E.A.R,Norway,13,13,91,6,7
F.E.A.R,China,19,8,151,1,68
F.E.A.R,Sweden,98,220,742,33,136
F.E.A.R,USA,12,9,342,55,258
F.E.A.R,USA,8,4,209,1,30
F.E.A.R,USA,7,4,168,1,8
F.E.A.R,USA,11,6,26,5,120
F.E.A.R,USA,49,31,294,2,70
F.E.A.R,Ukraine,10,8,32,13,68
F.E.A.R,USA,12,10,51,5,22
F.E.A.R,Poland,46,41,129,29,79
F.E.A.R,Denmark,27,33,174,6,61
F.E.A.R,USA,26,26,264,3,32
F.E.A.R,Indonesia,22,17,128,37,251
F.E.A.R,USA,38,65,351,15,37
F.E.A.R,Norway,17,13,98,8,16
F.E.A.R,Austria,88,297,1371,124,239
F.E.A.R,Turkey,34,33,1298,141,152
F.E.A.R,China,12,8,161,10,49
F.E.A.R,Ukraine,10,8,70,19,135
F.E.A.R,Sweden,26,18,53,4,23
F.E.A.R,SouthKorea,56,79,1374,70,462
F.E.A.R,USA,74,105,181,18,148
F.E.A.R,Germany,7,5,27,4,26
F.E.A.R,Austria,28,38,500,25,175
F.E.A.R,Norway,9,6,118,1,11
F.E.A.R,Poland,17,14,266,2,12
F.E.A.R,USA,105,115,490,19,33
F.E.A.R,Russia,111,436,1880,101,304
F.E.A.R,Ukraine,10,4,297,3,32
F.E.A.R,Poland,29,36,170,12,147
F.E.A.R,China,131,509,3461,54,577
F.E.A.R,Turkey,32,25,401,2,21
F.E.A.R,Indonesia,24,23,290,22,11
F.E.A.R,USA,24,34,458,2,30
F.E.A.R,Sweden,24,29,307,13,37
F.E.A.R,USA,10,3,218,9,22
F.E.A.R,Germany,24,15,1513,434,272
F.E.A.R,Turkey,6,3,45,8,7
F.E.A.R,Poland,37,258,351,2,69
F.E.A.R,Denmark,8,5,78,7,44
F.E.A.R,Germany,101,289,3270,52,262
F.E.A.R,Austria,21,17,158,9,47
F.E.A.R,USA,41,56,1049,12,113
F.E.A.R,Denmark,24,26,149,33,52
F.E.A.R,SouthKorea,26,39,521,72,100
```

```
F.E.A.R,Austria,30,39,928,8,113
F.E.A.R,Germany,65,92,1296,19,103
F.E.A.R,USA,21,26,178,20,52
F.E.A.R,Norway,19,16,199,22,189
F.E.A.R,USA,36,26,343,6,17
F.E.A.R,USA,34,29,174,444,397
F.E.A.R,Ukraine,6,4,85,1,29
F.E.A.R,Austria,37,64,168,91,74
F.E.A.R,USA,15,17,151,2,9
F.E.A.R,Poland,16,13,110,10,43
F.E.A.R,China,32,26,306,5,36
F.E.A.R,Indonesia,28,38,234,343,200
F.E.A.R,USA,75,91,618,21,274
F.E.A.R,USA,24,20,255,33,346
F.E.A.R,Austria,11,38,156,1,33
F.E.A.R,Sweden,63,111,615,29,76
F.E.A.R,USA,14,10,436,14,175
F.E.A.R,USA,16,11,323,26,37
F.E.A.R,China,11,7,65,57,104
F.E.A.R,USA,33,32,168,32,58
F.E.A.R,Austria,3,2,32,1,2
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Conclusion:

To improve the accuracy, more attributes ('Last time online', 'Recently Played games', 'Wish list', 'Time spent online', 'Time of Login') and data (more number of steam profile data) can be added. However, a few of these attributes can be viewed by the server managers themselves, but not to other users, hence making it a very powerful tool in hands of the steam developers.

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GitHub Link:

https://github.com/YShaik9010/Datamining1463.git