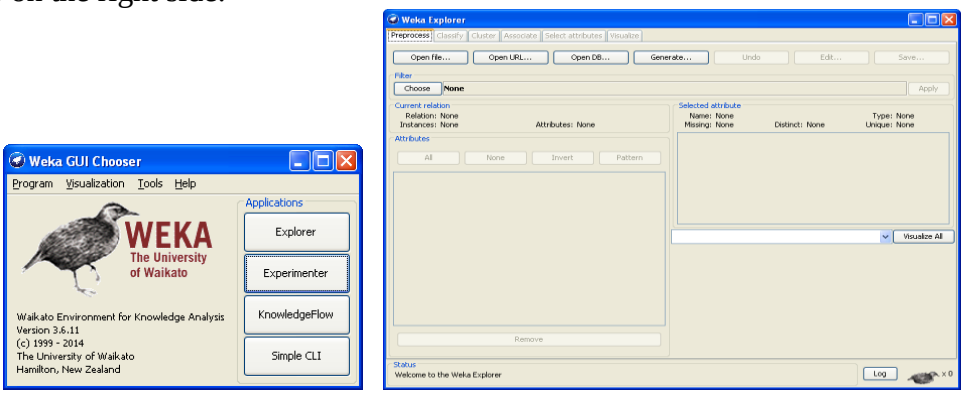
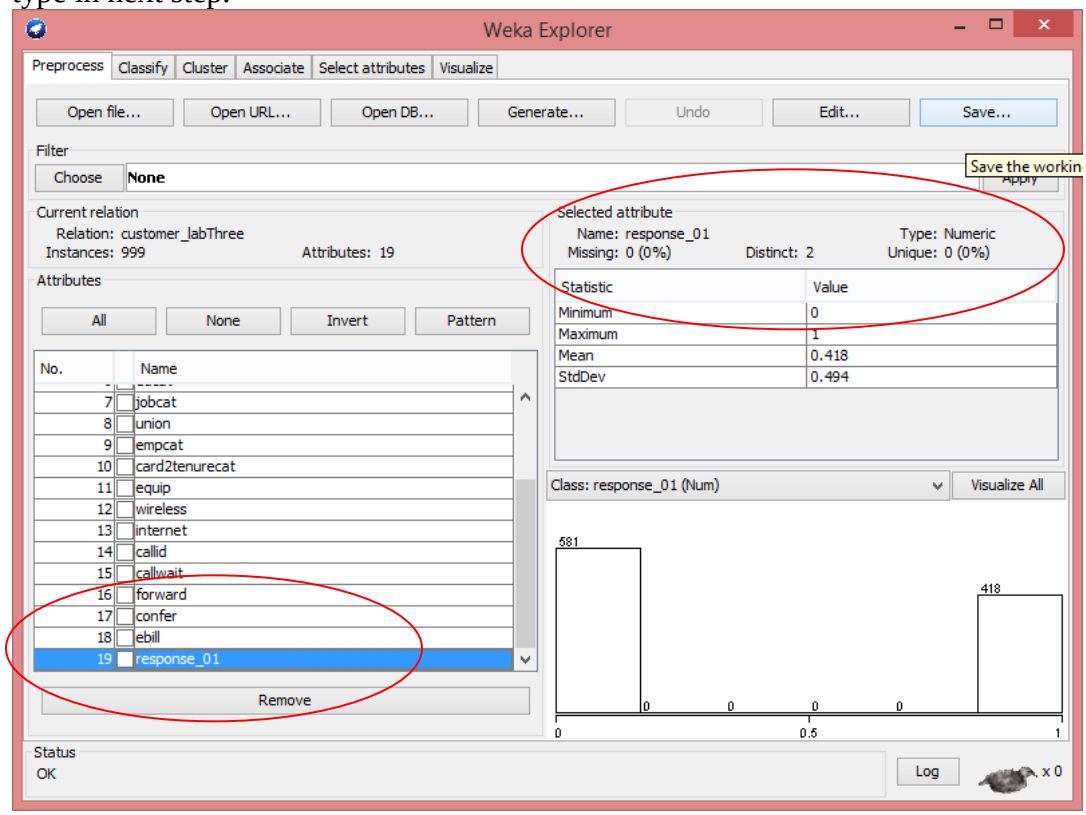
Lab Exercise Three
Classification with WEKA Explorer

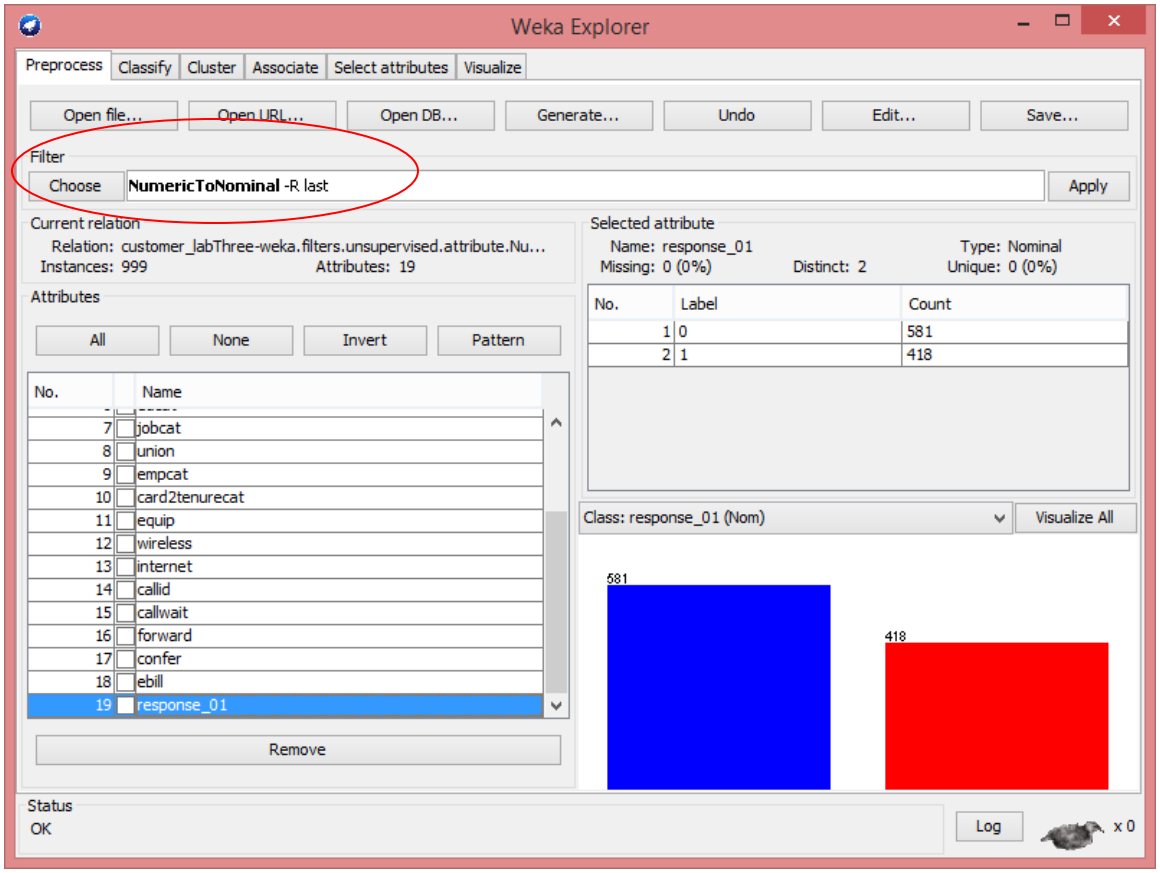
1. Fire up WEKA to get the GUI Chooser panel. Select Explorer from the four choices on the right side.

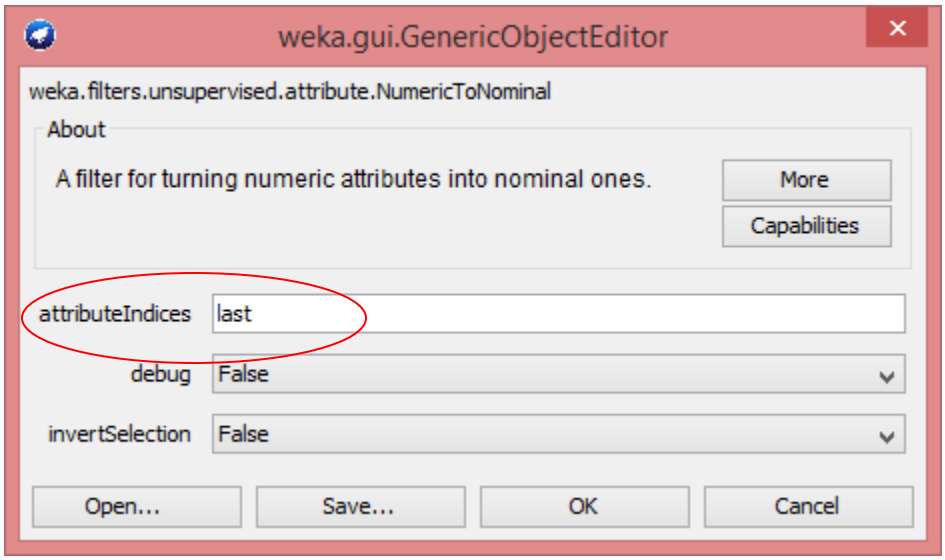


2. We are on ***Preprocess*** now. Click the ***Open file*** button to bring up a standard dialog through which you can select a file. Choose the **customer_labThree.cvs** file.
3. To perform classification with Weka, the last attribute in the dataset is taken as class label and it should be *nominal*. Since the last attribute of data set **customer_labThree.cvs** is *numeric* type (1/0), we should convert it to *nominal* type in next step.

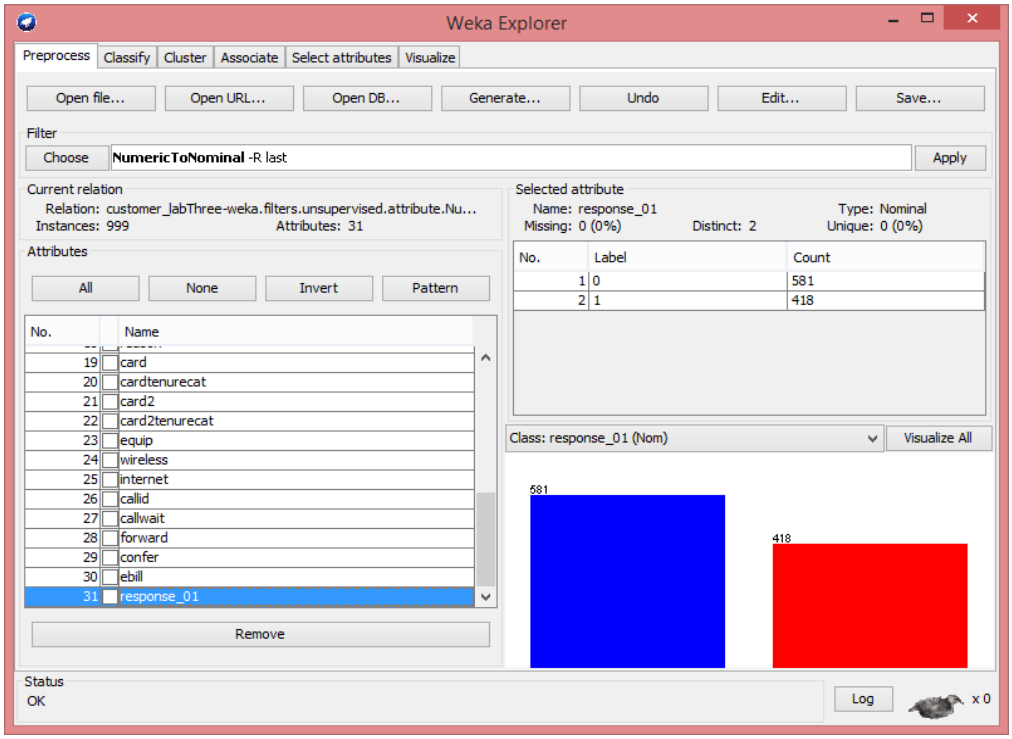


4. Unsupervised attribute filter – ***NumericToNominal*** is chosen to perform this conversion. Since we would like to convert the last attribute only, change the ***attributeIndices*** to **last**.

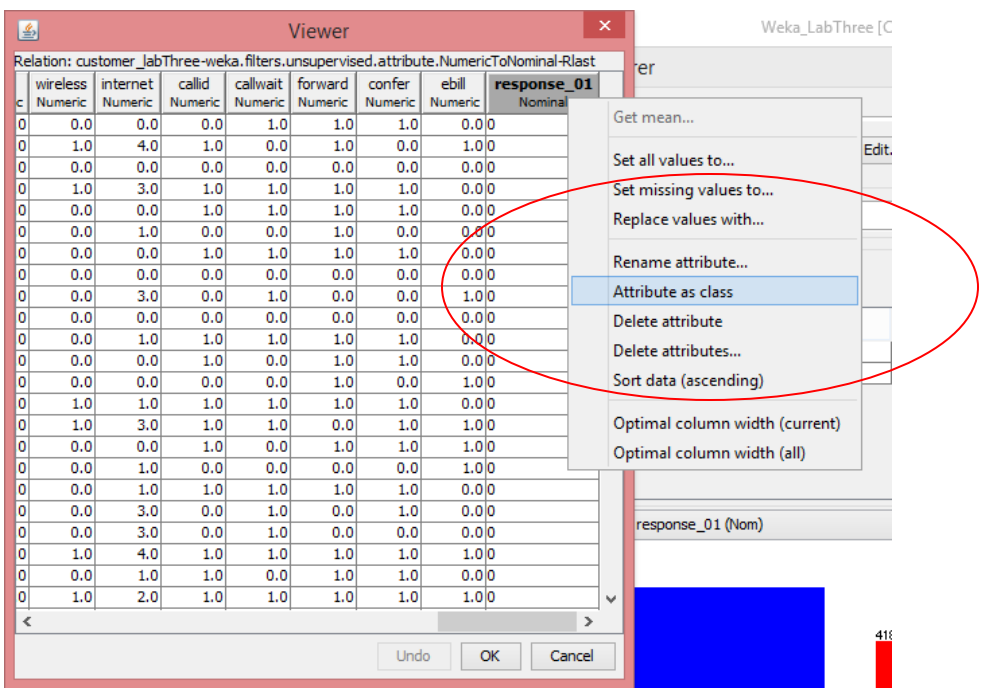




5. After applying the filter, the last attribute becomes nominal type and it is taken as the class label for the dataset – now the data set is visualized in two colors.

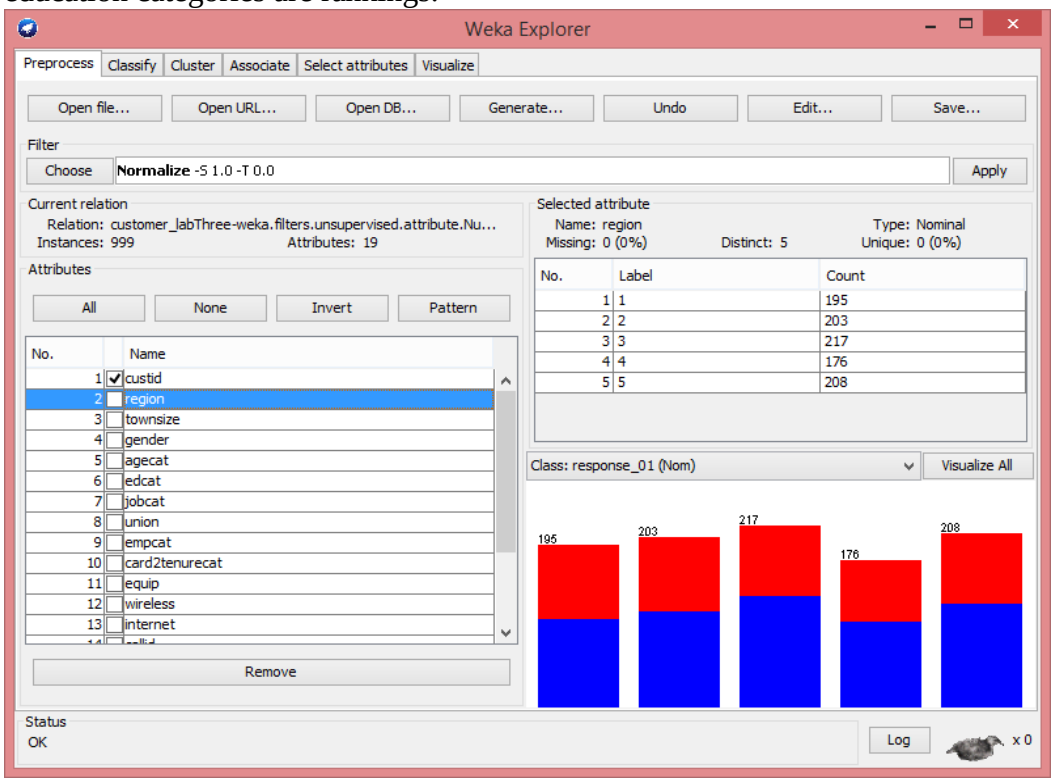


6. If the class attribute is not the last attribute, you could set it in edit window.



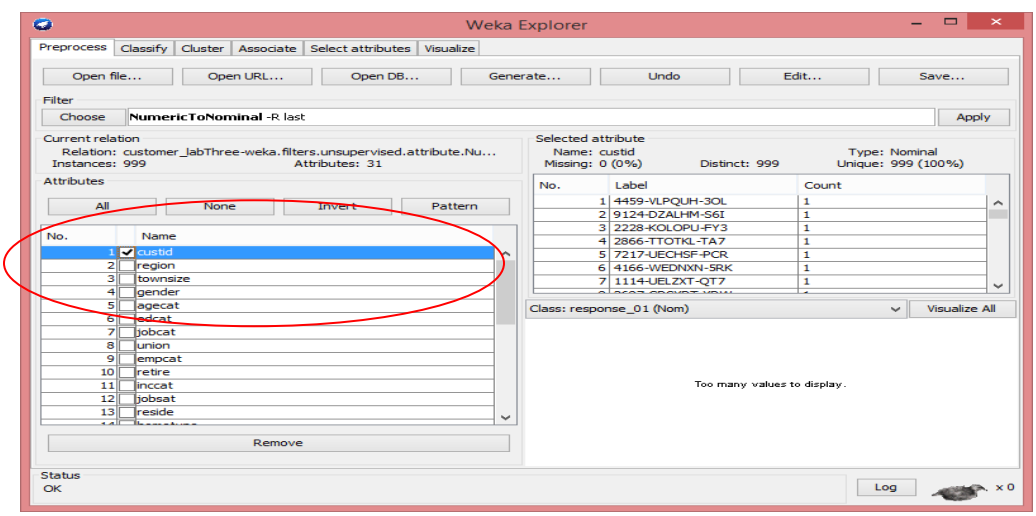
7. You should also to convert the types of other attributes. Attributes region, townsize, agecat, jobcat, empcat, card2tenurecat, and internet are all nominal values, however, they are treated as numeric type by Weka. And attributes gender, union, equip, wireless, called, callwait, forward, confer, ebill are binary values,

they are treated as numeric types as well. **NumericToNominal** filter should be applied to convert them. You could also normalize attribute educat to [0, 1] since education categories are rankings.

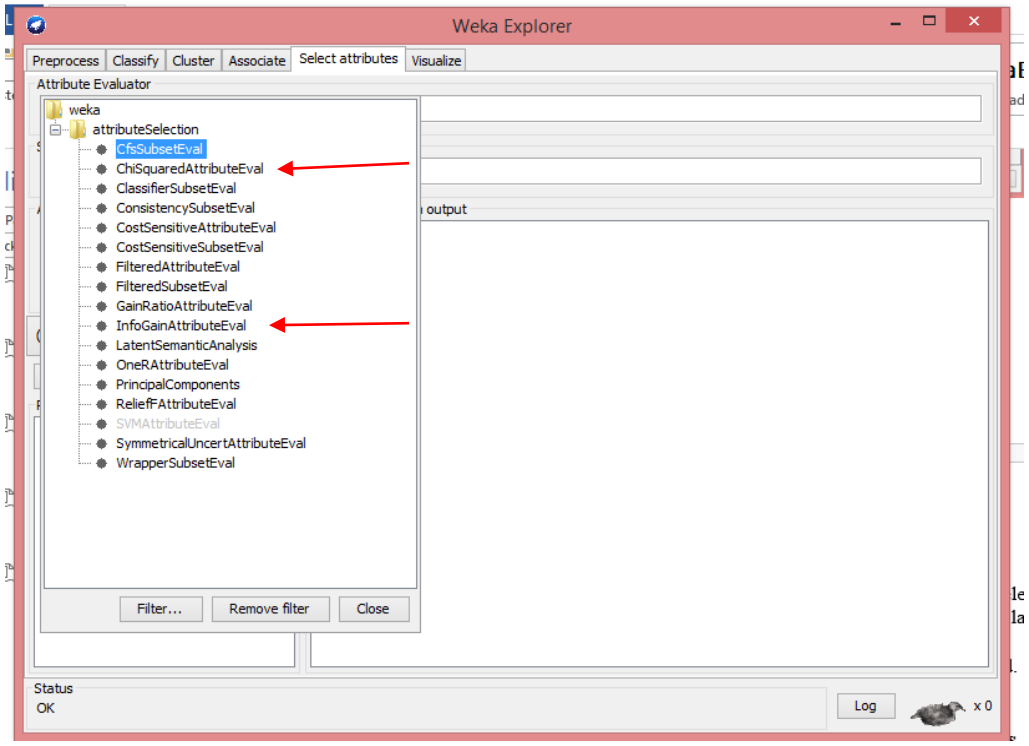


Attribute Selection - Since not all attributes are relevant to the classification job, you should perform attribute selection before training the classifier.

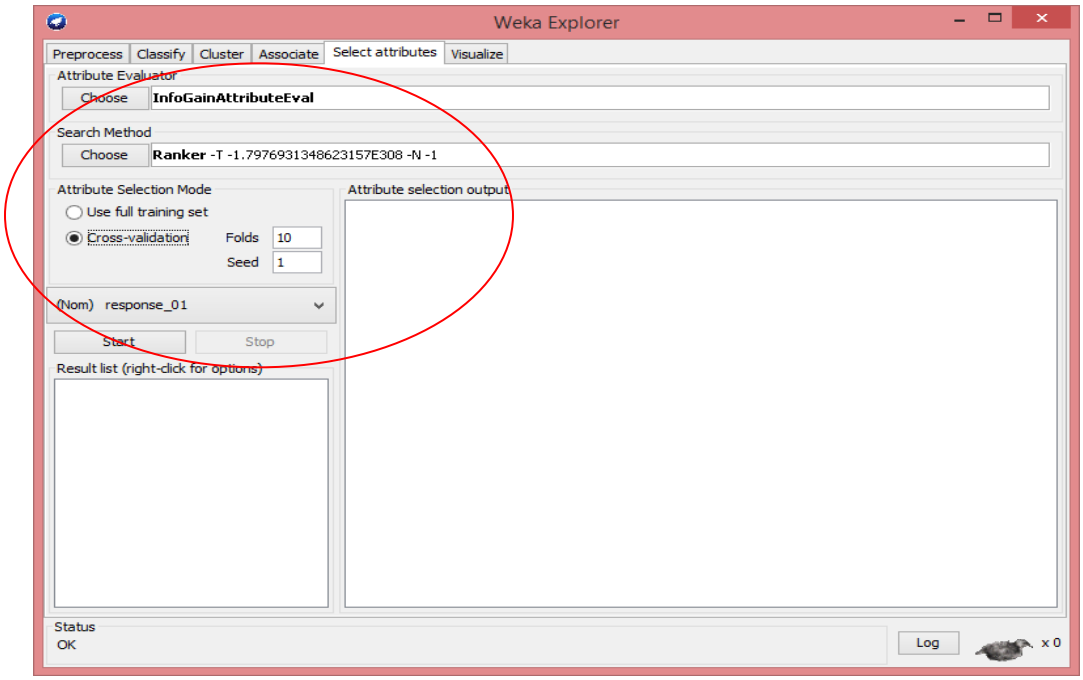
8. You could remove irrelevant attributes by hand. For example, the first attribute ***custId*** should be removed. Select it and click ***Remove*** button to remove it.

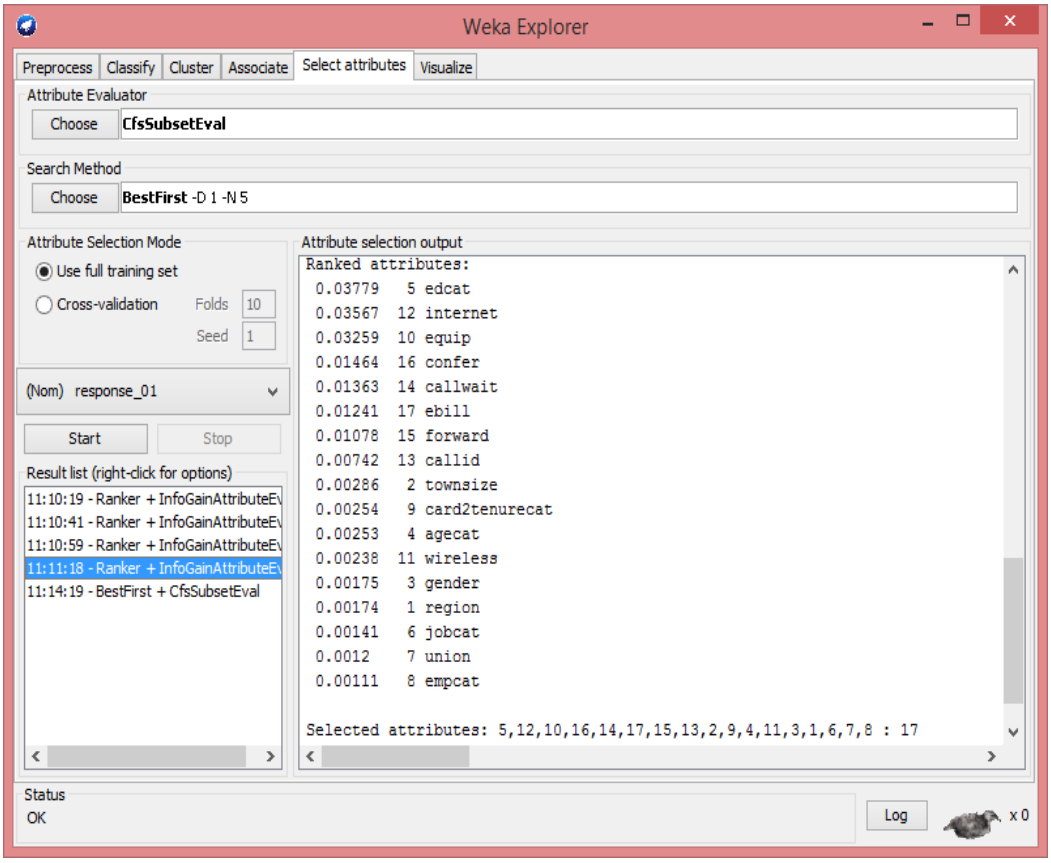


9. You also could run automatic attribute selection. We have introduced two methods of evaluating attributes individually – **InfoGainAttributeEval** and **ChiSquaredAttributeEval**. The default attribute selection method of Weka is **CfsSubsetEval**, which evaluates subsets of attributes.

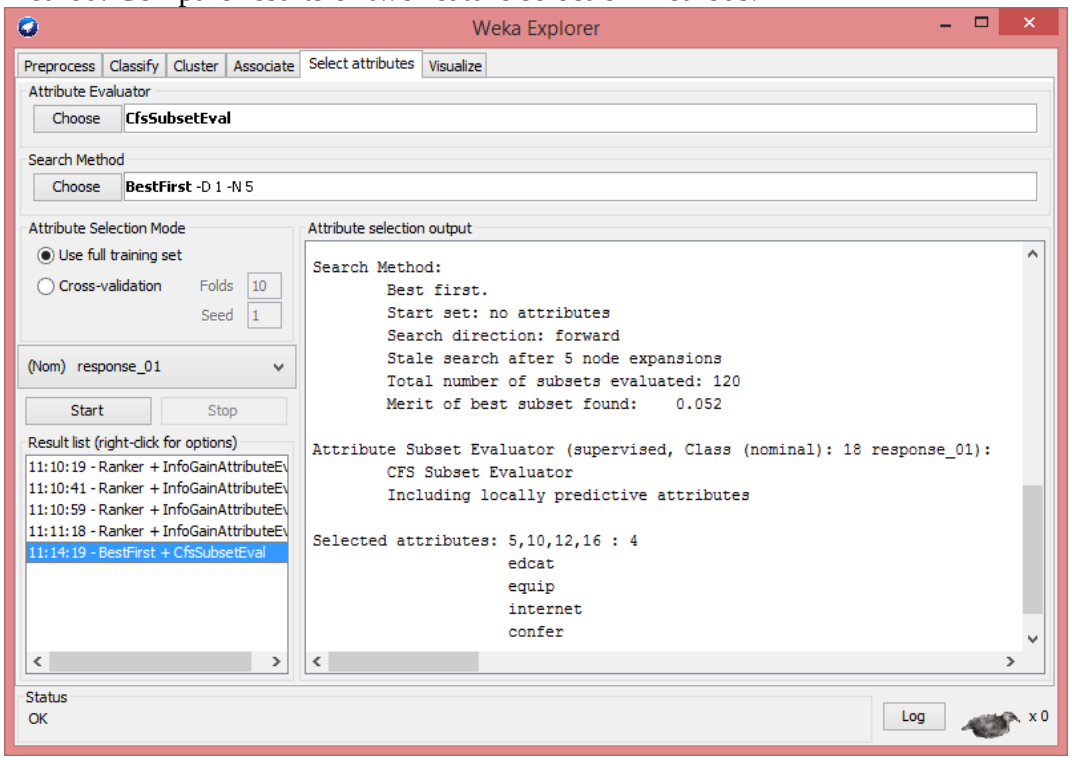


10. To use evaluator **InfoGainAttributeEval**, a search method **Ranker** is selected to rank all attributes regarding the evaluation results. We use the full dataset as training dataset. The results show that the first 8 attributes are good.

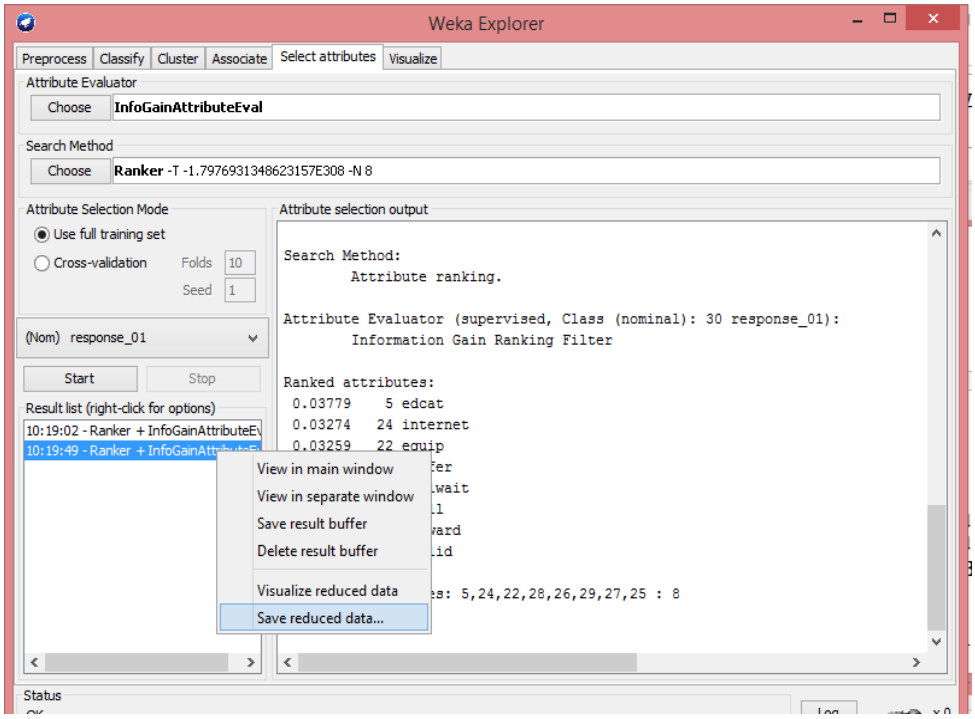




11. Run feature selection the second time with **CfsSubsetEval** and **BestFirst** search method**.** Compare results of two feature selection methods.

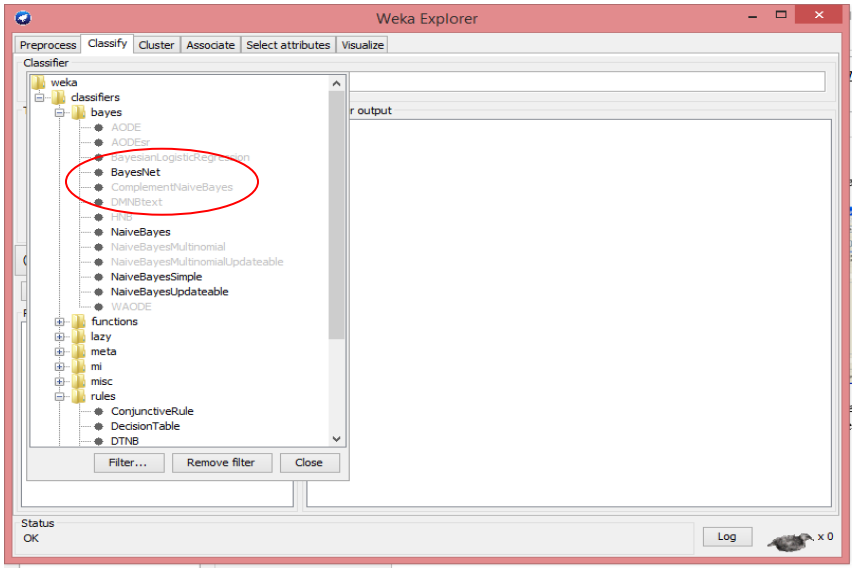


12. If you decide to reduce the dataset by removing unimportant attributes, you could choose to save the reduced dataset by right-click the Result list. Save the file name as **customer.arff**.

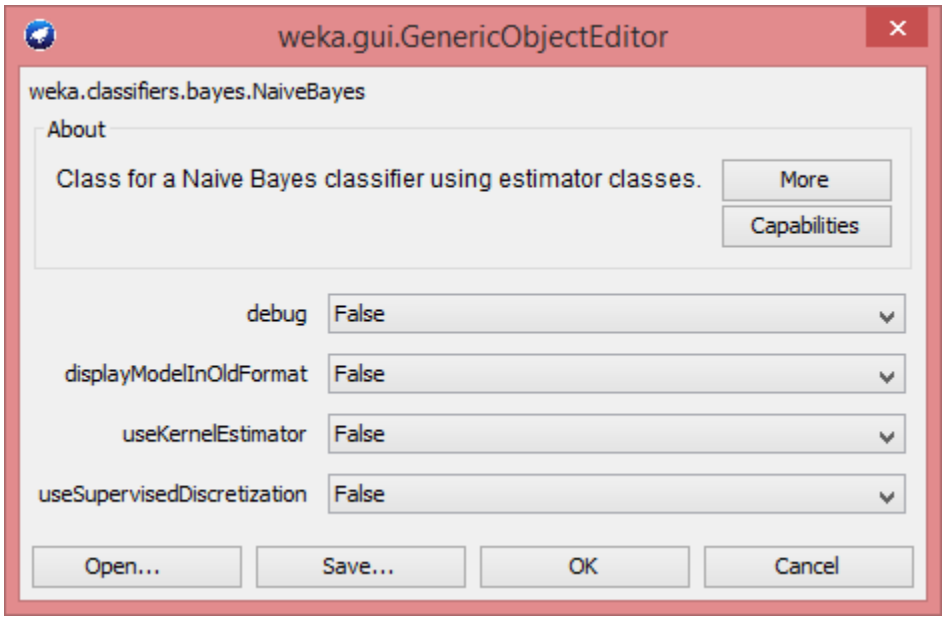


Naïve Bayes Classifier: bayes/NaïveBayes

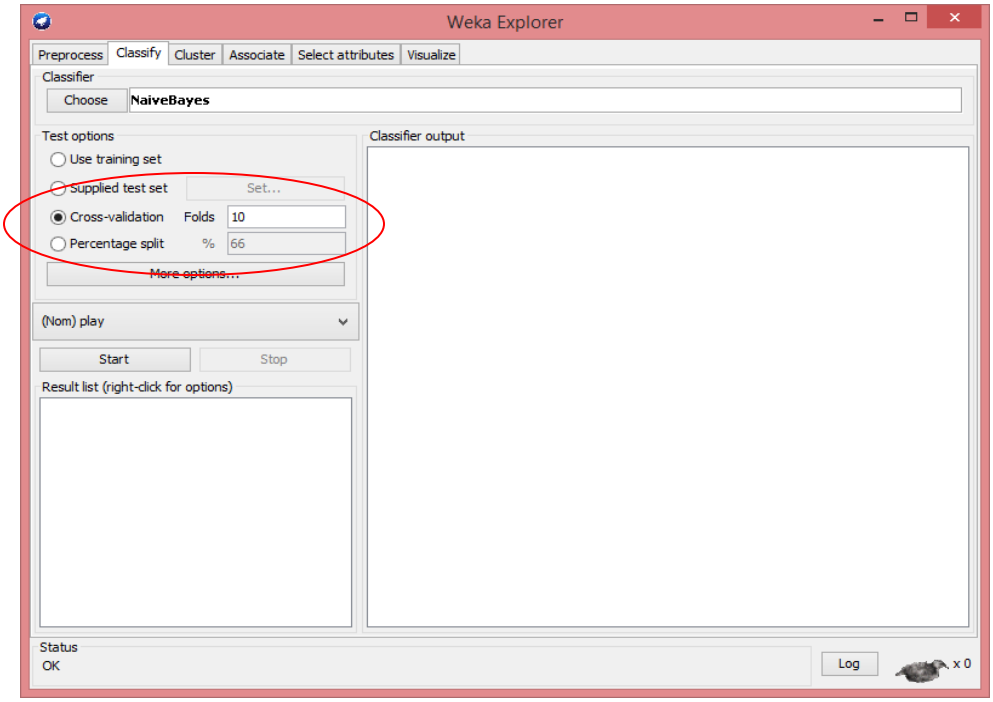
13. Open the saved processed data file **customer.arff** and then click **Classify** Tab on top of the window. Click Choose button under *Classifier*. The drop down list of all classifiers show. Choose **NaiveBayes** from **bayes** folder.



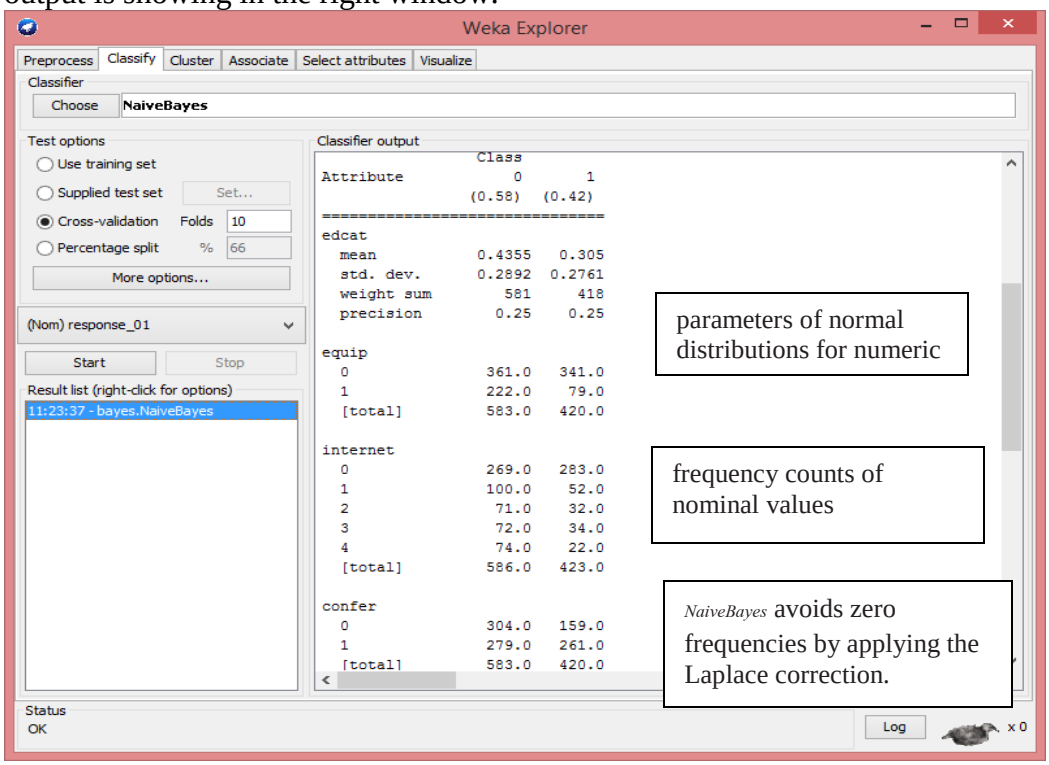
14. Left click the field of **Classifier**, choose Show Property from the drop down list. The property window of **NaiveBayes** opens, if you do not want to use Normal Distribution for numeric data, set *useKernelEstimator* to **ture**; You also could perform supervised discretization on numeric data by setting *useSupervisedDiscretization* to **ture**. Click OK button to save all the settings.

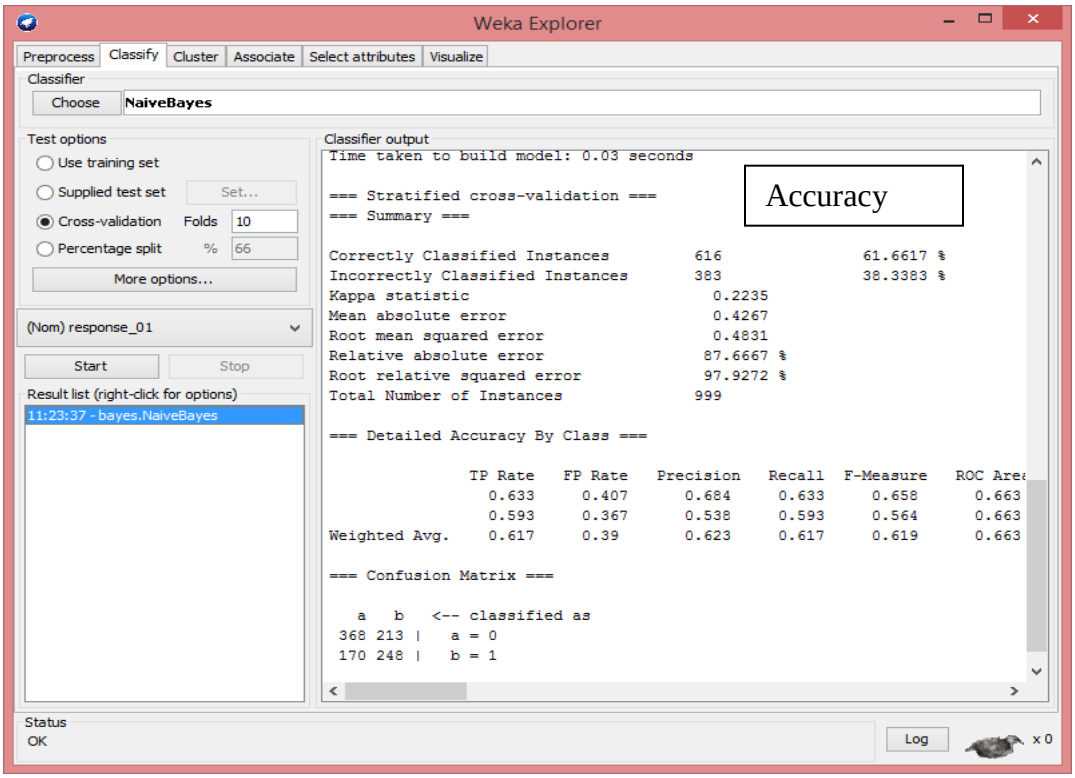


15. To partition the training data set and test data set, choose **10-fold cross-validation**.



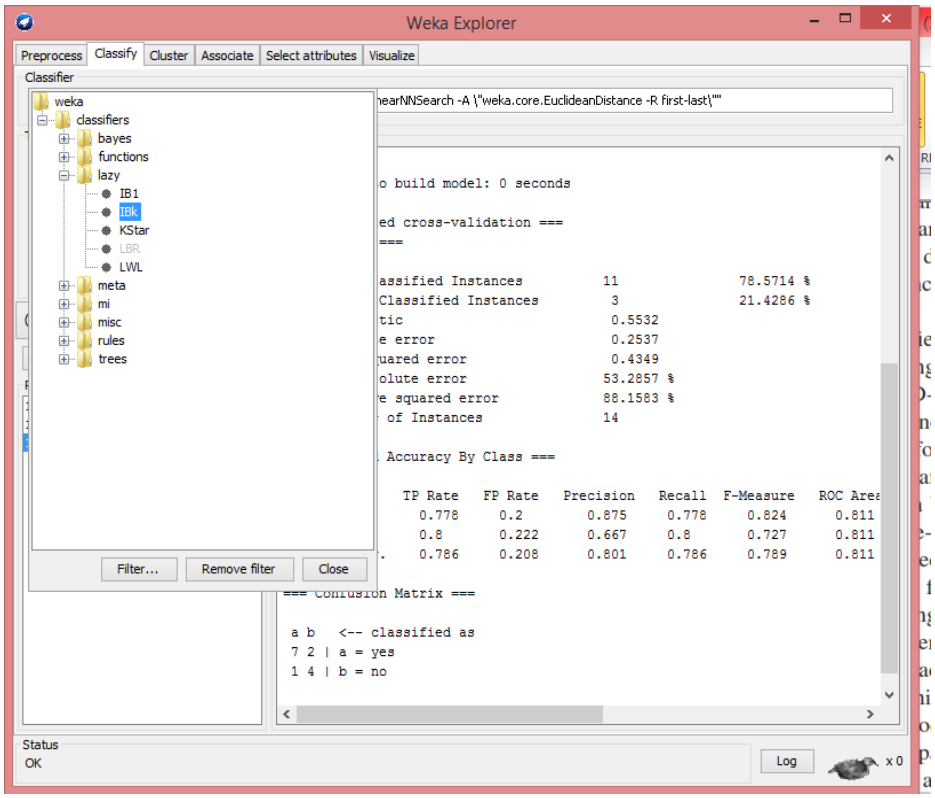
16. Click **Start** button on the left of the window, the algorithm begins to run. The output is showing in the right window.

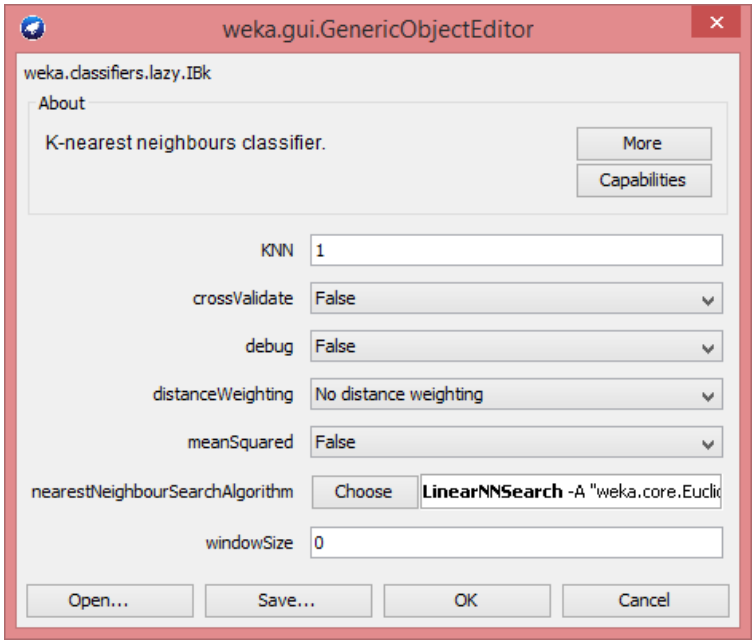


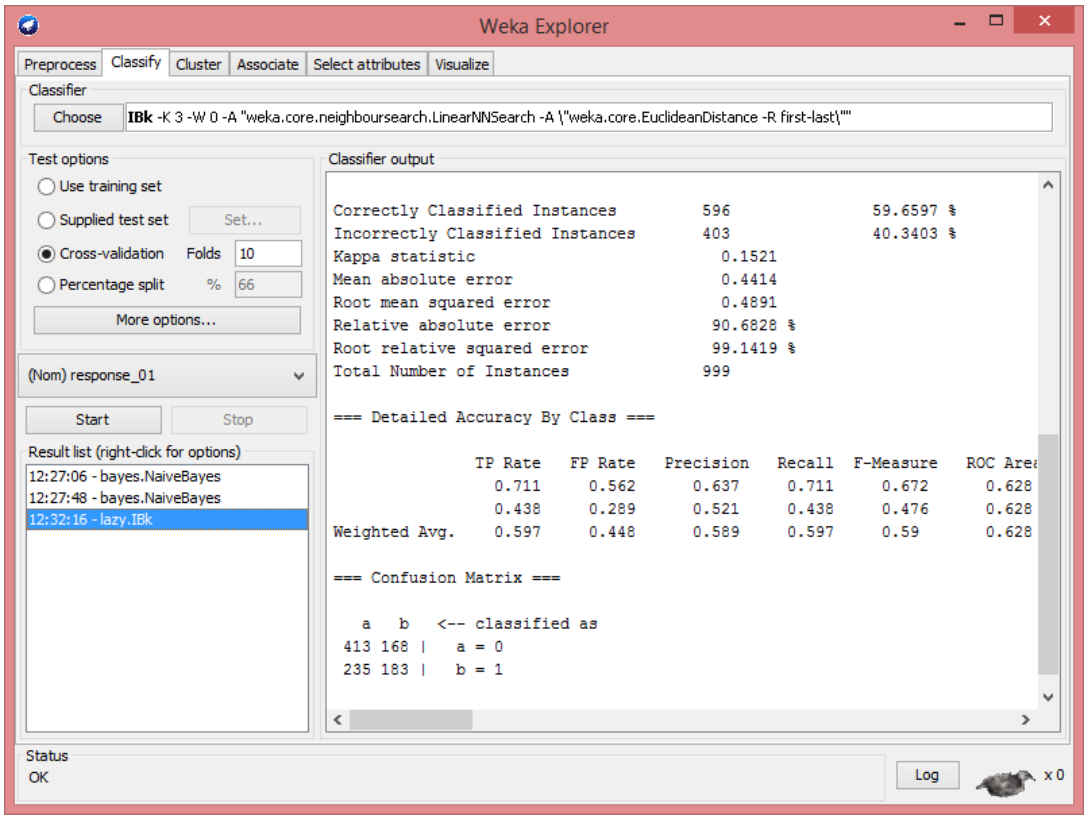


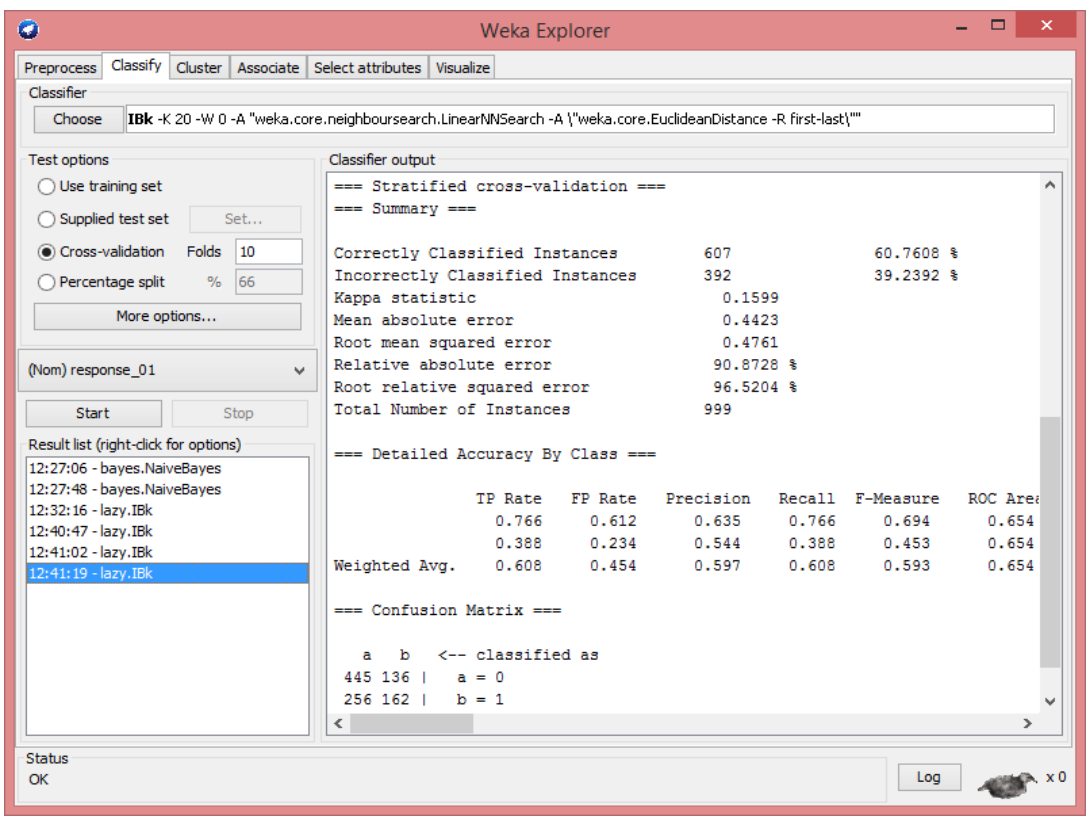
K-Nearest-Neighbor: lazy/IBK

17. We would like to perform K-Nearest-Neighbor classification on the same dataset. You could try different K and see what value gives a better result. Compare the results with Naïve Bayes classifier.



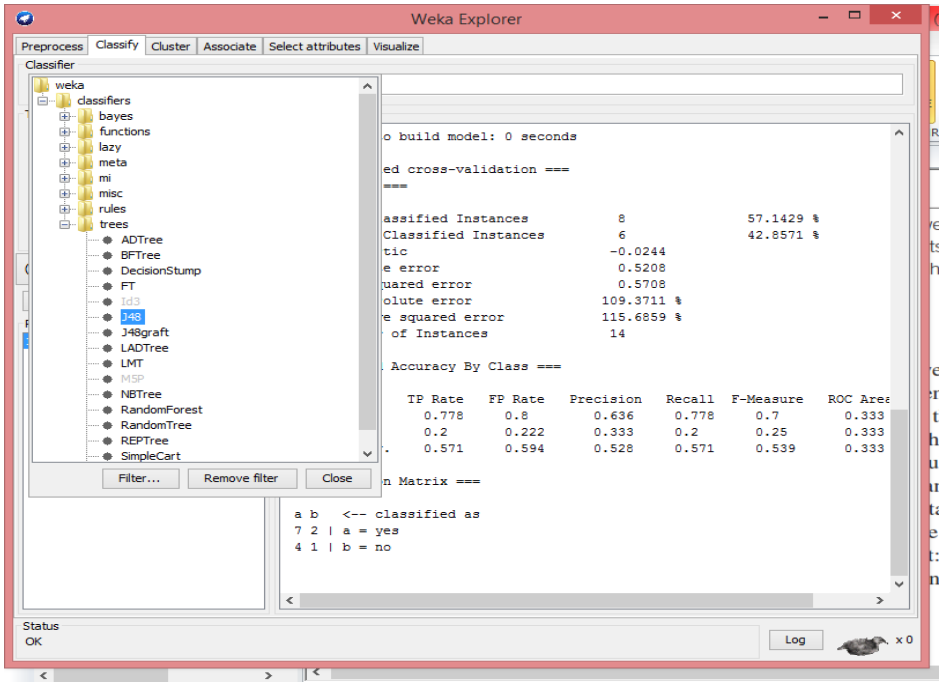


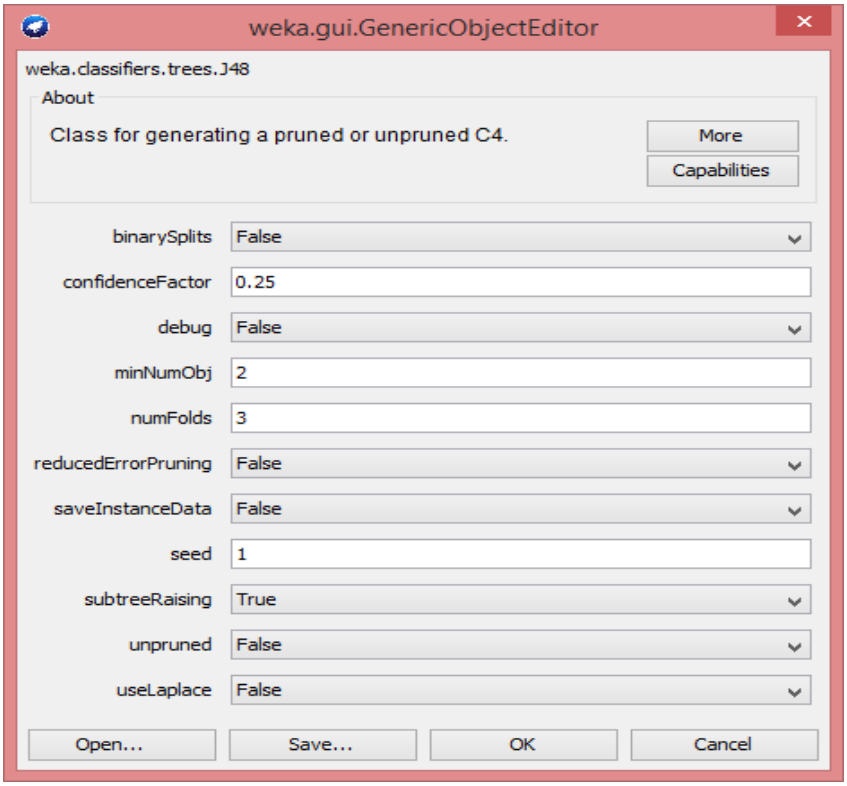

Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
IBk -K 3 -W 0 -A "weka.core.neighboursearch.LinearNNSearch -A \"weka.core.EuclideanDistance -R first-last\""
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) response_01
Start
Stop
Result list (right-click for options)
12:27:06 - bayes.NaiveBayes
12:27:48 - bayes.NaiveBayes
12:32:16 - lazy.IBk
Classifier output
Correctly Classified Instances 596 59.6597 %
Incorrectly Classified Instances 403 40.3403 %
Kappa statistic 0.1521
Mean absolute error 0.4414
Root mean squared error 0.4891
Relative absolute error 90.6828 %
Root relative squared error 99.1419 %
Total Number of Instances 999
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure ROC Area
0.711 0.562 0.637 0.711 0.672 0.628
0.438 0.289 0.521 0.438 0.476 0.628
Weighted Avg. 0.597 0.448 0.589 0.597 0.59 0.628
=== Confusion Matrix ===
a b <-- classified as
413 168 | a = 0
235 183 | b = 1
Status
OK
Log
x 0


Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
IBk -K 20 -W 0 -A "weka.core.neighboursearch.LinearNNSearch -A \"weka.core.EuclideanDistance -R first-last\""
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) response_01
Start
Stop
Result list (right-click for options)
12:27:06 - bayes.NaiveBayes
12:27:48 - bayes.NaiveBayes
12:32:16 - lazy.IBk
12:40:47 - lazy.IBk
12:41:02 - lazy.IBk
12:41:19 - lazy.IBk
Classifier output
=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances 607 60.7608 %
Incorrectly Classified Instances 392 39.2392 %
Kappa statistic 0.1599
Mean absolute error 0.4423
Root mean squared error 0.4761
Relative absolute error 90.8728 %
Root relative squared error 96.5204 %
Total Number of Instances 999
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure ROC Area
0.766 0.612 0.635 0.766 0.694 0.654
0.388 0.234 0.544 0.388 0.453 0.654
Weighted Avg. 0.608 0.454 0.597 0.608 0.593 0.654
=== Confusion Matrix ===
a b <-- classified as
445 136 | a = 0
256 162 | b = 1
Status
OK
Log
x 0

Decision Tree: trees/J48 (Implementing C4.5)

18. We would like to build a Decision Tree model on the same given training data set. Take all default values of the parameters.





Weka Explorer

Preprocess | Classify | Cluster | Associate | Select attributes | Visualize

Classifier

Choose: J48 -C 0.25 -M 2

Test options

- Use training set
- Supplied test set — Set...
- Cross-validation — Folds 10
- Percentage split — % 66

More options...

(Nom) response_01

Start | Stop

Result list (right-click for options)

- 12:27:06 - bayes.NaiveBayes
- 12:27:48 - bayes.NaiveBayes
- 12:32:16 - lazy.IBk
- 12:40:47 - lazy.IBk
- 12:41:02 - lazy.IBk
- 12:41:19 - lazy.IBk
- 12:46:25 - trees.J48

Classifier output

```
Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     customer_labThree-weka.filters.unsupervised.attribute.Numeric
Instances:    999
Attributes:   5
              edcat
              equip
              internet
              confer
              response_01
Test mode:10-fold cross-validation

=== Classifier model (full training set) ===

J48 pruned tree
------------------

equip = 0
|   edcat <= 0.25
|   |   confer = 0: 0 (213.0/101.0)
|   |   confer = 1: 1 (254.0/98.0)
|   edcat > 0.25: 0 (233.0/83.0)
equip = 1: 0 (299.0/78.0)

Number of Leaves  :     4

Size of the tree :      7
```

Status: OK

Log | x 0

Weka Explorer

Preprocess | Classify | Cluster | Associate | Select attributes | Visualize

Classifier

Choose: J48 -C 0.25 -M 2

Test options

- Use training set
- Supplied test set — Set...
- Cross-validation — Folds 10
- Percentage split — % 66

More options...

(Nom) response_01

Start | Stop

Result list (right-click for options)

- 12:27:06 - bayes.NaiveBayes
- 12:27:48 - bayes.NaiveBayes
- 12:32:16 - lazy.IBk
- 12:40:47 - lazy.IBk
- 12:41:02 - lazy.IBk
- 12:41:19 - lazy.IBk
- 12:46:25 - trees.J48

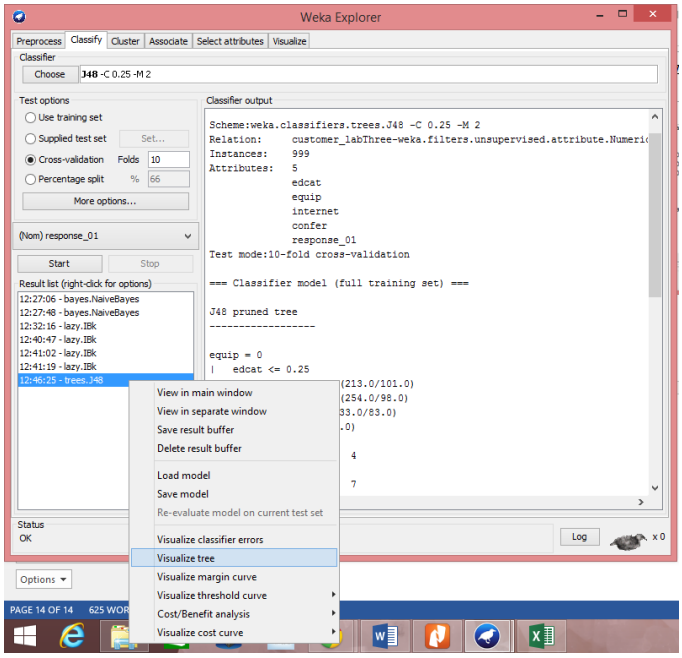
Classifier output

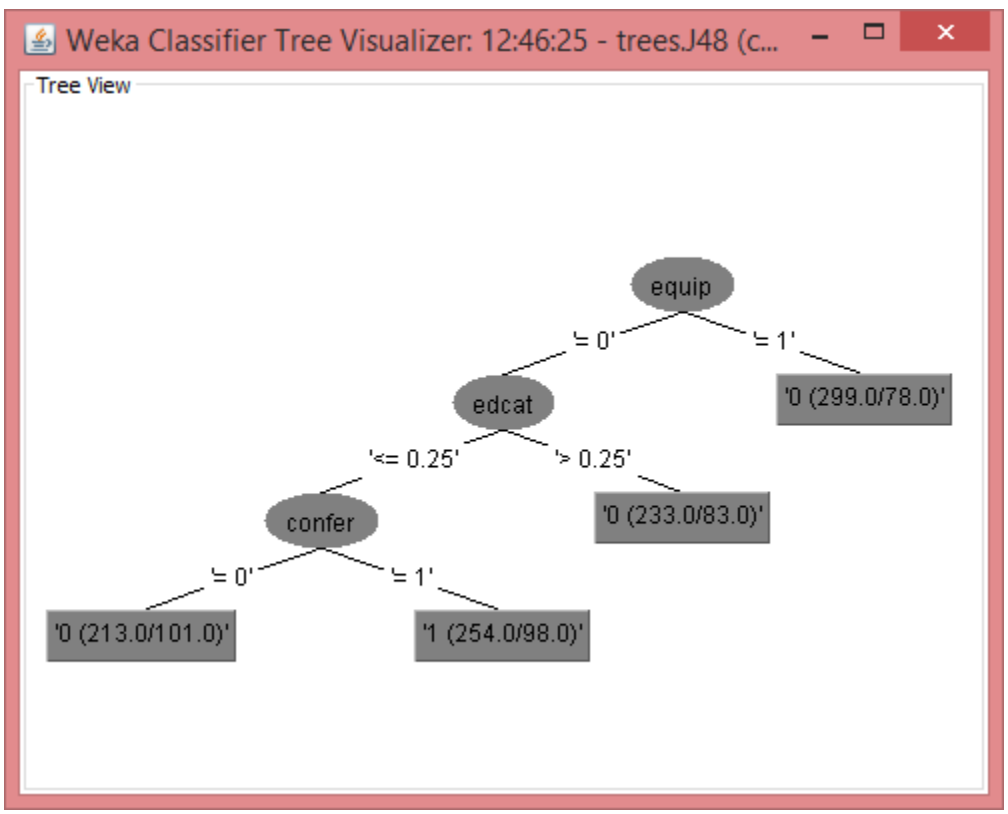
```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         613               61.3614 %
Incorrectly Classified Instances       386               38.6386 %
Kappa statistic                          0.1693
Mean absolute error                      0.4571
Root mean squared error                  0.4826
Relative absolute error                 93.9202 %
Root relative squared error             97.832  %
Total Number of Instances              999

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area
                 0.781     0.62       0.637     0.781     0.702      0.619
                 0.38      0.219      0.556     0.38      0.452      0.619
Weighted Avg.    0.614     0.452      0.603     0.614     0.597      0.619

=== Confusion Matrix ===

   a   b   <-- classified as
 454 127 |   a = 0
 259 159 |   b = 1
```

Status: OK

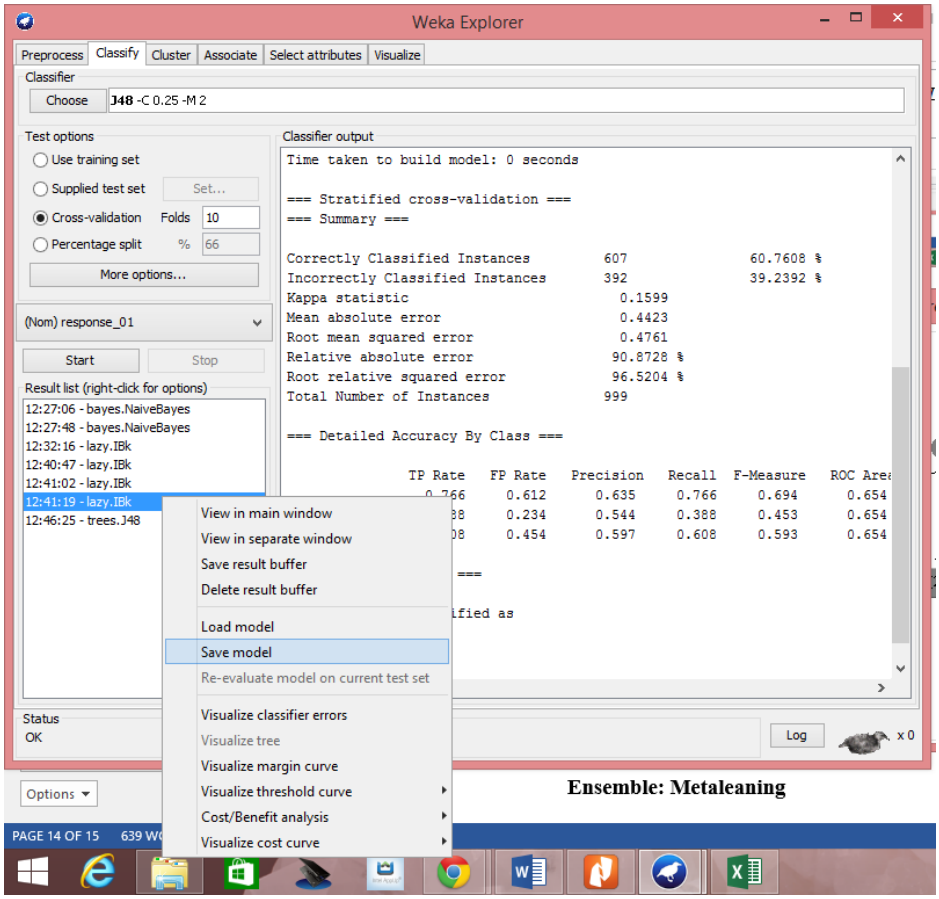
Log | x 0

19. To visualize the decision tree we build, right-click the Result list item for J48.

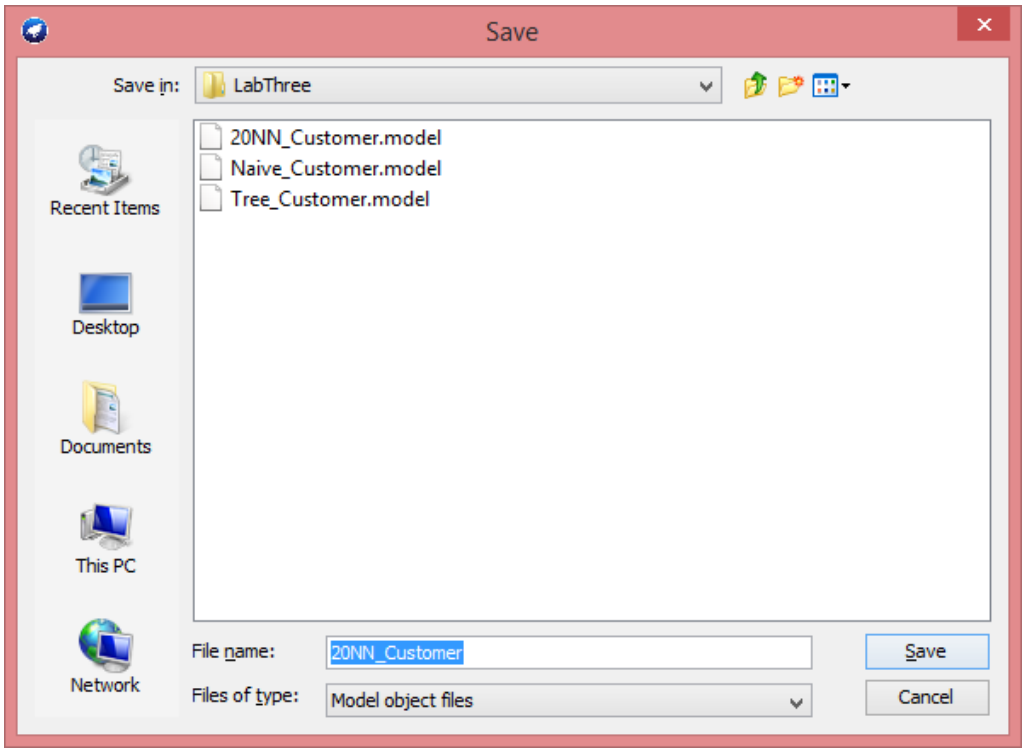




20. All trained classification models could be saved by right-click the Result list items.



Ensemble: Metaleaning



Ensemble (Metaleaning) classifier.meta. Voting

21. You could combine multiple classifiers to perfrom an ensemble method.