DATA MINING ASSIGNMENT 2

Decision tree classification

TASK 1: One type of model that you can create is a decision tree. Train a decision tree using the complete dataset as the training data. Report the model obtained after training.

PROCEDURE:

1) Open Weka GUI Chooser.

2) Select WORKBENCH present in Applications.

3) Go to OPEN file and browse the file that is already stored in the system “credit-g.arff”.

4) Go to Classify tab.

5) Here the c4.5 algorithm has been chosen which is entitled as j48 in Java and can be selected by clicking the button choose and select tree j48.

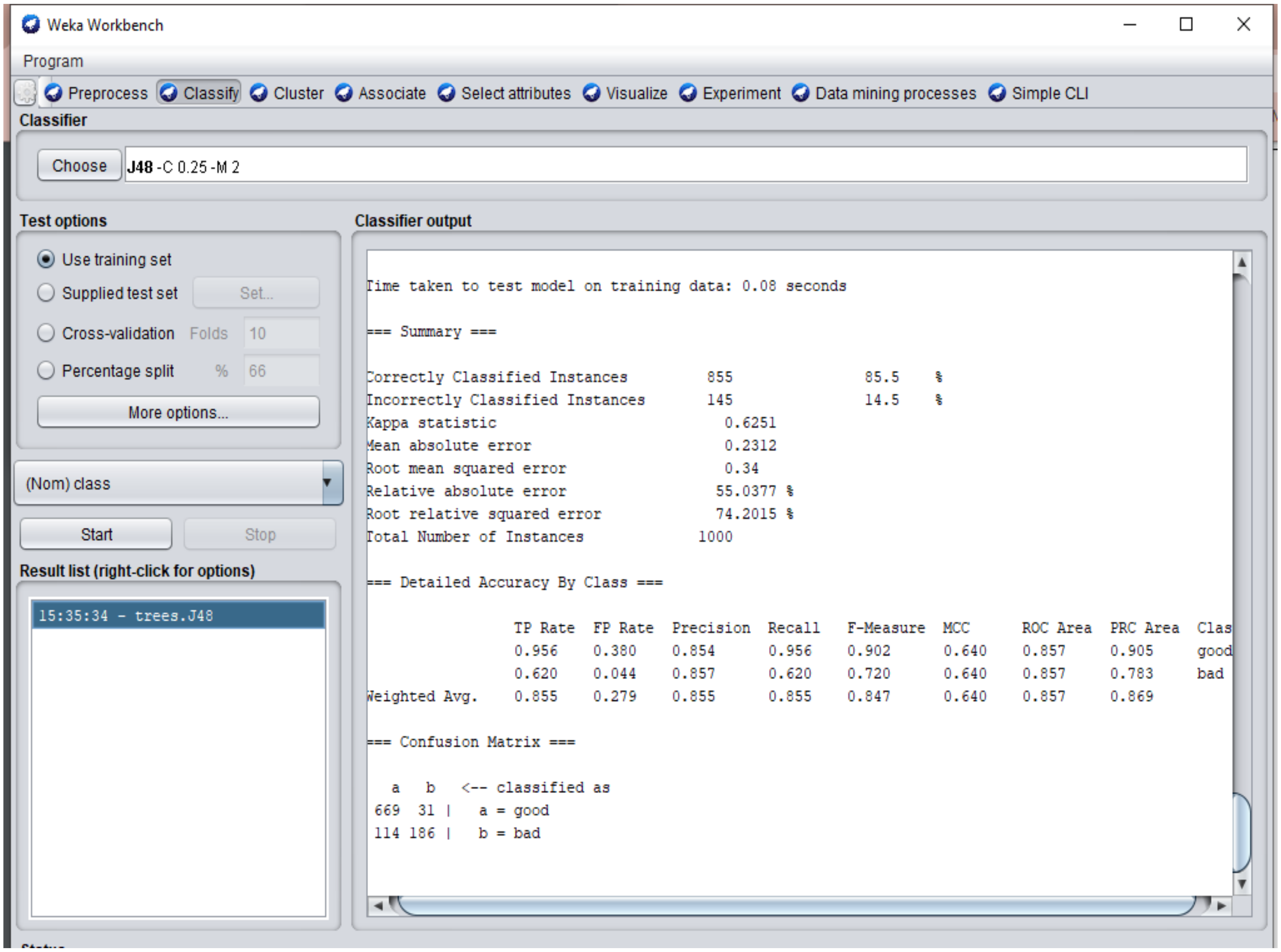
6) Select Test options “Use training set”.

7) Select class attribute.

8) Click Start.

9) Now we can see the output details in the Classifier output.

10) Right click on the result list and select “visualize tree” option.



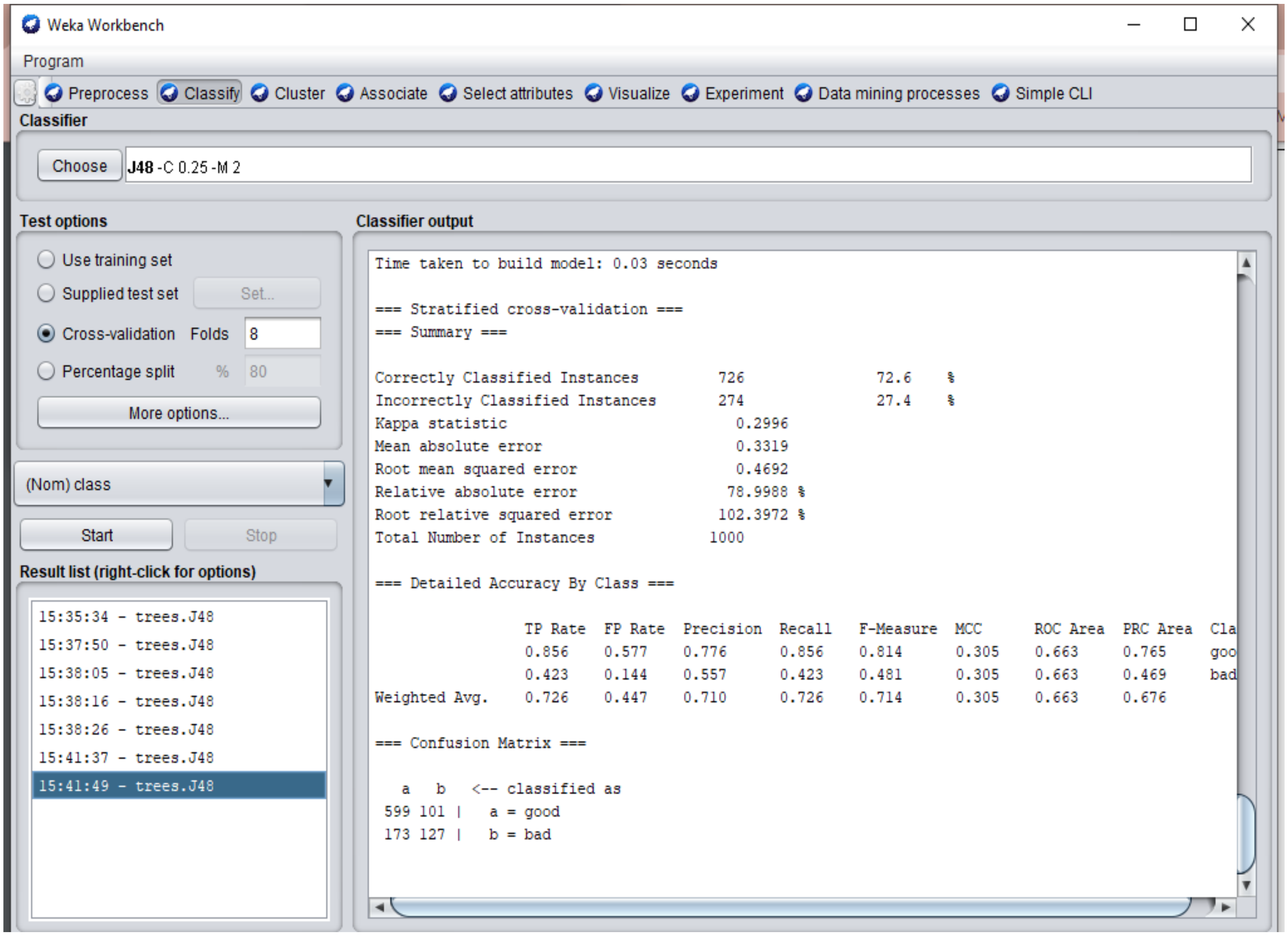
J48 -C 0.25 -M 2

● Use training set
○ Supplied test set
○ Cross-validation Folds 10
○ Percentage split % 66

(Nom) class

15:35:34 - trees.J48

```
Time taken to test model on training data: 0.08 seconds

=== Summary ===

Correctly Classified Instances         855               85.5    %
Incorrectly Classified Instances       145               14.5    %
Kappa statistic                          0.6251
Mean absolute error                      0.2312
Root mean squared error                  0.34
Relative absolute error                 55.0377 %
Root relative squared error             74.2015 %
Total Number of Instances             1000

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Clas
                 0.956    0.380    0.854      0.956    0.902      0.640    0.857     0.905     good
                 0.620    0.044    0.857      0.620    0.720      0.640    0.857     0.783     bad
Weighted Avg.    0.855    0.279    0.855      0.855    0.847      0.640    0.857     0.869

=== Confusion Matrix ===

   a   b   <-- classified as
 669  31 |   a = good
 114 186 |   b = bad
```



Classifier

J48 -C 0.25 -M 2

Test options

○ Use training set

○ Supplied test set

● Cross-validation Folds 8

○ Percentage split % 80

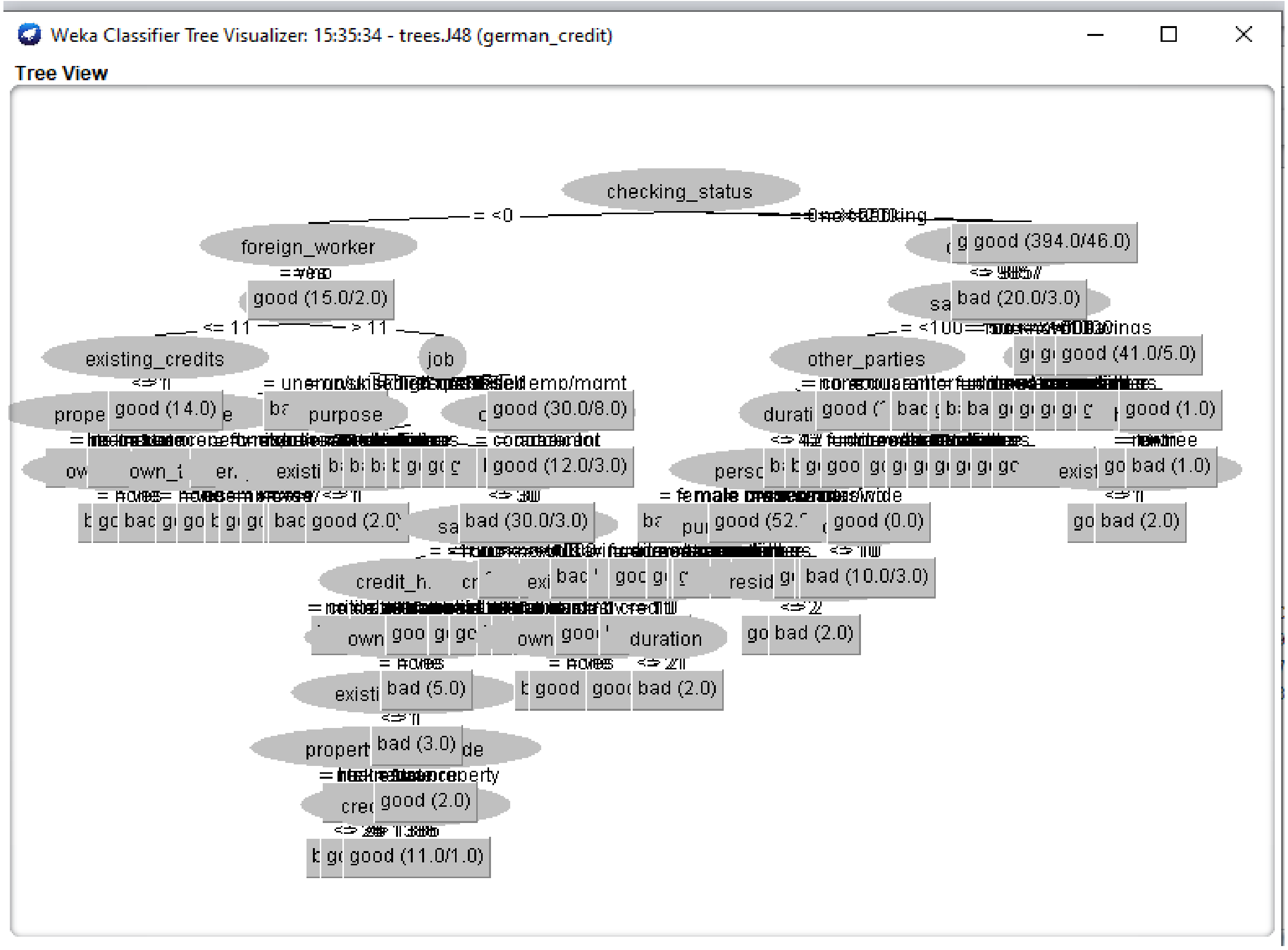
(Nom) class

Result list (right-click for options)

```
15:35:34 - trees.J48
15:37:50 - trees.J48
15:38:05 - trees.J48
15:38:16 - trees.J48
15:38:26 - trees.J48
15:41:37 - trees.J48
15:41:49 - trees.J48
```

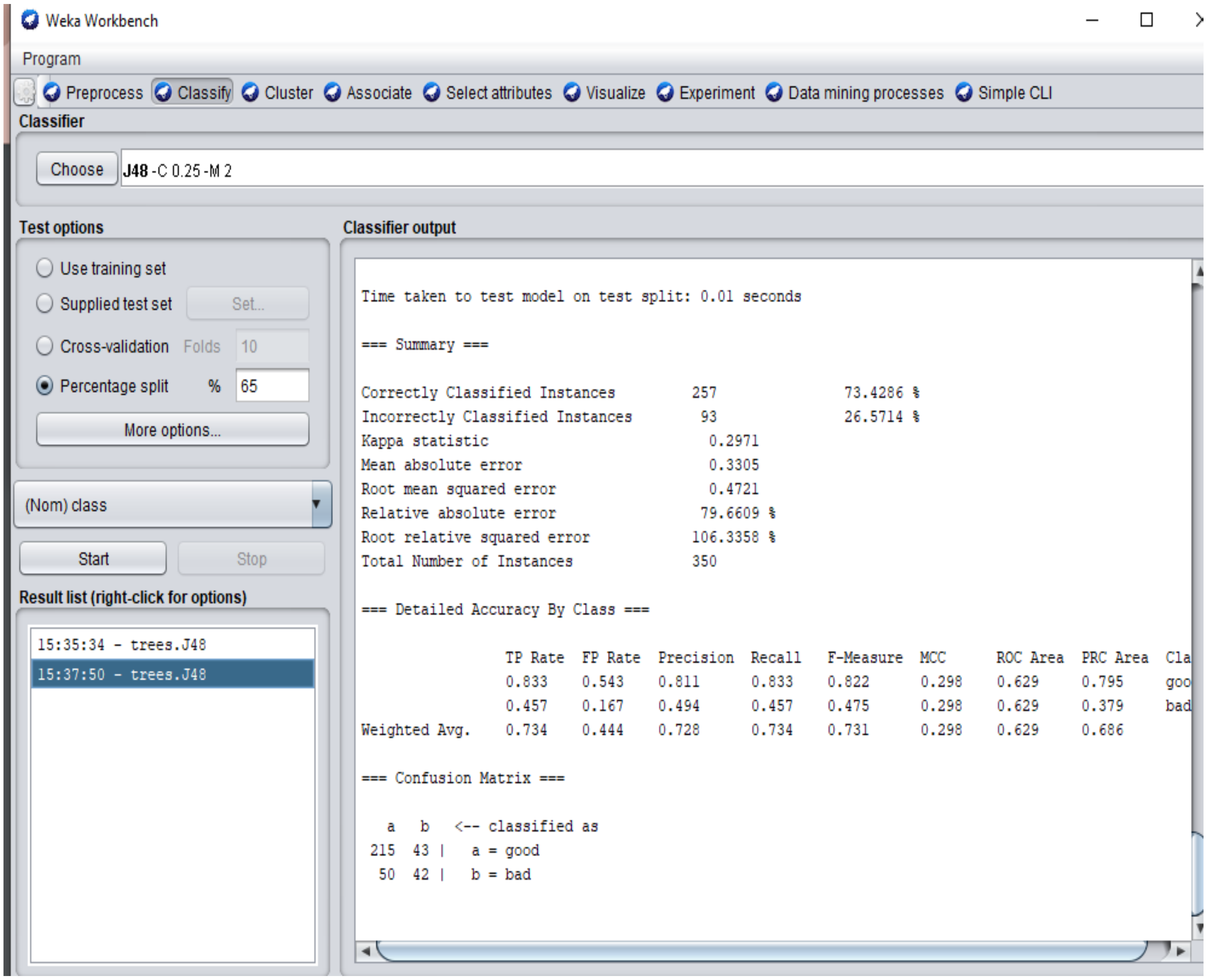
Classifier output

```
Time taken to build model: 0.03 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         726               72.6    %
Incorrectly Classified Instances       274               27.4    %
Kappa statistic                          0.2996
Mean absolute error                      0.3319
Root mean squared error                  0.4692
Relative absolute error                 78.9988 %
Root relative squared error            102.3972 %
Total Number of Instances             1000

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.856    0.577    0.776      0.856    0.814      0.305    0.663     0.765     goo
                 0.423    0.144    0.557      0.423    0.481      0.305    0.663     0.469     bad
Weighted Avg.    0.726    0.447    0.710      0.726    0.714      0.305    0.663     0.676

=== Confusion Matrix ===

   a   b   <-- classified as
 599 101 |   a = good
 173 127 |   b = bad
```


Weka Classifier Tree Visualizer: 15:35:34 - trees.J48 (german_credit)
Tree View
checking_status
= <0
foreign_worker
good (394.0/46.0)
good (15.0/2.0)
bad (20.0/3.0)
<= 11
> 11
existing_credits
job
other_parties
good (41.0/5.0)
good (14.0)
purpose
good (30.0/8.0)
good (1.0)
good (12.0/3.0)
bad (1.0)
good (2.0)
bad (30.0/3.0)
good (0.0)
bad (2.0)
credit_h
bad (10.0/3.0)
duration
bad (2.0)
bad (5.0)
bad (3.0)
good (2.0)
good (11.0/1.0)

TASK 2: Train a Decision Tree using percentage split and report your results. Increase percentage split by 5% upto 80% starting from 65% and check at which percentage split we are getting the best accuracy.

1. When percentage split is 65%, the accuracy is 73.4286%



Classifier: J48 -C 0.25 -M 2

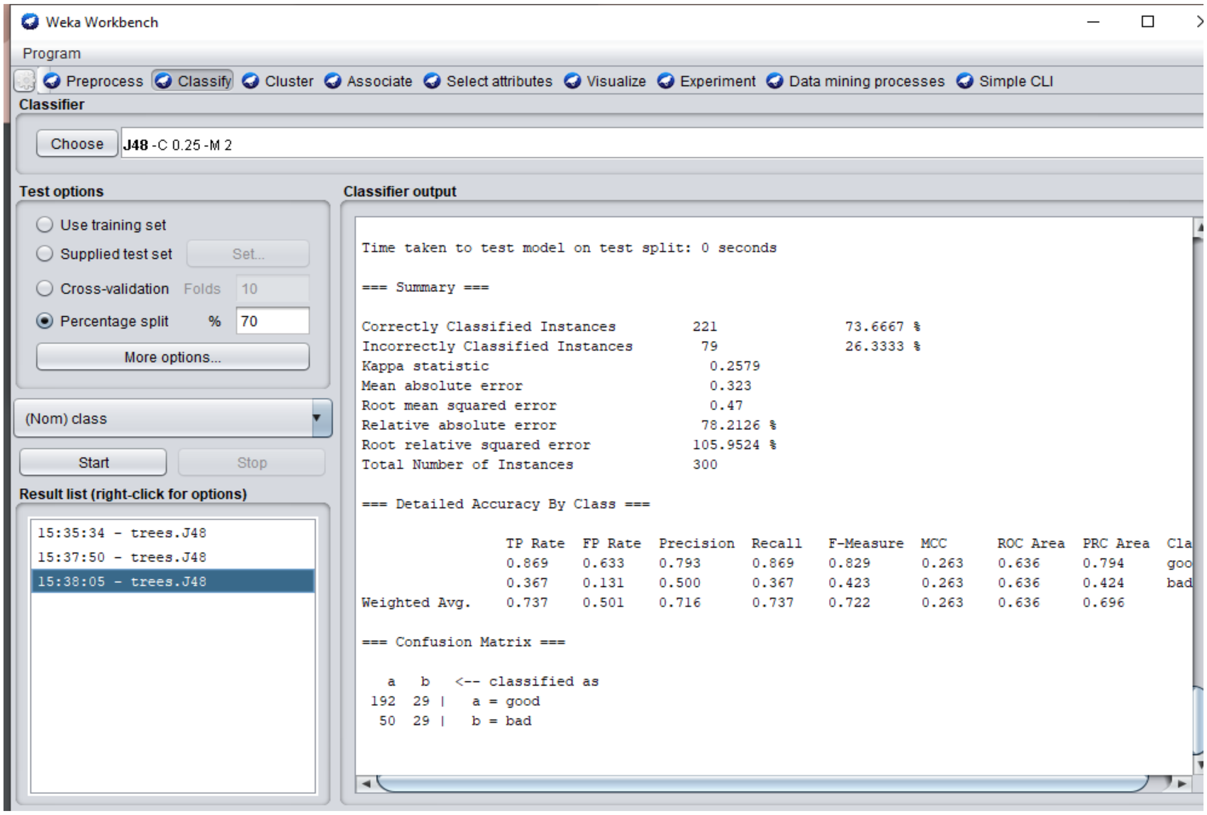
Test options:
- ○ Use training set
- ○ Supplied test set Set...
- ○ Cross-validation Folds 10
- ● Percentage split % 65

(Nom) class

Result list:
- 15:35:34 - trees.J48
- 15:37:50 - trees.J48

```
Time taken to test model on test split: 0.01 seconds

=== Summary ===

Correctly Classified Instances         257               73.4286 %
Incorrectly Classified Instances        93               26.5714 %
Kappa statistic                          0.2971
Mean absolute error                      0.3305
Root mean squared error                  0.4721
Relative absolute error                 79.6609 %
Root relative squared error            106.3358 %
Total Number of Instances              350

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.833    0.543    0.811      0.833    0.822      0.298    0.629     0.795     goo
                 0.457    0.167    0.494      0.457    0.475      0.298    0.629     0.379     bad
Weighted Avg.    0.734    0.444    0.728      0.734    0.731      0.298    0.629     0.686

=== Confusion Matrix ===

   a   b   <-- classified as
 215  43 |   a = good
  50  42 |   b = bad
```

2. When percentage split is 70%, the accuracy is 73.6667%



Classifier: **J48** -C 0.25 -M 2

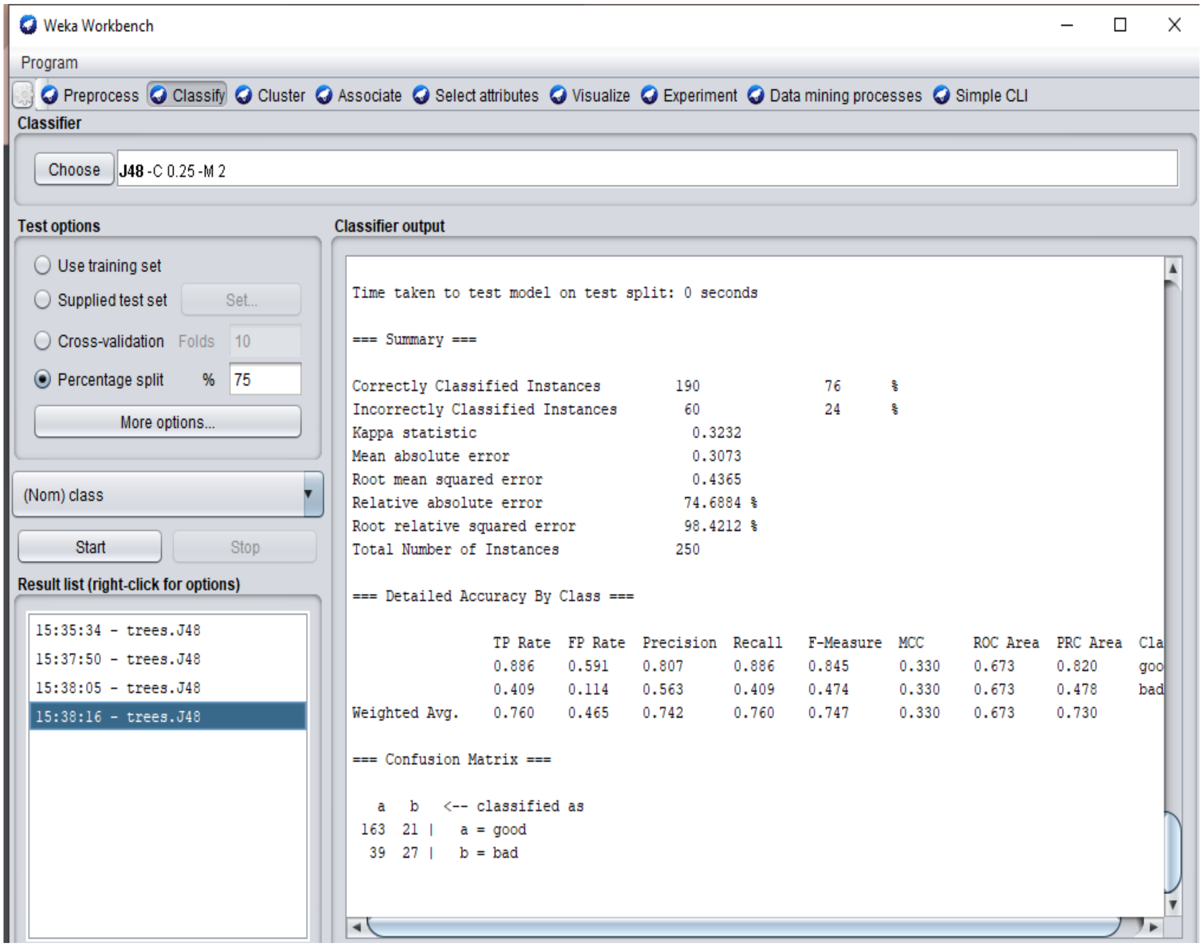
● Percentage split % 70

(Nom) class

```
15:35:34 - trees.J48
15:37:50 - trees.J48
15:38:05 - trees.J48
```

```
Time taken to test model on test split: 0 seconds

=== Summary ===

Correctly Classified Instances         221               73.6667 %
Incorrectly Classified Instances        79               26.3333 %
Kappa statistic                          0.2579
Mean absolute error                      0.323
Root mean squared error                  0.47
Relative absolute error                 78.2126 %
Root relative squared error            105.9524 %
Total Number of Instances              300

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.869    0.633    0.793      0.869    0.829      0.263    0.636     0.794     goo
                 0.367    0.131    0.500      0.367    0.423      0.263    0.636     0.424     bad
Weighted Avg.    0.737    0.501    0.716      0.737    0.722      0.263    0.636     0.696

=== Confusion Matrix ===

   a   b   <-- classified as
 192  29 |   a = good
  50  29 |   b = bad
```

3. When percentage split is 75%, the accuracy is 76%



Classifier

J48 -C 0.25 -M 2

Test options

● Percentage split % 75

(Nom) class

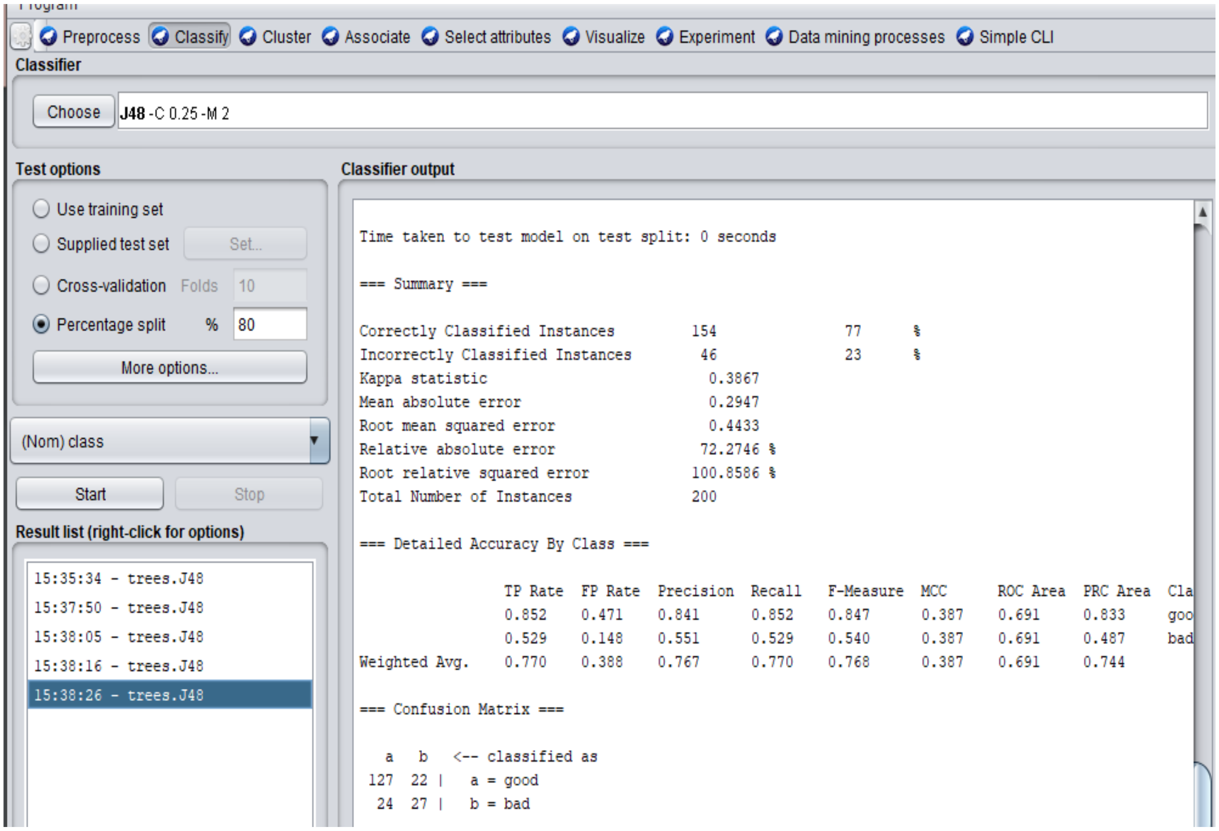
Result list (right-click for options)

```
15:35:34 - trees.J48
15:37:50 - trees.J48
15:38:05 - trees.J48
15:38:16 - trees.J48
```

Classifier output

```
Time taken to test model on test split: 0 seconds

=== Summary ===

Correctly Classified Instances         190               76      %
Incorrectly Classified Instances        60               24      %
Kappa statistic                          0.3232
Mean absolute error                      0.3073
Root mean squared error                  0.4365
Relative absolute error                 74.6884 %
Root relative squared error             98.4212 %
Total Number of Instances              250

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.886    0.591    0.807      0.886    0.845      0.330    0.673     0.820     goo
                 0.409    0.114    0.563      0.409    0.474      0.330    0.673     0.478     bad
Weighted Avg.    0.760    0.465    0.742      0.760    0.747      0.330    0.673     0.730

=== Confusion Matrix ===

   a   b   <-- classified as
 163  21 |   a = good
  39  27 |   b = bad
```

4. When percentage split is 80%, the accuracy is 77%



Classifier

J48 -C 0.25 -M 2

Test options

○ Use training set
○ Supplied test set
○ Cross-validation Folds 10
● Percentage split % 80

(Nom) class

Result list (right-click for options)

```
15:35:34 - trees.J48
15:37:50 - trees.J48
15:38:05 - trees.J48
15:38:16 - trees.J48
15:38:26 - trees.J48
```

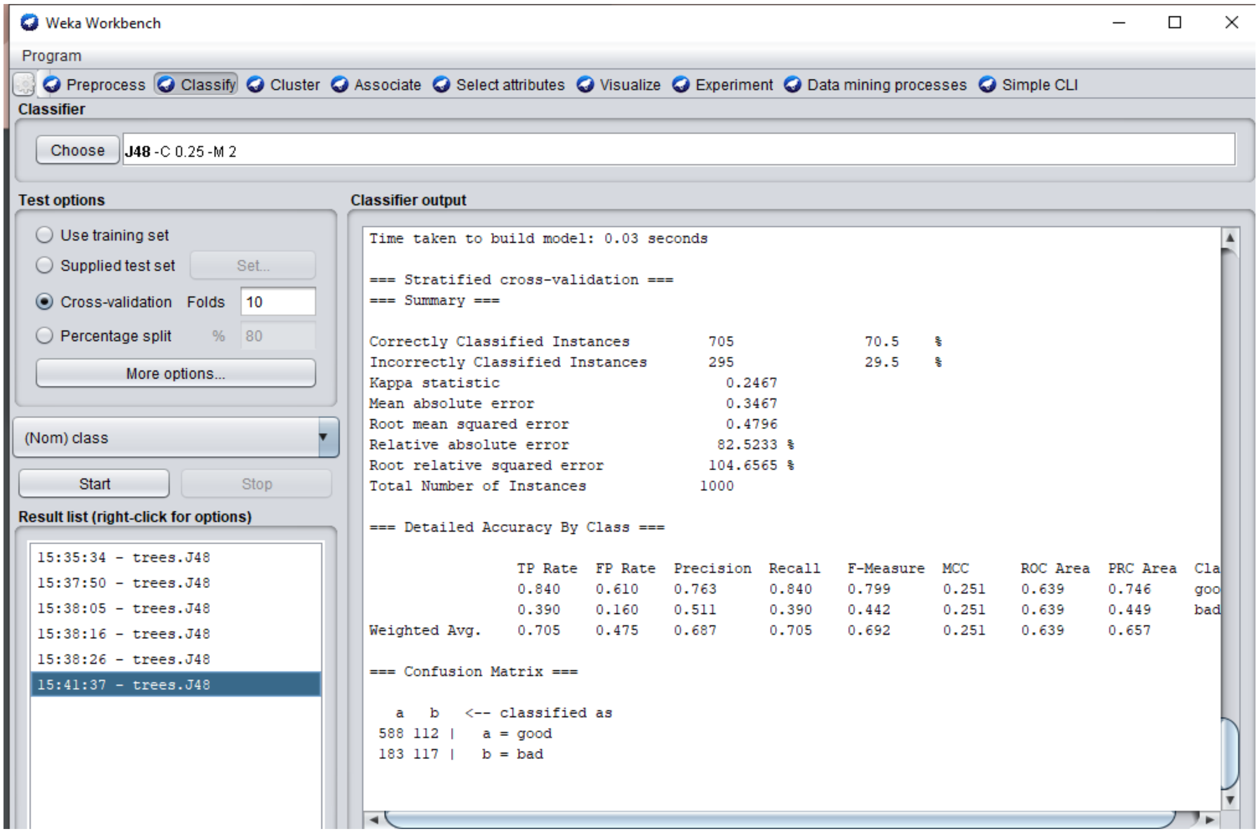
Classifier output

```
Time taken to test model on test split: 0 seconds

=== Summary ===

Correctly Classified Instances         154               77      %
Incorrectly Classified Instances        46               23      %
Kappa statistic                          0.3867
Mean absolute error                      0.2947
Root mean squared error                  0.4433
Relative absolute error                 72.2746 %
Root relative squared error            100.8586 %
Total Number of Instances              200

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.852    0.471    0.841      0.852    0.847      0.387    0.691     0.833     goo
                 0.529    0.148    0.551      0.529    0.540      0.387    0.691     0.487     bad
Weighted Avg.    0.770    0.388    0.767      0.770    0.768      0.387    0.691     0.744

=== Confusion Matrix ===

   a   b   <-- classified as
 127  22 |   a = good
  24  27 |   b = bad
```

CONCLUSION: When the percentage split is 80%, the accuracy is high(77%).

TASK 3: Train a Decision Tree using cross validation and report your results.

1. When cross validation folds : 10, accuracy is 70.5%



Classifier: J48 -C 0.25 -M 2

Test options: ● Cross-validation Folds 10

% 80

(Nom) class

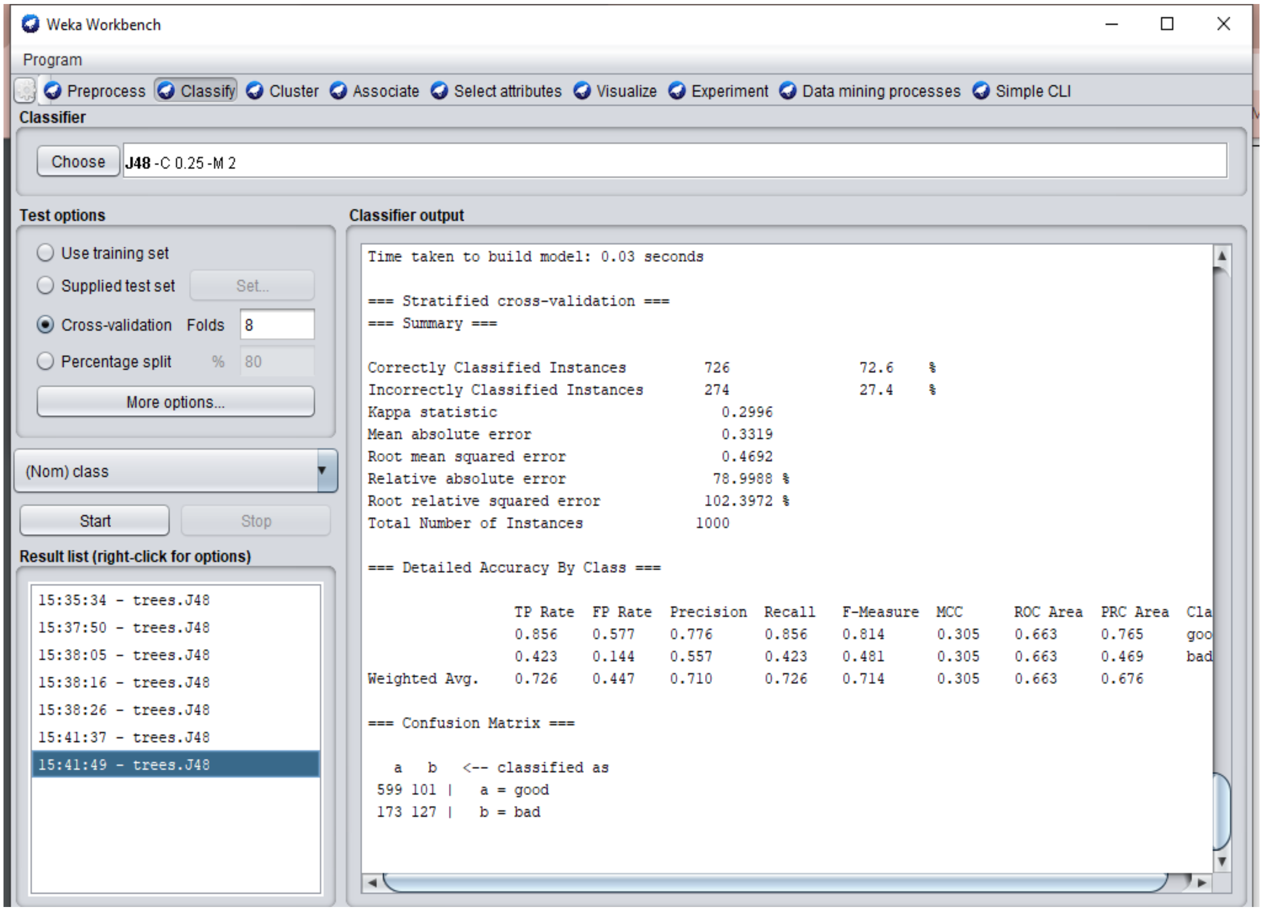
Result list (right-click for options)

```
15:35:34 - trees.J48
15:37:50 - trees.J48
15:38:05 - trees.J48
15:38:16 - trees.J48
15:38:26 - trees.J48
15:41:37 - trees.J48
```

Classifier output

```
Time taken to build model: 0.03 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         705               70.5    %
Incorrectly Classified Instances       295               29.5    %
Kappa statistic                          0.2467
Mean absolute error                      0.3467
Root mean squared error                  0.4796
Relative absolute error                 82.5233 %
Root relative squared error            104.6565 %
Total Number of Instances             1000

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.840    0.610    0.763      0.840    0.799      0.251    0.639     0.746     goo
                 0.390    0.160    0.511      0.390    0.442      0.251    0.639     0.449     bad
Weighted Avg.    0.705    0.475    0.687      0.705    0.692      0.251    0.639     0.657

=== Confusion Matrix ===

   a   b   <-- classified as
 588 112 |   a = good
 183 117 |   b = bad
```

2. When cross validation folds : 8, accuracy is 72.6%



Choose J48 -C 0.25 -M 2

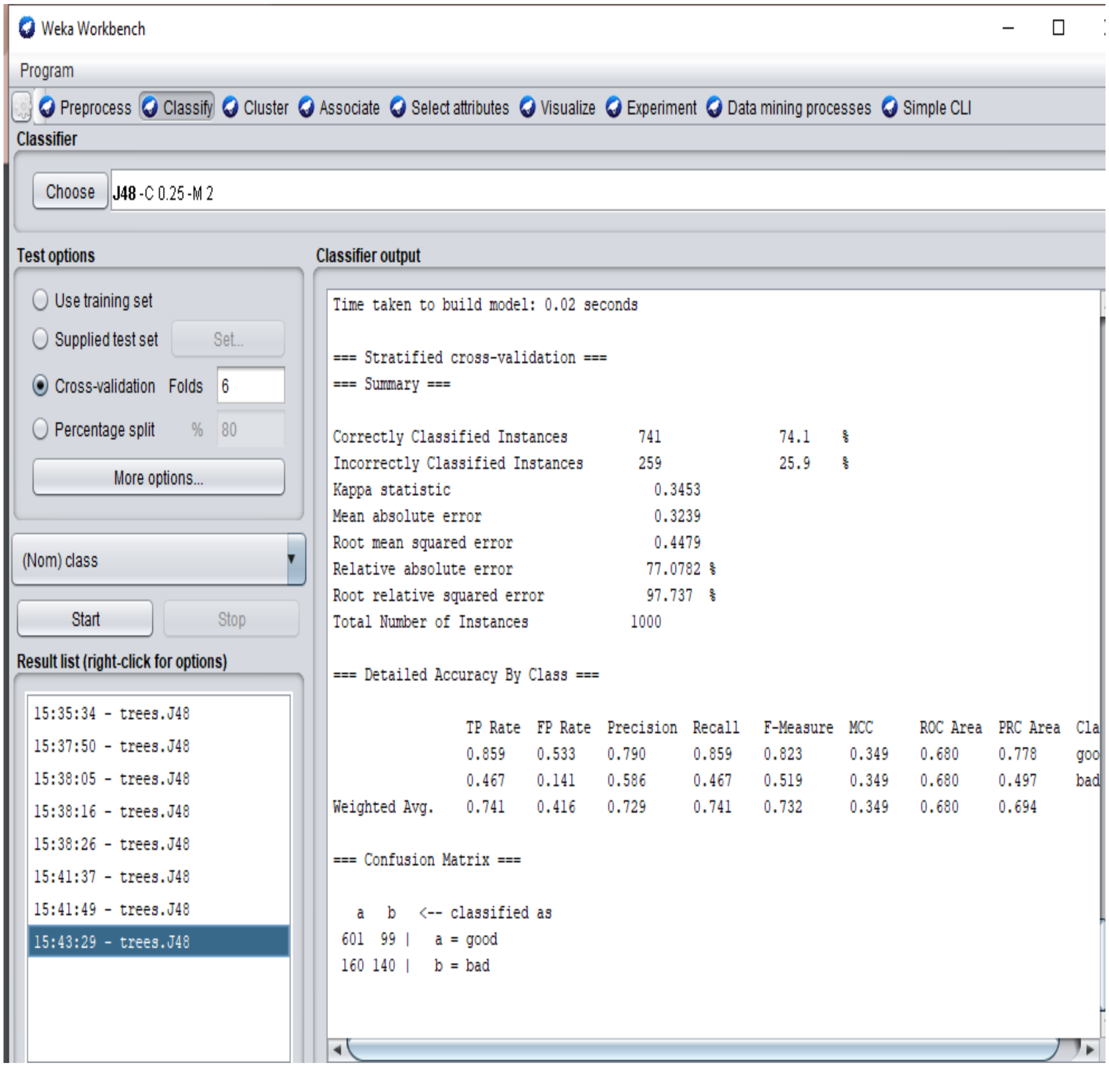
○ Use training set
○ Supplied test set
● Cross-validation Folds 8
○ Percentage split % 80

(Nom) class

```
15:35:34 - trees.J48
15:37:50 - trees.J48
15:38:05 - trees.J48
15:38:16 - trees.J48
15:38:26 - trees.J48
15:41:37 - trees.J48
15:41:49 - trees.J48
```

```
Time taken to build model: 0.03 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         726               72.6    %
Incorrectly Classified Instances       274               27.4    %
Kappa statistic                          0.2996
Mean absolute error                      0.3319
Root mean squared error                  0.4692
Relative absolute error                 78.9988 %
Root relative squared error            102.3972 %
Total Number of Instances             1000

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.856    0.577    0.776      0.856    0.814      0.305    0.663     0.765     goo
                 0.423    0.144    0.557      0.423    0.481      0.305    0.663     0.469     bad
Weighted Avg.    0.726    0.447    0.710      0.726    0.714      0.305    0.663     0.676

=== Confusion Matrix ===

   a   b   <-- classified as
 599 101 |   a = good
 173 127 |   b = bad
```

3. When cross validation folds : 6, accuracy is 74.1%



Classifier: J48 -C 0.25 -M 2

● Cross-validation Folds 6

(Nom) class

```
15:35:34 - trees.J48
15:37:50 - trees.J48
15:38:05 - trees.J48
15:38:16 - trees.J48
15:38:26 - trees.J48
15:41:37 - trees.J48
15:41:49 - trees.J48
15:43:29 - trees.J48
```

```
Time taken to build model: 0.02 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         741               74.1    %
Incorrectly Classified Instances       259               25.9    %
Kappa statistic                          0.3453
Mean absolute error                      0.3239
Root mean squared error                  0.4479
Relative absolute error                 77.0782 %
Root relative squared error             97.737  %
Total Number of Instances             1000

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Cla
                 0.859    0.533    0.790      0.859    0.823      0.349    0.680     0.778     goo
                 0.467    0.141    0.586      0.467    0.519      0.349    0.680     0.497     bad
Weighted Avg.    0.741    0.416    0.729      0.741    0.732      0.349    0.680     0.694

=== Confusion Matrix ===

   a   b   <-- classified as
 601  99 |   a = good
 160 140 |   b = bad
```

CONCLUSION: The accuracy is high(74.1%) when cross validation folds: 6