

Experiment-1.2

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Aim of the Experiment :

Train and test the classification performance of Tree based Supervised Learning Algorithms for the following classifiers:

- a) Decision Tree
- b) Neural Network
- c) Naive Bayes
- d) Random Forest

Analyze the difference in the performance of the classifiers using different parameters of Confusion Matrix.

Objective of the Experiment :

Task to be done for this experiment is that we have to create a Weather Table which includes attributes like outlook, temperature, humidity, windy and play. Then we will open the weather dataset in WEKA Tool and train and test the classification performance of classifiers like Decision Tree, Random Forest, Naive Bayes and Neural Network. We will analyze the difference in performance of classifiers using different parameters of Confusion Matrix.

Procedure/ Steps for Experiment :

Step 1: Open Start → Programs → Accessories → Notepad.

Step 2: Write the dataset of **Weather Table** in Notepad with all attributes and their value.

Step 3: After writing the dataset, save the file with **.arff** format.



```
File Edit Format View Help
@relation weather.symbolic

@attribute outlook {sunny, overcast, rainy}
@attribute temperature {hot, mild, cool}
@attribute humidity {high, normal}
@attribute windy {TRUE, FALSE}
@attribute play {yes, no}

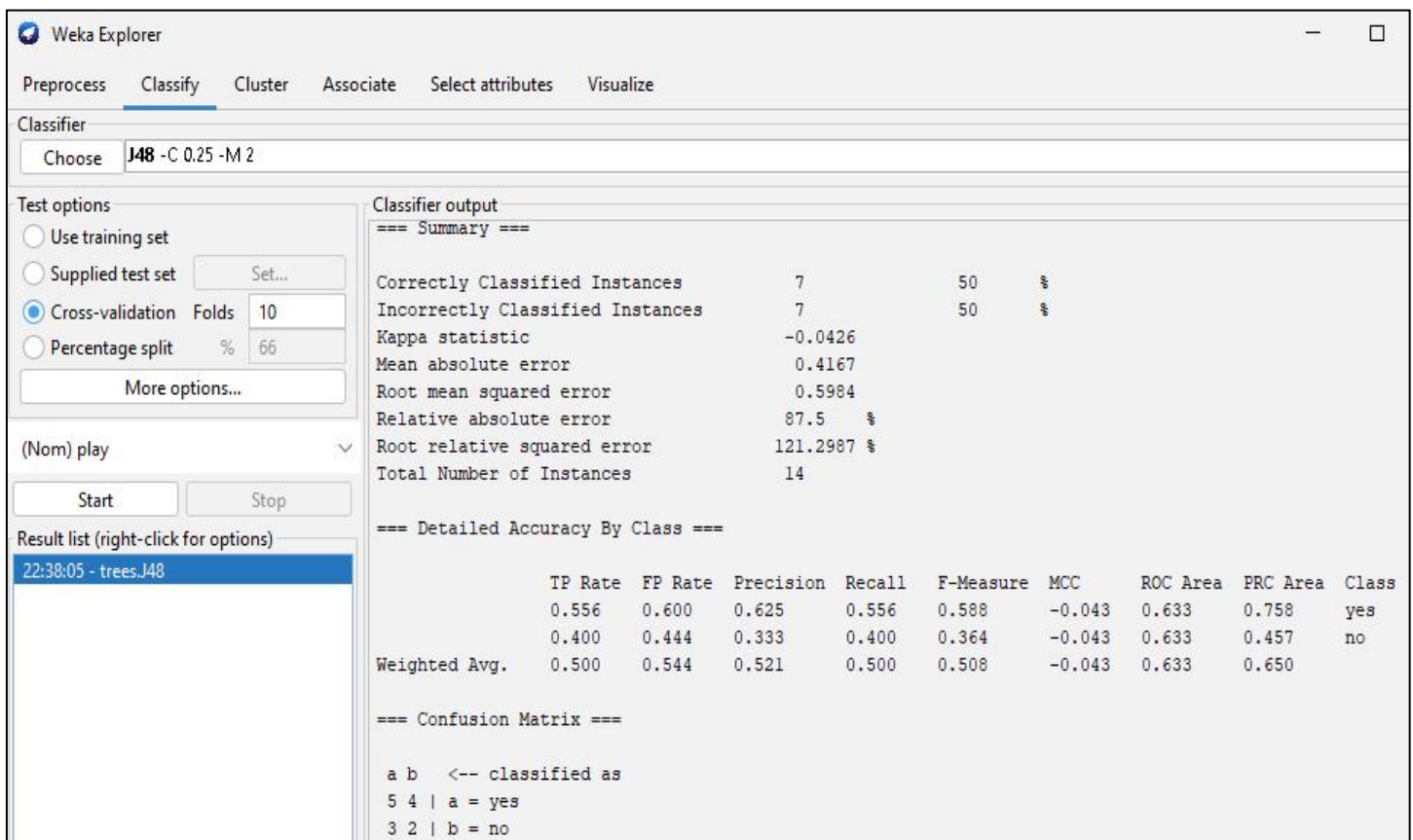
@data
sunny,hot,high,FALSE,no
sunny,hot,high,TRUE,no
overcast,hot,high,FALSE,yes
rainy,mild,high,FALSE,yes
rainy,cool,normal,FALSE,yes
rainy,cool,normal,TRUE,no
overcast,cool,normal,TRUE,yes
sunny,mild,high,FALSE,no
sunny,cool,normal,FALSE,yes
rainy,mild,normal,FALSE,yes
sunny,mild,normal,TRUE,yes
overcast,mild,high,TRUE,yes
overcast,hot,normal,FALSE,yes
rainy,mild,high,TRUE,no
```

Step 4: Now open the Weather dataset in the WEKA Too using ‘**Open file**’ option.

Step 5: Now click on ‘**Classify**’ tab to apply different types of classifiers on dataset.

A) Decision Tree:

- 1) Go to **Classify** tab and click on ‘**Choose**’ button in Classifier.
- 2) Under the **trees** section, select the **J48** classifier.
- 3) Set k-fold as 10 in cross validation.
- 4) Click on ‘**Start**’ button to apply the J48 classifier.
- 5) Check the confusion matrix obtained for Decision Tree.



The screenshot shows the Weka Explorer interface with the 'Classify' tab selected. The 'Classifier' dropdown is set to 'J48 -C 0.25 -M 2'. Under 'Test options', 'Cross-validation' is selected with 'Folds' set to 10. The 'Start' button has been clicked, and the 'Classifier output' pane displays the results.

Classifier output

```

=== Summary ===
Correctly Classified Instances      7           50  %
Incorrectly Classified Instances    7           50  %
Kappa statistic                    -0.0426
Mean absolute error                 0.4167
Root mean squared error             0.5984
Relative absolute error             87.5  %
Root relative squared error        121.2987 %
Total Number of Instances          14

=== Detailed Accuracy By Class ===

```

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.556	0.600	0.625	0.556	0.588	-0.043	0.633	0.758	yes
	0.400	0.444	0.333	0.400	0.364	-0.043	0.633	0.457	no
Weighted Avg.	0.500	0.544	0.521	0.500	0.508	-0.043	0.633	0.650	

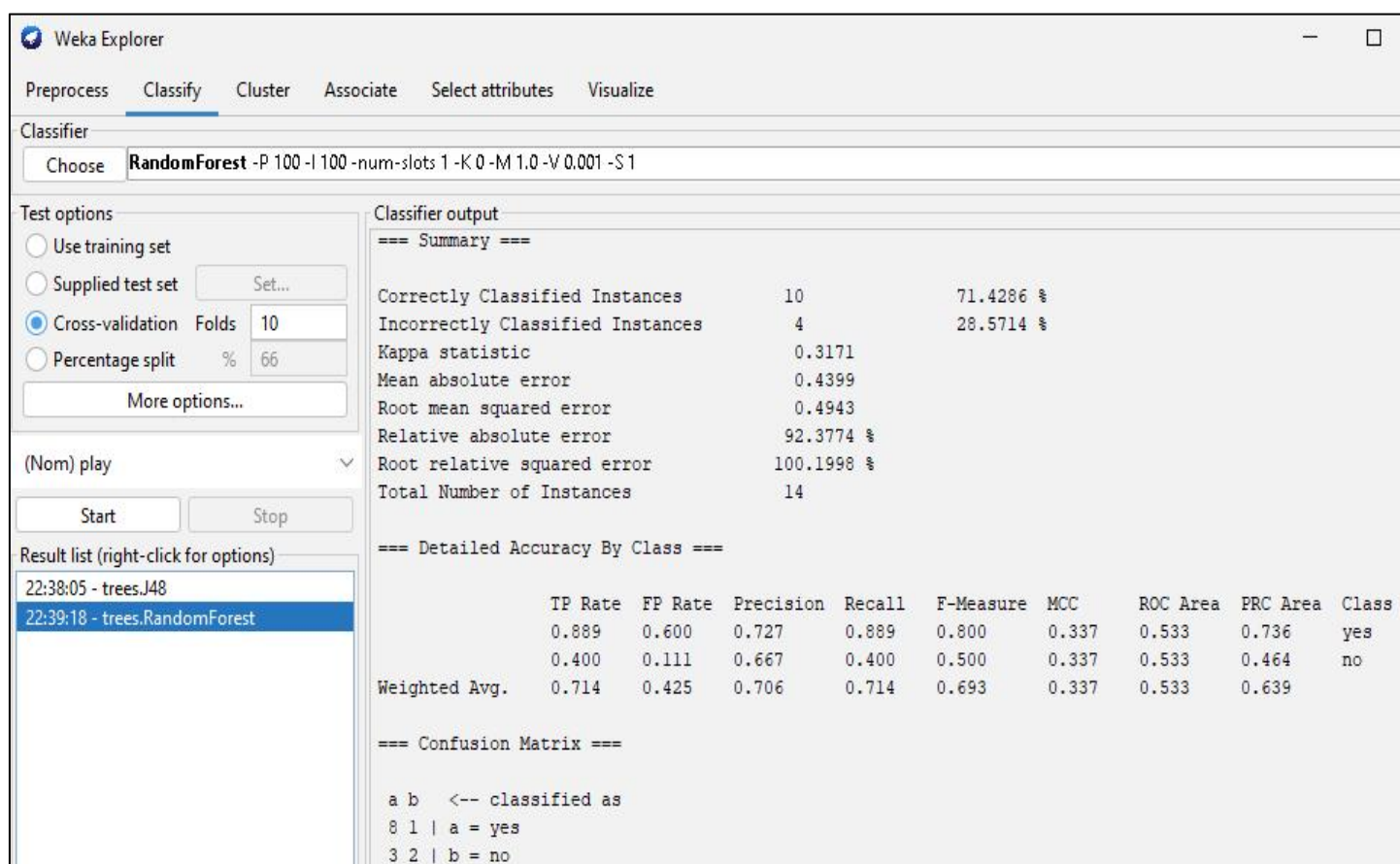
```

=== Confusion Matrix ===
a b  <-- classified as
5 4 | a = yes
3 2 | b = no

```

B) Random Forest:

- 1) Go to **Classify** tab and click on ‘**Choose**’ button in Classifier.
- 2) Under the **trees** section, select the **Random Forest**.
- 3) Set k-fold as 10 in cross validation.
- 4) Click on ‘**Start**’ button to apply the Random Forest.
- 5) Check the confusion matrix obtained for Random Forest.



The screenshot shows the Weka Explorer interface with the 'Classify' tab selected. The 'Classifier' dropdown is set to 'RandomForest'. The 'Test options' section shows 'Cross-validation' selected with 'Folds' set to 10. The 'Start' button has been clicked, and the 'Classifier output' pane displays the results.

Classifier output

```

=== Summary ===
Correctly Classified Instances      10           71.4286 %
Incorrectly Classified Instances     4           28.5714 %
Kappa statistic                    0.3171
Mean absolute error                 0.4399
Root mean squared error             0.4943
Relative absolute error             92.3774 %
Root relative squared error        100.1998 %
Total Number of Instances          14

=== Detailed Accuracy By Class ===

```

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.889	0.600	0.727	0.889	0.800	0.337	0.533	0.736	yes
	0.400	0.111	0.667	0.400	0.500	0.337	0.533	0.464	no
Weighted Avg.	0.714	0.425	0.706	0.714	0.693	0.337	0.533	0.639	

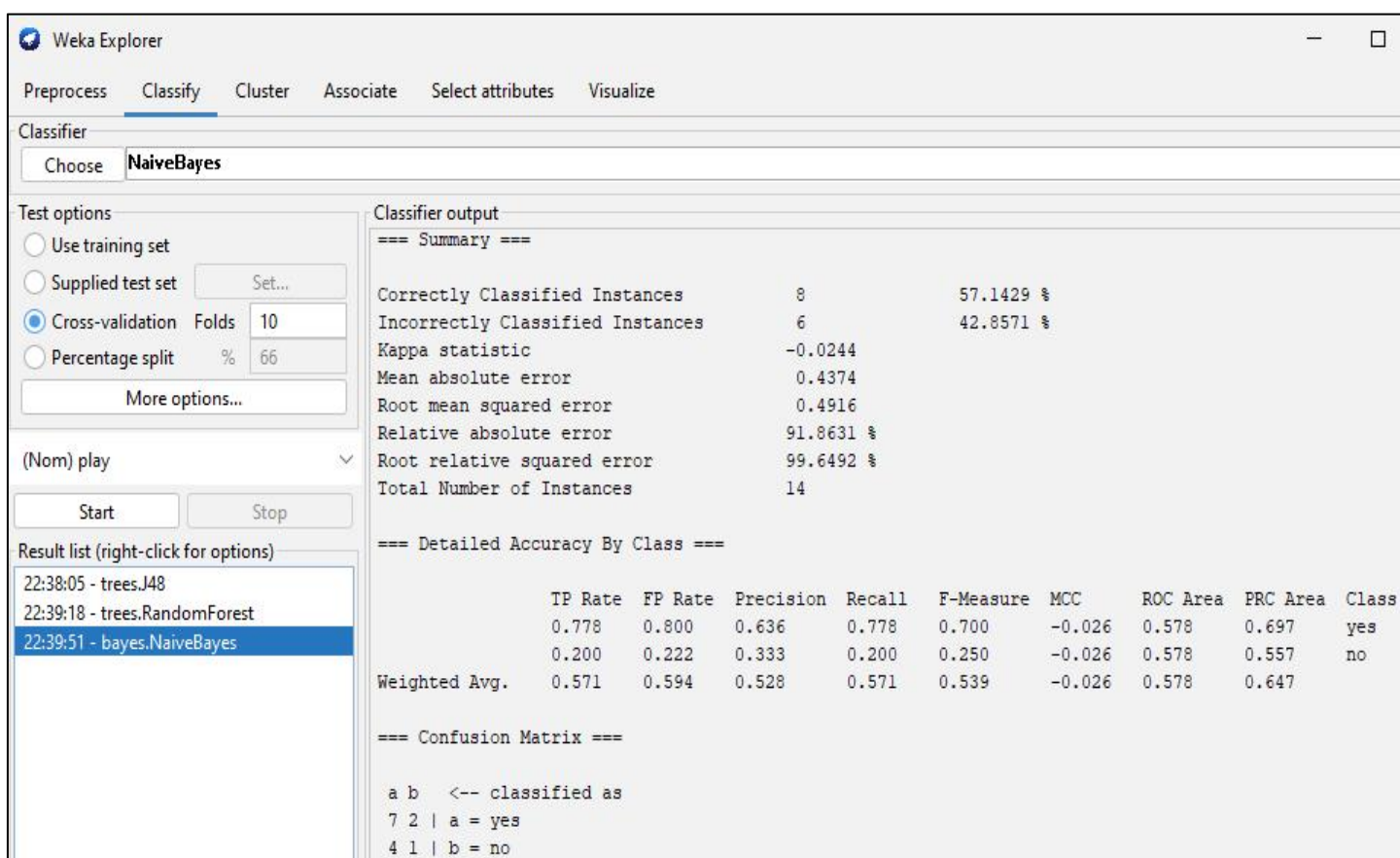
```

=== Confusion Matrix ===
 a b  <-- classified as
8 1 | a = yes
3 2 | b = no

```

C) Naive Bayes:

- 1) Go to **Classify** tab and click on ‘**Choose**’ button in Classifier.
- 2) Under the **bayes** section, select the **Naive Bayes**.
- 3) Set k-fold as 10 in cross validation.
- 4) Click on ‘**Start**’ button to apply the Naive Bayes.
- 5) Check the confusion matrix obtained for Naive Bayes.



The screenshot shows the Weka Explorer interface with the 'Classify' tab selected. The 'Classifier' dropdown is set to 'NaiveBayes'. Under 'Test options', 'Cross-validation' is selected with 'Folds' set to 10. The 'Start' button has been clicked, and the results are displayed in the 'Classifier output' pane.

Classifier output

```

=== Summary ===

Correctly Classified Instances      8           57.1429 %
Incorrectly Classified Instances    6           42.8571 %
Kappa statistic                    -0.0244
Mean absolute error                 0.4374
Root mean squared error             0.4916
Relative absolute error             91.8631 %
Root relative squared error         99.6492 %
Total Number of Instances          14

=== Detailed Accuracy By Class ===

               TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
               ----
Weighted Avg.   0.571   0.594   0.528     0.571    0.539     -0.026   0.578     0.647
               ----
               yes
               no

```

Confusion Matrix

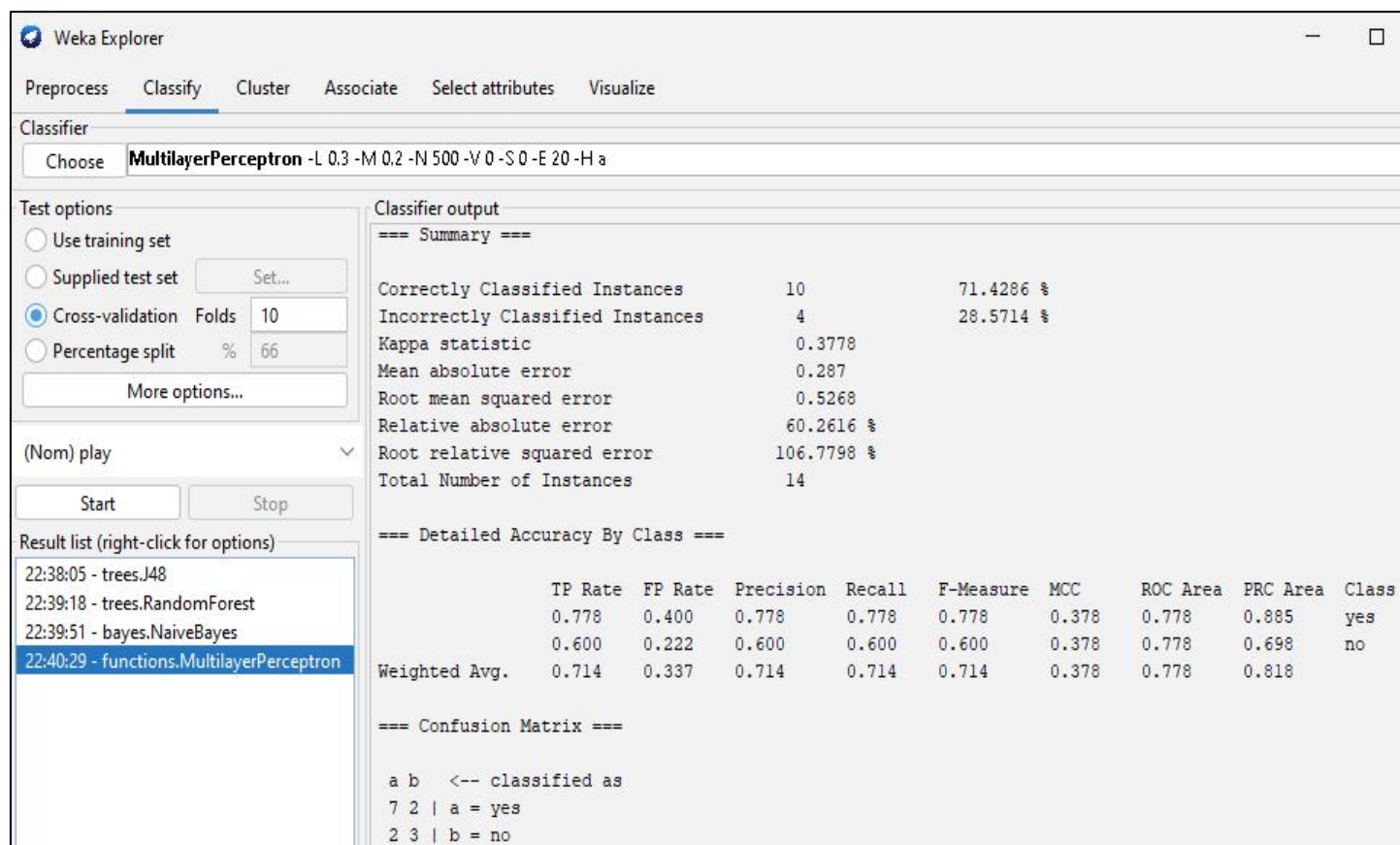
```

a b  <-- classified as
7 2 | a = yes
4 1 | b = no

```


D) Neural Network:

- 1) Go to **Classify** tab and click on ‘**Choose**’ button in Classifier.
- 2) Under the **functions** section, select the **Multilayer Perceptron**.
- 3) Set k-fold as 10 in cross validation.
- 4) Click on **Multilayer Perceptron** again. A dialog box will appear.
- 5) Set GUI as True and then Click on OK.
- 6) Click on ‘**Start**’ button to apply the Multilayer Perceptron.
- 7) A box will appear which will show pictorial representation of neural network architecture.
- 8) Click on ‘**Start**’ button and then accept.
- 9) Check the confusion matrix obtained for Multilayer Perceptron.



Weka Explorer

Preprocess **Classify** Cluster Associate Select attributes Visualize

Classifier: **MultilayerPerceptron -L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a**

Test options

- ☐ Use training set
- ☐ Supplied test set
- ☒ Cross-validation Folds:
- ☐ Percentage split %

(Nom) play ☒

Result list (right-click for options)

- 22:38:05 - trees.J48
- 22:39:18 - trees.RandomForest
- 22:39:51 - bayes.NaiveBayes
- 22:40:29 - functions.MultilayerPerceptron**

Classifier output

=== Summary ===

Correctly Classified Instances	10	71.4286 %
Incorrectly Classified Instances	4	28.5714 %
Kappa statistic	0.3778	
Mean absolute error	0.287	
Root mean squared error	0.5268	
Relative absolute error	60.2616 %	
Root relative squared error	106.7798 %	
Total Number of Instances	14	

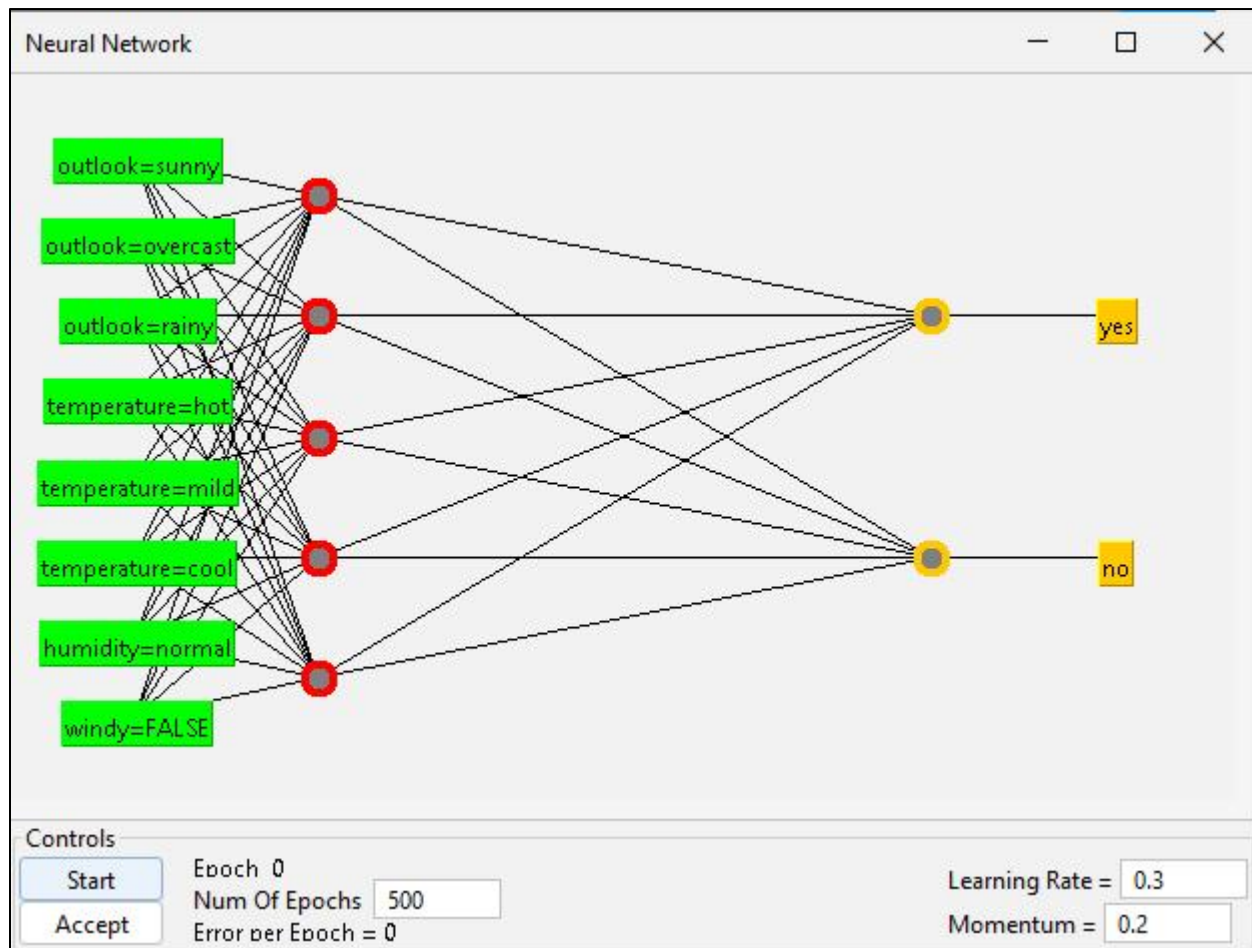
=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
Weighted Avg.	0.714	0.337	0.714	0.714	0.714	0.378	0.778	0.818	

=== Confusion Matrix ===

```

a b  <-- classified as
7 2 | a = yes
2 3 | b = no
  
```



Learning outcomes (What I have learnt):

1. I learnt about the Weka Tool and its applications.
2. I learnt about how to create dataset in .arff format.
3. I learnt about how to open .arff format file in Weka Tool.
4. I learnt about different types of classifiers in Weka Tool.
5. I learnt about Confusion Matrix and its different parameters.