



DEPARTMENT OF  
COMPUTER SCIENCE AND ENGINEERING

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**Title: Introduction to WEKA**

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ARTIFICIAL INTELLIGENCE LAB  
CSE 404



GREEN UNIVERSITY OF BANGLADESH

# 1 Objective(s)

- To understand WEKA tool usage to analysis training data.

## 2 WEKA Introduction

In order to experiment with the application, first we will run the program and we can see the window like figure 1. Now we will choose "Explorer" option and the next window in figure 2 will open where the data set needs to be presented to WEKA in a format the program understands. There are rules for the type of data that WEKA will accept and three options for loading data into the program.

- Open File- allows for the user to select files residing on the local machine or recorded medium
- Open URL- provides a mechanism to locate a file or data source from a different location specified by the user
- Open Database- allows the user to retrieve files or data from a database source provided by the user



Figure 1: WEKA GUI

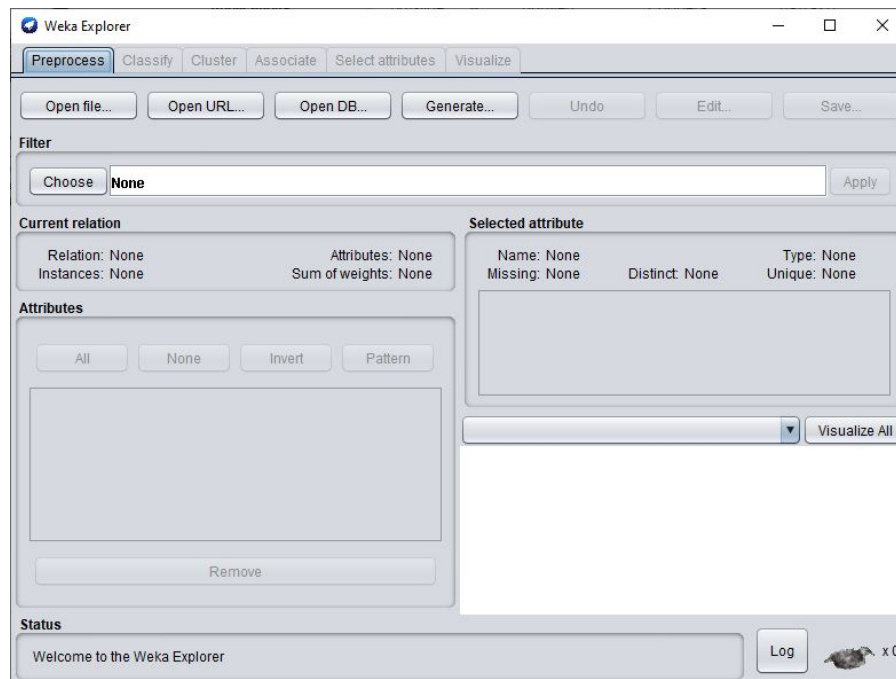


Figure 2: WEKA Explorer

## 2.1 Pre-processing

At the very beginning lets open a data file by the explorer form local machine. Usually after installation the default data files are located in C:\Program Files\Weka-3-8\data, if the WEKA installed version is Weka 3.8. Figure 3 is the opening of "*weather.numeric.arff*" using WEKA explorer and figure 4 is representing the contents of the file. The visual representation of the attributes and their counts are showing in figure 5 after opening the file. You can select different attributes by using cursor and see different visualization and count values of instances present in the data file.

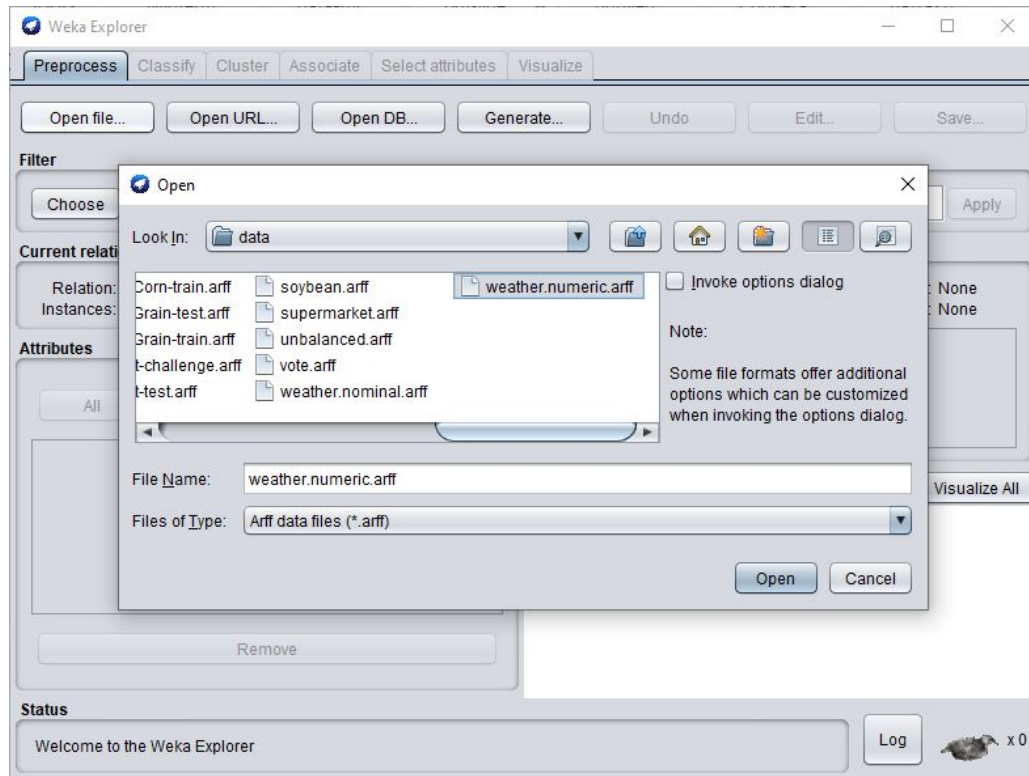


Figure 3: Opening "weather.numeric.arff" file

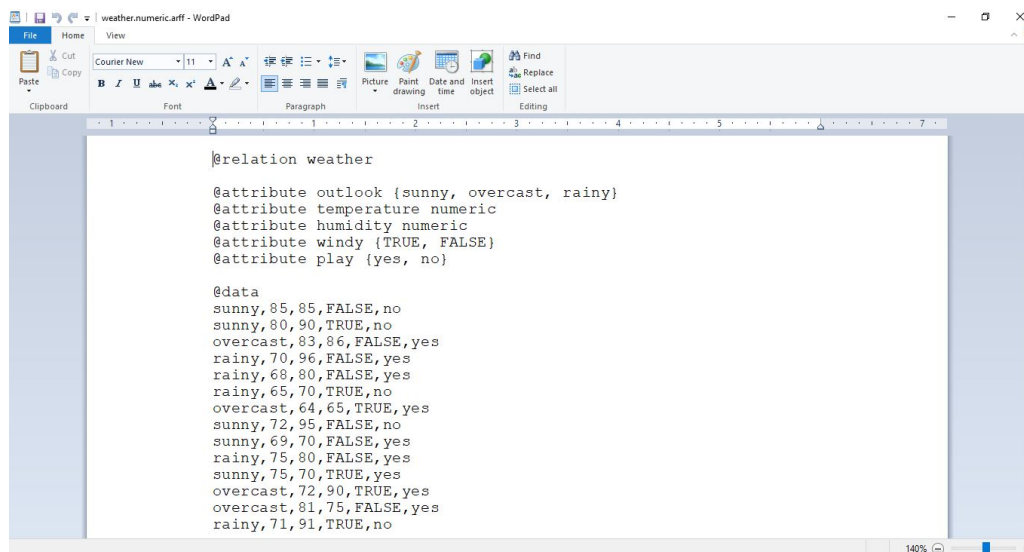


Figure 4: Contents of "weather.numeric.arff" file

## 2.2 Classification

The user has the option of applying many different algorithms to the data set in order to produce a representation of information. The best approach is to independently apply a mixture of the available choices and see what yields something close to the desired results. The Classify tab is where the user selects the classifier choices. Following output subsection shows some of the categories.

### 2.2.1 Output

```

1  === Run information ===
2
3  Scheme:      weka.classifiers.rules.ZeroR
4  Relation:    weather
5  Instances:   14
6  Attributes:  5
7               outlook
8               temperature
9               humidity
10              windy
11              play
12 Test mode:    10-fold cross-validation
13
14 === Classifier model (full training set) ===
15
16 ZeroR predicts class value: yes
17
18 Time taken to build model: 0 seconds
19
20 === Stratified cross-validation ===
21 === Summary ===
22
23 Correctly Classified Instances      9           64.2857 %
24 Incorrectly Classified Instances    5           35.7143 %
25 Kappa statistic                     0
26 Mean absolute error                 0.4762
27 Root mean squared error             0.4934
28 Relative absolute error             100          %
29 Root relative squared error         100          %

```

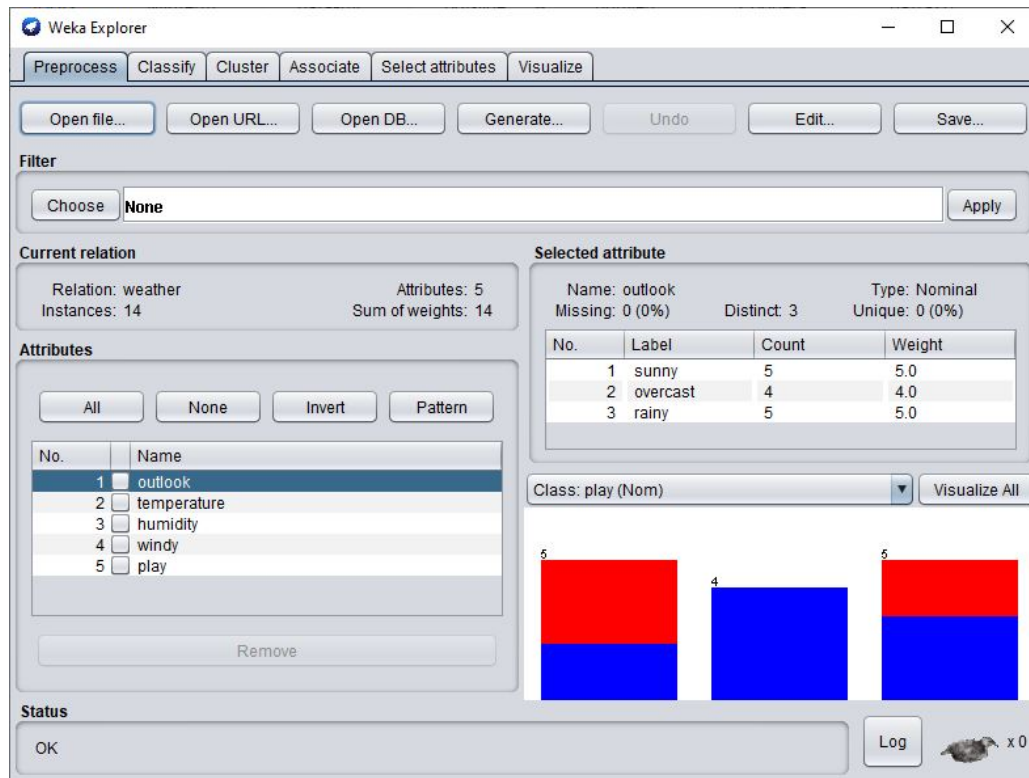


Figure 5: Visual representation of the attributes of "weather.numeric.arff" file

```

30 | Total Number of Instances          14
31 |
32 | === Detailed Accuracy By Class ===
33 |
34 |           TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC
35 |           Area    PRC Area   Class
36 |           1.000    1.000    0.643    1.000    0.783      0.000    0.178
37 |           0.000    0.000    0.000    0.000    0.000      0.000    0.178
38 |           0.555    0.318    yes
39 | Weighted Avg.    0.643    0.643    0.413    0.643    0.503      0.000    0.178
40 |           0.470
41 |
42 | === Confusion Matrix ===
43 |  a b   <-- classified as
44 |  9 0 | a = yes
45 |  5 0 | b = no

```

## 2.3 Clustering

The Cluster tab opens the process that is used to identify commonalities or clusters of occurrences within the data set and produce information for the user to analyze. There are a few options within the cluster window that are similar to those described in the Classify tab. These options are: use training set, supplied test set and percentage split. The fourth option is classes to cluster evaluation, which compares how well the data compares with a pre-assigned class within the data. While in cluster mode, users have the option of ignoring some of the attributes from the data set. This can be useful if there are specific attributes causing the results to be out of range, or for large data sets. Following output subsection shows the Cluster window and some of its options.

### 2.3.1 Output

```
1  === Run information ===
2
3  Scheme:          weka.clusterers.EM -I 100 -N -1 -X 10 -max -1 -ll-cv 1.0E-6 -ll-
   iter 1.0E-6 -M 1.0E-6 -K 10 -num-slots 1 -S 100
4  Relation:        weather
5  Instances:        14
6  Attributes:        5
7                     outlook
8                     temperature
9                     humidity
10                    windy
11                    play
12  Test mode:        evaluate on training data
13
14  === Clustering model (full training set) ===
15
16  EM
17  ==
18  Number of clusters selected by cross validation: 1
19  Number of iterations performed: 2
20
21                Cluster
22  Attribute          0
23                    (1)
24  =====
25  outlook
26    sunny              6
27    overcast           5
28    rainy              6
29    [total]           17
30  temperature
31    mean              73.5714
32    std. dev.         6.3326
33
34  humidity
35    mean              81.6429
36    std. dev.         9.9111
37
38  windy
39    TRUE               7
40    FALSE             9
41    [total]           16
42  play
43    yes               10
44    no                6
45    [total]           16
46
47  Time taken to build model (full training data) : 0.13 seconds
48
49  === Model and evaluation on training set ===
50
51  Clustered Instances
52  0      14 (100%)
53
54  Log likelihood: -9.4063
```

## 2.4 Association

The associate tab opens a window to select the options for associations within the data set. The user selects one of the choices and presses start to yield the results. There are few options for this window and one of the most popular, Apriori, is shown in output subsection given below.

### 2.4.1 Output

```
1 === Run information ===
2
3 Scheme:          weka.associations.FilteredAssociator -F "weka.filters.MultiFilter
   -F \"weka.filters.unsupervised.attribute.ReplaceMissingValues \" -c -1 -W
   weka.associations.Apriori -- -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
   -c -1
4 Relation:        weather
5 Instances:       14
6 Attributes:      5
7                  outlook
8                  temperature
9                  humidity
10                 windy
11                 play
```

## 2.5 Selecting Attributes

The next tab is used to select the specific attributes used for the calculation process. By default all of the available attributes are used in the evaluation of the data set. If the user wanted to exclude certain categories of the data they would deselect those specific choices from the list in the cluster window. This is useful if some of the attributes are of a different form such as alphanumeric data that could alter the results. The software searches through the selected attributes to decide which of them will best fit the desired calculation. To perform this, the user has to select two options, an attribute evaluator and a search method. Once this is done the program evaluates the data based on the subset of the attributes, then it performs the necessary search for commonality with the date. Figure 8 shows the opinions of attribute evaluation.

### 2.5.1 Output

```
1 === Run information ===
2
3 Evaluator:       weka.attributeSelection.CfsSubsetEval -P 1 -E 1
4 Search:          weka.attributeSelection.BestFirst -D 1 -N 5
5 Relation:        weather
6 Instances:       14
7 Attributes:      5
8                  outlook
9                  temperature
10                 humidity
11                 windy
12                 play
13 Evaluation mode:  evaluate on all training data
14
15 === Attribute Selection on all input data ===
16
17 Search Method:
18   Best first.
19   Start set: no attributes
20   Search direction: forward
21   Stale search after 5 node expansions
22   Total number of subsets evaluated: 11
```

```

23 | Merit of best subset found:      0.196
24 |
25 | Attribute Subset Evaluator (supervised, Class (nominal): 5 play):
26 |   CFS Subset Evaluator
27 |   Including locally predictive attributes
28 |
29 | Selected attributes: 1,4 : 2
30 |                       outlook
31 |                       windy

```

## 2.6 Visualization

The last tab in the window is the visualization tab which is shown in figure 6. Using the other tabs in the program, calculations and comparisons have occurred on the data set. Selections of attributes and methods of manipulation have been chosen. The final piece of the puzzle is looking at the information that has been derived throughout the process. The user can now actually see the data displayed in a two dimensional representation of the information. The first screen that the user sees when they select the visualization option is a matrix of plots representing the different attributes within the data set plotted against the other attributes. If a lot of attributes are selected, there is a scroll bar to view all of the produced plots. The user can select a specific plot from the matrix to analyze its contents in a larger, popup window. A grid pattern of the plots allows the user to select the attribute positioning to their liking for better understanding. Once a specific plot has been selected, the user can change the attributes from one view to another.

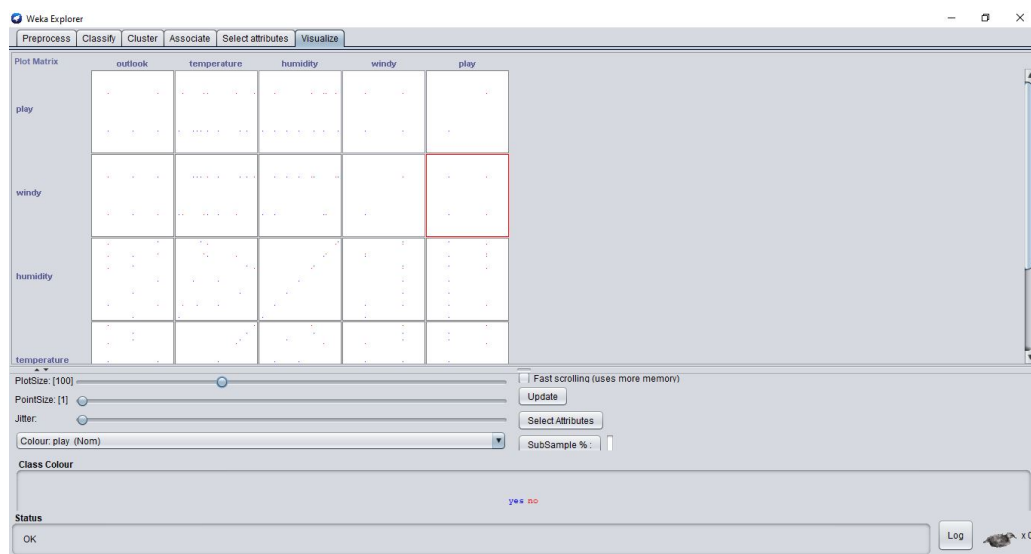


Figure 6: Visualization tab

## 3 Discussion & Conclusion

Based on the focused objective(s) to understand the use of WEKA tool and practice classification, clustering and attribute selection etc. The additional lab exercise will increase confidence towards the fulfilment of the objectives(s).

## 4 Lab Exercise

- Open new data file and configure WEKA for that particular file. Now run the above mentioned methods in section 2 observe the results and generate inner reflection.
- Lab report will be given in the next lab after other experiment on WEKA.



## 5 Policy

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