INDEX

Kappa Statistics :
It is going to measure the precision of the data items. It is used to determine the chance agreement due to guessing a possibility in the same way the chances of correct answers is possible on multiple test.

Absolute Error :
Amount of error calculated.

Mean Absolute Error :
The mean absolute error is the average of all Absolute Error.

Root Mean Squared Error :
It measures the difference between the values which are predicted by a model and the actual value.

Relative Absolute Error :
The absolute error gives how large the error is, while the relative error gives how large error is related to correct value.

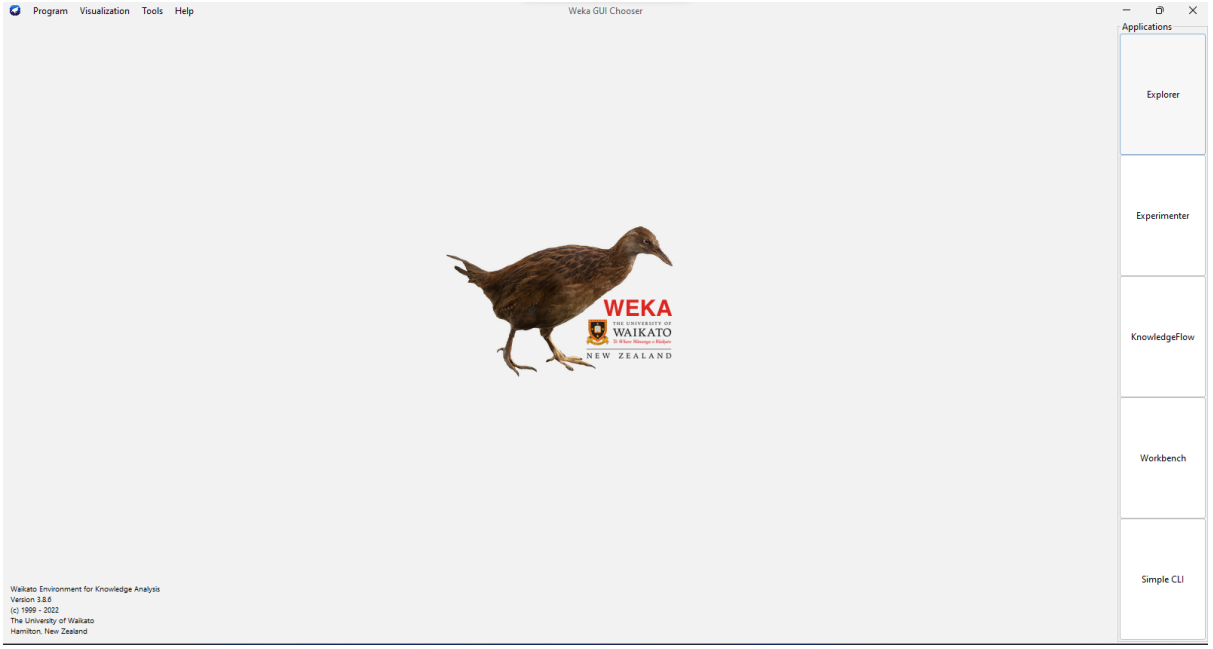
Root Relative Squared Error :
It is relative to what it would have been if a simple predictor has been used.

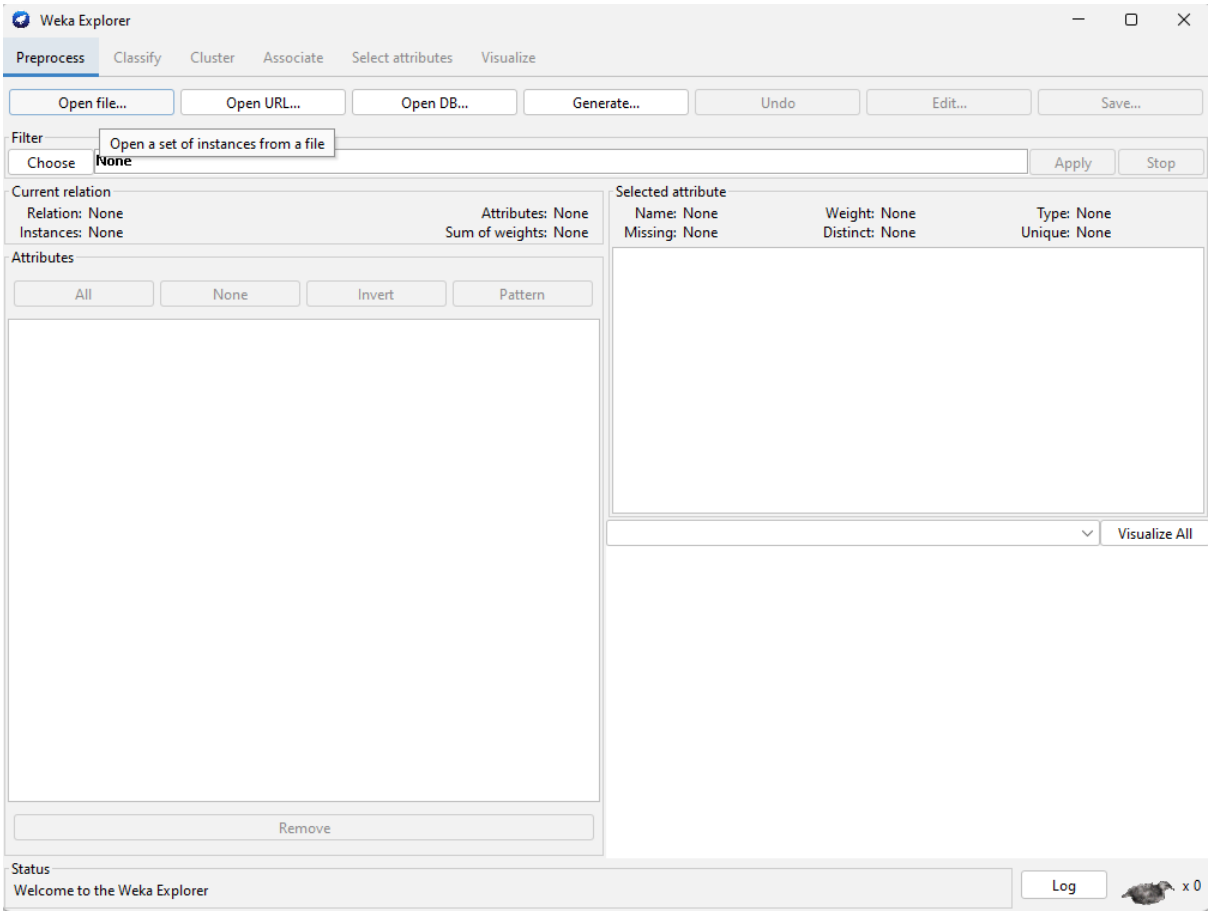
TP(True Positive)
FP(False Positive)

Precision :
Almost near to accuracy.

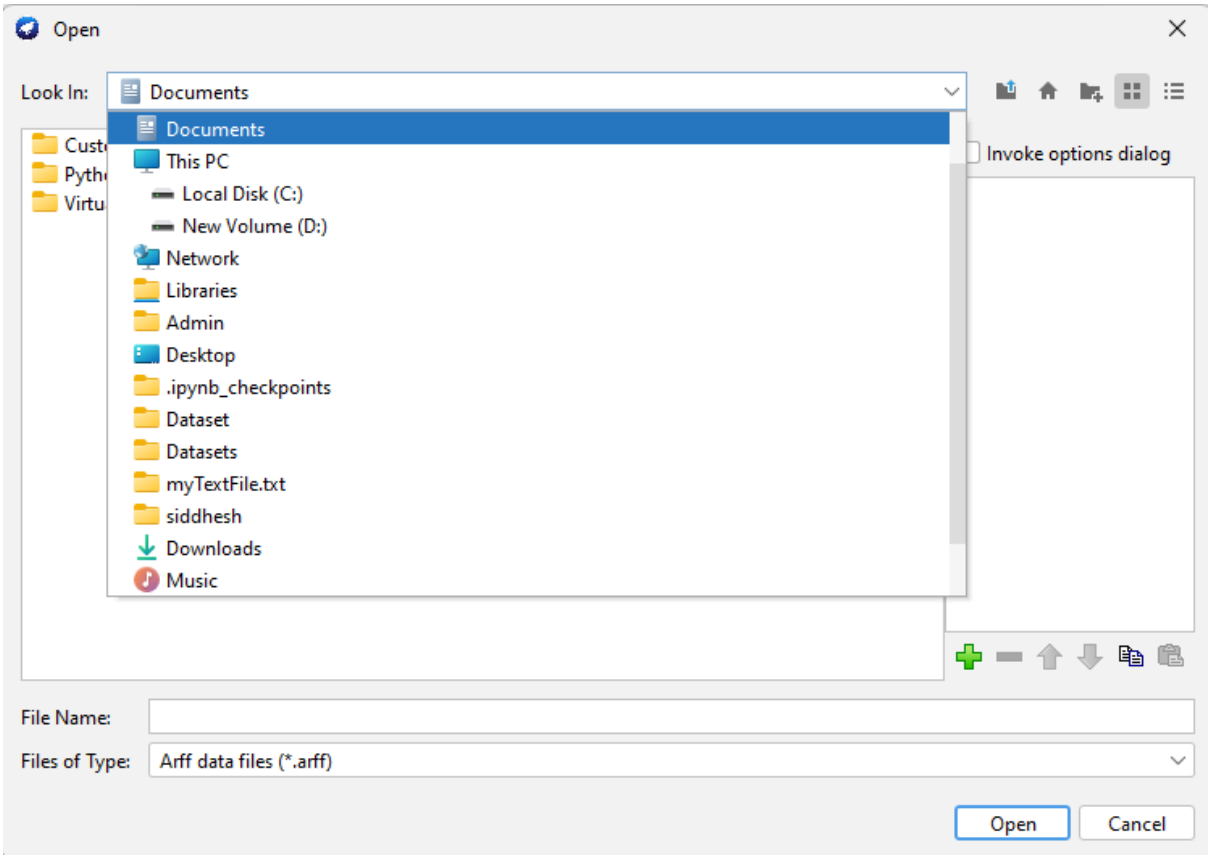
Practical 1: Supervised Learning

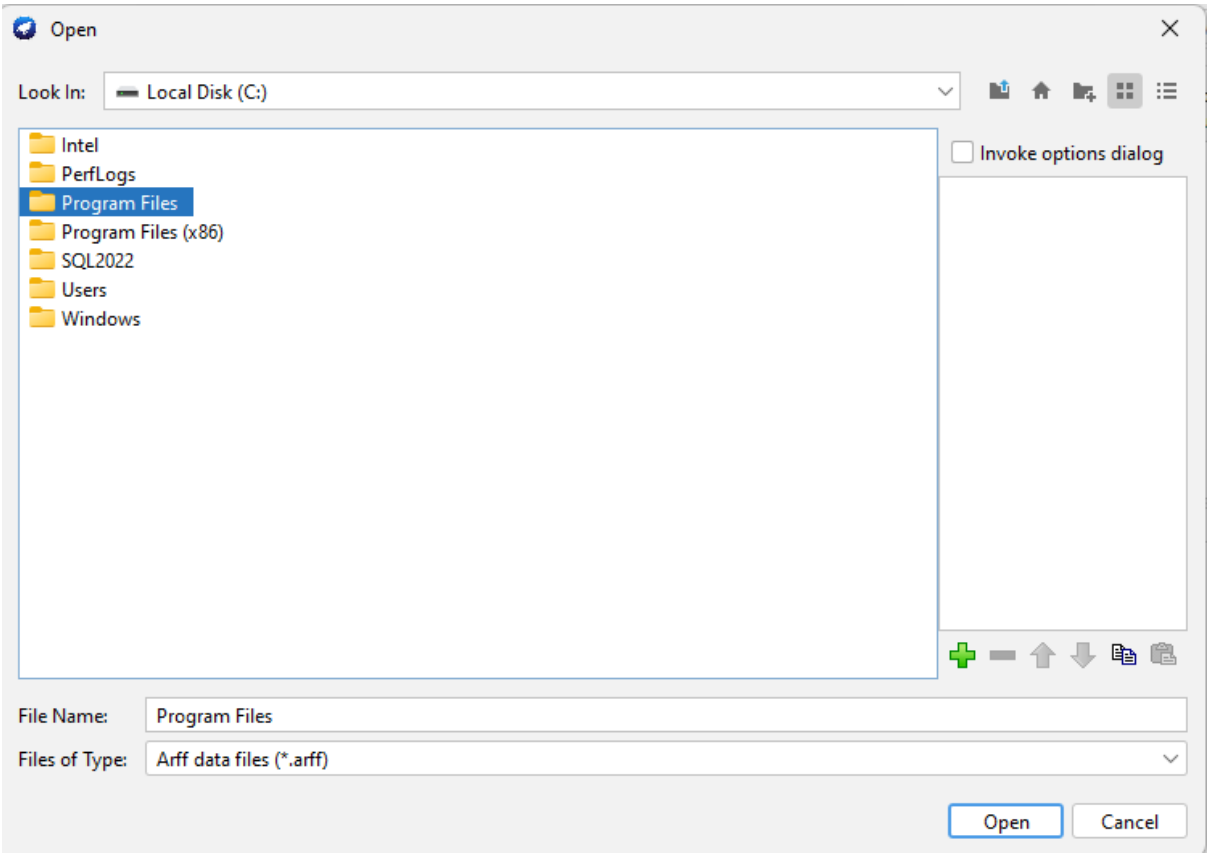
- ## Decision Tree

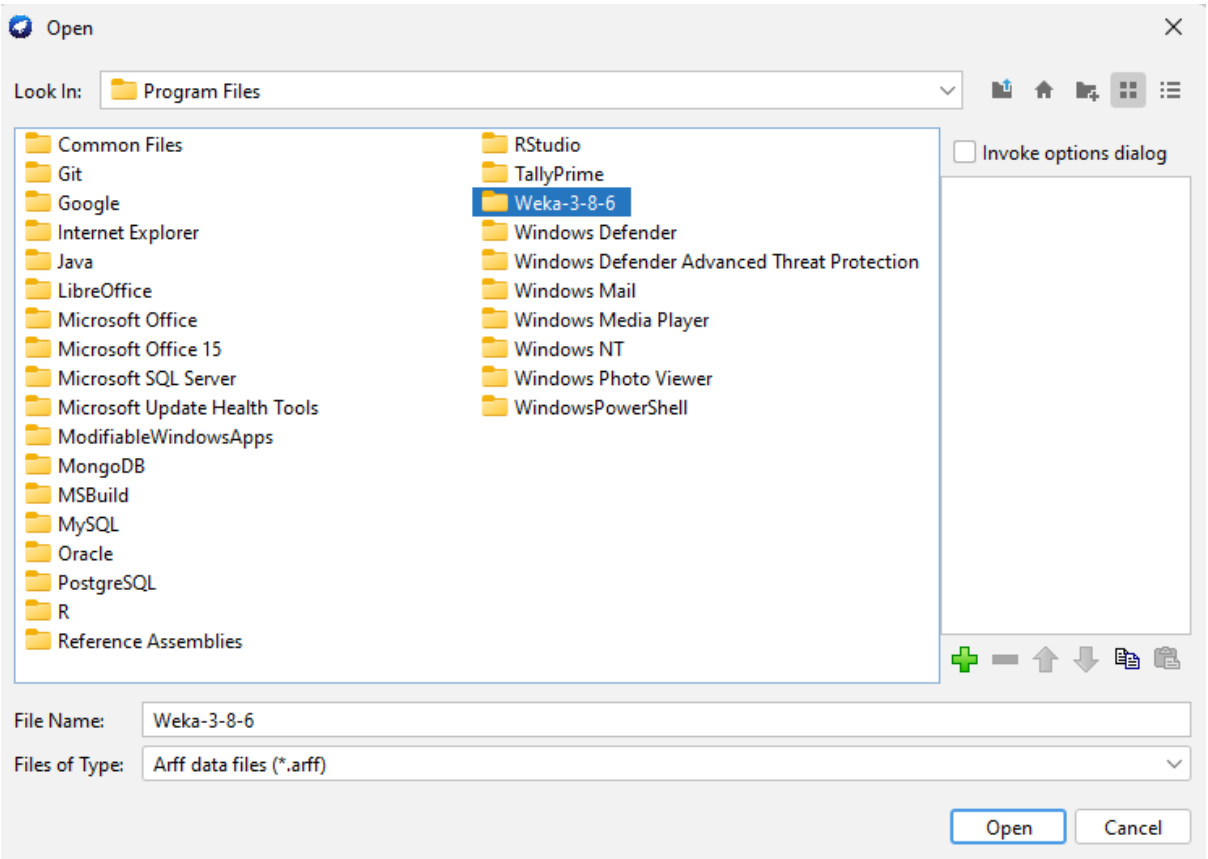


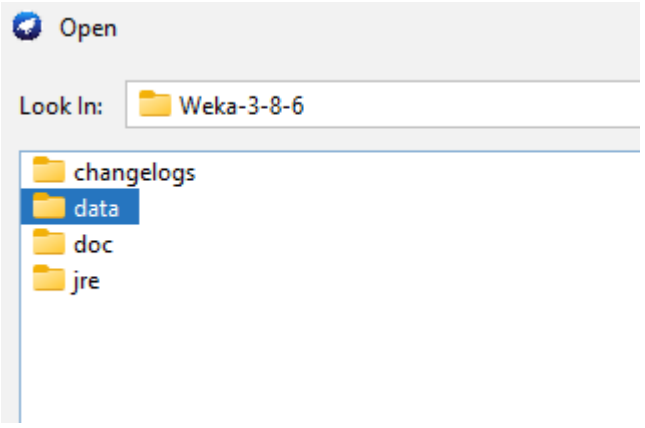


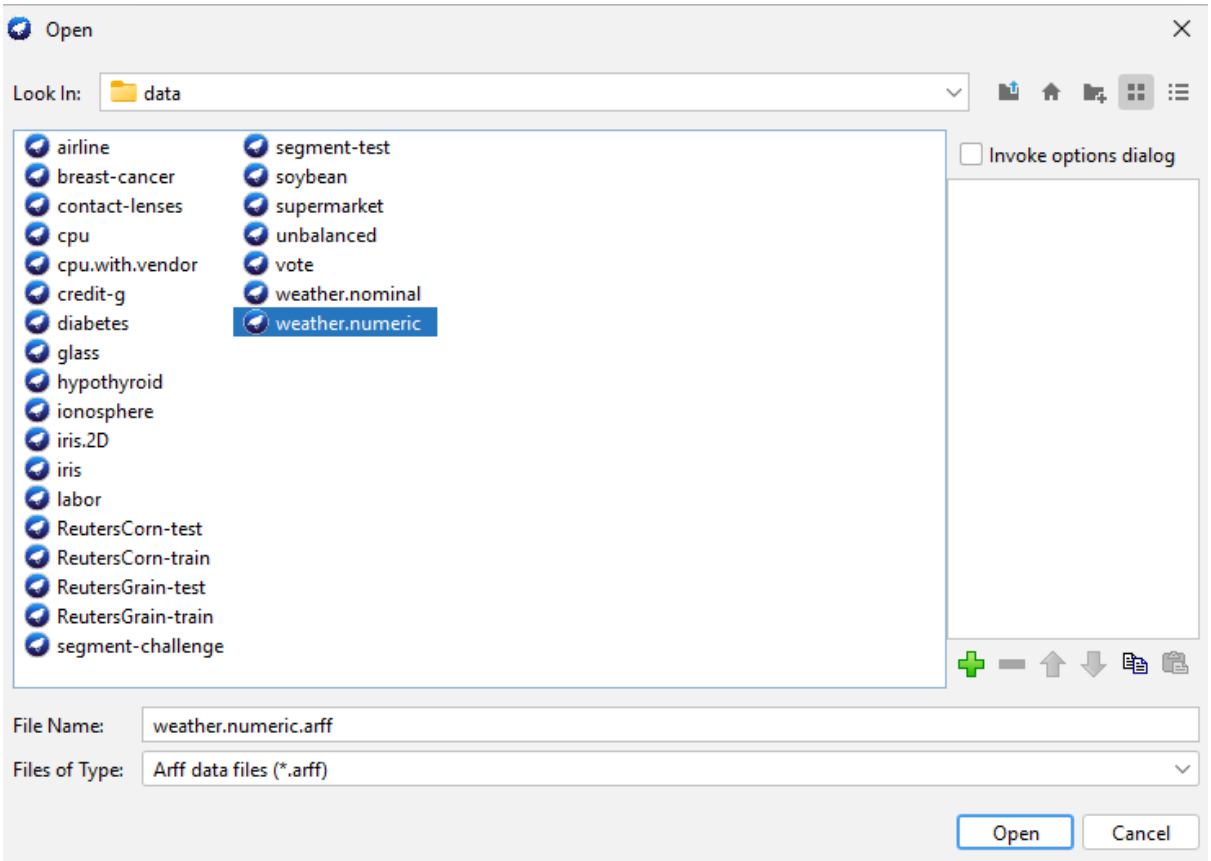
Click on Open FIle

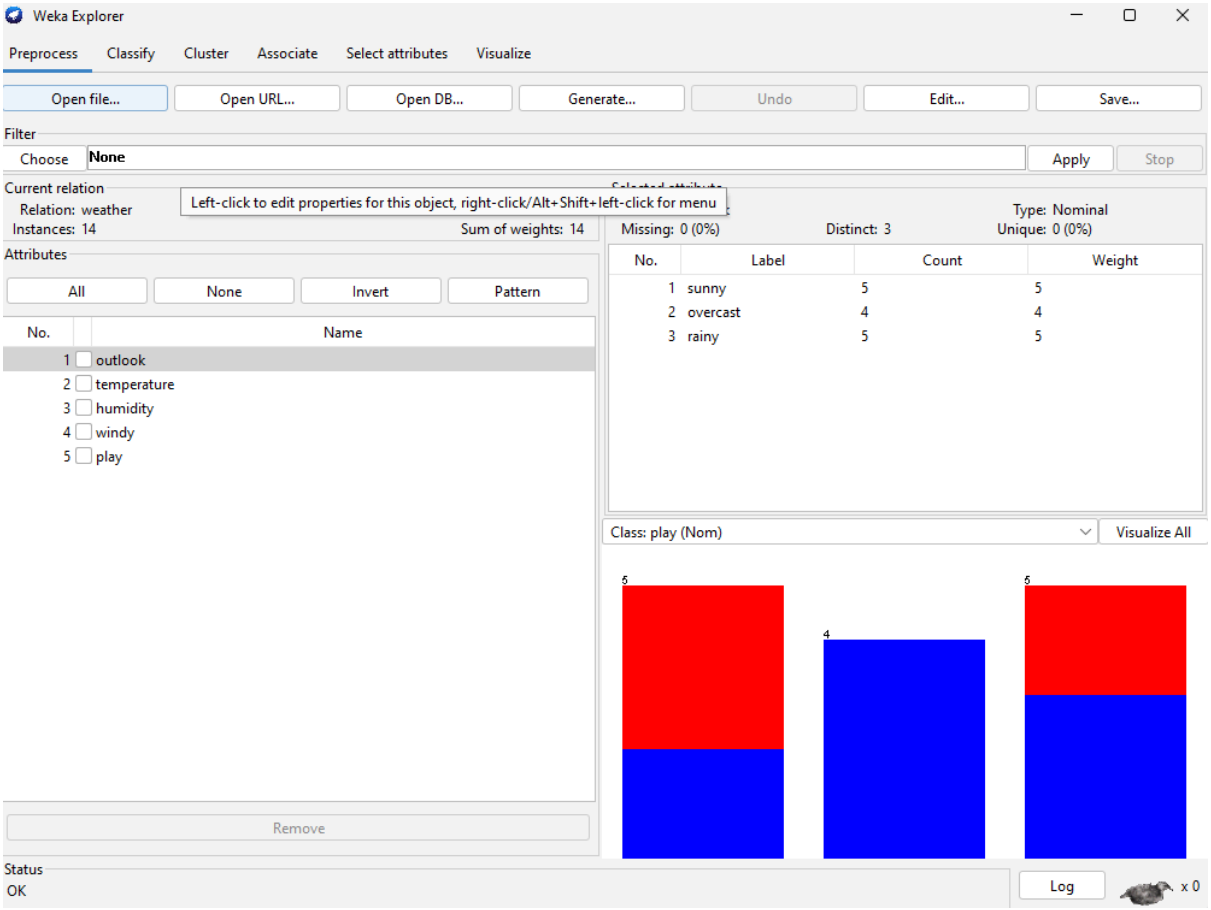

Open
Look In:
Documents
Documents
This PC
Local Disk (C:)
New Volume (D:)
Network
Libraries
Admin
Desktop
.ipynb_checkpoints
Dataset
Datasets
myTextFile.txt
siddhesh
Downloads
Music
Invoke options dialog
File Name:
Files of Type:
Arff data files (*.arff)
Open
Cancel


Open
Look In:
Local Disk (C:)
Intel
PerfLogs
Program Files
Program Files (x86)
SQL2022
Users
Windows
Invoke options dialog
File Name:
Program Files
Files of Type:
Arff data files (*.arff)
Open
Cancel

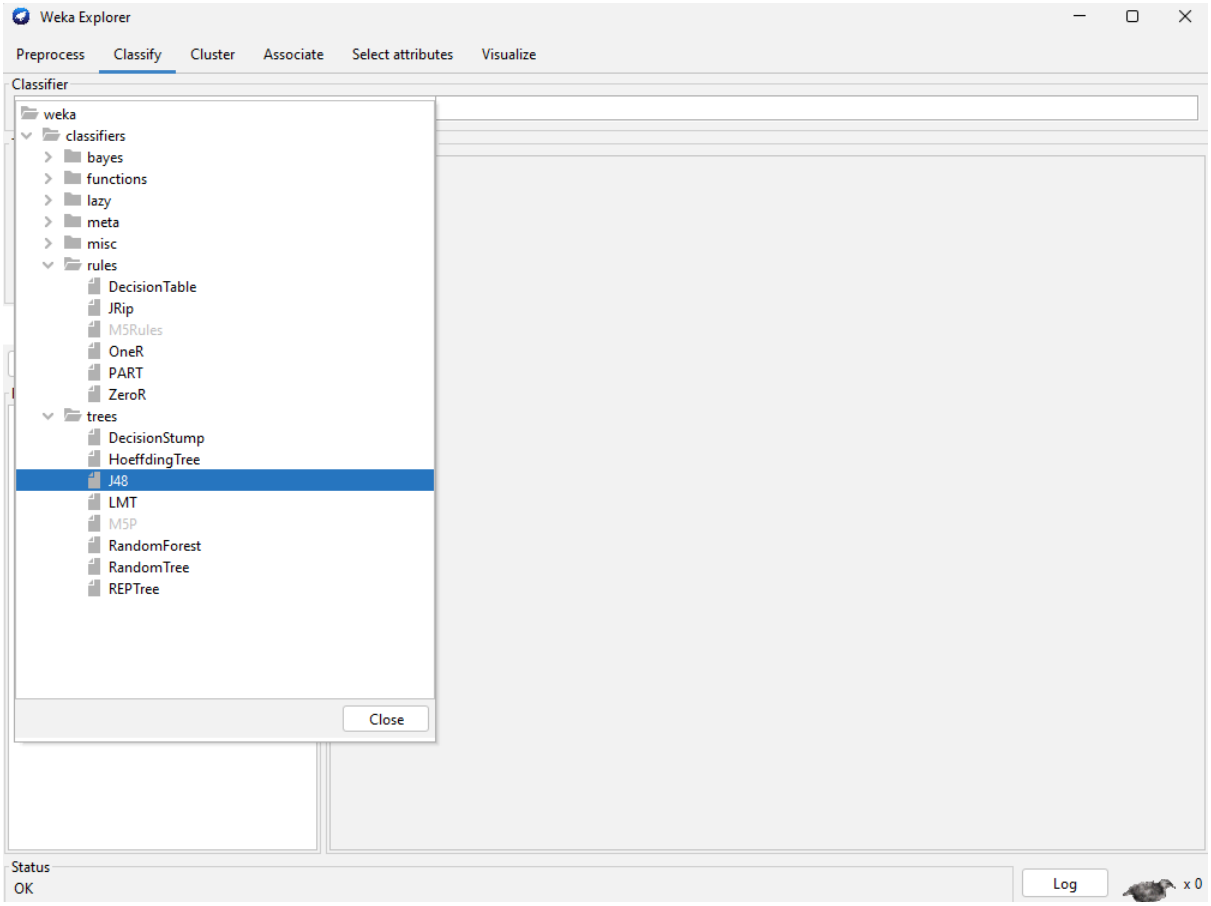

Open
Look In:
Program Files
Common Files
Git
Google
Internet Explorer
Java
LibreOffice
Microsoft Office
Microsoft Office 15
Microsoft SQL Server
Microsoft Update Health Tools
ModifiableWindowsApps
MongoDB
MSBuild
MySQL
Oracle
PostgreSQL
R
Reference Assemblies
RStudio
TallyPrime
Weka-3-8-6
Windows Defender
Windows Defender Advanced Threat Protection
Windows Mail
Windows Media Player
Windows NT
Windows Photo Viewer
WindowsPowerShell
Invoke options dialog
File Name:
Weka-3-8-6
Files of Type:
Arff data files (*.arff)
Open
Cancel

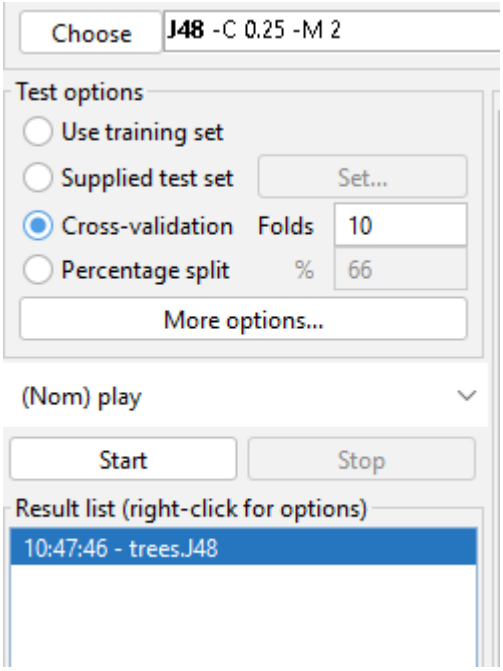

Open
Look In:
Weka-3-8-6
changelogs
data
doc
jre


Open
Look In: data
airline
breast-cancer
contact-lenses
cpu
cpu.with.vendor
credit-g
diabetes
glass
hypothyroid
ionosphere
iris.2D
iris
labor
ReutersCorn-test
ReutersCorn-train
ReutersGrain-test
ReutersGrain-train
segment-challenge
segment-test
soybean
supermarket
unbalanced
vote
weather.nominal
weather.numeric
Invoke options dialog
File Name: weather.numeric.arff
Files of Type: Arff data files (*.arff)
Open
Cancel


Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Generate...
Undo
Edit...
Save...
Filter
Choose
None
Apply
Stop
Current relation
Relation: weather
Instances: 14
Sum of weights: 14
Left-click to edit properties for this object, right-click/Alt+Shift+left-click for menu
Missing: 0 (0%)
Distinct: 3
Type: Nominal
Unique: 0 (0%)
Attributes
All
None
Invert
Pattern
No.
Name
1 outlook
2 temperature
3 humidity
4 windy
5 play
Remove
No.
Label
Count
Weight
1 sunny 5 5
2 overcast 4 4
3 rainy 5 5
Class: play (Nom)
Visualize All
5
4
5
Status
OK
Log
x 0

Click on Classify Tab and Click Choose J48 and Click on Start





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) play

Start | Stop

Result list (right-click for options)

10:47:46 - trees.J48

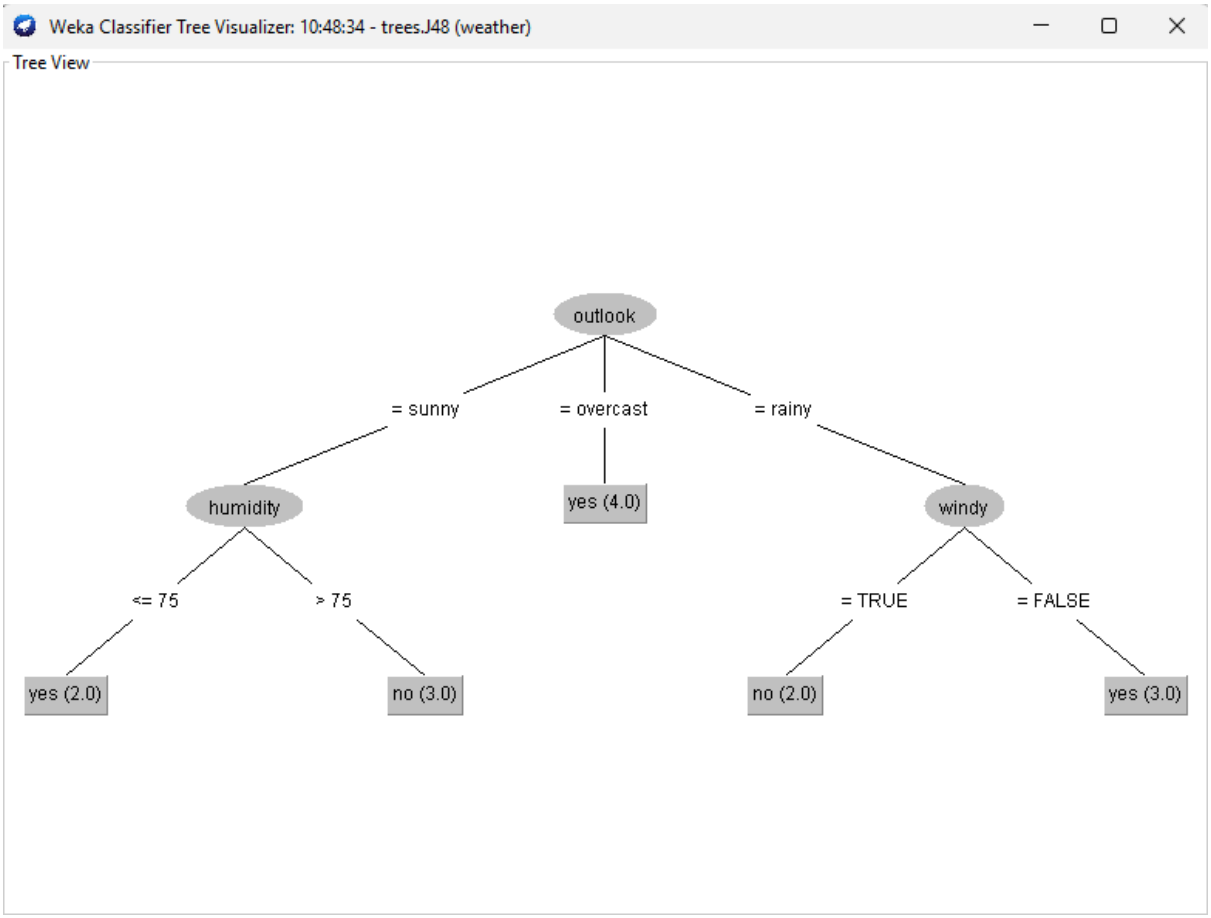
Classifier output

```
Number of Leaves  :     5

Size of the tree :      8


Time taken to build model: 0 seconds

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

Correctly Classified Instances           9               64.2857 %
Incorrectly Classified Instances         5               35.7143 %
Kappa statistic                          0.186
Mean absolute error                      0.2857
Root mean squared error                  0.4818
Relative absolute error                 60      %
Root relative squared error             97.6586 %
Total Number of Instances               14

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.778    0.600    0.700      0.778    0.737      0.189    0.789     0.847     yes
                 0.400    0.222    0.500      0.400    0.444      0.189    0.789     0.738     no
Weighted Avg.    0.643    0.465    0.629      0.643    0.632      0.189    0.789     0.808

=== Confusion Matrix ===

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

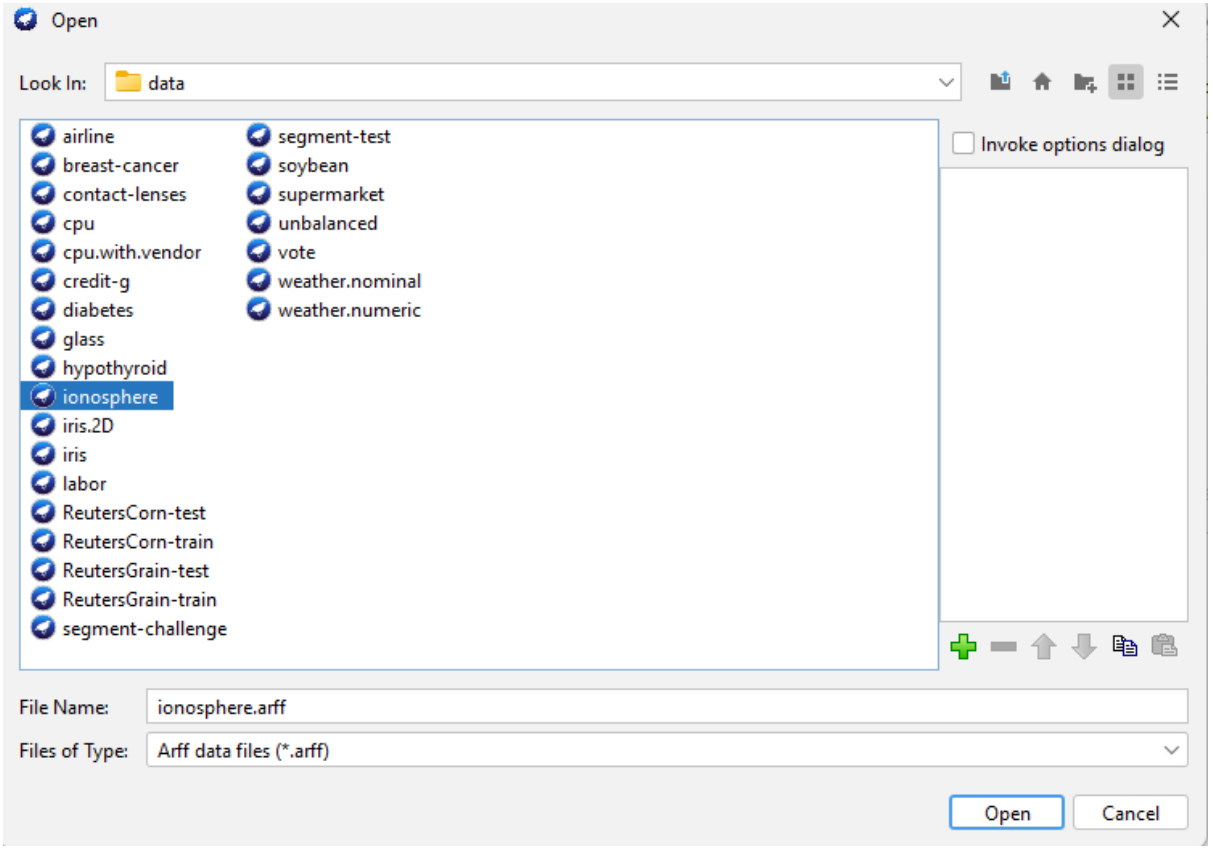
Status

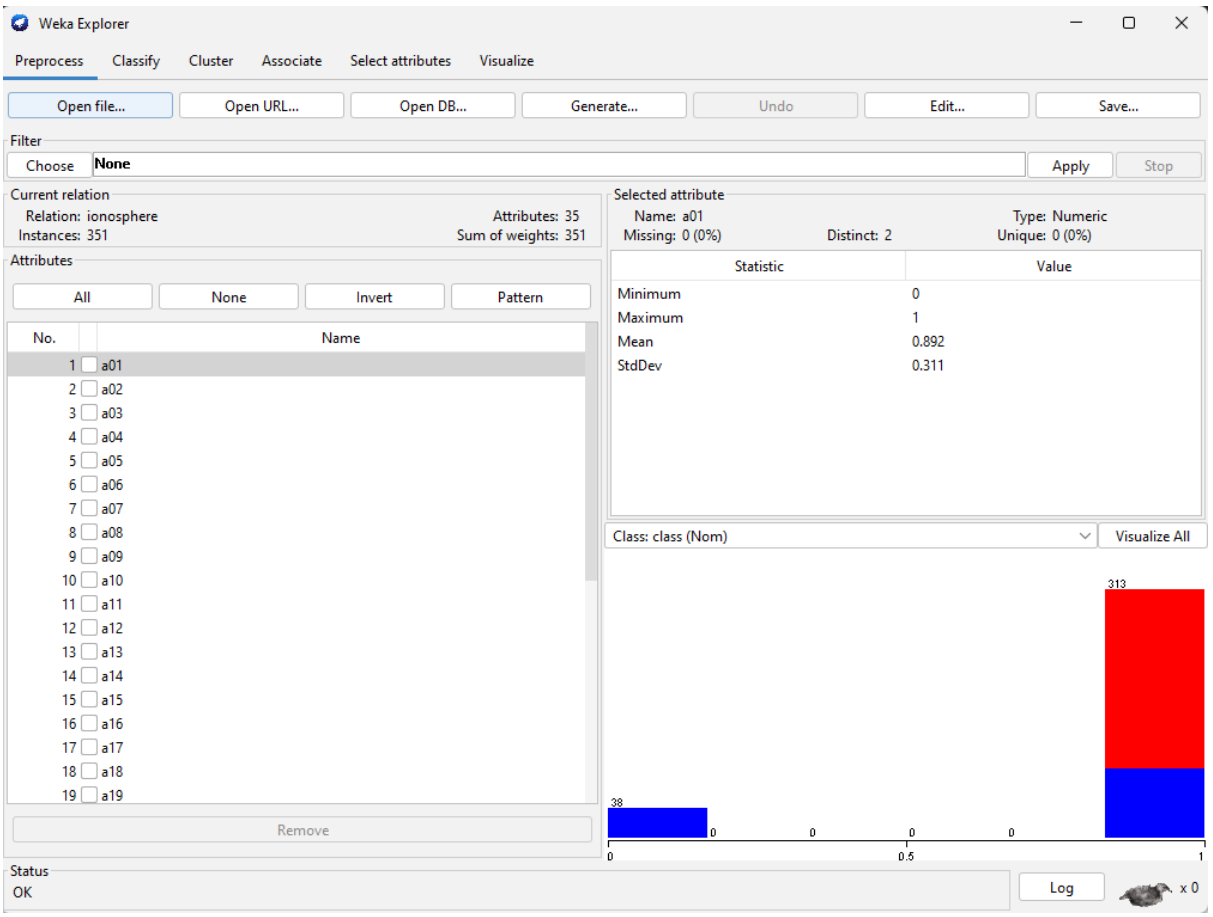
OK

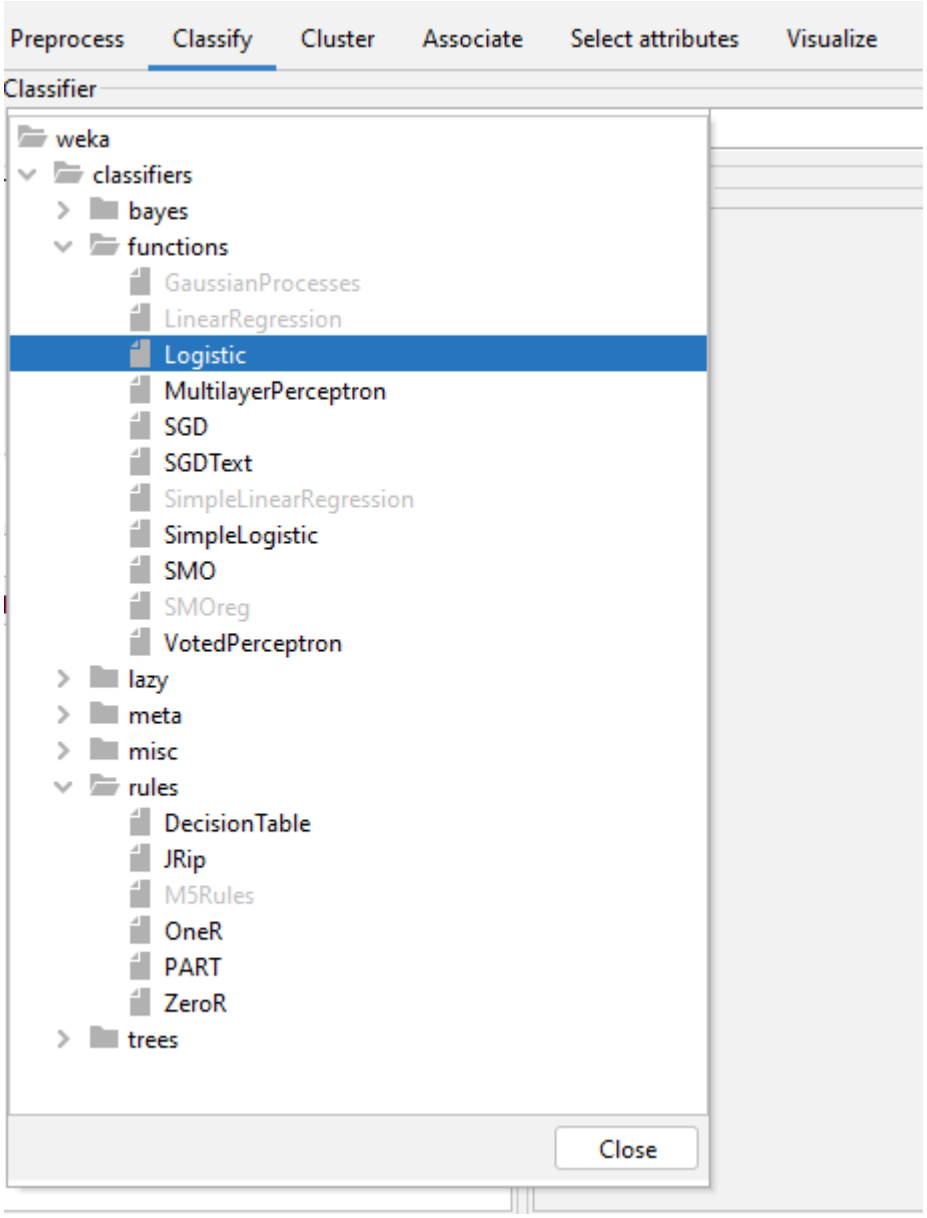
Log | x 0

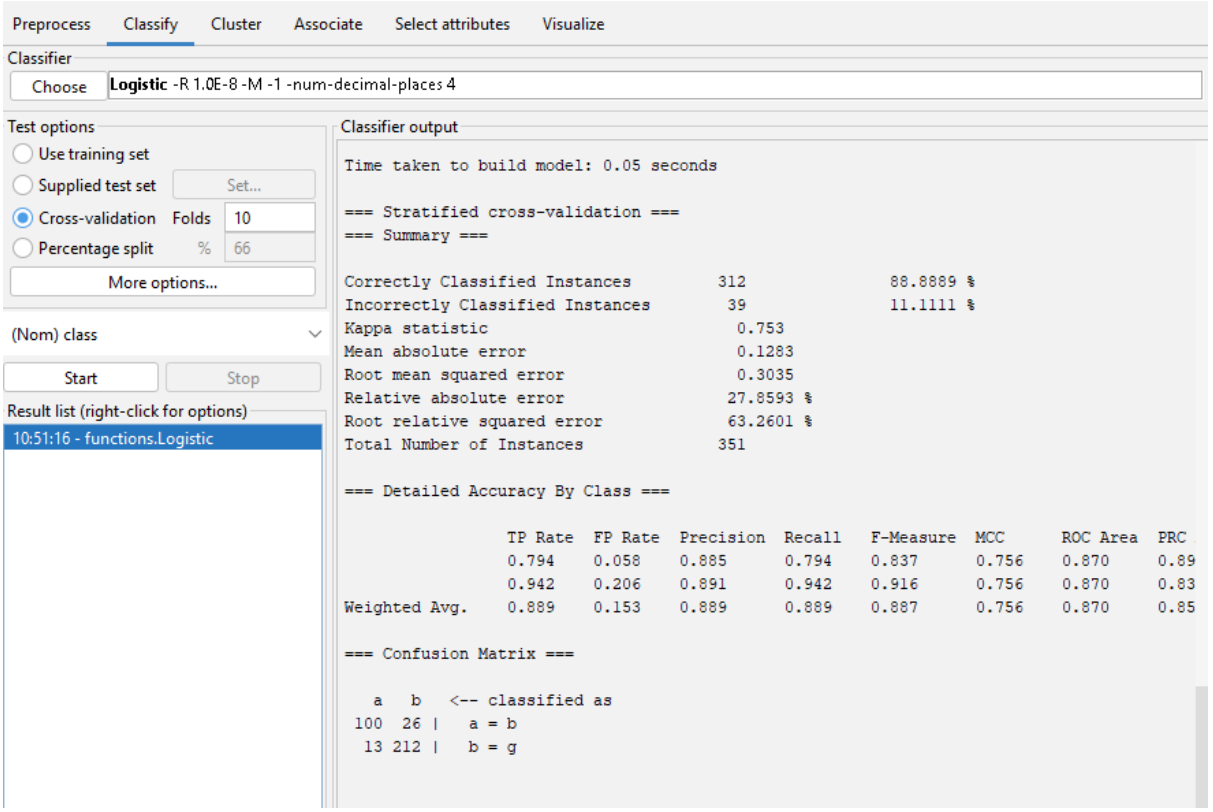

Weka Classifier Tree Visualizer: 10:48:34 - trees.J48 (weather)
Tree View
outlook
= sunny
= overcast
= rainy
humidity
yes (4.0)
windy
<= 75
> 75
= TRUE
= FALSE
yes (2.0)
no (3.0)
no (2.0)
yes (3.0)

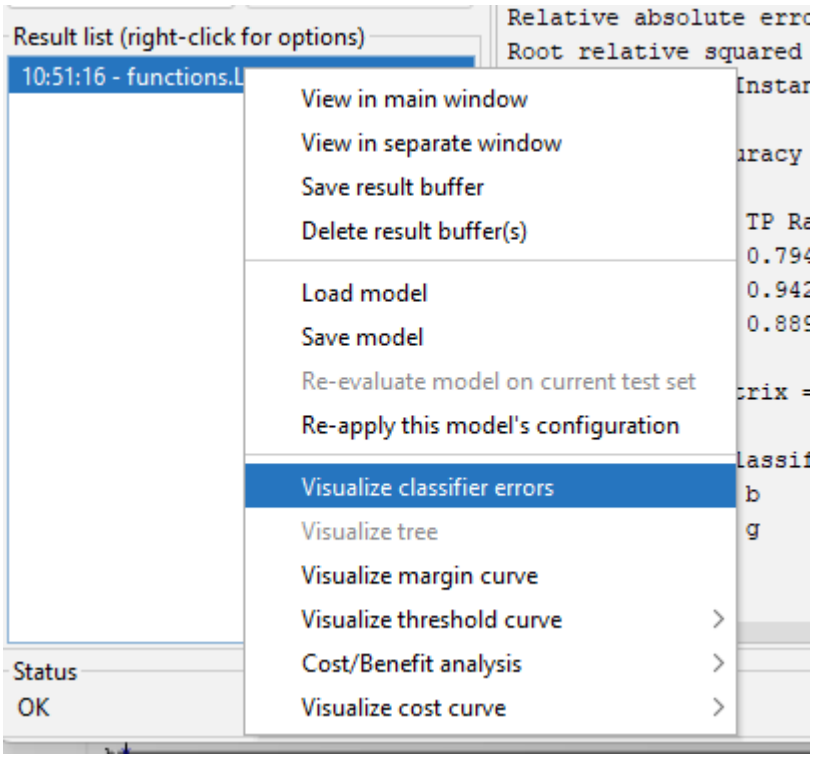
- **Logistic**

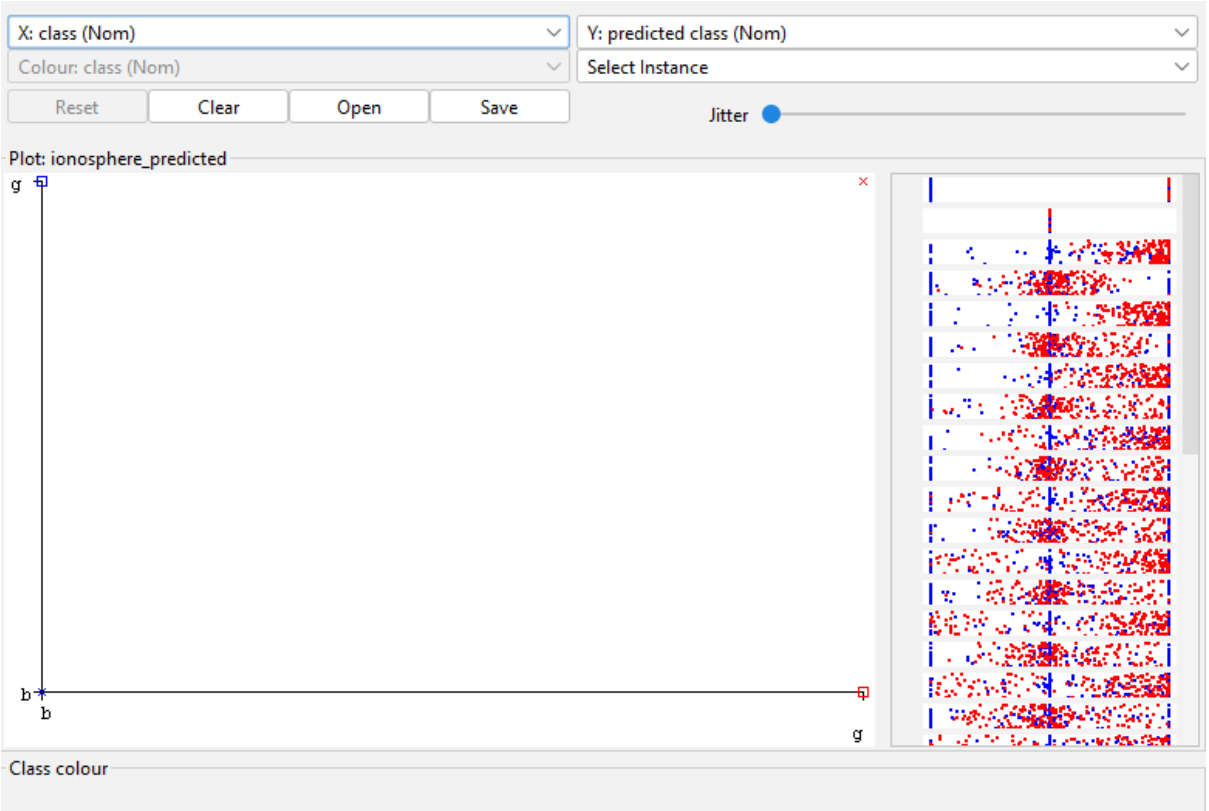

Open
Look In:
data
airline
breast-cancer
contact-lenses
cpu
cpu.with.vendor
credit-g
diabetes
glass
hypothyroid
ionosphere
iris.2D
iris
labor
ReutersCorn-test
ReutersCorn-train
ReutersGrain-test
ReutersGrain-train
segment-challenge
segment-test
soybean
supermarket
unbalanced
vote
weather.nominal
weather.numeric
Invoke options dialog
File Name:
ionosphere.arff
Files of Type:
Arff data files (*.arff)
Open
Cancel


Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Generate...
Undo
Edit...
Save...
Filter
Choose
None
Apply
Stop
Current relation
Relation: ionosphere
Instances: 351
Attributes: 35
Sum of weights: 351
Selected attribute
Name: a01
Missing: 0 (0%)
Distinct: 2
Type: Numeric
Unique: 0 (0%)
Statistic
Value
Minimum 0
Maximum 1
Mean 0.892
StdDev 0.311
Attributes
All
None
Invert
Pattern
No.
Name
1 a01
2 a02
3 a03
4 a04
5 a05
6 a06
7 a07
8 a08
9 a09
10 a10
11 a11
12 a12
13 a13
14 a14
15 a15
16 a16
17 a17
18 a18
19 a19
Remove
Class: class (Nom)
Visualize All
313
38
0
0
0
0
0
0.5
1
Status
OK
Log
x 0


Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
GaussianProcesses
LinearRegression
Logistic
MultilayerPerceptron
SGD
SGDText
SimpleLinearRegression
SimpleLogistic
SMO
SMOreg
VotedPerceptron
lazy
meta
misc
rules
DecisionTable
JRip
M5Rules
OneR
PART
ZeroR
trees
Close

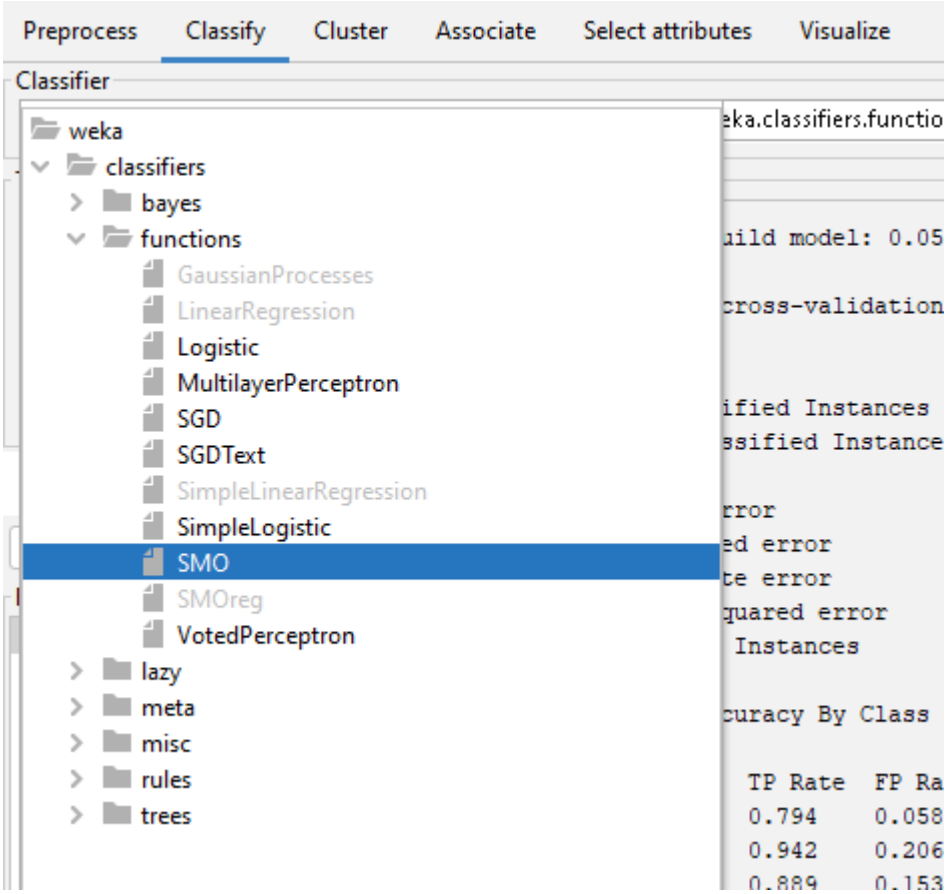

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
Logistic -R 1.0E-8 -M -1 -num-decimal-places 4
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
10:51:16 - functions.Logistic
Classifier output
Time taken to build model: 0.05 seconds
=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances 312 88.8889 %
Incorrectly Classified Instances 39 11.1111 %
Kappa statistic 0.753
Mean absolute error 0.1283
Root mean squared error 0.3035
Relative absolute error 27.8593 %
Root relative squared error 63.2601 %
Total Number of Instances 351
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure MCC ROC Area PRC
0.794 0.058 0.885 0.794 0.837 0.756 0.870 0.89
0.942 0.206 0.891 0.942 0.916 0.756 0.870 0.83
Weighted Avg. 0.889 0.153 0.889 0.889 0.887 0.756 0.870 0.85
=== Confusion Matrix ===
a b <-- classified as
100 26 | a = b
13 212 | b = g

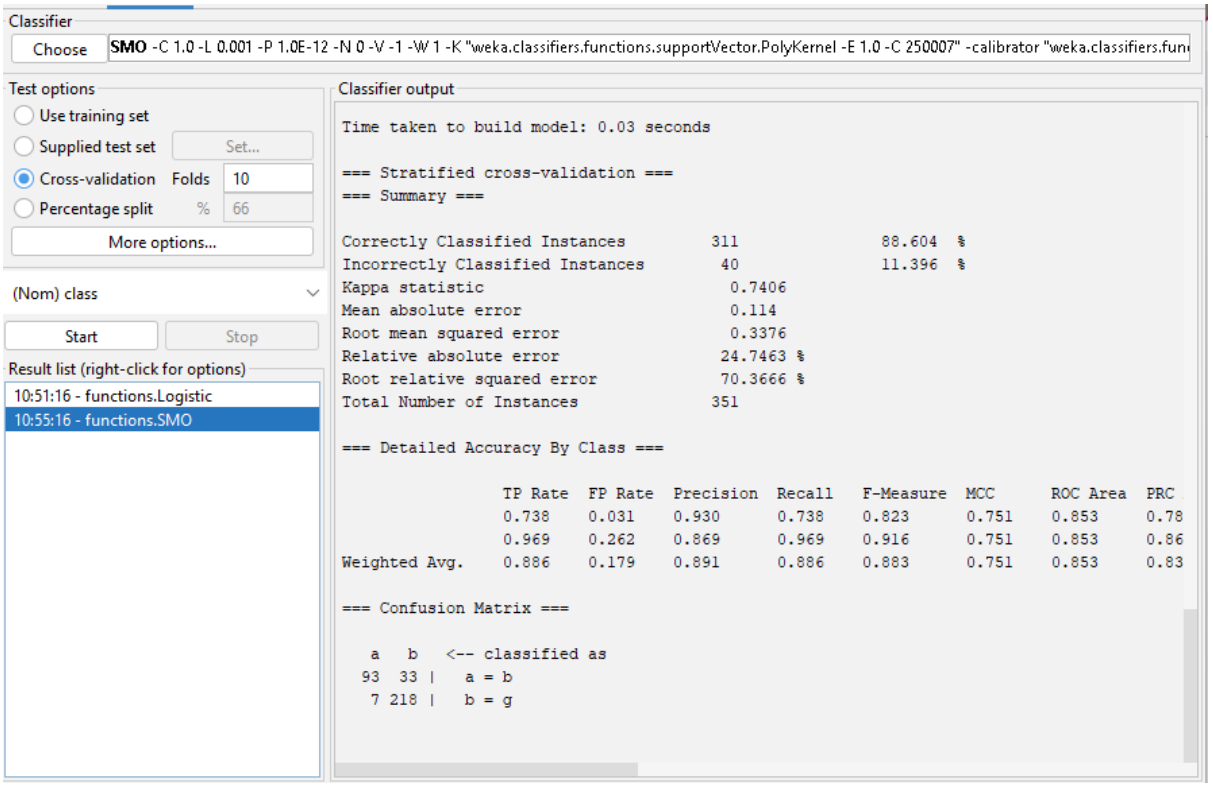

Result list (right-click for options)
10:51:16 - functions.L
View in main window
View in separate window
Save result buffer
Delete result buffer(s)
Load model
Save model
Re-evaluate model on current test set
Re-apply this model's configuration
Visualize classifier errors
Visualize tree
Visualize margin curve
Visualize threshold curve
Cost/Benefit analysis
Visualize cost curve
Status
OK
Relative absolute erro
Root relative squared
Instar
uracy
TP Ra
0.794
0.942
0.889
trix =
lassif
b
g



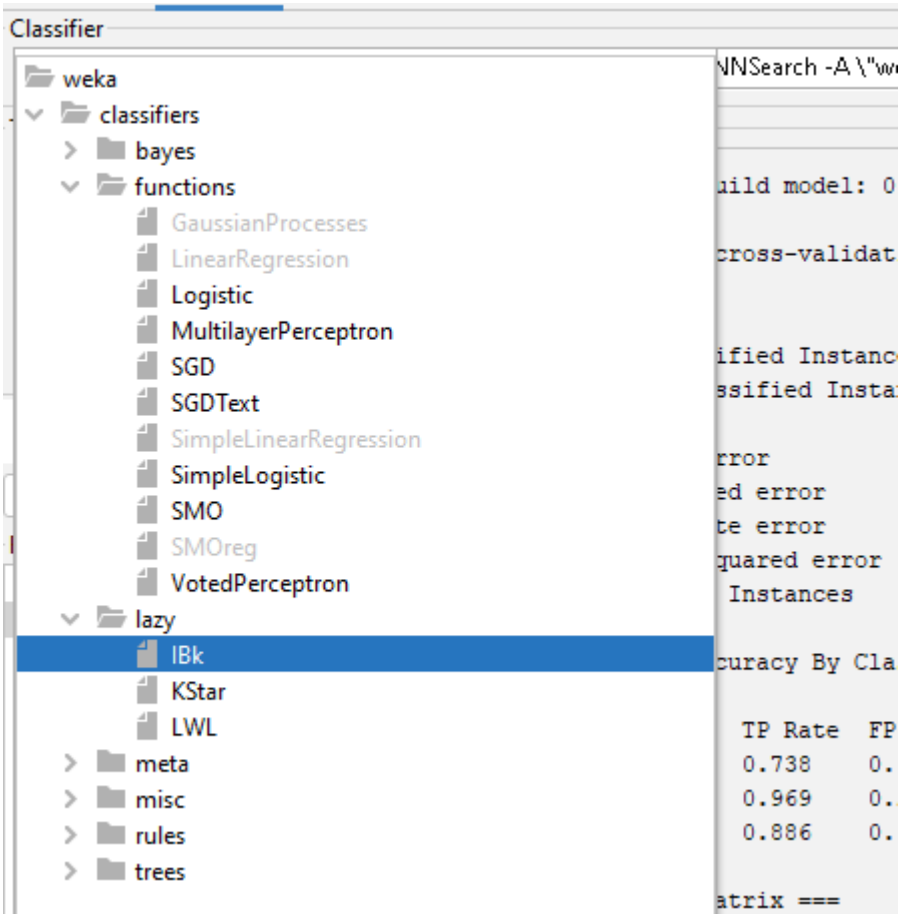
- **KNN**

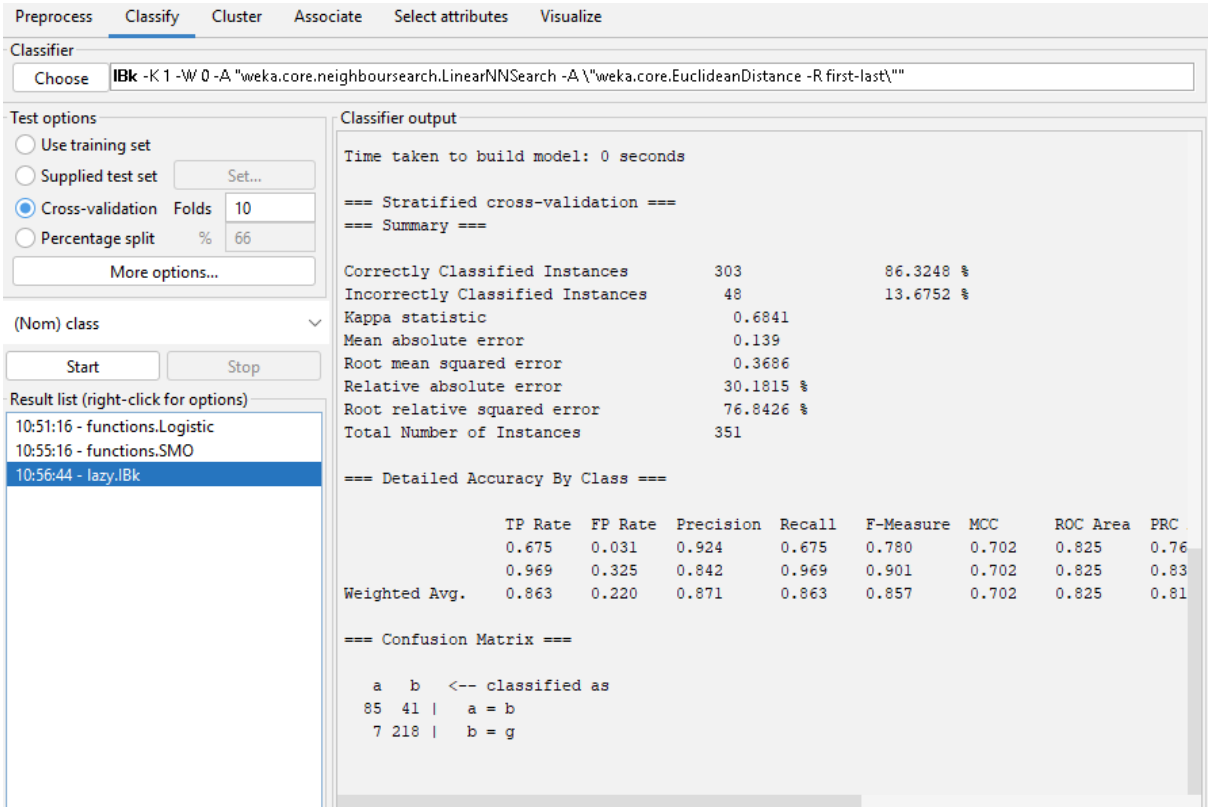
Use the same dataset as used for Logistic Regression
Click on Choose and Select SMO and click on start

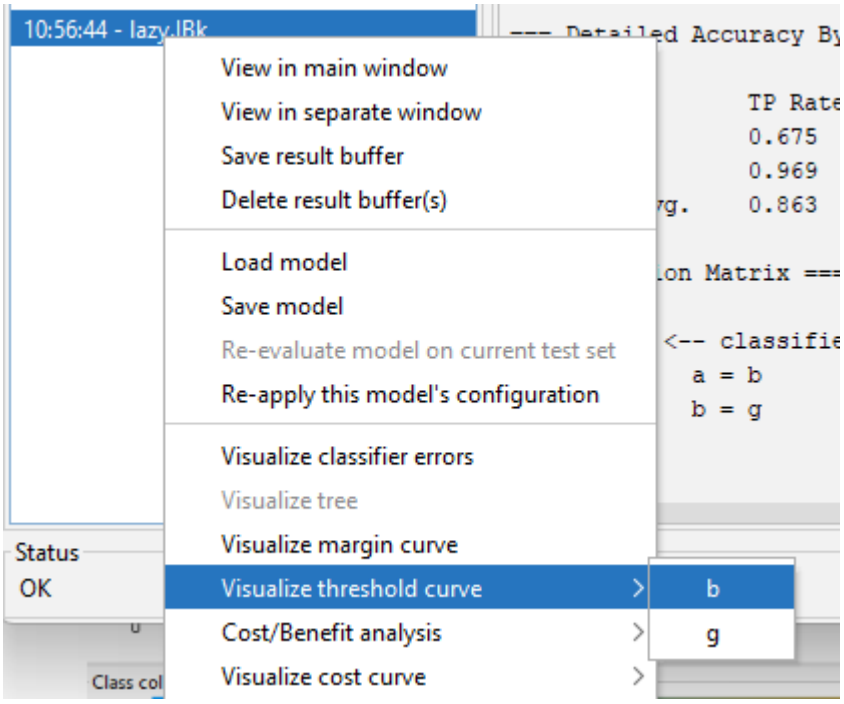

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
GaussianProcesses
LinearRegression
Logistic
MultilayerPerceptron
SGD
SGDText
SimpleLinearRegression
SimpleLogistic
SMO
SMOreg
VotedPerceptron
lazy
meta
misc
rules
trees
eka.classifiers.functio
uild model: 0.05
cross-validation
ified Instances
ssified Instance
rror
ed error
te error
quared error
Instances
curacy By Class
TP Rate FP Ra
0.794 0.058
0.942 0.206
0.889 0.153

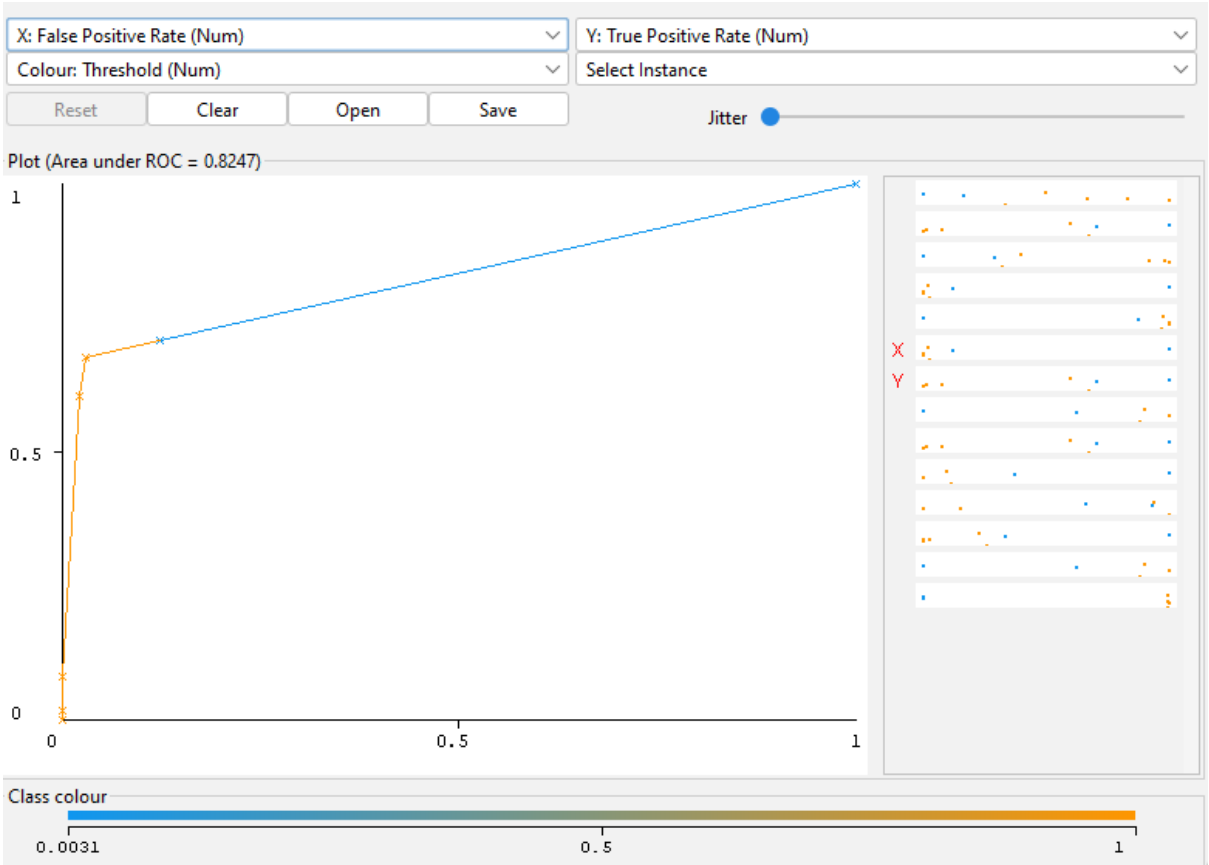

Classifier
Choose
SMO -C 1.0 -L 0.001 -P 1.0E-12 -N 0 -V -1 -W 1 -K "weka.classifiers.functions.supportVector.PolyKernel -E 1.0 -C 250007" -calibrator "weka.classifiers.fun
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
10:51:16 - functions.Logistic
10:55:16 - functions.SMO
Classifier output
Time taken to build model: 0.03 seconds
=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances 311 88.604 %
Incorrectly Classified Instances 40 11.396 %
Kappa statistic 0.7406
Mean absolute error 0.114
Root mean squared error 0.3376
Relative absolute error 24.7463 %
Root relative squared error 70.3666 %
Total Number of Instances 351
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure MCC ROC Area PRC
0.738 0.031 0.930 0.738 0.823 0.751 0.853 0.78
0.969 0.262 0.869 0.969 0.916 0.751 0.853 0.86
Weighted Avg. 0.886 0.179 0.891 0.886 0.883 0.751 0.853 0.83
=== Confusion Matrix ===
a b <-- classified as
93 33 | a = b
7 218 | b = g

- **IBK**

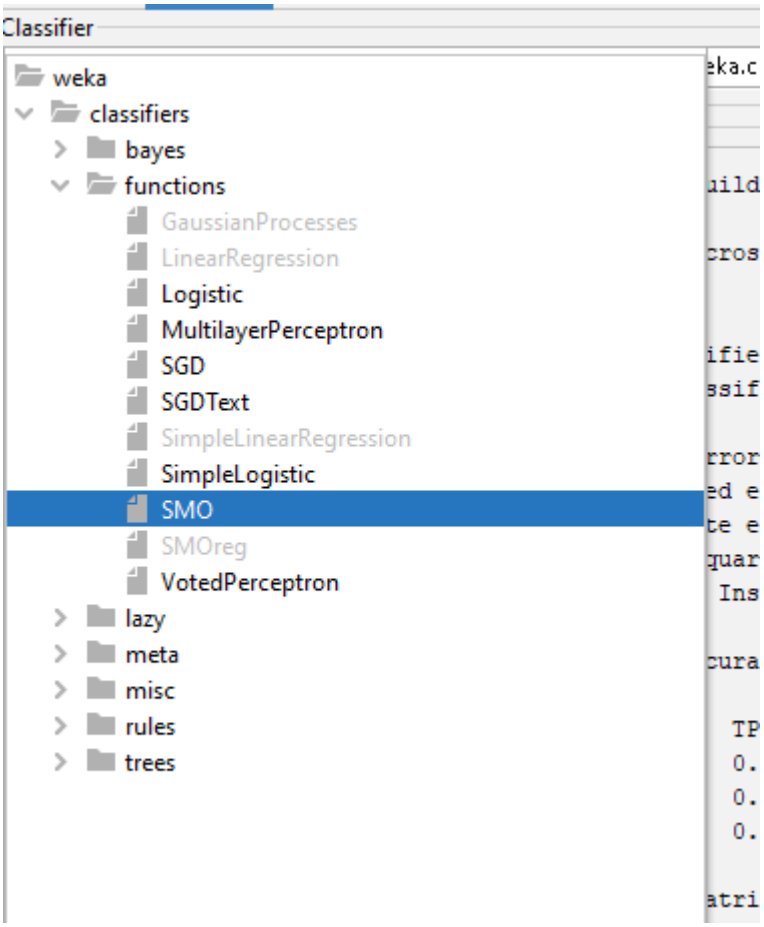

Classifier
weka
classifiers
bayes
functions
GaussianProcesses
LinearRegression
Logistic
MultilayerPerceptron
SGD
SGDText
SimpleLinearRegression
SimpleLogistic
SMO
SMOreg
VotedPerceptron
lazy
IBk
KStar
LWL
meta
misc
rules
trees
NNSearch -A \"w
uild model: 0
cross-validat
ified Instanc
ssified Insta
rror
ed error
te error
quared error
Instances
curacy By Cla
TP Rate FP
0.738 0.
0.969 0.
0.886 0.
atrix ===

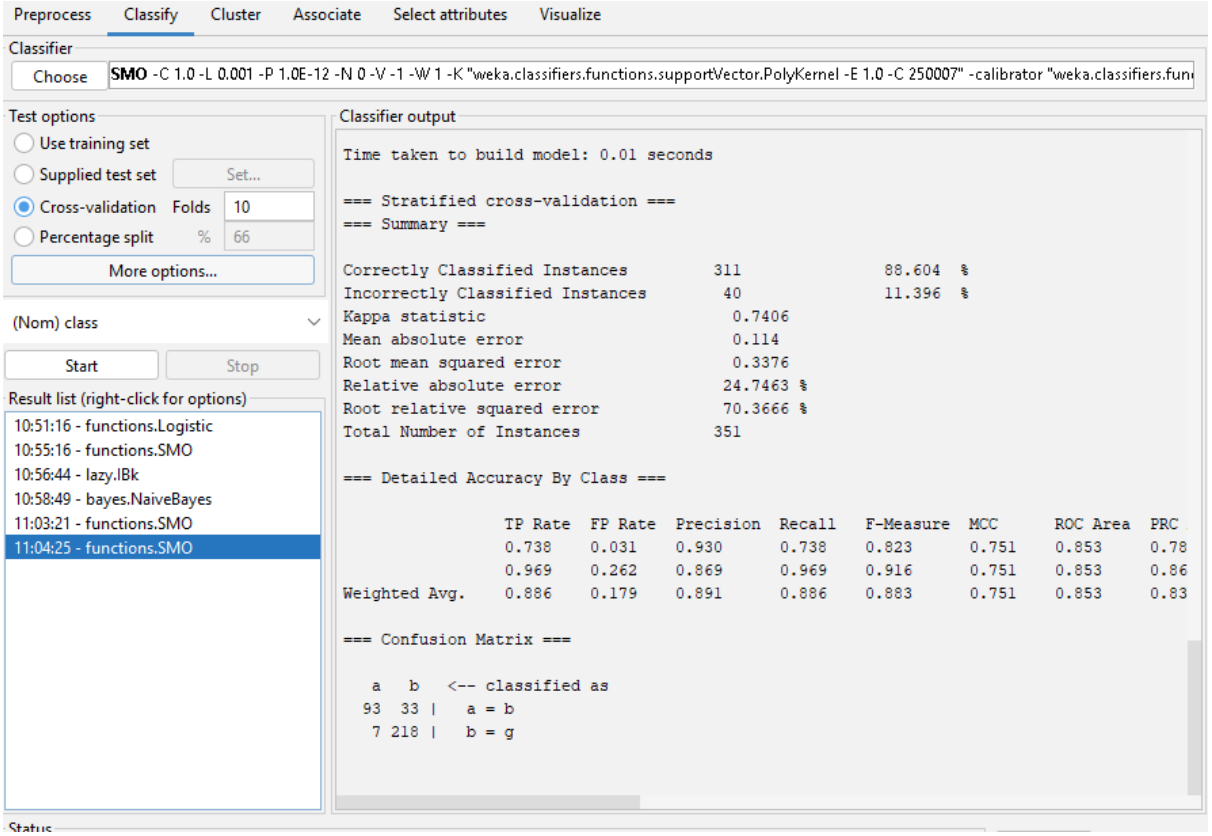

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
IBk -K 1 -W 0 -A "weka.core.neighboursearch.LinearNNSearch -A \"weka.core.EuclideanDistance -R first-last\""
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
10:51:16 - functions.Logistic
10:55:16 - functions.SMO
10:56:44 - lazy.IBk
Classifier output
Time taken to build model: 0 seconds
=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances 303 86.3248 %
Incorrectly Classified Instances 48 13.6752 %
Kappa statistic 0.6841
Mean absolute error 0.139
Root mean squared error 0.3686
Relative absolute error 30.1815 %
Root relative squared error 76.8426 %
Total Number of Instances 351
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure MCC ROC Area PRC
0.675 0.031 0.924 0.675 0.780 0.702 0.825 0.76
0.969 0.325 0.842 0.969 0.901 0.702 0.825 0.83
Weighted Avg. 0.863 0.220 0.871 0.863 0.857 0.702 0.825 0.81
=== Confusion Matrix ===
a b <-- classified as
85 41 | a = b
7 218 | b = g


10:56:44 - lazy.IBk
View in main window
View in separate window
Save result buffer
Delete result buffer(s)
Load model
Save model
Re-evaluate model on current test set
Re-apply this model's configuration
Visualize classifier errors
Visualize tree
Visualize margin curve
Visualize threshold curve
Cost/Benefit analysis
Visualize cost curve
b
g
Status
OK
Class col
TP Rate
0.675
0.969
0.863
<-- classifie
a = b
b = g

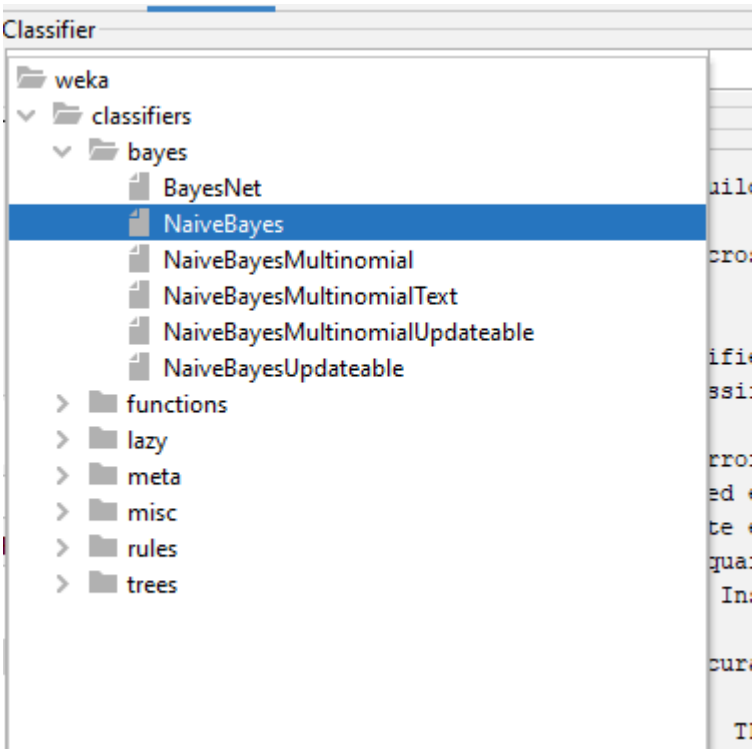

X: False Positive Rate (Num)
Y: True Positive Rate (Num)
Colour: Threshold (Num)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot (Area under ROC = 0.8247)
1
0.5
0
0
0.5
1
X
Y
Class colour
0.0031
0.5
1

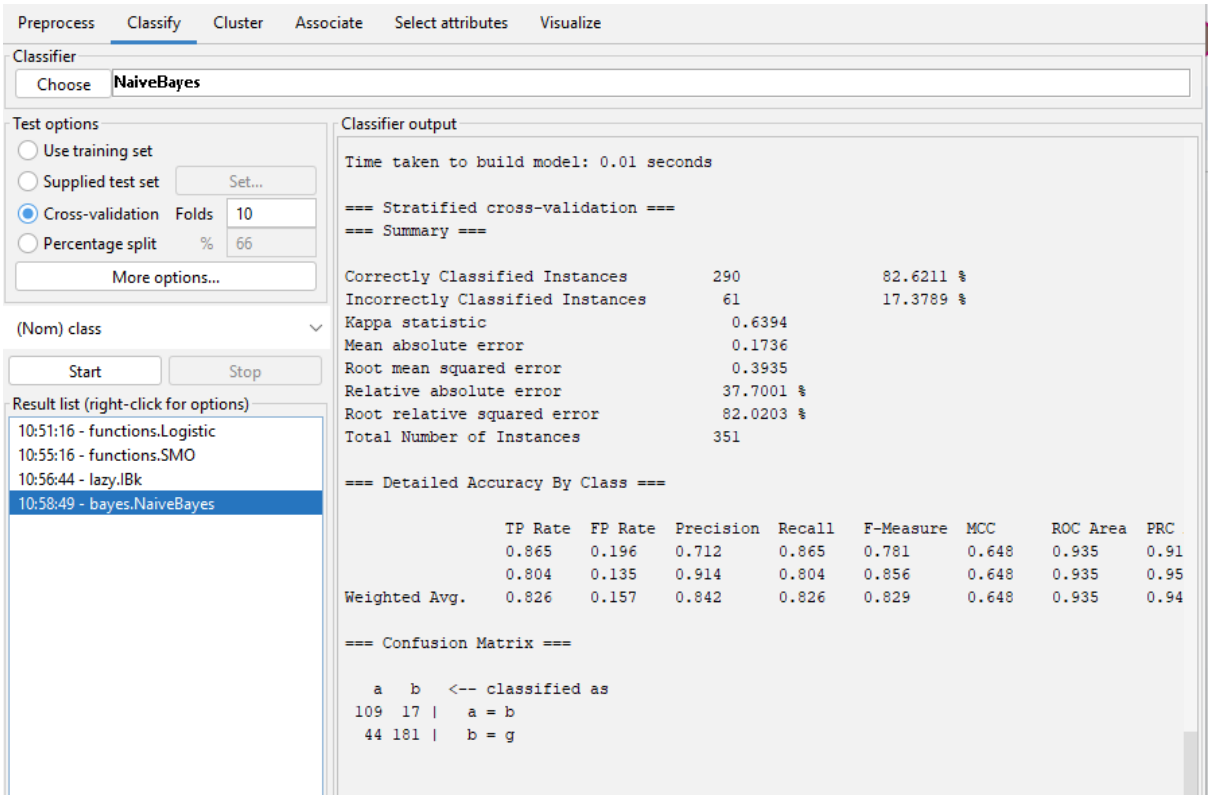
- **SMO**

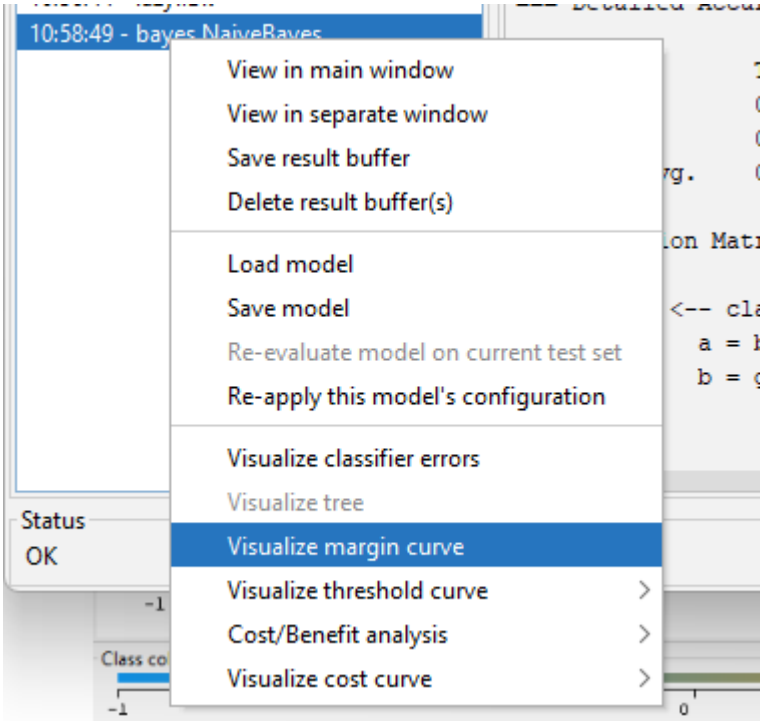

Classifier
weka
classifiers
bayes
functions
GaussianProcesses
LinearRegression
Logistic
MultilayerPerceptron
SGD
SGDText
SimpleLinearRegression
SimpleLogistic
SMO
SMOreg
VotedPerceptron
lazy
meta
misc
rules
trees

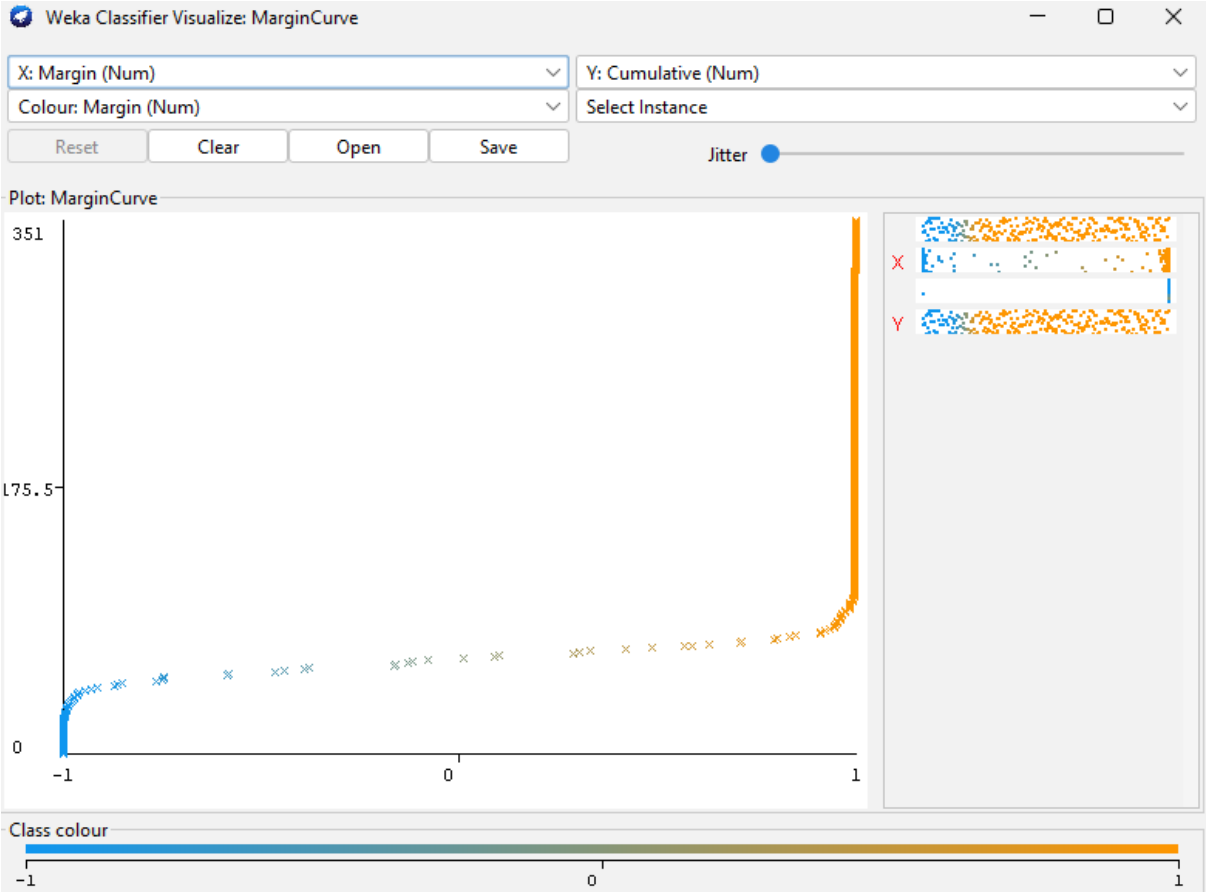

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
SMO -C 1.0 -L 0.001 -P 1.0E-12 -N 0 -V -1 -W 1 -K "weka.classifiers.functions.supportVector.PolyKernel -E 1.0 -C 250007" -calibrator "weka.classifiers.fun
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
10:51:16 - functions.Logistic
10:55:16 - functions.SMO
10:56:44 - lazy.IBk
10:58:49 - bayes.NaiveBayes
11:03:21 - functions.SMO
11:04:25 - functions.SMO
Classifier output
Time taken to build model: 0.01 seconds
=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances 311 88.604 %
Incorrectly Classified Instances 40 11.396 %
Kappa statistic 0.7406
Mean absolute error 0.114
Root mean squared error 0.3376
Relative absolute error 24.7463 %
Root relative squared error 70.3666 %
Total Number of Instances 351
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure MCC ROC Area PRC
0.738 0.031 0.930 0.738 0.823 0.751 0.853 0.78
0.969 0.262 0.869 0.969 0.916 0.751 0.853 0.86
Weighted Avg. 0.886 0.179 0.891 0.886 0.883 0.751 0.853 0.83
=== Confusion Matrix ===
a b <-- classified as
93 33 | a = b
7 218 | b = g
Status

- **Naive Bayes**


Classifier
weka
classifiers
bayes
BayesNet
NaiveBayes
NaiveBayesMultinomial
NaiveBayesMultinomialText
NaiveBayesMultinomialUpdateable
NaiveBayesUpdateable
functions
lazy
meta
misc
rules
trees


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)
10:51:16 - functions.Logistic
10:55:16 - functions.SMO
10:56:44 - lazy.IBk
10:58:49 - bayes.NaiveBayes
Classifier output
Time taken to build model: 0.01 seconds
=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances 290 82.6211 %
Incorrectly Classified Instances 61 17.3789 %
Kappa statistic 0.6394
Mean absolute error 0.1736
Root mean squared error 0.3935
Relative absolute error 37.7001 %
Root relative squared error 82.0203 %
Total Number of Instances 351
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure MCC ROC Area PRC
0.865 0.196 0.712 0.865 0.781 0.648 0.935 0.91
0.804 0.135 0.914 0.804 0.856 0.648 0.935 0.95
Weighted Avg. 0.826 0.157 0.842 0.826 0.829 0.648 0.935 0.94
=== Confusion Matrix ===
a b <-- classified as
109 17 | a = b
44 181 | b = g

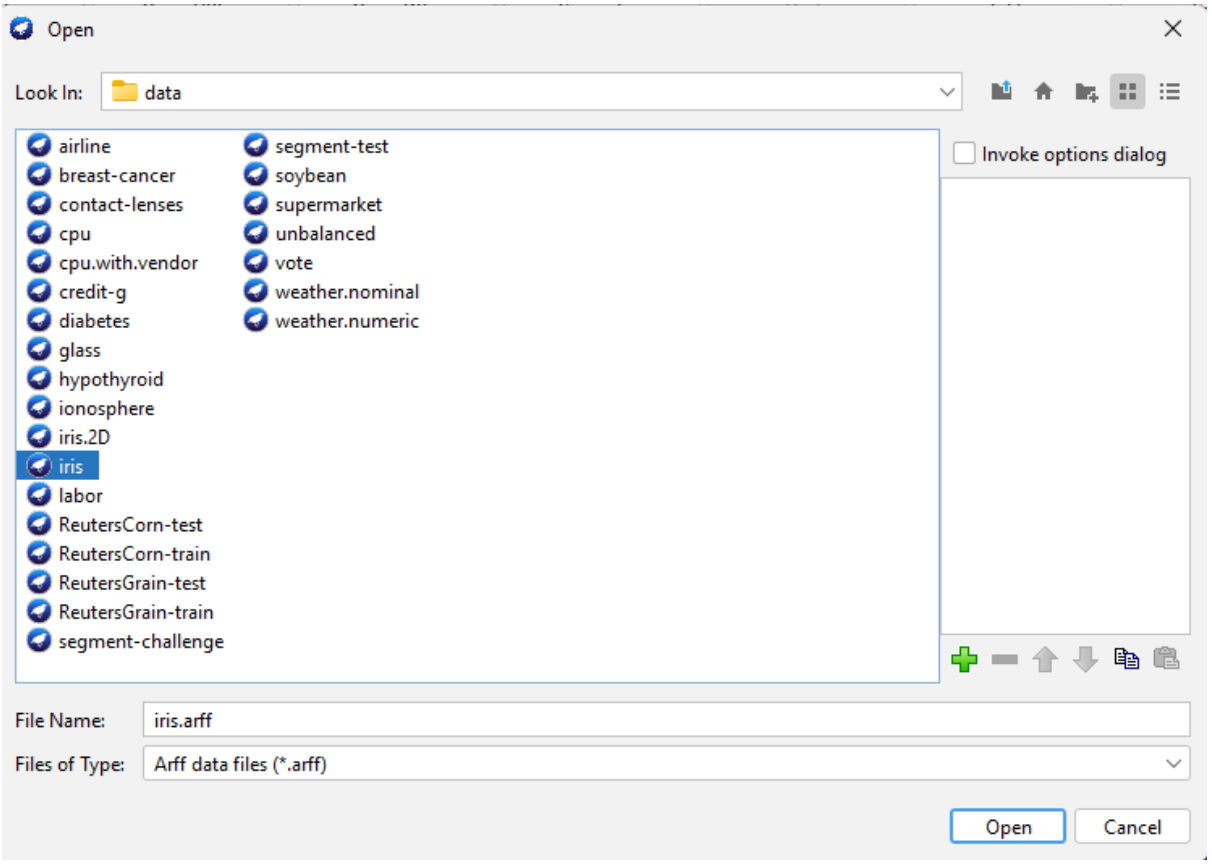

10:58:49 - bayes.NaiveBayes
View in main window
View in separate window
Save result buffer
Delete result buffer(s)
Load model
Save model
Re-evaluate model on current test set
Re-apply this model's configuration
Visualize classifier errors
Visualize tree
Visualize margin curve
Visualize threshold curve
Cost/Benefit analysis
Visualize cost curve
Status
OK

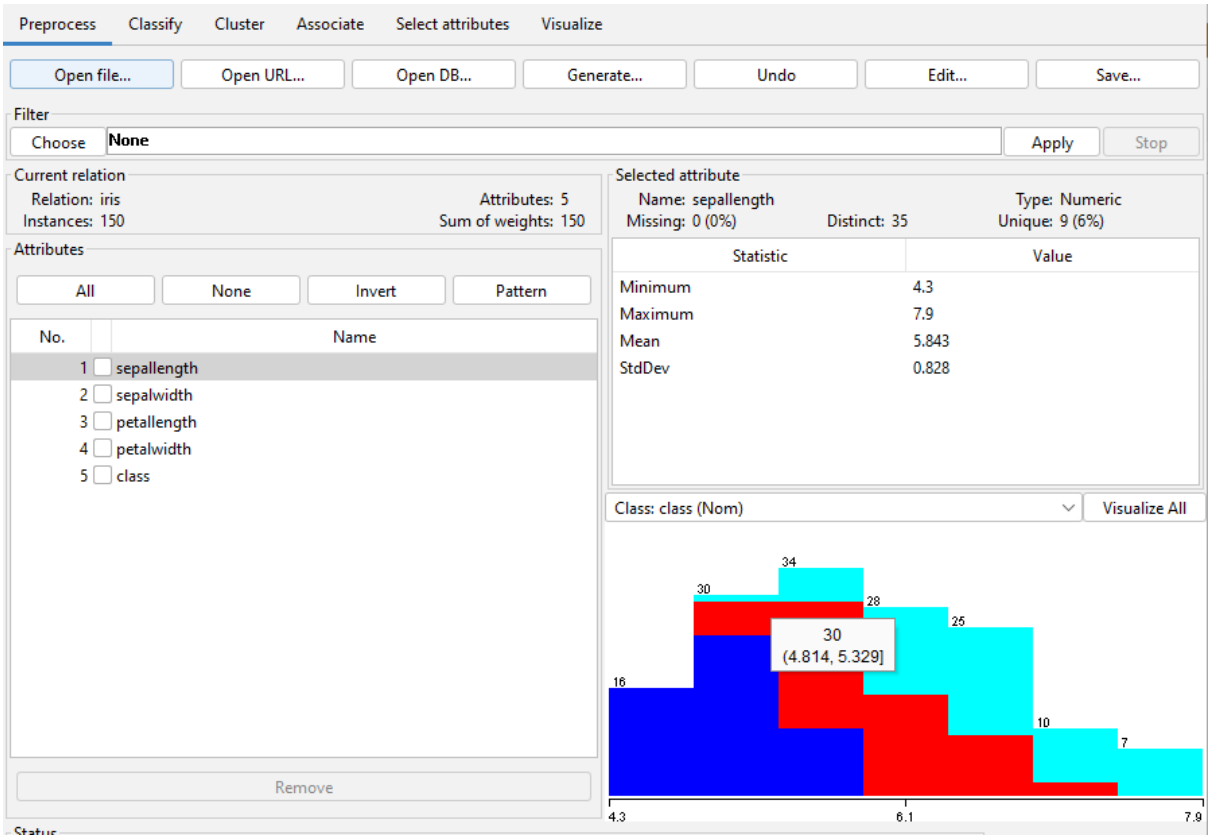

Weka Classifier Visualize: MarginCurve
X: Margin (Num)
Y: Cumulative (Num)
Colour: Margin (Num)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: MarginCurve
351
175.5
0
-1
0
1
X
Y
Class colour
-1
0
1

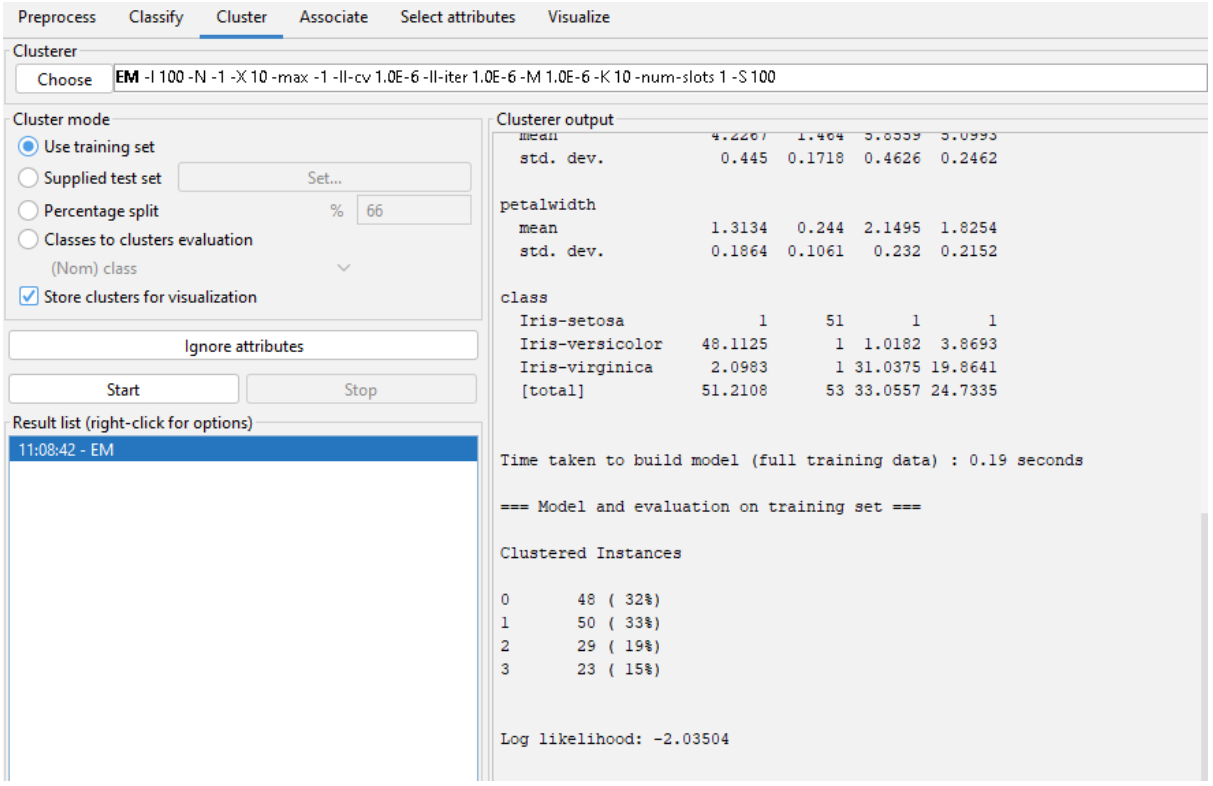
Practical 2: Unsupervised Learning

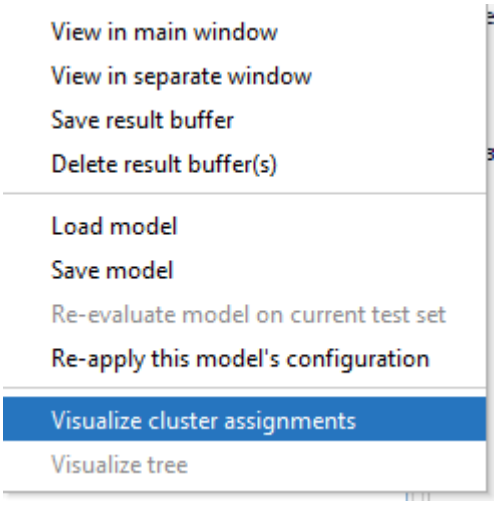
A. Clustering

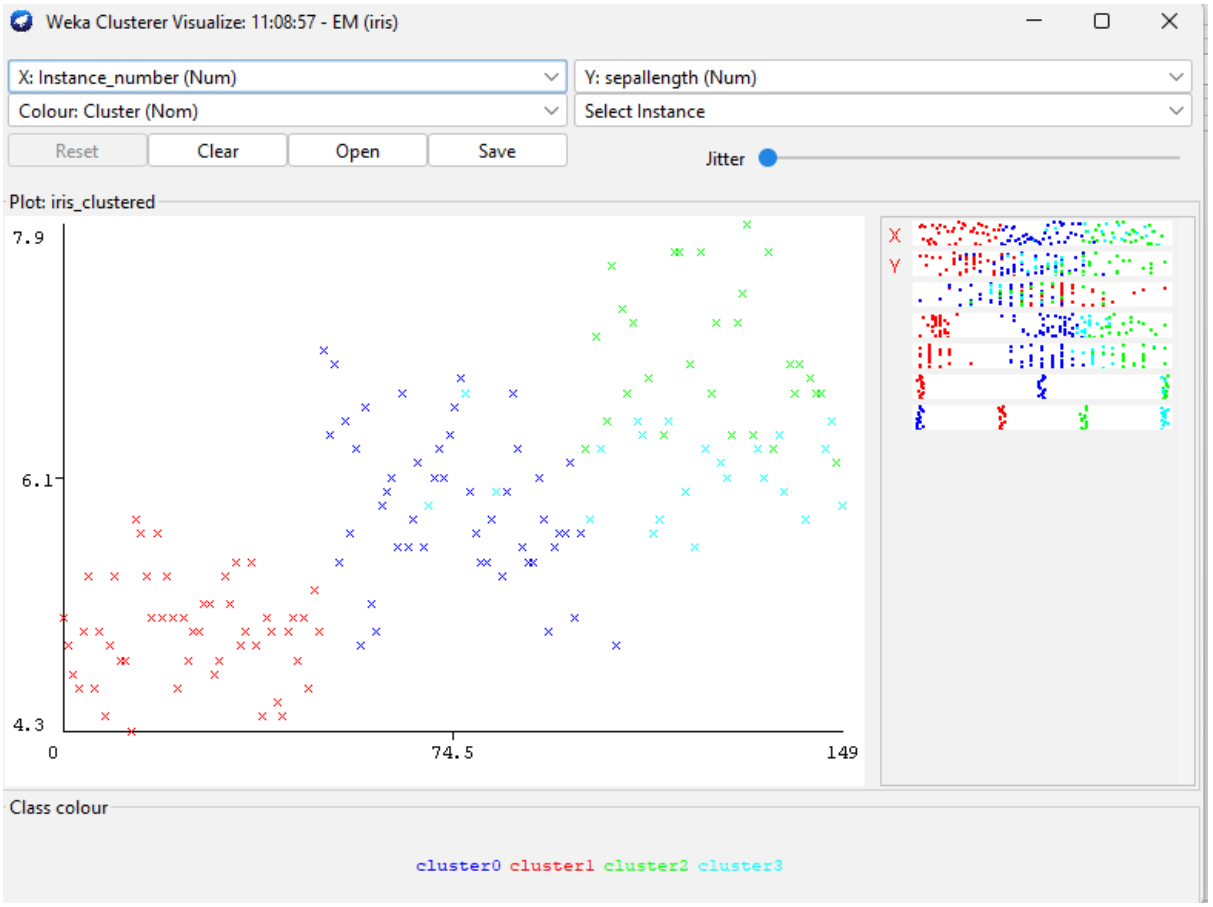
- **EM**



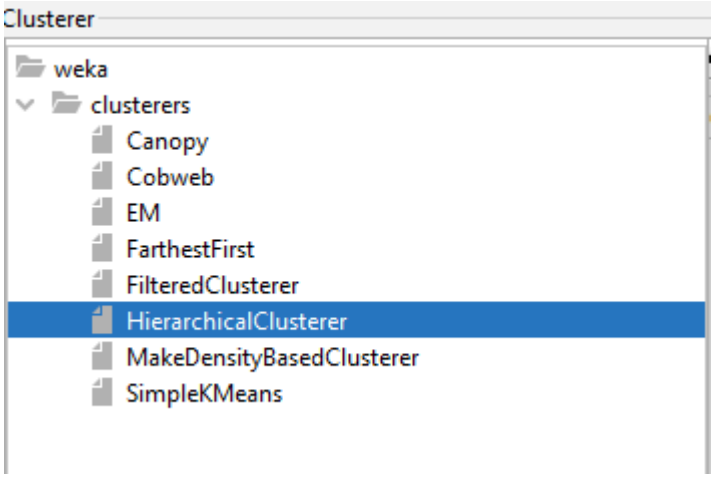

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Generate...
Undo
Edit...
Save...
Filter
Choose
None
Apply
Stop
Current relation
Relation: iris
Instances: 150
Attributes: 5
Sum of weights: 150
Selected attribute
Name: sepallength
Missing: 0 (0%)
Distinct: 35
Type: Numeric
Unique: 9 (6%)
Statistic
Value
Minimum 4.3
Maximum 7.9
Mean 5.843
StdDev 0.828
Attributes
All
None
Invert
Pattern
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Remove
Class: class (Nom)
Visualize All
30
(4.814, 5.329]
4.3
6.1
7.9

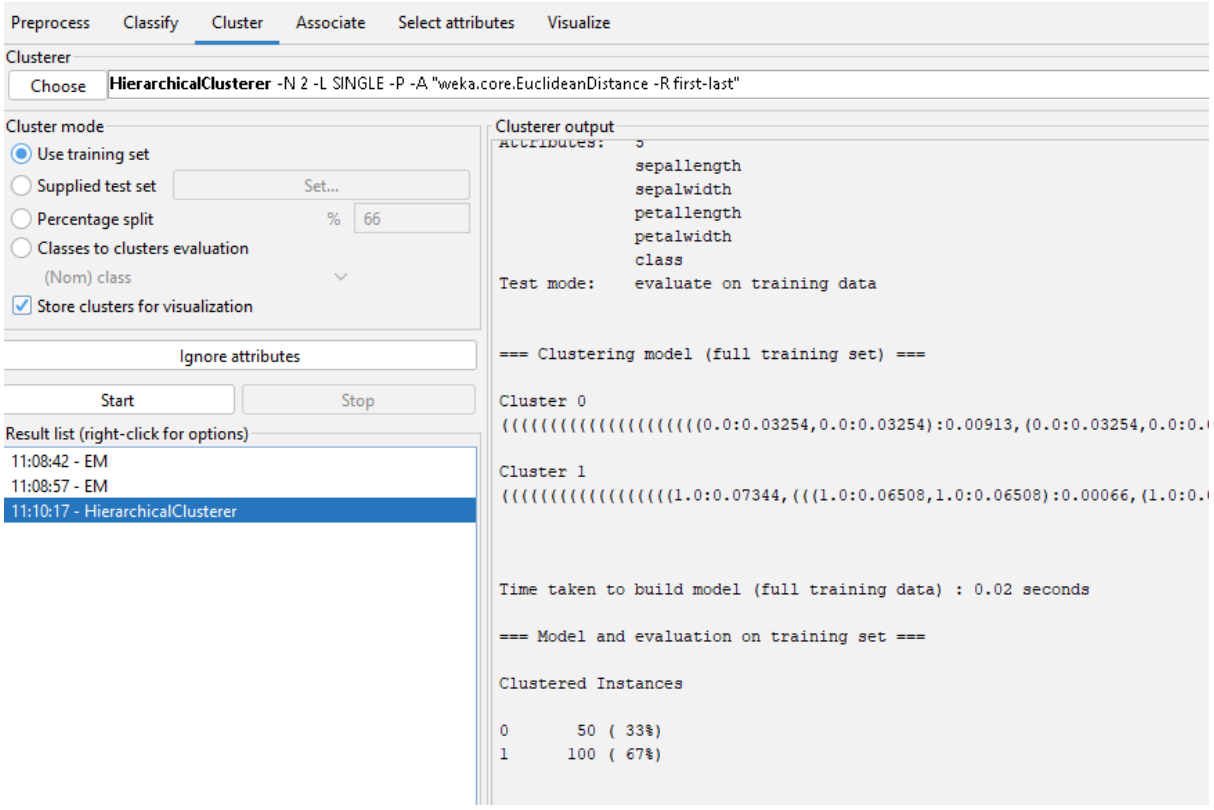

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
EM -I 100 -N -1 -X 10 -max -1 -ll-cv 1.0E-6 -ll-iter 1.0E-6 -M 1.0E-6 -K 10 -num-slots 1 -S 100
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
11:08:42 - EM
Clusterer output
std. dev. 0.445 0.1718 0.4626 0.2462
petalwidth
mean 1.3134 0.244 2.1495 1.8254
std. dev. 0.1864 0.1061 0.232 0.2152
class
Iris-setosa 1 51 1 1
Iris-versicolor 48.1125 1 1.0182 3.8693
Iris-virginica 2.0983 1 31.0375 19.8641
[total] 51.2108 53 33.0557 24.7335
Time taken to build model (full training data) : 0.19 seconds
=== Model and evaluation on training set ===
Clustered Instances
0 48 (32%)
1 50 (33%)
2 29 (19%)
3 23 (15%)
Log likelihood: -2.03504

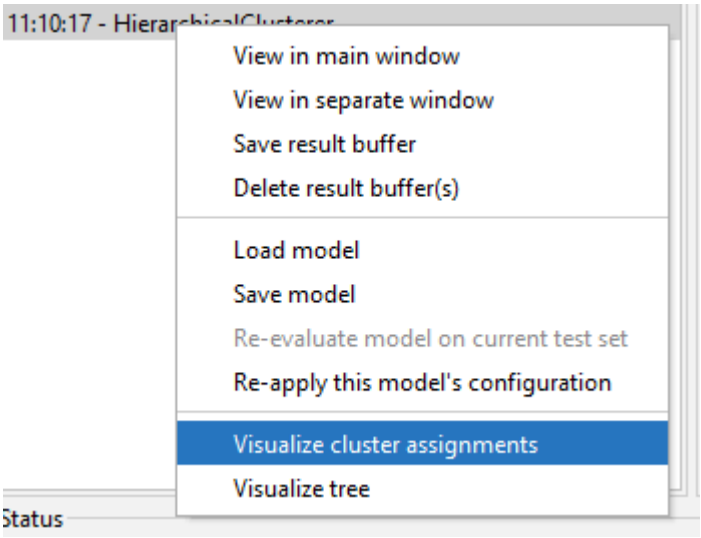


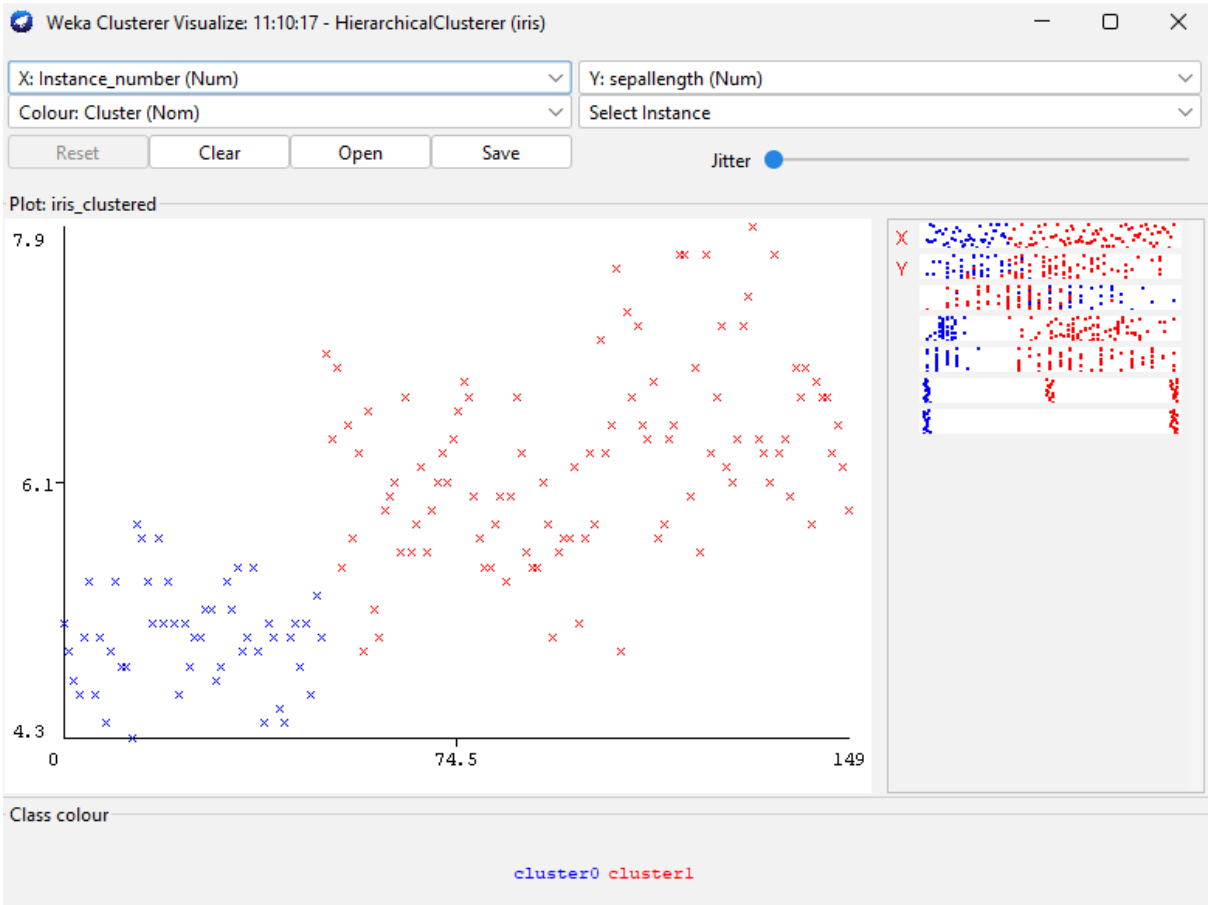


- **Hierarchical Clustering**

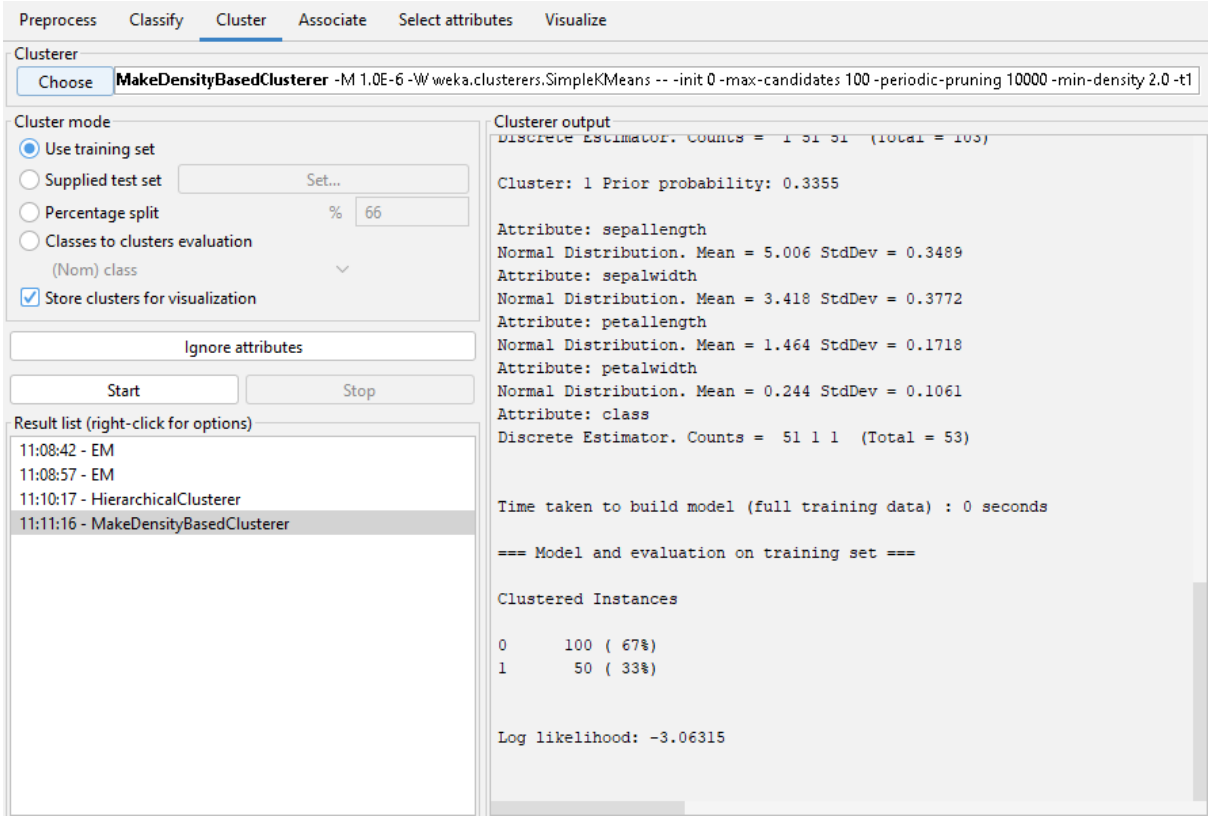

Clusterer
weka
clusterers
Canopy
Cobweb
EM
FarthestFirst
FilteredClusterer
HierarchicalClusterer
MakeDensityBasedClusterer
SimpleKMeans

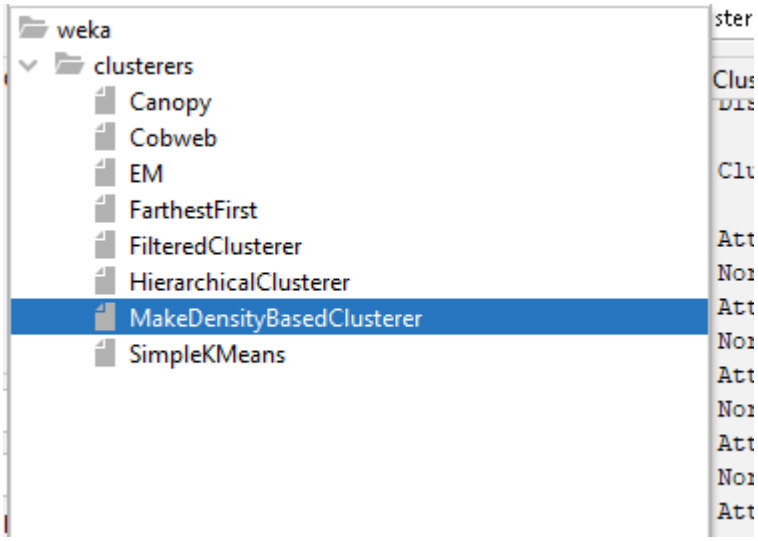

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
HierarchicalClusterer -N 2 -L SINGLE -P -A "weka.core.EuclideanDistance -R first-last"
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
11:08:42 - EM
11:08:57 - EM
11:10:17 - HierarchicalClusterer
Clusterer output
sepallength
sepalwidth
petallength
petalwidth
class
Test mode: evaluate on training data
=== Clustering model (full training set) ===
Cluster 0
Cluster 1
Time taken to build model (full training data) : 0.02 seconds
=== Model and evaluation on training set ===
Clustered Instances
0 50 (33%)
1 100 (67%)

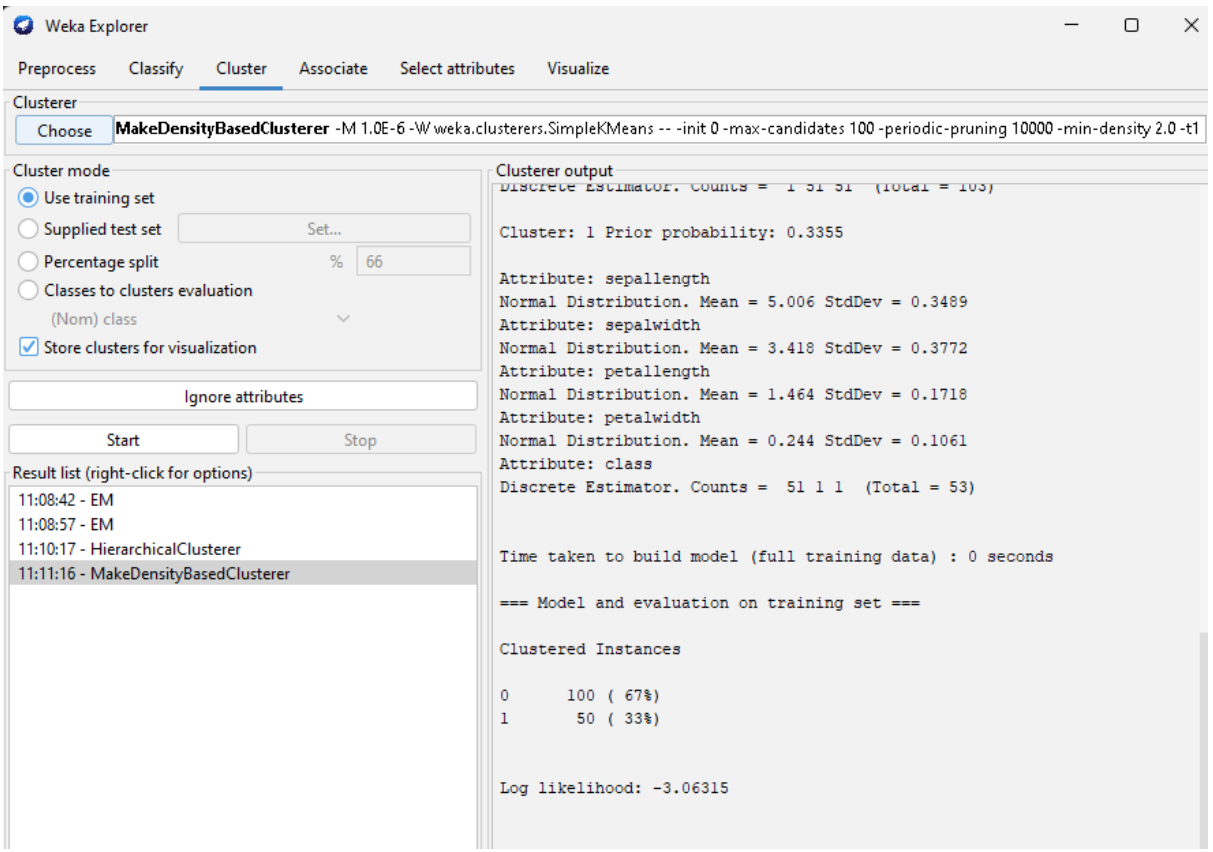


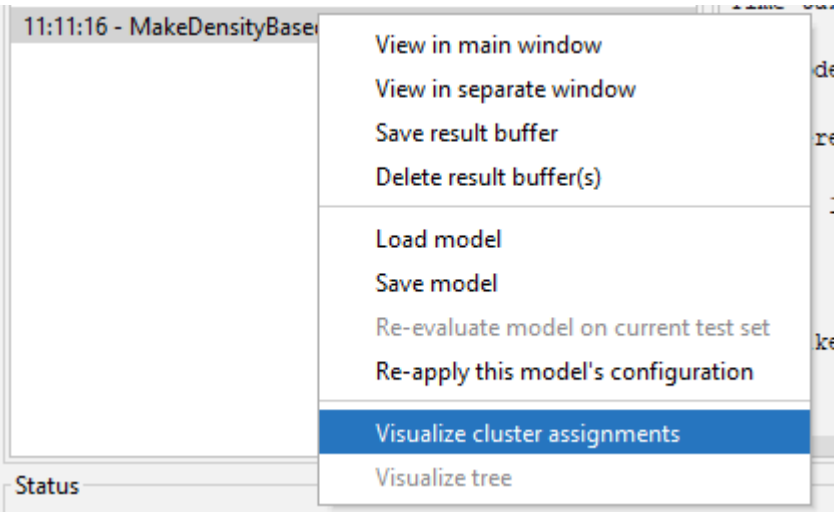


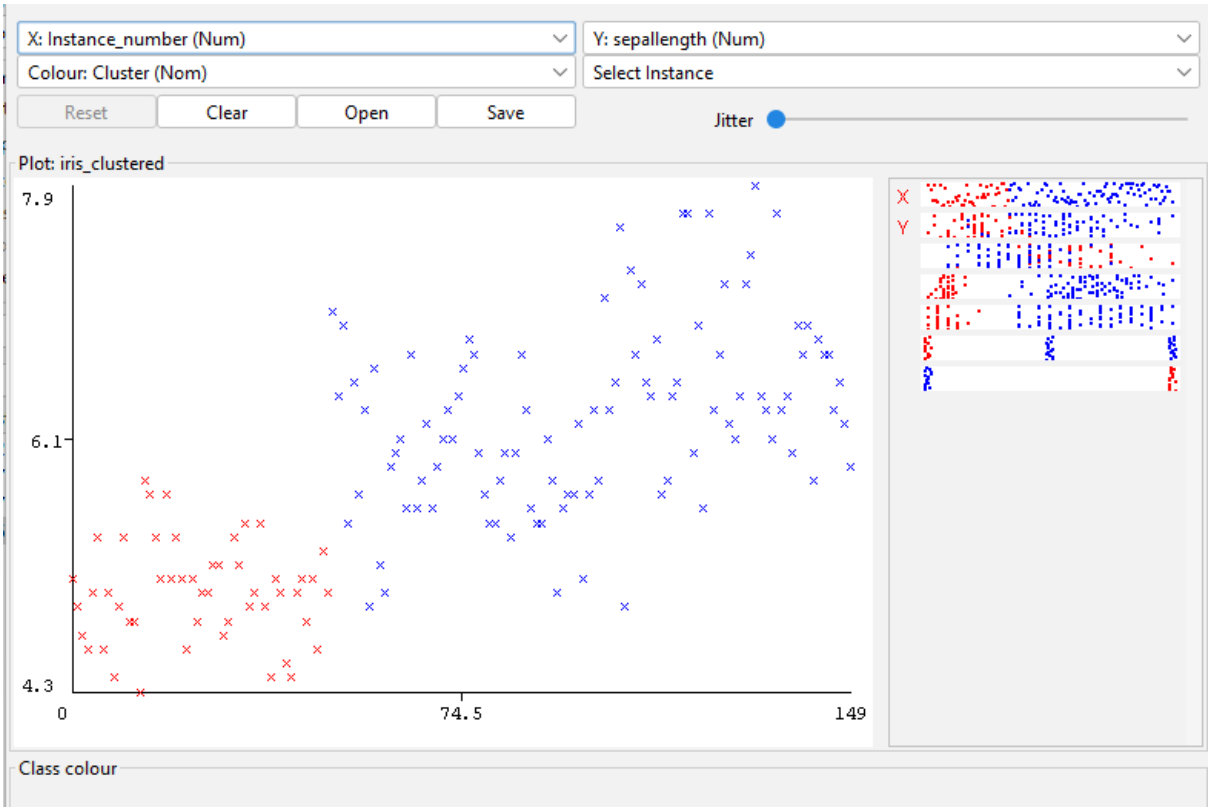
- **Density Based Cluster**


Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
MakeDensityBasedClusterer -M 1.0E-6 -W weka.clusterers.SimpleKMeans -- -init 0 -max-candidates 100 -periodic-pruning 10000 -min-density 2.0 -t1
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
11:08:42 - EM
11:08:57 - EM
11:10:17 - HierarchicalClusterer
11:11:16 - MakeDensityBasedClusterer
Clusterer output
Cluster: 1 Prior probability: 0.3355
Attribute: sepallength
Normal Distribution. Mean = 5.006 StdDev = 0.3489
Attribute: sepalwidth
Normal Distribution. Mean = 3.418 StdDev = 0.3772
Attribute: petallength
Normal Distribution. Mean = 1.464 StdDev = 0.1718
Attribute: petalwidth
Normal Distribution. Mean = 0.244 StdDev = 0.1061
Attribute: class
Discrete Estimator. Counts = 51 1 1 (Total = 53)
Time taken to build model (full training data) : 0 seconds
=== Model and evaluation on training set ===
Clustered Instances
0 100 (67%)
1 50 (33%)
Log likelihood: -3.06315

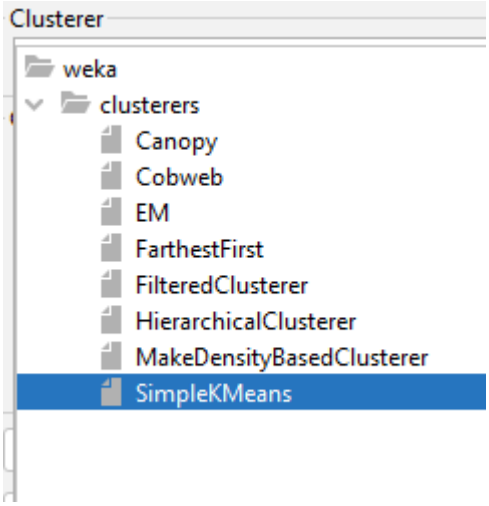

weka
clusterers
Canopy
Cobweb
EM
FarthestFirst
FilteredClusterer
HierarchicalClusterer
MakeDensityBasedClusterer
SimpleKMeans

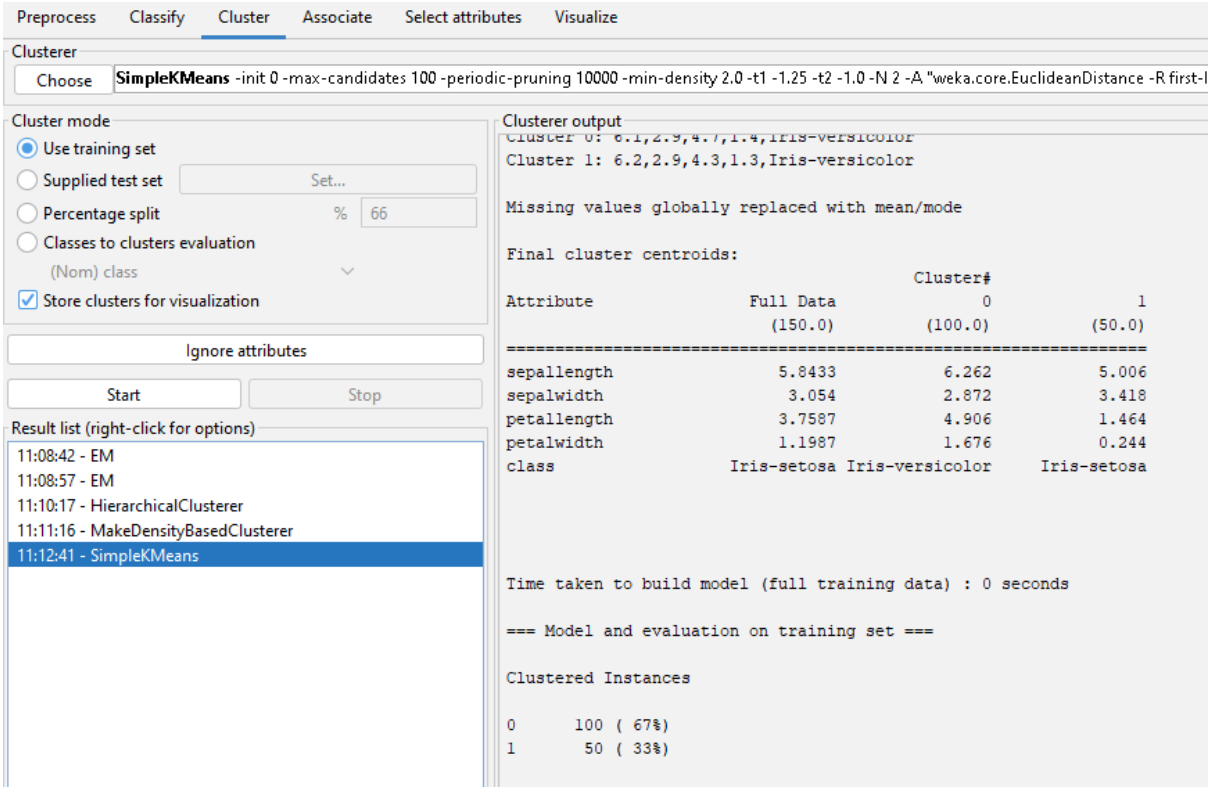

Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
MakeDensityBasedClusterer -M 1.0E-6 -W weka.clusterers.SimpleKMeans -- -init 0 -max-candidates 100 -periodic-pruning 10000 -min-density 2.0 -t1
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
11:08:42 - EM
11:08:57 - EM
11:10:17 - HierarchicalClusterer
11:11:16 - MakeDensityBasedClusterer
Clusterer output
Cluster: 1 Prior probability: 0.3355
Attribute: sepallength
Normal Distribution. Mean = 5.006 StdDev = 0.3489
Attribute: sepalwidth
Normal Distribution. Mean = 3.418 StdDev = 0.3772
Attribute: petallength
Normal Distribution. Mean = 1.464 StdDev = 0.1718
Attribute: petalwidth
Normal Distribution. Mean = 0.244 StdDev = 0.1061
Attribute: class
Discrete Estimator. Counts = 51 1 1 (Total = 53)
Time taken to build model (full training data) : 0 seconds
=== Model and evaluation on training set ===
Clustered Instances
0 100 (67%)
1 50 (33%)
Log likelihood: -3.06315

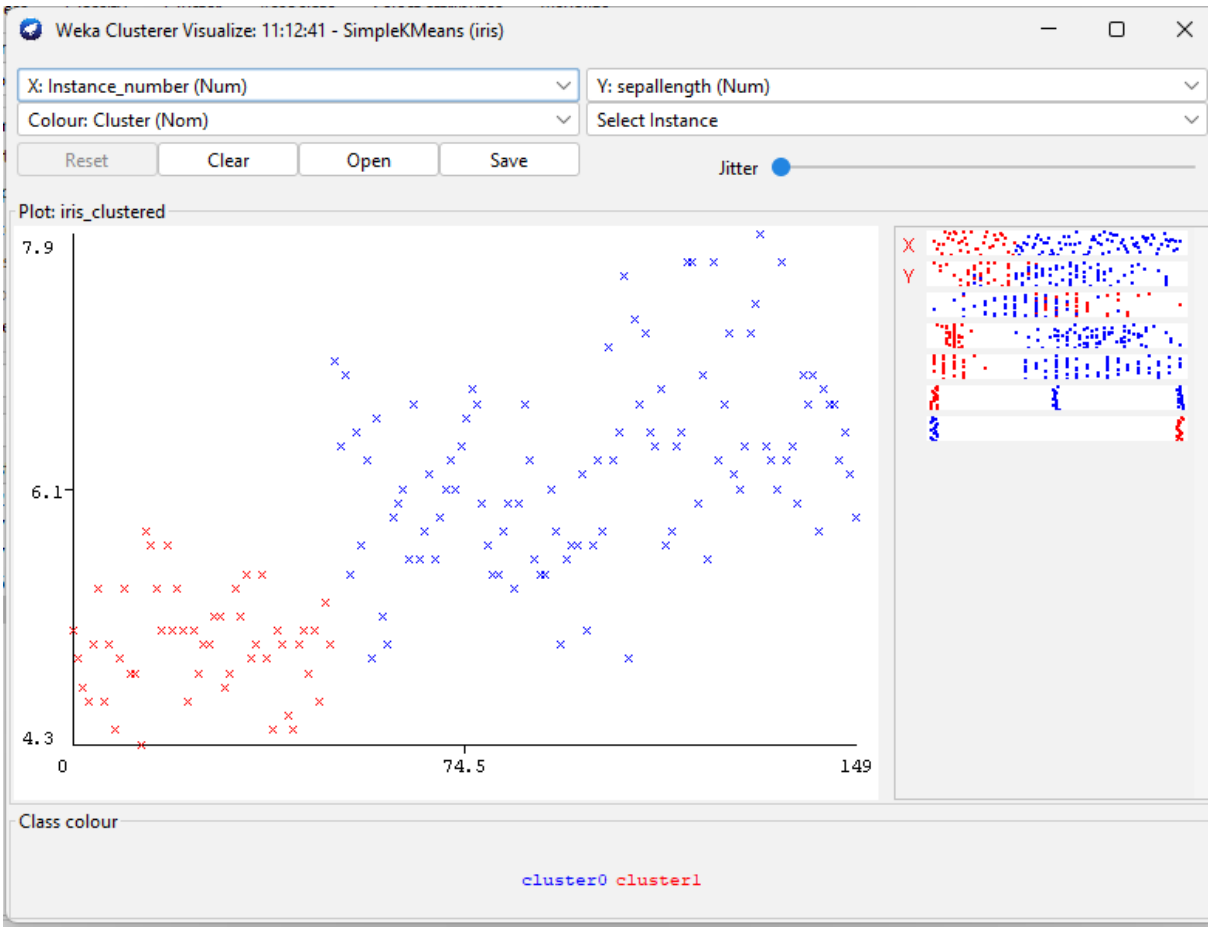

11:11:16 - MakeDensityBase
View in main window
View in separate window
Save result buffer
Delete result buffer(s)
Load model
Save model
Re-evaluate model on current test set
Re-apply this model's configuration
Visualize cluster assignments
Visualize tree
Status


X: Instance_number (Num)
Y: sepallength (Num)
Colour: Cluster (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: iris_clustered
7.9
6.1
4.3
0
74.5
149
X
Y
Class colour

- **Simple K Means**

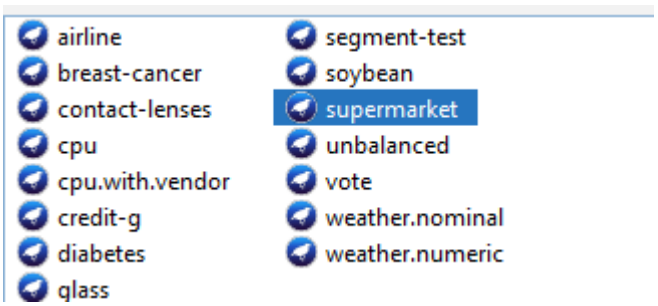


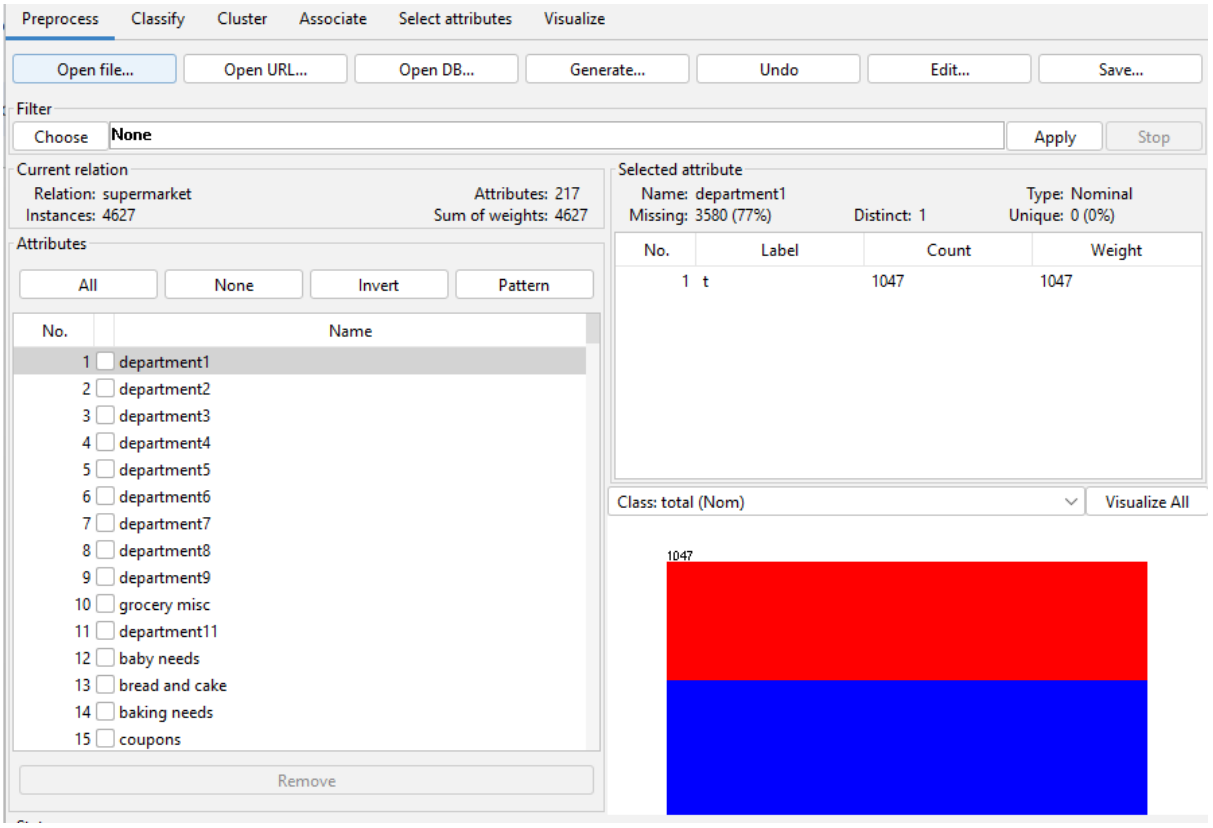


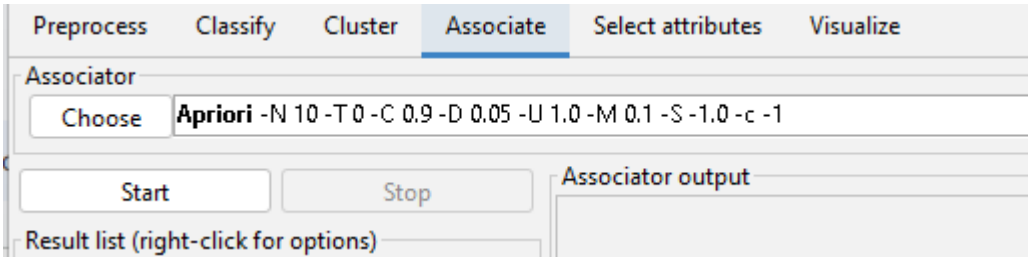


- **Association**

B. Apriori




Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Generate...
Undo
Edit...
Save...
Filter
Choose
None
Apply
Stop
Current relation
Relation: supermarket
Instances: 4627
Attributes: 217
Sum of weights: 4627
Selected attribute
Name: department1
Missing: 3580 (77%)
Distinct: 1
Type: Nominal
Unique: 0 (0%)
No. Label Count Weight
1 t 1047 1047
Attributes
All
None
Invert
Pattern
No. Name
1 department1
2 department2
3 department3
4 department4
5 department5
6 department6
7 department7
8 department8
9 department9
10 grocery misc
11 department11
12 baby needs
13 bread and cake
14 baking needs
15 coupons
Remove
Class: total (Nom)
Visualize All
1047


Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0 -c -1
Start
Stop
Associator output
Result list (right-click for options)

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

Associator

Choose **Apriori** -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0 -c -1

Start | Stop

Result list (right-click for ...

11:14:49 - Apriori

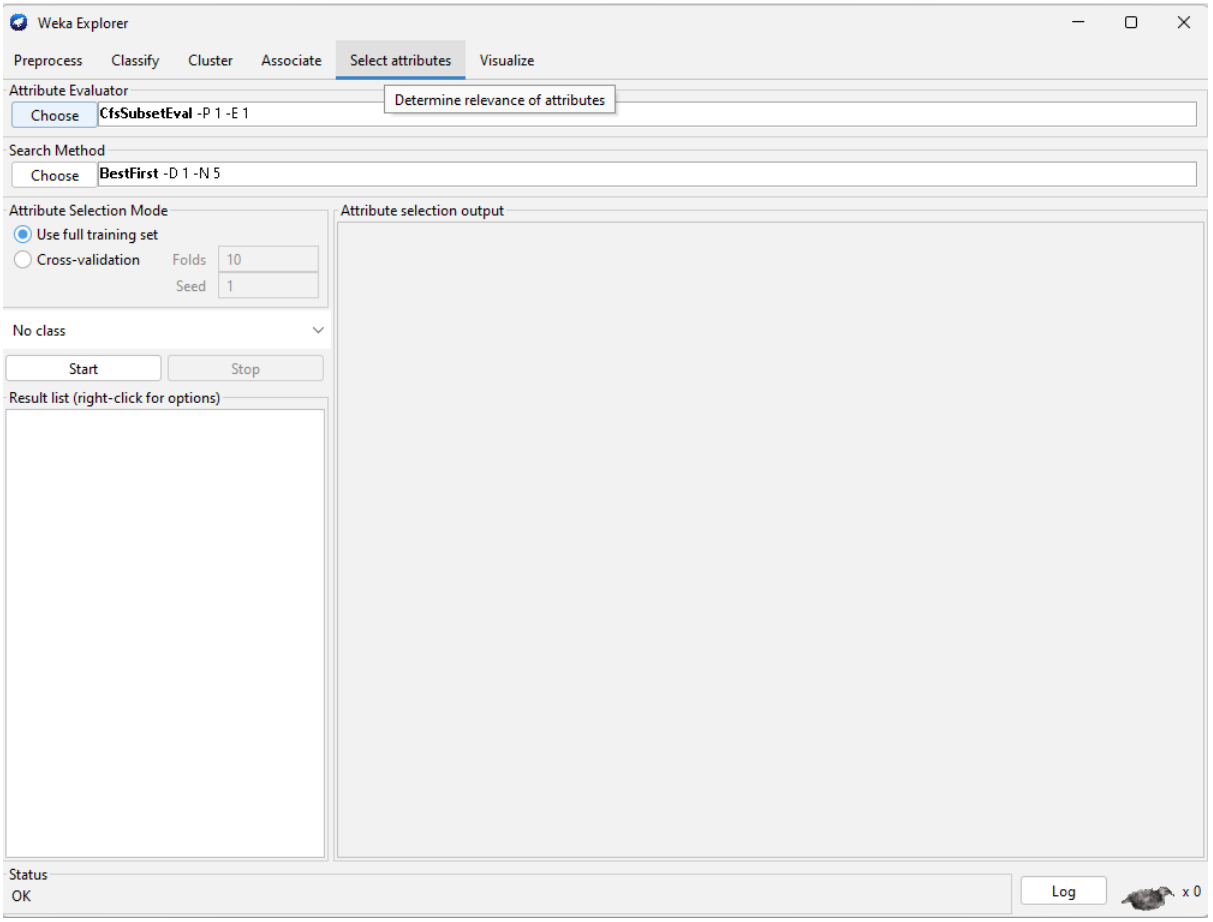
Associator output

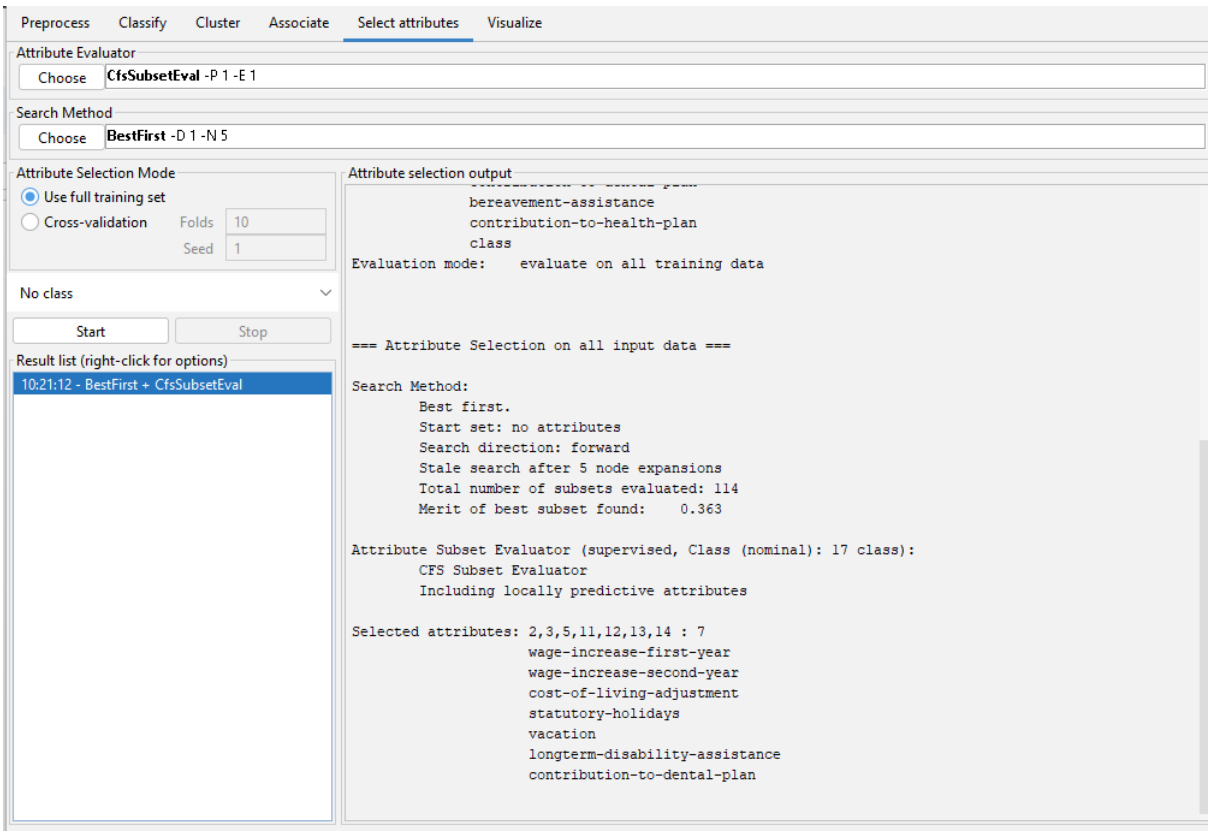
```
=== Run information ===

Scheme:       weka.associations.Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0 -c -1
Relation:     supermarket
Instances:    4627
Attributes:   217
              [list of attributes omitted]
=== Associator model (full training set) ===


Apriori
=======

Minimum support: 0.15 (694 instances)
Minimum metric <confidence>: 0.9
Number of cycles performed: 17

Generated sets of large itemsets:

Size of set of large itemsets L(1): 44

Size of set of large itemsets L(2): 380

Size of set of large itemsets L(3): 910

Size of set of large itemsets L(4): 633

Size of set of large itemsets L(5): 105
```

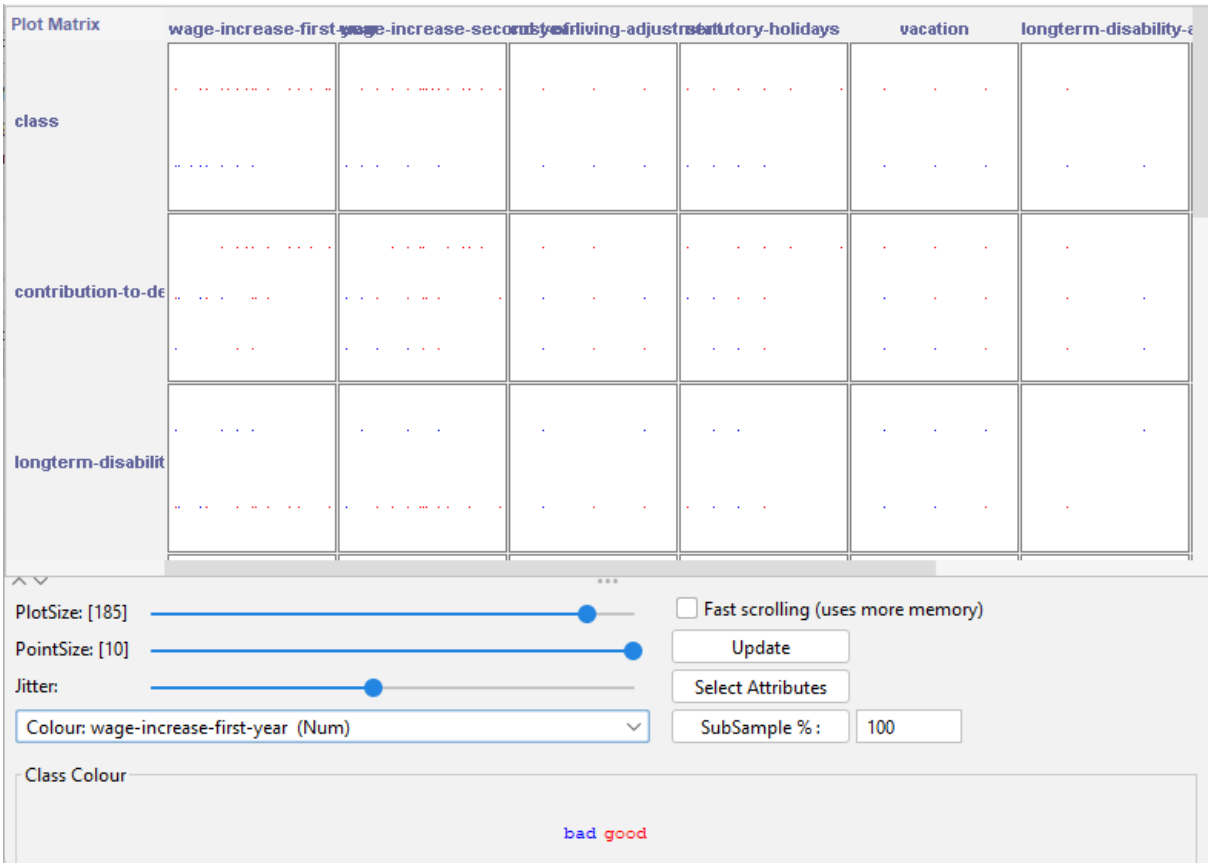
Practical 3: Feature Extraction

Load labor

Select attribute




Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval -P 1 -E 1
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds 10
Seed 1
No class
Start
Stop
Result list (right-click for options)
10:21:12 - BestFirst + CfsSubsetEval
Attribute selection output
bereavement-assistance
contribution-to-health-plan
class
Evaluation mode: evaluate on all training data
=== Attribute Selection on all input data ===
Search Method:
Best first.
Start set: no attributes
Search direction: forward
Stale search after 5 node expansions
Total number of subsets evaluated: 114
Merit of best subset found: 0.363
Attribute Subset Evaluator (supervised, Class (nominal): 17 class):
CFS Subset Evaluator
Including locally predictive attributes
Selected attributes: 2,3,5,11,12,13,14 : 7
wage-increase-first-year
wage-increase-second-year
cost-of-living-adjustment
statutory-holidays
vacation
longterm-disability-assistance
contribution-to-dental-plan


Plot Matrix
wage-increase-first-year
wage-increase-second-year
cost-of-living-adjustment
statutory-holidays
vacation
longterm-disability-a
class
contribution-to-de
longterm-disabilit
PlotSize: [185]
PointSize: [10]
Jitter:
Fast scrolling (uses more memory)
Update
Select Attributes
Colour: wage-increase-first-year (Num)
SubSample % :
100
Class Colour
bad good

729 - Siddhesh Mane
Big Data Analytics

Practical 4 : MongoDB CRUD Operations

Download shell and compass
Also download community server

Following is the syntax of basic CRUD operations in MongoDB

```
> db.users.find()
< {
    _id: ObjectId("64d47cad98531ebb6daa4782"),
    name: 'Sid',
    age: 27
  }
  {
    _id: ObjectId("64d47cad98531ebb6daa4783"),
    name: 'Gautham',
    age: 30
  }
  {
    _id: ObjectId("64d47dfc98531ebb6daa4784"),
    name: 'Aarti',
    age: 25
  }
  {
    _id: ObjectId("64d59ac8a0a1a00ededbcc3e"),
    name: 'Jayesh',
    age: 22
  }
  {
    _id: ObjectId("64d59ac8a0a1a00ededbcc3f"),
    name: 'Amar',
    age: 20
```

```
> db.users.find({age:{$lt:28}},{name:1,age:1});
< {
    _id: ObjectId("64d47c4f98531ebb6daa4781"),
    name: 'Sid',
    age: 27
  }
  {
    _id: ObjectId("64d47cad98531ebb6daa4782"),
    name: 'Sid',
    age: 27
  }
  {
    _id: ObjectId("64d47dfc98531ebb6daa4784"),
    name: 'Aarti',
    age: 25
```

```
> db.users.find()
< {
    _id: ObjectId("64d47cad98531ebb6daa4782"),
    name: 'Sid',
    age: 27
  }
  {
    _id: ObjectId("64d47cad98531ebb6daa4783"),
    name: 'Gautham',
    age: 30
  }
  {
    _id: ObjectId("64d47dfc98531ebb6daa4784"),
    name: 'Aarti',
    age: 25
  }
```

```
> db.users.insertMany([{name:"Jayesh",age:22},{name:"Amar",age:20}]);
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId("64d59ac8a0a1a00ededbcc3e"),
      '1': ObjectId("64d59ac8a0a1a00ededbcc3f")
    }
  }
```

```
> db.users.find()
< {
    _id: ObjectId("64d47cad98531ebb6daa4782"),
    name: 'Sid',
    age: 27
  }
  {
    _id: ObjectId("64d47cad98531ebb6daa4783"),
    name: 'Gautham',
    age: 30
  }
  {
    _id: ObjectId("64d47dfc98531ebb6daa4784"),
    name: 'Aarti',
    age: 25
  }
  {
    _id: ObjectId("64d59ac8a0a1a00ededbcc3e"),
    name: 'Jayesh',
    age: 22
  }
  {
    _id: ObjectId("64d59ac8a0a1a00ededbcc3f"),
    name: 'Amar',
    age: 20
```

```
> show collections;
< users
> db.users.updateOne({name:"Sid"},{$set: {email:"sid@gmail.com"}});
< {
    acknowledged: true,
    insertedId: null,
    matchedCount: 1,
    modifiedCount: 1,
    upsertedCount: 0
  }
> db.users.updateMany({age:{$lt:30}},{$set: {email:"abc@mail.com"}});
< {
    acknowledged: true,
    insertedId: null,
    matchedCount: 4,
    modifiedCount: 4,
    upsertedCount: 0
  }
> db.users.deleteOne({name:"Aarti"});
< {
    acknowledged: true,
    deletedCount: 1
  }
```

```
> db.users.deleteMany({age:{$lt:30}});
< {
    acknowledged: true,
    deletedCount: 3
  }
> db.find;
< userdb.find
> db.users.drop;
< [Function: drop] AsyncFunction {
    apiVersions: [ 1, Infinity ],
    returnsPromise: true,
    serverVersions: [ '0.0.0', '999.999.999' ],
    topologies: [ 'ReplSet', 'Sharded', 'LoadBalanced', 'Standalone' ],
    returnType: { type: 'unknown', attributes: {} },
    deprecated: false,
    platforms: [ 'Compass', 'Browser', 'CLI' ],
    isDirectShellCommand: false,
    acceptsRawInput: false,
    shellCommandCompleter: undefined,
    help: [Function (anonymous)] Help
  }
> db.find();
✖ ▸ TypeError: db.find is not a function
```

Practical 5 : Aggregation

```
> db.createCollection("sales");
< { ok: 1 }
> db.sales.insertMany([{id:1,item:"Americanos",price:5,size:"Short",quantity:22,date:ISODate("2022-01-16T08:00:00Z")},])
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId("64d5a3c5a0a1a00ededbcc40")
    }
  }
```

```
> db.sales.insertMany([{id:2,item:"Cappuccino",price:6,size:"Short",quantity:12,date:ISODate("2022-01-17T09:00:00Z")},{id:3,item:"Lattes",price:25,size:"Tall",quantity:30,date:ISODa
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId("64d5a4aba0a1a00ededbcc41"),
      '1': ObjectId("64d5a4aba0a1a00ededbcc42")
    }
  }
```

```
> db.sales.aggregate([{$match:{item:"Lattes"}},{$group:{_id:"$size", totalQty:{$sum:"$quantity"}}},{$sort:{totalQty:-1}}])
< {
    _id: 'Tall',
    totalQty: 60
  }
```

```
> db.sales.aggregate([{$match:{item:"Americanos"}},{$group:{_id:"$size", totalQty:{$sum:"$quantity"}}},{$sort:{totalQty:-1}}])
< {
    _id: 'Short',
    totalQty: 43
  }
  {
    _id: 'Tall',
    totalQty: 30
  }
```

```
> db.cars.insertMany([{make:"Honda",model:"GOld_Wing",year:2023,type:"Bike",reg_no:"cbs10"},{make:"Ford",model:"Transit",year:2011,type:"Van",reg_no:"for12"}])
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId("64d5b4b0a0a1a00ededbcc51"),
      '1': ObjectId("64d5b4b0a0a1a00ededbcc52")
    }
  }
```

Practical 6 : Sort

```
> db.cars.insertMany([{"make":"Nissan","model":"GTR","year":2016,"type":"Sports","reg_no":"EDS 5578"},
  {"make":"BMW","model":"X5","year":2020,"type":"SUV","reg_no":"LLS 6899"},
  {"make":"Toyata","model":"Yaris","year":2019,"type":"Compact","reg_no":"HXE 0153"},
  {"make":"Audi","model":"RS3","year":2018,"type":"Sports","reg_no":"RFD 7866"},
  {"make":"Ford","model":"Transit","year":2017,"type":"Van","reg_no":"TST 9880"},
  {"make":"Honda","model":"Gold Wing","year":2018,"type":"Bike","reg_no":"LKS 2477"}])
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId("64dd86755db01734109aeceb"),
      '1': ObjectId("64dd86755db01734109aecec"),
      '2': ObjectId("64dd86755db01734109aeced"),
      '3': ObjectId("64dd86755db01734109aecee"),
      '4': ObjectId("64dd86755db01734109aecef"),
      '5': ObjectId("64dd86755db01734109aecf0")
    }
  }
```

```
> db.cars.find()
< {
    _id: ObjectId("64d5b405a0a1a00ededbcc4d"),
    make: 'Mahindra',
    model: 'XUV',
    year: 2019,
    type: 'classic',
    reg_no: 'xuv700'
  }
  {
    _id: ObjectId("64d5b405a0a1a00ededbcc4e"),
    make: 'BMW',
    model: 'X5',
    year: 2020,
    type: 'SUV',
    reg_no: 'x123'
  }
  {
    _id: ObjectId("64d5b44ea0a1a00ededbcc4f"),
    make: 'Nissan',
    model: 'GTR',
    year: 2021,
    type: 'Sports',
    reg_no: 'gtr100'
  }
```

sort({year:1}) : Sorts the year in ascending order, -1 sorts in descending order

```
> db.cars.find({},{_id:0}).sort({year:1})
< {
    make: 'Ford',
    model: 'Transit',
    year: 2011,
    type: 'Van',
    reg_no: 'for12'
  }
  {
    make: 'Mahindra',
    model: 'XUV',
    year: 2019,
    type: 'classic',
    reg_no: 'xuv700'
  }
```

```
> db.cars.find({},{make:1, _id:0}).sort({make:1})
< {
    make: 'BMW'
  }
  {
    make: 'Ford'
  }
  {
    make: 'Honda'
  }
  {
    make: 'Mahindra'
  }
  {
    make: 'Nissan'
  }
  {
    make: 'Toyota'
  }
```

Limit

pretty() : to display it proper

```
> db.cars.find({},{_id:0}).sort({make:1,year:1}).limit(2).pretty()
< {
    make: 'BMW',
    model: 'X5',
    year: 2020,
    type: 'SUV',
    reg_no: 'x123'
  }
  {
    make: 'Ford',
    model: 'Transit',
    year: 2011,
    type: 'Van',
    reg_no: 'for12'
  }
```

```
> db.cars.find({},{_id:0}).sort({make:1,year:1}).skip(4).limit(2).pretty()
< {
    make: 'Nissan',
    model: 'GTR',
    year: 2021,
    type: 'Sports',
    reg_no: 'gtr100'
  }
  {
    make: 'Toyota',
    model: 'Yaris',
    year: 2021,
    type: 'Compact',
    reg_no: 'hxe153'
  }
```

skip(4) : skip start 4 columns and displays rest.

```
> db.cars.find({},{_id:0}).sort({make:1,year:1}).skip(4).limit(2).pretty()
< {
    make: 'Nissan',
    model: 'GTR',
    year: 2021,
    type: 'Sports',
    reg_no: 'gtr100'
  }
  {
    make: 'Toyota',
    model: 'Yaris',
    year: 2021,
    type: 'Compact',
    reg_no: 'hxe153'
  }
```

Practical 7 : Comparison Operator

```
> use supermarket;
< switched to db supermarket
> db.employee.insertMany([{"_id":001,"emp_name":"Siddhesh", "emp_age":22,"job_role":"Data Analyst","sal":200000}])
< {
    acknowledged: true,
    insertedIds: {
      '0': 1
    }
  }
```

Similarly create more 5 records.

```
> db.employee.find()
< {
    _id: 1,
    emp_name: 'Siddhesh',
    emp_age: 22,
    job_role: 'Senior Manager',
    sal: 200000
  }
  {
    _id: 2,
    emp_name: 'Gautham',
    emp_age: 23,
    job_role: 'Cashier',
    sal: 150000
  }
  {
    _id: 3,
    emp_name: 'Jayesh',
    emp_age: 21,
    job_role: 'Store Associate',
    sal: 250000
  }
```

```
> db.createCollection("inventory")
< { ok: 1 }
> db.inventory.insertMany([{"_id":"SM01", "name":"Chocolate Bar - 100 g", "price":5.23, "quantity":25000, "category":["chocolate","sweets"]}])
< {
    acknowledged: true,
    insertedIds: {
      '0': 'SM01'
    }
  }
> db.inventory.insertMany([{"_id":"SM02", "name":"Milk 1Lt", "price":3, "quantity":1000, "category":["dairy","healthy"]},{"_id":"SM03", "name":
  {"_id":"SM07","name": "ZZ Butter 500g", "price": 25, "quantity": 500, "category" : ["dairy", "healthy","premium"]},
  {"_id":"SM08","name": "Beans (Packed) - 250g", "price": 6.75, "quantity" : 6000, "category": ["vegetables", "healthy", "organic"]}])
< {
    acknowledged: true,
    insertedIds: {
      '0': 'SM02',
      '1': 'SM03',
      '2': 'SM04',
      '3': 'SM05',
      '4': 'SM06',
      '5': 'SM07',
      '6': 'SM08'
    }
  }
```

```
> db.inventory.find()
< {
    _id: 'SM01',
    name: 'Chocolate Bar - 100 g',
    price: 5.23,
    quantity: 25000,
    category: [
      'chocolate',
      'sweets'
    ]
  }
  {
    _id: 'SM02',
    name: 'Milk 1Lt',
    price: 3,
    quantity: 1000,
    category: [
      'dairy',
      'healthy'
    ]
  }
```

```
> db.payments.insertMany([
 {"_id": "BL2021005", "gross_amount": 105.65, "discounts": 10, "net_amount": 95.65, "date_time":ISODate("2021-01-01T16:15:55Z")},
 {"_id": "BL2021006", "gross_amount": 45.25, "discounts" : 0, "net_amount": 45.25, "date_time":ISODate("2021-01-01T16:00:00Z")},
 {"_id":"BL2021007", "gross_amount": 153.33, "discounts" : 20.33, "net_amount": 133, "date_time":ISODate("2021-01-01T16:31:08Z")},
 {"_id": "BL2021008", "gross amount": 21, "discounts" : 0, "net_amount": 21, "date_time" : ISODate("2021-01-01T20:25:52Z")},
 {"_id": "BL2021009", "gross amount": 89.72, "discounts": 0.72, "net_amount": 89, "date_time":ISODate("2021-01-02T08:45:12Z")},
 {"_id": "BL2021010", "gross_amount": 33.5, "discounts": 20.5, "net_amount": 13, "date_time":ISODate("2021-01-02T11:02:35Z")}
 ])
< {
   acknowledged: true,
   insertedIds: {
     '0': 'BL2021005',
     '1': 'BL2021006',
     '2': 'BL2021007',
     '3': 'BL2021008',
     '4': 'BL2021009',
     '5': 'BL2021010'
   }
 }
```

```
> db.payments.find()
< {
    _id: 'BL2021005',
    gross_amount: 105.65,
    discounts: 10,
    net_amount: 95.65,
    date_time: 2021-01-01T16:15:55.000Z
  }
  {
    _id: 'BL2021006',
    gross_amount: 45.25,
    discounts: 0,
    net_amount: 45.25,
    date_time: 2021-01-01T16:00:00.000Z
  }
```

```
> db.createCollection("promo")
< { ok: 1 }
> db.promo.insertMany([
  {"_id": "PROMO01", "name": "Sales Promo", "period": 7, "daily sales" : [ 20, 50, 12, 30, 45, 15,60]},
  {"_id": "PROMO02", "name": "Milk Promo", "period": 2, "daily sales" : [ 120, 200 ]},
  {"_id": "PROMO03", "name": "Meat Promo", "period": 3, "daily sales": [ 101, 250 ]},
  {"_id": "PROMO04", "name": "New Year Promo", "period": 7, "daily sales": [ 65, 88, 105, 188, 74, 278, 350 ]}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': 'PROMO01',
      '1': 'PROMO02',
      '2': 'PROMO03',
      '3': 'PROMO04'
    }
  }
```

```
> db.promo.find()
< {
    _id: 'PROMO01',
    name: 'Sales Promo',
    period: 7,
    'daily sales': [
      20,
      50,
      12,
      30,
      45,
      15,
      60
    ]
  }
  {
```

Queries

Equal operator

```
> db.inventory.find({"_id":{ $eq:"SM08"}}).pretty()
< {
    _id: 'SM08',
    name: 'Beans (Packed) - 250g',
    price: 6.75,
    quantity: 6000,
    category: [
      'vegetables',
      'healthy',
      'organic'
    ]
  }
```

```
> db.inventory.find({"_id":{ $eq:"SM08"}})
< {
    _id: 'SM08',
    name: 'Beans (Packed) - 250g',
    price: 6.75,
    quantity: 6000,
    category: [
      'vegetables',
      'healthy',
      'organic'
    ]
  }
```

Greater operator

```
> db.inventory.find({"quantity":{ $gt:12000}}).pretty()
< {
    _id: 'SM01',
    name: 'Chocolate Bar - 100 g',
    price: 5.23,
    quantity: 25000,
    category: [
      'chocolate',
      'sweets'
    ]
  }
```

Greater than equal

```
> db.inventory.find({"quantity":{ $gte:12000}}).pretty()
< {
    _id: 'SM01',
    name: 'Chocolate Bar - 100 g',
    price: 5.23,
    quantity: 25000,
    category: [
      'chocolate',
      'sweets'
    ]
  }
  {
    _id: 'SM06',
    name: 'Bell Pepper (Packed) - 250g',
    price: 4.95,
    quantity: 12000,
    category: [
      'vegetables',
      'healthy',
      'organic'
    ]
  }
```

Less than equal

```
> db.inventory.find({"quantity":{ $lte:1000}}).pretty()
< {
    _id: 'SM02',
    name: 'Milk 1Lt',
    price: 3,
    quantity: 1000,
    category: [
      'dairy',
      'healthy'
    ]
  }
  {
    _id: 'SM07',
    name: 'ZZ Butter 500g',
    price: 25,
    quantity: 500,
    category: [
      'dairy',
      'healthy',
      'premium'
    ]
  }
```

Not equal

```
> db.employee.find({ $nor: [{"job_role":"Store Associate"}, {"emp_age": {$gte:21, $lte:22}}]}).pretty()
< {
    _id: 2,
    emp_name: 'Gautham',
    emp_age: 23,
    job_role: 'Cashier',
    sal: 150000
  }
  {
    _id: 5,
    emp_name: 'Aarti',
    emp_age: 26,
    job_role: 'Senior Cashier',
    sal: 50000
  }
```

```
> db.promo.find({"period":{ $ne:7}}).pretty()
< {
    _id: 'PROMO02',
    name: 'Milk Promo',
    period: 2,
    'daily sales': [
      120,
      200
    ]
  }
  {
    _id: 'PROMO03',
    name: 'Meat Promo',
    period: 3,
    'daily sales': [
      101,
      250
    ]
  }
```

Practical 8 : Logical Operators

And

```
> db.employee.find({ $and: [{"job_role":"Store Associate"}, {"emp_age": {$gte:21, $lte:23}}]}).pretty()
< {
    _id: 3,
    emp_name: 'Jayesh',
    emp_age: 21,
    job_role: 'Store Associate',
    sal: 250000
  }
```

Or (If any condition matches, it displays the result)

```
> db.employee.find({ $or: [{"job_role":"Store Associate"}, {"emp_age": {$gte:21, $lte:22}}]}).pretty()
< {
    _id: 1,
    emp_name: 'Siddhesh',
    emp_age: 22,
    job_role: 'Senior Manager',
    sal: 200000
  }
  {
    _id: 3,
    emp_name: 'Jayesh',
    emp_age: 21,
    job_role: 'Store Associate',
    sal: 250000
  }
  {
    _id: 4,
    emp_name: 'Pratik',
    emp_age: 25,
    job_role: 'Store Associate',
    sal: 100000
  }
```

Nor (Opposite of OR)

```
> db.employee.find({ $nor: [{"job_role":"Store Associate"}, {"emp_age": {$gte:21, $lte:22}}]}).pretty()
< {
    _id: 2,
    emp_name: 'Gautham',
    emp_age: 23,
    job_role: 'Cashier',
    sal: 150000
  }
  {
    _id: 5,
    emp_name: 'Aarti',
    emp_age: 26,
    job_role: 'Senior Cashier',
    sal: 50000
  }
```

Practical 9: MongoDB $abs, $floor, $ceil Operator

```
> db.student.insertMany([
  {"std_name":"Siddhesh","gender":"Male","class":"X","fees":5000,"exam_fees":500,"age":16,"total_marks":465,"result":"Pass"},
  {"std_name":"Gautham","gender":"Male","class":"IX","fees":4000,"exam_fees":500,"age":15,"total_marks":420,"result":"Pass"},
  {"std_name":"Aarti","gender":"Female","class":"IX","fees":4000,"exam_fees":500,"age":15,"total_marks":401,"result":"Pass"},
  {"std_name":"Ankita","gender":"Female","class":"VII","fees":3500,"exam_fees":500,"age":13,"total_marks":400,"result":"Pass"},
  {"std_name":"Jayesh","gender":"Male","class":"V","fees":3000,"exam_fees":500,"age":12,"total_marks":395,"result":"Pass"},
  {"std_name":"Pratik","gender":"Male","class":"IV","fees":3000,"exam_fees":500,"age":11,"total_marks":415,"result":"Pass"}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId("64de0b5ce572de65422ce337"),
      '1': ObjectId("64de0b5ce572de65422ce338"),
      '2': ObjectId("64de0b5ce572de65422ce339"),
      '3': ObjectId("64de0b5ce572de65422ce33a"),
      '4': ObjectId("64de0b5ce572de65422ce33b"),
      '5': ObjectId("64de0b5ce572de65422ce33c")
    }
  }
```

Query :

```
db.student.aggregate([
{$match:{gender:"Female"}},{$project:{std_name:1,class:1,age:1,result:1,Total_Fees:{$abs:{
$add:["$fees","$exam_fees"]}}}}
]);
```

```
> db.student.aggregate([
    {$match:{gender:"Female"}},{$project:{std_name:1,class:1,age:1,result:1,Total_Fees:{$abs:{$add:["$fees","$exam_fees"]}}}}
  ])
< {
    _id: ObjectId("64de0b5ce572de65422ce33a"),
    std_name: 'Ankita',
    class: 'VII',
    age: 13,
    result: 'Pass',
    Total_Fees: 4000
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce339"),
    std_name: 'Aarti',
    class: 'IX',
    age: 15,
    result: 'Pass',
    Total_Fees: 4500
  }
```

db.student.aggregate([
 {$match:{gender:"Female"}},{$project:{std_name:1,class:1,floor_grade:{$floor:"$grade"}}}
])

```
> db.student.aggregate([
    {$match:{gender:"Female"}},{$project:{std_name:1,class:1,floor_grade:{$floor:"$grade"}}}
  ])
< {
    _id: ObjectId("64de0b5ce572de65422ce33a"),
    std_name: 'Ankita',
    class: 'VII',
    floor_grade: Decimal128("8")
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce339"),
    std_name: 'Aarti',
    class: 'IX',
    floor_grade: Decimal128("7")
  }
```

db.student.aggregate([
{$match:{gender:"Female"}},{$project:{std_name:1,class:1,grade:1,ceil_grade:{$ceil:"$grade"}}}
])

```
> db.student.aggregate([
    {$match:{gender:"Female"}},{$project:{std_name:1,class:1,grade:1,ceil_grade:{$ceil:"$grade"}}}
  ])
< {
    _id: ObjectId("64de0b5ce572de65422ce33a"),
    std_name: 'Ankita',
    class: 'VII',
    grade: Decimal128("8.12"),
    ceil_grade: Decimal128("9")
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce339"),
    std_name: 'Aarti',
    class: 'IX',
    grade: Decimal128("7.1"),
    ceil_grade: Decimal128("8")
  }
```

Practical 10: MongoDB $log, $mod, $divide, $multiply operator.

```
db.shape.insertMany([
{"name":"rectangle","area":16},
{"name":"rectangle","area":6},
{"name":"circle","area":19,"unit":{"diameter":6,"radius":3}},
{"name":"rectangle","area":20},
{"name":"square","area":20},
{"name":"triangle","area":null}
])
{
  acknowledged: true,
  insertedIds: {
    '0': ObjectId("64de0d40e572de65422ce33d"),
    '1': ObjectId("64de0d40e572de65422ce33e"),
    '2': ObjectId("64de0d40e572de65422ce33f"),
    '3': ObjectId("64de0d40e572de65422ce340"),
    '4': ObjectId("64de0d40e572de65422ce341"),
    '5': ObjectId("64de0d40e572de65422ce342")
  }
}
```

$log

```
db.shape.aggregate([
 {$match:{name:"square"}},{$project:{name:1,area:1,logArea:{$log:["$area",10]}}}
 ])
```

```
> db.shape.aggregate([
    {$match:{name:"square"}},{$project:{name:1,area:1,logArea:{$log:["$area",10]}}}
    ])
< {
    _id: ObjectId("64de0d40e572de65422ce342"),
    name: 'square',
    area: null,
    logArea: null
  }
  {
    _id: ObjectId("64de0d40e572de65422ce341"),
    name: 'square',
    area: 20,
    logArea: 1.301029995663981
  }
```

```
> db.createCollection("items")
< { ok: 1 }
> db.items.insertMany([
  {"_id" : 1,"item_name" : "Apple","total_Price" : null,"quantity" : 40},
  {"_id" : 2,"item_name" : "Banana","total_Price" : 1000,"quantity" : 72},
  {"_id" : 3,"item_name" : "Cherry","total_Price" : 215,"quantity" : 25},
  {"_id" : 4,"item_name" : "Apple","total_Price" : null,"quantity" : 25},
  {"_id" : 5,"item_name" : "Banana","total_Price" : 400,"quantity" : 35},
  {"_id" : 6,"item_name" : "Banana","total_Price" : 510,"quantity" : 100},
  {"_id" : 7,"item_name" : "Cherry","total_Price" : 500,"quantity" : 41},
  {"_id" : 8,"item_name" : "Rasberry","total_Price" : 80,"quantity" : "Ten"},
  {"_id" : 9,"item_name" : "Banana","total_Price" : 205,"quantity" : 10},
  {"_id" : 10,"item_name" : "Apple","total_Price" : 95,"quantity" : null}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': 1,
      '1': 2,
      '2': 3,
      '3': 4,
      '4': 5,
      '5': 6,
      '6': 7,
      '7': 8,
```

$mod

db.items.aggregate([
{$match:{item_name:"Cherry"}},{$project:{item_name:1,total_Price:1,quantity:1,remainderValue:{$mod:["$total_Price","$quantity"]}}}
])

```
> db.items.aggregate([
    {$match:{item_name:"Cherry"}},{$project:{item_name:1,total_Price:1,quantity:1,remainderValue:{$mod:["$total_Price","$quantity"]}}}
    ])
< {
    _id: 3,
    item_name: 'Cherry',
    total_Price: 215,
    quantity: 25,
    remainderValue: 15
  }
  {
    _id: 7,
    item_name: 'Cherry',
    total_Price: 500,
    quantity: 41,
    remainderValue: 8
  }
```

```
> db.createCollection("swproduct")
< { ok: 1 }
> db.swproduct.insertMany([
  {"_id" : 1,"name" : "BlueBox","x" : 10,"y" : 50,"billYear" : 2018},
  {"_id" : 2,"name" : "GreenBox","x" : 10,"y" : 6,"billYear" : 2017},
  {"_id" : 3,"name" : "RedBox","x" : 7,"y" : 9,"billYear" : 2018},
  {"_id" : 4,"name" : "WhiteBox","x" : 2,"y" : 7,"z" : 4,"billYear" : 2019},
  {"_id" : 5,"name" : "BlueBox","x" : 4,"y" : 12,"billYear" : 2020},
  {"_id" : 6,"name" : "BlueBox","x" : 10,"y" : 5,"billYear" : 2021},
  {"_id" : 7,"name" : "WhiteBox","x" : 5,"y" : 1,"z" : 45,"billYear" : 2019},
  {"_id" : 8,"name" : "GreenBox","x" : -15,"y" : 5,"billYear" : 2018},
  {"_id" : 9,"name" : "BlackBox","billDetail" : {"x" : 45,"y" : 56},"billYear" : 2021},
  {"_id" : 10,"name" : "WhiteBox","x" : 4,"y" : 5,"z" : 6,"billYear" : 2020}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': 1,
      '1': 2,
      '2': 3,
      '3': 4,
      '4': 5,
      '5': 6,
      '6': 7,
      '7': 8,
```

$divide

db.swproduct.aggregate([
 {$match:{name:"GreenBox"}},{$project:{x:1,y:1,DIvision:{$divide:["$x","$y"]}}}
 ])

```
> db.swproduct.aggregate([
    {$match:{name:"GreenBox"}},{$project:{x:1,y:1,DIvision:{$divide:["$x","$y"]}}}
    ])
< {
    _id: 2,
    x: 10,
    y: 6,
    DIvision: 1.6666666666666667
  }
  {
    _id: 8,
    x: -15,
    y: 5,
    DIvision: -3
  }
```

```
> db.createCollection("hwproduct")
< { ok: 1 }
> db.hwproduct.insertMany([
  {"_id" : 1,"name" : "Mobile","totalPrice" : 100000,"totalQuantity" : 50,"billYear" : 2018},
  {"_id" : 2,"name" : "Keyboard","totalPrice" : 5000,"totalQuantity" : 10,"billYear" : 2017},
  {"_id" : 3,"name" : "Mouse","totalPrice" : 2000,"totalQuantity" : 5,"billYear" : 2018},
  {"_id" : 4,"name" : "Memory Card","totalPrice" : 2500,"totalQuantity" : 25,"billYear" : 2019},
  {"_id" : 5,"name" : "Mobile","totalPrice" : 20000,"totalQuantity" : 4,"billYear" : 2020},
  {"_id" : 6,"name" : "Mobile","totalPrice" : 25000,"totalQuantity" : 2,"billYear" : 2021},
  {"_id" : 7,"name" : "Memory Card","totalPrice" : 1000,"totalQuantity" : 10,"billYear" : 2019},
  {"_id" : 8,"name" : "Pen drive","totalPrice" : 15000,"totalQuantity" : "Two","billYear" : 2018},
  {"_id" : 9,"name" : "Laptop","billDetail" : {"totalPrice" : 45000,"totalQuantity" : 1},"billYear" : 2021},
  {"_id" : 10,"name" : "Memory Carde","totalPrice" : 4000,"totalQuantity" : 50,"billYear" : 2020}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': 1,
      '1': 2,
      '2': 3,
      '3': 4,
      '4': 5,
      '5': 6,
      '6': 7,
      '7': 8,
```

$multiply

db.hwproduct.aggregate([

{$match:{name:"Memory Card"}},{$project:{name:1,totalPrice:1,total_Quantity:1,totalAmount:{$multiply:["$totalPrice","$totalQuantity"]}}}
])

```
> db.hwproduct.aggregate([
    {$match:{name:"Memory Card"}},{$project:{name:1,totalPrice:1,total_Quantity:1,totalAmount:{$multiply:["$totalPrice","$totalQuantity"]}}}
    ])
< {
    _id: 7,
    name: 'Memory Card',
    totalPrice: 1000,
    totalAmount: 10000
  }
  {
    _id: 4,
    name: 'Memory Card',
    totalPrice: 2500,
    totalAmount: 62500
  }
  {
    _id: 10,
    name: 'Memory Card',
    totalPrice: 4000,
    totalAmount: 200000
  }
```

```
> db.createCollection("shapes1")
< { ok: 1 }
> db.shapes1.insertMany([
  {"_id" : 1,"name" : "rectangle","area" : 16},
  {"_id" : 2,"name" : "square","area" : 10},
  {"_id" : 3,"name" : "circle","perimeter" : 15,"area" : 10,"details" : {"radius" : 3,"diameter" : 6}},
  {"_id" : 4,"name" : "rectangle","area" : 0},
  {"_id" : 5,"name" : "oval","area" : 20},
  {"_id" : 6,"name" : "triangle","area" : 5},
  {"_id" : 7,"name" : "rectangle","area" : null}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': 1,
      '1': 2,
      '2': 3,
      '3': 4,
      '4': 5,
      '5': 6,
      '6': 7
    }
  }
```

Practical 11: MongoDB $pow, $sqrt, $subtract

$pow

```
db.shapes1.aggregate([
 {$match:{name:"square"}},{$project:{name:1,area:1,Power:{$pow:["$area",3]}}}
 ])
```

```
> db.shapes1.aggregate([
    {$match:{name:"square"}},{$project:{name:1,area:1,Power:{$pow:["$area",3]}}}
    ])
< {
    _id: 2,
    name: 'square',
    area: 10,
    Power: 1000
  }
```

```
> db.createCollection("toys")
< { ok: 1 }
> db.toys.insertMany([
  {"_id" : 1,"item_name" : "bat","quantity" : 4},
  {"_id" : 2,"item_name" : "ball","quantity" : null},
  {"_id" : 3,"item_name" : "box","details" : {"length" : 20,"width" : 25}},
  {"_id" : 4,"item_name" : "ball","quantity" : null},
  {"_id" : 5,"item_name" : "bat","quantity" : 20},
  {"_id" : 6,"item_name" : "toy","quantity" : -10},
  {"_id" : 7,"item_name" : "bat","quantity" : 75},
  {"_id" : 8,"item_name" : "bat","quantity" : 45}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': 1,
      '1': 2,
      '2': 3,
      '3': 4,
      '4': 5,
      '5': 6,
      '6': 7,
      '7': 8
    }
  }
```

$sqrt

db.toys.aggregate([
{$match:{item_name:"bat"}},{$project:{item_name:1,quantity:1,SquareRoot:{$sqrt:["$quantity"]}}}
])

```
> db.toys.aggregate([
    {$match:{item_name:"bat"}},{$project:{item_name:1,quantity:1,SquareRoot:{$sqrt:["$quantity"]}}}
    ])
< {
    _id: 8,
    item_name: 'bat',
    quantity: 45,
    SquareRoot: 6.708203932499369
  }
  {
    _id: 1,
    item_name: 'bat',
    quantity: 4,
    SquareRoot: 2
  }
  {
    _id: 5,
    item_name: 'bat',
    quantity: 20,
    SquareRoot: 4.47213595499958
  }
  {
    _id: 7,
    item_name: 'bat',
    quantity: 75,
    SquareRoot: 8.660254037844387
  }
```

```
> db.createCollection("student1")
< { ok: 1 }
> db.student1.insertMany([
  {"_id" : 1,"std_name" : "Sid","last_name" : "Mane","department" : "MCA","semester_fee" : 6000,"annual_fee" : 10000,
  "start_date" : ISODate("2019-07-03T08:00:00Z"),"end_date" : ISODate("2021-05-26T09:00:00Z")},
  {"_id" : 2,"std_name" : "Chandan","last_name" : "Gupta","department" : "BCA","semester_fee" : 4000,"annual_fee" : 6000,
  "start_date" : ISODate("2020-07-03T08:00:00Z"),"end_date" : ISODate("2023-05-01T09:00:00Z")},
  {"_id" : 3,"std_name" : "Manish","last_name" : "Mohan","department" : "MCA","semester_fee" : 7000,"annual_fee" : 12500,
  "start_date" : ISODate("2020-07-11T00:00:00Z"),"end_date" : ISODate("2022-05-25T09:00:00Z")},
  {"_id" : 4,"std_name" : "Jayu","last_name" : "Phadale","department" : "Btech","fees" : {"semester_fee" : 15000,"annual_fee" : 22500},
  "start_date" : ISODate("2018-07-11T08:00:00Z"),"end_date" : ISODate("2022-05-25T09:00:00Z")},
  {"_id" : 5,"std_name" : "Rohit","last_name" : "Sharma","department" : "BCA","semester_fee" : 11500,"annual_fee" : 20000,
  "start_date" : ISODate("2020-07-03T08:00:00Z"),"end_date" : ISODate("2023-05-01T09:00:00Z")},
  {"_id" : 6,"std_name" : "Virat","last_name" : "Kohli","department" : "MCA","semester_fees" : 12500,"annual_fee" : 25000,
  "start_date" : ISODate("2018-07-11T08:00:00Z"),"end_date" : ISODate("2020-05-25T09:00:00Z")}
  ])
< {
    acknowledged: true,
    insertedIds: {
      '0': 1,
      '1': 2,
      '2': 3,
      '3': 4,
      '4': 5,
      '5': 6
    }
  }
```

$subtract

```
db.student1.aggregate([
{$match:{std_name:"Sid"}},{$project:{std_name:1,last_name:1,annual_fee:1,semester_fee:1,
Fees:{$subtract:["$annual_fee","$semester_fee"]}}}
 ])
```

```
> db.student1.aggregate([
    {$match:{std_name:"Sid"}},{$project:{std_name:1,last_name:1,annual_fee:1,semester_fee:1,Fees:{$subtract:["$annual_fee","$semester_fee"]}}}
    ])
< {
    _id: 1,
    std_name: 'Sid',
    last_name: 'Mane',
    semester_fee: 6000,
    annual_fee: 10000,
    Fees: 4000
  }
```

Practical 12 : MongoDB $trunc, $round, $cmp operator

$trunc

```
db.student.aggregate([
  {$project:{grade:1,value:{$trunc:["$grade"]}}}
]);
```

```
> db.student.aggregate([
    {$project:{grade:1,value:{$trunc:["$grade"]}}}
  ]);
< {
    _id: ObjectId("64de0b5ce572de65422ce337"),
    grade: Decimal128("7.85"),
    value: Decimal128("7")
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce338"),
    grade: Decimal128("8.5"),
    value: Decimal128("8")
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce339"),
    grade: Decimal128("7.1"),
    value: Decimal128("7")
  }
```

$round

```
db.student.aggregate([
  {$project:{grade:1,value:{$round:["$grade"]}}}
]);
```

```
> db.student.aggregate([
    {$project:{grade:1,value:{$round:["$grade"]}}}
  ]);
< {
    _id: ObjectId("64de0b5ce572de65422ce337"),
    grade: Decimal128("7.85"),
    value: Decimal128("8")
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce338"),
    grade: Decimal128("8.5"),
    value: Decimal128("8")
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce339"),
    grade: Decimal128("7.1"),
    value: Decimal128("7")
  }
```

$cmp

Collection = area

```
db.area.insertMany([
  { "_id": 1, "name": "rectangle", "length": 11, "breadth": 10 },
  { "_id": 2, "name": "square", "length": 10, "breadth": 10 },
  { "_id": 3, "name": "rectangle", "length": 14, "breadth": 16 },
  { "_id": 4, "name": "square", "length": 6, "breadth": 6 },
  { "_id": 5, "name": "rectangle", "length": 11, "breadth": 16 }
])


db.area.aggregate([
  {$project:{_id:1,name:1,length:1,breath:1,result:{$cmp:["$length","$breath"]}}}
  ]);
```

```
> db.area.aggregate([
    {$project:{_id:1,name:1,length:1,breadth:1,result:{$cmp:["$length","$breadth"]}}}
    ]);
< {
    _id: 1,
    name: 'rectangle',
    length: 11,
    breadth: 10,
    result: 1
  }
  {
    _id: 2,
    name: 'square',
    length: 10,
    breadth: 10,
    result: 0
  }
  {
    _id: 3,
    name: 'rectangle',
    length: 14,
    breadth: 16,
    result: -1
  }
```

Practical 13 : MongoDB $concat, $size, $rename operator

$concat

```
db.student1.aggregate([
 {$project:{_id:1, name:{$concat:["$std_name","$last_name"]},department:1}}
 ]);
```

```
> db.student1.aggregate([
    {$project:{_id:1, name:{$concat:["$std_name","$last_name"]},department:1}}
    ]);
< {
    _id: 1,
    department: 'MCA',
    name: 'SidMane'
  }
```

$size

Collection : marks

```
db.marks.insertMany([
{"_id": 1,"name": "Jonny","class": "X","rollNo": 401,"age": 18,"marks": [55, 60, 70, 45, 95, 68],
"extraMarks": {"practical": [21, 18, 25, 30],"attendance": [5, 9]},"gender":
"Male","bloodgroup": "A+" },
{"_id": 2,"name": "Carry","class": "IX","rollNo": 35,"age": 17,"marks": [85, 40, 90, 75, 85,
77],"gender": "Male","bloodgroup": "B+" },
{"_id": 3,"name": "Jin","class": "IX","rollNo": 49,"age": 17,"marks": [85, 70, 80, 95, 94,
81],"gender": "Female","bloodgroup": "O+" },
{"_id": 4,"name": "Thomas","class": "X","rollNo": 61,"age": 18,"marks": [91, 65, 71, 63, 98,
76],
"extraMarks": {"practical": [26, 28, 25, 29],"attendance": [8, 8]},"gender":
"Male","bloodgroup": "A+"},
{"_id": 5,"name": "Mia","class": "IX","rollNo": 308,"age": 17,"marks": [97, 98, 95, 98],"gender":
"Female","bloodgroup": "B+"},
{"_id": 6,"name": "Oats","class": "IX","rollNo": 75,"age": 18,"marks": [99, 98, 98, 95,
96],"gender": "Male","bloodgroup": "A+"}
])
```

```
db.marks.insertMany([
{"_id": 1,"name": "Jonny","class": "X","rollNo": 401,"age": 18,"marks": [55, 60, 70, 45, 95, 68],
"extraMarks": {"practical": [21, 18, 25, 30],"attendance": [5, 9]},"gender": "Male","bloodgroup": "A+" },
{"_id": 2,"name": "Carry","class": "IX","rollNo": 35,"age": 17,"marks": [85, 40, 90, 75, 85, 77],"gender": "Male","bloodgroup": "B+" },
{"_id": 3,"name": "Jin","class": "IX","rollNo": 49,"age": 17,"marks": [85, 70, 80, 95, 94, 81],"gender": "Female","bloodgroup": "O+" },
{"_id": 4,"name": "Thomas","class": "X","rollNo": 61,"age": 18,"marks": [91, 65, 71, 63, 98, 76],
"extraMarks": {"practical": [26, 28, 25, 29],"attendance": [8, 8]},"gender": "Male","bloodgroup": "A+"},
{"_id": 5,"name": "Mia","class": "IX","rollNo": 308,"age": 17,"marks": [97, 98, 95, 98],"gender": "Female","bloodgroup": "B+"},
{"_id": 6,"name": "Oats","class": "IX","rollNo": 75,"age": 18,"marks": [99, 98, 98, 95, 96],"gender": "Male","bloodgroup": "A+"}
])
```

db.marks.aggregate([{$match:{class:"IX"}},{$project:{_id:0,name:1,class:1,rollNo:1, marks:1,gender:1,markssize:{$size:"$marks"}}}])

```
< {
    name: 'Carry',
    class: 'IX',
    rollNo: 35,
    marks: [
      85,
      40,
      90,
      75,
      85,
      77
    ],
    gender: 'Male',
    markssize: 6
  }
```

$rename
Collection shapes1

```
> db.shapes1.find()
< {
    _id: 1,
    area: 16,
    name: 'rectangle'
  }
  {
    _id: 2,
    area: 10,
    name: 'square'
  }
```

db.shapes1.updateMany({},{$rename: {"name": "shape"}})

```
> db.shapes1.updateMany({},{$rename: {"name": "shape"}})
< {
    acknowledged: true,
    insertedId: null,
    matchedCount: 7,
    modifiedCount: 7,
    upsertedCount: 0
  }
```

Update Many

```
  _id: ObjectId('64de0b5ce572de65422ce33a')
  std_name: "Ankita"
  gender: "Female"
  class: "VII"
  fees: 3500
  exam_fees: 500
  age: 13
  total_marks: 400
  result: "Pass"
  grade: 8.12
```

db.student.updateMany({"gender":"Female"},{$rename: {"grade": "cgpa"}})

```
> db.student.updateMany({"gender":"Female"},{$rename: {"grade": "cgpa"}})
< {
    acknowledged: true,
    insertedId: null,
    matchedCount: 2,
    modifiedCount: 2,
    upsertedCount: 0
  }
```

```
> db.student.find({"gender":"Female"})
< {
    _id: ObjectId("64de0b5ce572de65422ce339"),
    std_name: 'Aarti',
    gender: 'Female',
    class: 'IX',
    fees: 4000,
    exam_fees: 500,
    age: 15,
    total_marks: 401,
    result: 'Pass',
    cgpa: Decimal128("7.1")
  }
  {
    _id: ObjectId("64de0b5ce572de65422ce33a"),
    std_name: 'Ankita',
    gender: 'Female',
    class: 'VII',
    fees: 3500,
    exam_fees: 500,
    age: 13,
    total_marks: 400,
    result: 'Pass',
    cgpa: Decimal128("8.12")
  }
```