EXERCISE -5

(i) Implement the Classification using Decision Tree algorithm on 'Weather' dataset. Draw the confusion matrix and report the model with accuracy.
(ii) Implement Bayesian Classification and analyze the results on 'iris' Dataset.

5.1.1 Problem Statement:

Implement the Classification using Decision Tree algorithm on 'Weather' dataset. Draw the confusion matrix and report the model with accuracy.

5.1.2 Description:

About Dataset used

The weather data is a small open data set with only 14 examples.
In RapidMiner it is named Golf Dataset, whereas Weka has two data set: weather.nominal.arff and weather.numeric.arff
The dataset contains data about weather conditions are suitable for playing a game of golf.
the original dataset that only has 5 variables:
1.outlook
2.temperature
3.humidity
4.windy
5.play

About Arff:

An ARFF (Attribute-Relation File Format) file is an ASCII text file that describes a list of instances sharing a set of attributes.

ARFF files have two distinct sections. The first section is the **Header** information, which is followed the **Data** information.

The **Header** of the ARFF file contains the name of the relation, a list of the attributes (the columns in the data), and their types.

Lines that begin with a % are comments. The **@RELATION**, **@ATTRIBUTE** and **@DATA** declarations are case insensitive.

About CSV:

Files with .csv (Comma Separated Values) extension represent plain text files that contain records of data with comma separated values. Each line in a CSV file is a new record from the set of records contained in the file. Such files are generated when data transfer is intended from one storage system to another. Since all applications can recognize records separated by comma, import of such data files to database is done very conveniently. Almost all spreadsheet applications such as Microsoft Excel or OpenOffice Calc can import CSV without much effort. Data imported from such files is arranged in cells of a spreadsheet for representation to user.

Datatypes that are supported by Weka:

- numeric
- integer is treated as numeric
- real is treated as numeric
- [nominal-specification]
- string
- date [date-format]
- relational for multi-instance data (for future use)

where [nominal-specification] and [date-format] are defined below. The keywords **numeric**, **real**, **integer**, **string** and **date** are case insensitive.

Numeric attributes
Numeric attributes can be real or integer numbers.

Nominal attributes
Nominal values are defined by providing an [nominal-specification] listing the possible values: {[nominal-name1], [nominal-name2], [nominal-name3], ...}

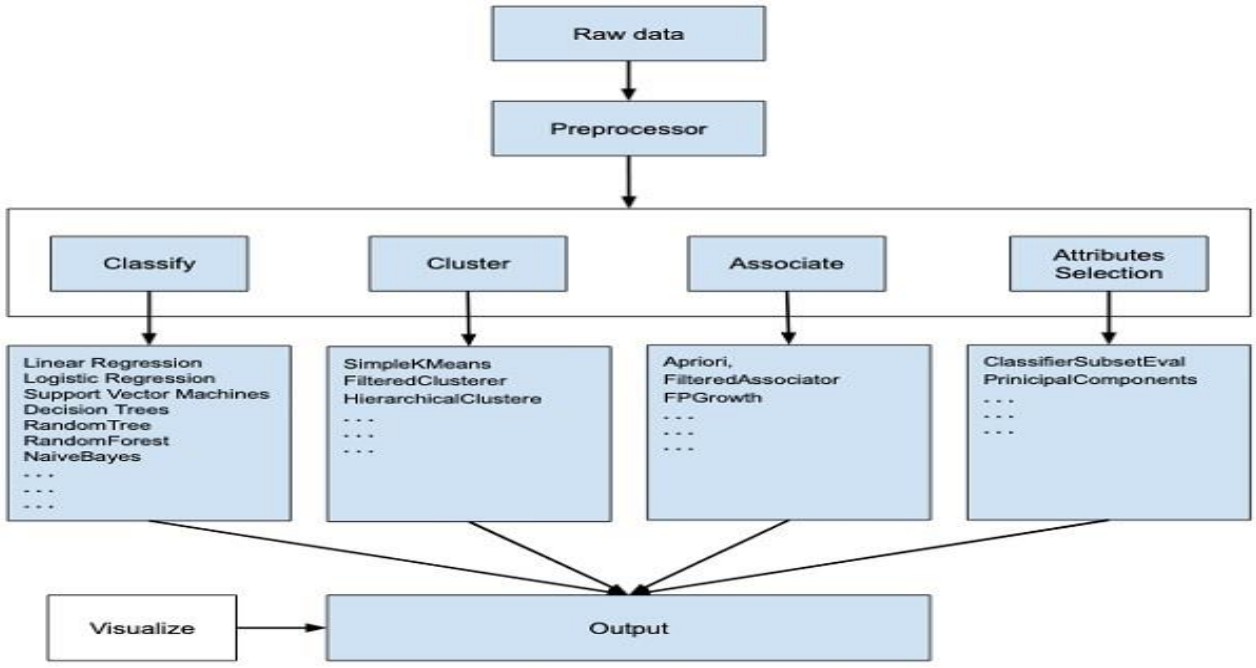
For example, the class value of the Iris dataset can be defined as follows:

```
@ATTRIBUTE class       {Iris-setosa,Iris-versicolor,Iris-virginica}
```

Values that contain spaces must be quoted.

About WEKA Software:

WEKA - an opensource software provides tools for data preprocessing, implementation of several Machine Learning algorithms, and visualization tools so that you can develop machine learning techniques and apply them to real-world data mining problems. What WEKA offers is summarized in the following diagram −



If you observe the beginning of the flow of the image, you will understand that there are many stages in dealing with Big Data to make it suitable for machine learning

First, you will start with the raw data collected from the field. This data may contain several null values and irrelevant fields. You use the data preprocessing tools provided in WEKA to cleanse the data.

Then, you would save the preprocessed data in your local storage for applying ML algorithms.

Next, depending on the kind of ML model that you are trying to develop you would select one of the options such as **Classify, Cluster**, or **Associate**. The **Attributes Selection** allows the automatic selection of features to create a reduced dataset.

Note that under each category, WEKA provides the implementation of several algorithms. You would select an algorithm of your choice, set the desired parameters and run it on the dataset.

Then, WEKA would give you the statistical output of the model processing. It provides you a visualization tool to inspect the data.

The various models can be applied on the same dataset. You can then compare the outputs of different models and select the best that meets your purpose.

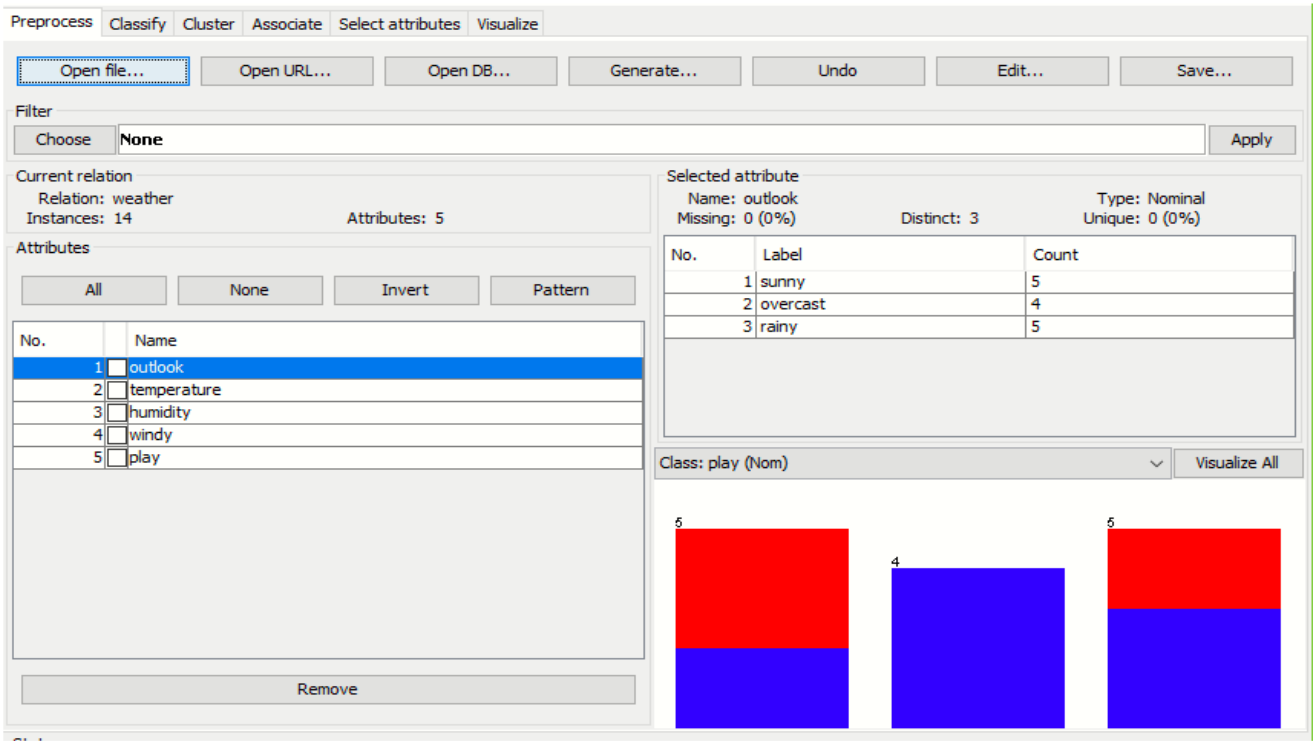
Thus, the use of WEKA results in a quicker development of machine learning models on the whole.

Now that we have seen what WEKA is and what it does, in the next chapter let us learn how to install WEKA on your local computer

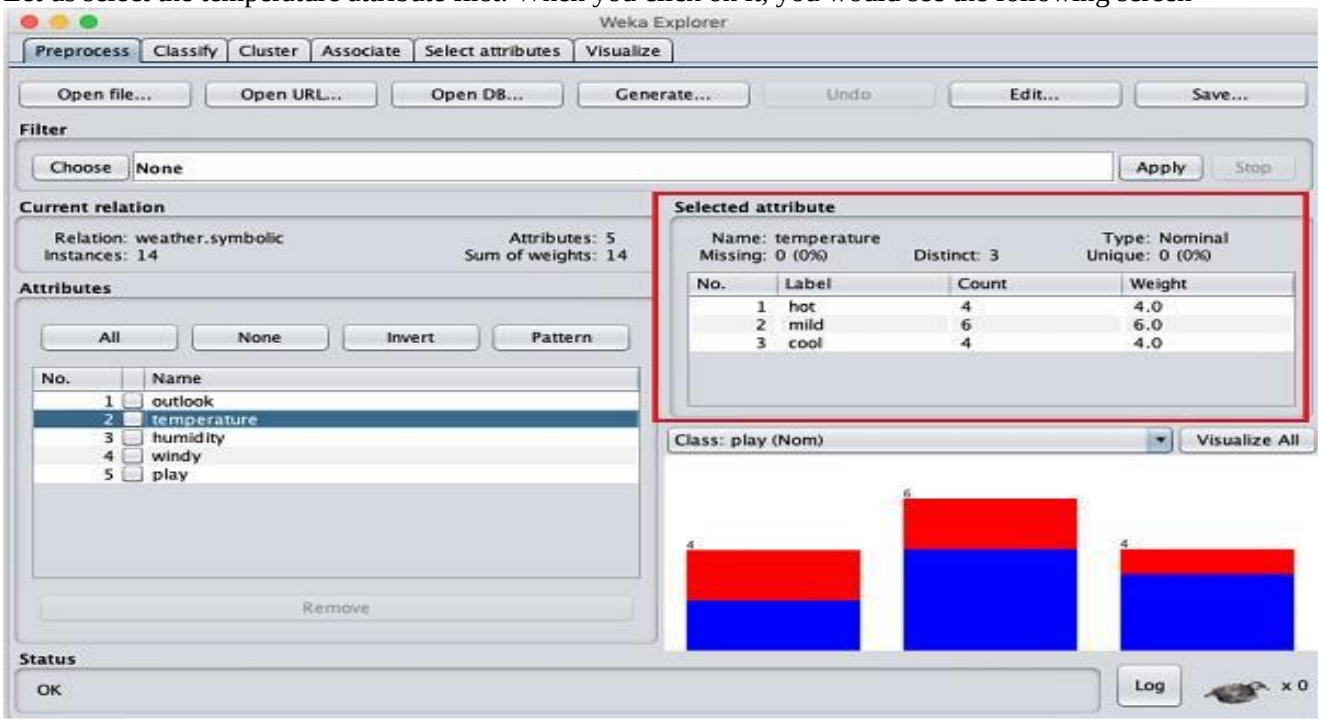
5.1.3 Steps to implement the classification:

1.To classify the Weather database using Decision Tree algorithm.

So first open the file by using the **Open file** ... option and select the **weather-numeric.arff** file.

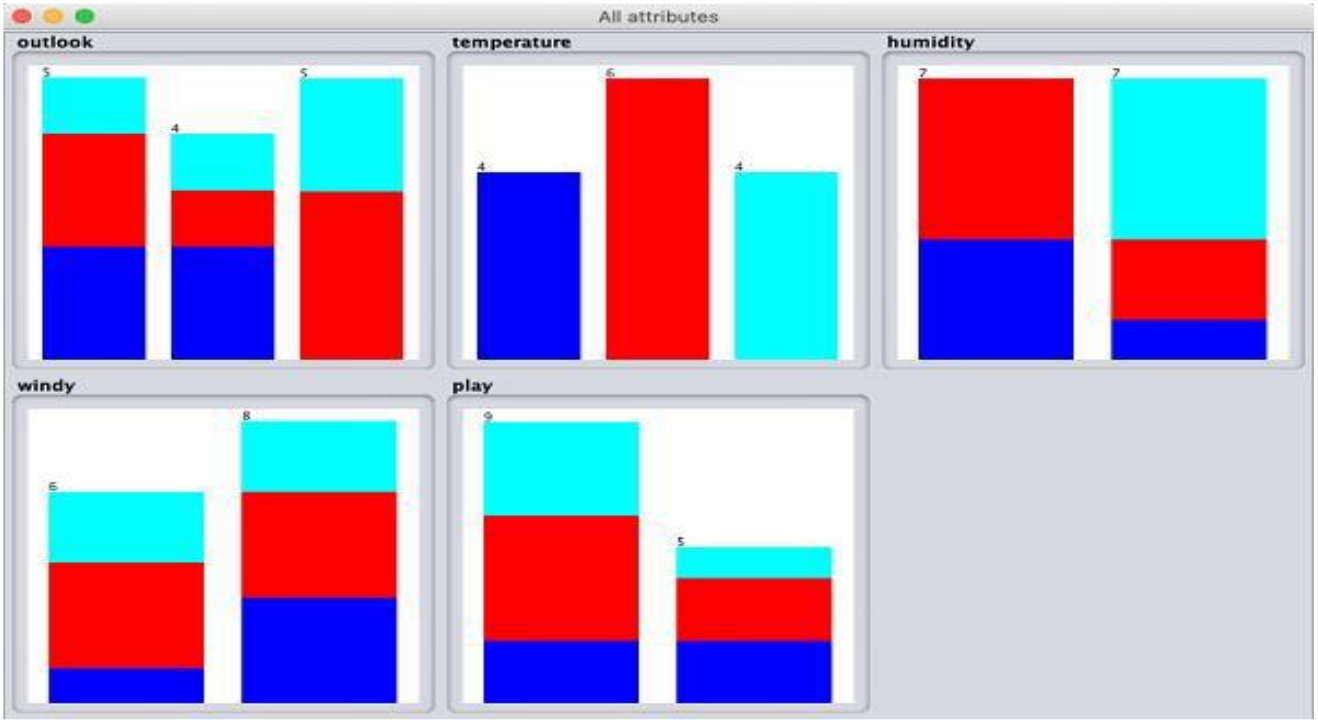


2. The **weather** database contains five fields - outlook, temperature, humidity, windy and play. When you select an attribute from this list by clicking on it, further details on the attribute itself are displayed on the right hand side.
Let us select the temperature attribute first. When you click on it, you would see the following screen −

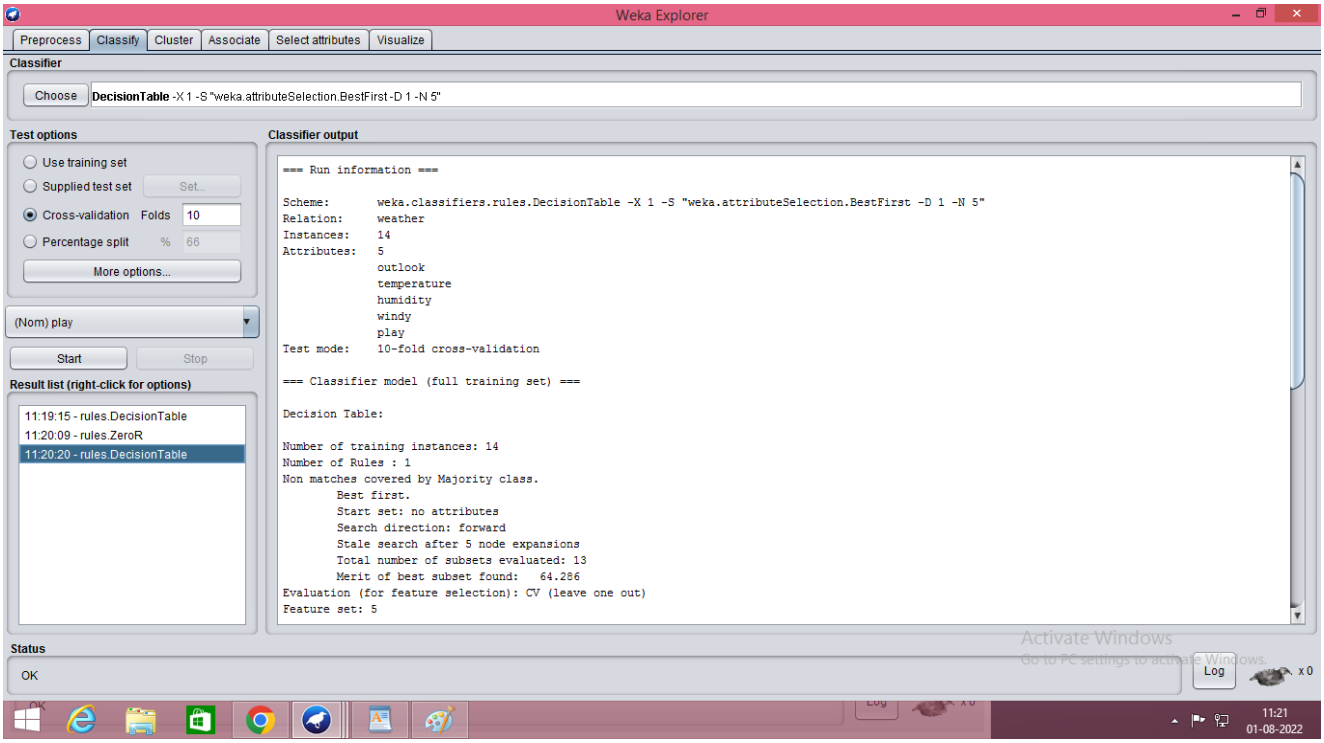


At the bottom of the window, you see the visual representation of the **class** values.

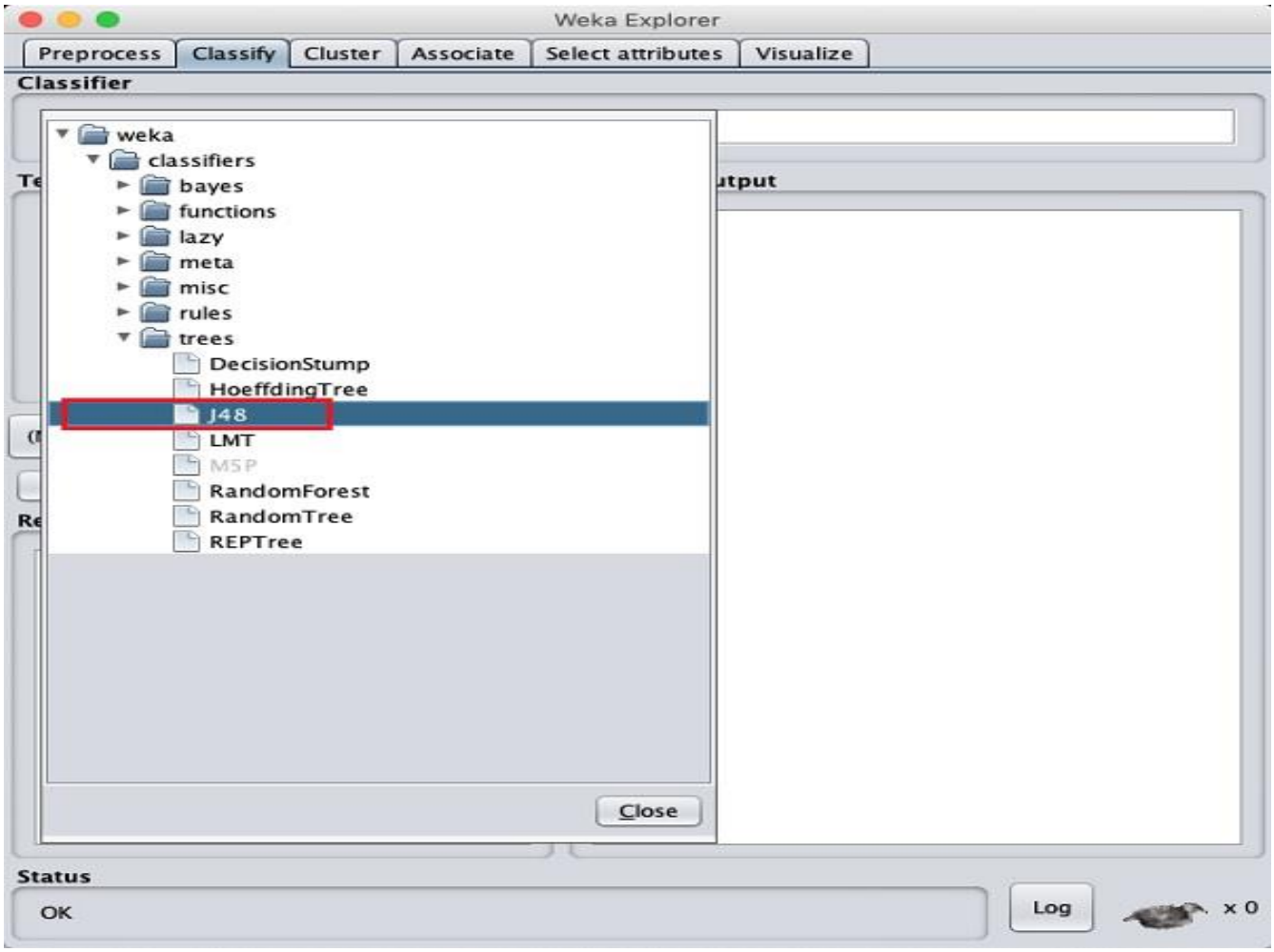
If you click on the **Visualize All** button, you will be able to see all features in one single window as shown here



3. Now to classify the **weather** database select and open classify option

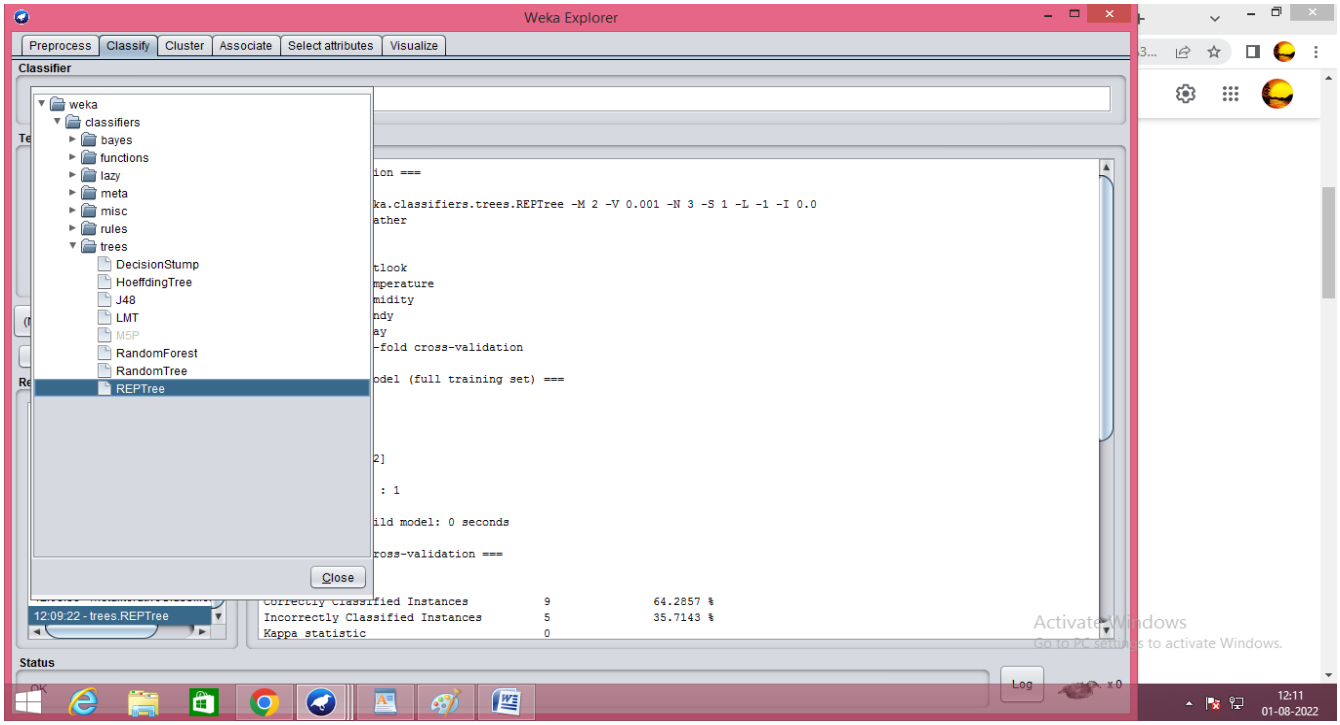


There are many classification methods are available in weka software some of them are bayes, meta, trees, lazy, rules ect..



4. According to the problem we are implementing and classifying weather dataset using Decision tree algorithm.

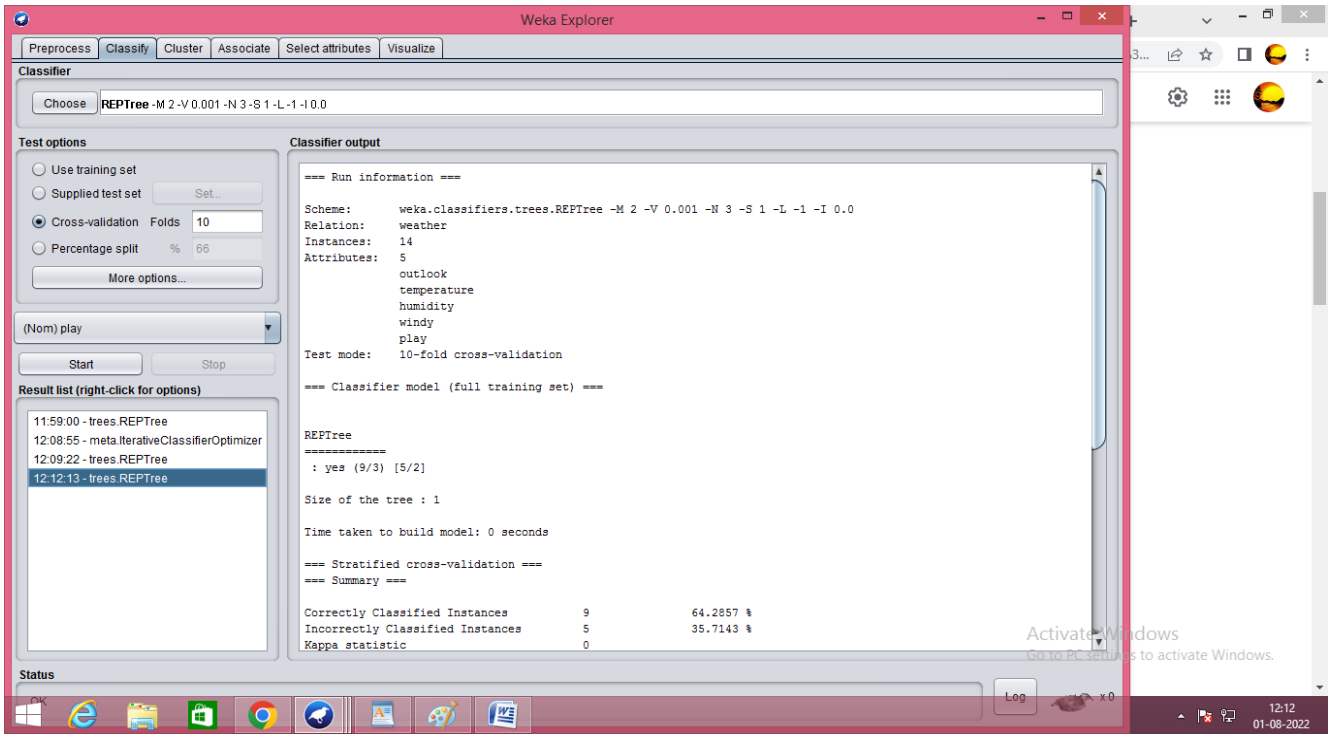
So, select choose and select anyone of the classification methods in weka.

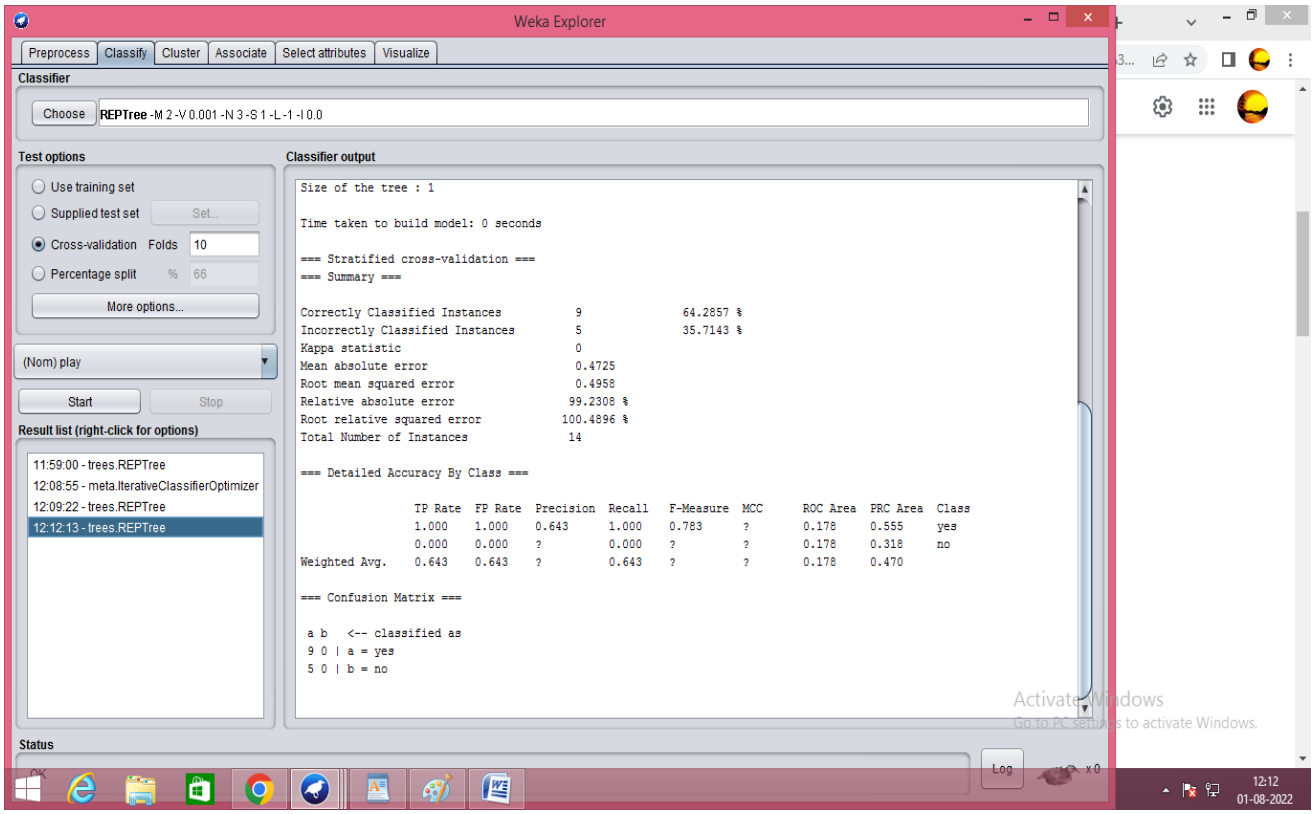


5. click on start to apply selected classification method to dataset.

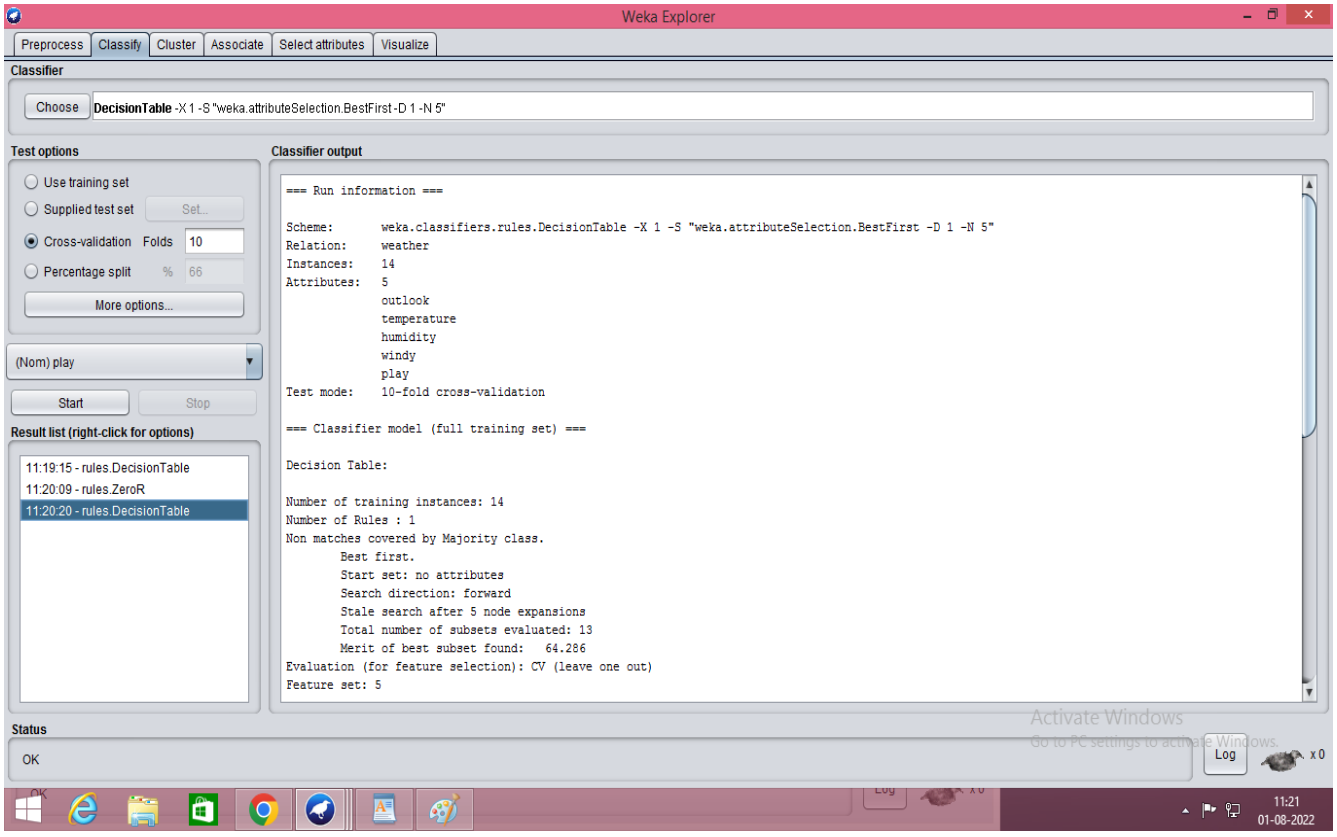
Then it will display all the details like about Attributes, Instances, size of tree Accuracy by class, corelation, confusion Matrix etc..

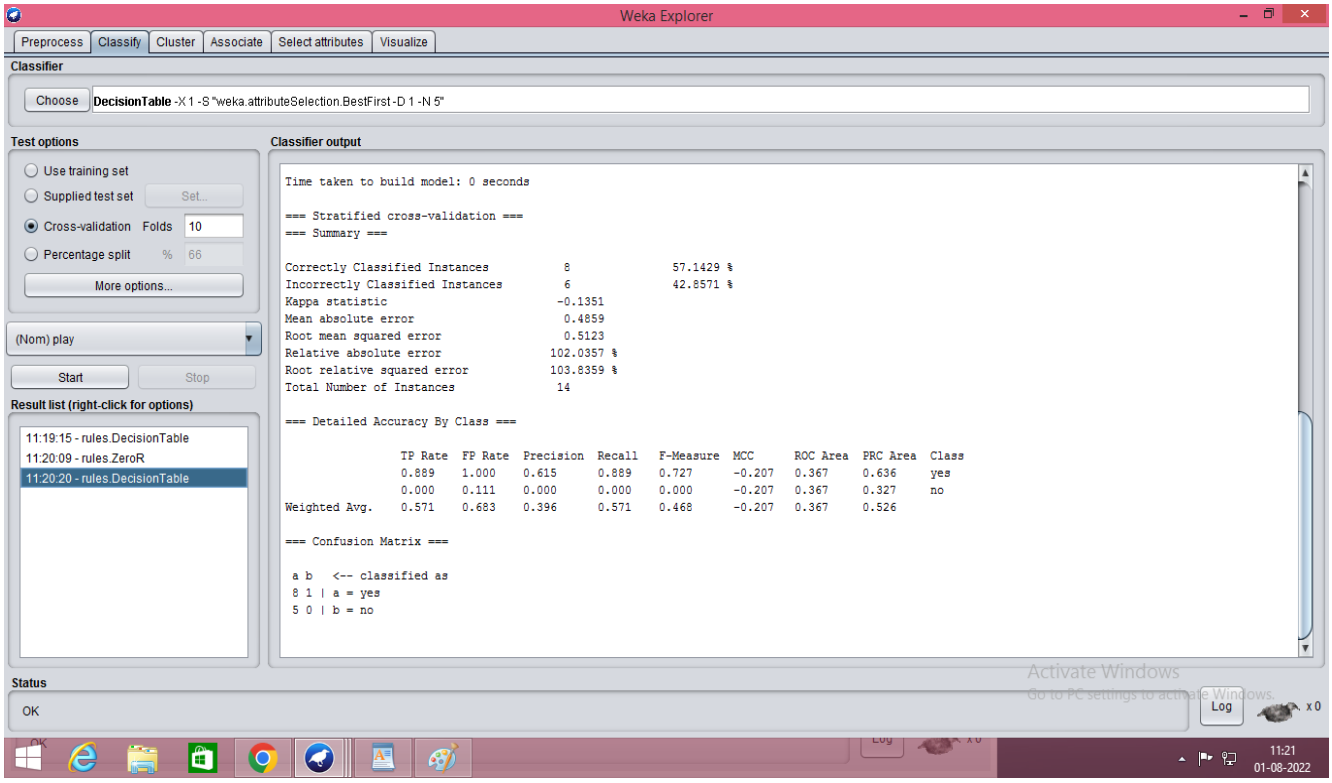
i) RETTree Classifier



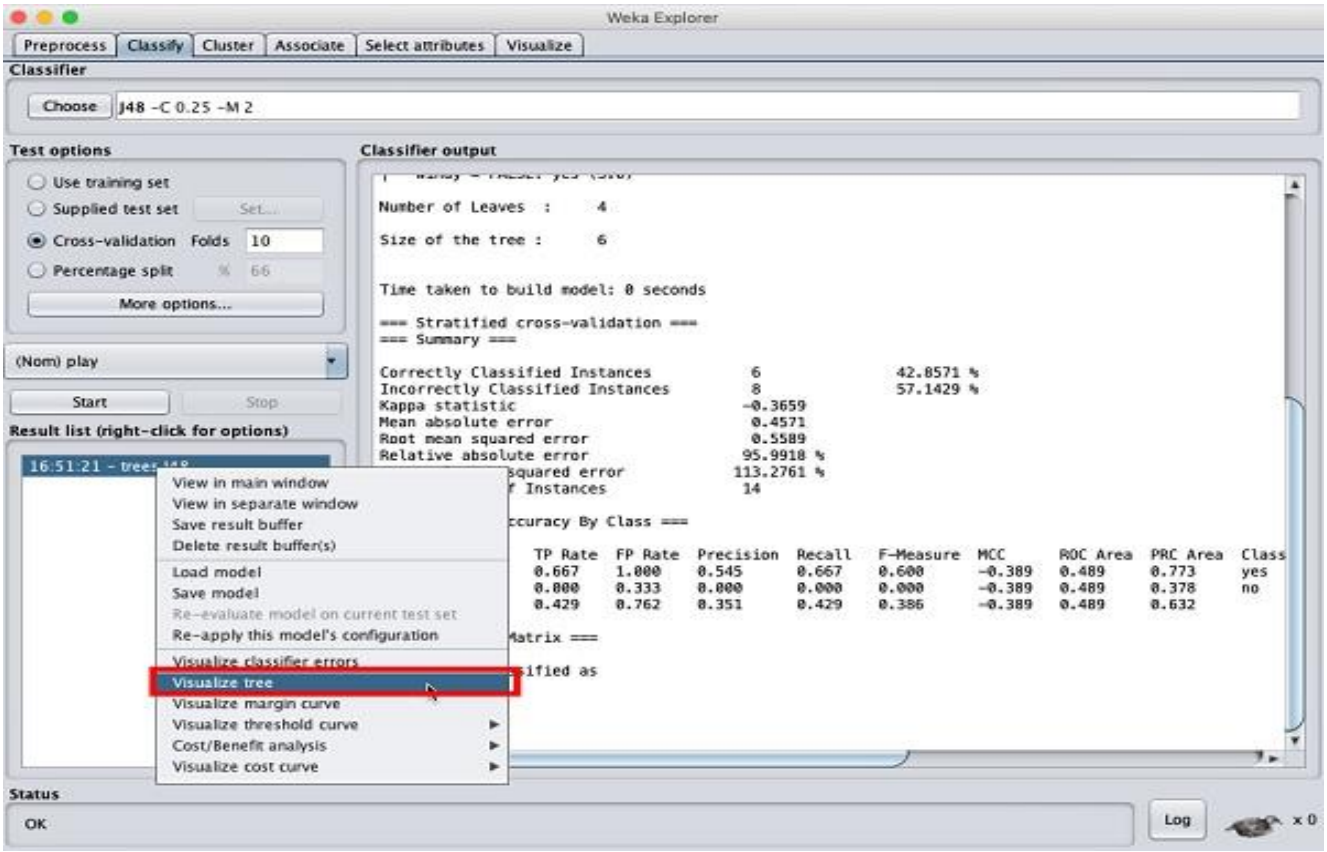


ii) Decision Tree Classifier:



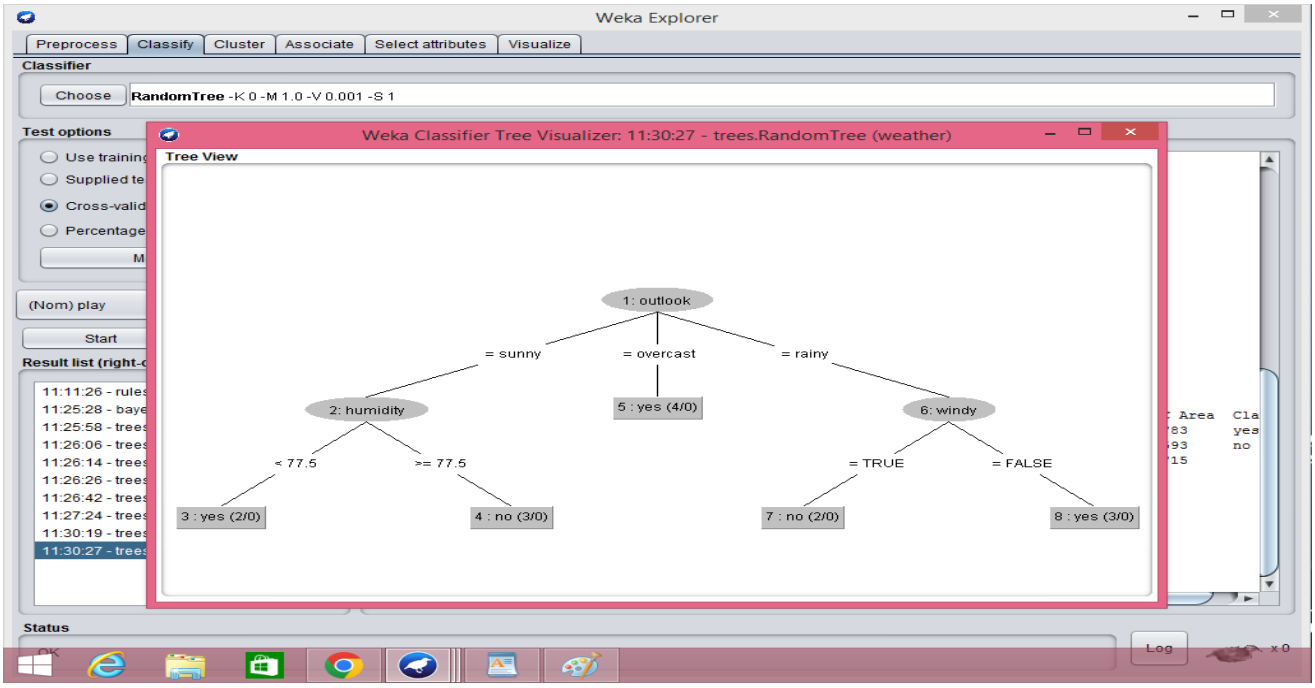


6. If you want to Visualize the tree under start button we have result list in that you can see all the list of classifications you done.



7. Now Right click on one classify method their it will display many options in that select Visualize tree

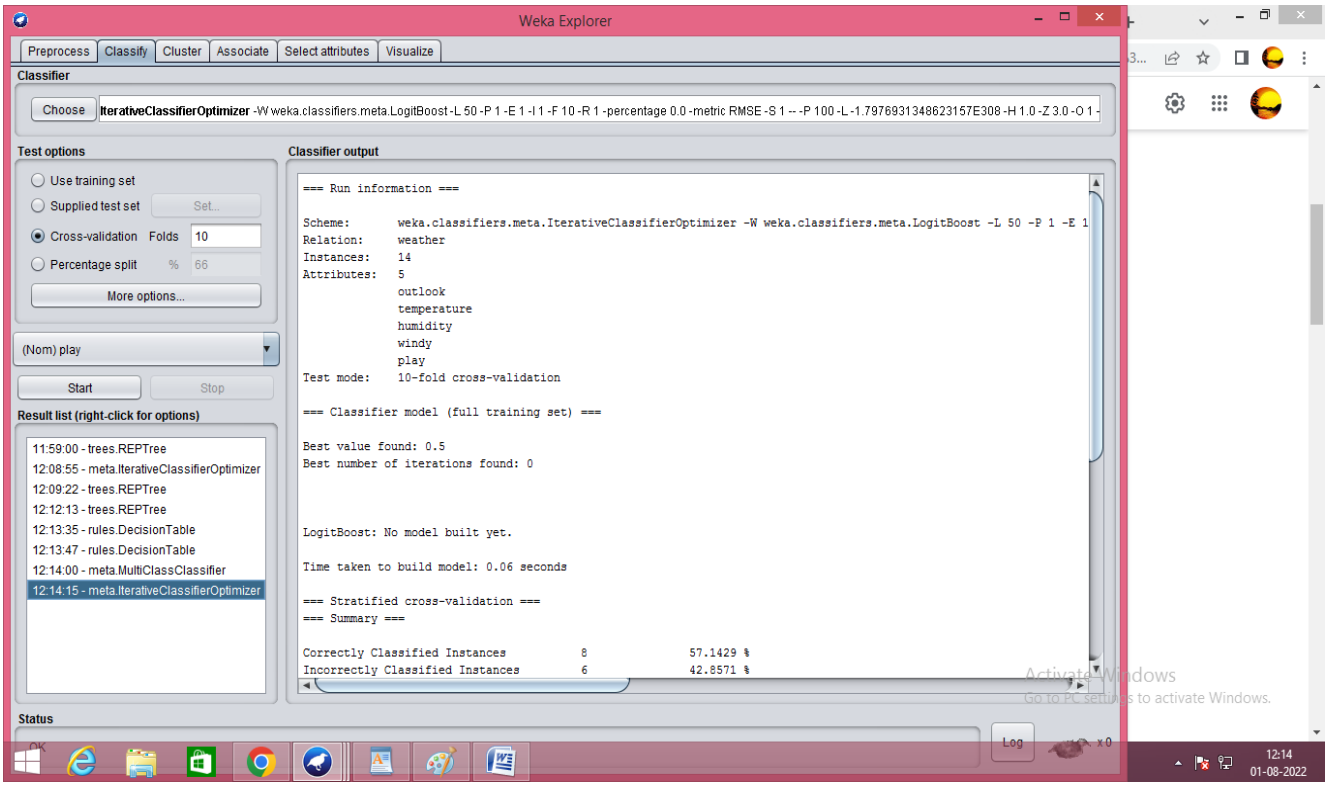
Automatically the tree will display.

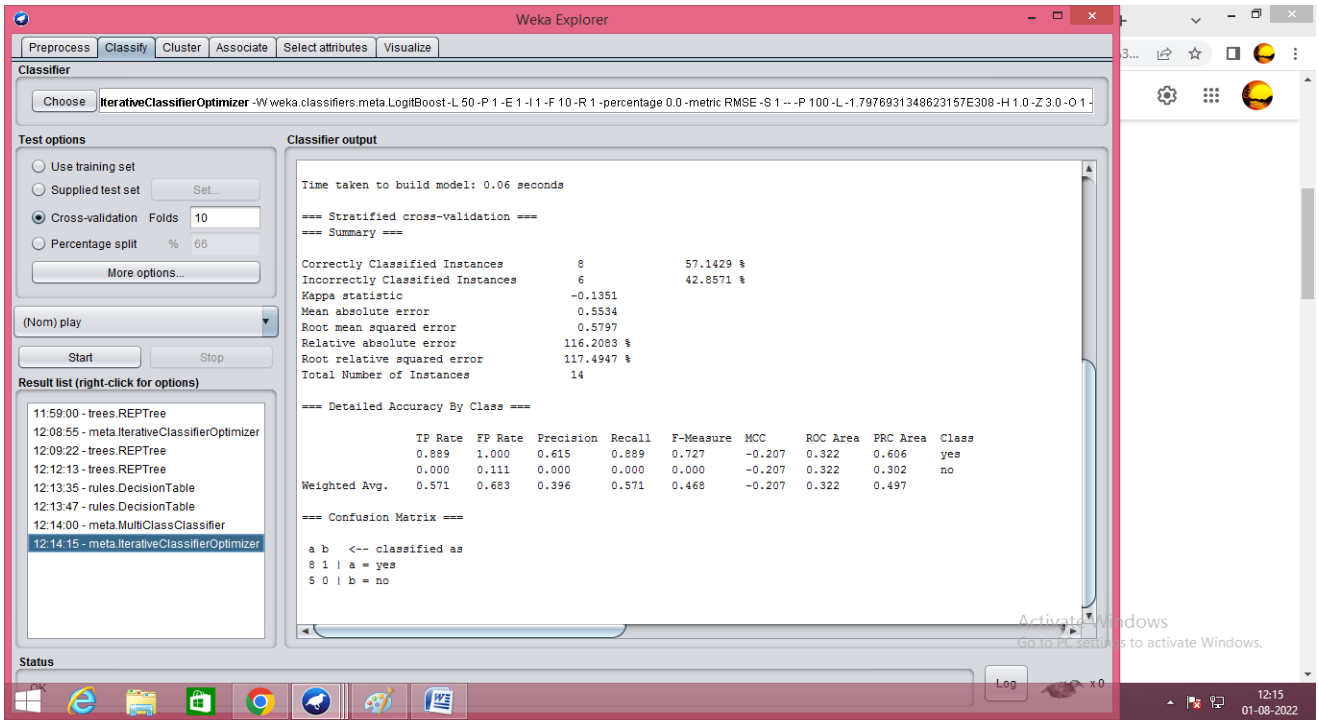


8.In weka software Meta Classifier will give best results with high accuracy

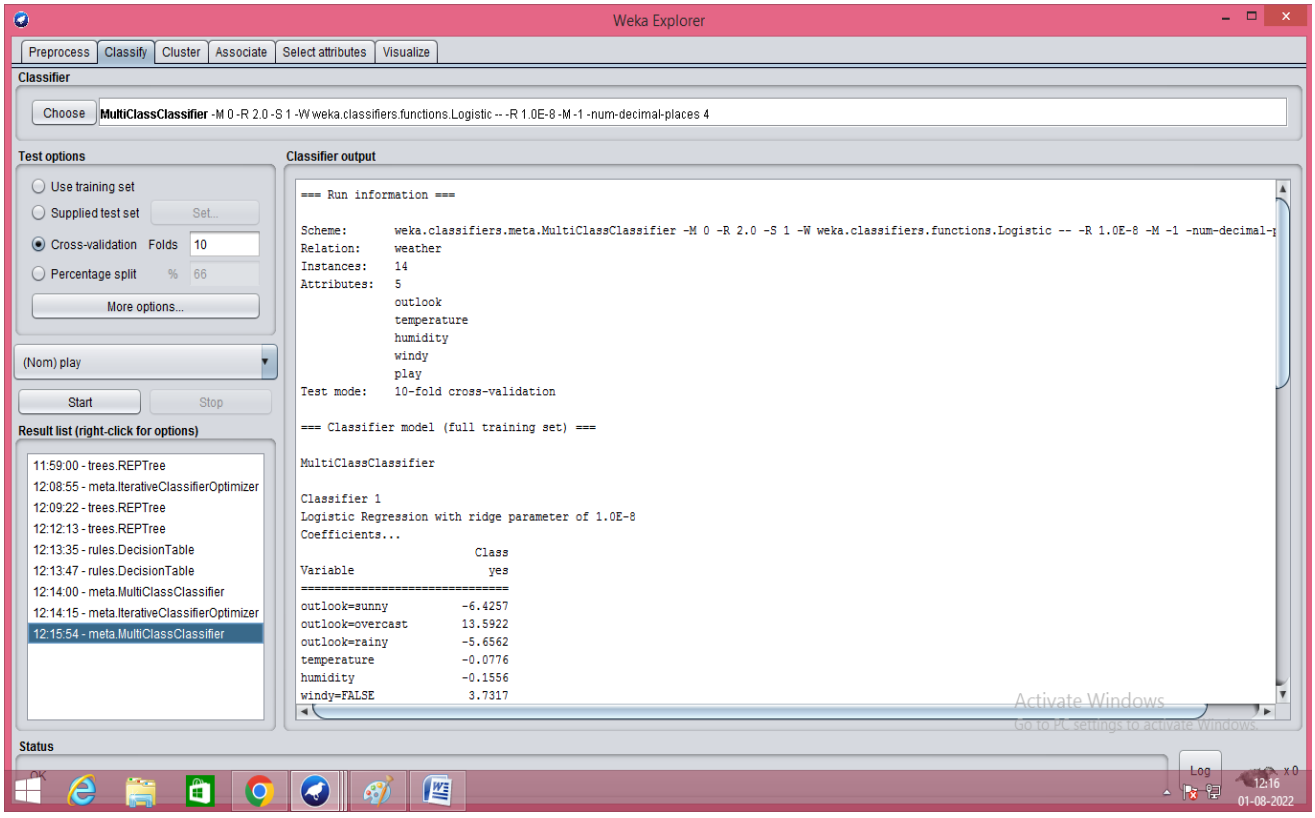
Let us classify the weather dataset by using some of the models of meta classifier.

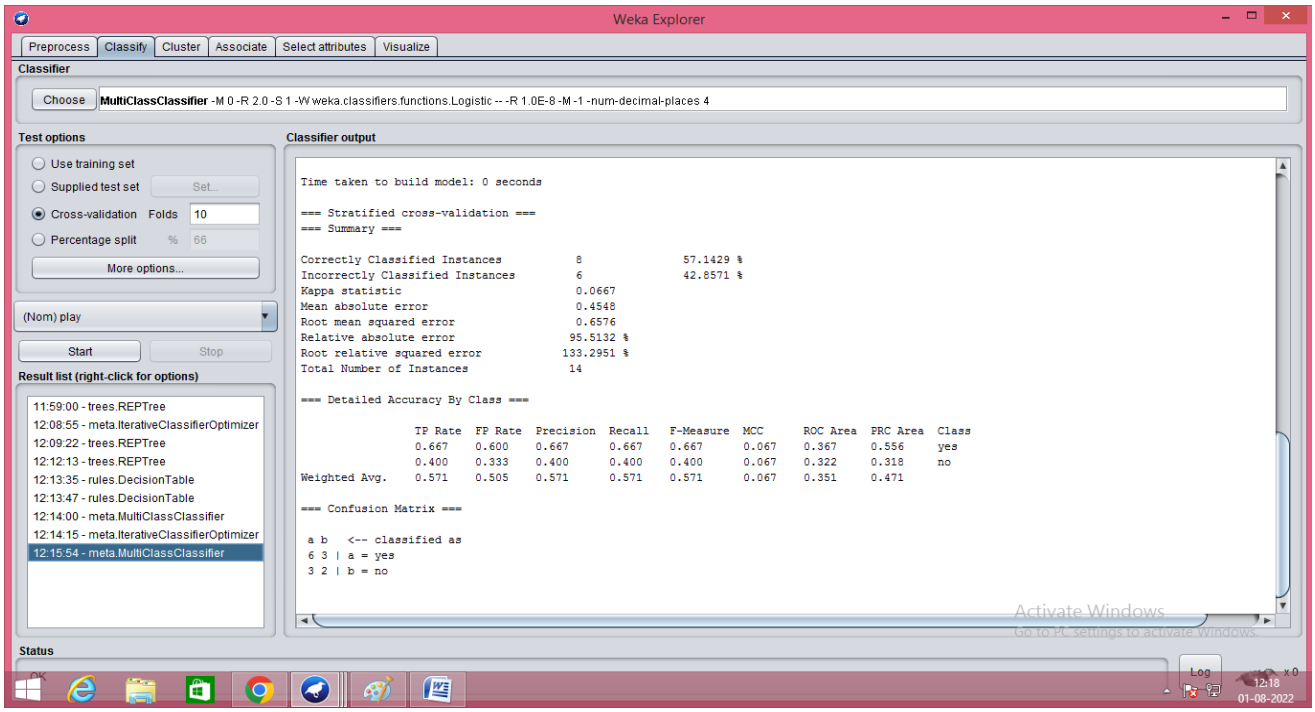
iii) Iterative classifier Optimizer





iv) MultiClassClassifier



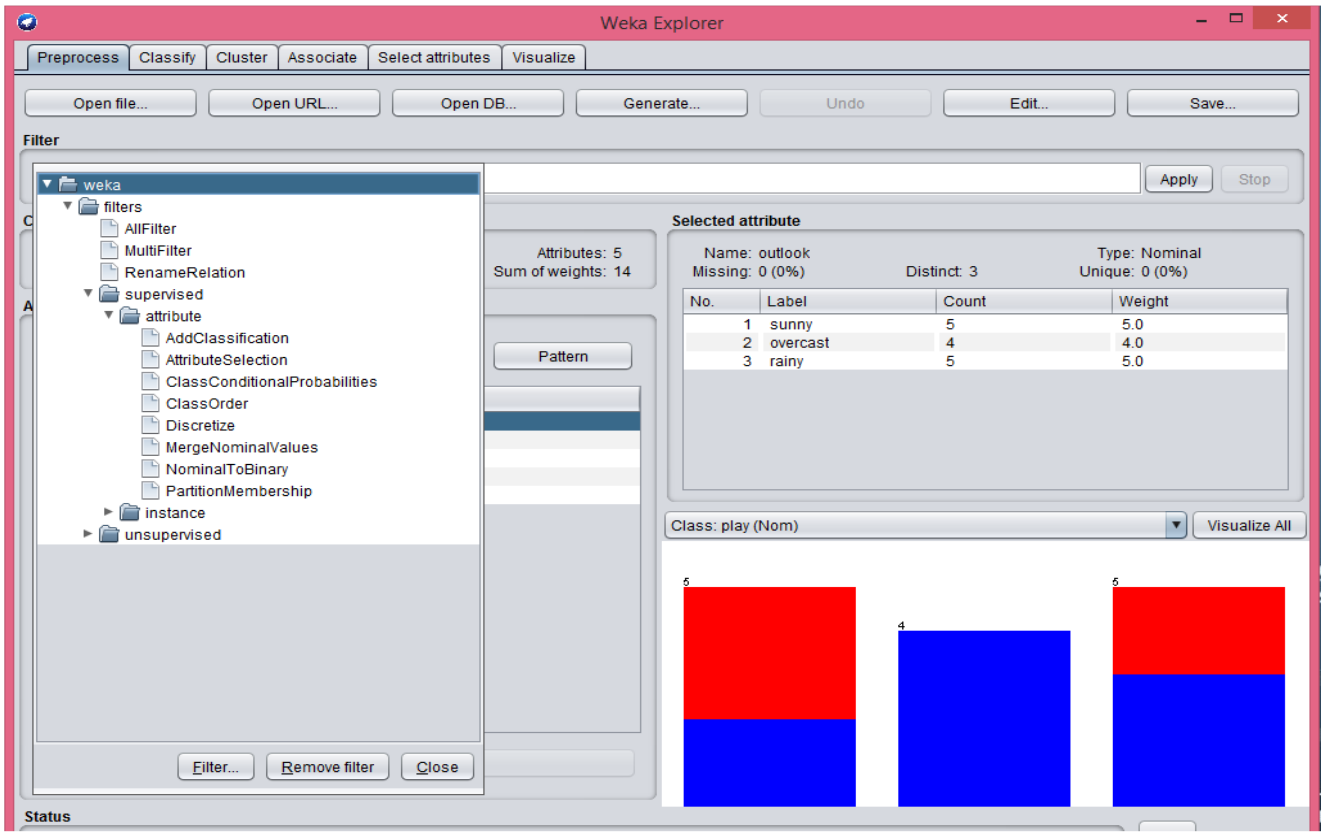


9. All the above classification is done without preprocessing.

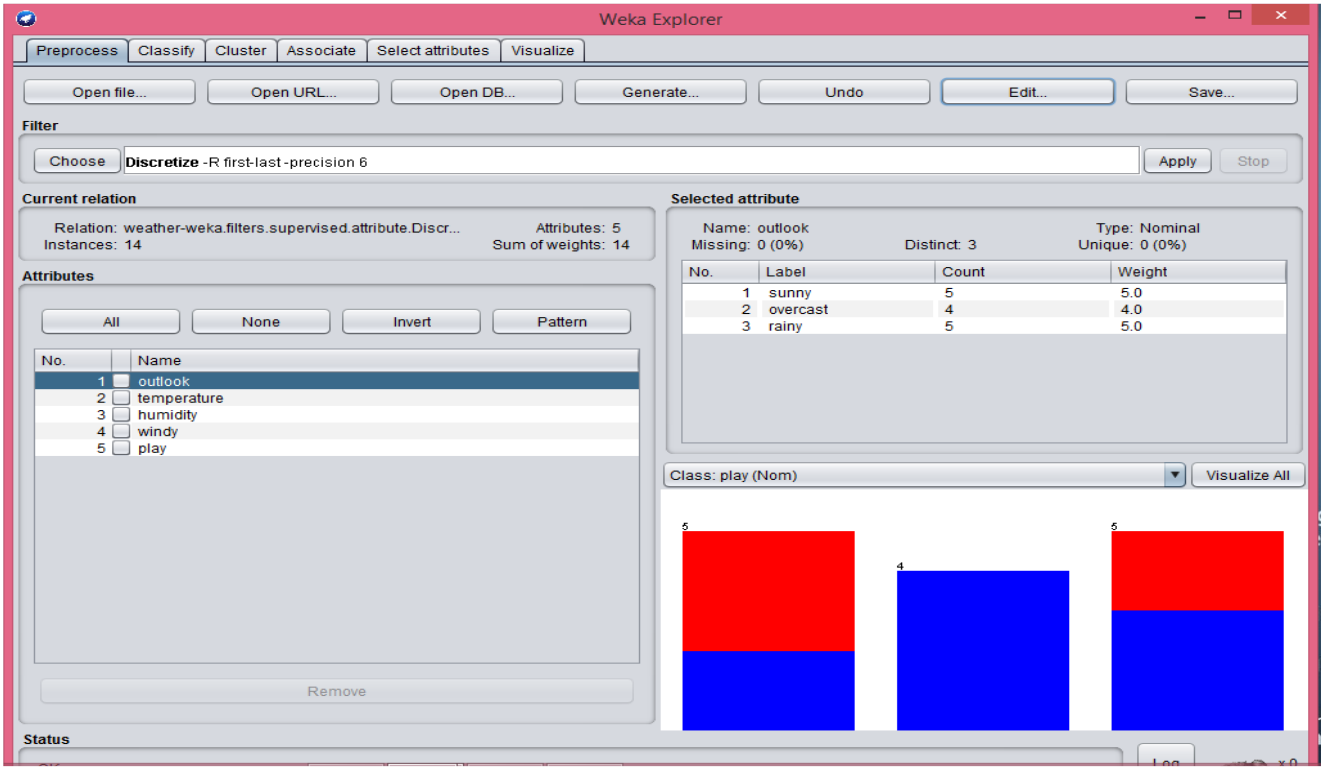
Now we will perform preprocessing on Weather Dataset.

10. Now to perform Discretize preprocessing filter, go to choose option now select the filter option under filter we have different modes of filters to perform preprocessing.

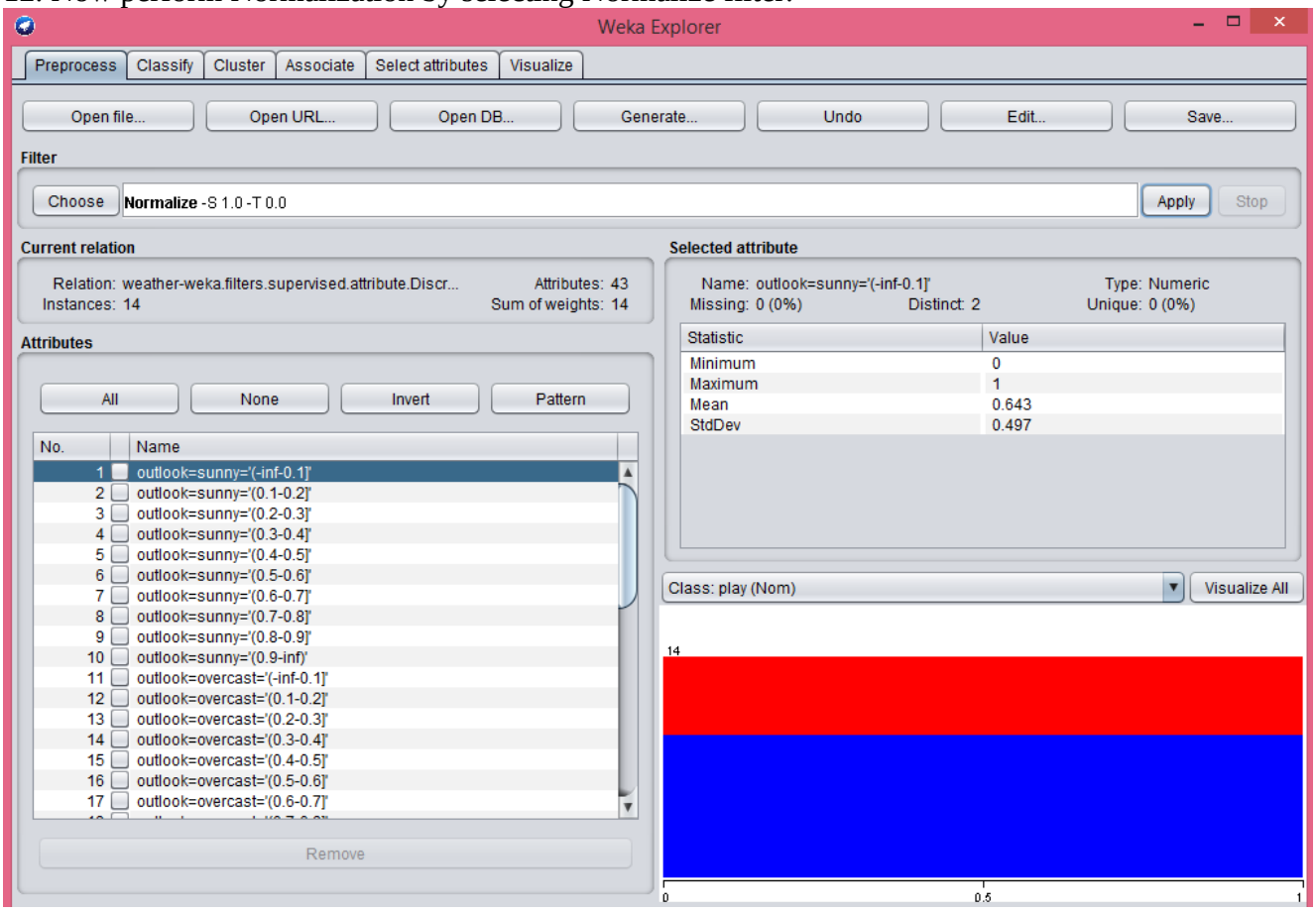
Select the attribute under supervised there we have a Discretize option choose that.



11. After choosing Discretize option click on Apply option to apply the filter to the dataset.

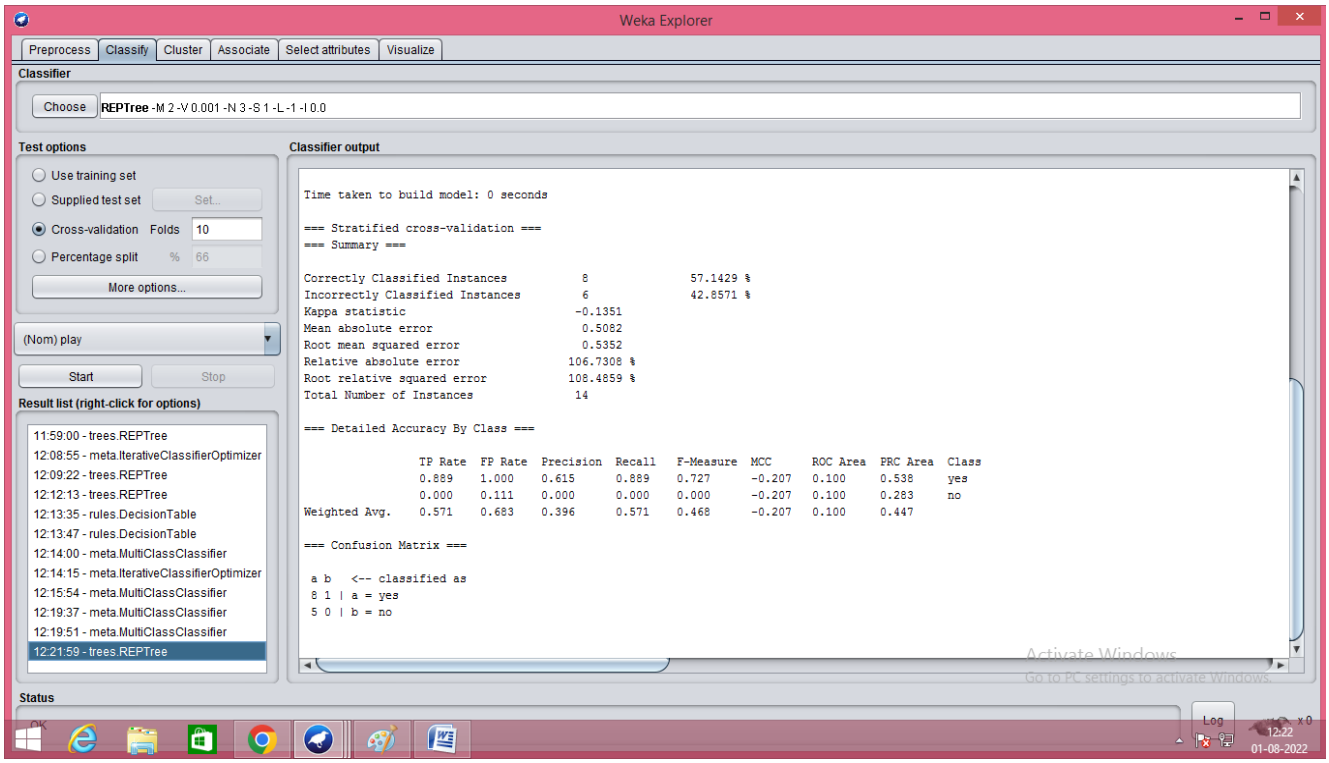


12. Now perform Normalization by selecting Normalize filter.

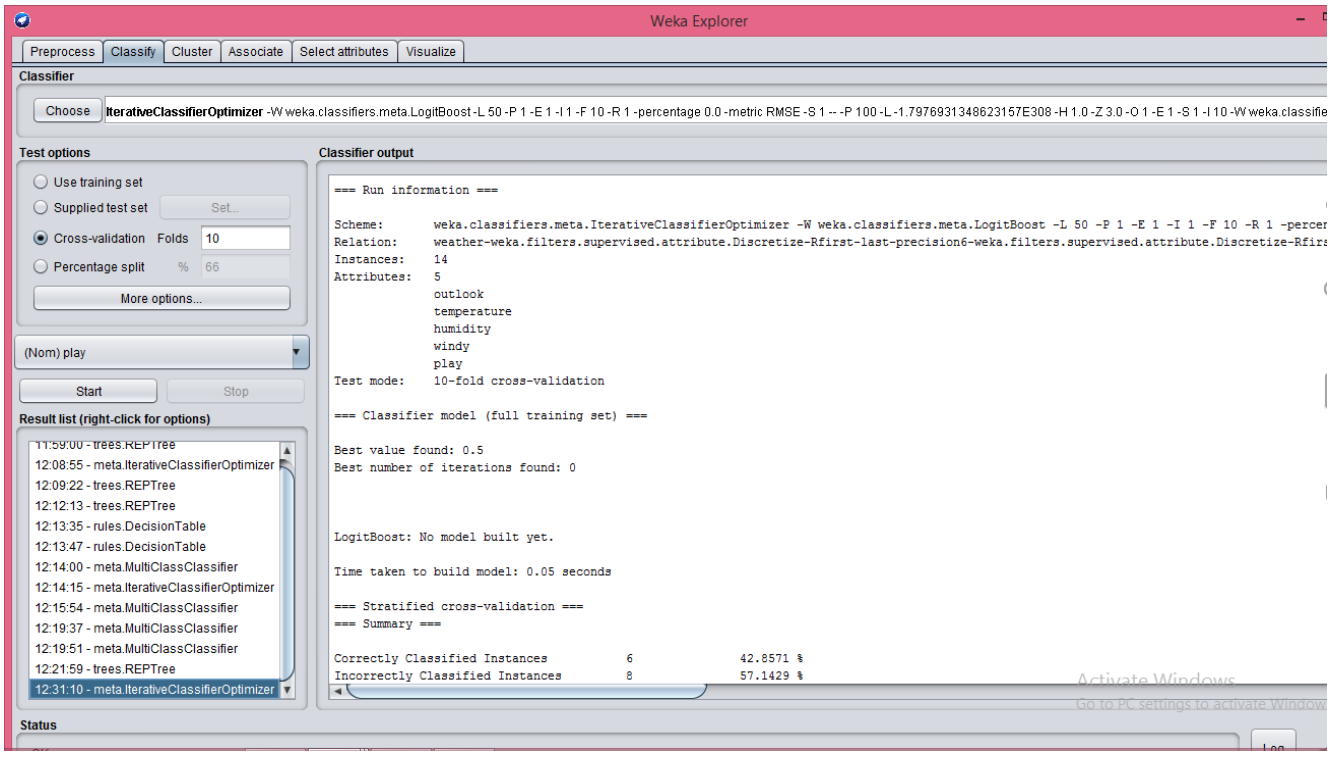


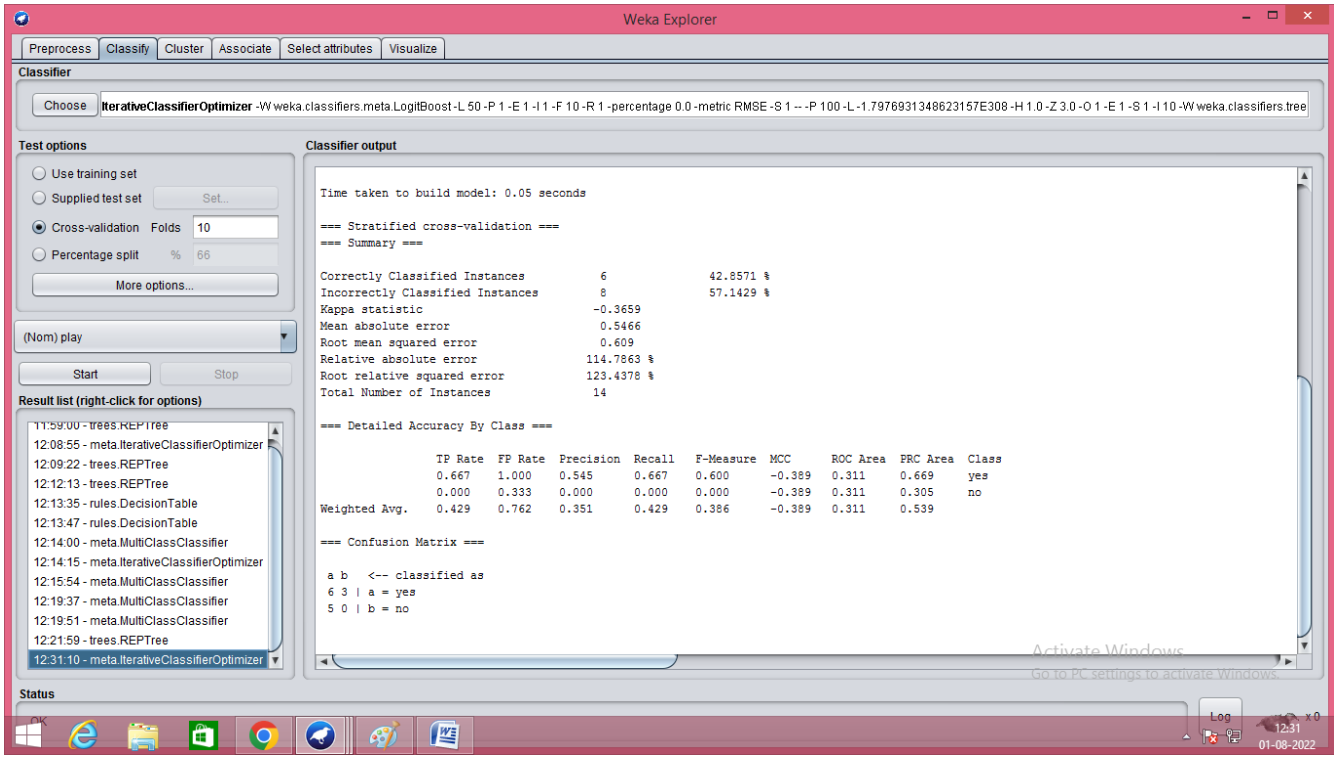
13. We performed preprocessing on weather dataset, now again classify the dataset by using different classification models to get accurate results.

i) REPTree Classifier

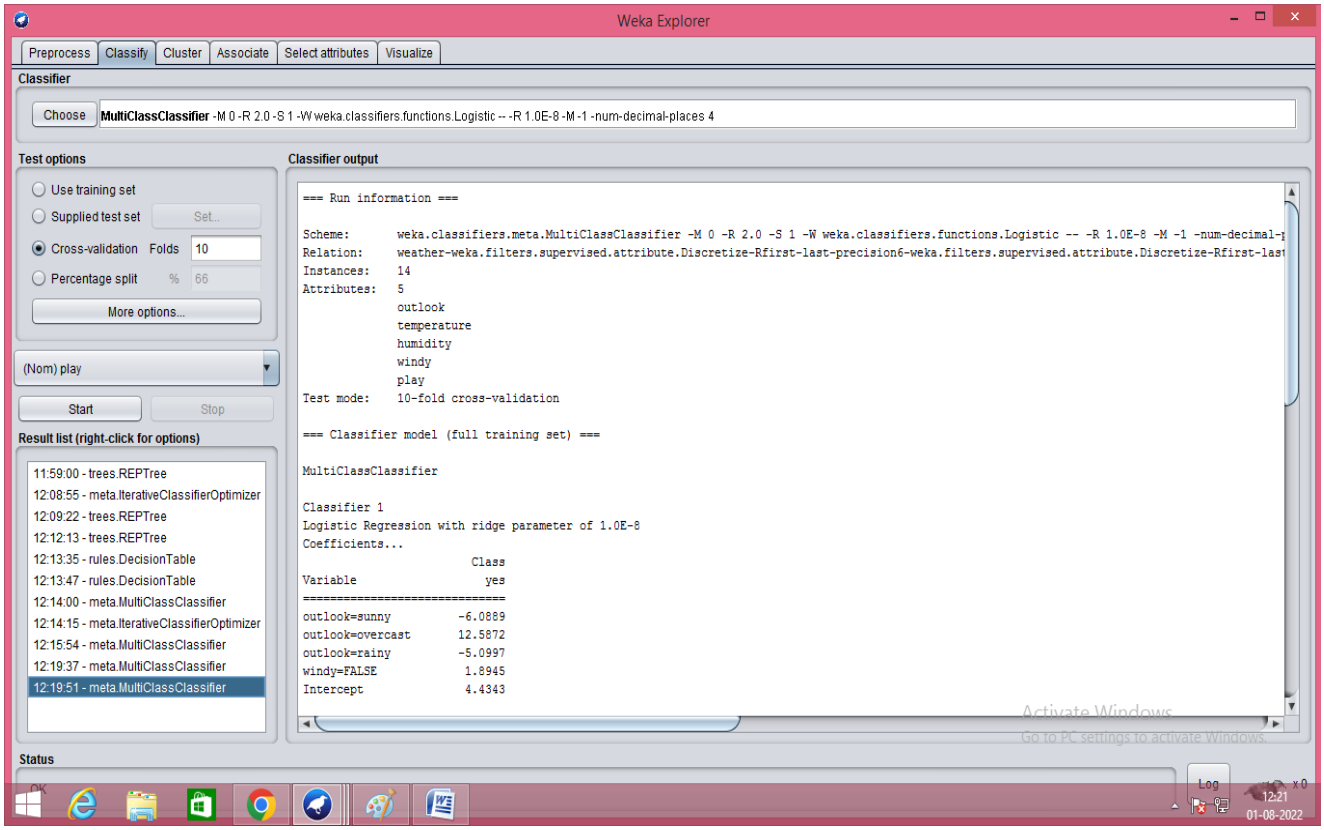


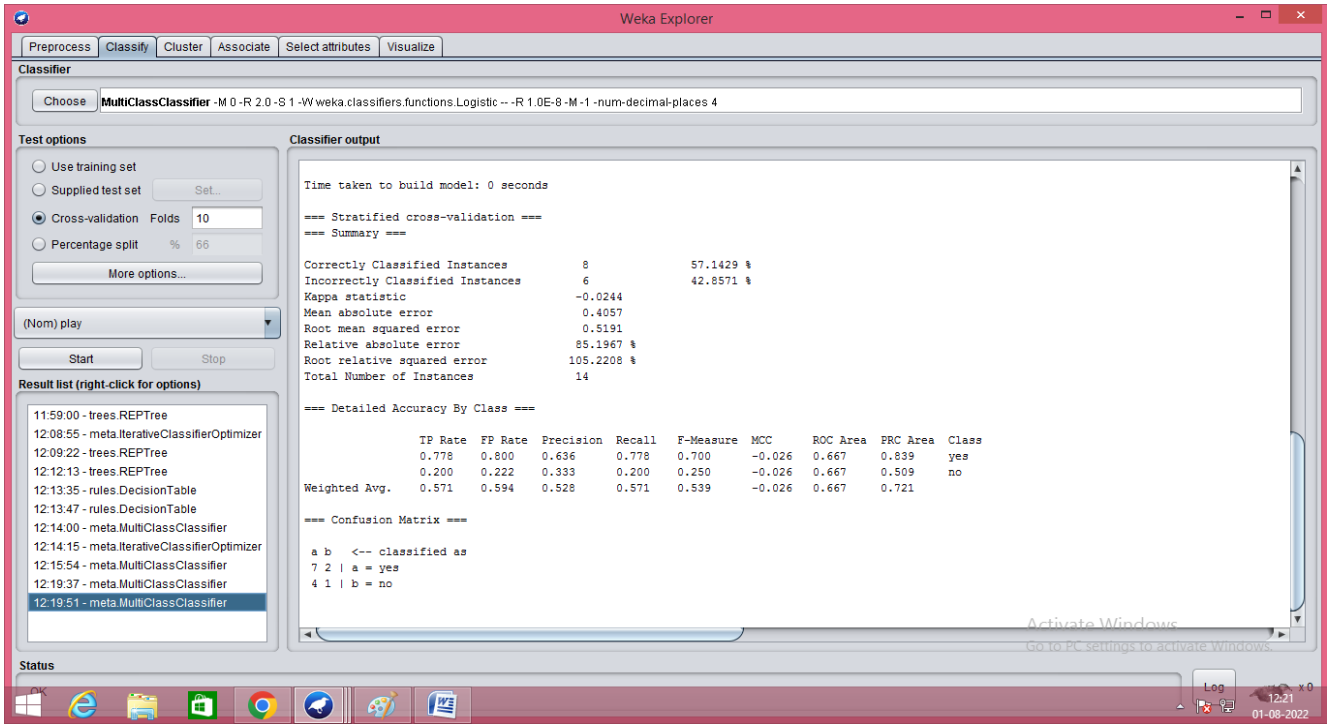
ii) Iterative Classifier Optimizer





iii) MultiClass Classifier:





5.1.4 Results and Discussion:

Implementing the Classification using Decision Tree algorithm on 'Weather' dataset is successfully completed by drawing the confusion matrix and report the model with accuracy.

We observed that when we classify the dataset by using Decision tree and other different classifier methods we get best and high accuracy in Meta classification models which is best classifier in weka software, Again we perform preprocessing on weather dataset and perform classification, by this we conclude that on preprocessed dataset when we perform classification it produce accurate and high results.

5.2.1 Problem Statement:

Implement Bayesian Classification and analyze the results on 'iris' Dataset.

5.2.2 Description:

About Dataset used

1. sepal length in cm
2. sepal width in cm
3. petal length in cm
4. petal width in cm
5. class:
6. Number of samples of each species of iris flowers:
7. Predicted attribute: class of iris plant.
8. Missing Attribute Values: None

The Iris Dataset contains information of three species of Iris flowers (Iris setosa, Iris virginica and Iris versicolor). The data set contains 3 classes of 50 instances each, where each class refers to a type of iris plant. One class is linearly separable from the other 2; the latter are NOT linearly separable from each other.
Data Set Characteristics: Multivariate
Area: Life Sciences
Number of samples (or instances) in the dataset: 150
Number of attributes (or features): 05 Attribute Information:
-- Iris Setosa
-- Iris Versicolour
-- Iris Virginica
Class Distribution: 33.3% for each of 3 classes.

About Arff:

An ARFF (Attribute-Relation File Format) file is an ASCII text file that describes a list of instances sharing a set of attributes.

ARFF files have two distinct sections. The first section is the **Header** information, which is followed the **Data** information.

The **Header** of the ARFF file contains the name of the relation, a list of the attributes (the columns in the data), and their types.

Lines that begin with a % are comments. The **@RELATION**, **@ATTRIBUTE** and **@DATA** declarations are case insensitive.

About CSV:

Files with .csv (Comma Separated Values) extension represent plain text files that contain records of data with comma separated values. Each line in a CSV file is a new record from the set of records contained in the file. Such files are generated when data transfer is intended from one storage system to another. Since all applications can recognize records separated by comma, import of such data files to database is done very conveniently.

Almost all spreadsheet applications such as Microsoft Excel or OpenOffice Calc can import CSV without much effort. Data imported from such files is arranged in cells of a spreadsheet for representation to user.

Datatypes that are supported by Weka:

- numeric
- integer is treated as numeric
- real is treated as numeric
- [nominal-specification]
- string
- date [date-format]
- relational for multi-instance data (for future use)

where [nominal-specification] and [date-format] are defined below. The keywords **numeric**, **real**, **integer**, **string** and **date** are case insensitive.

Numeric attributes
Numeric attributes can be real or integer numbers.

Nominal attributes
Nominal values are defined by providing an [nominal-specification] listing the possible values: {[nominal-name1], [nominal-name2], [nominal-name3], ...}

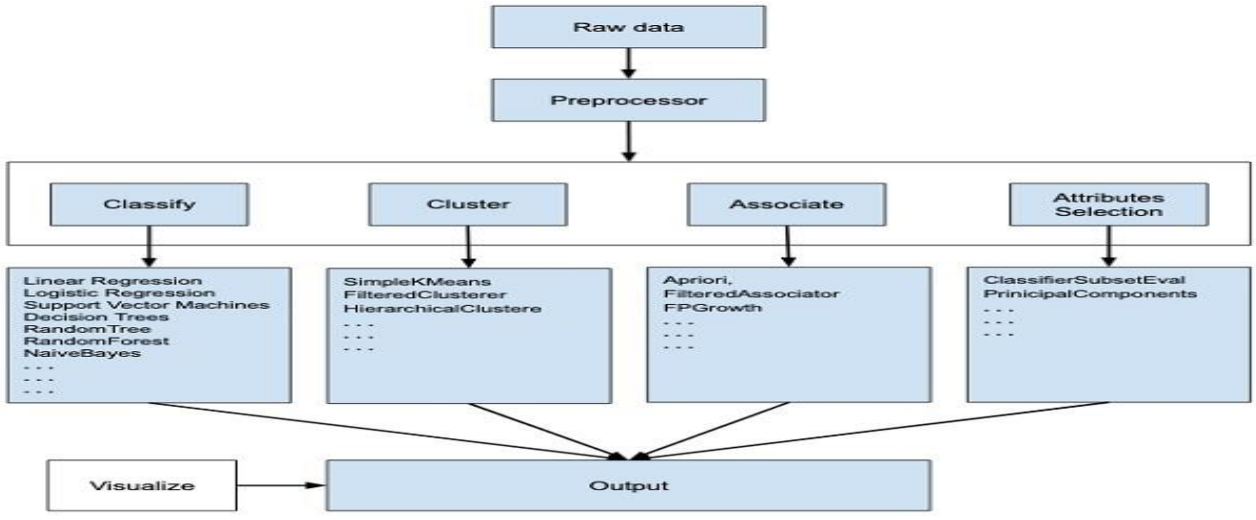
For example, the class value of the Iris dataset can be defined as follows:

```
@ATTRIBUTE class {Iris-setosa,Iris-versicolor,Iris-virginica}
```

Values that contain spaces must be quoted.

About WEKA Software:

WEKA - an opensource software provides tools for data preprocessing, implementation of several Machine Learning algorithms, and visualization tools so that you can develop machine learning techniques and apply them to real-world data mining problems. What WEKA offers is summarized in the following diagram −



If you observe the beginning of the flow of the image, you will understand that there are many stages in dealing with Big Data to make it suitable for machine learning −

First, you will start with the raw data collected from the field. This data may contain several null values and irrelevant fields. You use the data preprocessing tools provided in WEKA to cleanse the data.

Then, you would save the preprocessed data in your local storage for applying ML algorithms.

Next, depending on the kind of ML model that you are trying to develop you would select one of the options such as **Classify, Cluster**, or **Associate**. The **Attributes Selection** allows the automatic selection of features to create a reduced dataset.

Note that under each category, WEKA provides the implementation of several algorithms. You would select an algorithm of your choice, set the desired parameters and run it on the dataset.

Then, WEKA would give you the statistical output of the model processing. It provides you a visualization tool to inspect the data.

The various models can be applied on the same dataset. You can then compare the outputs of different models and select the best that meets your purpose.

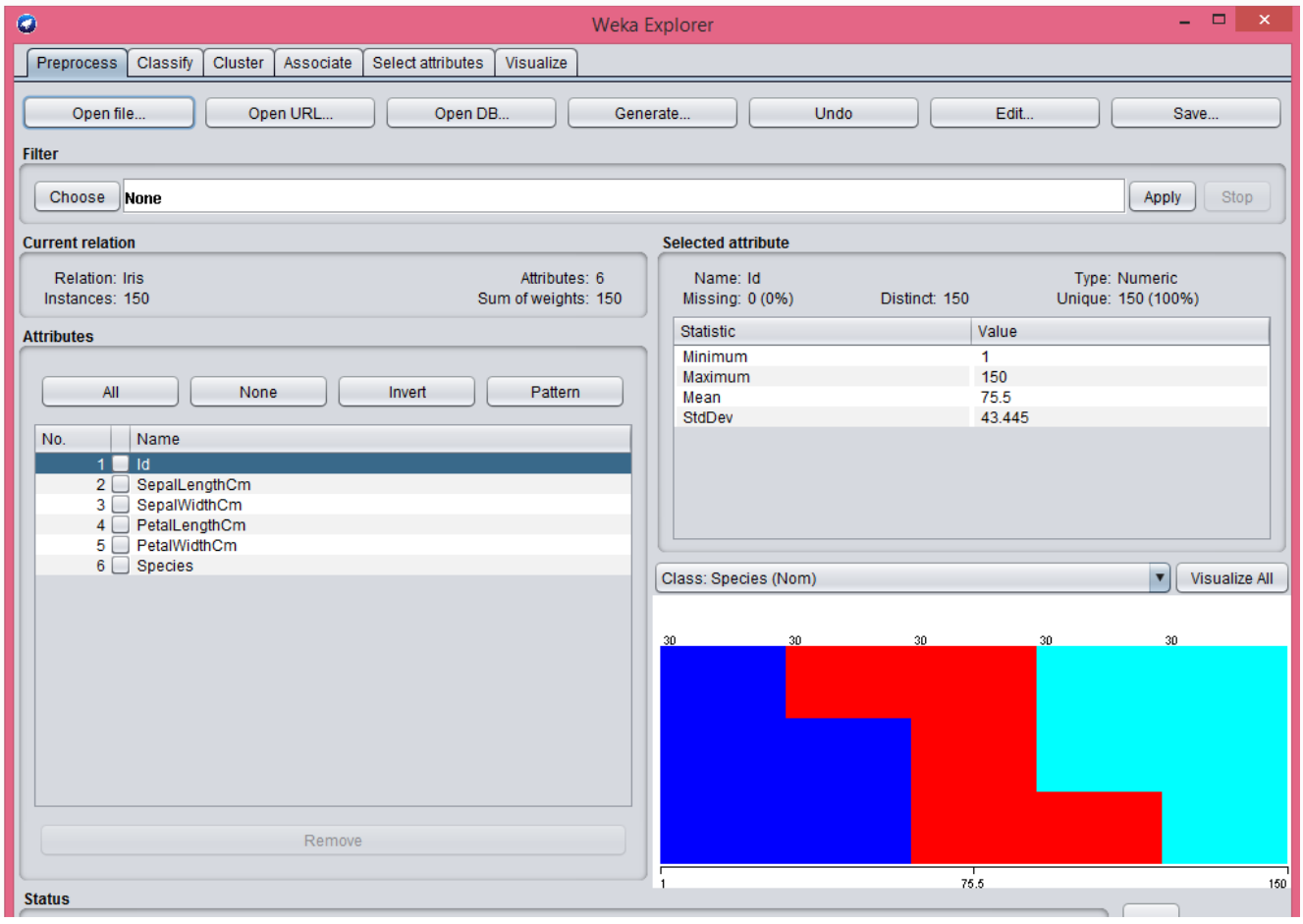
Thus, the use of WEKA results in a quicker development of machine learning models on the whole.

Now that we have seen what WEKA is and what it does, in the next chapter let us learn how to install WEKA on your local computer.

5.2.3 Steps to implement the classification:

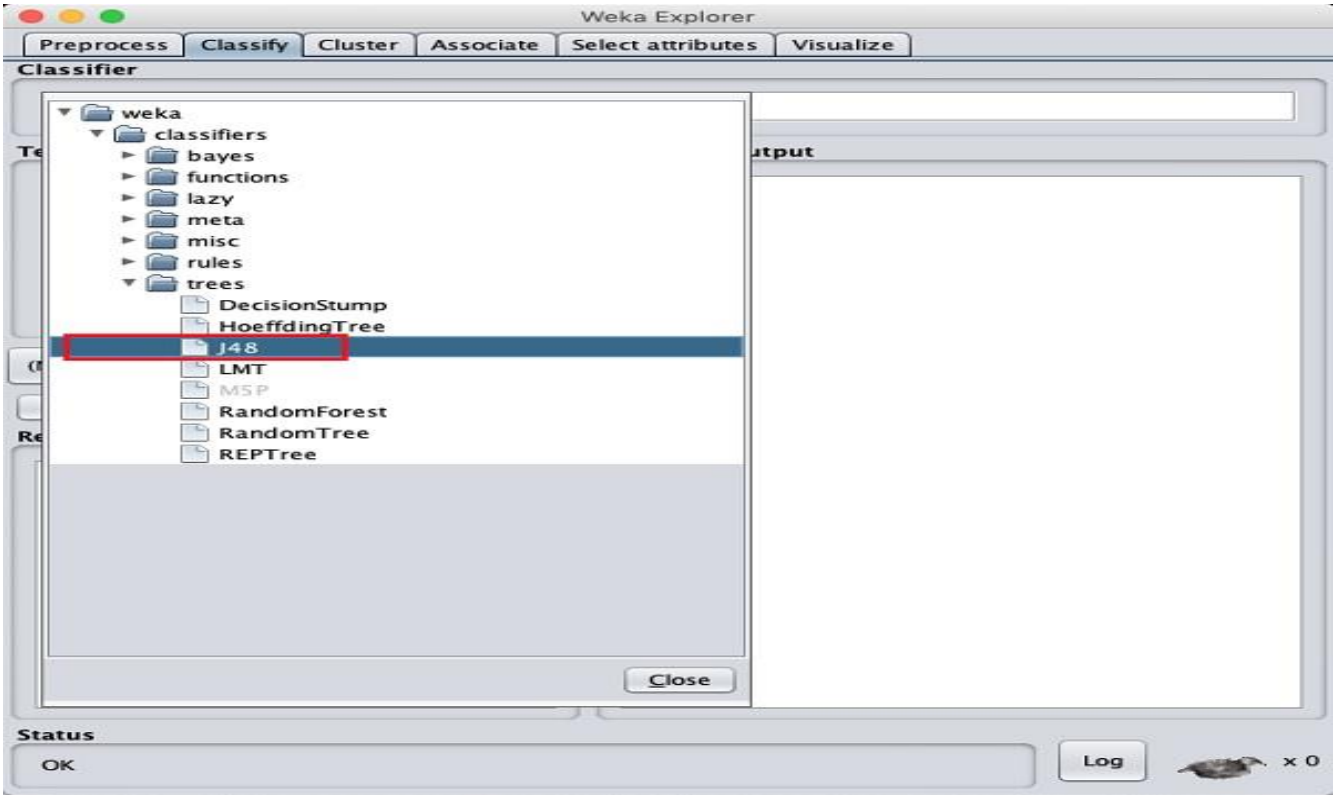
1.To classify the Iris database using Decision Tree algorithm.

So first open the file by using the **Open file** ... option and select the **Iris.arff** file.



2. Now to classify the **Iris** database select and open classify option.

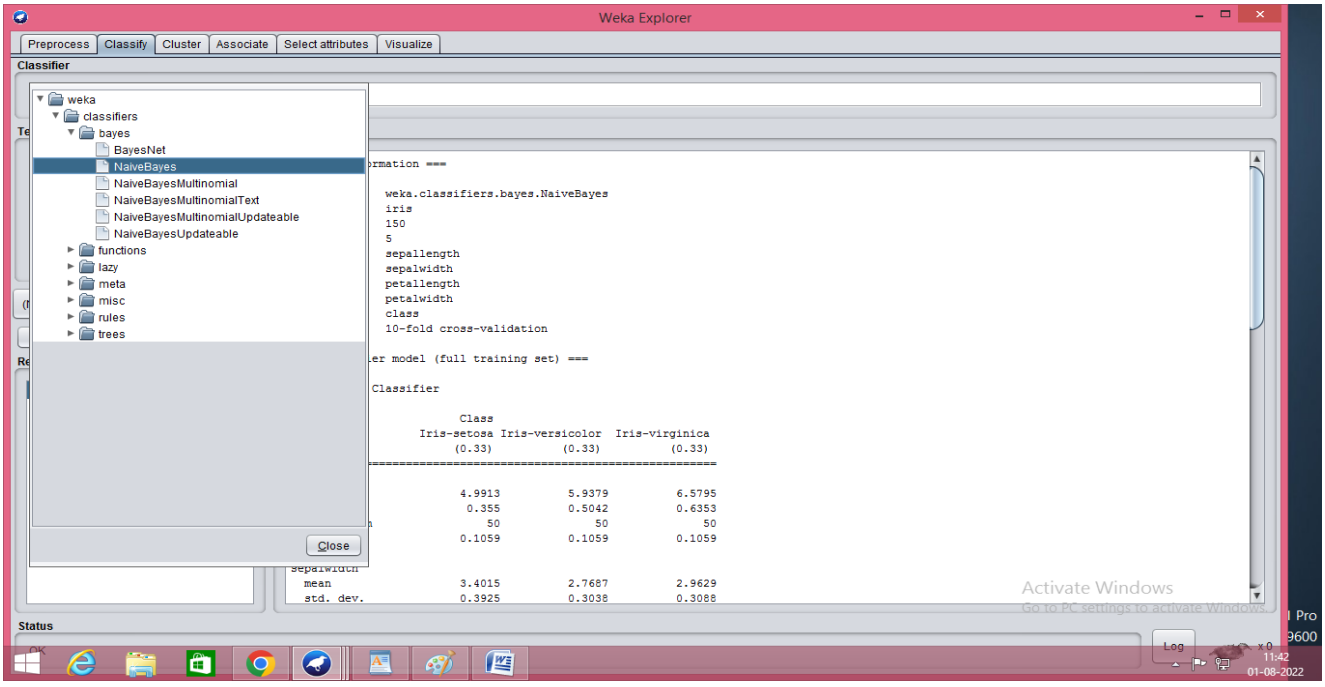
There are many classification methods are available in weka software some of them are bayes, meta, trees, lazy, rules ect..



3. According to the problem we are implementing and classifying Iris dataset using Bayesian Classification

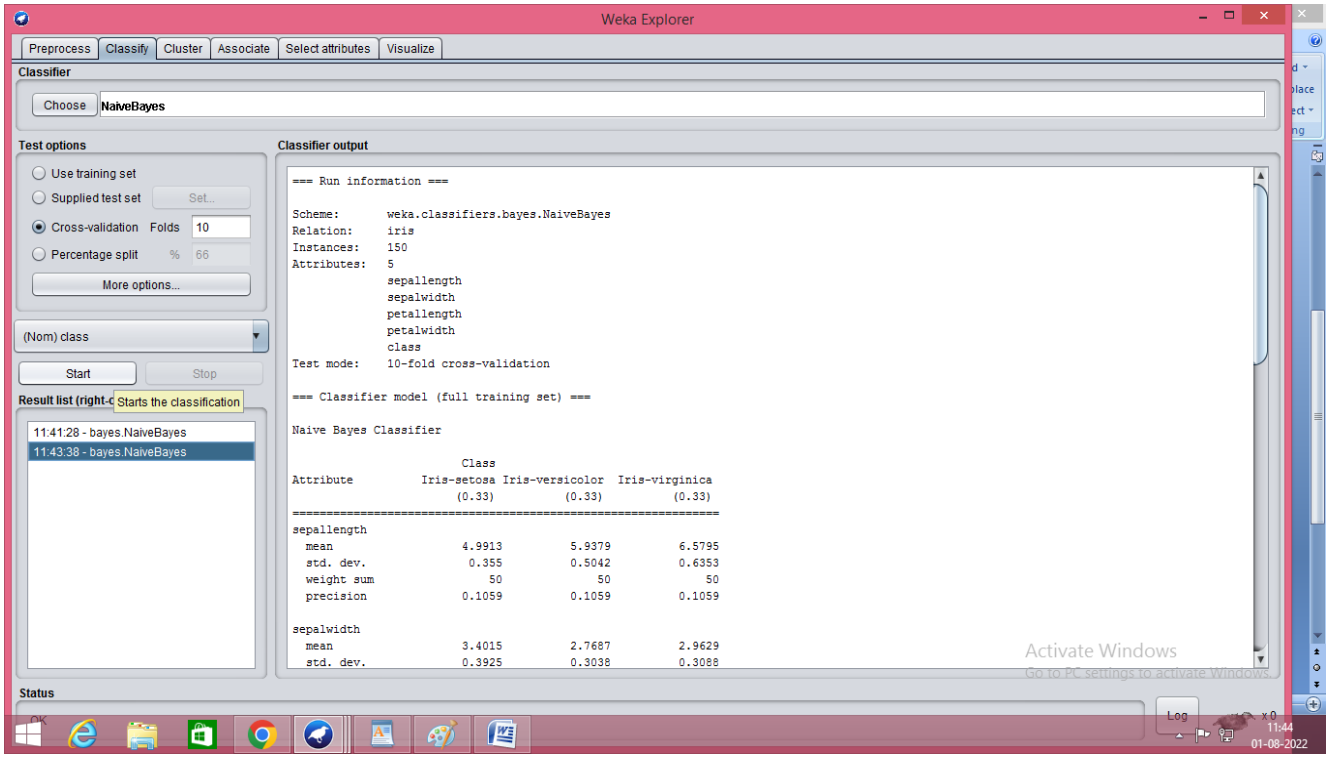
So, select choose and select bayes under bayes select an optimized Bayesian classification model.

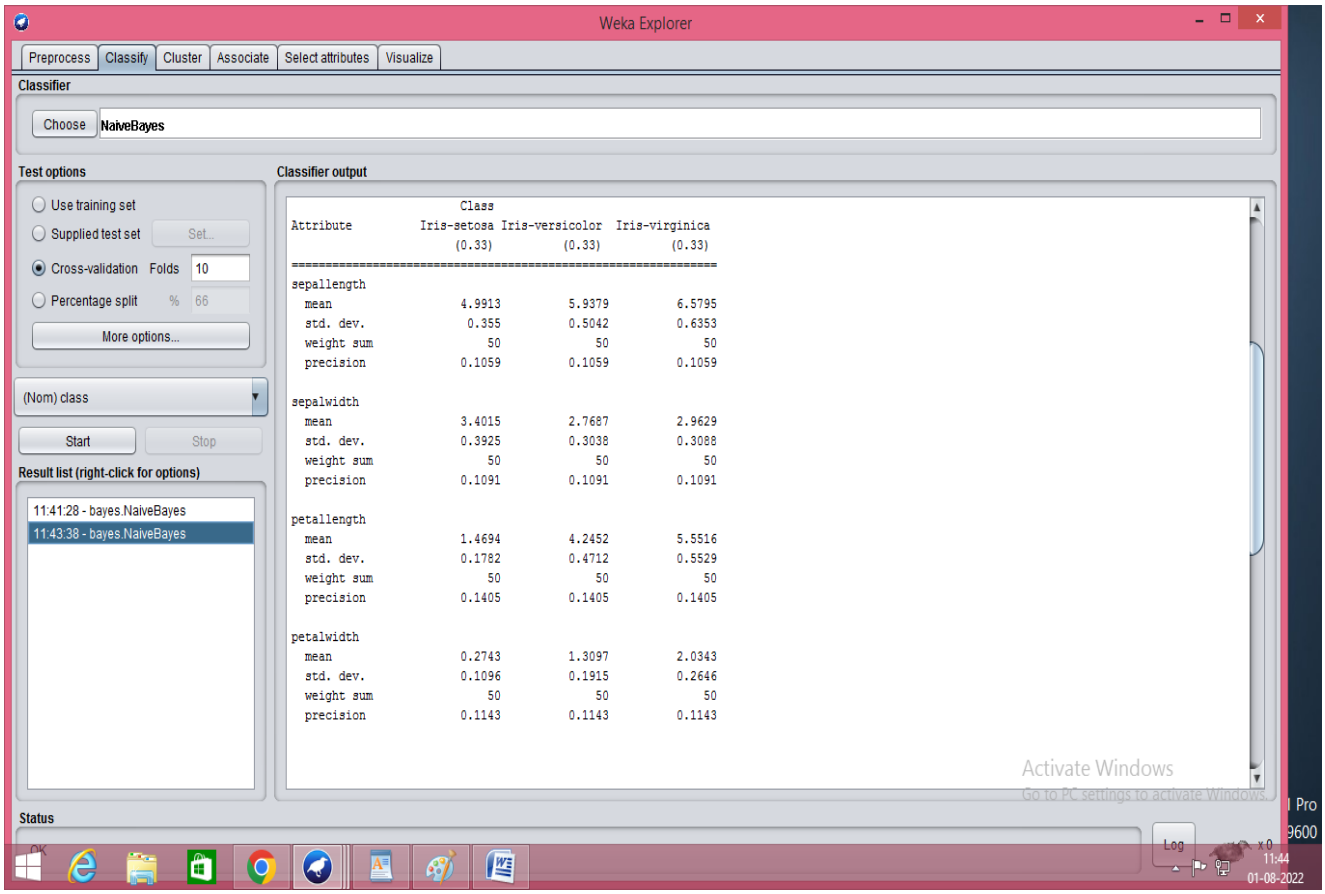
- **Naïve Bayes:**

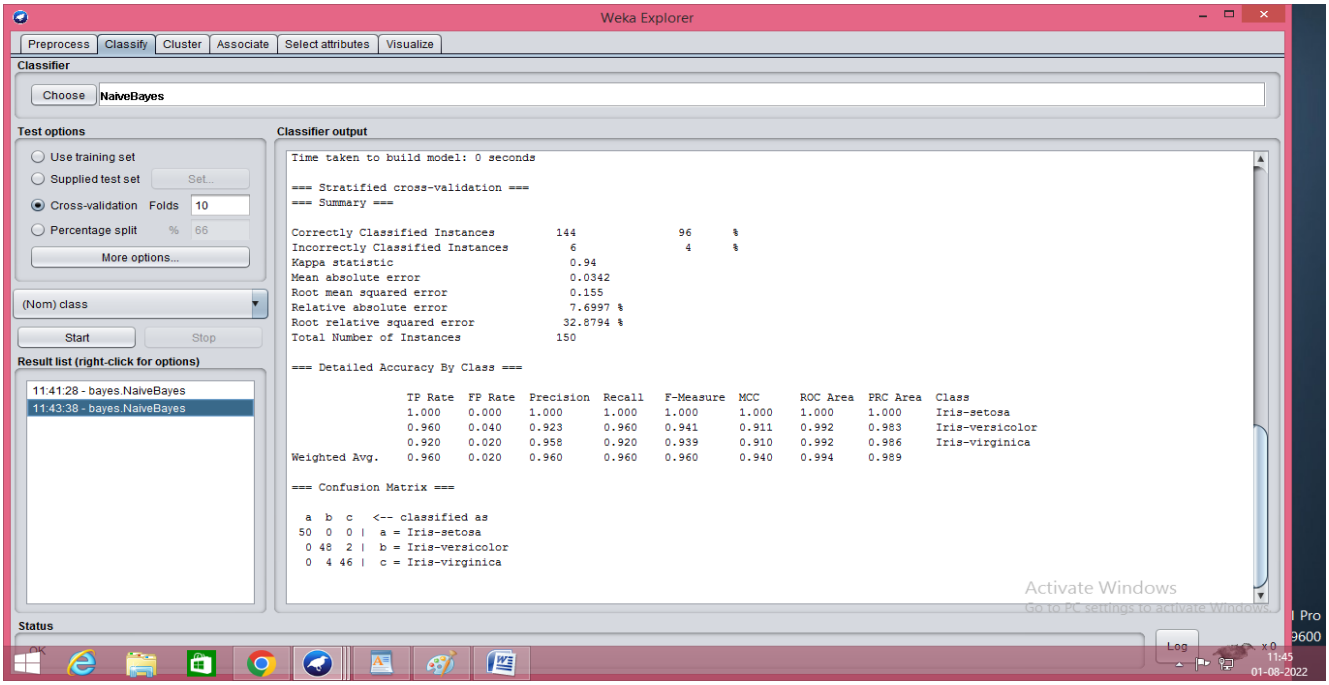


4.To apply the classification to dataset click on start button

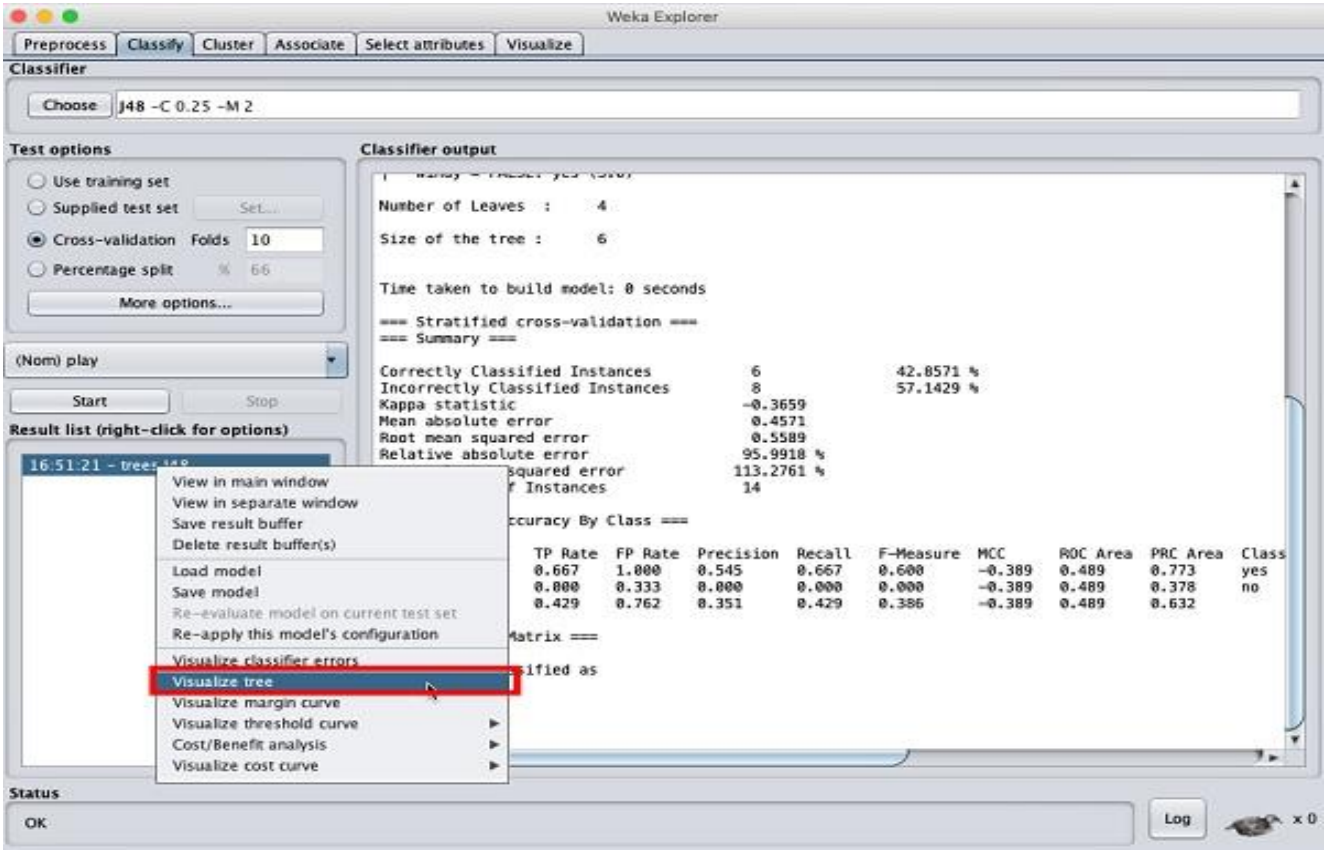
Then it will display all the details like about Attributes, Instances, size of tree Accuracy by class, corelation, confusion Matrix etc..







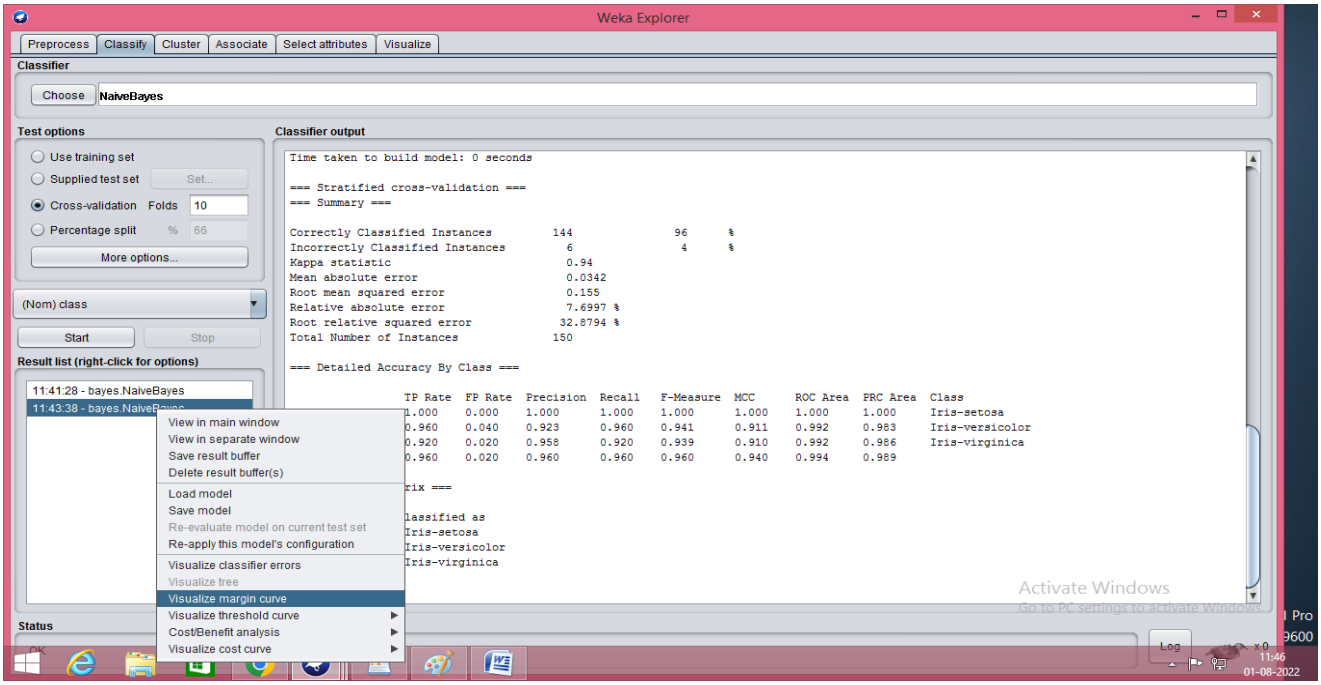
5. If you want to Visualize the classification under start button we have result list in that you can see all the list of classifications you done.



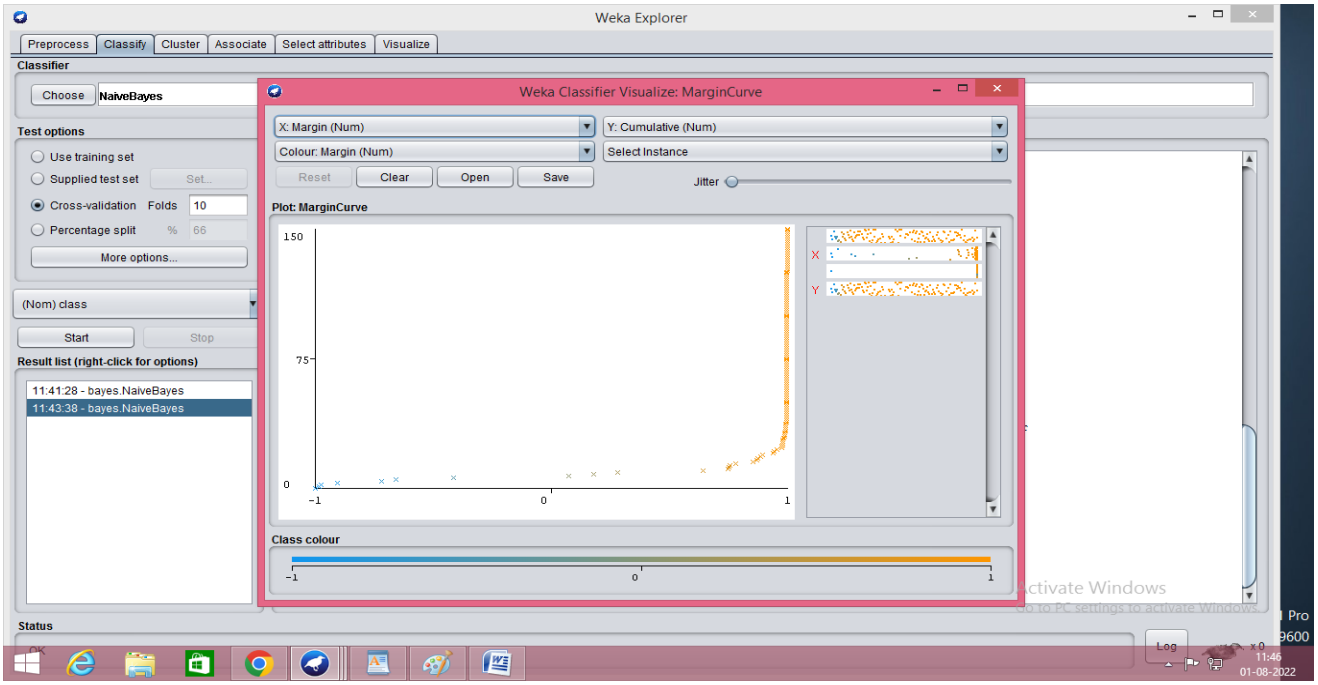
6. Now Right click on one classify model their it will display many options like Visualize tree, visualize margin curve, visualize threshold curve ect..

7. The classification model we used according to that option are unable.

8. Now select on Visualize Margin curve.



9.Automatically curve will display in another window.

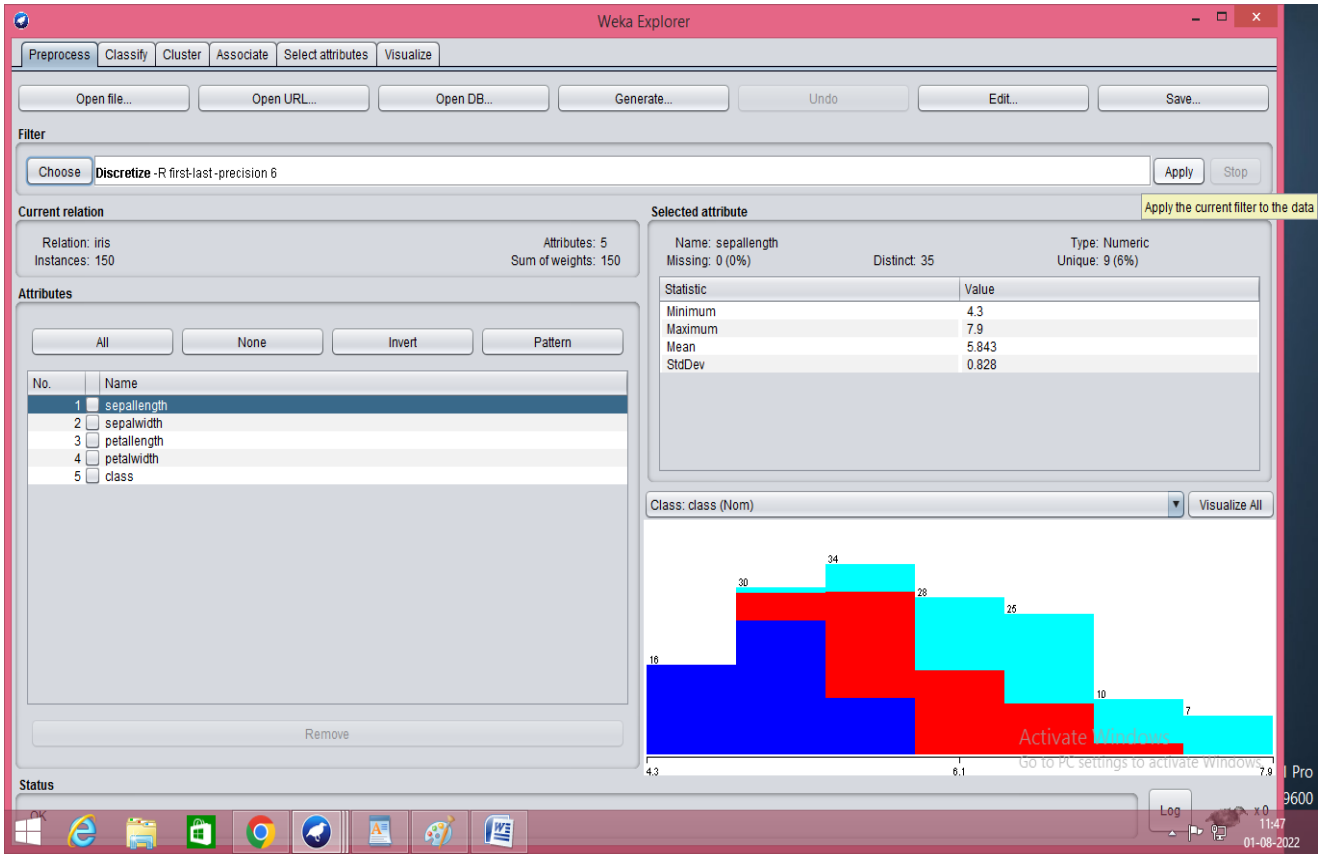


10. All the above classification is done without preprocessing.

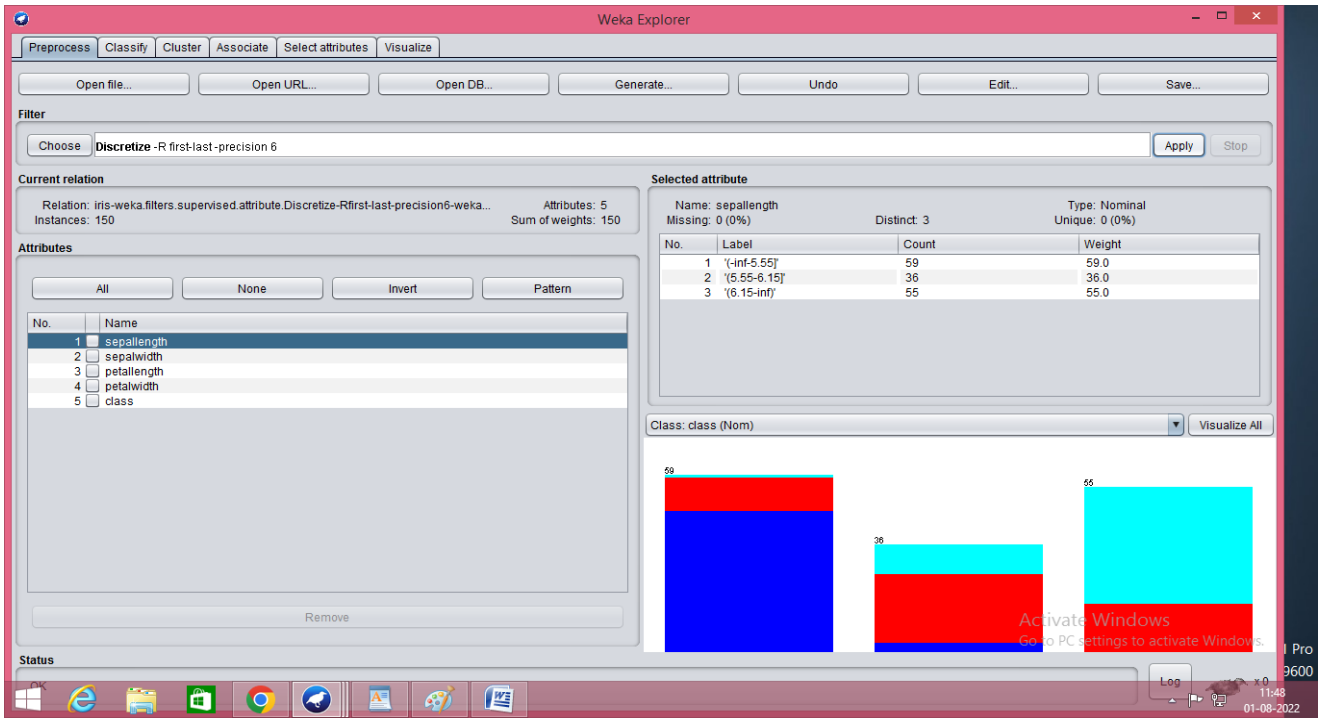
Now we will perform preprocessing on Iris Dataset.

11. Now to perform Discretize preprocessing filter, go to choose option now select the filter option under filter we have different modes of filters to perform preprocessing.

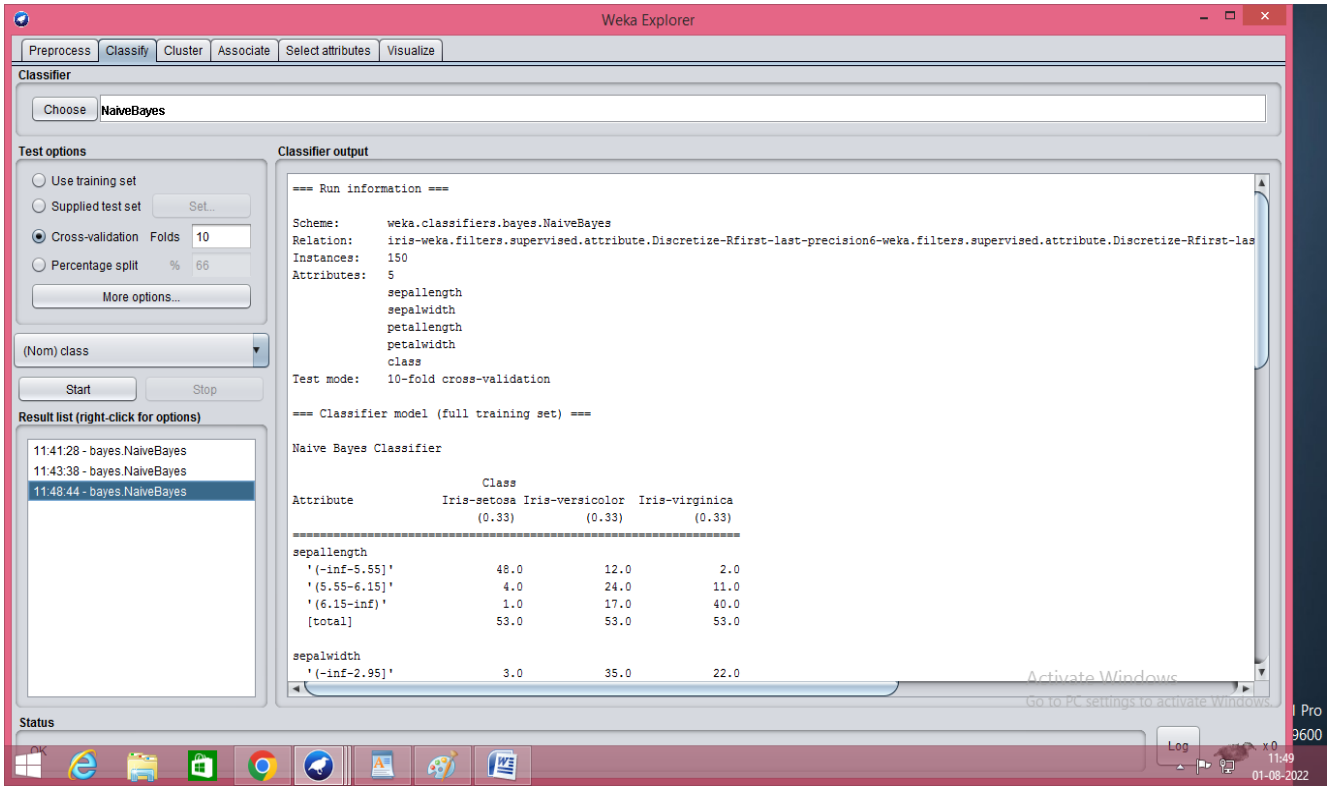
Select the attribute under supervised there we have a Discretize option choose that.

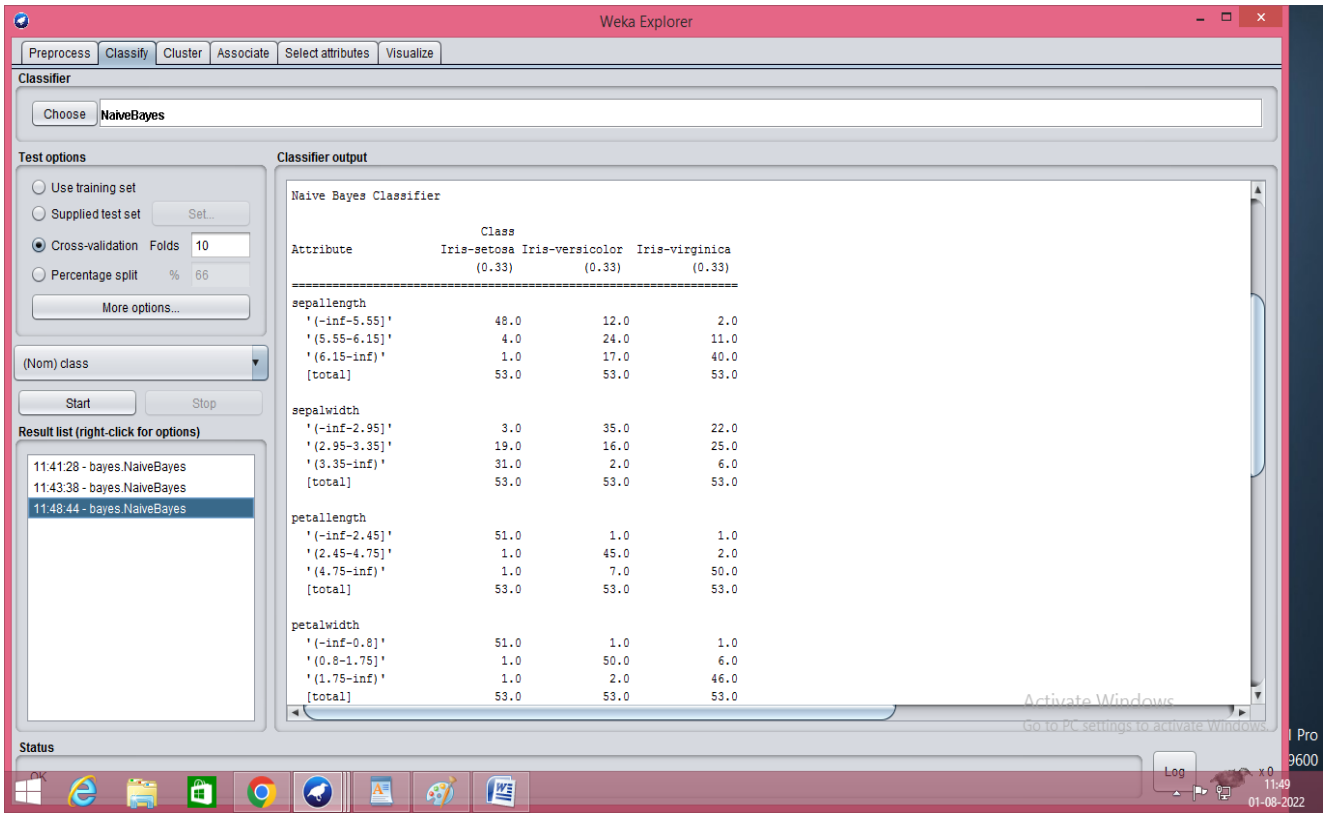


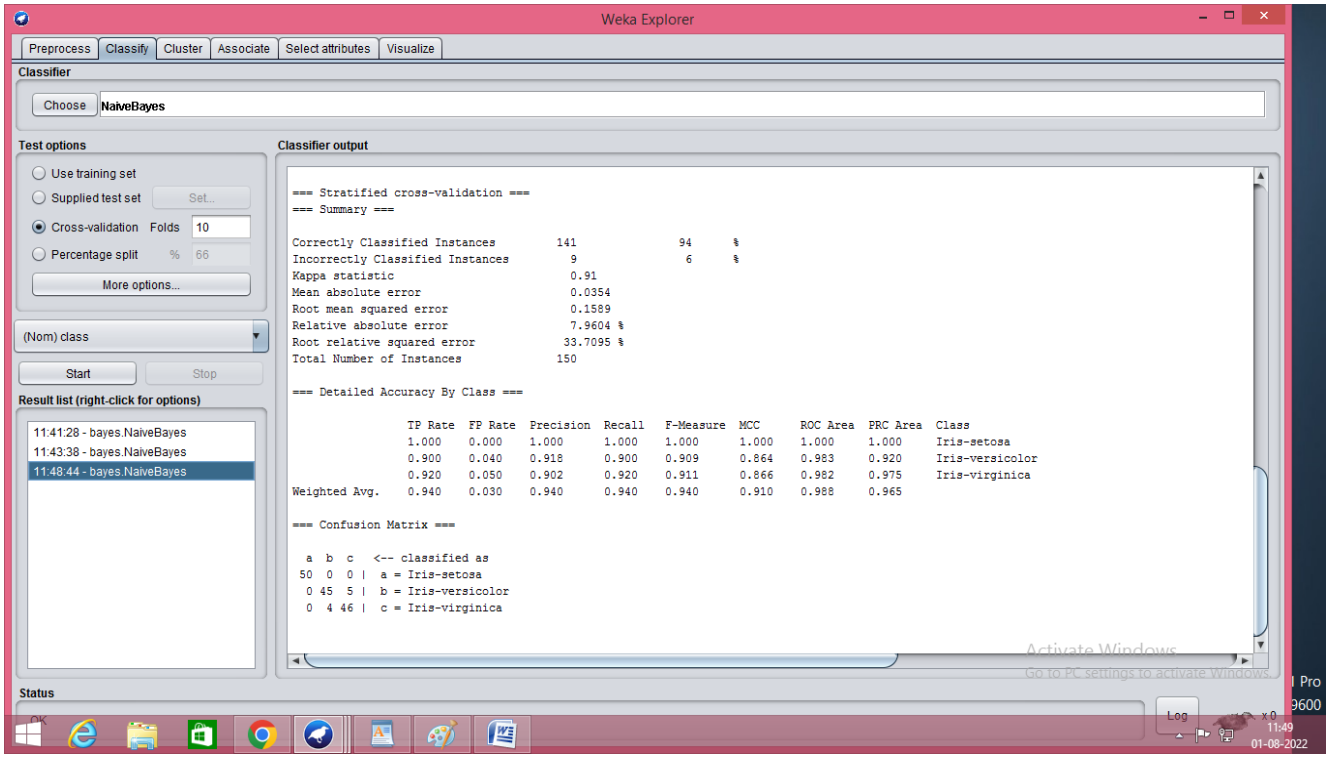
12. At the right side click on that Apply button to apply the current filter to the data.



13. We performed preprocessing on Iris dataset, now again classify the dataset by using bayesian classification models to get accurate results.


Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:41:28 - bayes.NaiveBayes
11:43:38 - bayes.NaiveBayes
11:48:44 - bayes.NaiveBayes
Classifier output
=== Run information ===
Scheme: weka.classifiers.bayes.NaiveBayes
Relation: iris-weka.filters.supervised.attribute.Discretize-Rfirst-last-precision6-weka.filters.supervised.attribute.Discretize-Rfirst-las
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
class
Test mode: 10-fold cross-validation
=== Classifier model (full training set) ===
Naive Bayes Classifier
Class
Attribute Iris-setosa Iris-versicolor Iris-virginica
(0.33) (0.33) (0.33)
sepallength
'(-inf-5.55]' 48.0 12.0 2.0
'(5.55-6.15]' 4.0 24.0 11.0
'(6.15-inf)' 1.0 17.0 40.0
[total] 53.0 53.0 53.0
sepalwidth
'(-inf-2.95]' 3.0 35.0 22.0
Status
OK
Log
x 0
11:49
01-08-2022


Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:41:28 - bayes.NaiveBayes
11:43:38 - bayes.NaiveBayes
11:48:44 - bayes.NaiveBayes
Classifier output
Naive Bayes Classifier
Class
Attribute Iris-setosa Iris-versicolor Iris-virginica
(0.33) (0.33) (0.33)
sepallength
'(-inf-5.55]' 48.0 12.0 2.0
'(5.55-6.15]' 4.0 24.0 11.0
'(6.15-inf)' 1.0 17.0 40.0
[total] 53.0 53.0 53.0
sepalwidth
'(-inf-2.95]' 3.0 35.0 22.0
'(2.95-3.35]' 19.0 16.0 25.0
'(3.35-inf)' 31.0 2.0 6.0
[total] 53.0 53.0 53.0
petallength
'(-inf-2.45]' 51.0 1.0 1.0
'(2.45-4.75]' 1.0 45.0 2.0
'(4.75-inf)' 1.0 7.0 50.0
[total] 53.0 53.0 53.0
petalwidth
'(-inf-0.8]' 51.0 1.0 1.0
'(0.8-1.75]' 1.0 50.0 6.0
'(1.75-inf)' 1.0 2.0 46.0
[total] 53.0 53.0 53.0
Status
OK
Log
x 0
11:49
01-08-2022



5.2.4 Results and Discussion:

Implementing Bayesian Classification and analyze the results on 'iris' Dataset is successfully completed by drawing the confusion matrix and report the model with accuracy.

We observed that when we classify the dataset by using Bayesian classifier called NaiveBayes without preprocessing, then that we get best and high accuracy of classification only when we preprocessed the Dataset.