Data Mining with WEKA

Original author: unknown. ? The WEKA team
Additional material: Tim Menzies, 2010

WEKA

- Machine learning/data mining software written in Java
  - Used for research, education, and applications
  - Complements “Data Mining” by Witten & Frank
- Main features
  - Comprehensive set of data pre-processing tools, learning alg orithms and evaluation methods
  - Graphical user interfaces (incl. data visualization)
  - Environment for comparing learning algorithms

Access

- WEKA is available at

  http://www.cs.waikato.ac.nz/ml/weka

- Also has a list of projects based on WEKA
- WEKA contributors:

  Abdelaziz Mahoui, Alexander K. Seewald, Ashraf M. Kibriya, Bernhard Pfahringer , Brent Martin, Peter Flach, Eibe Frank ,Gabi Schmidberger ,Ian H. Witten , J. Lindgren, Janice Boughton, Jason Wells, Len Trigg, Lucio de Souza Coelho, Malcolm Ware, Mark Hall ,Remco Bouckaert , Richard Kirkby, Shane Butler, Shane Legg, Stuart Inglis, Sylvain Roy, Tony Voyle, Xin Xu, Yong Wang, Zhihai Wang

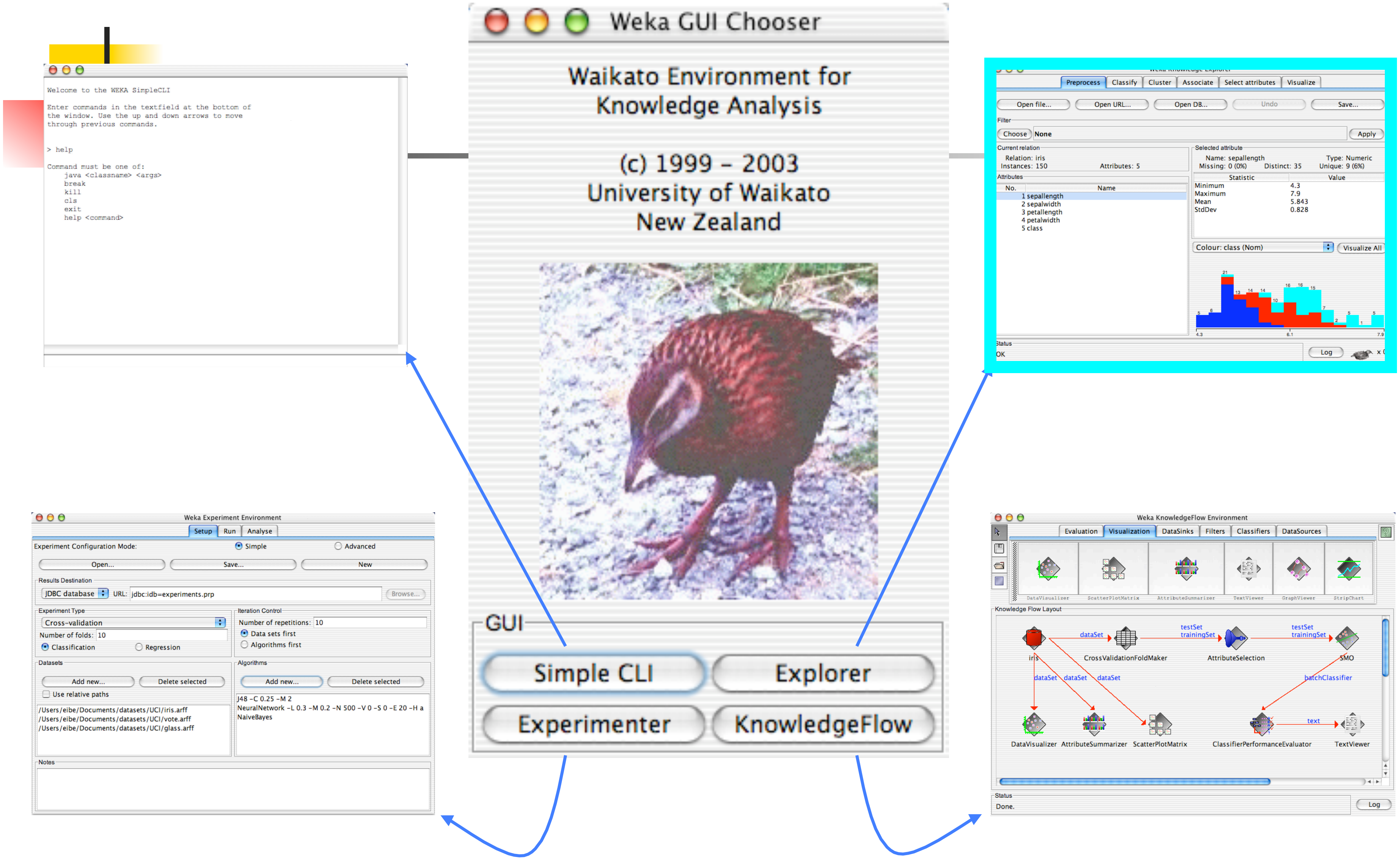
Data Files

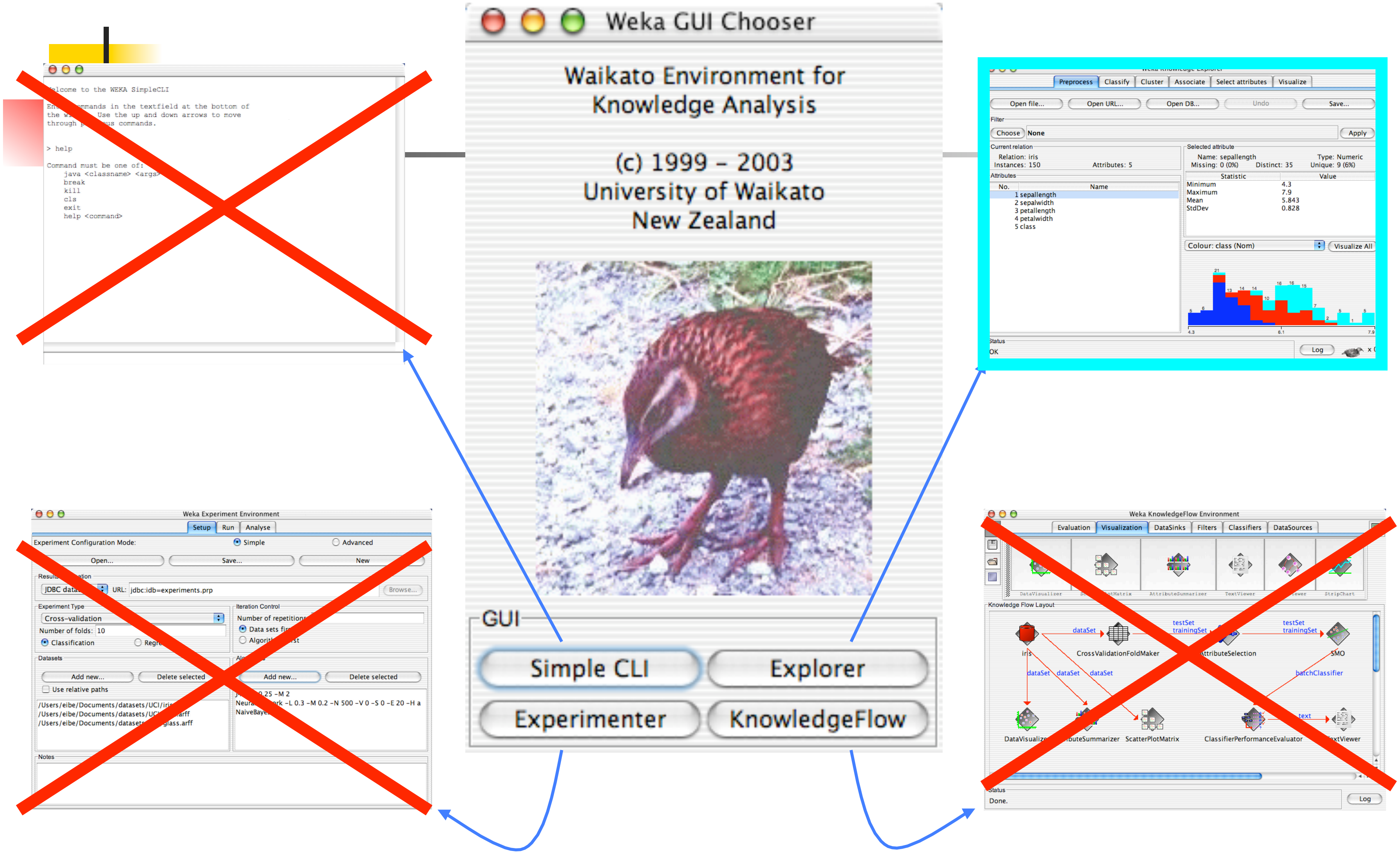
```
@relation heart-disease-simplified

@attribute age numeric
@attribute sex { female, male}
@attribute chest_pain_type { typ_angina, asympt, non_anginal, atyp_angina}
@attribute cholesterol numeric
@attribute exercise_induced_angina { no, yes}
@attribute class { present, not_present}

@data
63,male,typ_angina,233,no,not_present
67,male,asympt,286,yes,present
67,male,asympt,229,yes,present
38,female,non_anginal,?,no,not_present
...
```

numeric attribute

nominal attribute

Flat file in ARFF format


Weka GUI Chooser
Waikato Environment for
Knowledge Analysis
(c) 1999 – 2003
University of Waikato
New Zealand
GUI
Simple CLI
Explorer
Experimenter
KnowledgeFlow
Welcome to the WEKA SimpleCLI
Enter commands in the textfield at the bottom of
the window. Use the up and down arrows to move
through previous commands.
> help
Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Selected attribute
Name: sepallength
Type: Numeric
Missing: 0 (0%)
Distinct: 35
Unique: 9 (6%)
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Statistic
Value
Minimum
4.3
Maximum
7.9
Mean
5.843
StdDev
0.828
Colour: class (Nom)
Visualize All
Status
OK
Log
Weka Experiment Environment
Setup
Run
Analyse
Experiment Configuration Mode:
Simple
Advanced
Open...
Save...
New
Results Destination
JDBC database
URL: jdbc:idb=experiments.prp
Browse...
Experiment Type
Cross-validation
Number of folds: 10
Classification
Regression
Iteration Control
Number of repetitions: 10
Data sets first
Algorithms first
Datasets
Add new...
Delete selected
Use relative paths
/Users/eibe/Documents/datasets/UCI/iris.arff
/Users/eibe/Documents/datasets/UCI/vote.arff
/Users/eibe/Documents/datasets/UCI/glass.arff
Algorithms
Add new...
Delete selected
J48 -C 0.25 -M 2
NeuralNetwork -L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a
NaiveBayes
Notes
Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
Knowledge Flow Layout
iris
dataSet
CrossValidationFoldMaker
testSet
trainingSet
AttributeSelection
SMO
batchClassifier
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
text
TextViewer
Status
Done.
Log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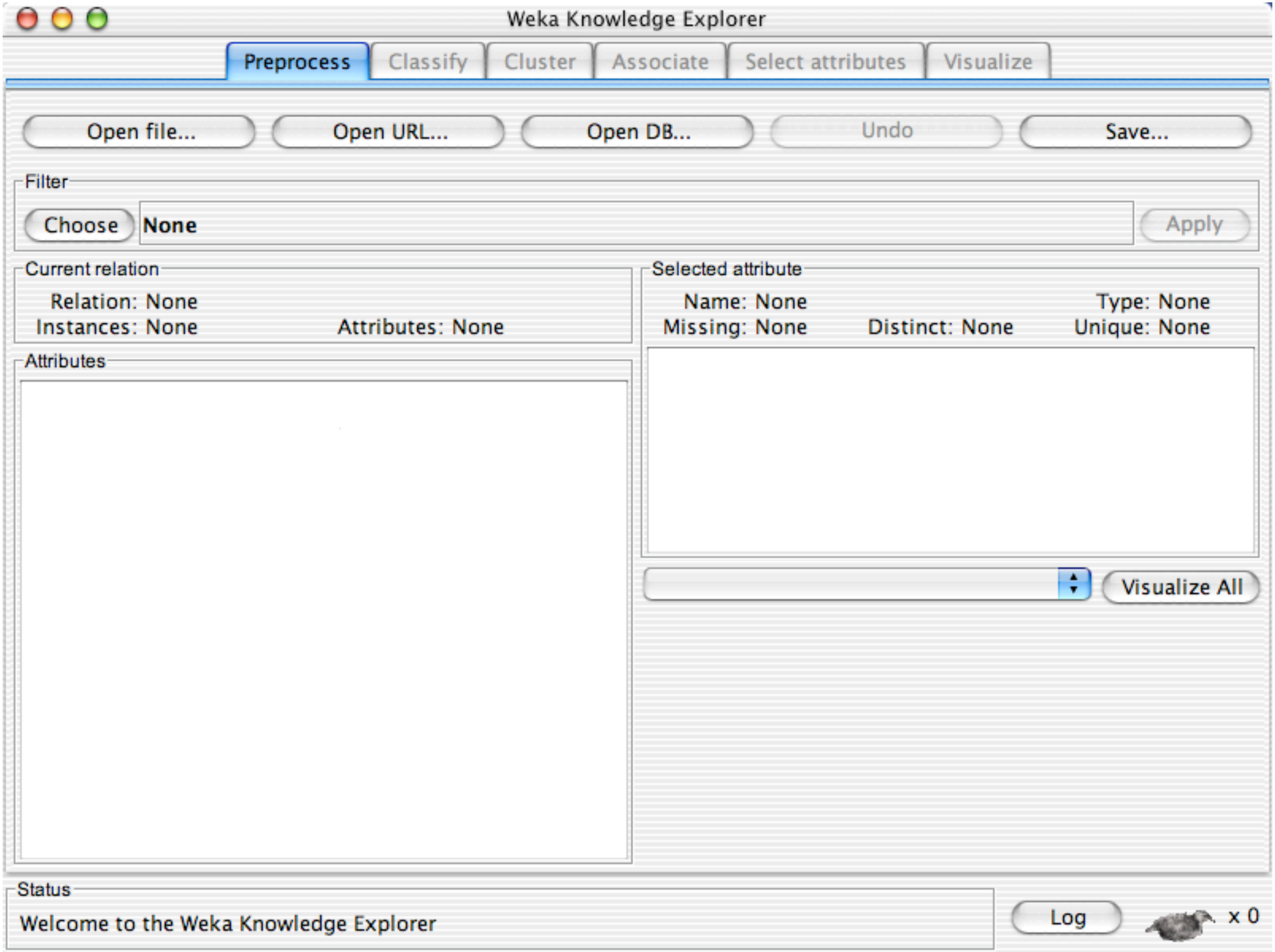
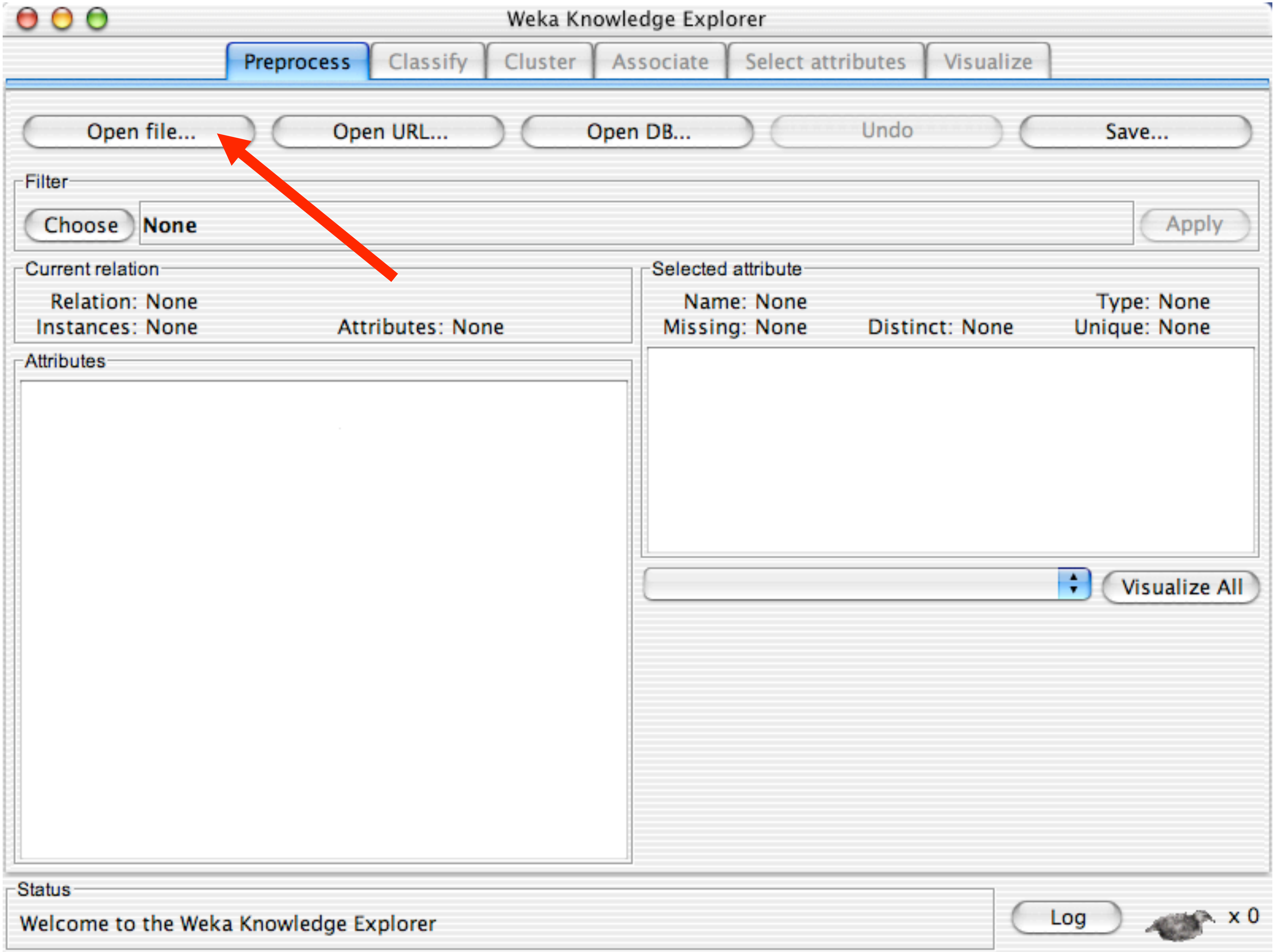
Weka Experiment Environment
Weka KnowledgeFlow Environment

Explorer: pre-processing

- Source
  - Data can be imported from a file in various formats: ARFF, CSV, C4.5, binary
  - Data can also be read from a URL or from an SQL database (using JDBC)
- Pre-processing tools
  - Called "filters"
  - Discretization, normalization, resampling, attribute selection, transforming and combining attributes, …


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: None
Instances: None
Attributes: None
Selected attribute
Name: None
Type: None
Missing: None
Distinct: None
Unique: None
Attributes
Visualize All
Status
Welcome to the Weka Knowledge Explorer
Log
x 0



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Save...
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Choose
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Relation: None
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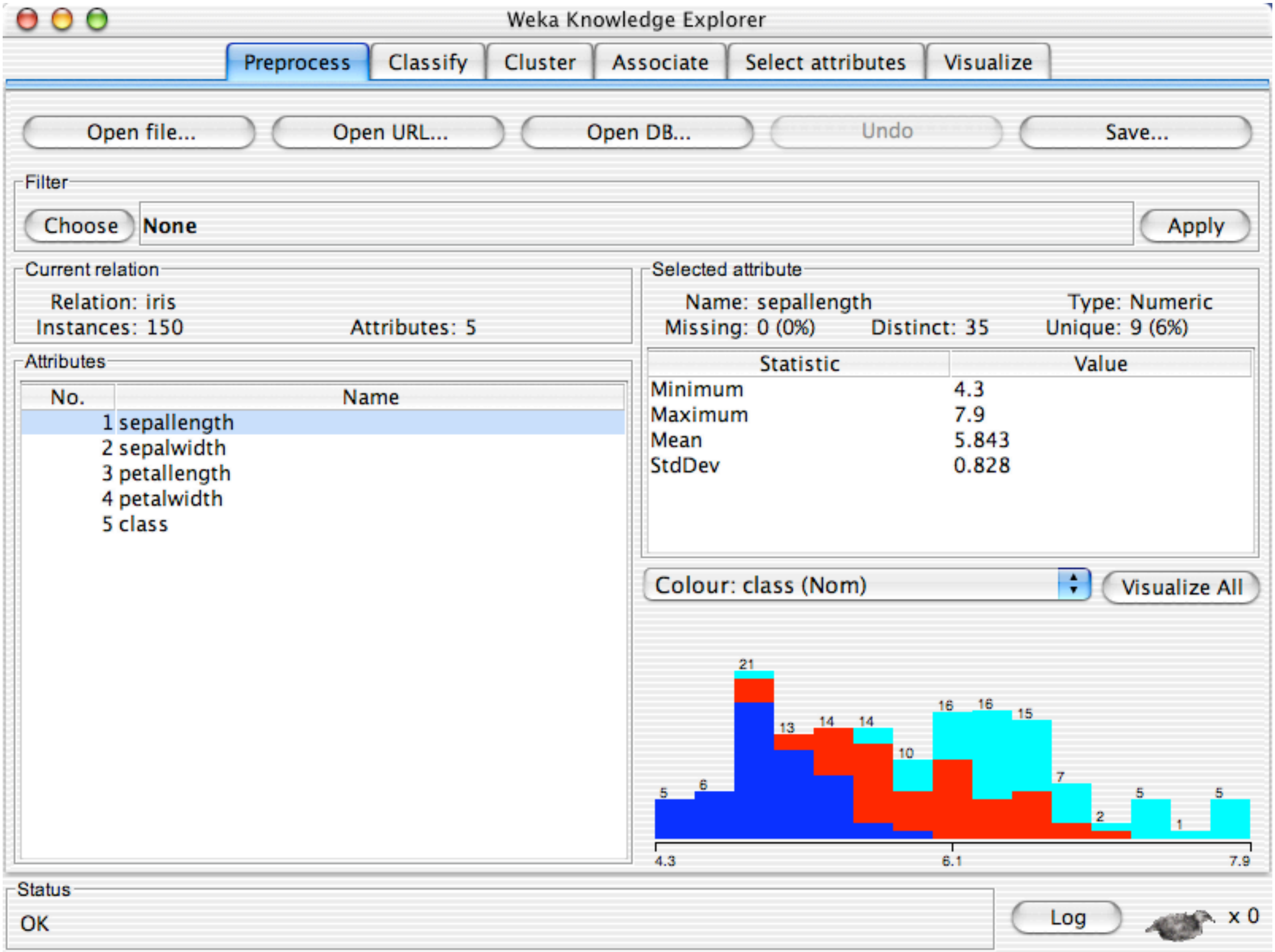
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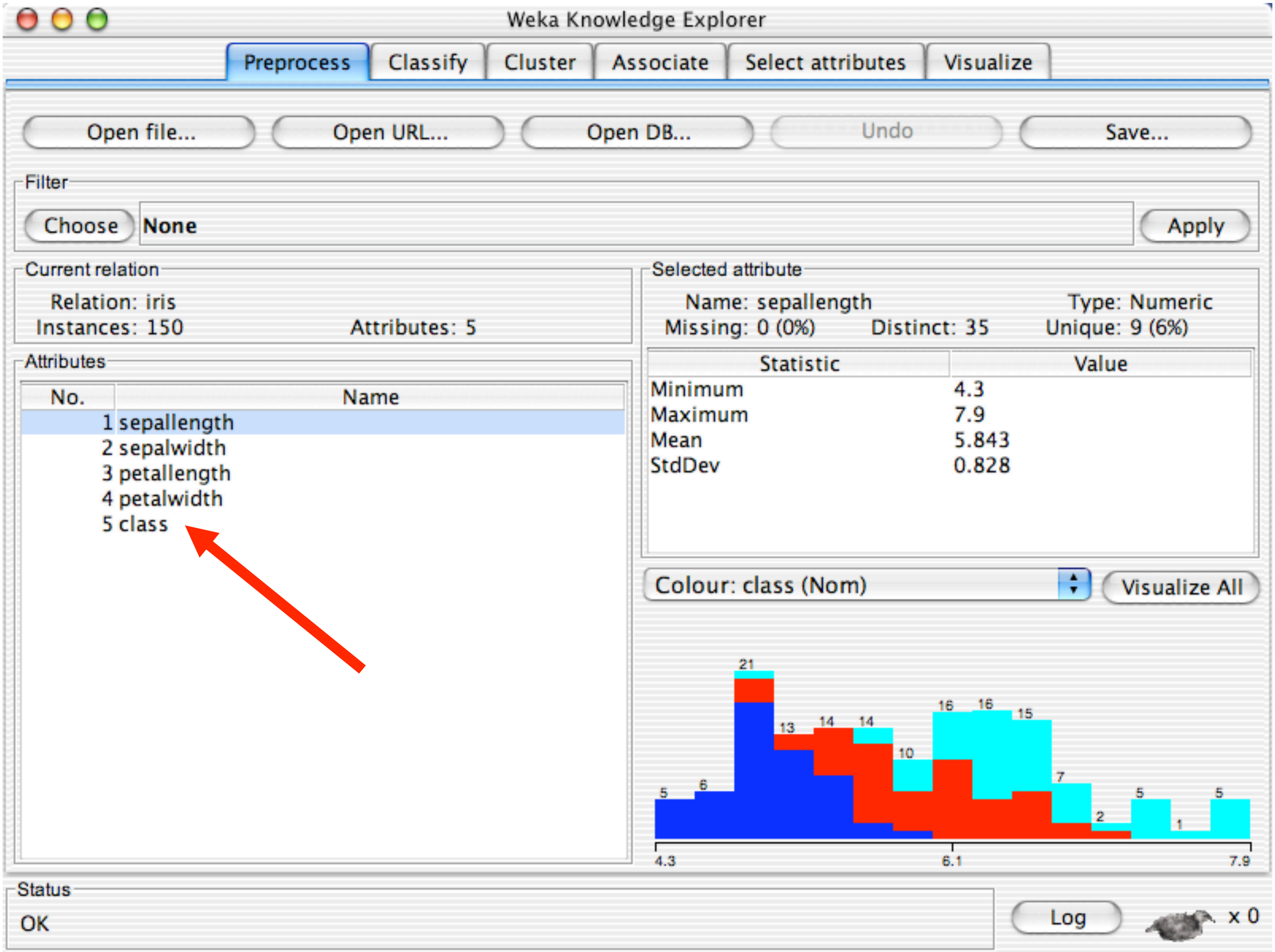
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Selected attribute
Name: sepallength
Type: Numeric
Missing: 0 (0%)
Distinct: 35
Unique: 9 (6%)
Statistic
Value
Minimum 4.3
Maximum 7.9
Mean 5.843
StdDev 0.828
Colour: class (Nom)
Visualize All
21
13
14
14
16
16
15
10
7
5
6
2
5
1
5
4.3
6.1
7.9
Status
OK
Log
x 0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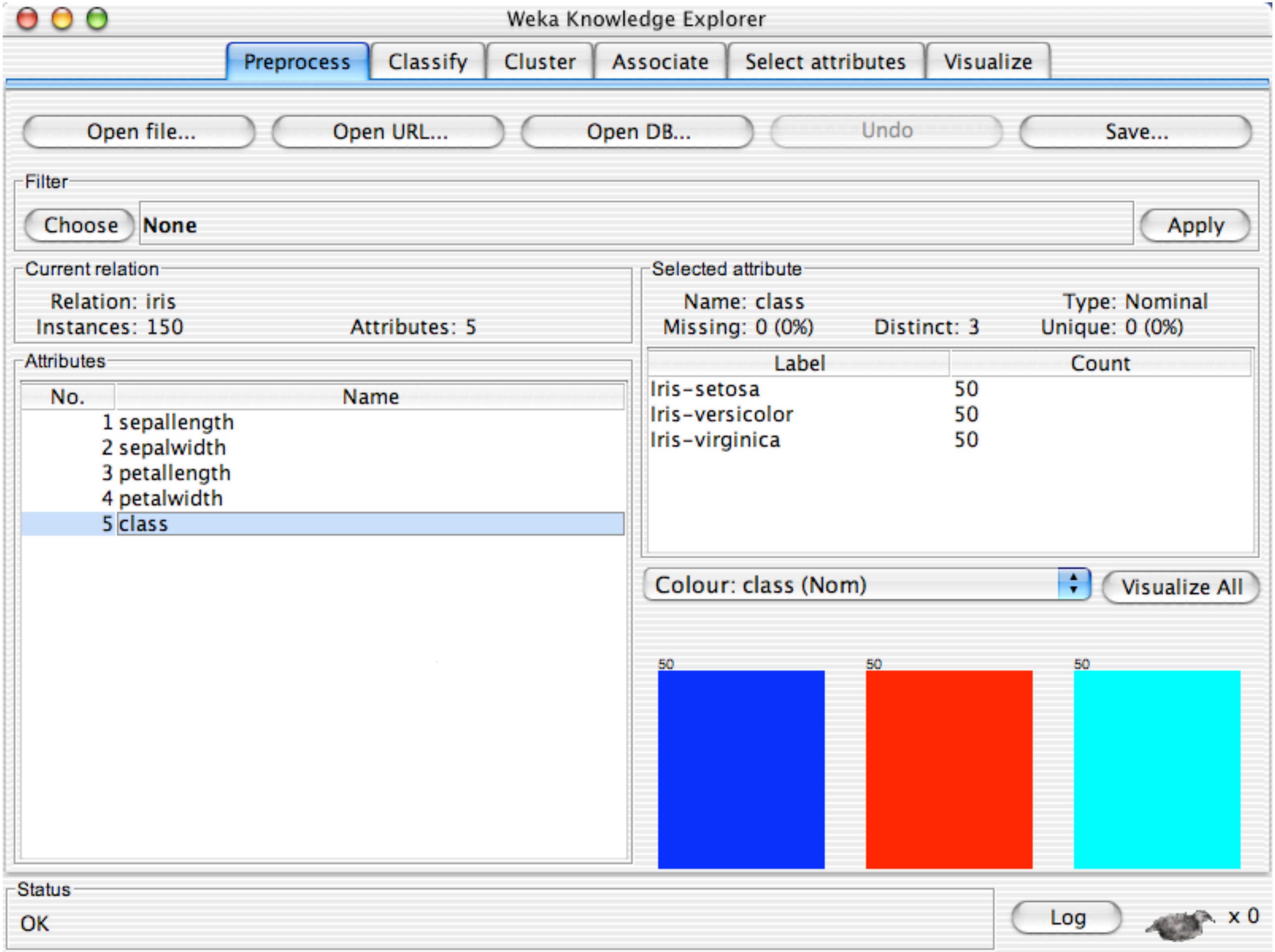
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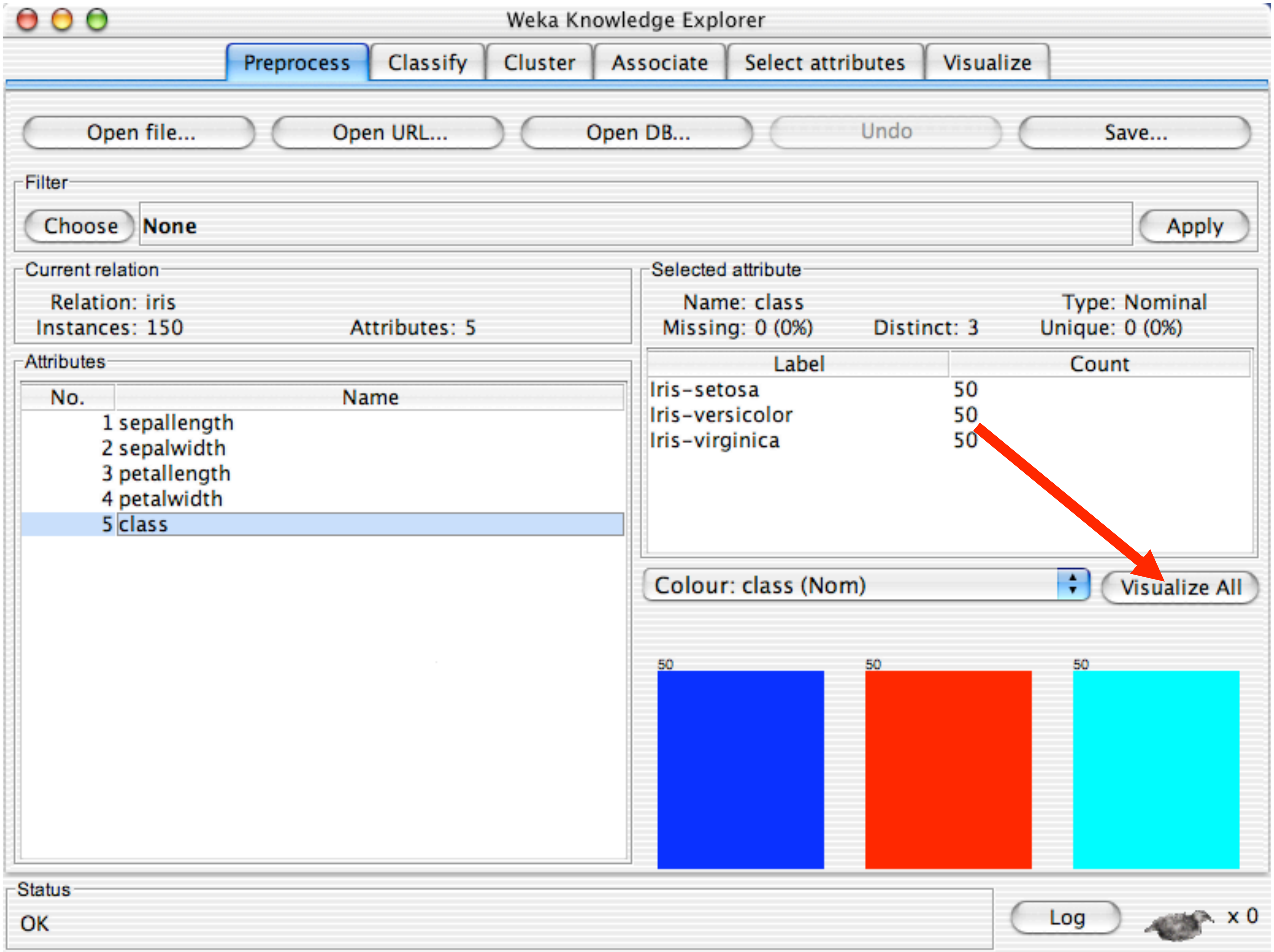
Relation: iris
Instances: 150
Attributes: 5
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Selected attribute
Name: class
Type: Nominal
Missing: 0 (0%)
Distinct: 3
Unique: 0 (0%)
Label
Count
Iris-setosa 50
Iris-versicolor 50
Iris-virginica 50
Colour: class (Nom)
Visualize All
50
50
50
Status
OK
Log
x 0


Weka Knowledge Explorer
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Undo
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Filter
Choose
None
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Current relation
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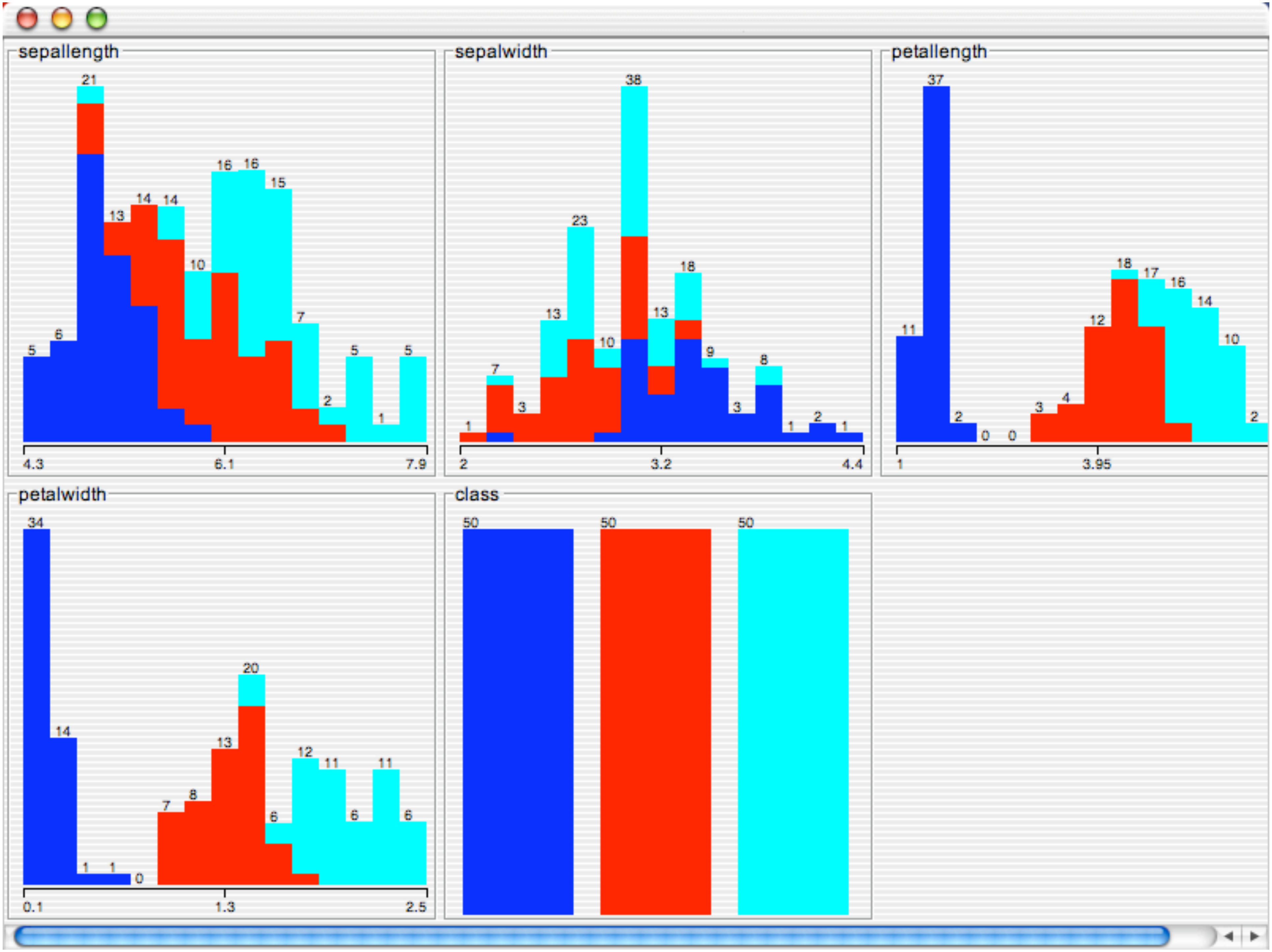
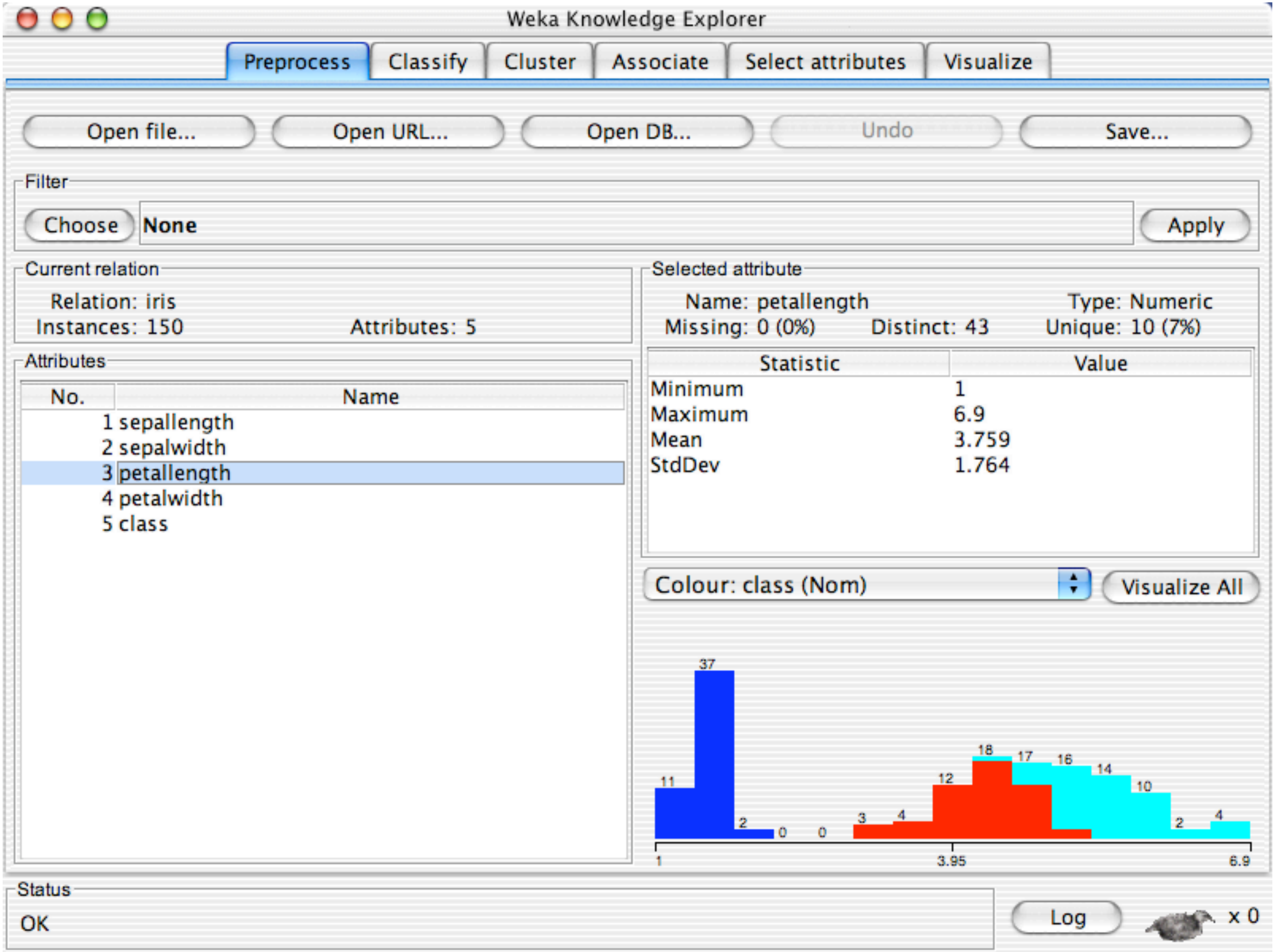
Attributes: 5
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Selected attribute
Name: class
Type: Nominal
Missing: 0 (0%)
Distinct: 3
Unique: 0 (0%)
Label
Count
Iris-setosa 50
Iris-versicolor 50
Iris-virginica 50
Colour: class (Nom)
Visualize All
50
50
50
Status
OK
Log
x 0


sepallength
21
13
14
14
16
16
15
10
7
5
6
5
2
1
5
4.3
6.1
7.9
sepalwidth
38
23
18
13
13
10
9
8
7
3
3
1
1
2
1
2
3.2
4.4
petallength
37
11
2
0
0
18
17
16
14
12
10
3
4
2
1
3.95
petalwidth
34
14
1
1
0
20
13
12
11
11
8
7
6
6
6
0.1
1.3
2.5
class
50
50
50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Attributes
No.
Name
1 sepallength
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3 petallength
4 petalwidth
5 class
Selected attribute
Name: petallength
Type: Numeric
Missing: 0 (0%)
Distinct: 43
Unique: 10 (7%)
Statistic
Value
Minimum 1
Maximum 6.9
Mean 3.759
StdDev 1.764
Colour: class (Nom)
Visualize All
11
37
2
0
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3
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12
18
17
16
14
10
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4
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3.95
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Status
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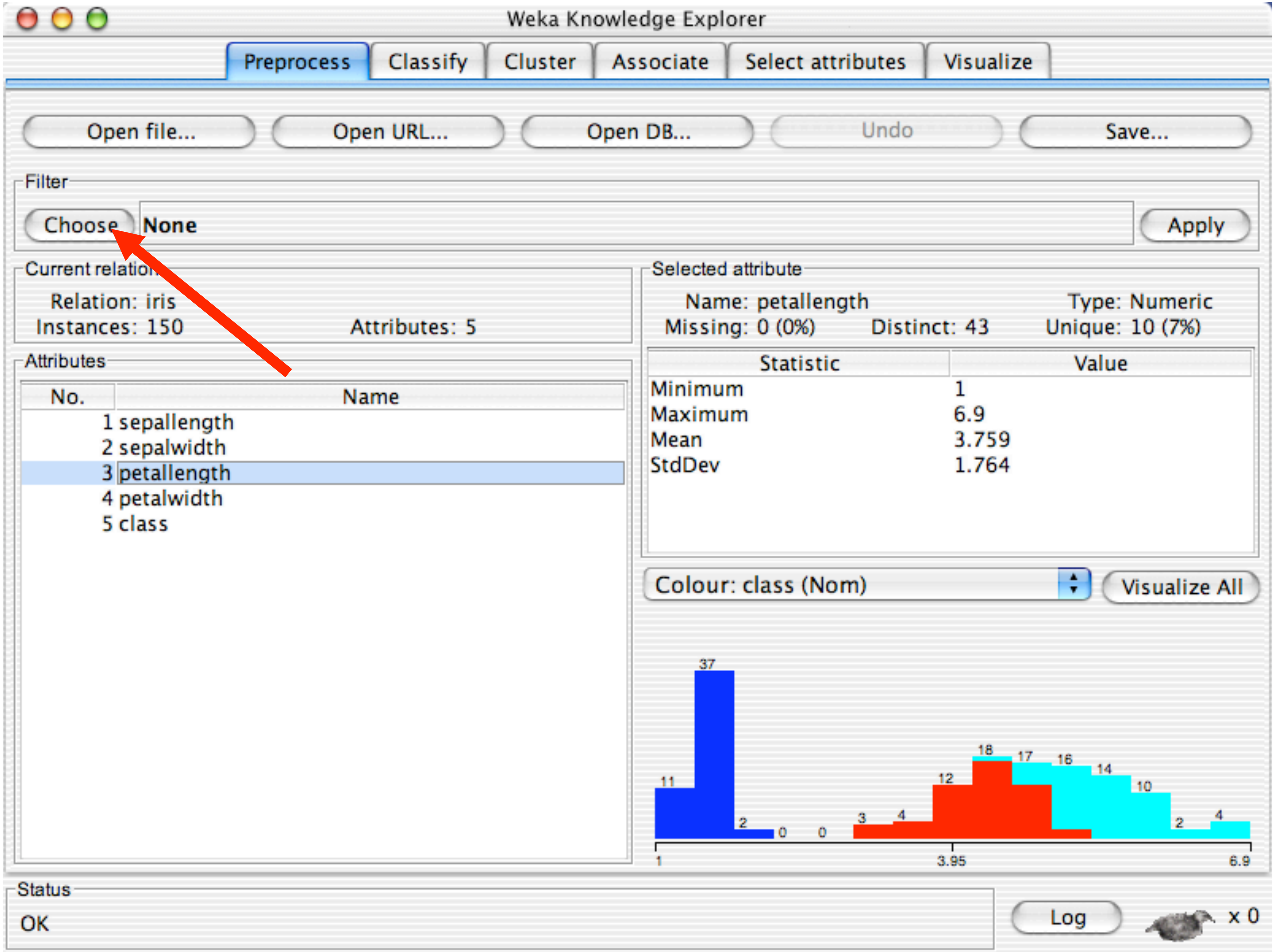
Log
x 0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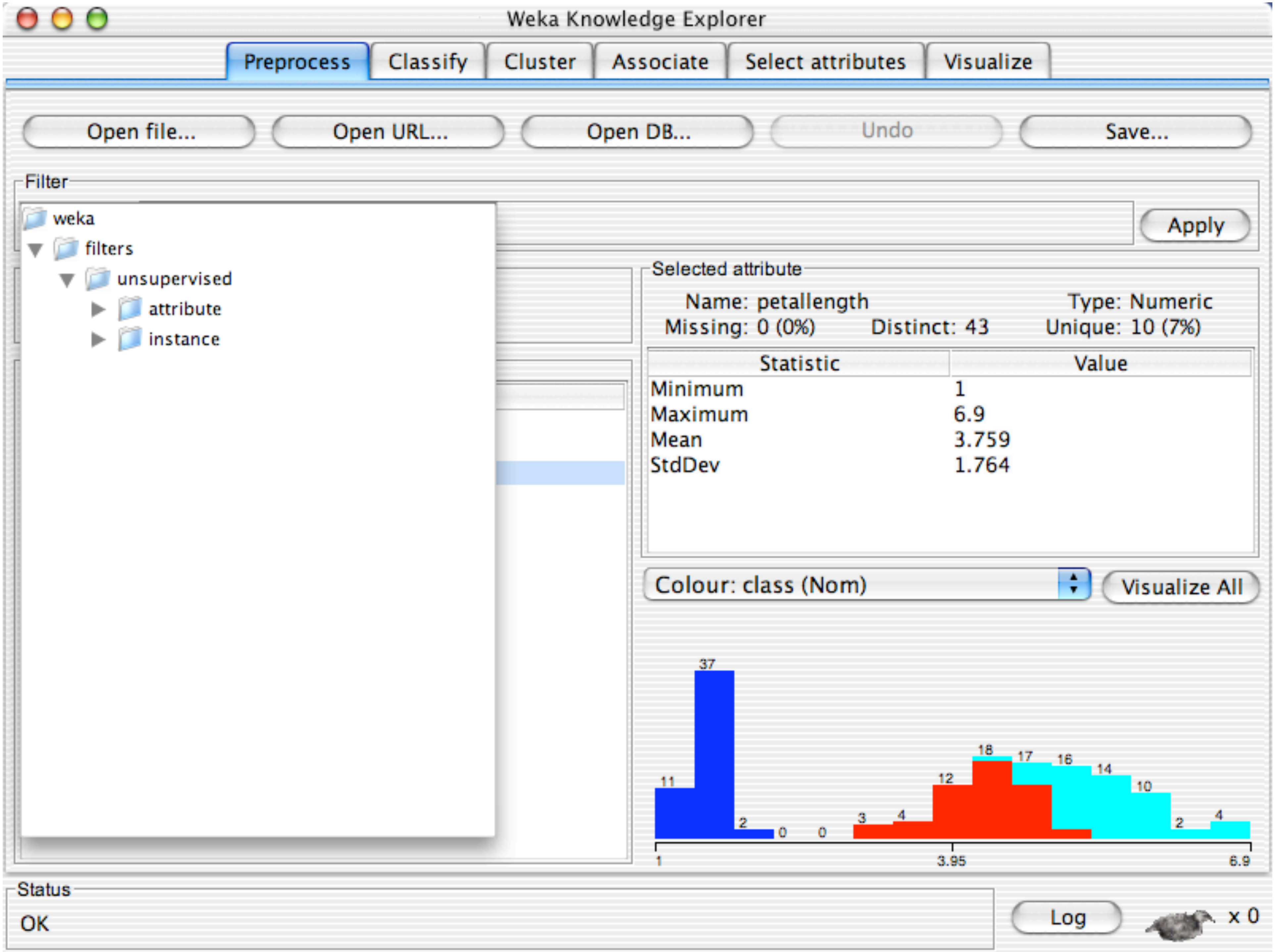
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
weka
filters
unsupervised
attribute
instance
Apply
Selected attribute
Name: petallength
Type: Numeric
Missing: 0 (0%)
Distinct: 43
Unique: 10 (7%)
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Minimum 1
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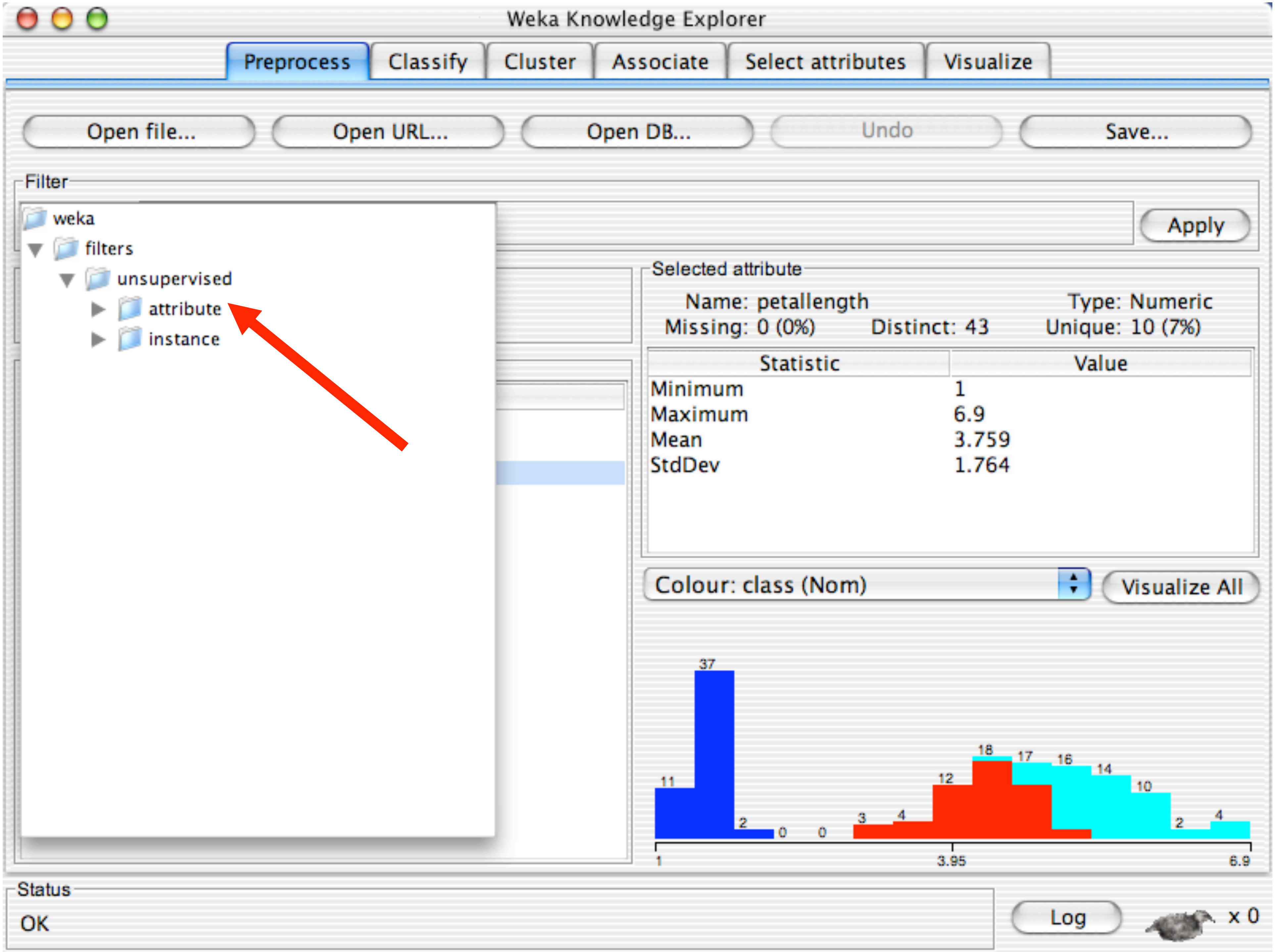
Visualize All
11 37 2 0 0 3 4 12 18 17 16 14 10 2 4
1
3.95
6.9
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
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Select attributes
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Open file...
Open URL...
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Filter
weka
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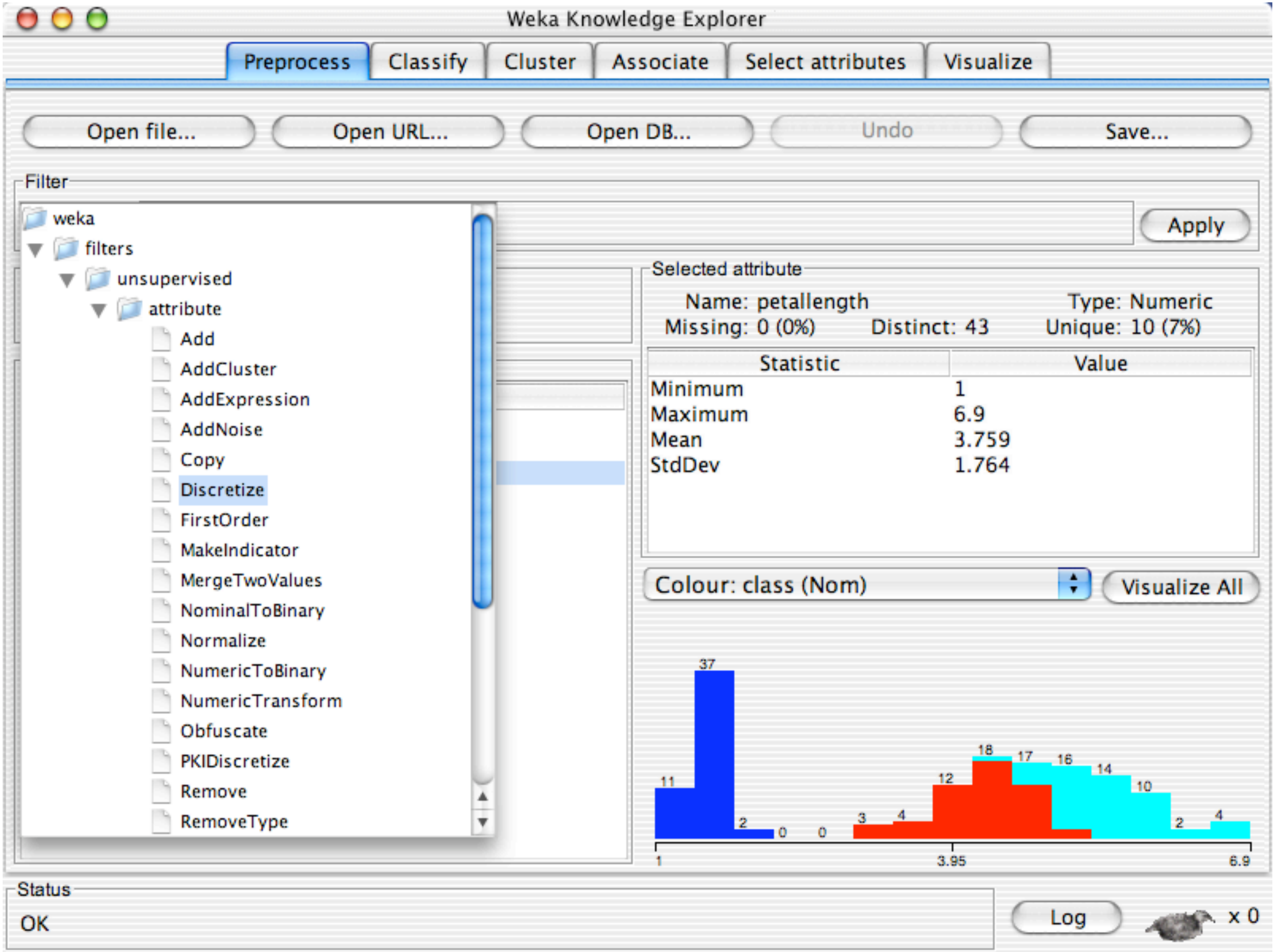

Weka Knowledge Explorer
Preprocess
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Open file...
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Open DB...
Undo
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Filter
Apply
weka
filters
unsupervised
attribute
Add
AddCluster
AddExpression
AddNoise
Copy
Discretize
FirstOrder
MakeIndicator
MergeTwoValues
NominalToBinary
Normalize
NumericToBinary
NumericTransform
Obfuscate
PKIDiscretize
Remove
RemoveType
Selected attribute
Name: petallength
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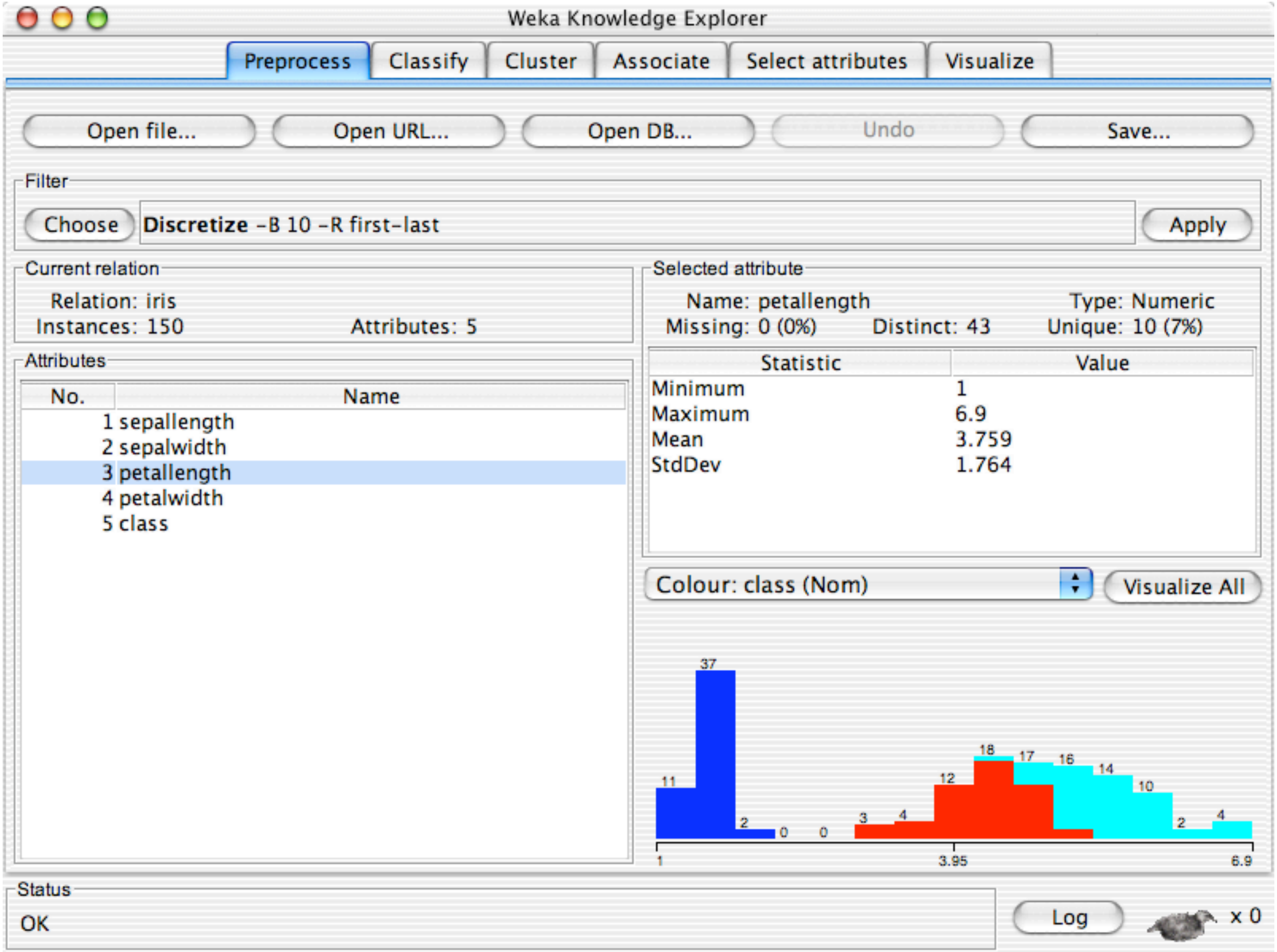
Weka Knowledge Explorer
Preprocess
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Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
Discretize -B 10 -R first-last
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Attributes
No.
Name
1 sepallength
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Visualize All
11 37 2 0 0 3 4 12 18 17 16 14 10 2 4
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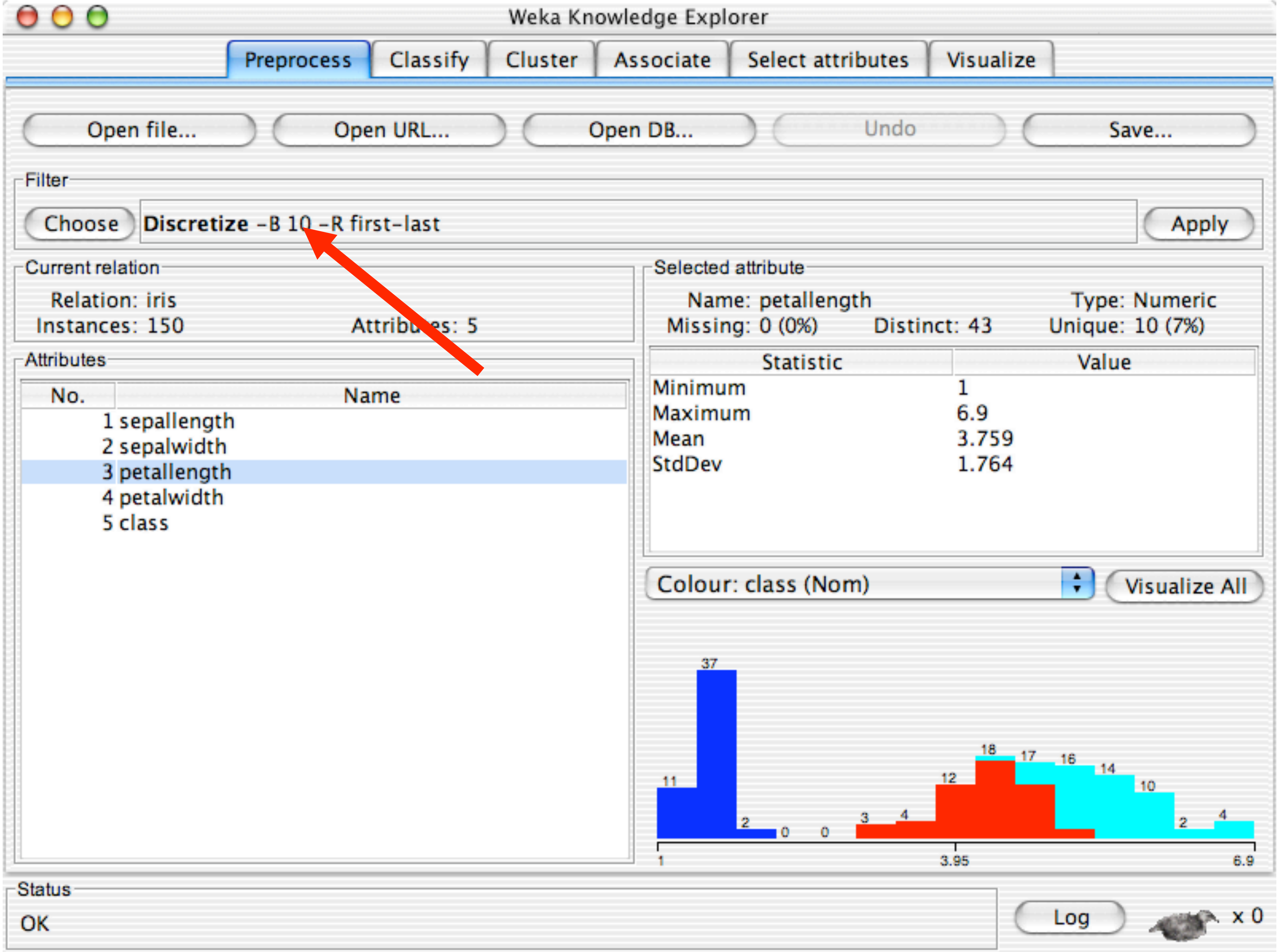

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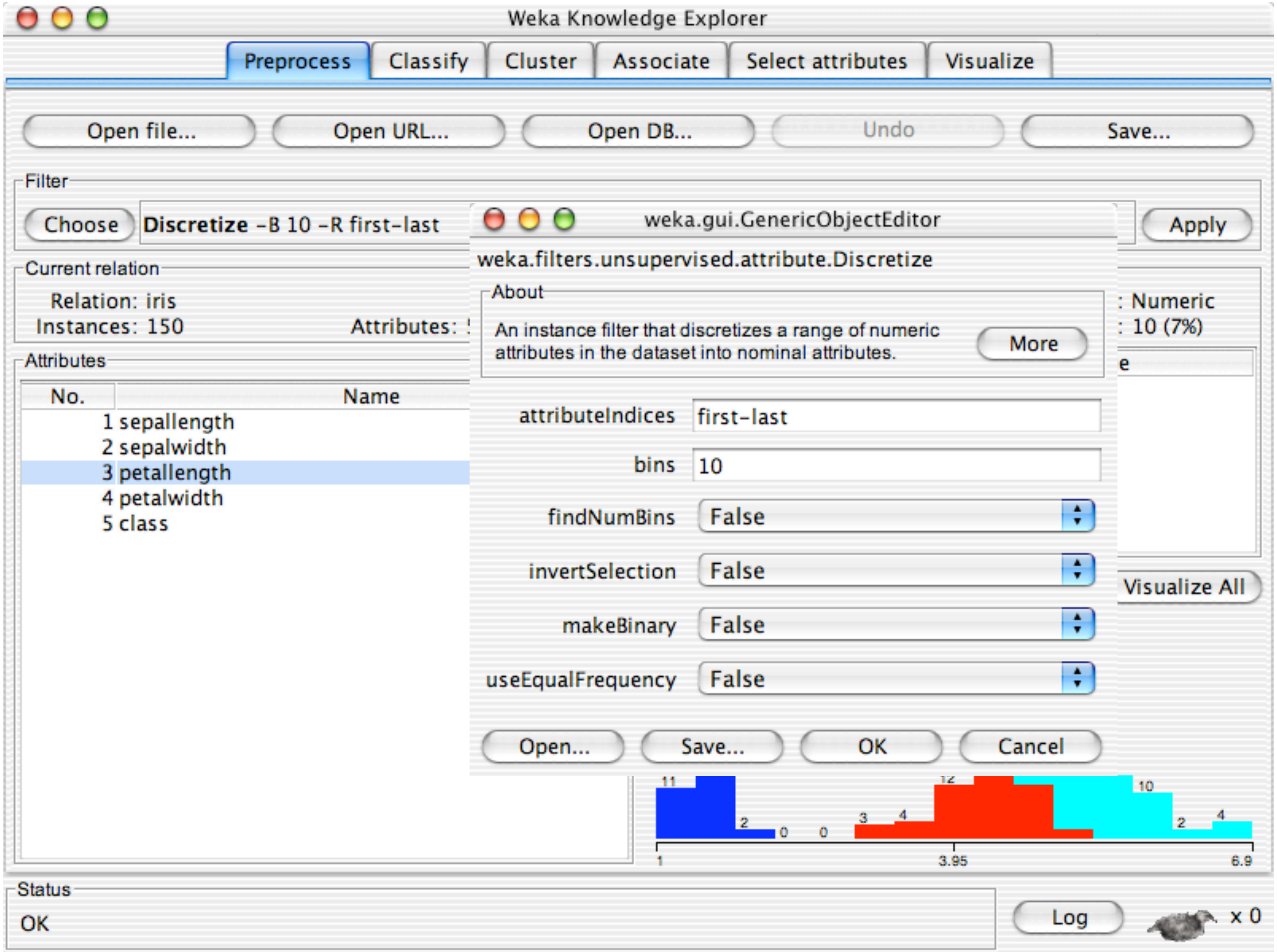
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Attributes
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Name
1 sepallength
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Visualize All
weka.gui.GenericObjectEditor
weka.filters.unsupervised.attribute.Discretize
About
An instance filter that discretizes a range of numeric attributes in the dataset into nominal attributes.
More
attributeIndices
first-last
bins
10
findNumBins
False
invertSelection
False
makeBinary
False
useEqualFrequency
False
Open...
Save...
OK
Cancel
11
2
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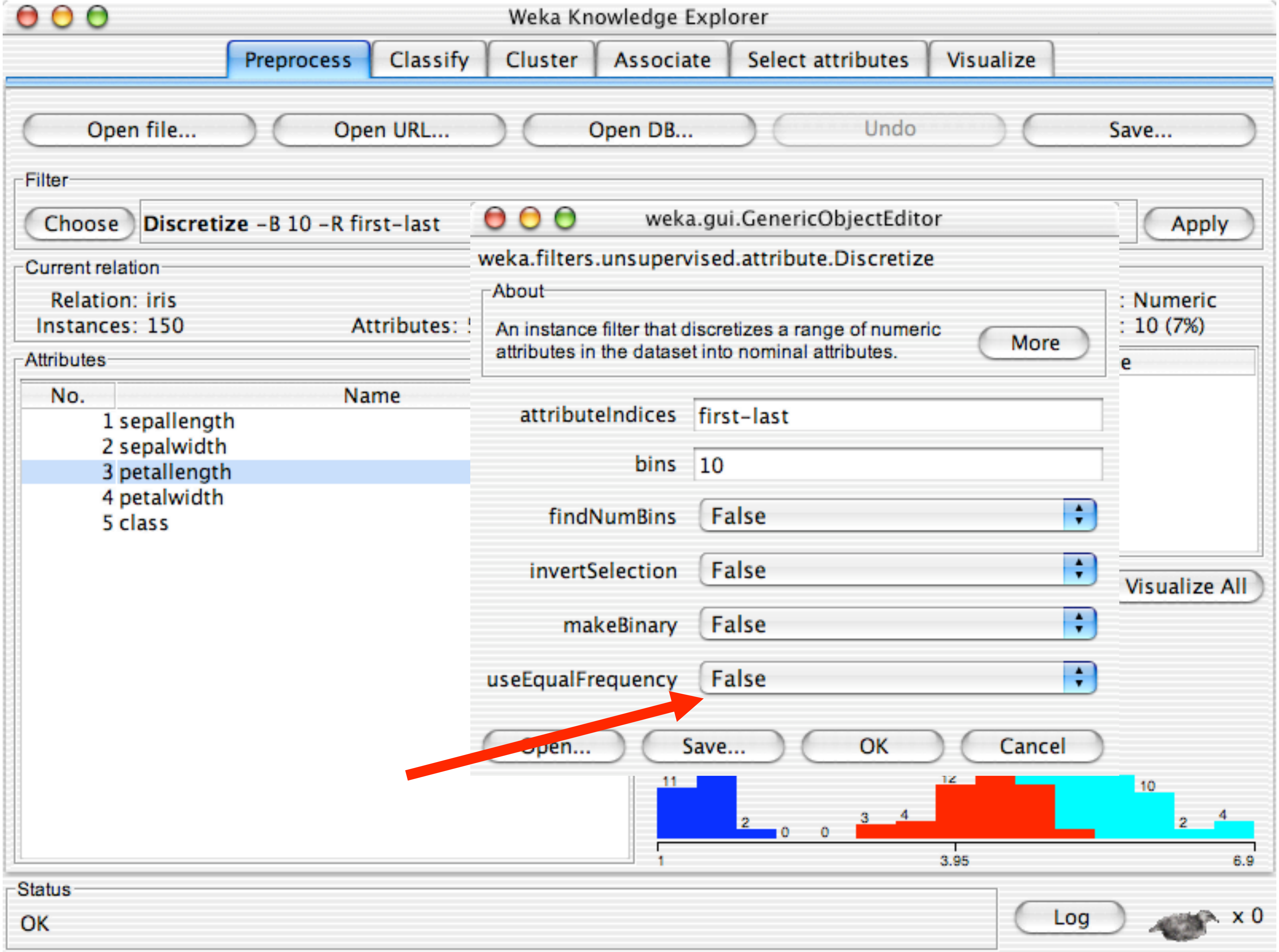
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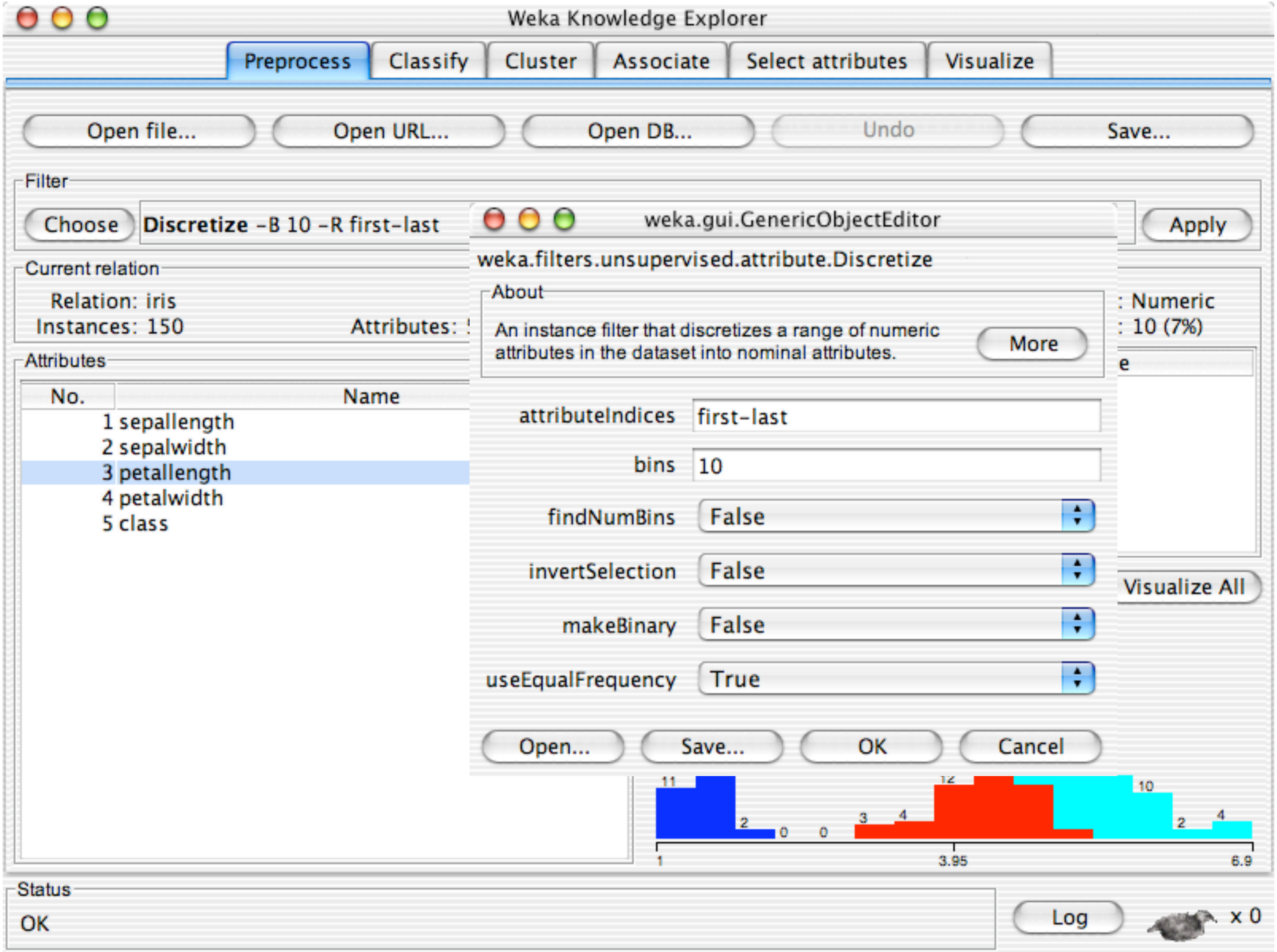

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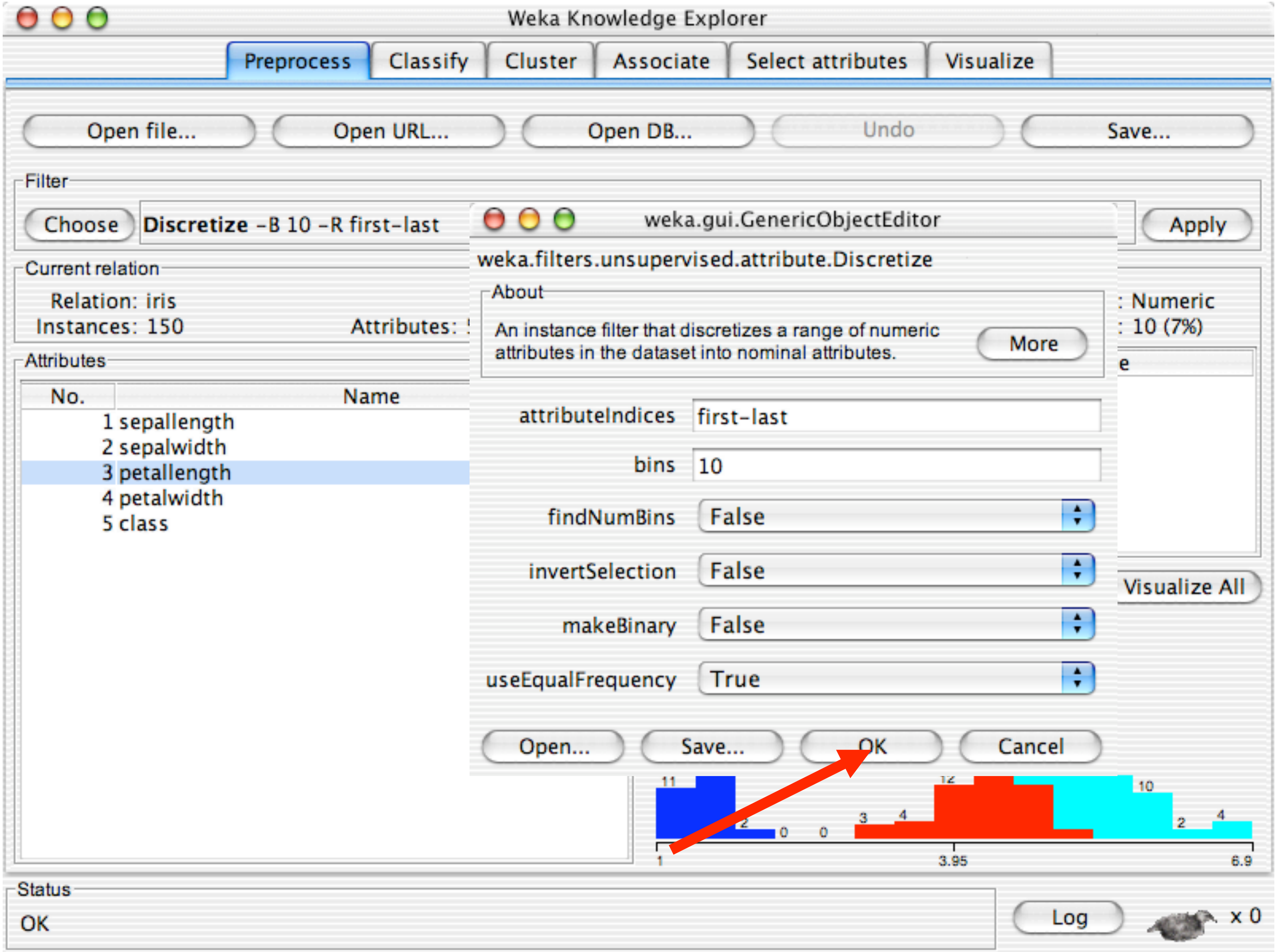
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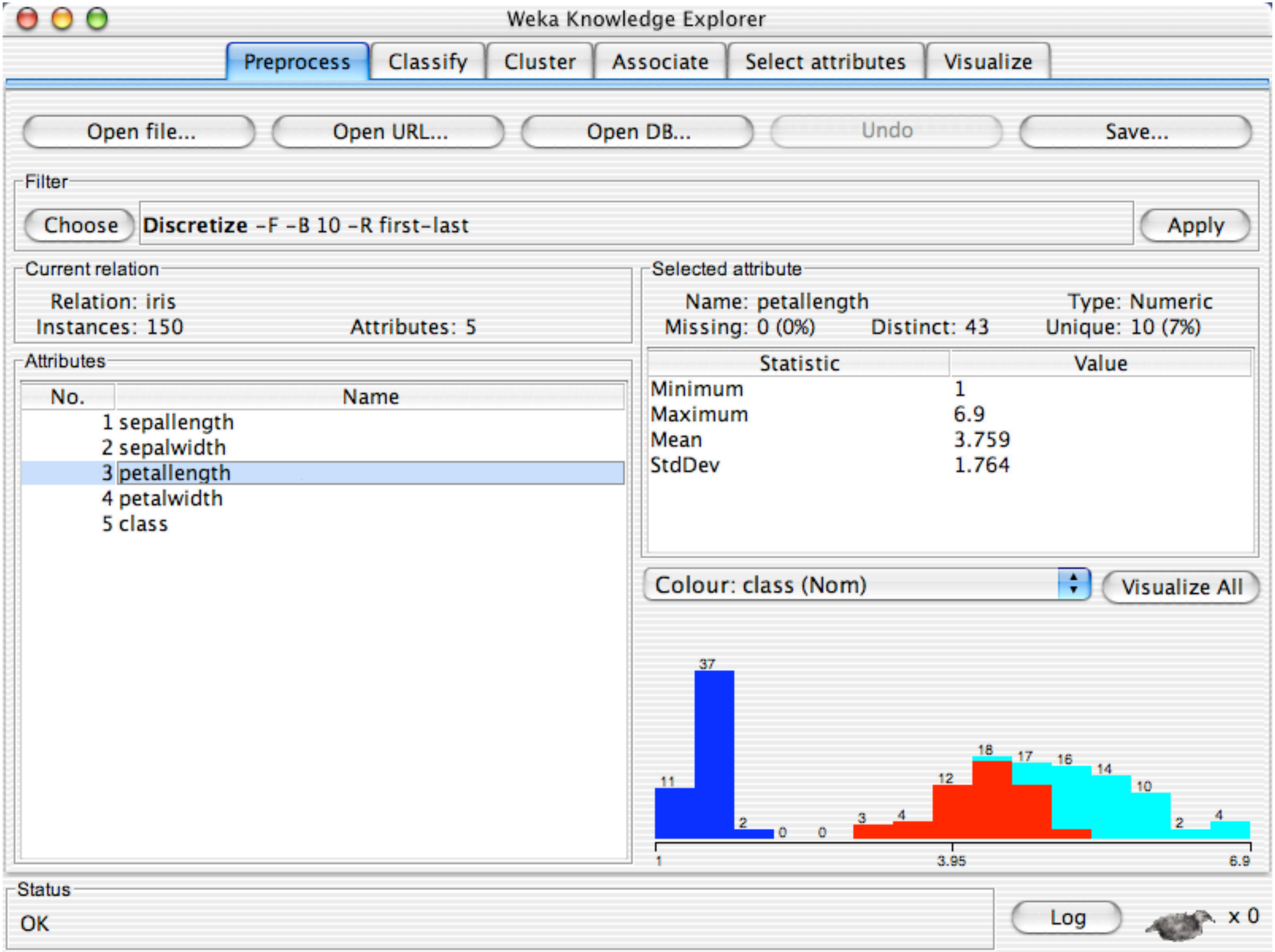
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Cluster
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Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
Discretize -F -B 10 -R first-last
Apply
Current relation
Relation: iris
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Attributes: 5
Attributes
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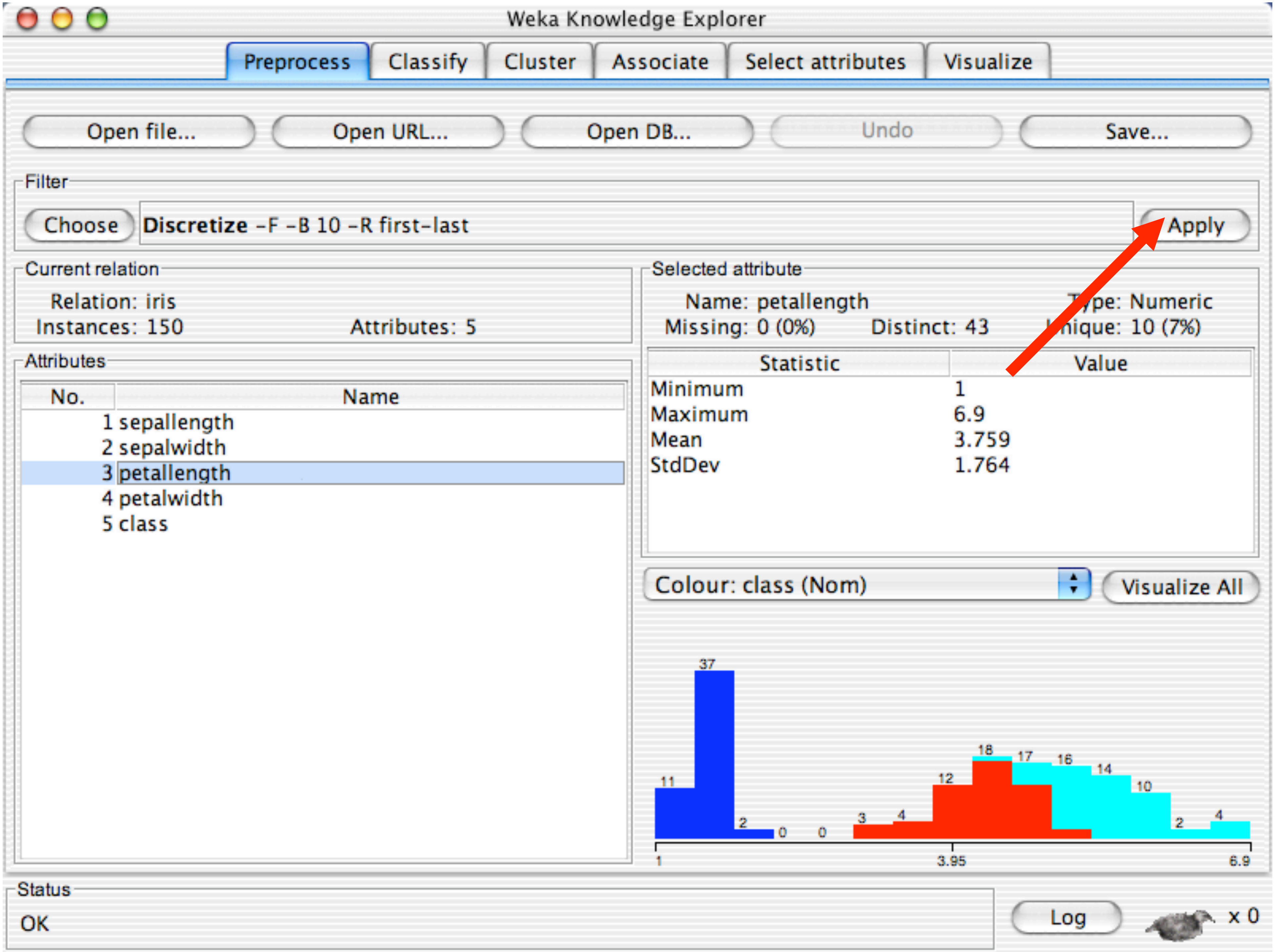
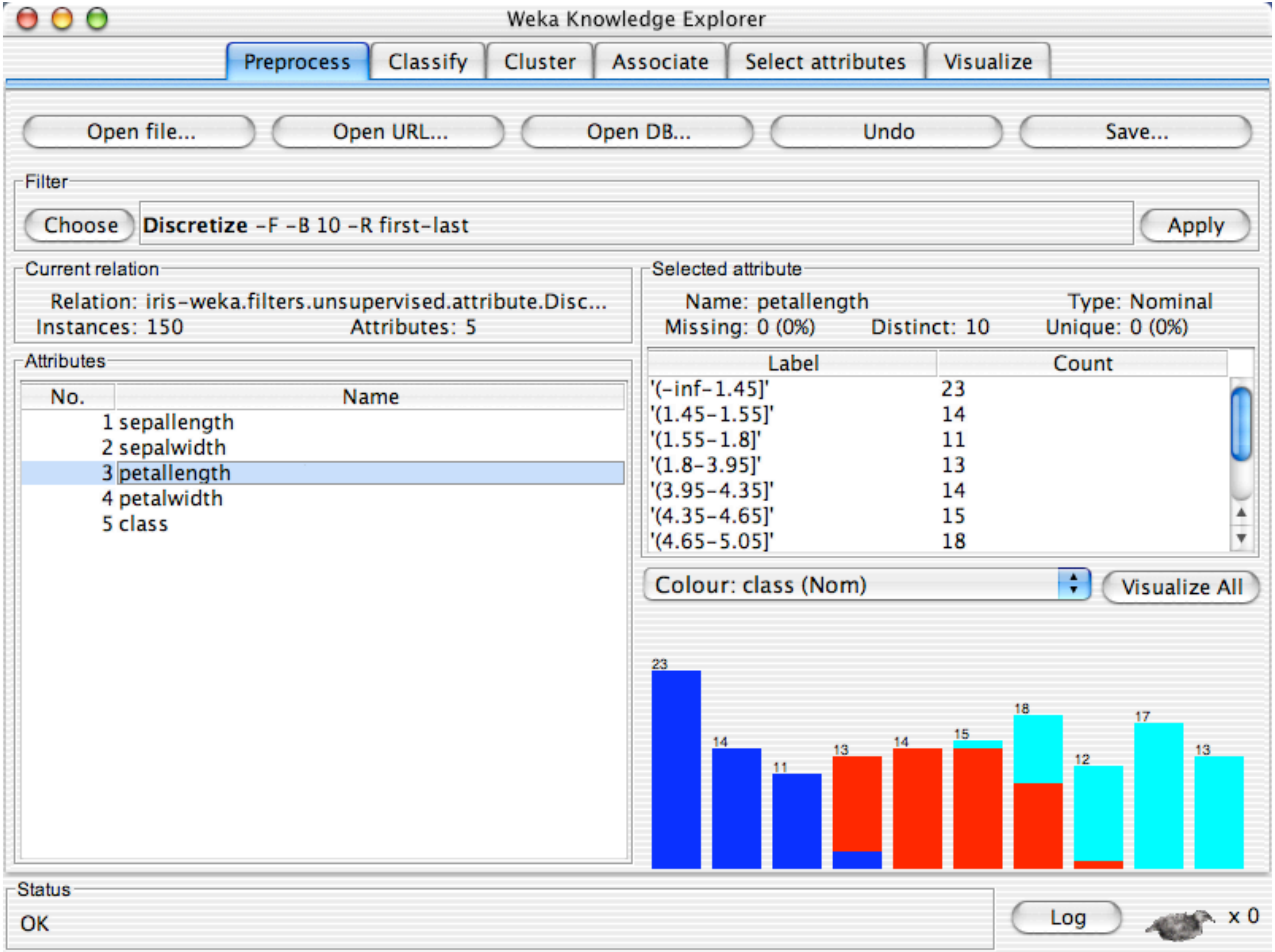
Unique: 10 (7%)
Statistic
Value
Minimum
1
Maximum
6.9
Mean
3.759
StdDev
1.764
Colour: class (Nom)
Visualize All
11
37
2
0
0
3
4
12
18
17
16
14
10
2
4
1
3.95
6.9
Status
OK
Log
x 0



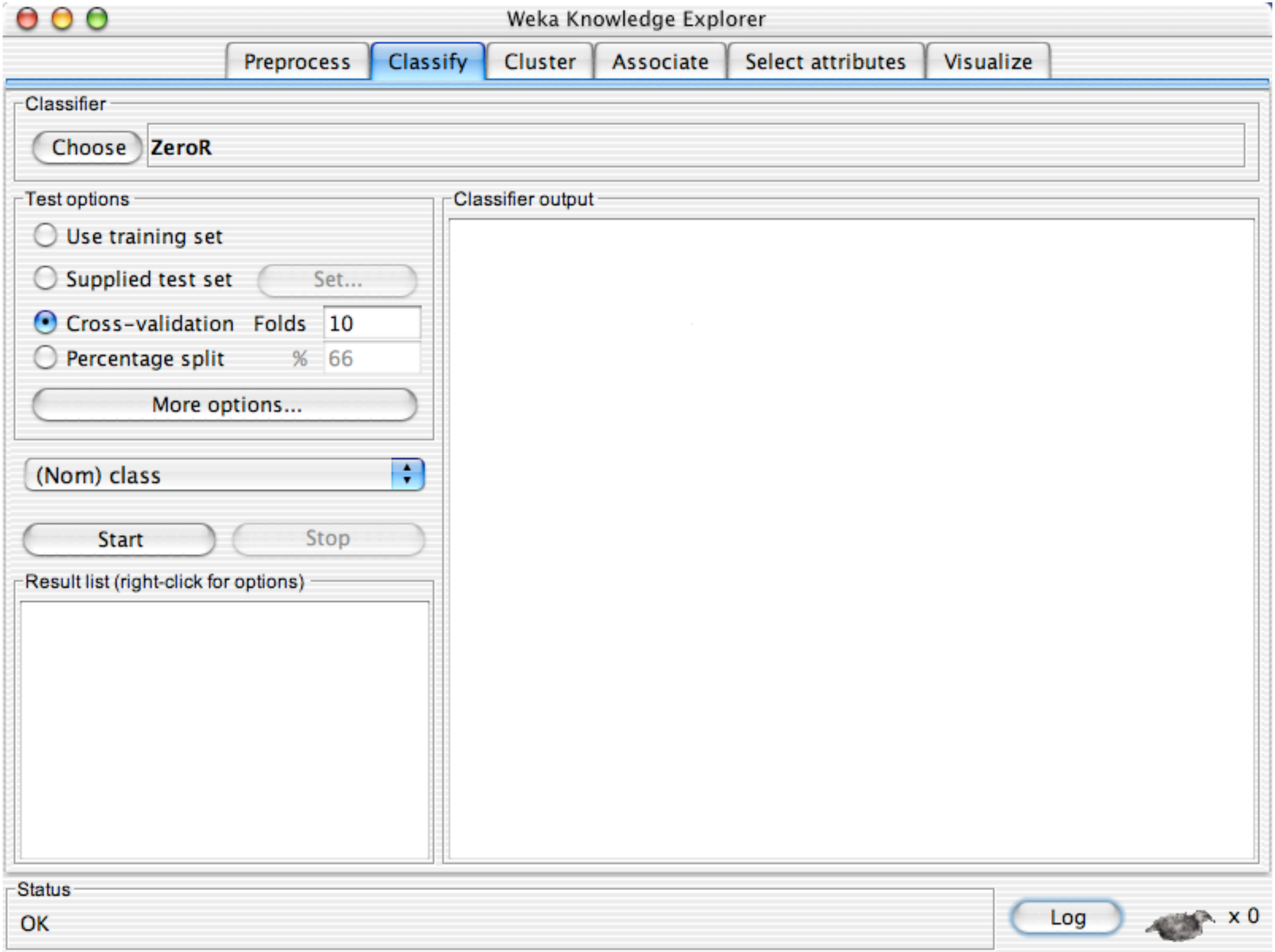
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
Discretize -F -B 10 -R first-last
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Selected attribute
Name: petallength
Type: Numeric
Missing: 0 (0%)
Distinct: 43
Unique: 10 (7%)
Statistic
Value
Minimum 1
Maximum 6.9
Mean 3.759
StdDev 1.764
Colour: class (Nom)
Visualize All
Status
OK
Log
x 0

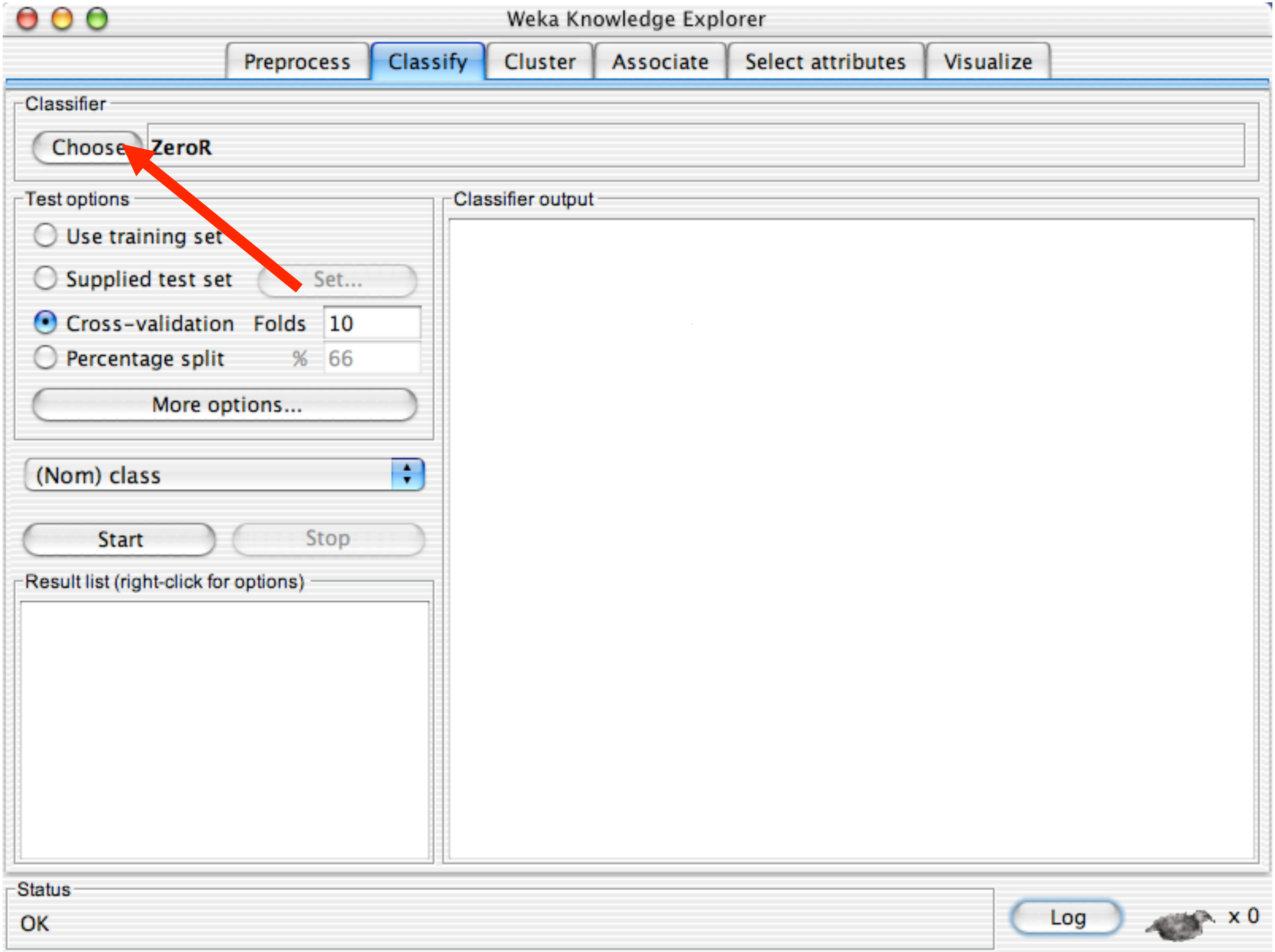


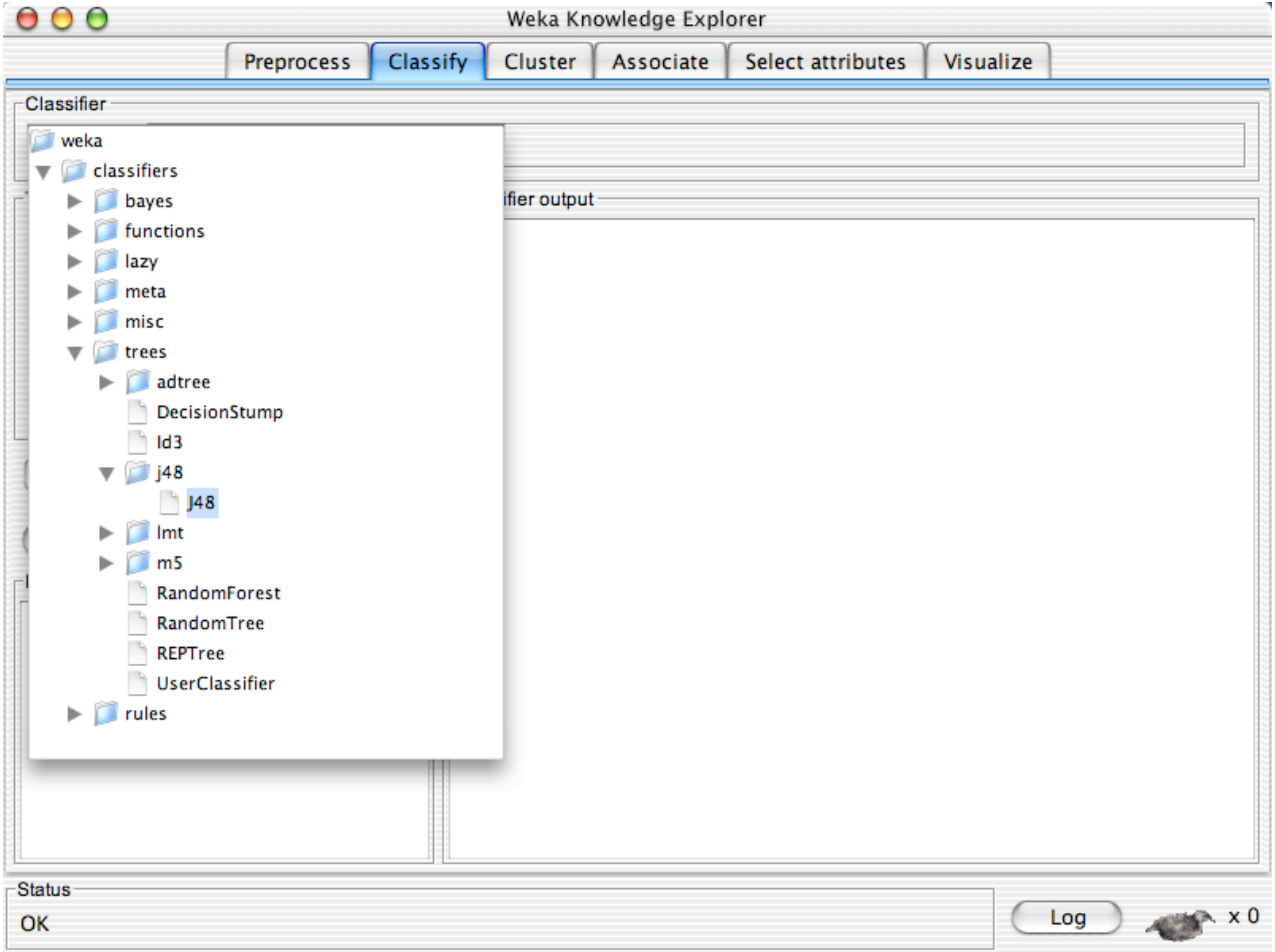
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
Discretize -F -B 10 -R first-last
Apply
Current relation
Relation: iris-weka.filters.unsupervised.attribute.Disc...
Instances: 150
Attributes: 5
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Selected attribute
Name: petallength
Type: Nominal
Missing: 0 (0%)
Distinct: 10
Unique: 0 (0%)
Label
Count
'(-inf-1.45]' 23
'(1.45-1.55]' 14
'(1.55-1.8]' 11
'(1.8-3.95]' 13
'(3.95-4.35]' 14
'(4.35-4.65]' 15
'(4.65-5.05]' 18
Colour: class (Nom)
Visualize All
23
14
11
13
14
15
18
12
17
13
Status
OK
Log
x 0

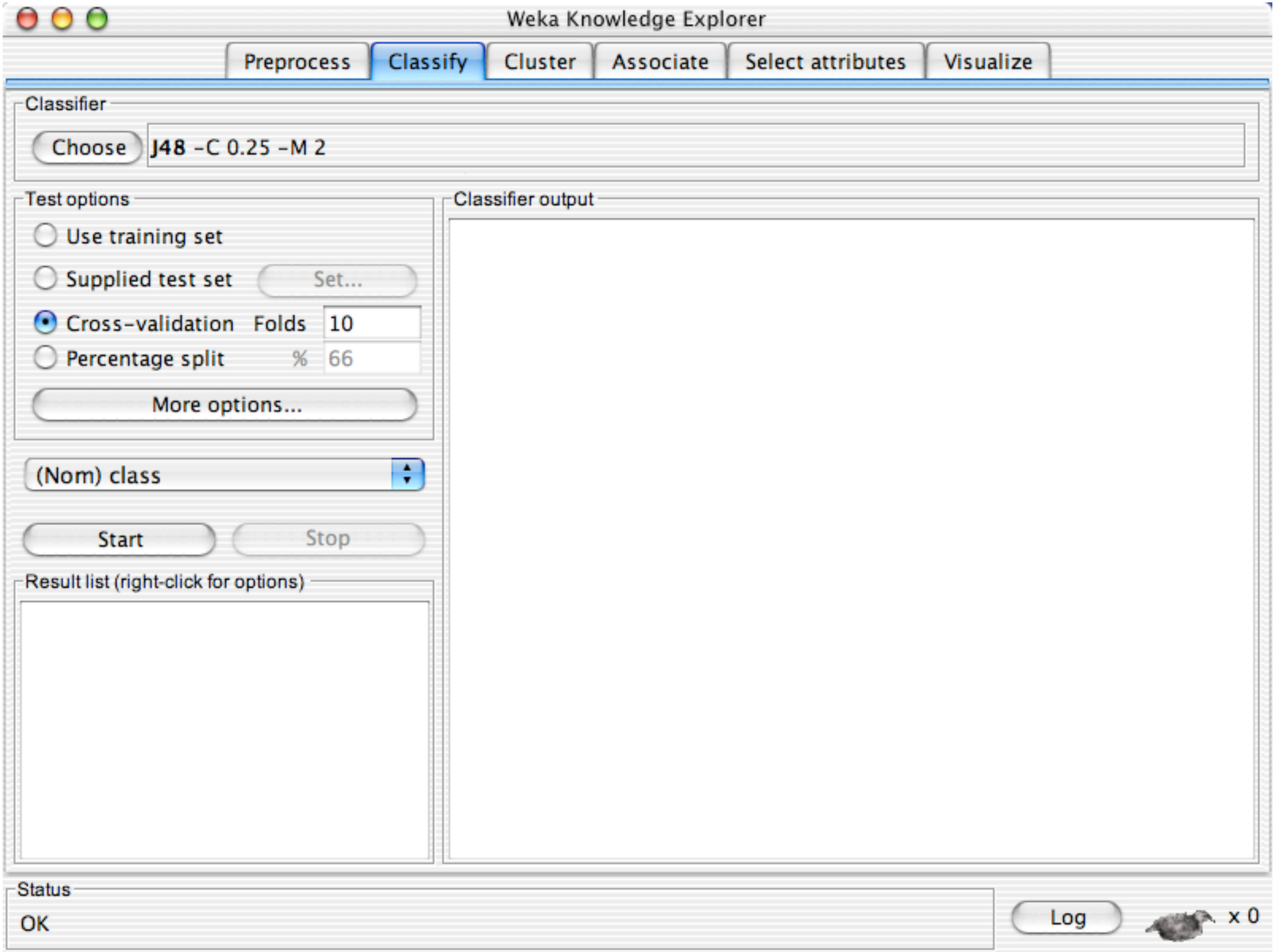
Explorer: building "classifiers"

- Classifiers in WEKA are models for predicting nominal or numeric quantities
- Implemented learning schemes include:
  - Decision trees and lists, instance-based classifiers, support v ector machines, multi-layer perceptrons, logistic regression, Bayes' nets, …
- "Meta"-classifiers include:
  - Bagging, boosting, stacking, error-correcting output codes, lo cally weighted learning, …

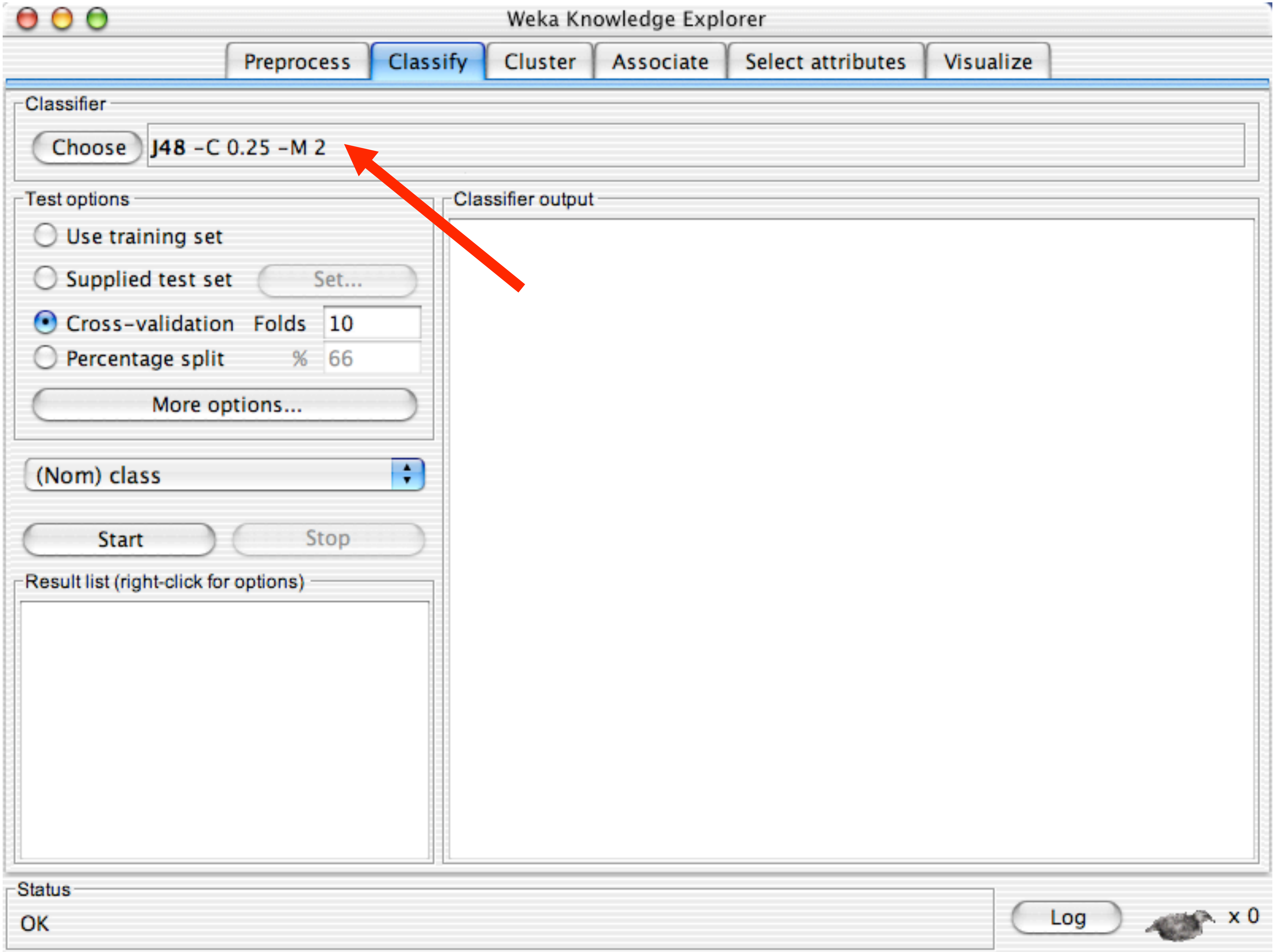

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
ZeroR
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0

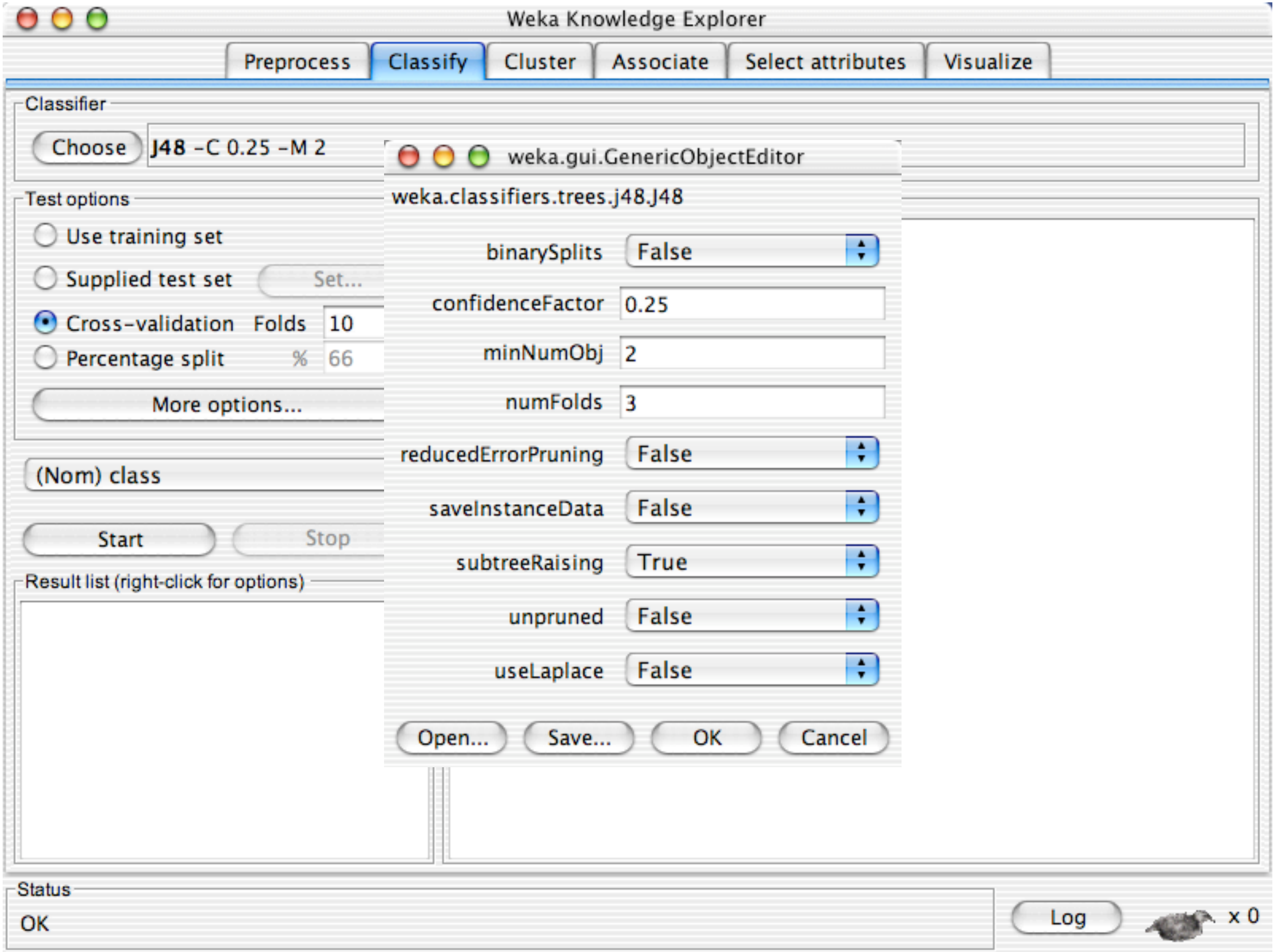

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
ZeroR
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
lazy
meta
misc
trees
adtree
DecisionStump
Id3
j48
J48
lmt
m5
RandomForest
RandomTree
REPTree
UserClassifier
rules
ifier output
Status
OK
Log
x 0

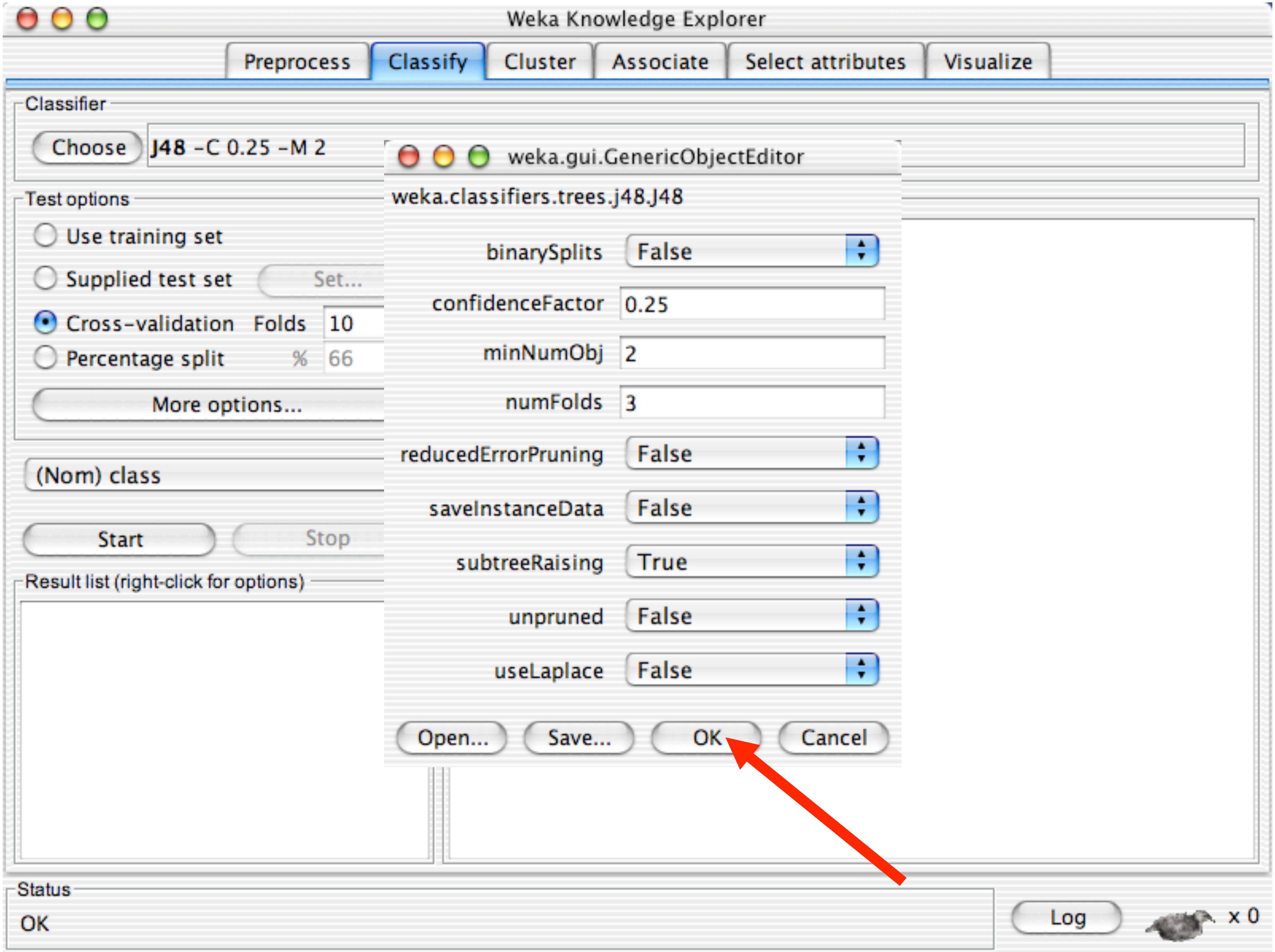


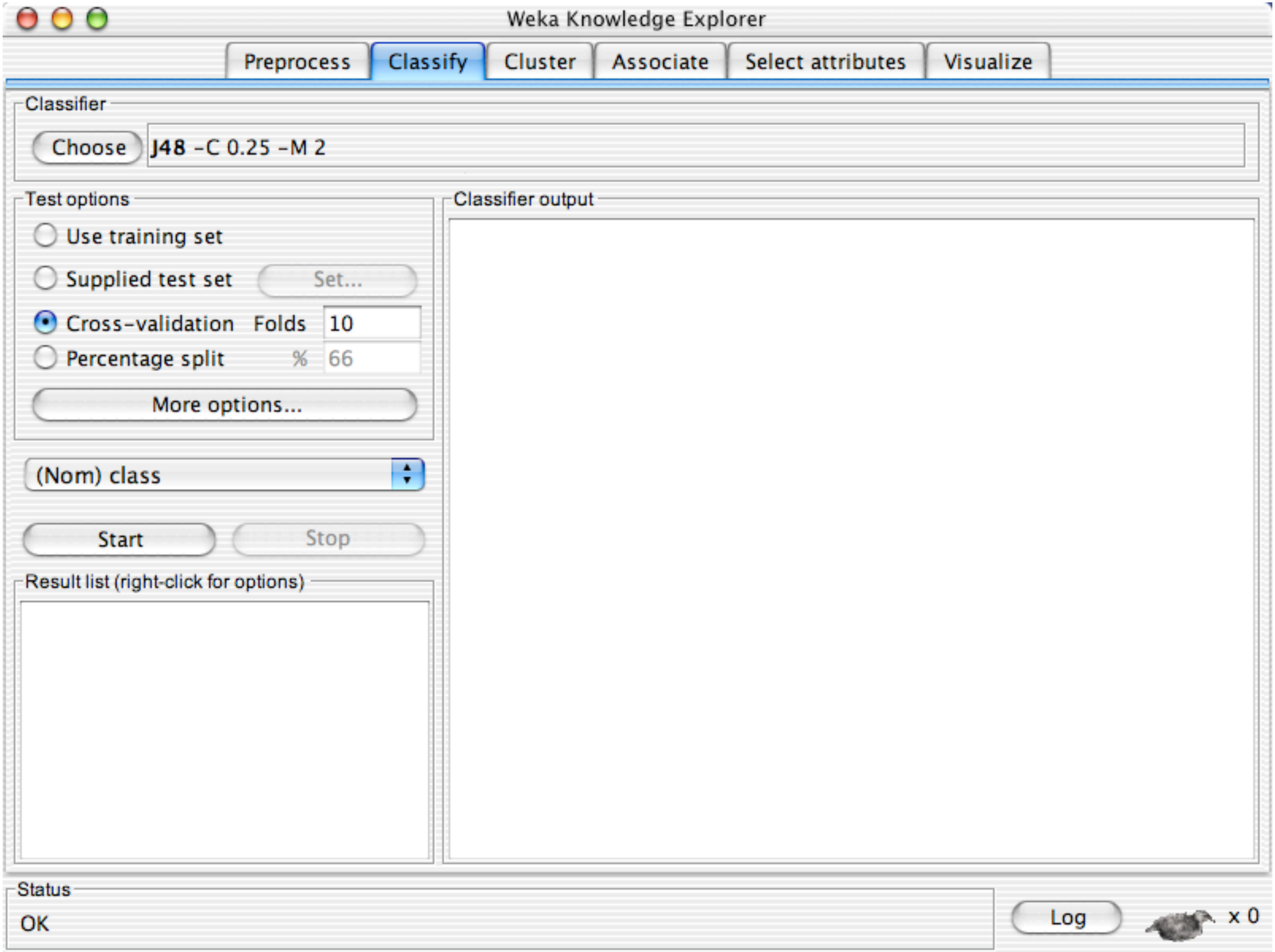
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0

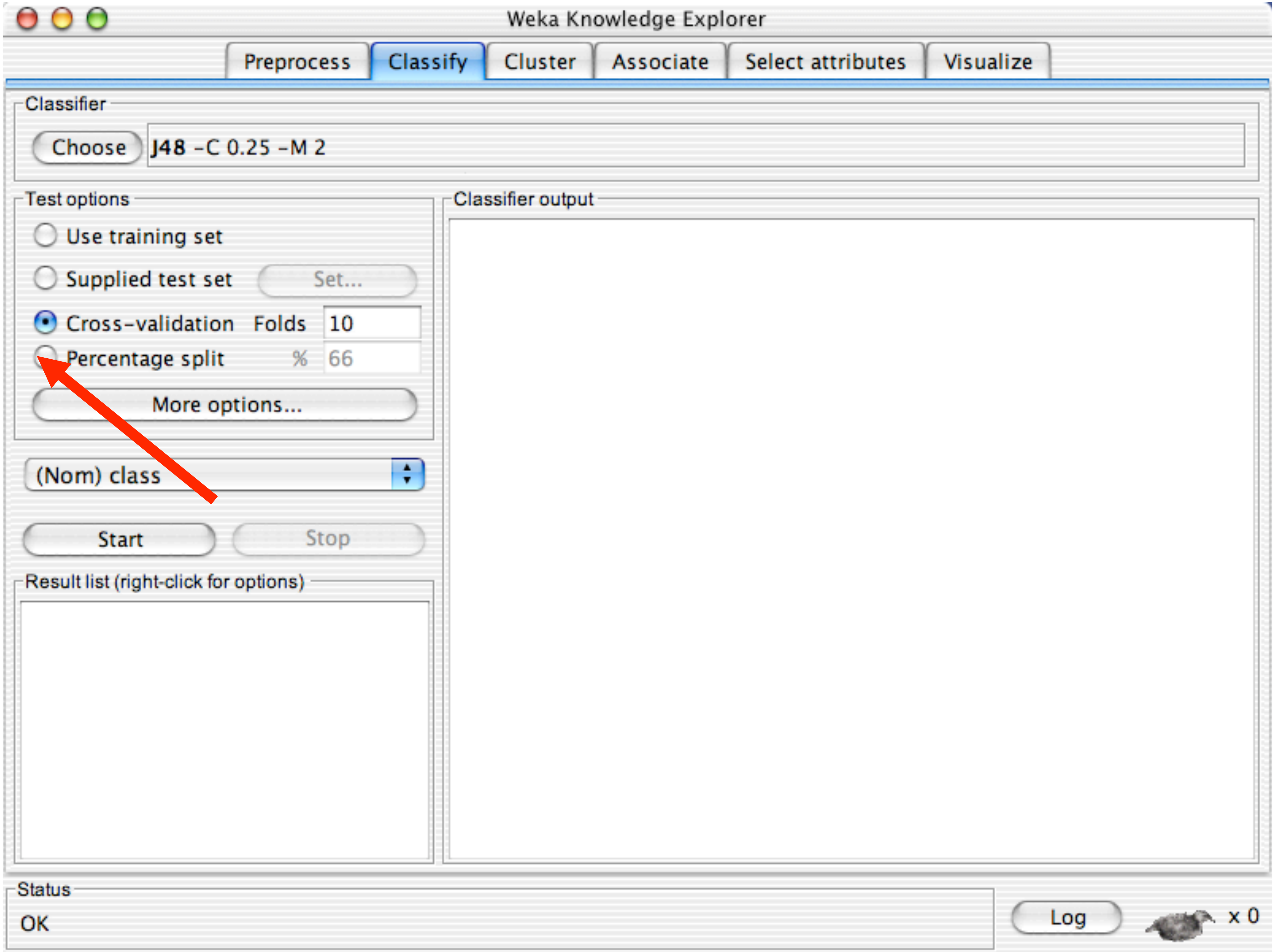

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0

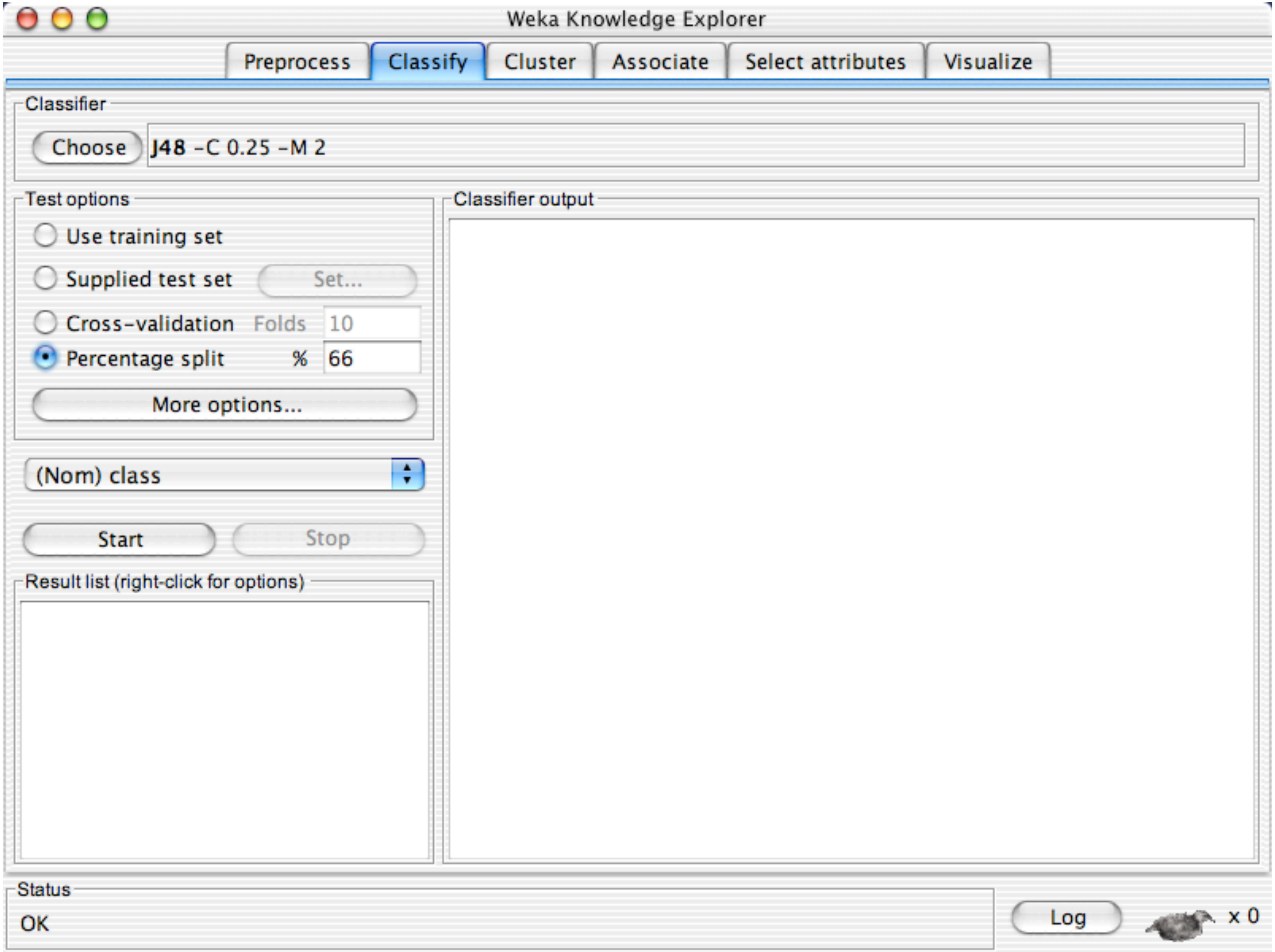


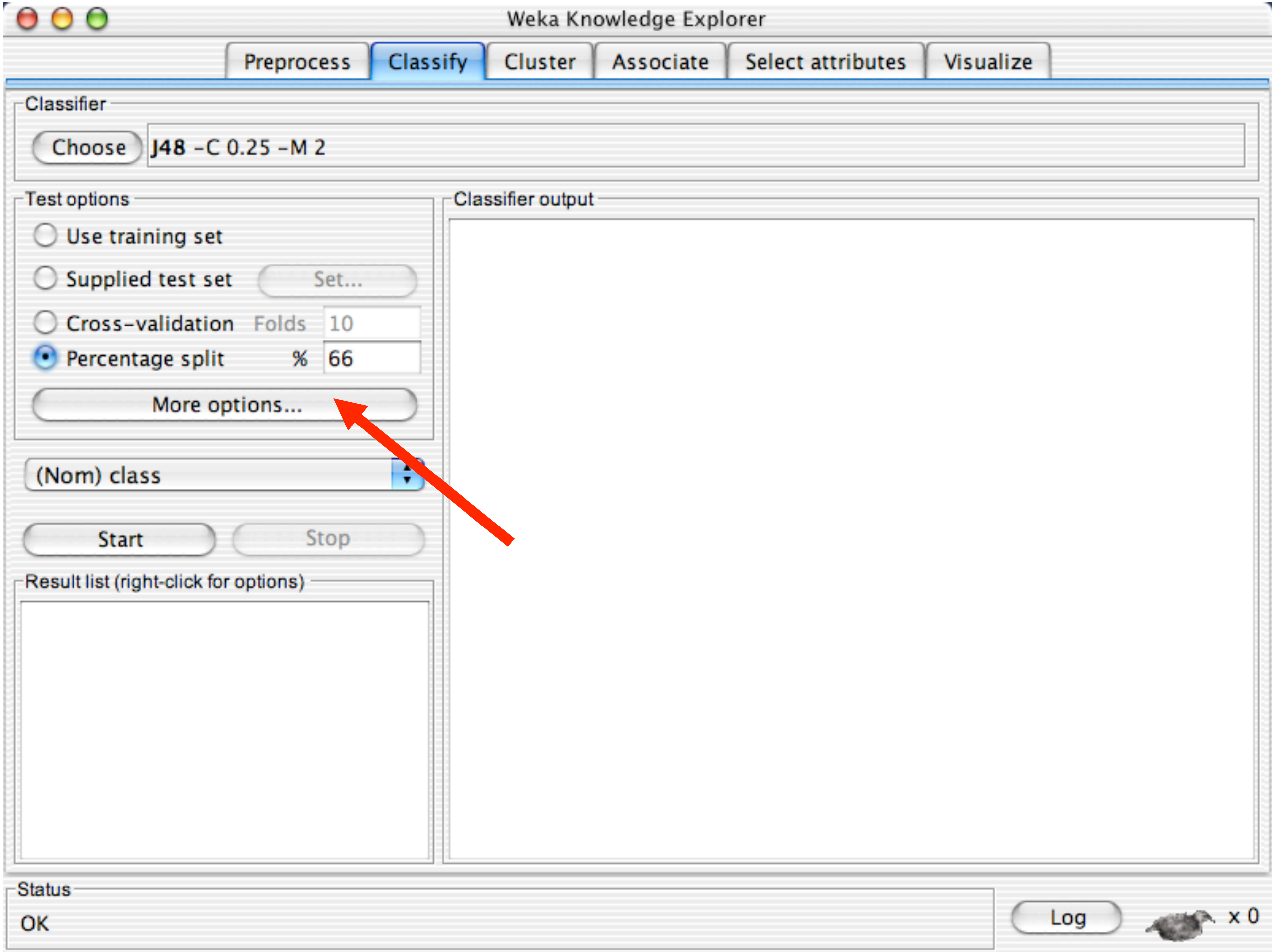
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
weka.gui.GenericObjectEditor
weka.classifiers.trees.j48.J48
binarySplits
False
confidenceFactor
0.25
minNumObj
2
numFolds
3
reducedErrorPruning
False
saveInstanceData
False
subtreeRaising
True
unpruned
False
useLaplace
False
Open...
Save...
OK
Cancel
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
weka.gui.GenericObjectEditor
weka.classifiers.trees.j48.J48
binarySplits
False
confidenceFactor
0.25
minNumObj
2
numFolds
3
reducedErrorPruning
False
saveInstanceData
False
subtreeRaising
True
unpruned
False
useLaplace
False
Open...
Save...
OK
Cancel
Status
OK
Log
x 0

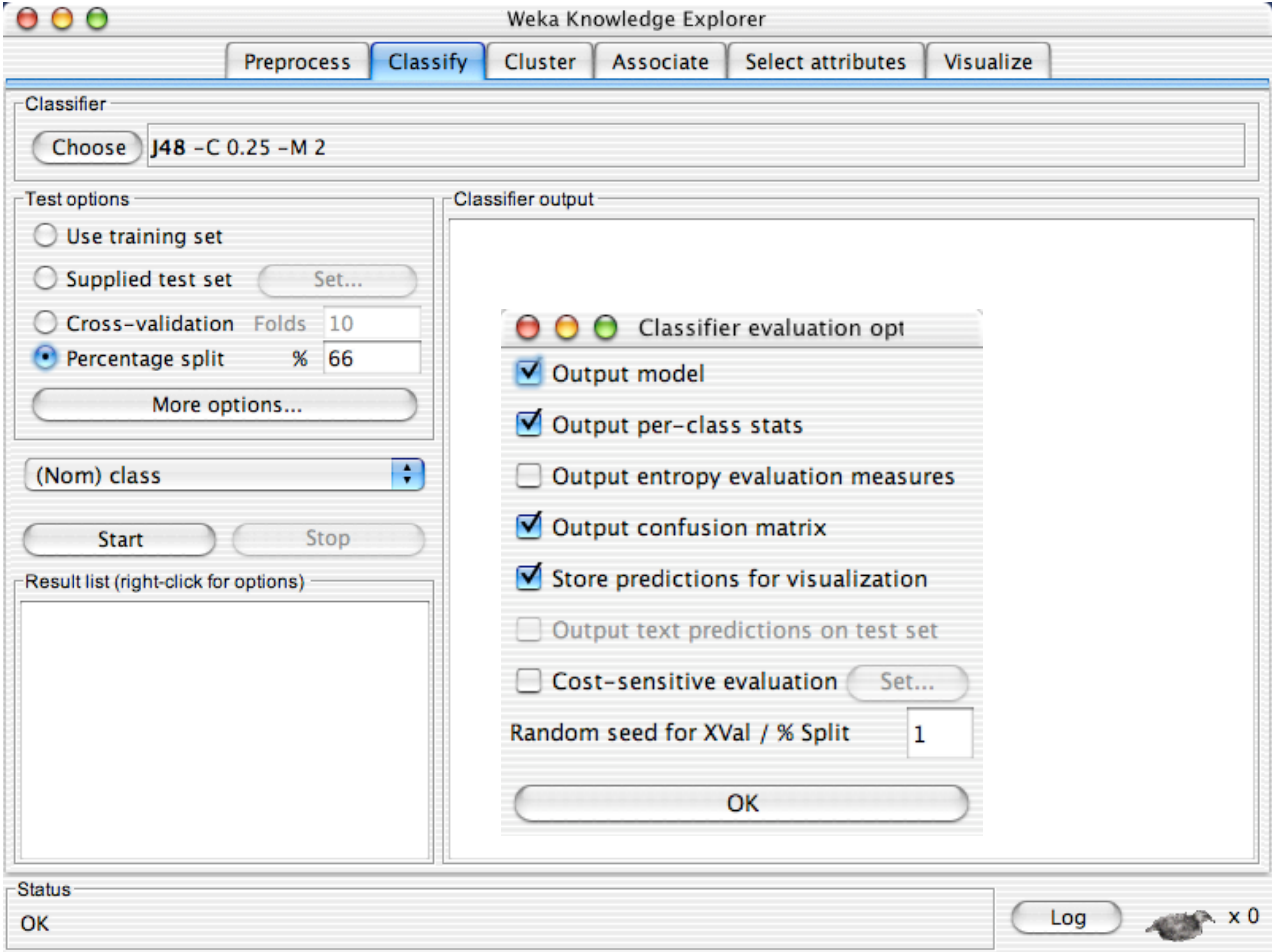

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0

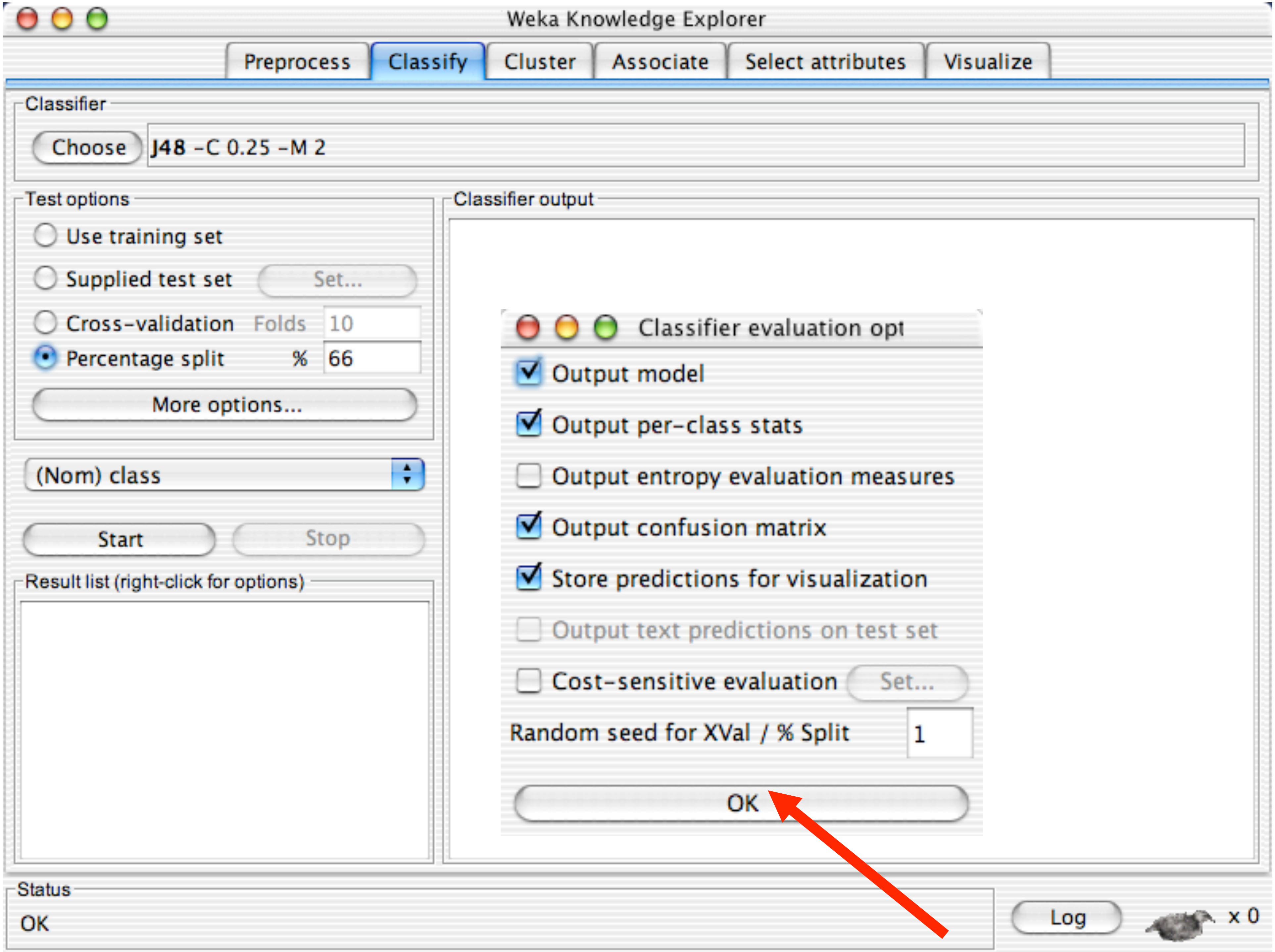

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0

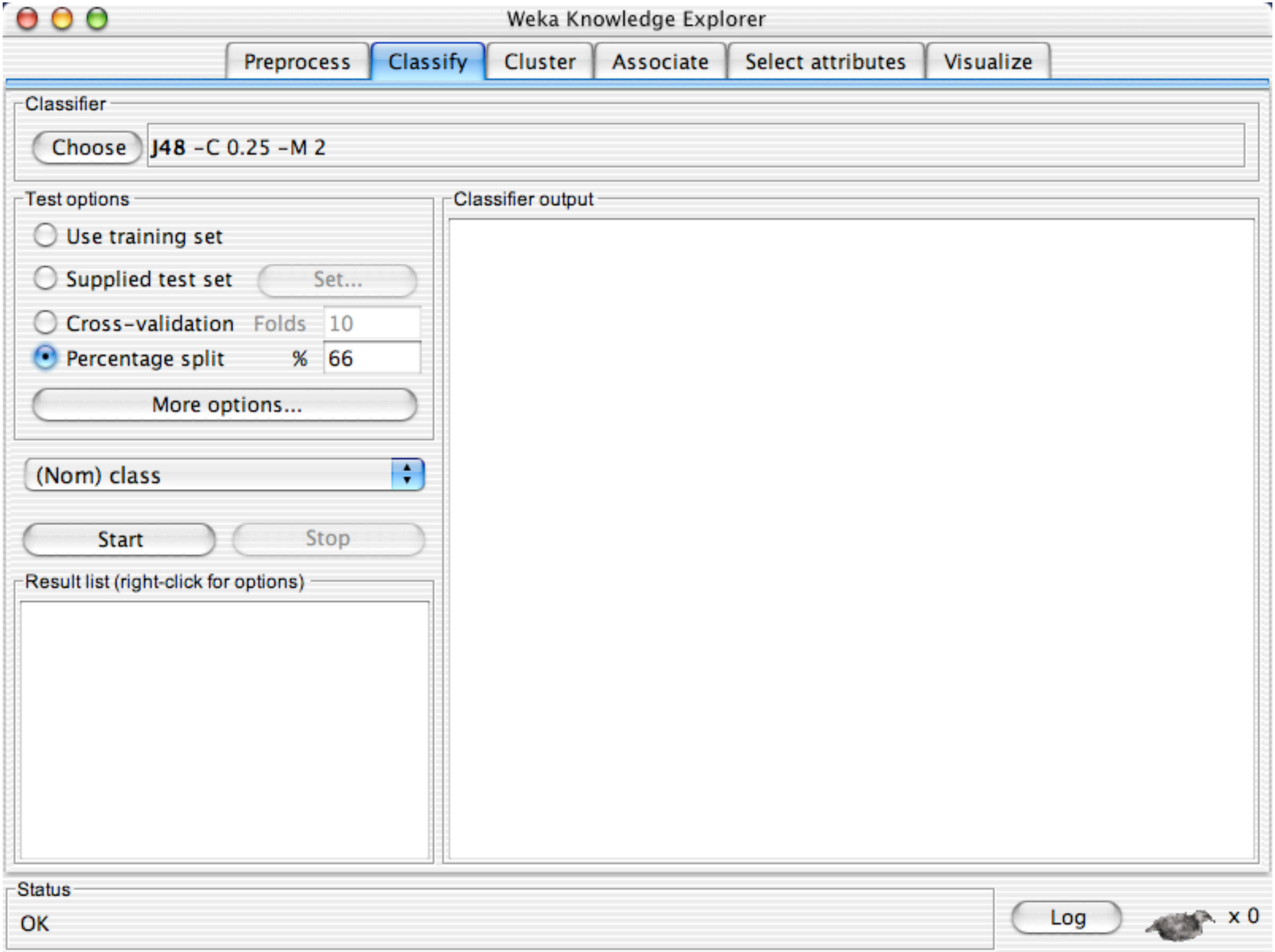

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0

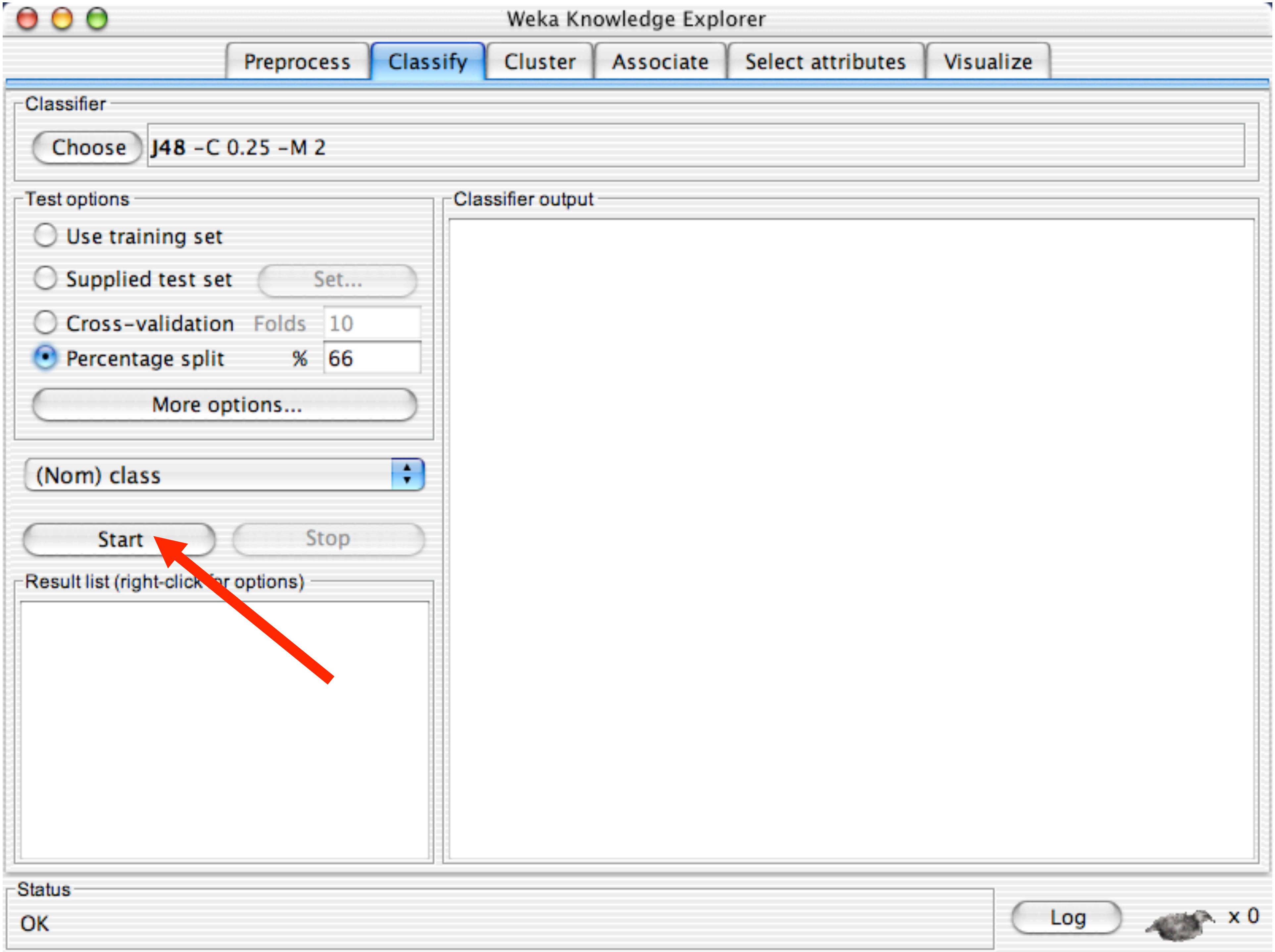


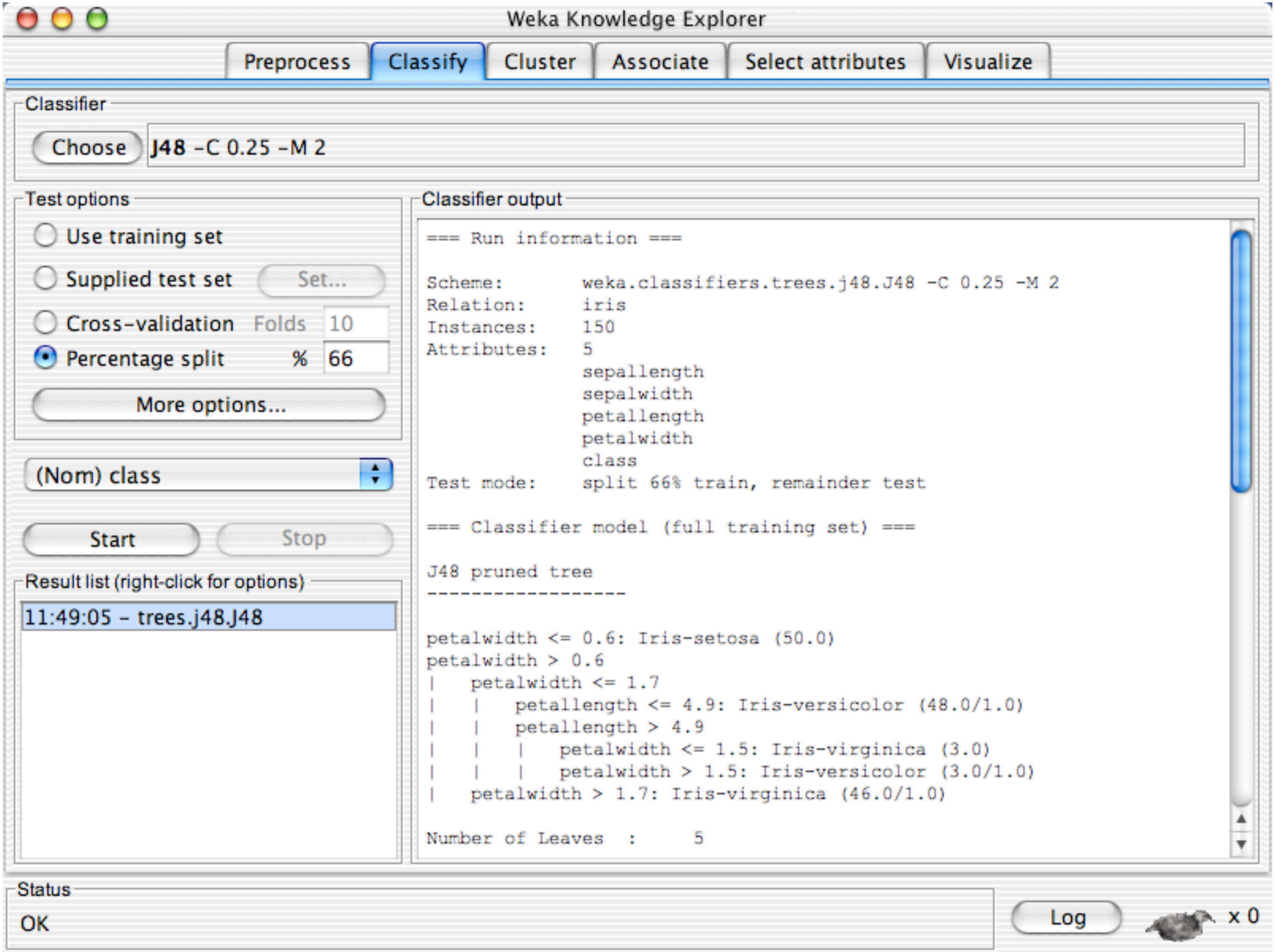
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0

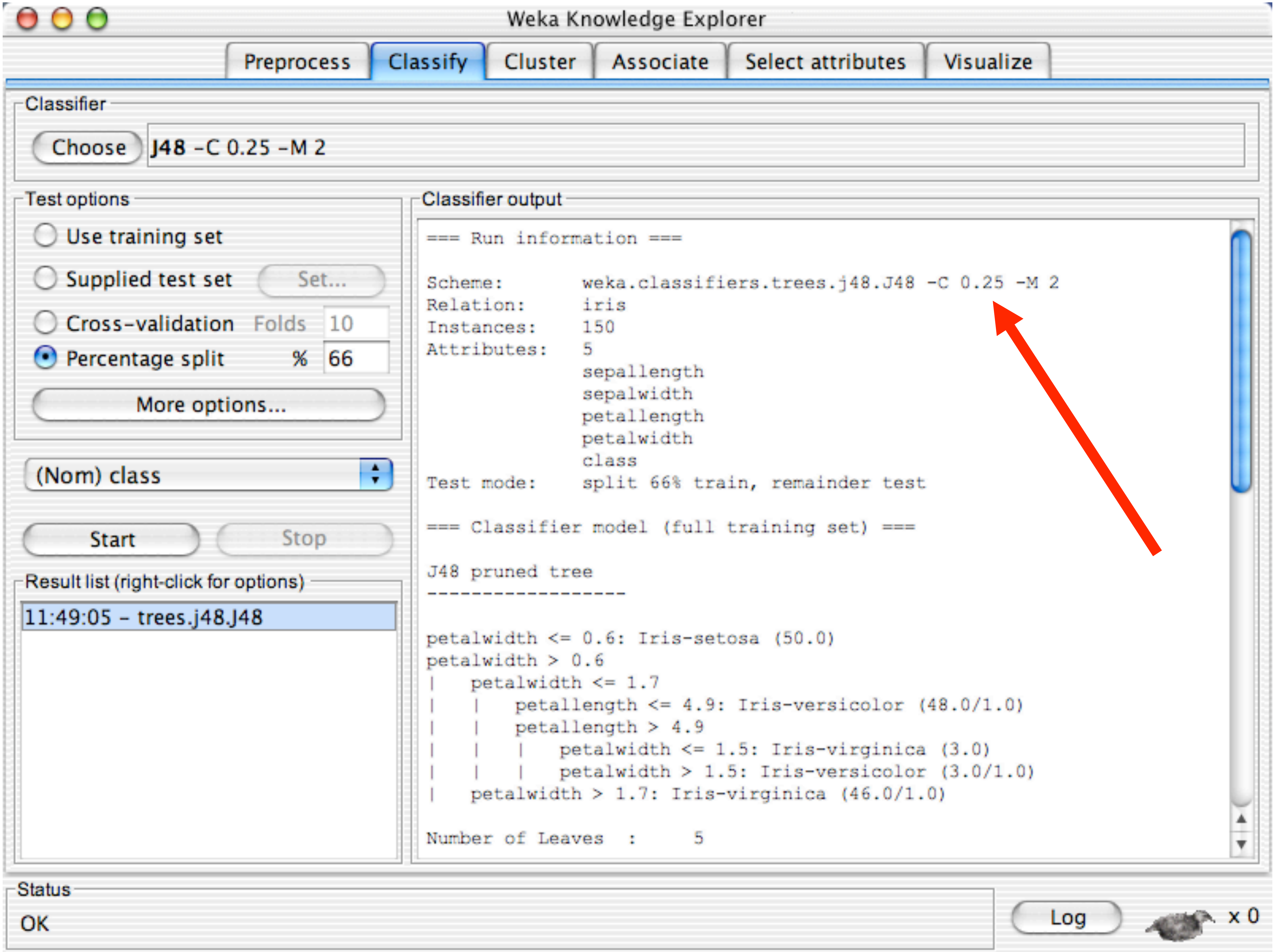

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Classifier evaluation opt
Output model
Output per-class stats
Output entropy evaluation measures
Output confusion matrix
Store predictions for visualization
Output text predictions on test set
Cost-sensitive evaluation
Set...
Random seed for XVal / % Split
1
OK
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
Classifier output
Classifier evaluation opt
Output model
Output per-class stats
Output entropy evaluation measures
Output confusion matrix
Store predictions for visualization
Output text predictions on test set
Cost-sensitive evaluation
Set...
Random seed for XVal / % Split
1
OK
Status
OK
Log
x 0

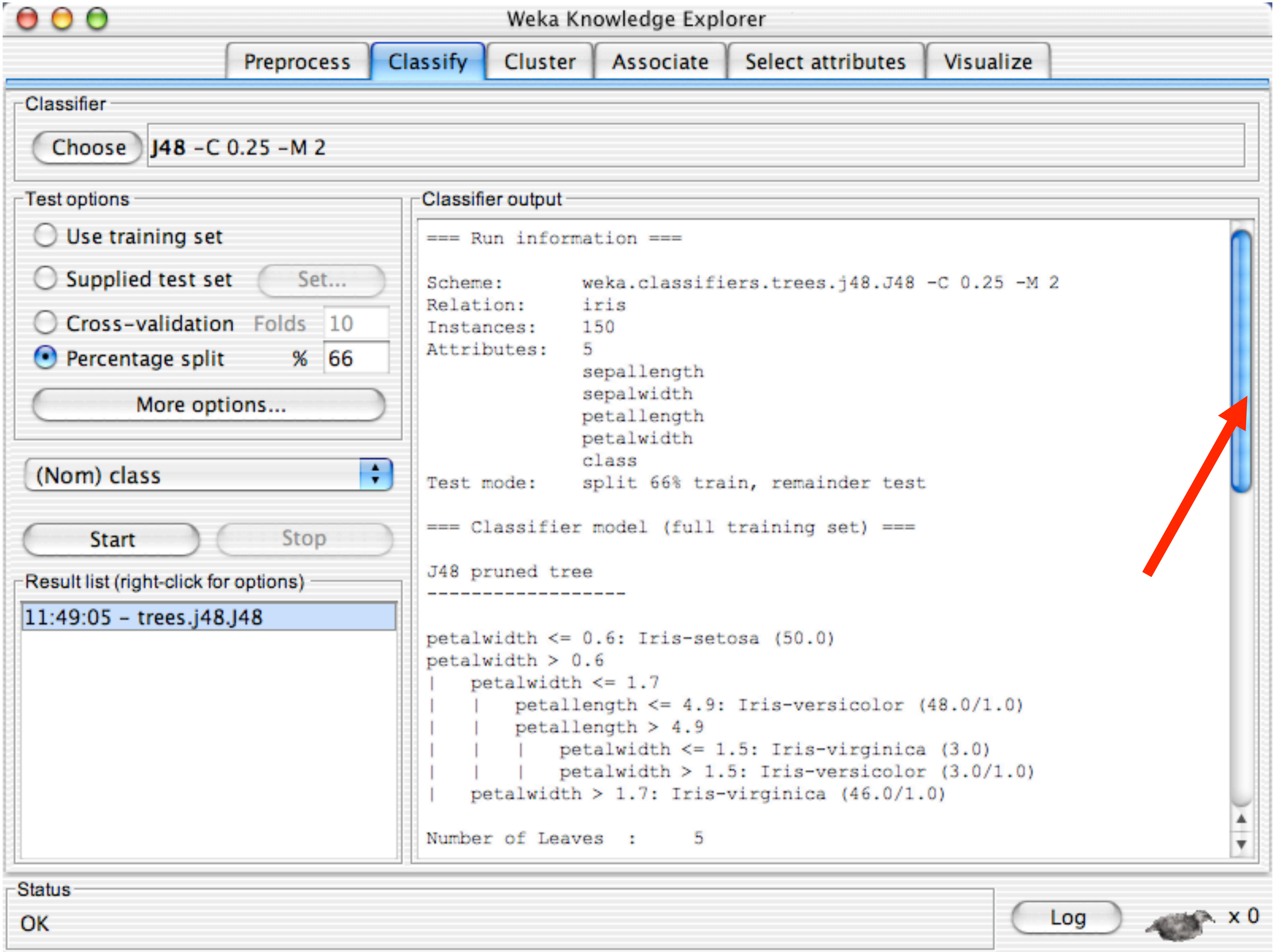

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
=== Run information ===
Scheme: weka.classifiers.trees.j48.J48 -C 0.25 -M 2
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
class
Test mode: split 66% train, remainder test
=== Classifier model (full training set) ===
J48 pruned tree
----
petalwidth <= 0.6: Iris-setosa (50.0)
petalwidth > 0.6
| petalwidth <= 1.7
| | petallength <= 4.9: Iris-versicolor (48.0/1.0)
| | petallength > 4.9
| | | petalwidth <= 1.5: Iris-virginica (3.0)
| | | petalwidth > 1.5: Iris-versicolor (3.0/1.0)
| petalwidth > 1.7: Iris-virginica (46.0/1.0)
Number of Leaves : 5
Status
OK
Log
x 0



Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
=== Run information ===
Scheme: weka.classifiers.trees.j48.J48 -C 0.25 -M 2
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
class
Test mode: split 66% train, remainder test
=== Classifier model (full training set) ===
J48 pruned tree
----
petalwidth <= 0.6: Iris-setosa (50.0)
petalwidth > 0.6
| petalwidth <= 1.7
| | petallength <= 4.9: Iris-versicolor (48.0/1.0)
| | petallength > 4.9
| | | petalwidth <= 1.5: Iris-virginica (3.0)
| | | petalwidth > 1.5: Iris-versicolor (3.0/1.0)
| petalwidth > 1.7: Iris-virginica (46.0/1.0)
Number of Leaves : 5
Status
OK
Log
x 0



Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
=== Run information ===
Scheme: weka.classifiers.trees.j48.J48 -C 0.25 -M 2
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
class
Test mode: split 66% train, remainder test
=== Classifier model (full training set) ===
J48 pruned tree
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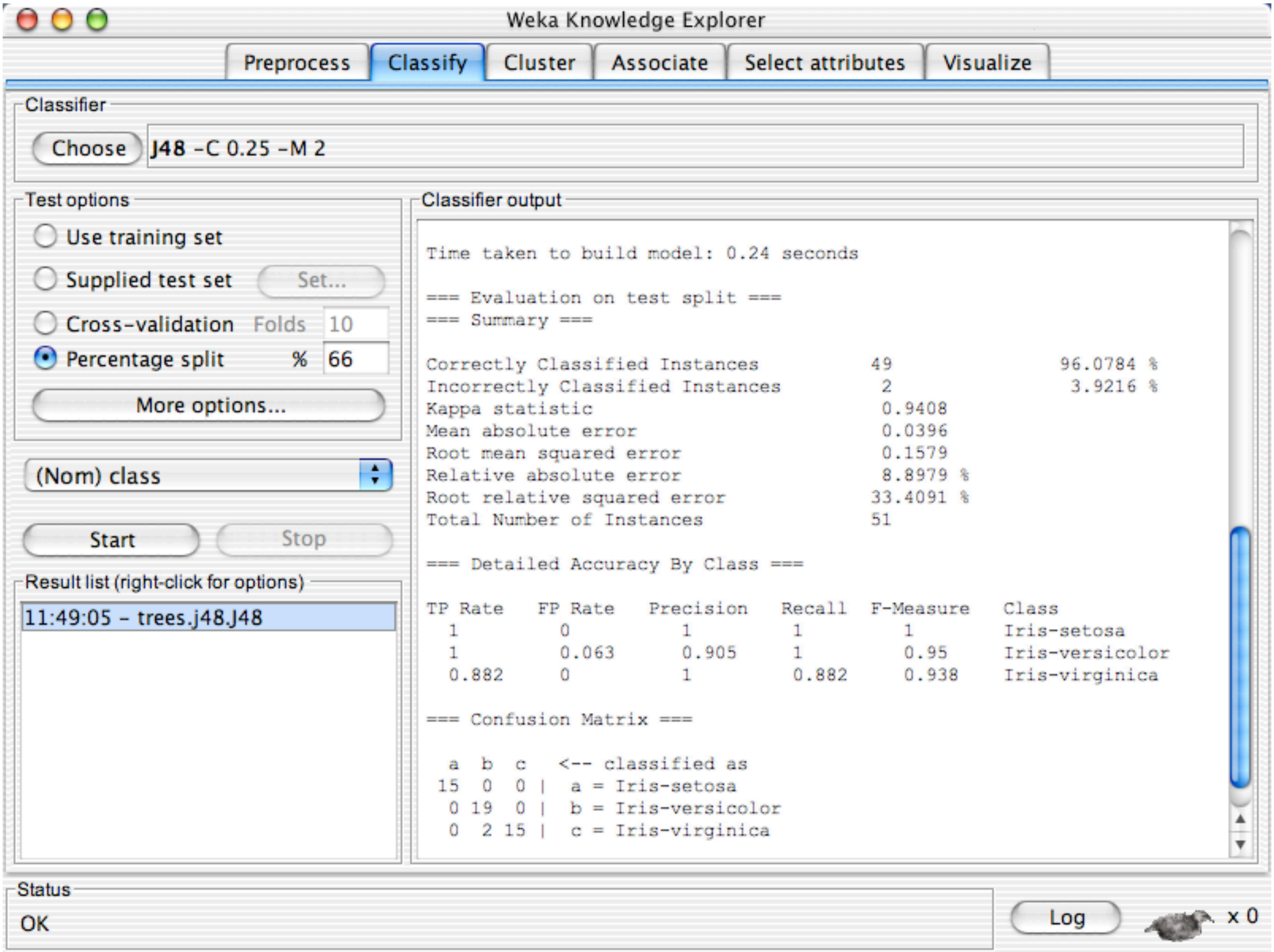
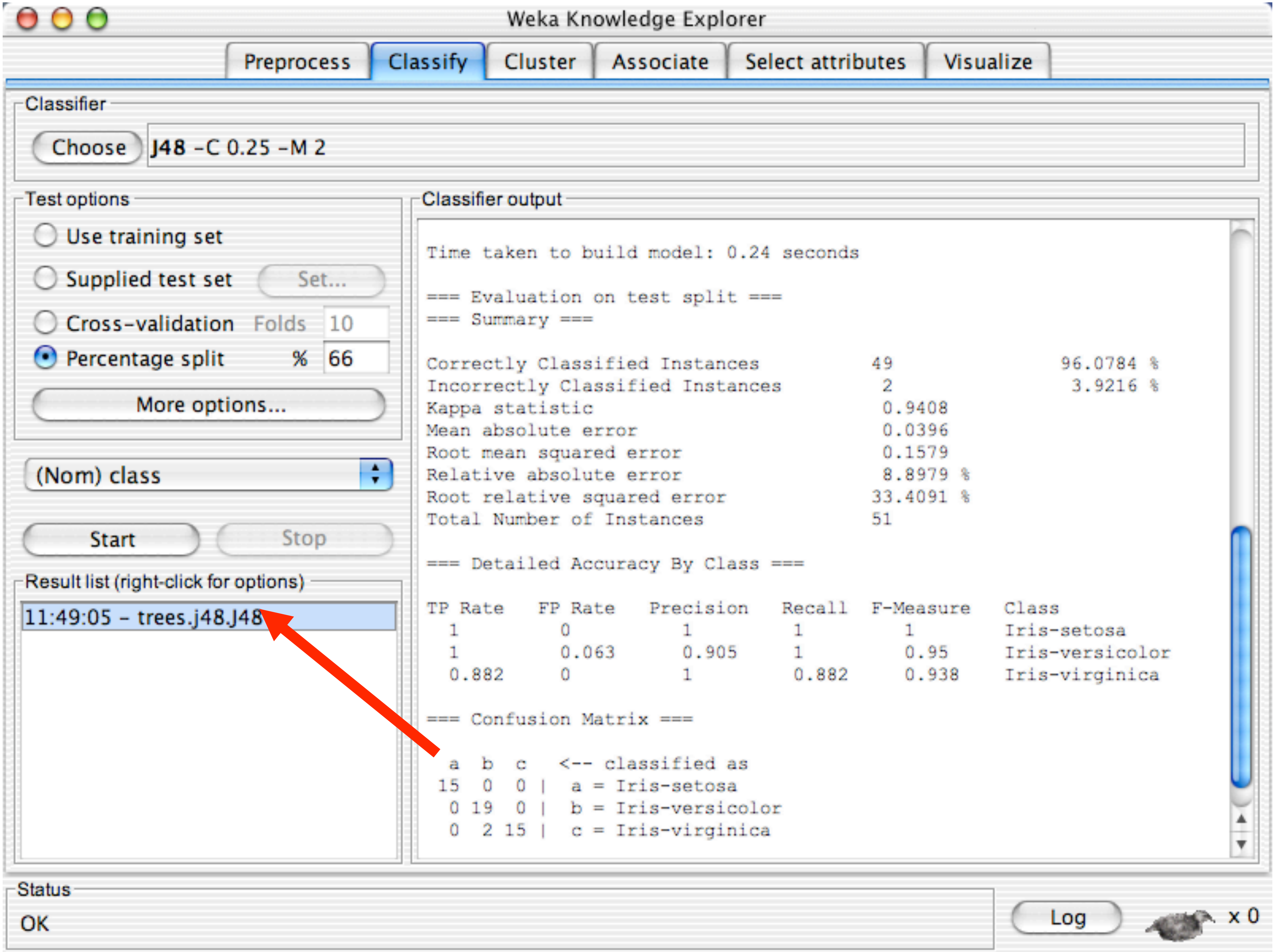
petalwidth > 0.6
| petalwidth <= 1.7
| | petallength <= 4.9: Iris-versicolor (48.0/1.0)
| | petallength > 4.9
| | | petalwidth <= 1.5: Iris-virginica (3.0)
| | | petalwidth > 1.5: Iris-versicolor (3.0/1.0)
| petalwidth > 1.7: Iris-virginica (46.0/1.0)
Number of Leaves : 5
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
Mean absolute error 0.0396
Root mean squared error 0.1579
Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
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0.882 0 1 0.882 0.938 Iris-virginica
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a b c <-- classified as
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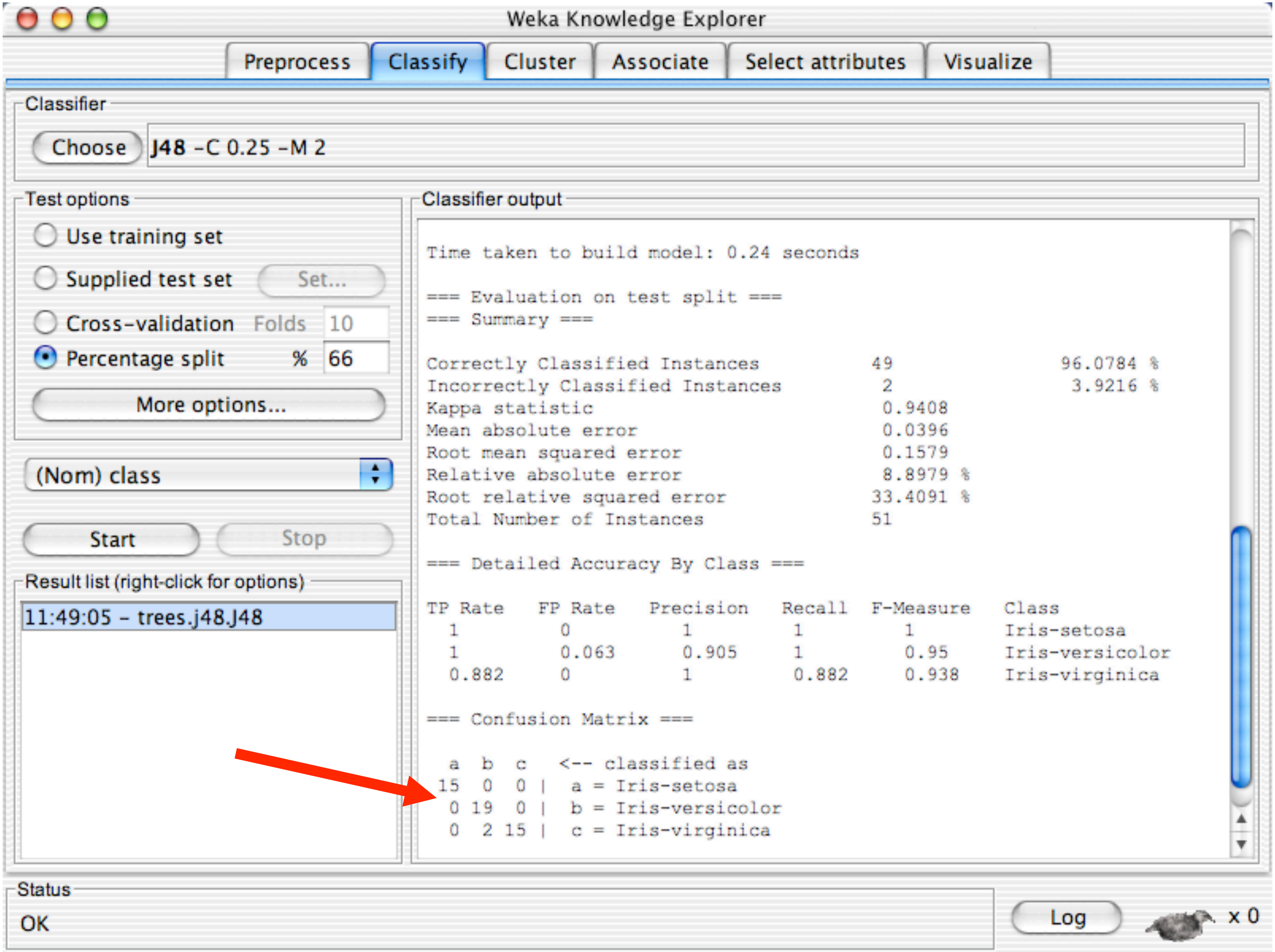
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
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=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
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Root mean squared error 0.1579
Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
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1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
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a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0

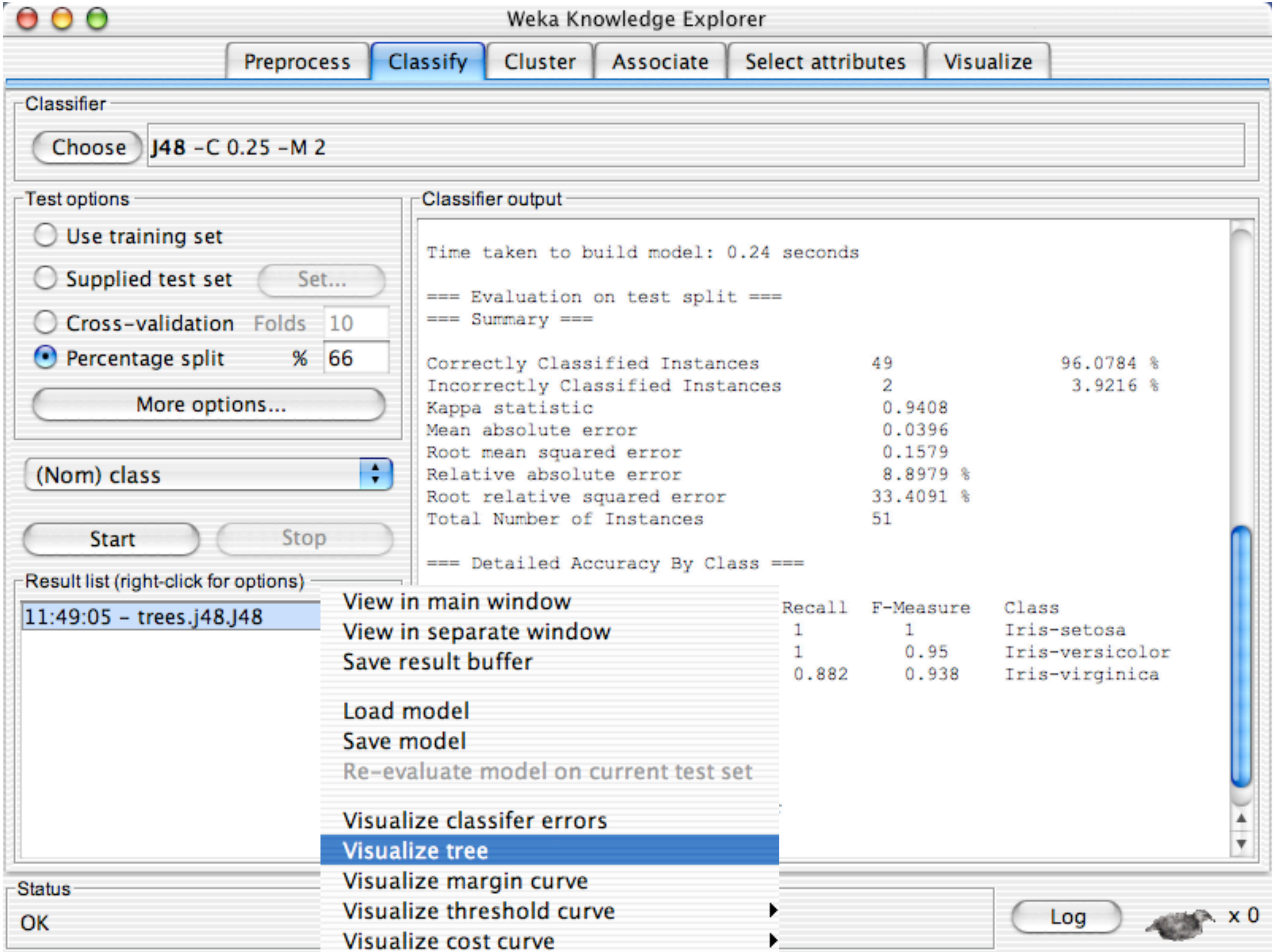
a	b	c	<-- classified as
15	0	0	a= Iris-setosa
0	19	0	b=Iris-versicolor
0	2	15	c=Iris-virginica

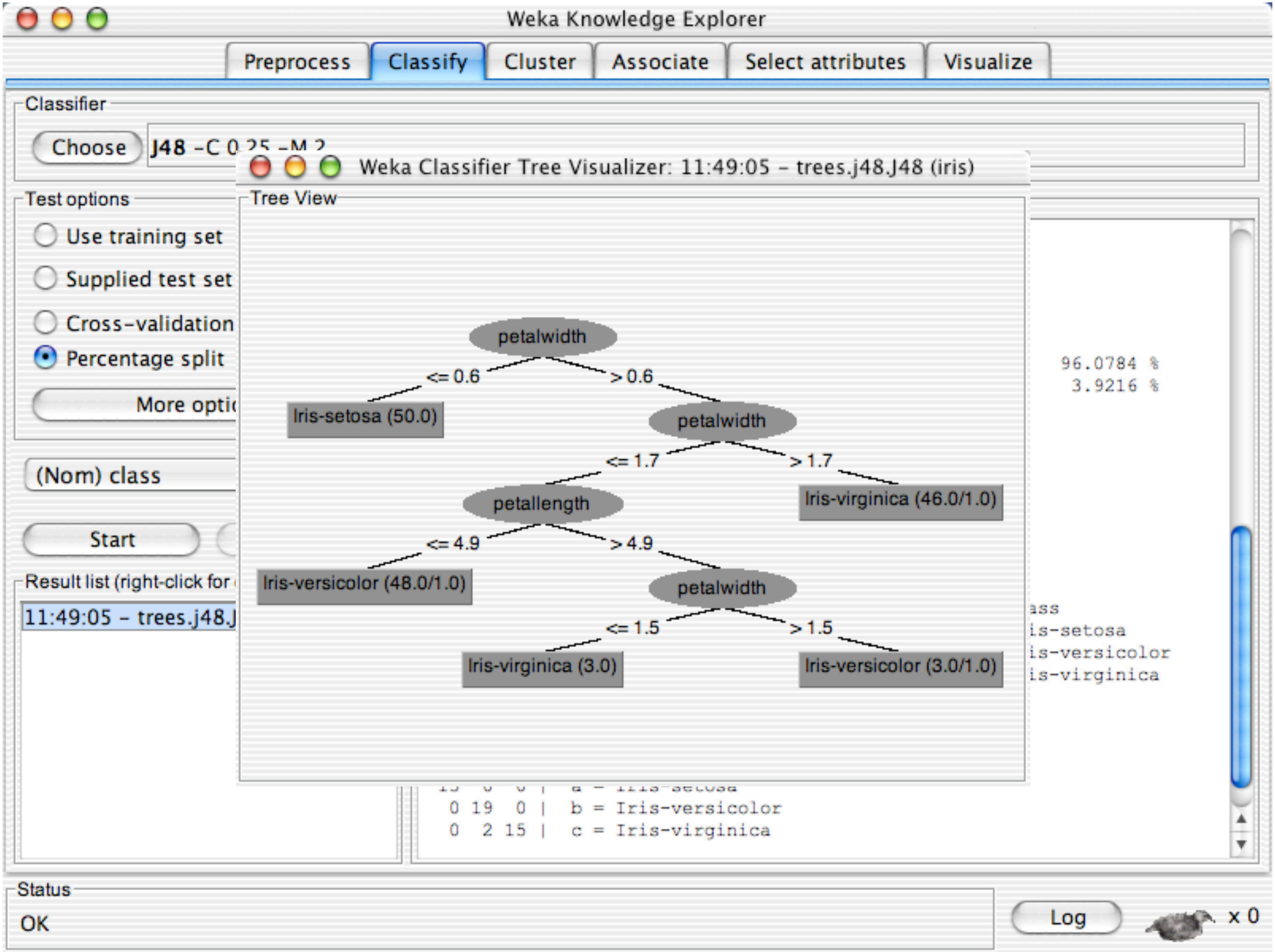
consider "TRUE"= iris-virginica and FALSE= everything else

	Ground truth	
	FALSE	TRUE
detector silent	A =34	B = 2
detector loud	C= 0	D = 15

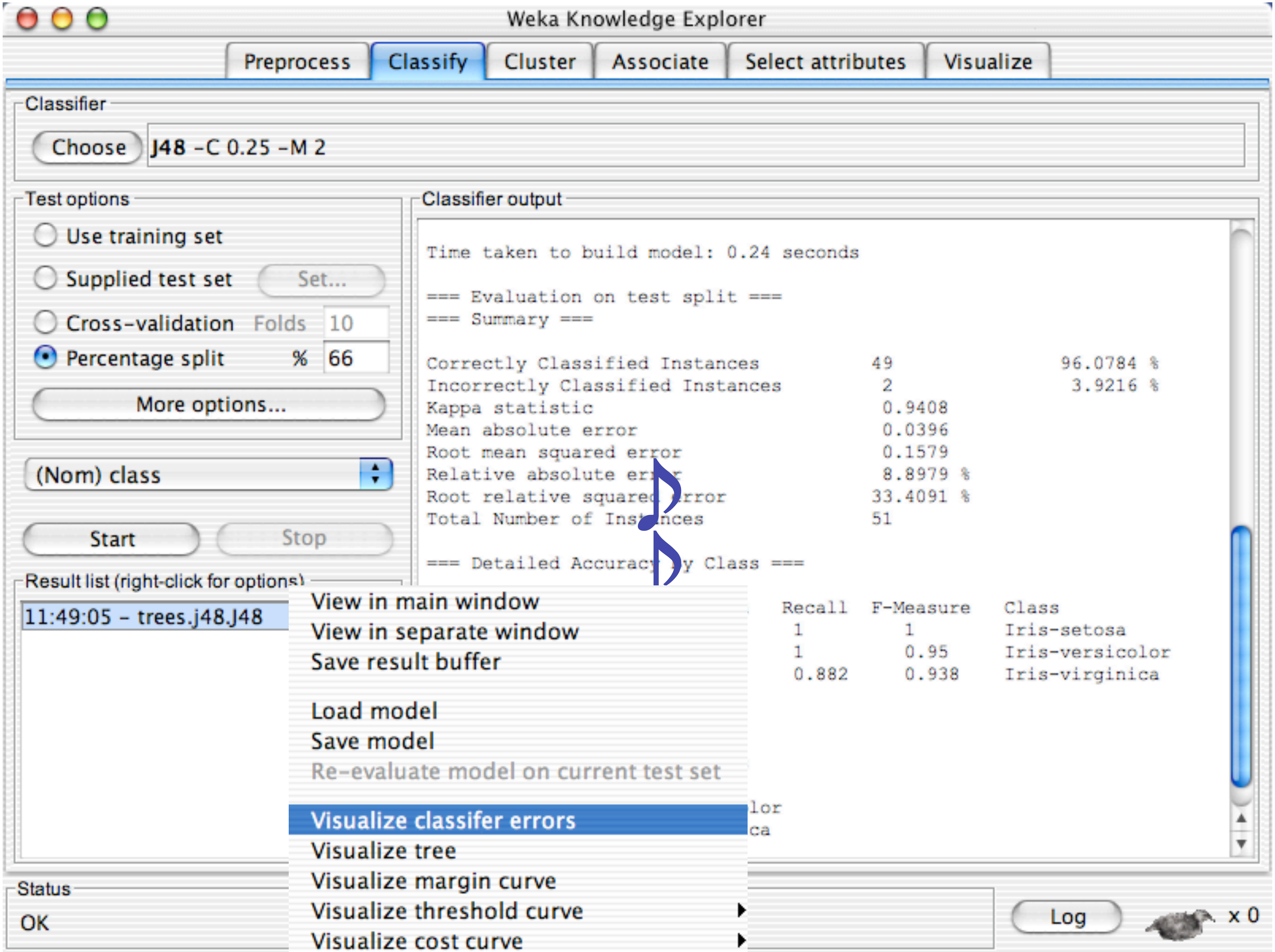
accuracy	(A+D)/(A+B+C+D)	(34+15)/51	96%
recall (pd)	D/(B+D)	15/(2+15)	88%
false alarm (pf)	C/(A+C)	0/34	0%
precision	D/(C+D)	15/(15+0)	100%
f-measure	2*prec*pd/ (prec+pd)	2*1*0.88/ (1+0.88)	94%

Collect separately for each class.
Repeat 10 times (re-ordering data) * 10-way
Repeat for each learner * discretizer * x * y * ….


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
Mean absolute error 0.0396
Root mean squared error 0.1579
Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
Recall F-Measure Class
1 1 Iris-setosa
1 0.95 Iris-versicolor
0.882 0.938 Iris-virginica
View in main window
View in separate window
Save result buffer
Load model
Save model
Re-evaluate model on current test set
Visualize classifer errors
Visualize tree
Visualize margin curve
Visualize threshold curve
Visualize cost curve
Status
OK
Log
x 0



Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Weka Classifier Tree Visualizer: 11:49:05 - trees.j48.J48 (iris)
Test options
Tree View
Use training set
Supplied test set
Cross-validation
Percentage split
More opti
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.J
petalwidth
<= 0.6
> 0.6
Iris-setosa (50.0)
petalwidth
<= 1.7
> 1.7
petallength
Iris-virginica (46.0/1.0)
<= 4.9
> 4.9
Iris-versicolor (48.0/1.0)
petalwidth
<= 1.5
> 1.5
Iris-virginica (3.0)
Iris-versicolor (3.0/1.0)
96.0784 %
3.9216 %
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
Mean absolute error 0.0396
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Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
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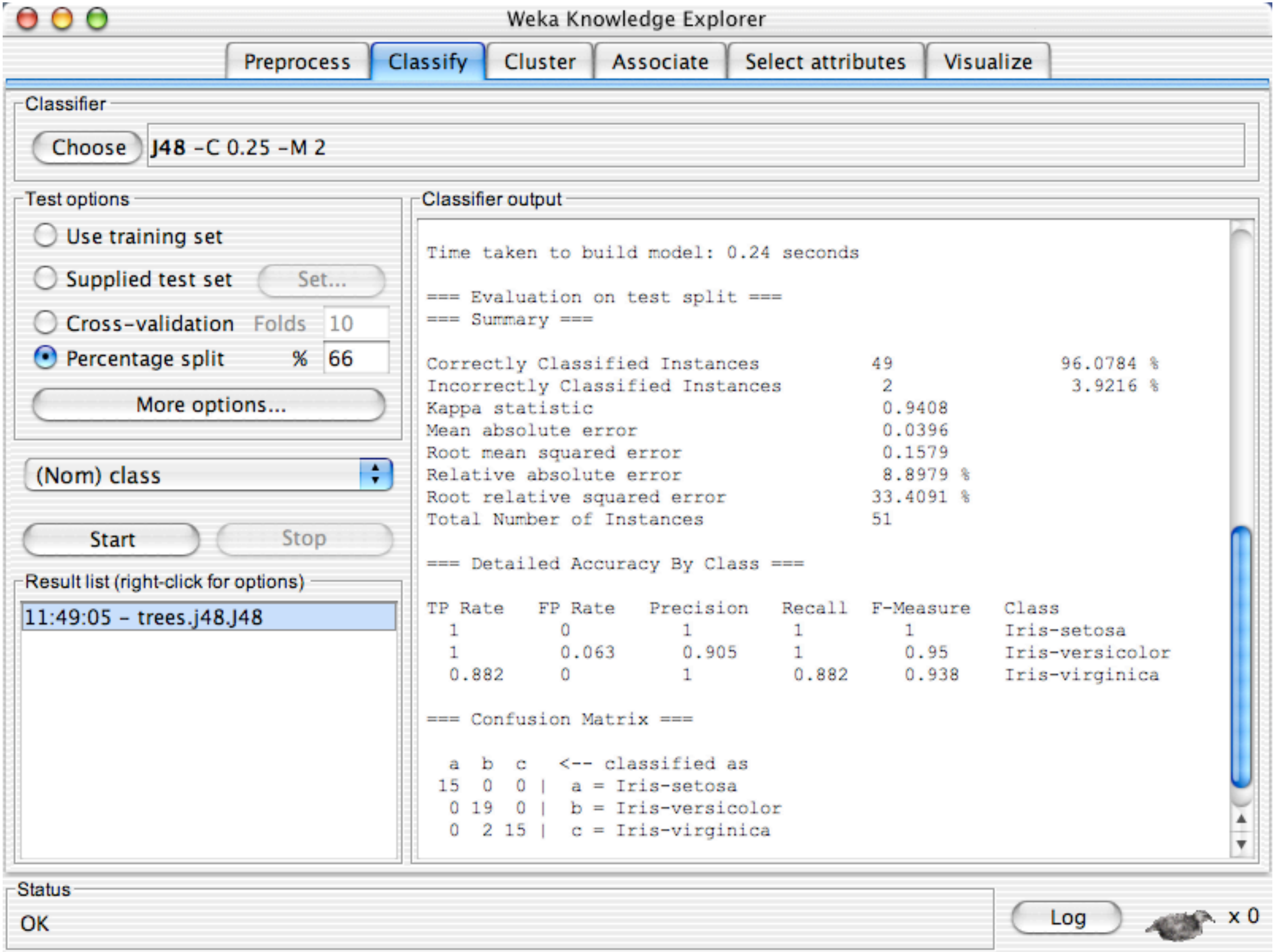
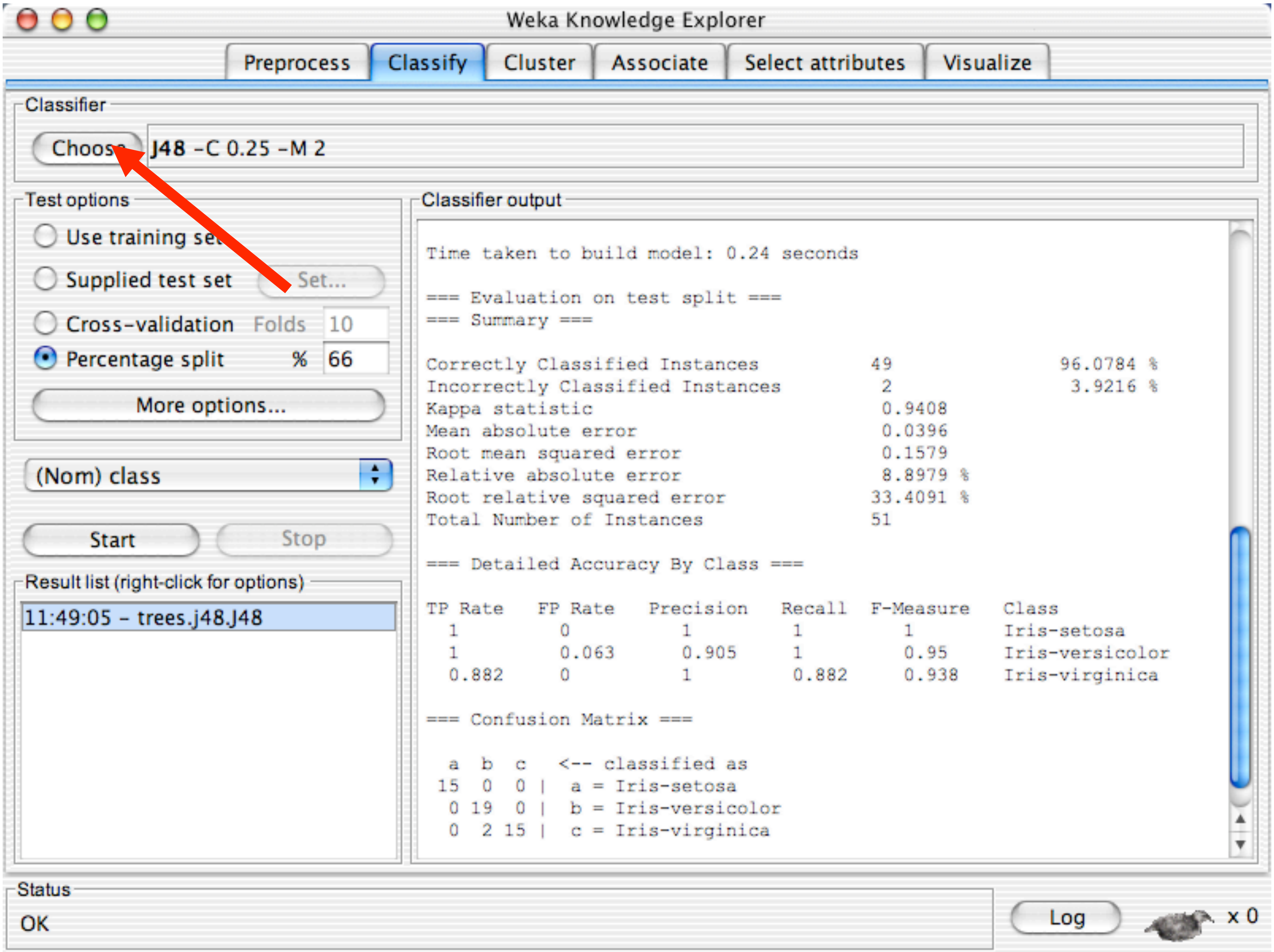
=== Detailed Accuracy By Class ===
Recall F-Measure Class
1 1 Iris-setosa
1 0.95 Iris-versicolor
0.882 0.938 Iris-virginica
View in main window
View in separate window
Save result buffer
Load model
Save model
Re-evaluate model on current test set
Visualize classifer errors
Visualize tree
Visualize margin curve
Visualize threshold curve
Visualize cost curve
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
Mean absolute error 0.0396
Root mean squared error 0.1579
Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
=== Evaluation on test split ===
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Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
Mean absolute error 0.0396
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Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
Total Number of Instances 51
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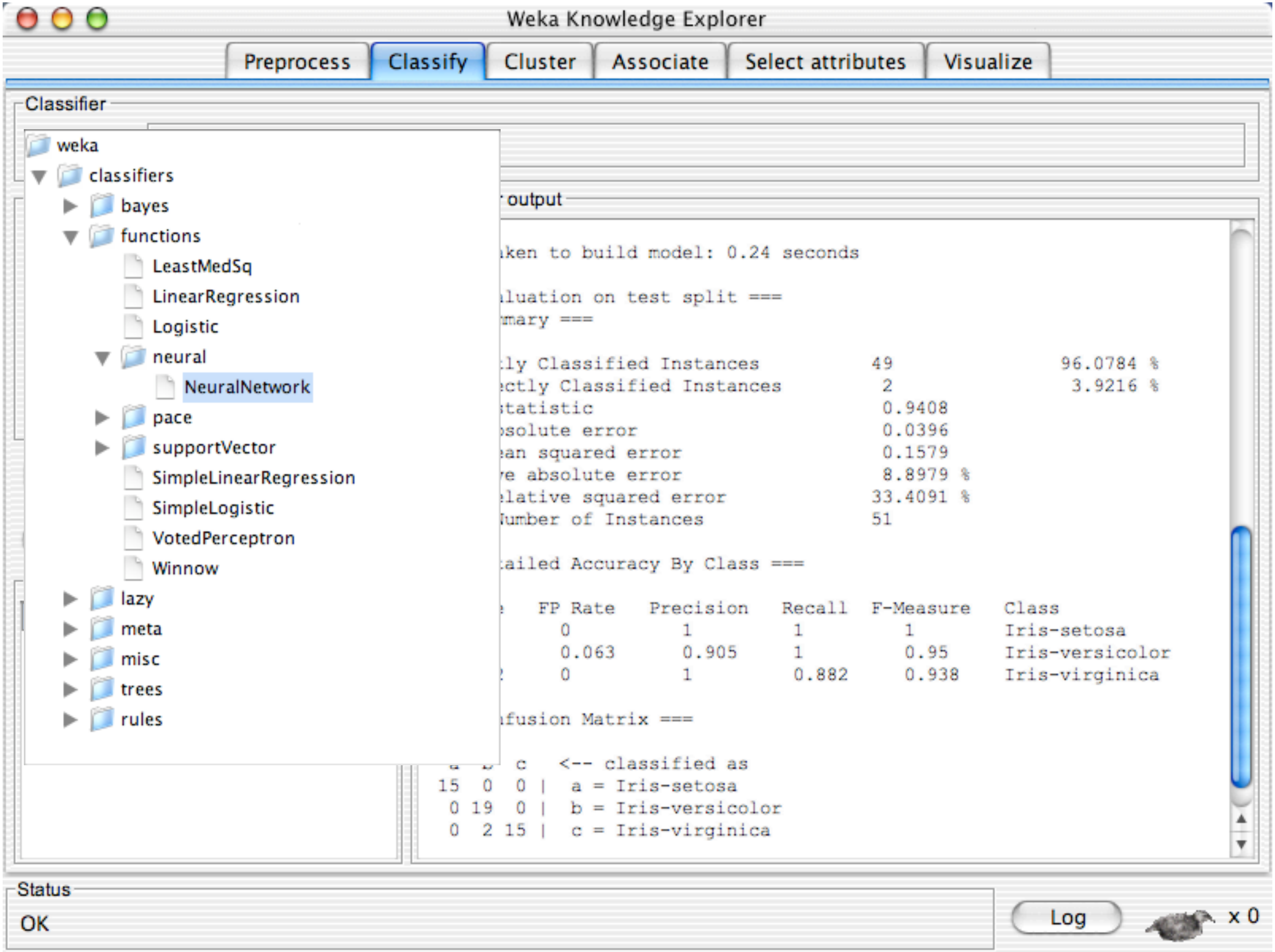
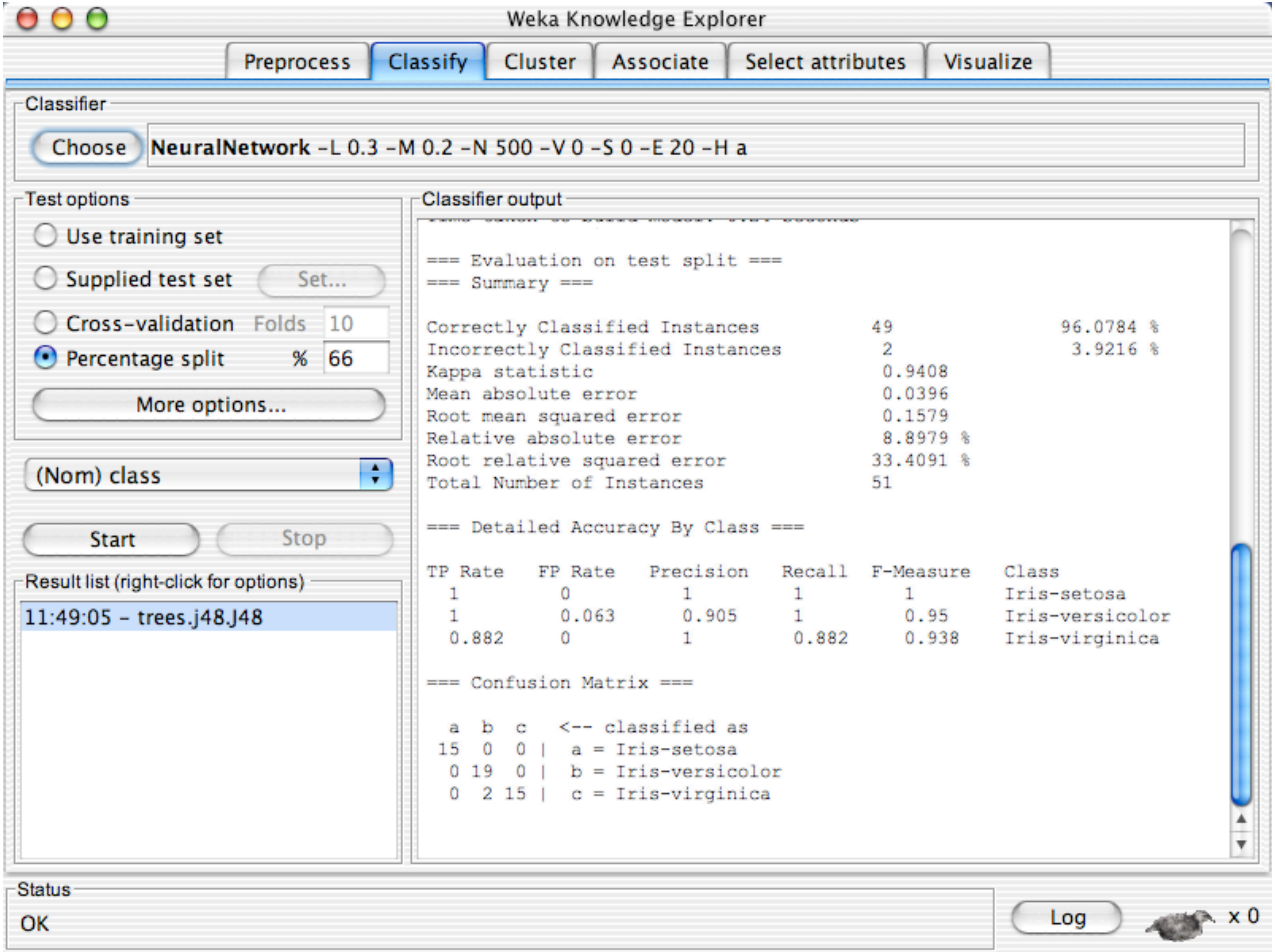
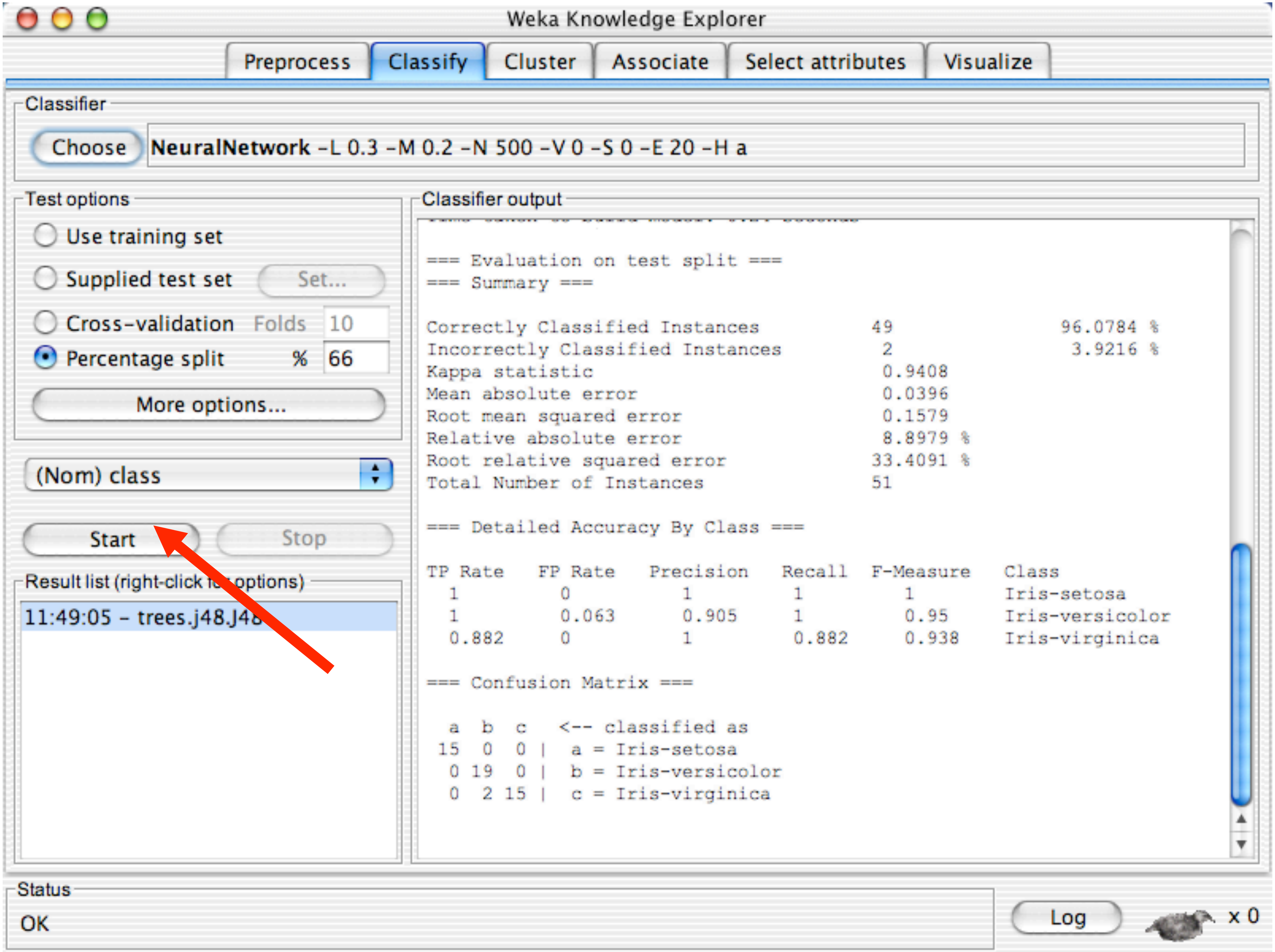
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0



Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
LeastMedSq
LinearRegression
Logistic
neural
NeuralNetwork
pace
supportVector
SimpleLinearRegression
SimpleLogistic
VotedPerceptron
Winnow
lazy
meta
misc
trees
rules
output
FP Rate Precision Recall F-Measure Class
0 1 1 1 Iris-setosa
0.063 0.905 1 0.95 Iris-versicolor
0 1 0.882 0.938 Iris-virginica
c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NeuralNetwork -L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
Mean absolute error 0.0396
Root mean squared error 0.1579
Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NeuralNetwork -L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a
Test options
Use training set
Supplied test set
Set...
Cross-validation Folds 10
Percentage split % 66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 49 96.0784 %
Incorrectly Classified Instances 2 3.9216 %
Kappa statistic 0.9408
Mean absolute error 0.0396
Root mean squared error 0.1579
Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
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TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
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a b c <-- classified as
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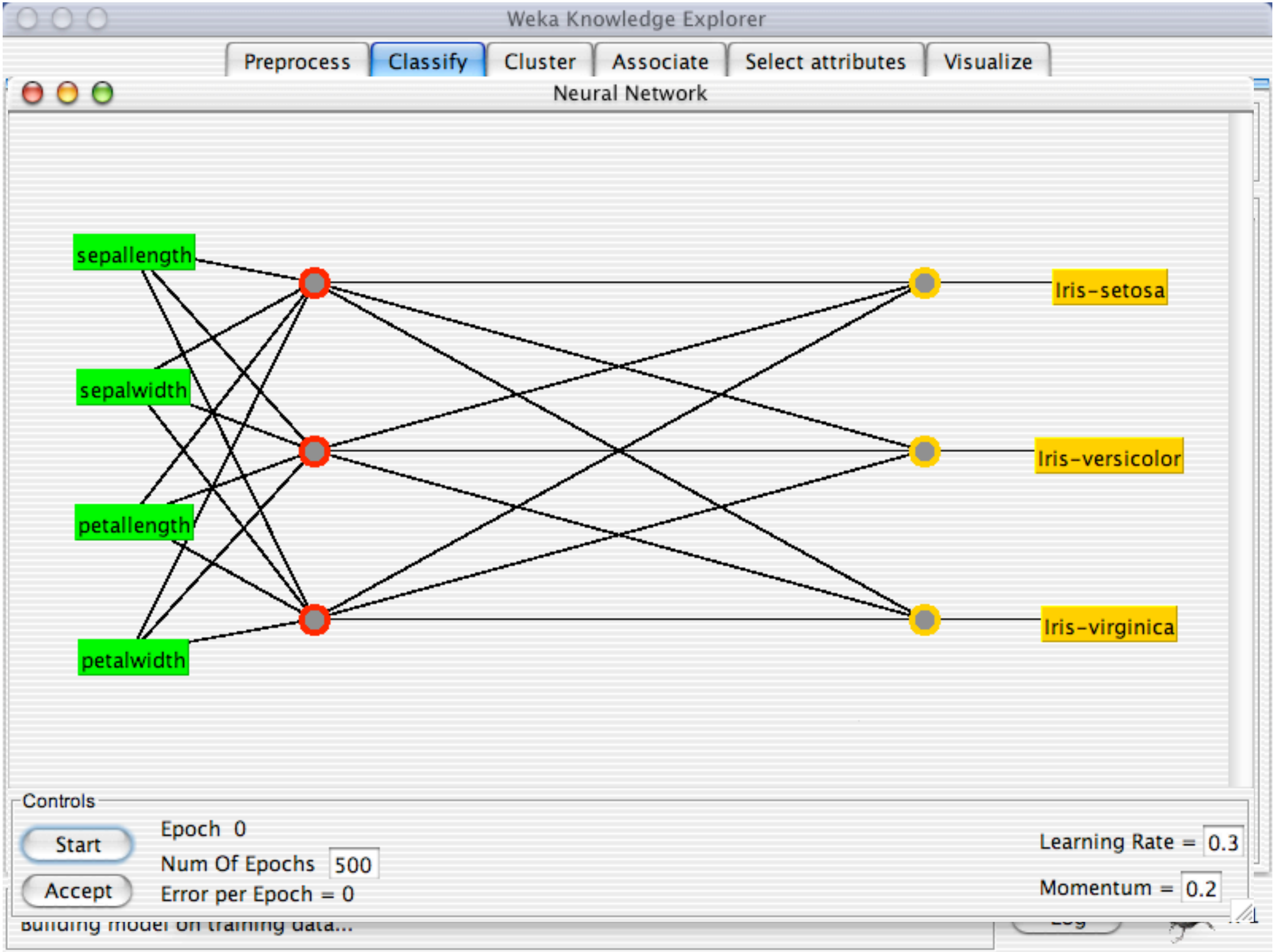
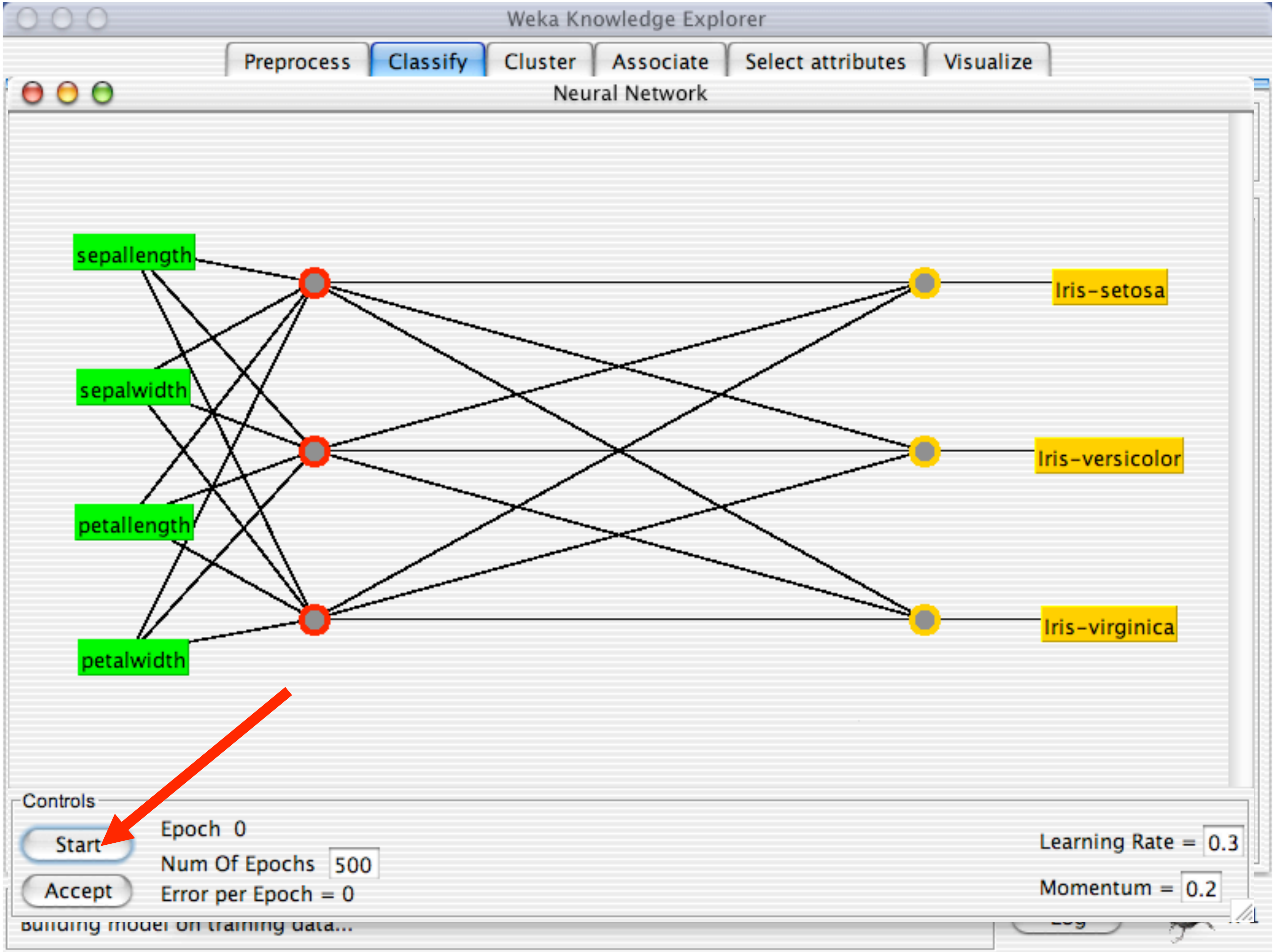
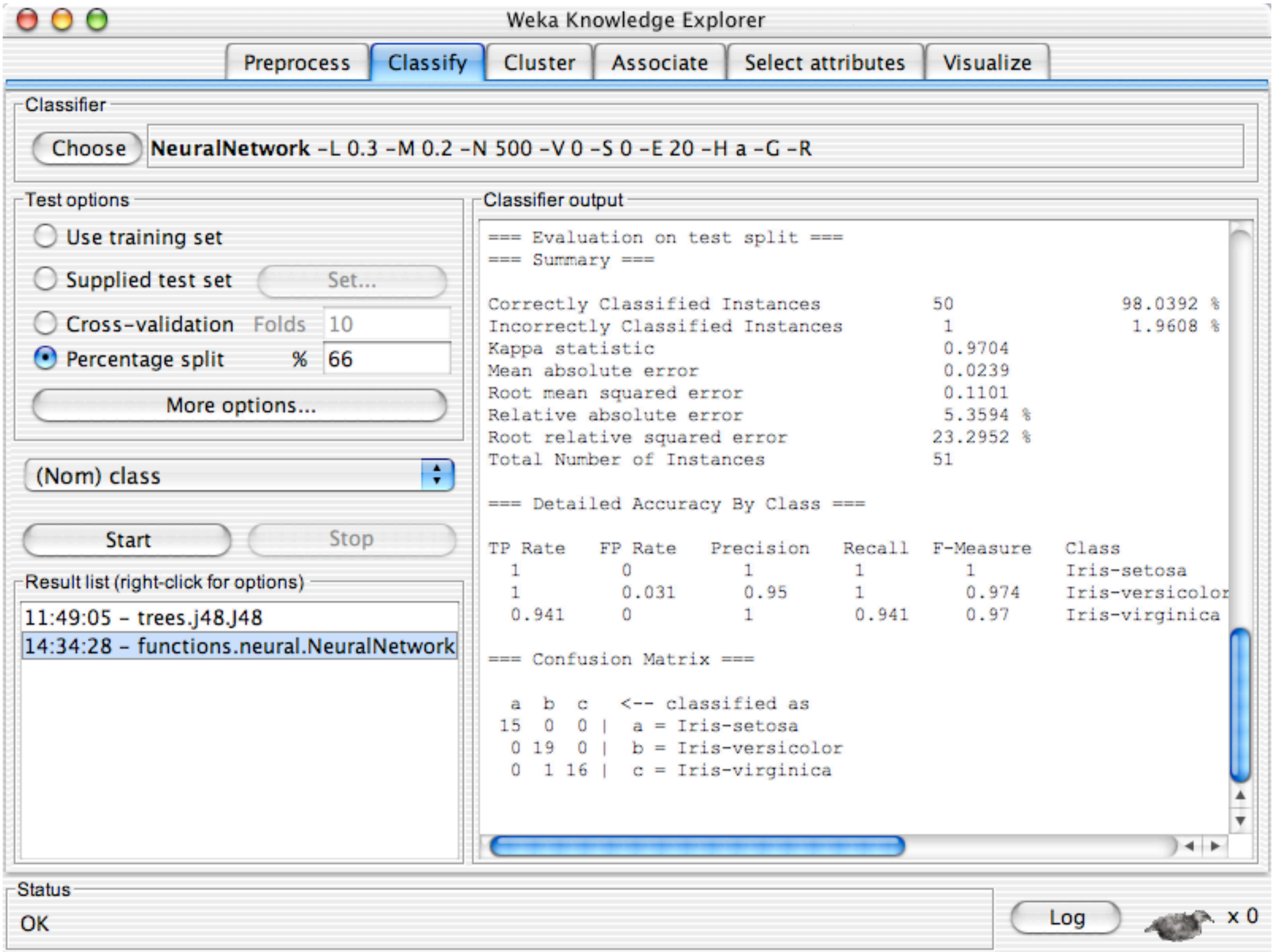
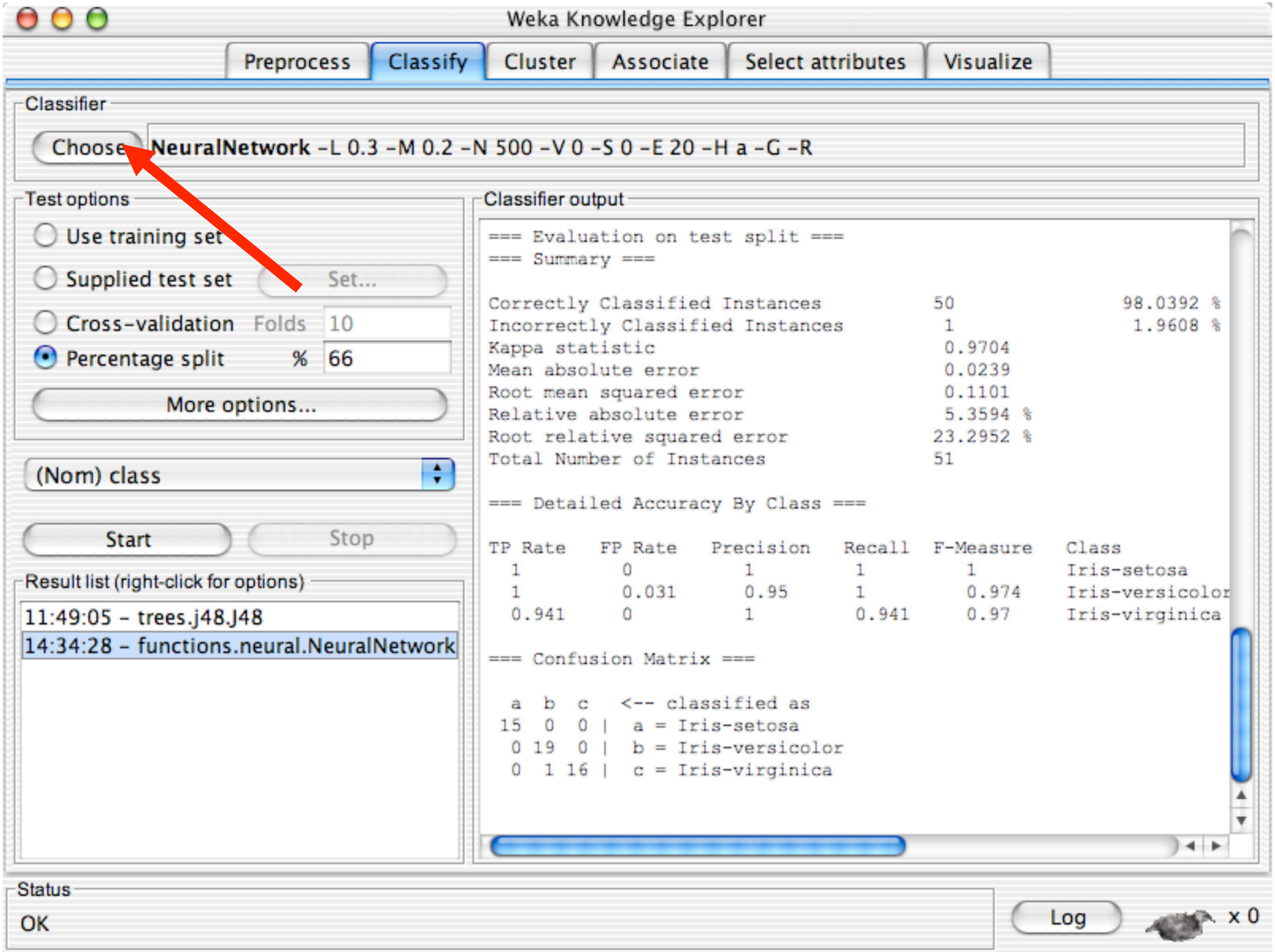
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Neural Network
sepallength
sepalwidth
petallength
petalwidth
Iris-setosa
Iris-versicolor
Iris-virginica
Controls
Start
Accept
Epoch 0
Num Of Epochs 500
Error per Epoch = 0
Learning Rate = 0.3
Momentum = 0.2


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Neural Network
sepallength
sepalwidth
petallength
petalwidth
Iris-setosa
Iris-versicolor
Iris-virginica
Controls
Start
Accept
Epoch 0
Num Of Epochs 500
Error per Epoch = 0
Learning Rate = 0.3
Momentum = 0.2


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NeuralNetwork -L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a -G -R
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
Classifier output
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 50 98.0392 %
Incorrectly Classified Instances 1 1.9608 %
Kappa statistic 0.9704
Mean absolute error 0.0239
Root mean squared error 0.1101
Relative absolute error 5.3594 %
Root relative squared error 23.2952 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
1 0.031 0.95 1 0.974 Iris-versicolor
0.941 0 1 0.941 0.97 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 1 16 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NeuralNetwork -L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a -G -R
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
Classifier output
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Correctly Classified Instances 50 98.0392 %
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Kappa statistic 0.9704
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Relative absolute error 5.3594 %
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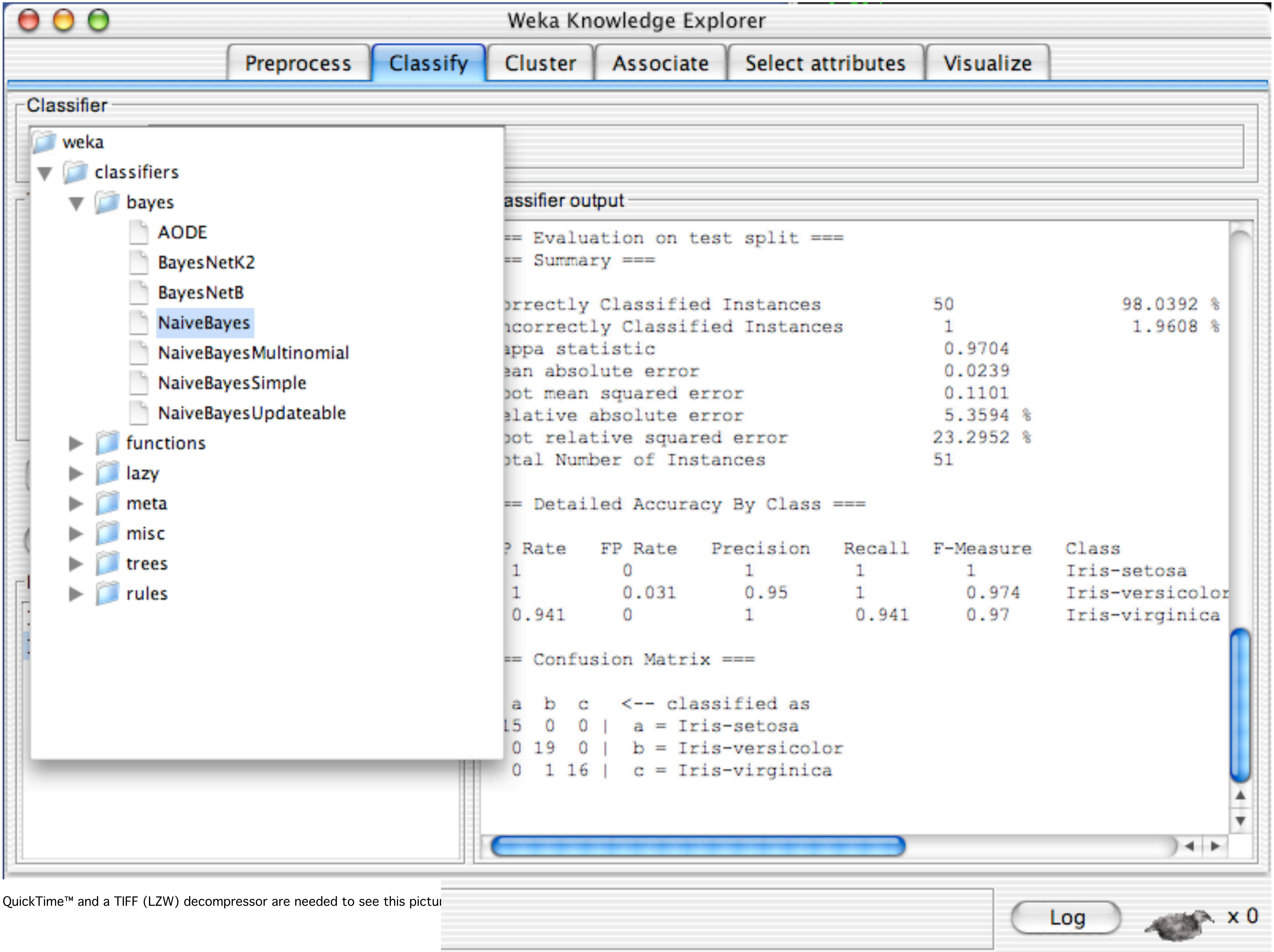
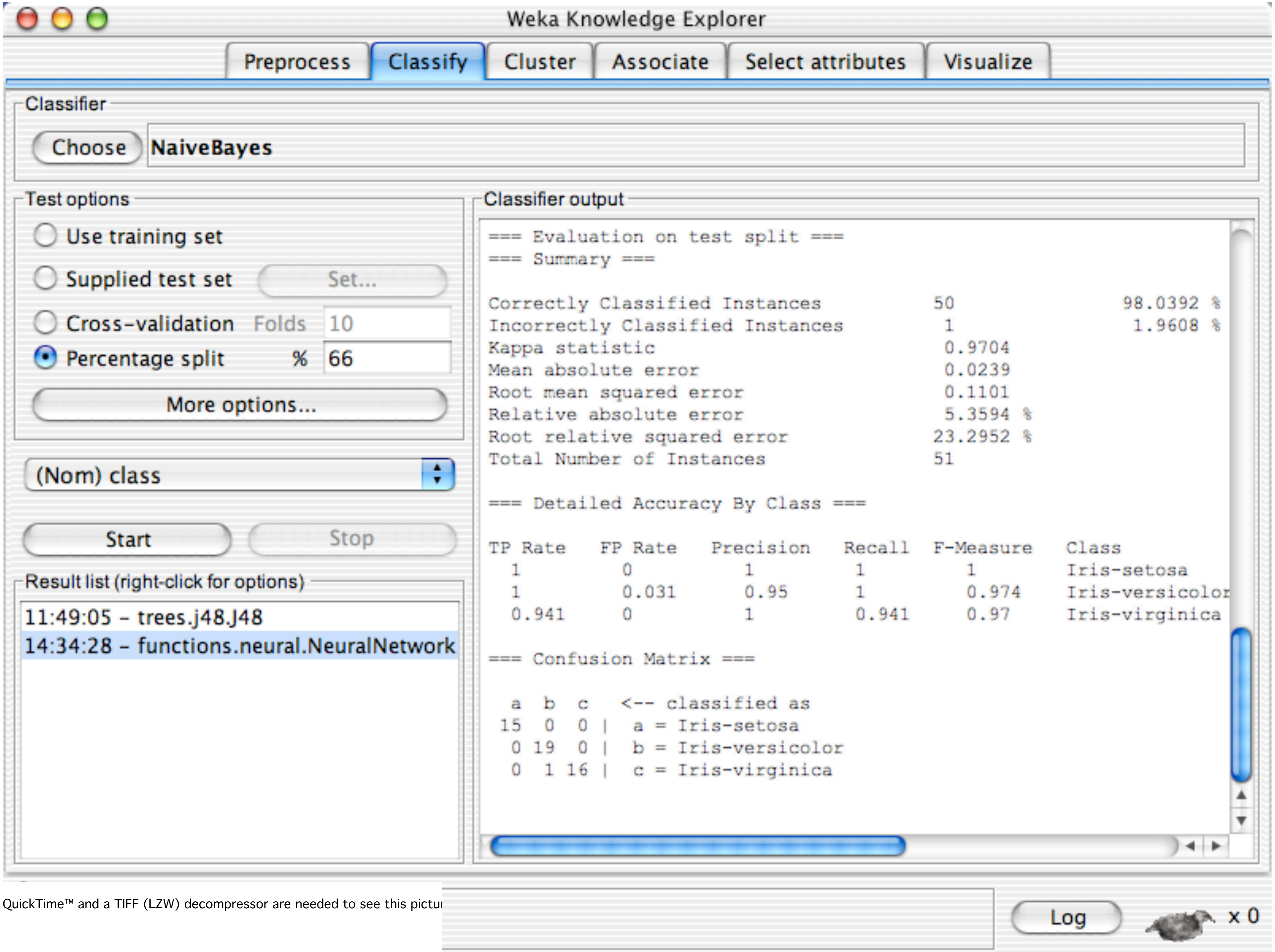
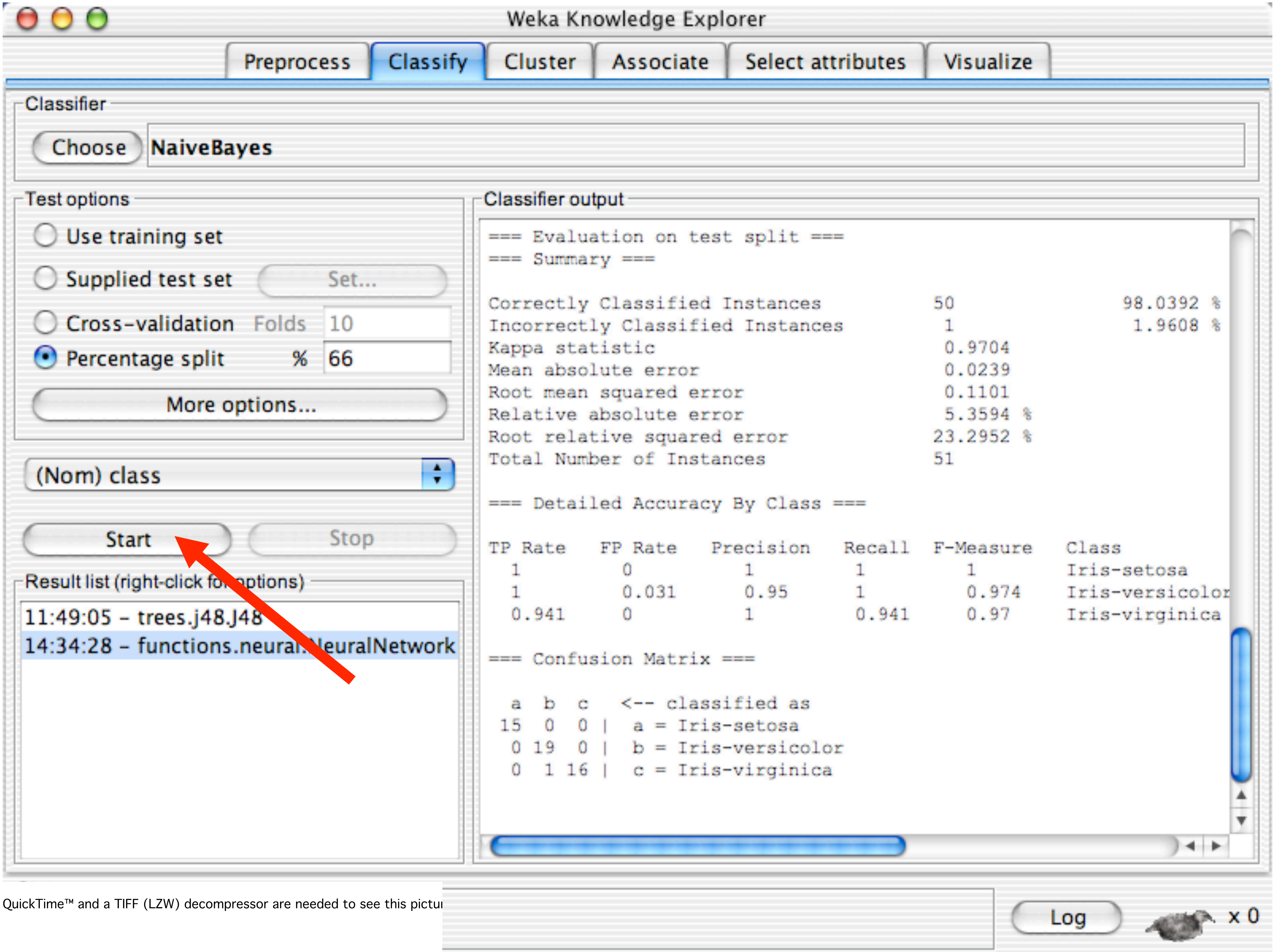
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 1 16 | c = Iris-virginica
Status
OK
Log
x 0



QuickTime™ and a TIFF (LZW) decompressor are needed to see this pictu



QuickTime™ and a TIFF (LZW) decompressor are needed to see this pictu


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
Classifier output
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Kappa statistic 0.9704
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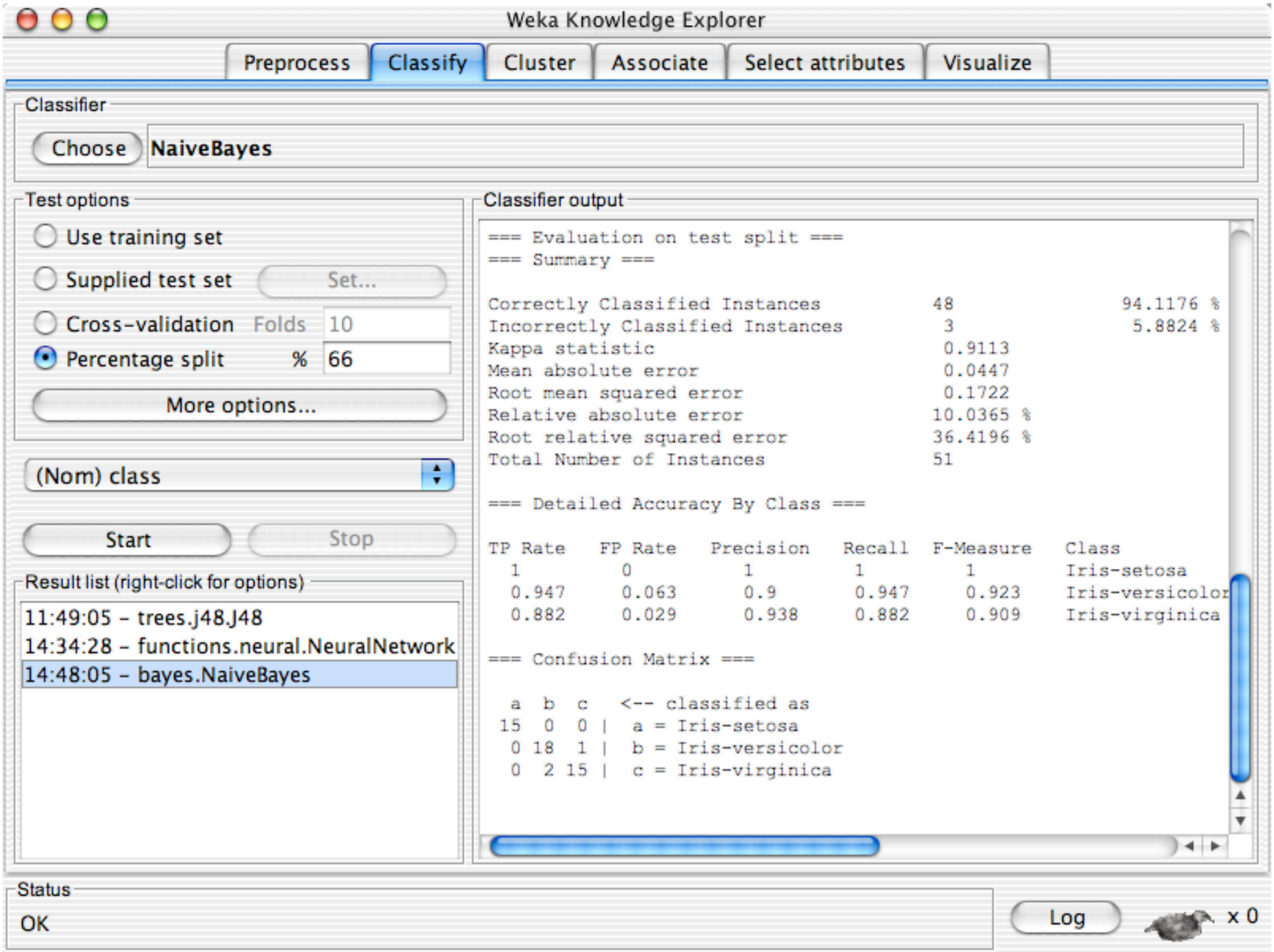
QuickTime™ and a TIFF (LZW) decompressor are needed to see this pictu
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
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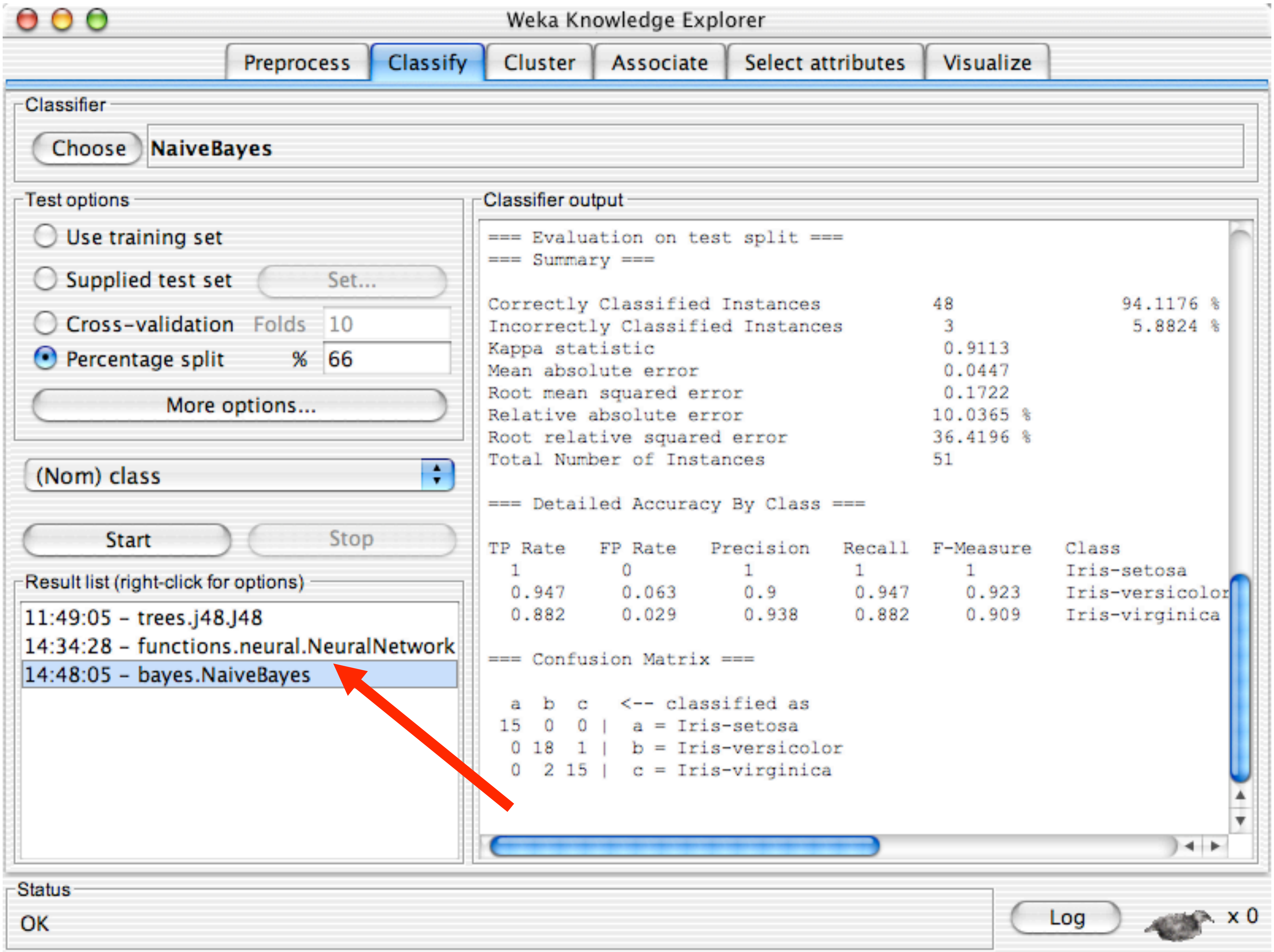
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 – trees.j48.J48
14:34:28 – functions.neural.NeuralNetwork
14:48:05 – bayes.NaiveBayes
Classifier output
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 48 94.1176 %
Incorrectly Classified Instances 3 5.8824 %
Kappa statistic 0.9113
Mean absolute error 0.0447
Root mean squared error 0.1722
Relative absolute error 10.0365 %
Root relative squared error 36.4196 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
0.947 0.063 0.9 0.947 0.923 Iris-versicolor
0.882 0.029 0.938 0.882 0.909 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation Folds 10
Percentage split % 66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 – trees.j48.J48
14:34:28 – functions.neural.NeuralNetwork
14:48:05 – bayes.NaiveBayes
Classifier output
=== Evaluation on test split ===
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0.882 0.029 0.938 0.882 0.909 Iris-virginica
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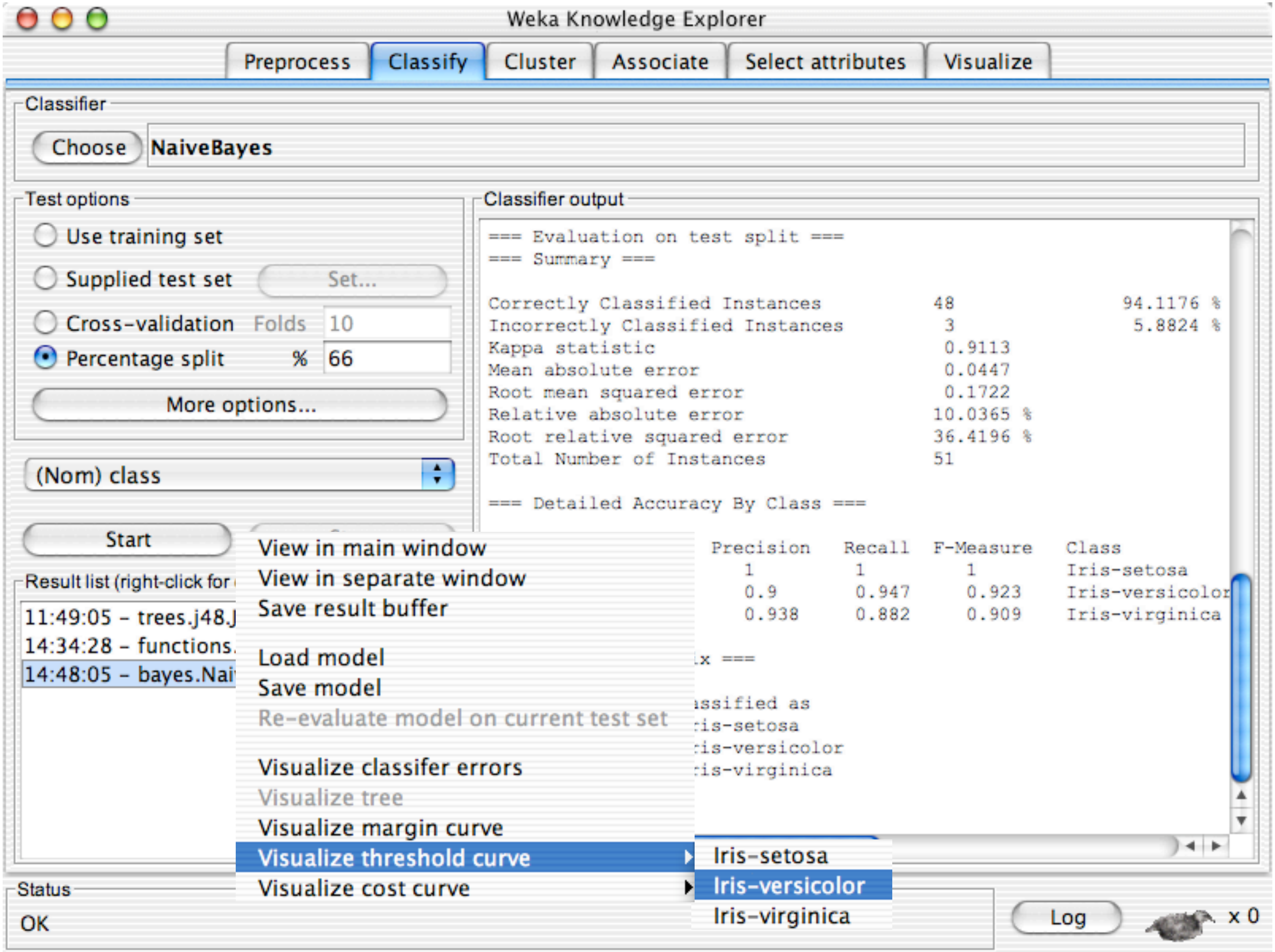
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.J
14:34:28 - functions.
14:48:05 - bayes.Nai
Classifier output
=== Evaluation on test split ===
=== Summary ===
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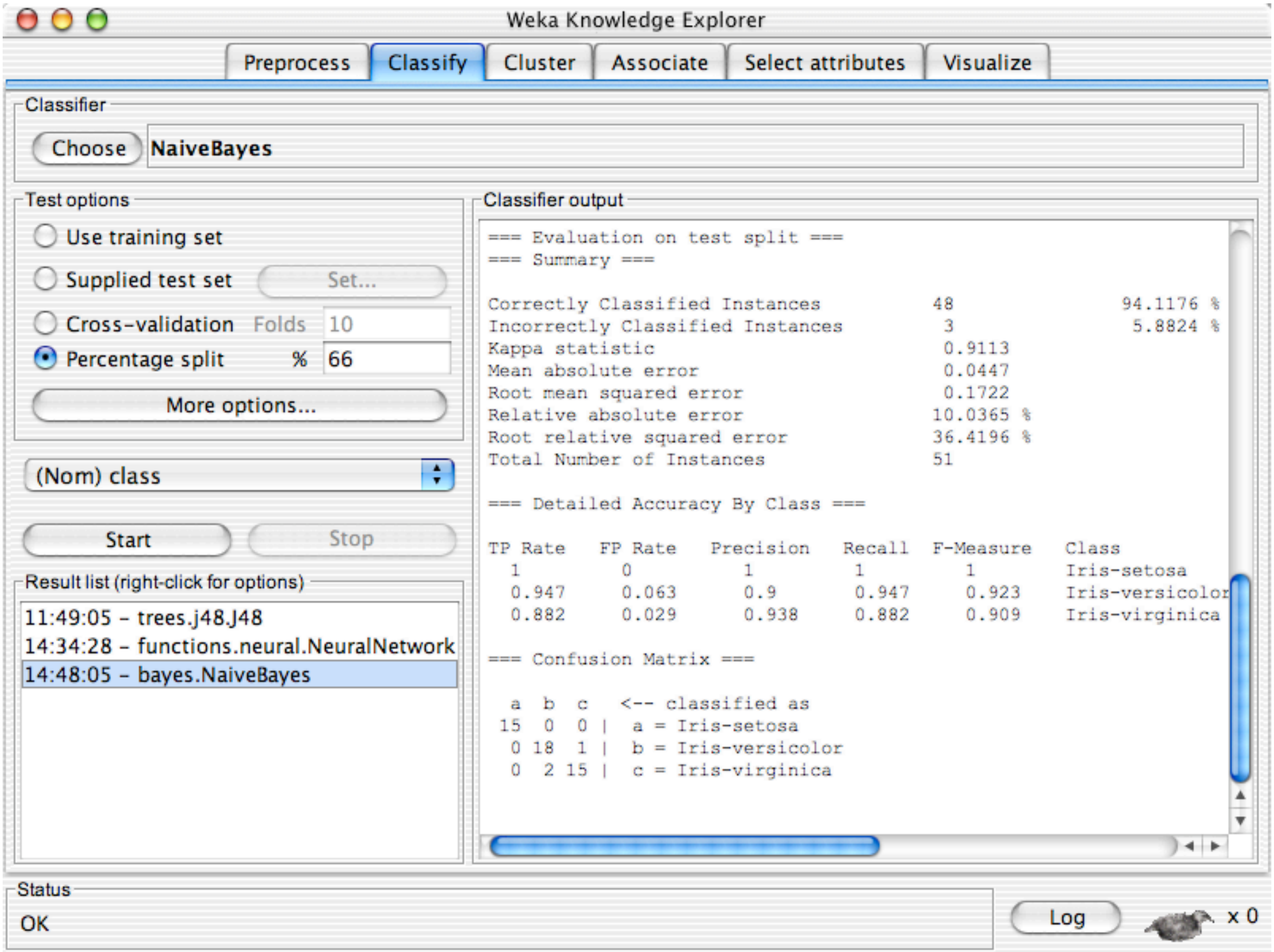
Root mean squared error 0.1722
Relative absolute error 10.0365 %
Root relative squared error 36.4196 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
Precision Recall F-Measure Class
1 1 1 Iris-setosa
0.9 0.947 0.923 Iris-versicolor
0.938 0.882 0.909 Iris-virginica
View in main window
View in separate window
Save result buffer
Load model
Save model
Re-evaluate model on current test set
Visualize classifer errors
Visualize tree
Visualize margin curve
Visualize threshold curve
Visualize cost curve
Iris-setosa
Iris-versicolor
Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
% 66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
14:48:05 - bayes.NaiveBayes
Classifier output
=== Evaluation on test split ===
=== Summary ===
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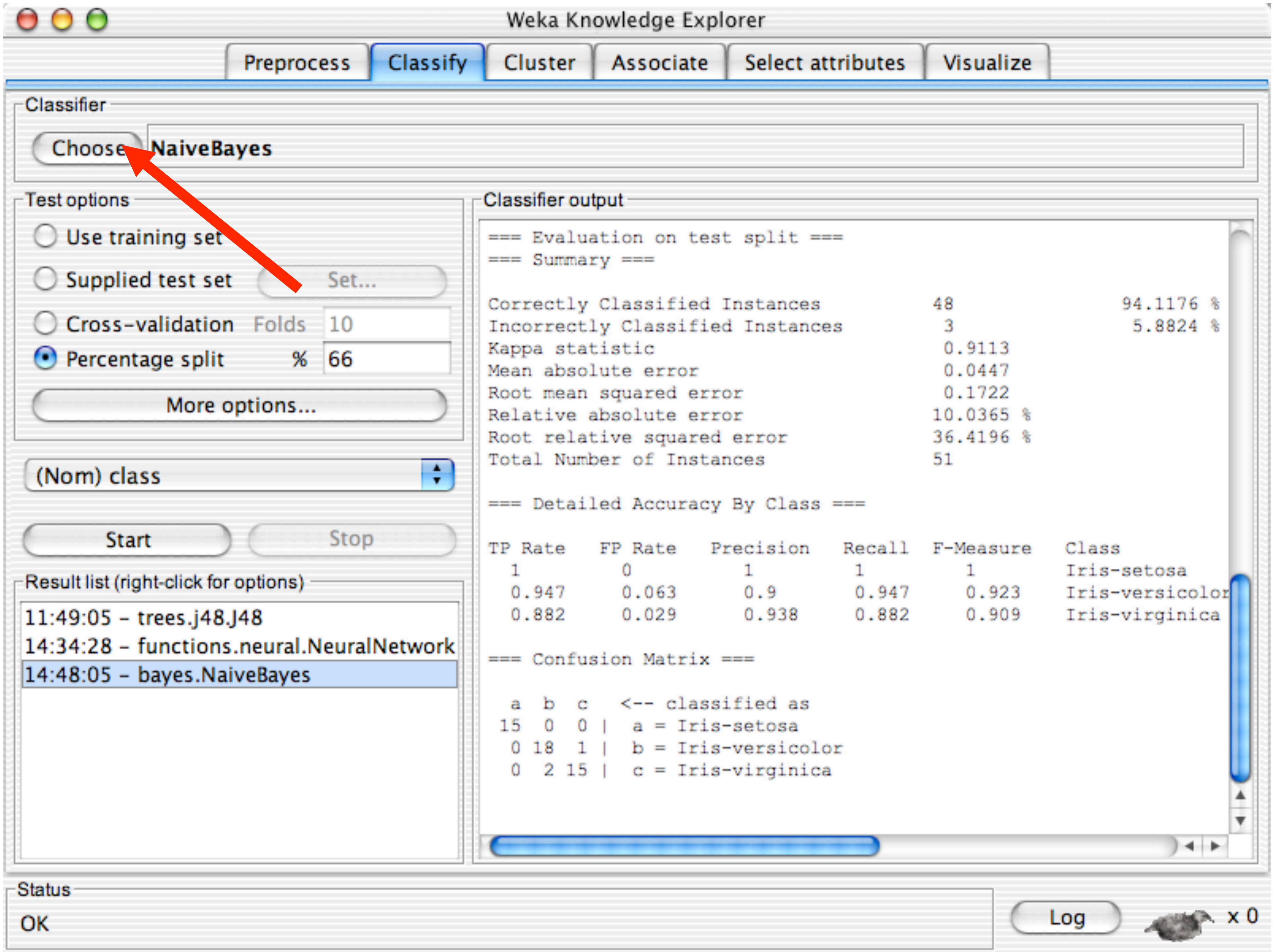
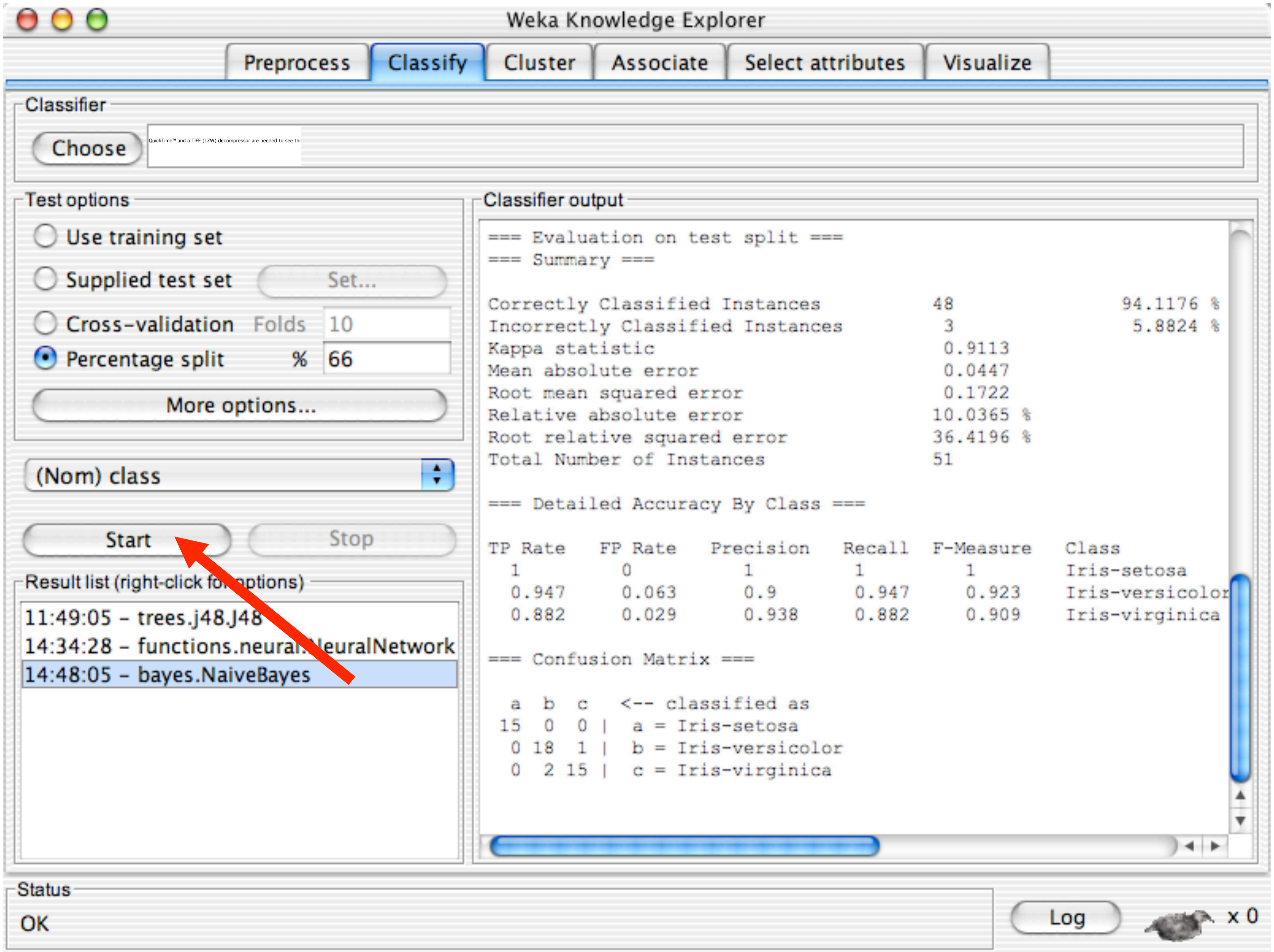
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NaiveBayes
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
14:48:05 - bayes.NaiveBayes
Classifier output
=== Evaluation on test split ===
=== Summary ===
Correctly Classified Instances 48 94.1176 %
Incorrectly Classified Instances 3 5.8824 %
Kappa statistic 0.9113
Mean absolute error 0.0447
Root mean squared error 0.1722
Relative absolute error 10.0365 %
Root relative squared error 36.4196 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
0.947 0.063 0.9 0.947 0.923 Iris-versicolor
0.882 0.029 0.938 0.882 0.909 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
14:48:05 - bayes.NaiveBayes
Classifier output
=== Evaluation on test split ===
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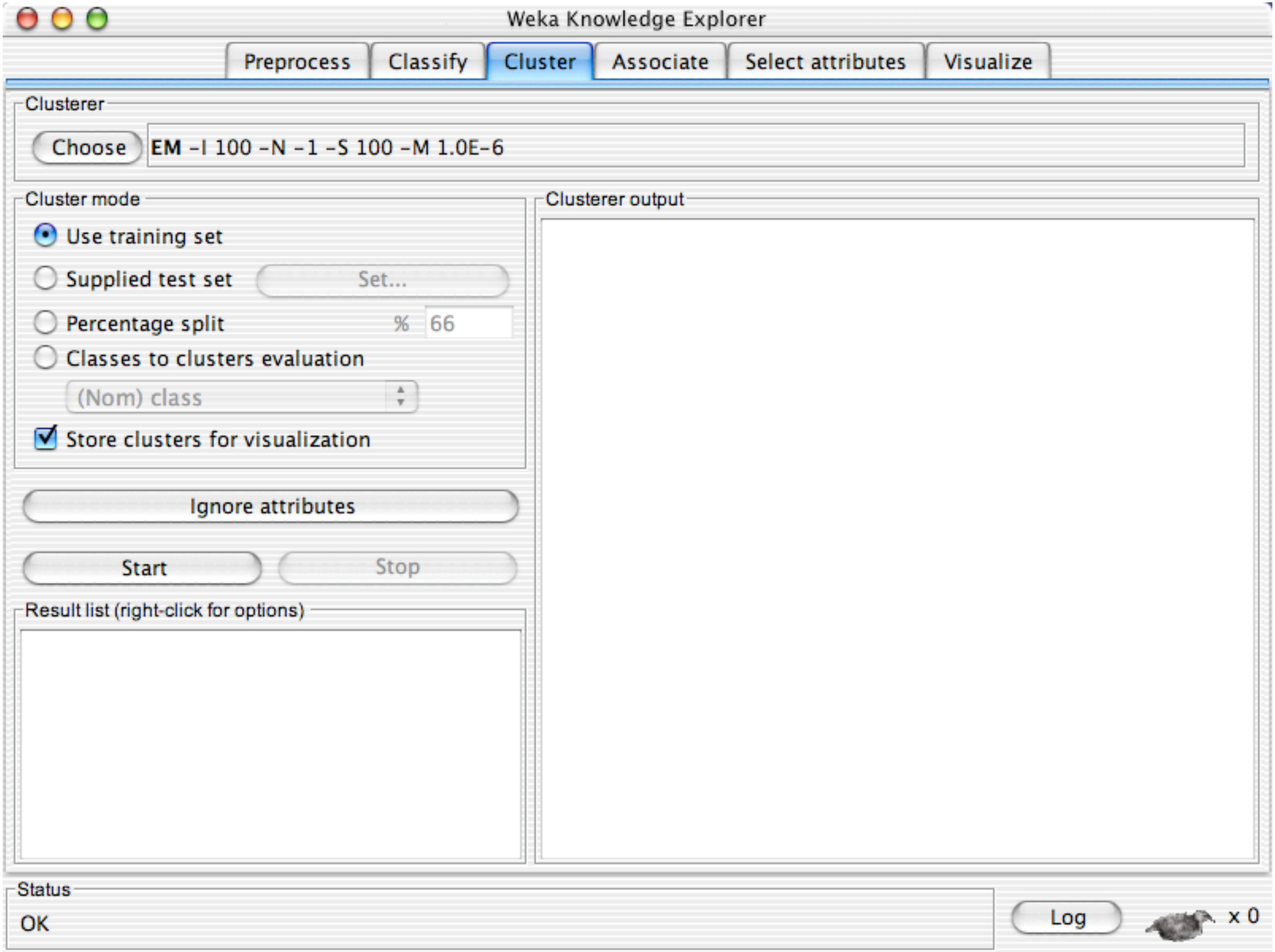
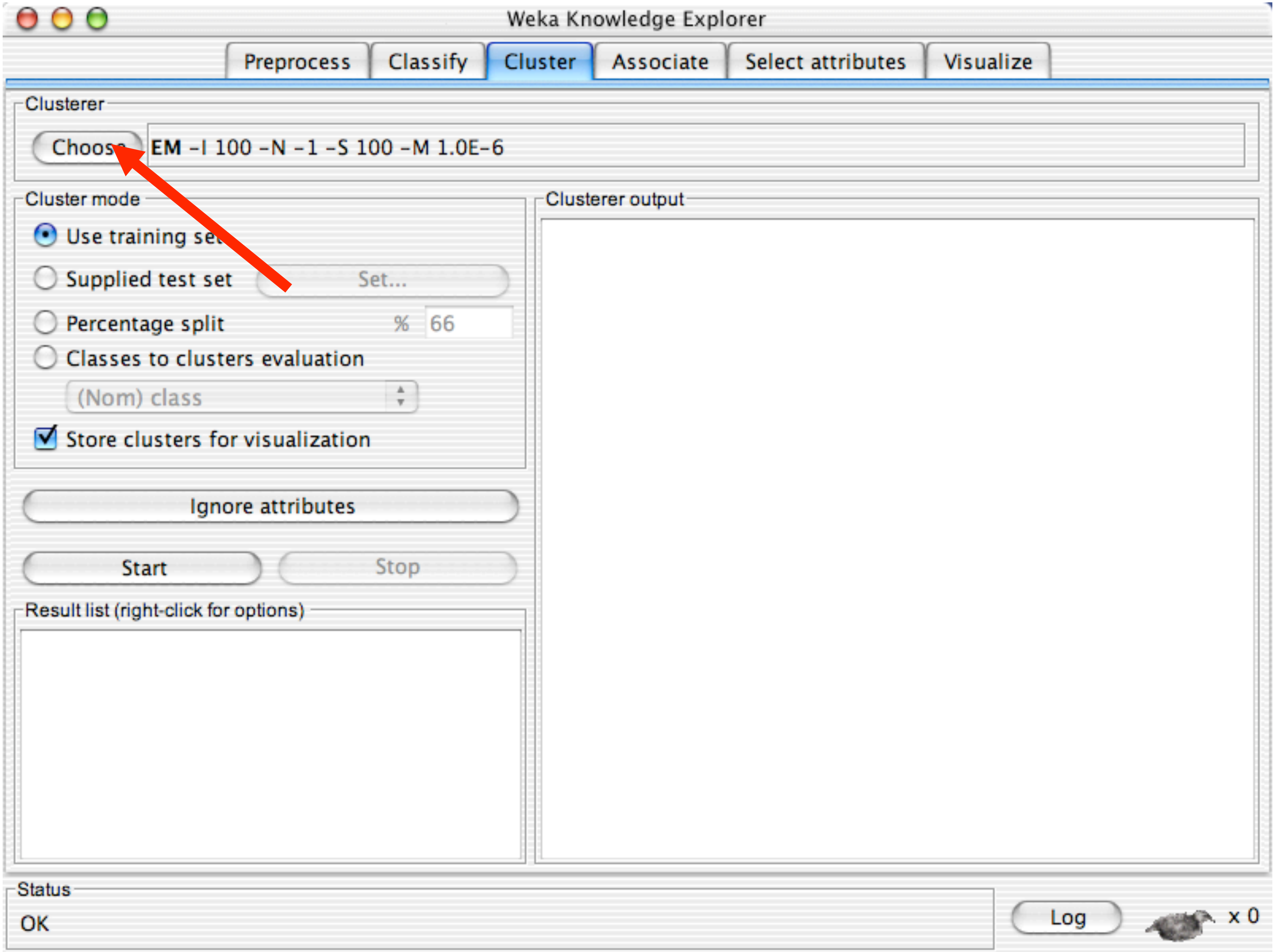
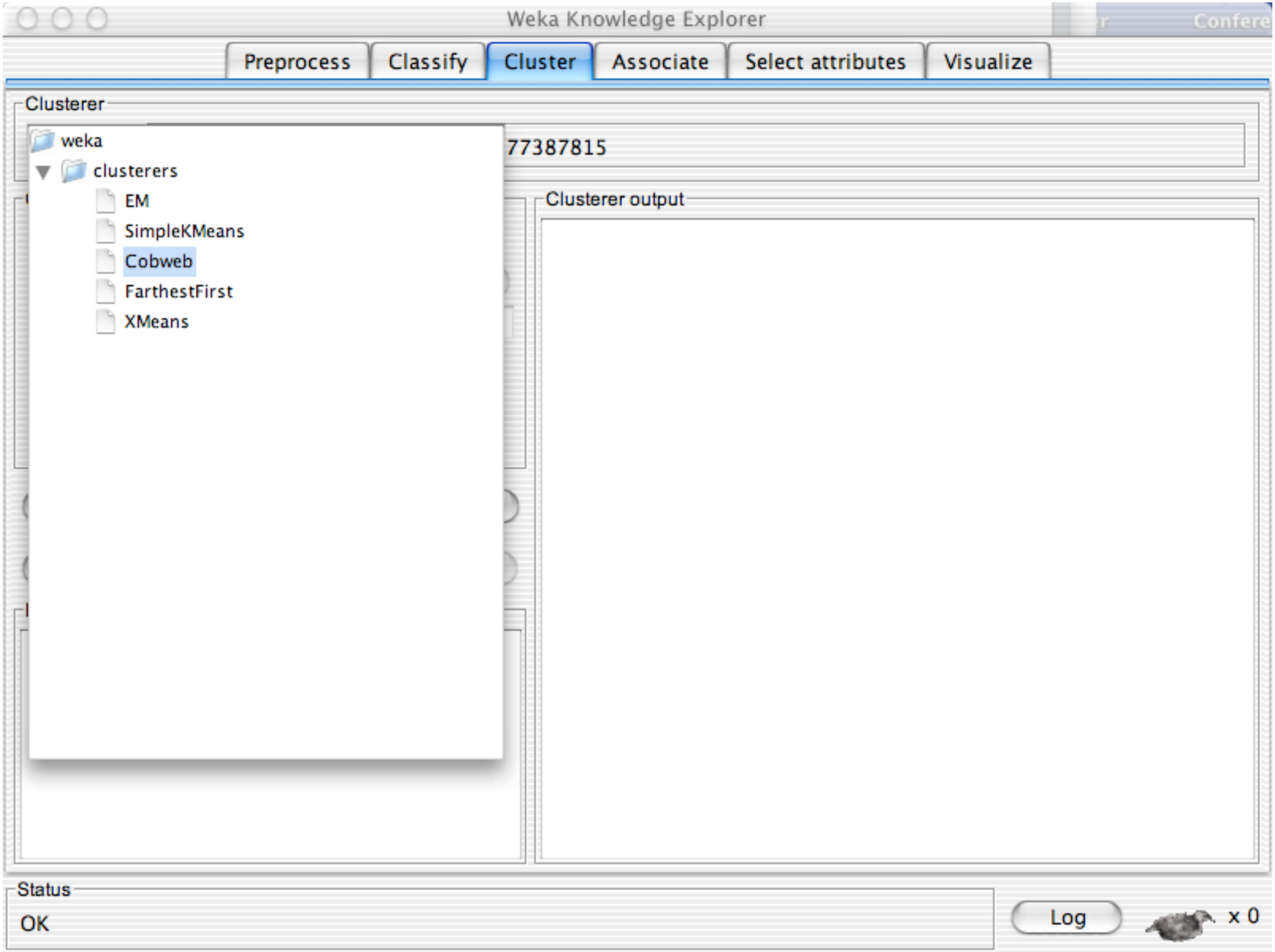
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0

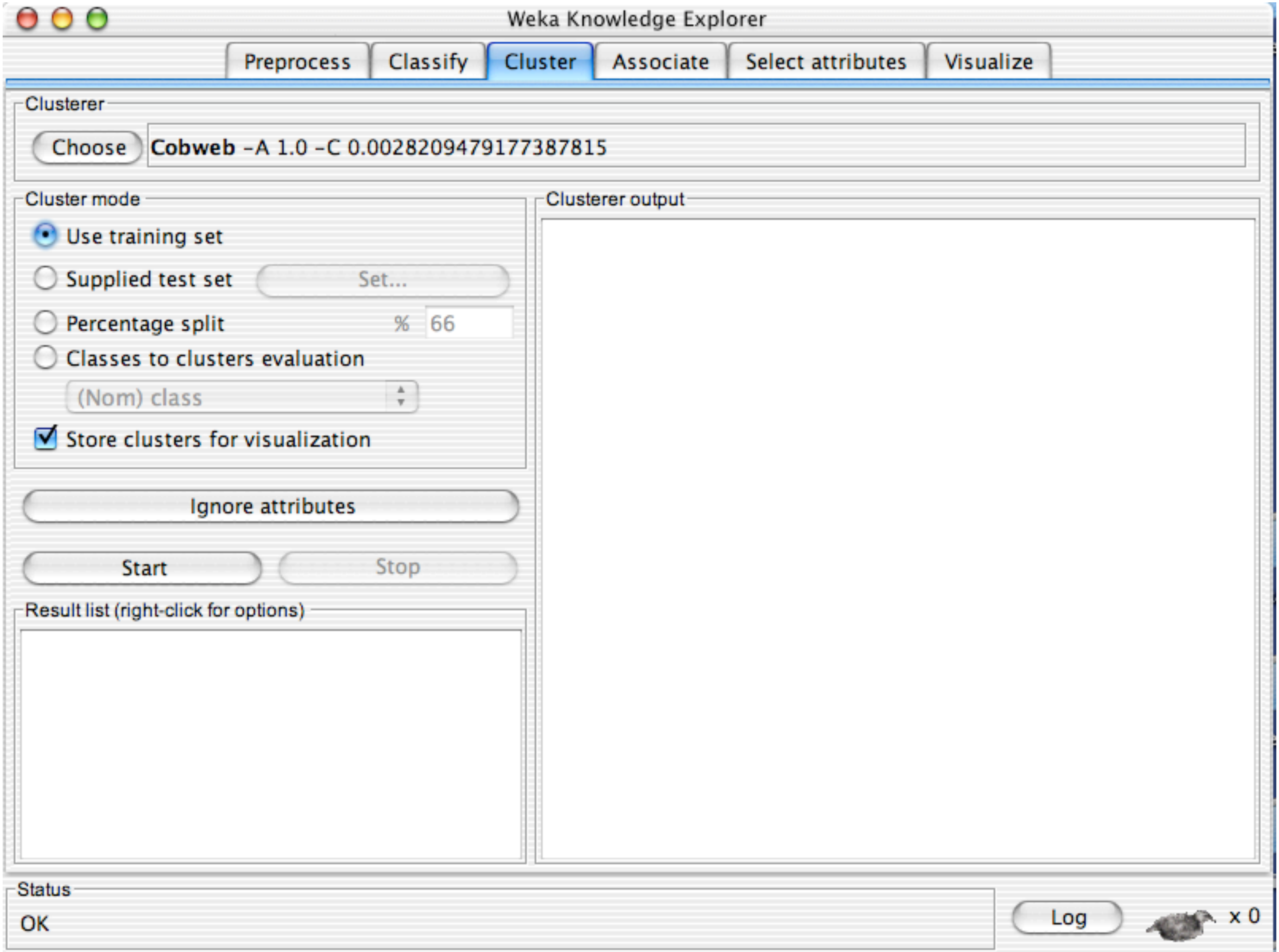
Explorer: clustering data

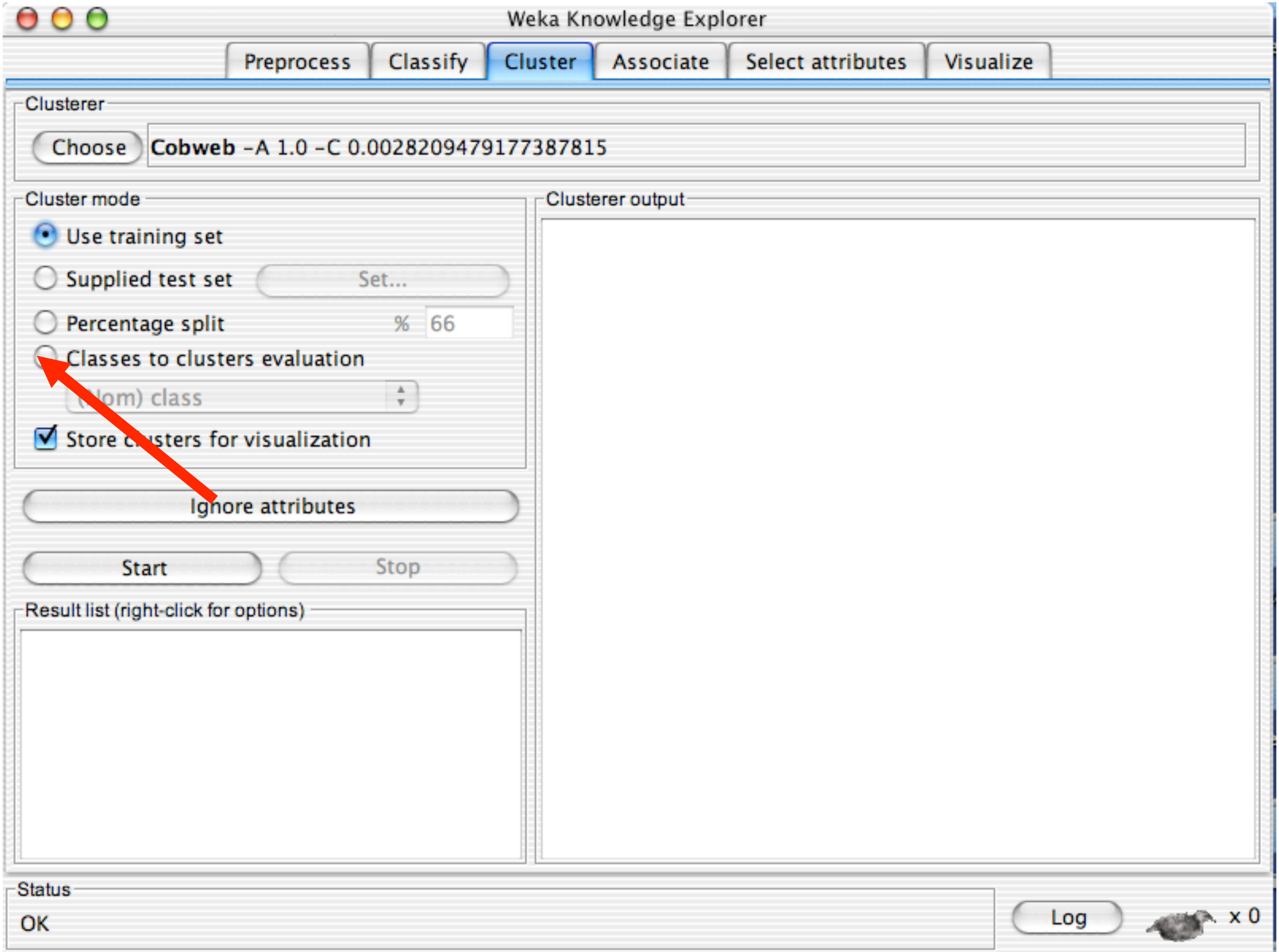
- WEKA contains “clusterers” for finding groups of similar instances in a dataset
- Implemented schemes are:
  - *k*-Means, EM, Cobweb, *X*-means, FarthestFirst
- Clusters can be visualized and compared to “t rue” clusters (if given)
- Evaluation based on loglikelihood if clustering scheme produces a probability distribution

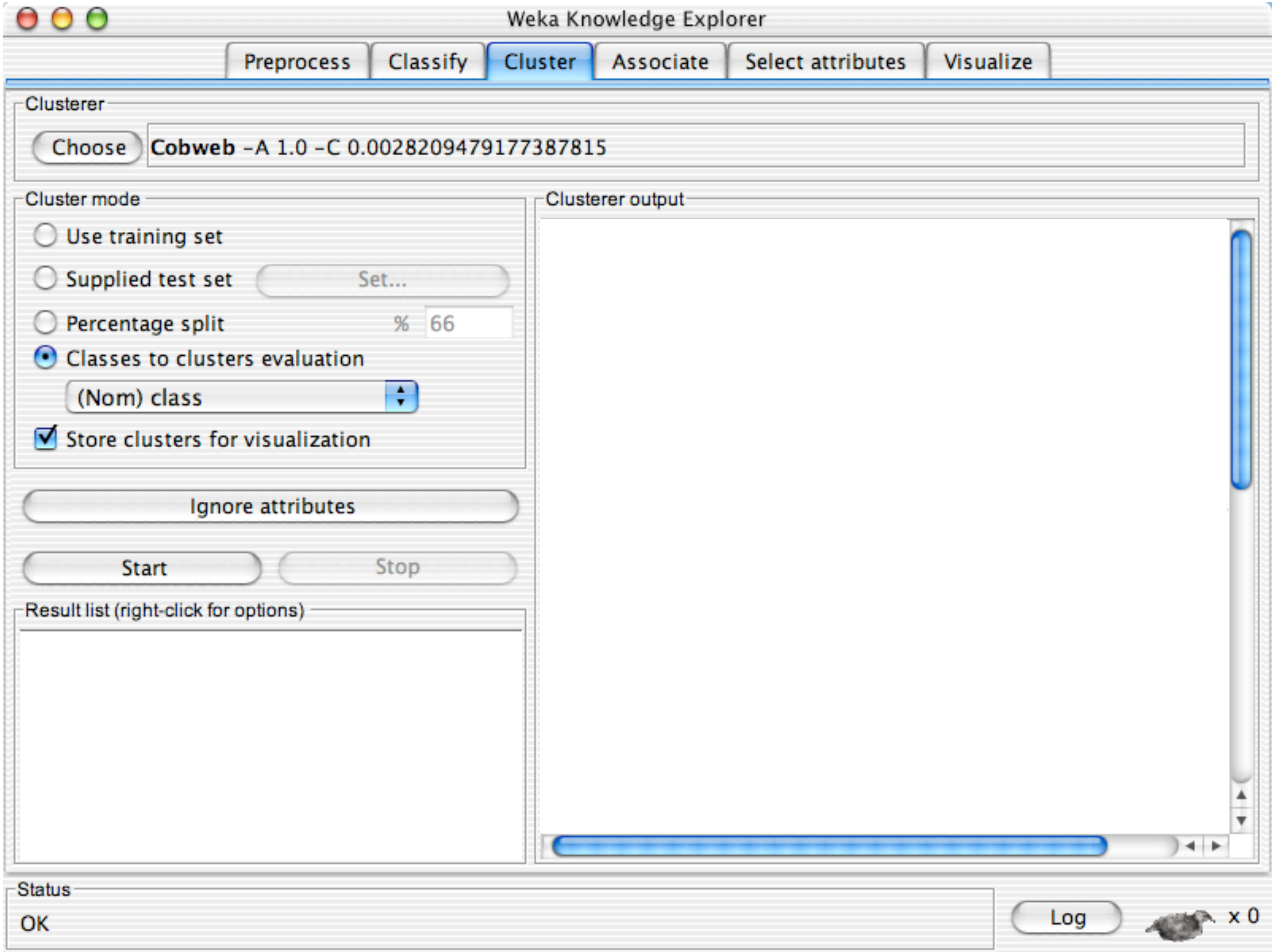

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
EM -I 100 -N -1 -S 100 -M 1.0E-6
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
Clusterer output
Status
OK
Log
x 0

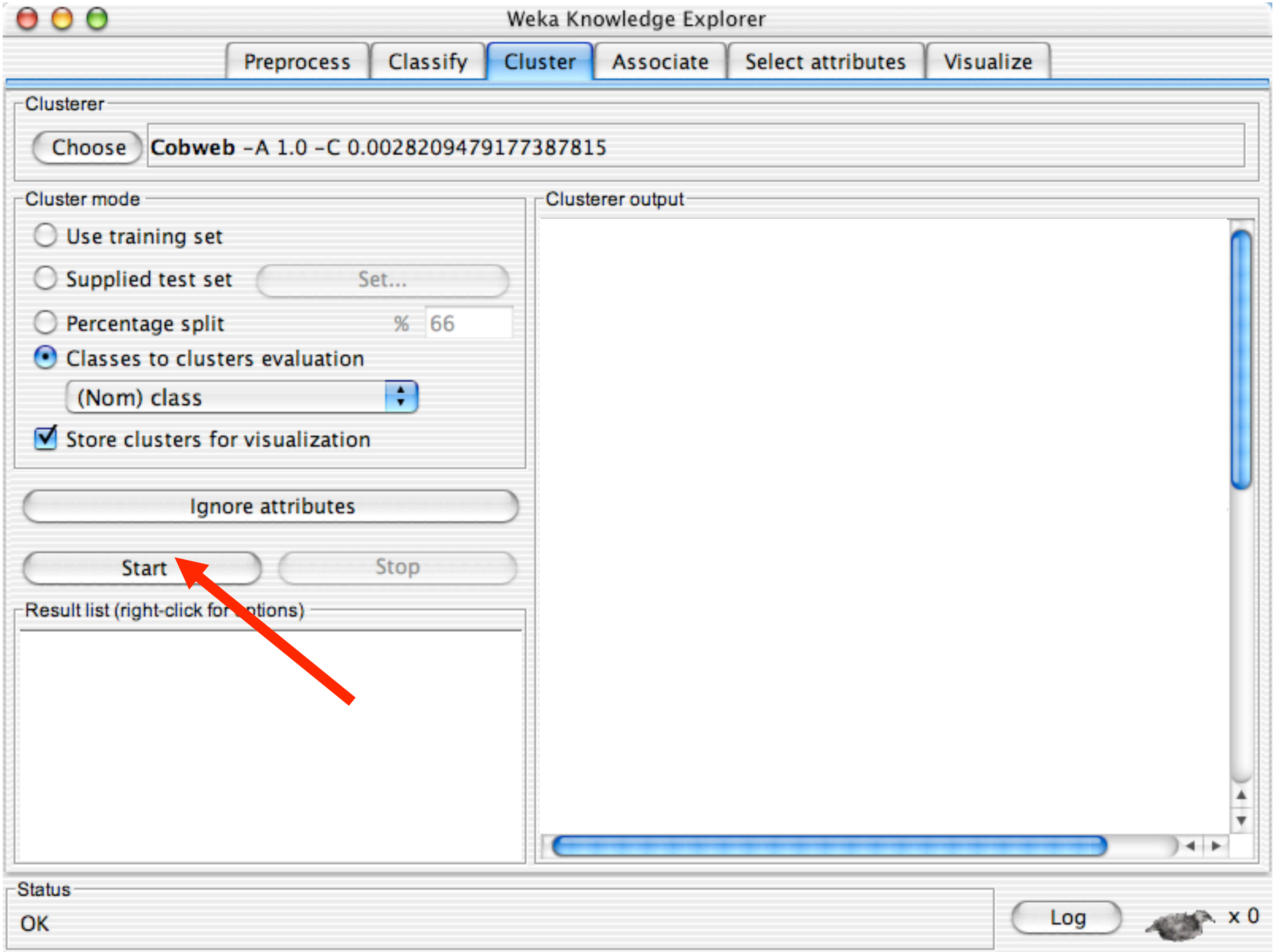

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
EM -I 100 -N -1 -S 100 -M 1.0E-6
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
Clusterer output
Status
OK
Log
x 0

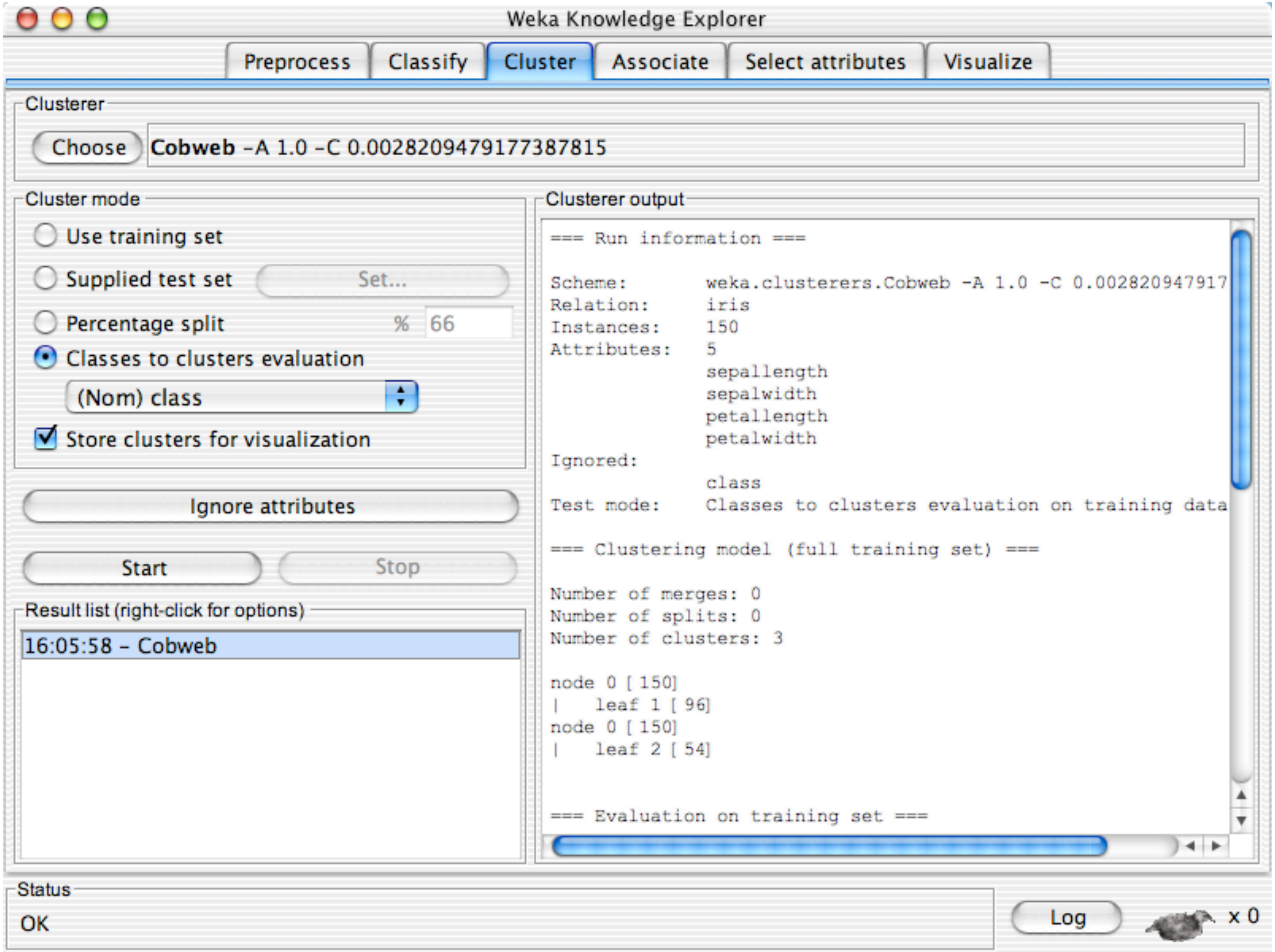

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
weka
clusterers
EM
SimpleKMeans
Cobweb
FarthestFirst
XMeans
77387815
Clusterer output
Status
OK
Log
x 0

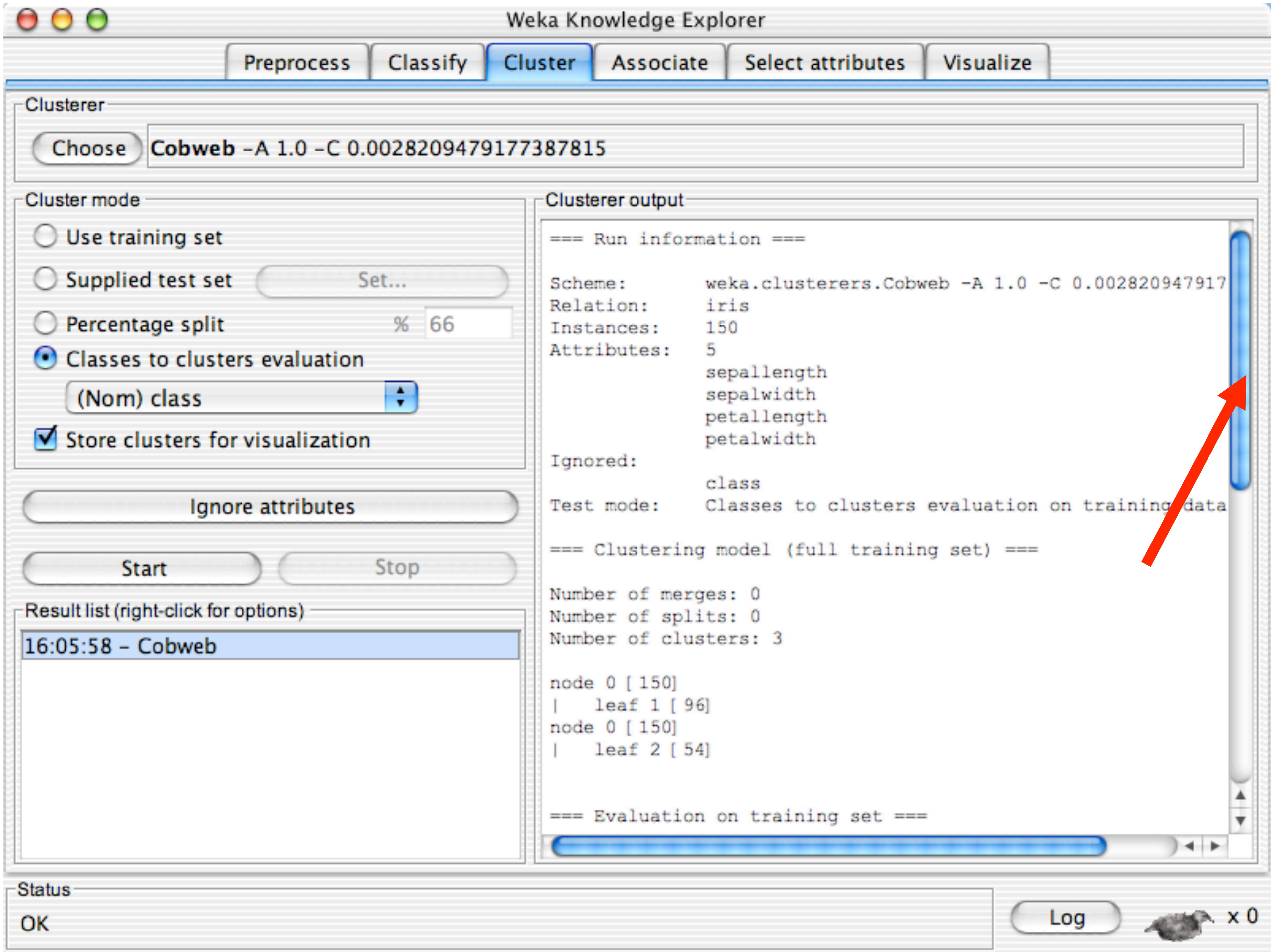

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
Clusterer output
Status
OK
Log
x 0

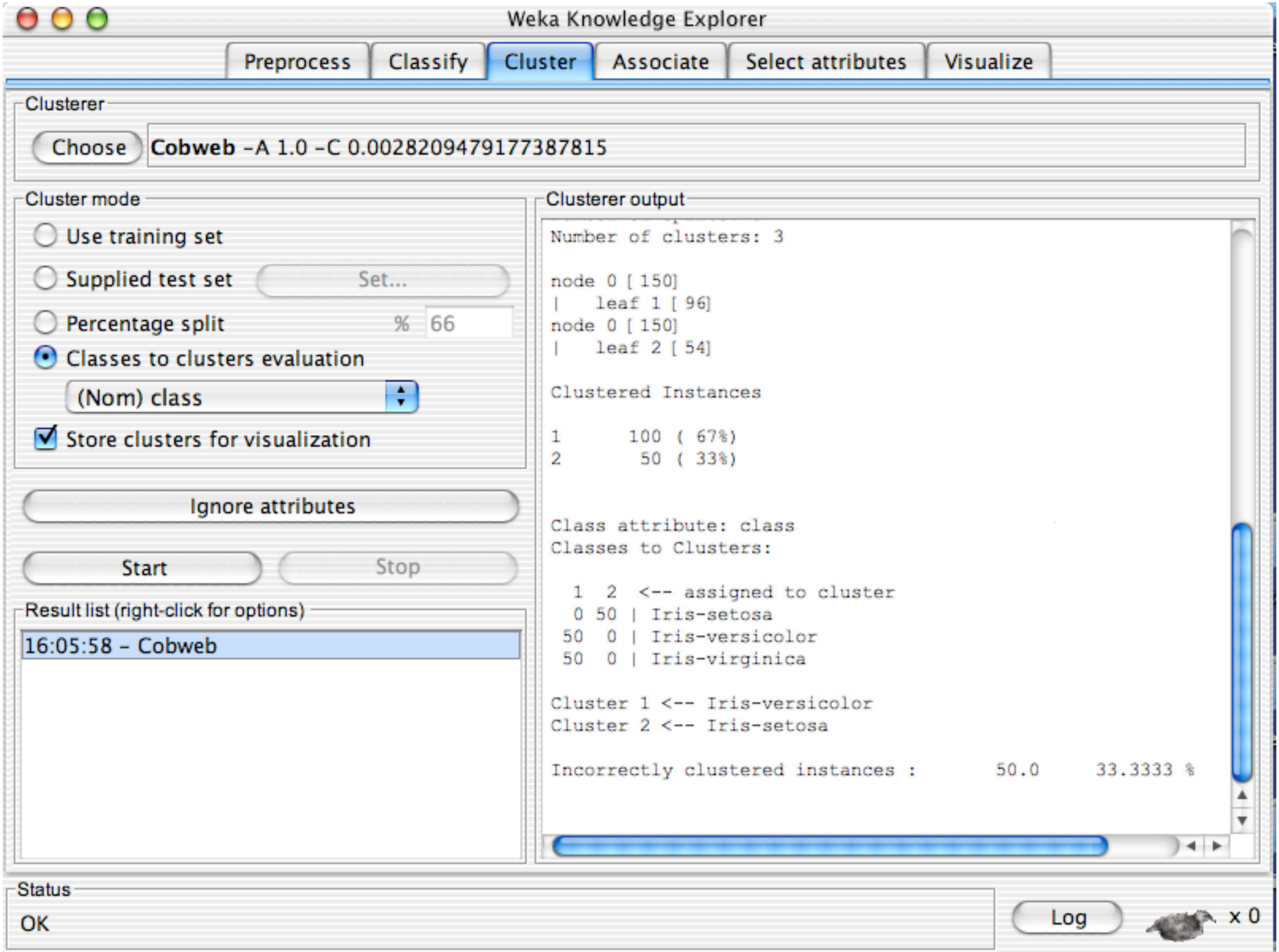

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
Clusterer output
Status
OK
Log
x 0

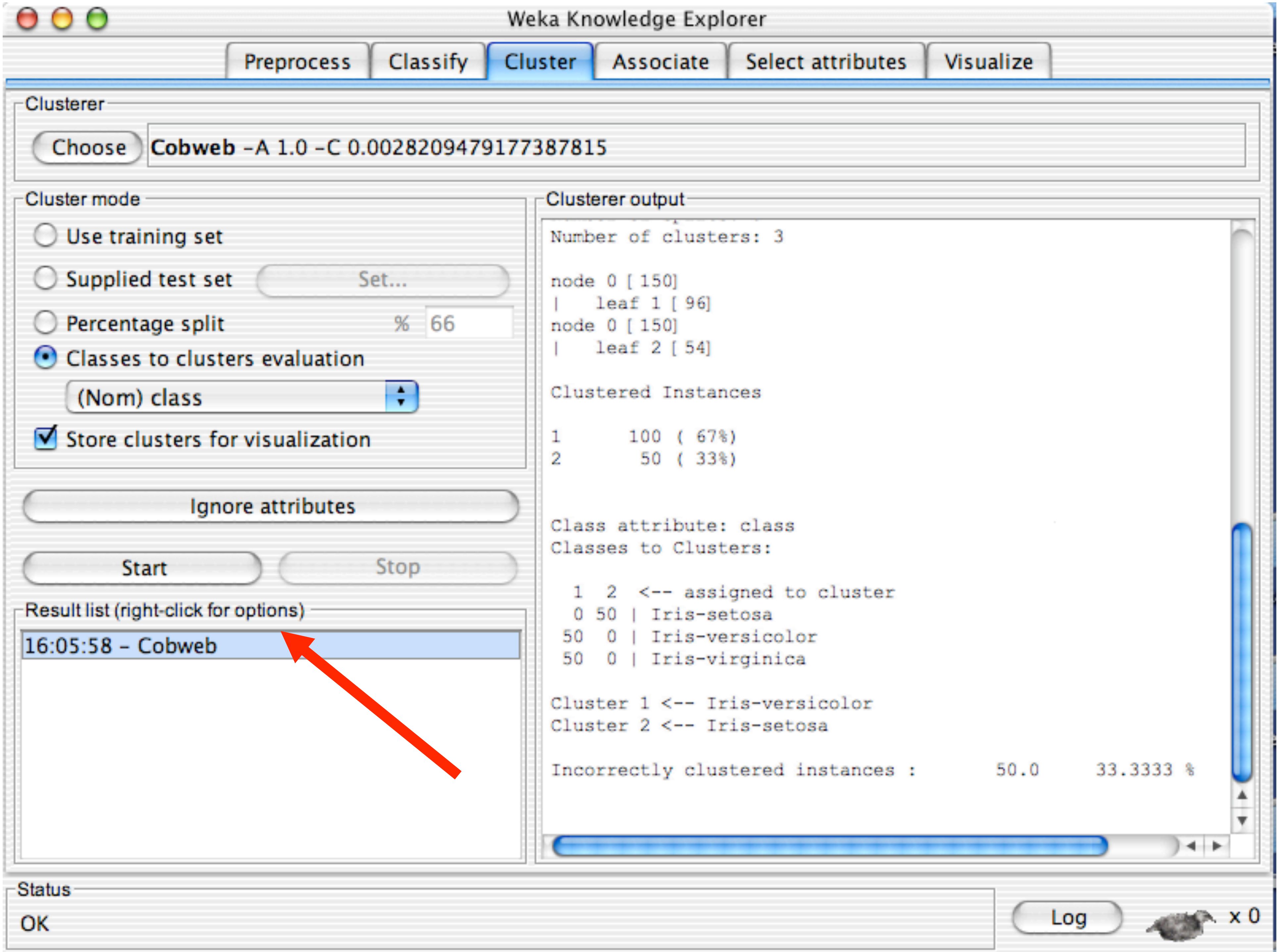

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
Clusterer output
Status
OK
Log
x 0

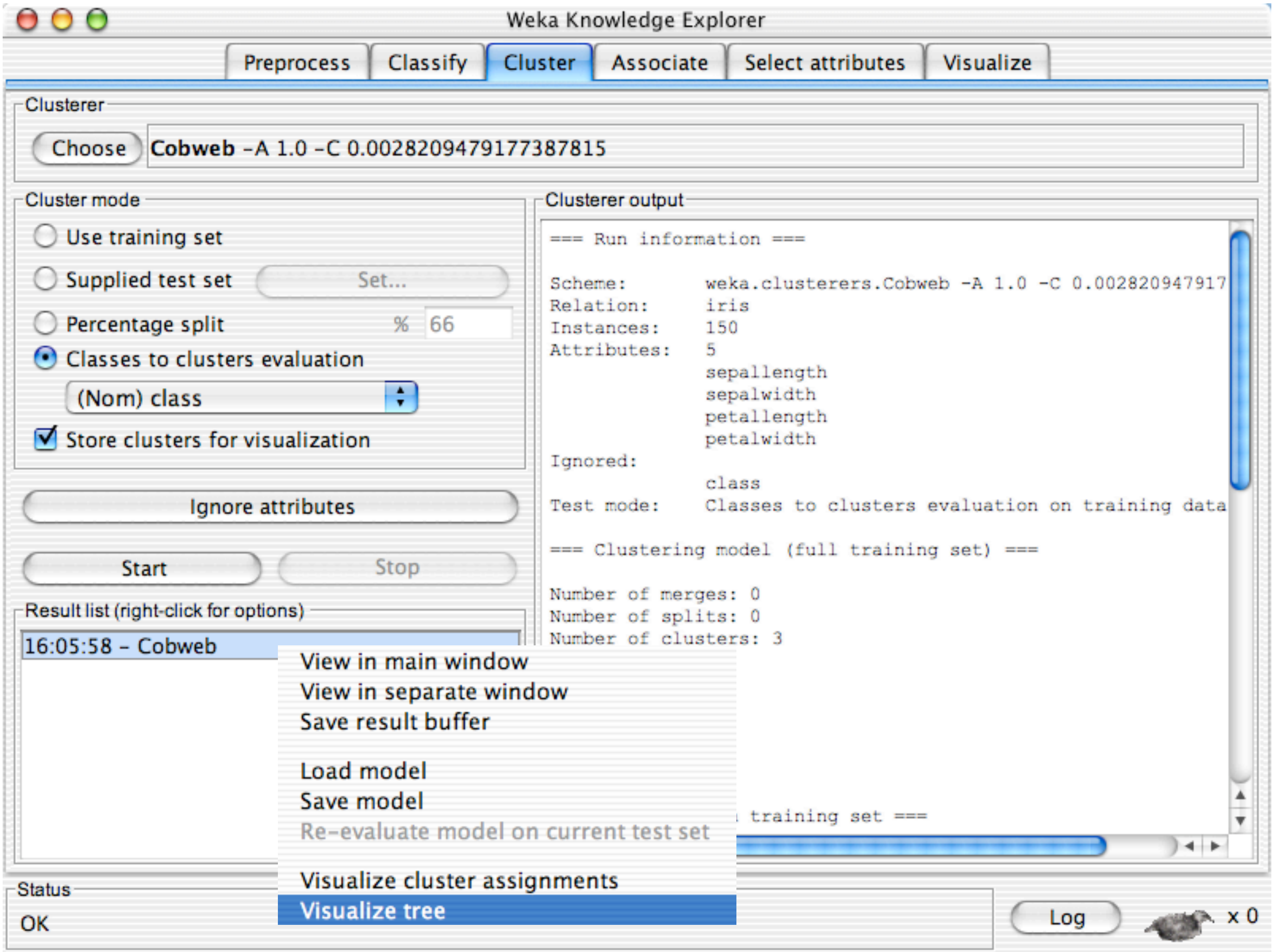

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
Clusterer output
Status
OK
Log
x 0

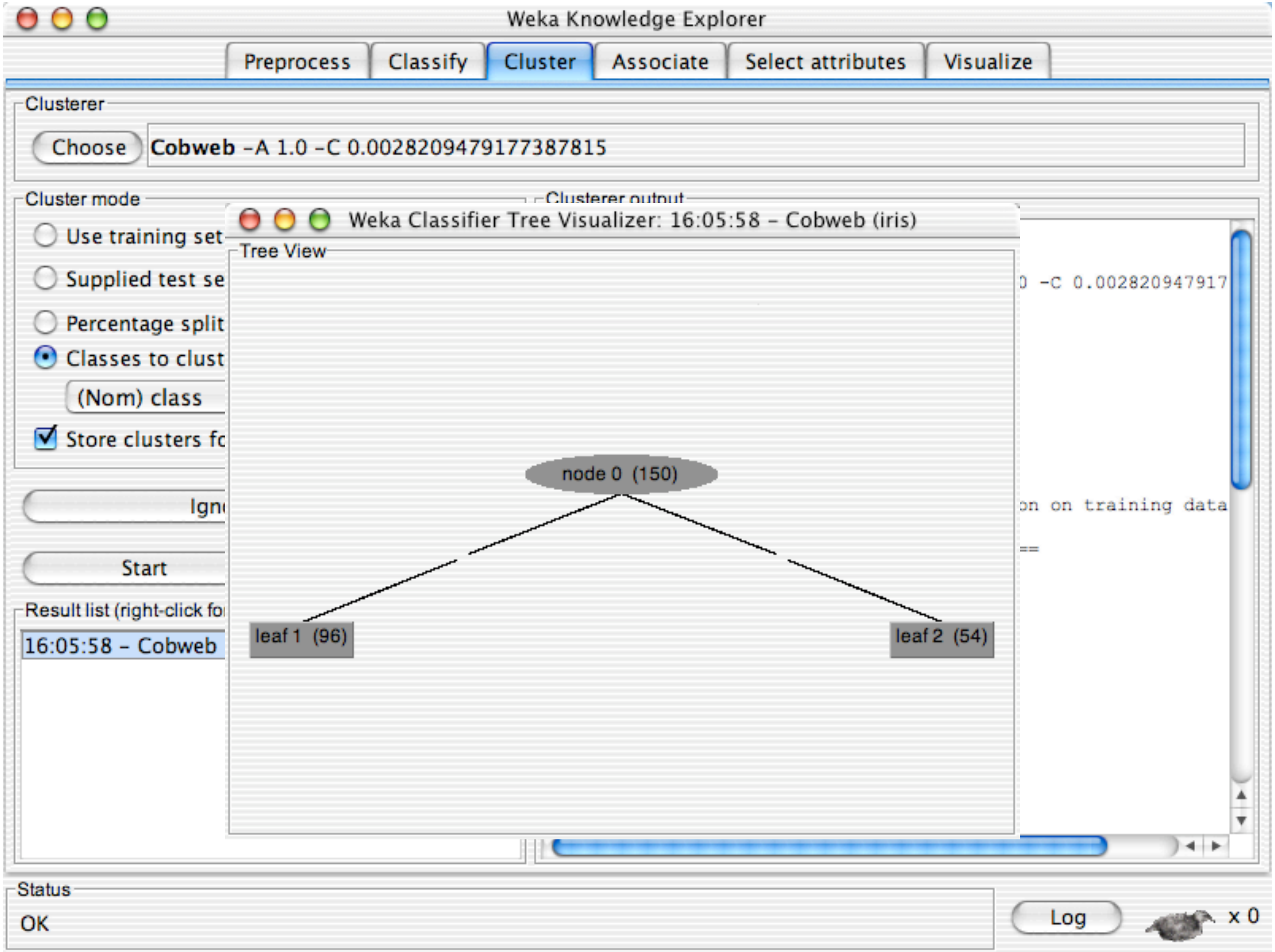

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
16:05:58 - Cobweb
Clusterer output
=== Run information ===
Scheme: weka.clusterers.Cobweb -A 1.0 -C 0.002820947917
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
Ignored:
class
Test mode: Classes to clusters evaluation on training data
=== Clustering model (full training set) ===
Number of merges: 0
Number of splits: 0
Number of clusters: 3
node 0 [150]
| leaf 1 [96]
node 0 [150]
| leaf 2 [54]
=== Evaluation on training set ===
Status
OK
Log
x 0

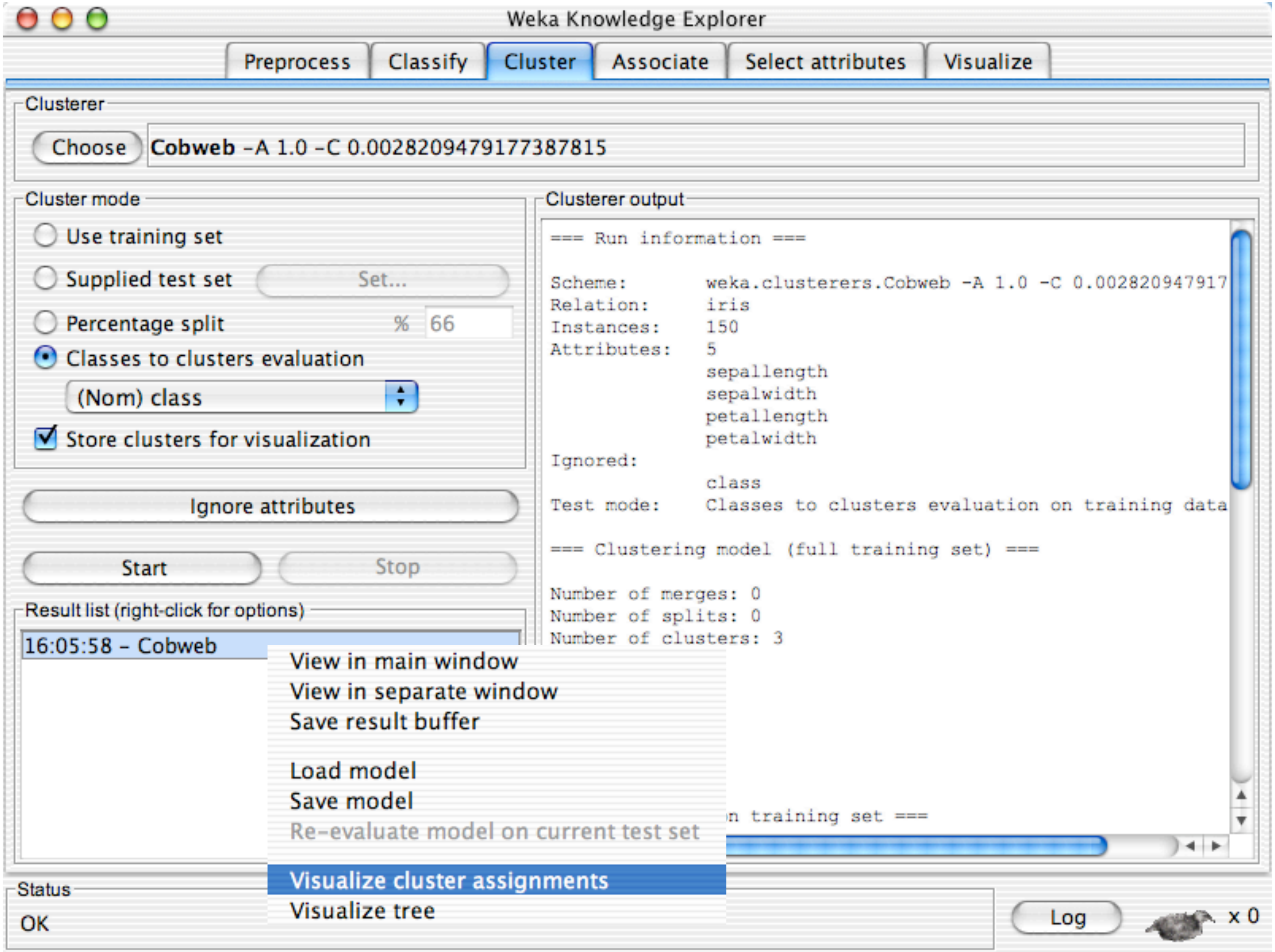

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
16:05:58 - Cobweb
Clusterer output
=== Run information ===
Scheme: weka.clusterers.Cobweb -A 1.0 -C 0.002820947917
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
Ignored:
class
Test mode: Classes to clusters evaluation on training data
=== Clustering model (full training set) ===
Number of merges: 0
Number of splits: 0
Number of clusters: 3
node 0 [150]
| leaf 1 [96]
node 0 [150]
| leaf 2 [54]
=== Evaluation on training set ===
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
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)
16:05:58 - Cobweb
Clusterer output
Number of clusters: 3
node 0 [150]
| leaf 1 [96]
node 0 [150]
| leaf 2 [54]
Clustered Instances
1 100 (67%)
2 50 (33%)
Class attribute: class
Classes to Clusters:
1 2 <-- assigned to cluster
0 50 | Iris-setosa
50 0 | Iris-versicolor
50 0 | Iris-virginica
Cluster 1 <-- Iris-versicolor
Cluster 2 <-- Iris-setosa
Incorrectly clustered instances : 50.0 33.3333 %
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
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)
16:05:58 - Cobweb
Clusterer output
Number of clusters: 3
node 0 [150]
| leaf 1 [96]
node 0 [150]
| leaf 2 [54]
Clustered Instances
1 100 (67%)
2 50 (33%)
Class attribute: class
Classes to Clusters:
1 2 <-- assigned to cluster
0 50 | Iris-setosa
50 0 | Iris-versicolor
50 0 | Iris-virginica
Cluster 1 <-- Iris-versicolor
Cluster 2 <-- Iris-setosa
Incorrectly clustered instances : 50.0 33.3333 %
Status
OK
Log
x 0

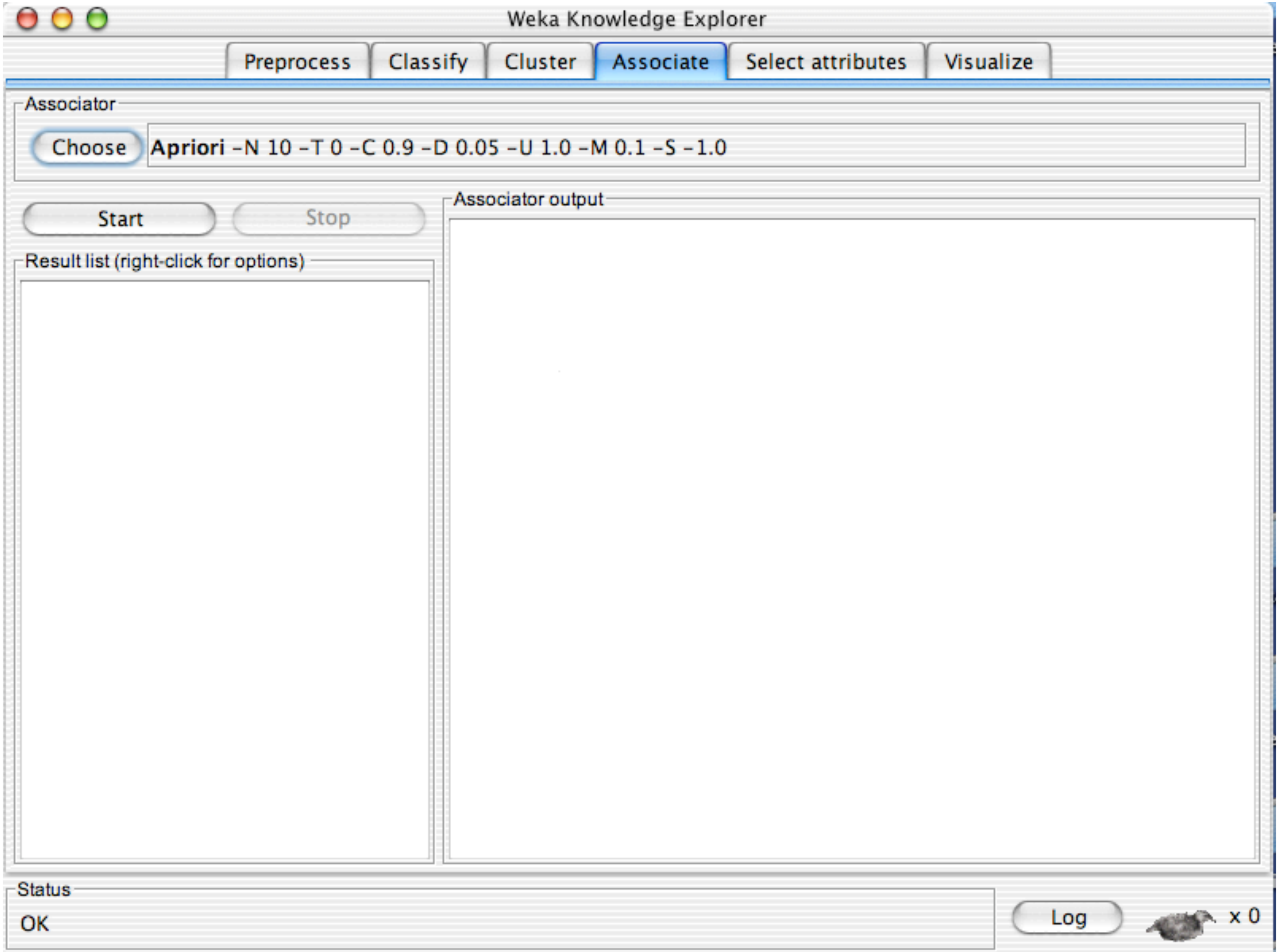

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
16:05:58 - Cobweb
Clusterer output
=== Run information ===
Scheme: weka.clusterers.Cobweb -A 1.0 -C 0.002820947917
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
Ignored:
class
Test mode: Classes to clusters evaluation on training data
=== Clustering model (full training set) ===
Number of merges: 0
Number of splits: 0
Number of clusters: 3
training set ===
View in main window
View in separate window
Save result buffer
Load model
Save model
Re-evaluate model on current test set
Visualize cluster assignments
Visualize tree
Status
OK
Log
x 0

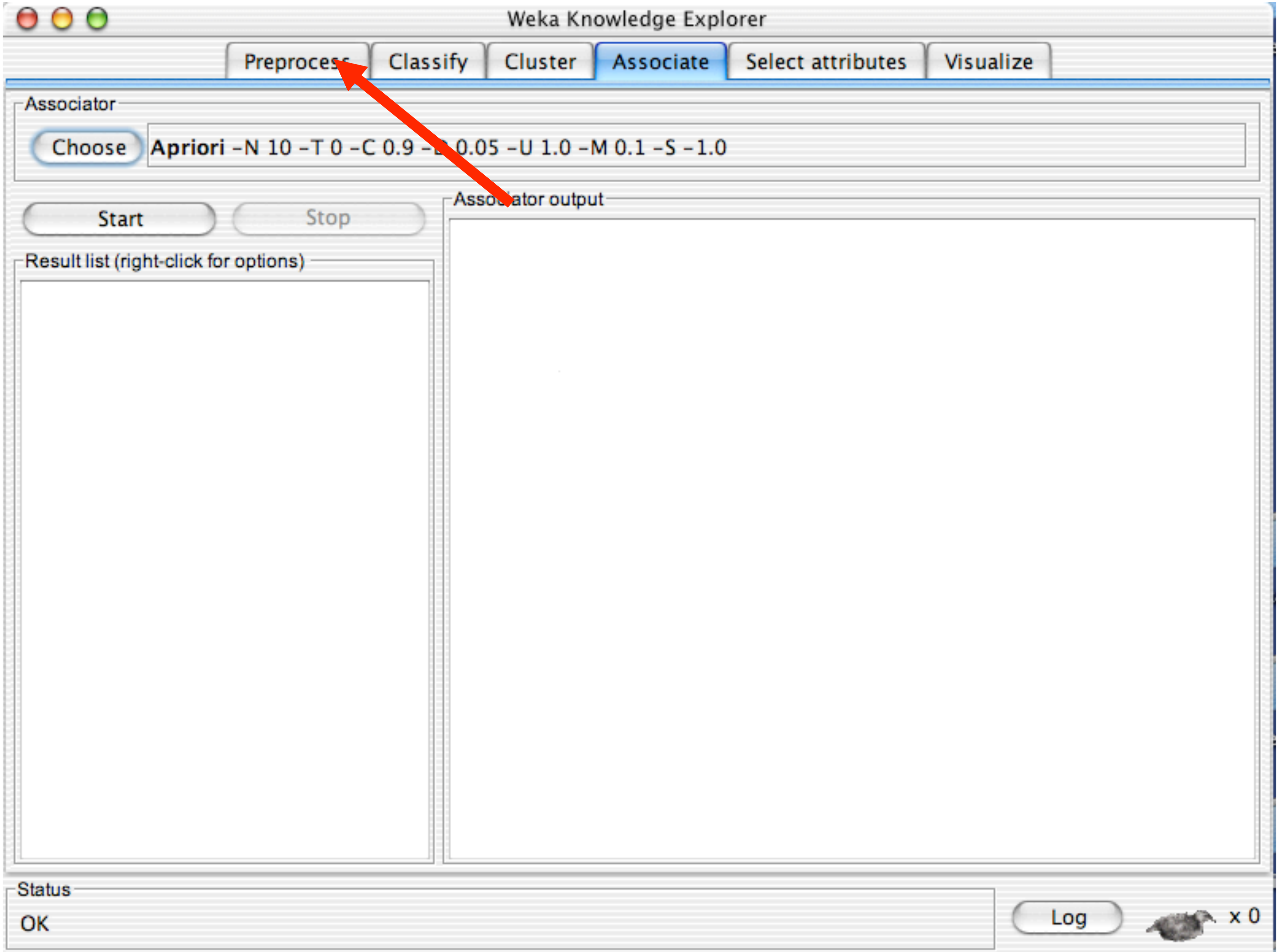

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test se
Percentage split
Classes to clust
(Nom) class
Store clusters fo
Ign
Start
Result list (right-click fo
16:05:58 - Cobweb
Clusterer output
Weka Classifier Tree Visualizer: 16:05:58 - Cobweb (iris)
Tree View
node 0 (150)
leaf 1 (96)
leaf 2 (54)
0 -C 0.002820947917
on on training data
Status
OK
Log
x 0

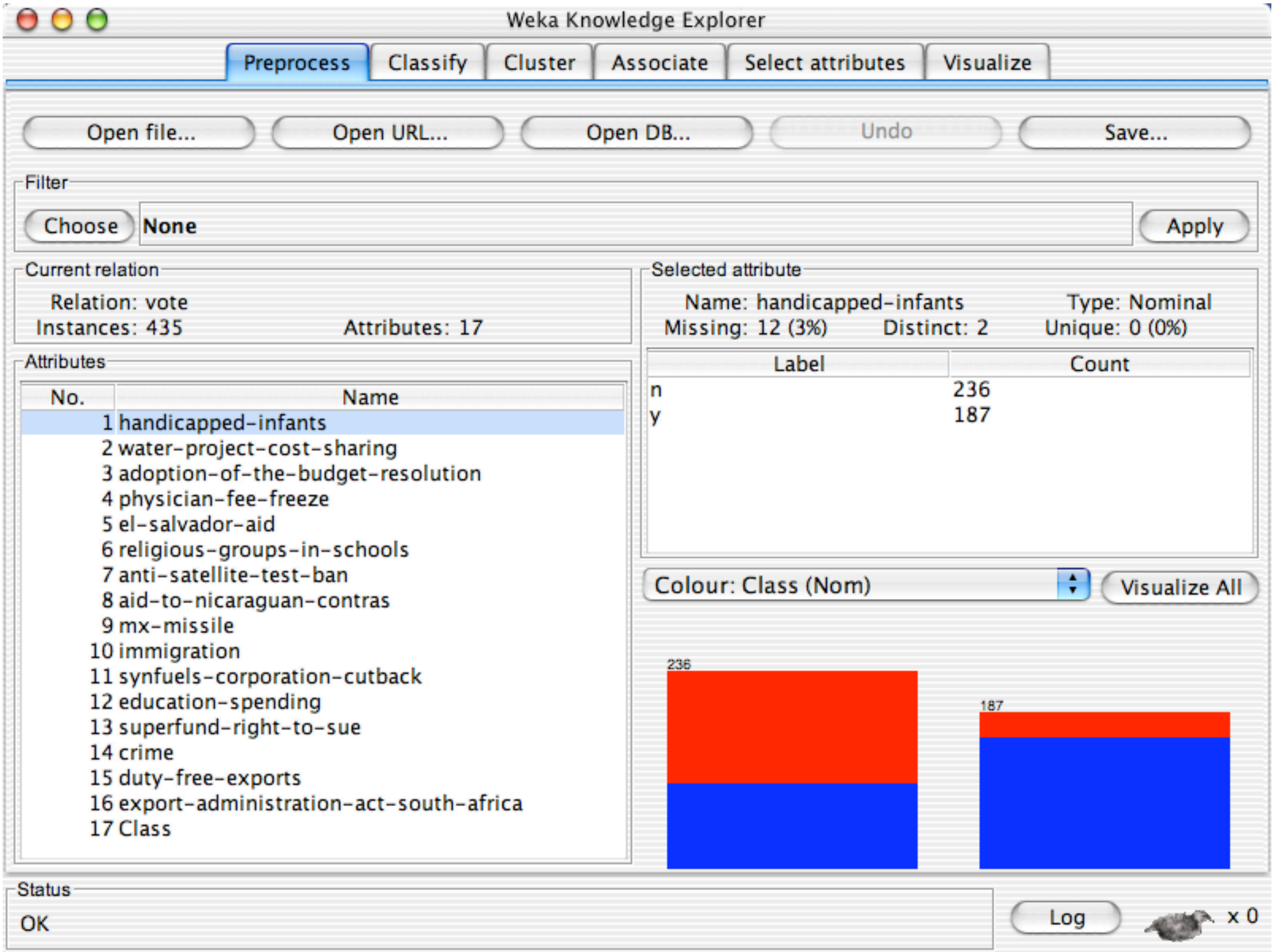

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes
Start
Stop
Result list (right-click for options)
16:05:58 - Cobweb
Clusterer output
=== Run information ===
Scheme: weka.clusterers.Cobweb -A 1.0 -C 0.002820947917
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
Ignored:
class
Test mode: Classes to clusters evaluation on training data
=== Clustering model (full training set) ===
Number of merges: 0
Number of splits: 0
Number of clusters: 3
View in main window
View in separate window
Save result buffer
Load model
Save model
Re-evaluate model on current test set
Visualize cluster assignments
Visualize tree
n training set ===
Status
OK
Log
x 0

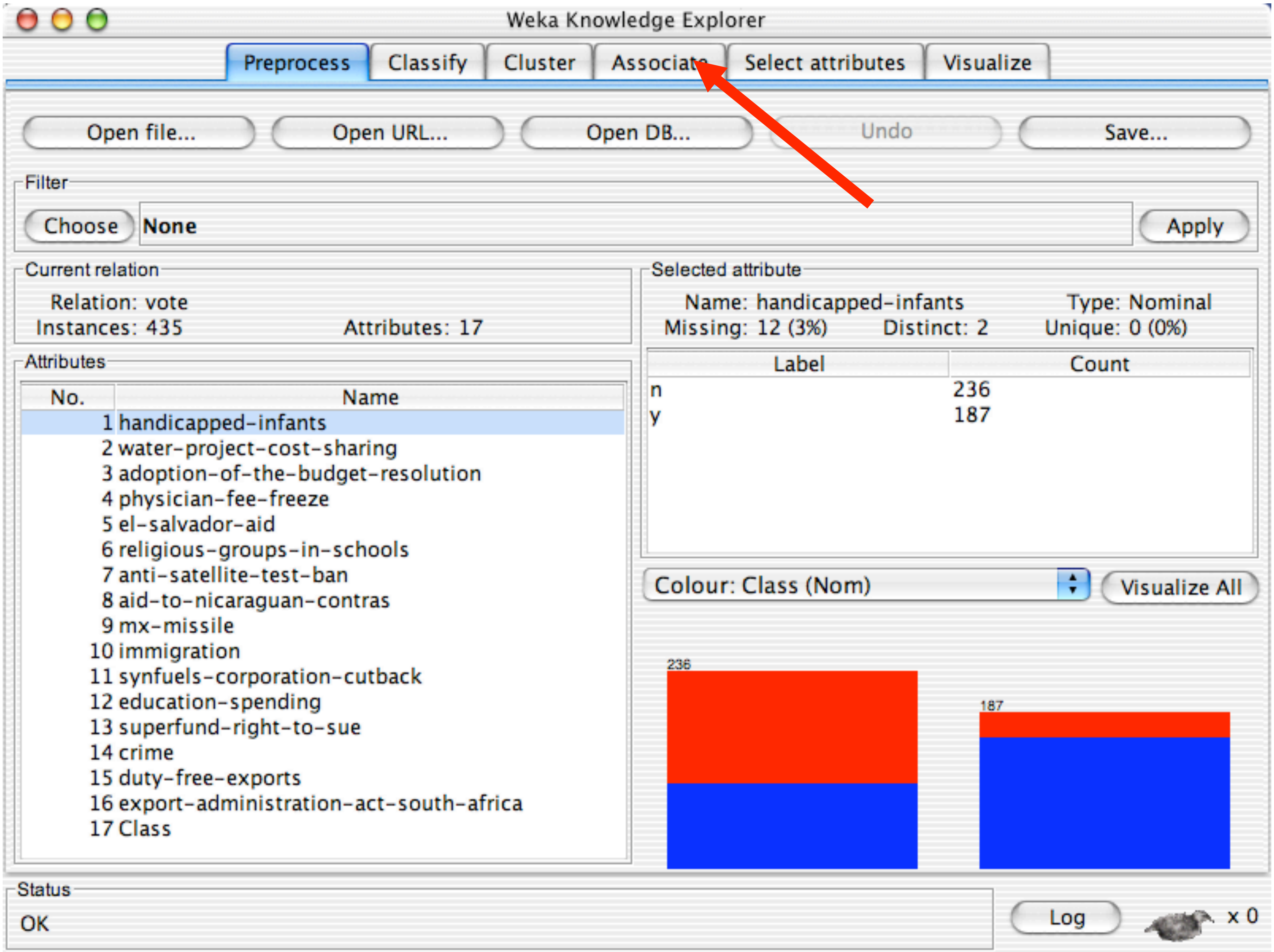
Explorer: finding associations

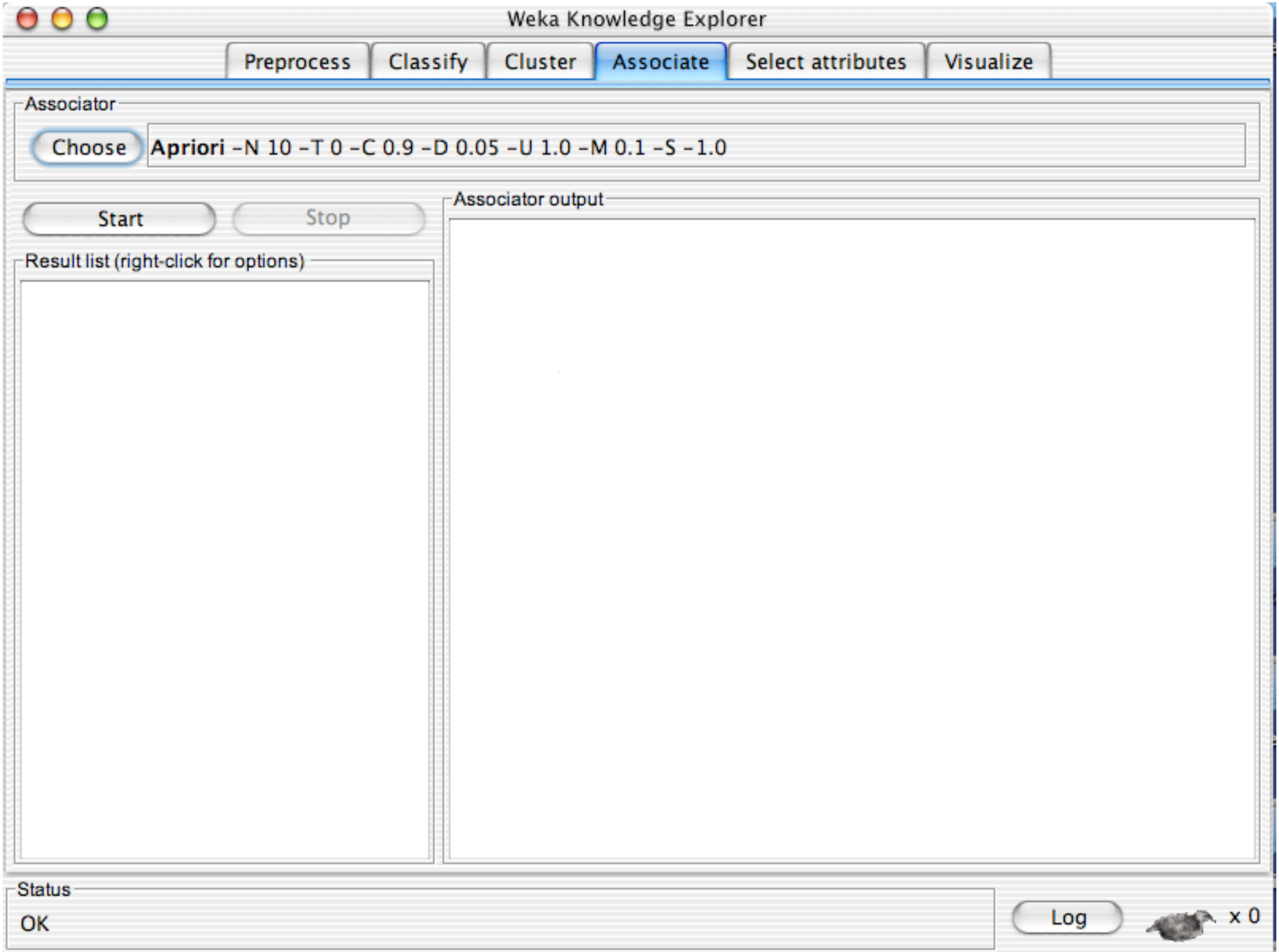
- WEKA contains an implementation of the Apri ori algorithm for learning association rules
  - Works only with discrete data
- Can identify statistical dependencies between groups of attributes:
  - milk, butter $\Rightarrow$ bread, eggs (with confidence 0.9 and support 2000)
- Apriori can compute all rules that have a give n minimum support and exceed a given confi dence

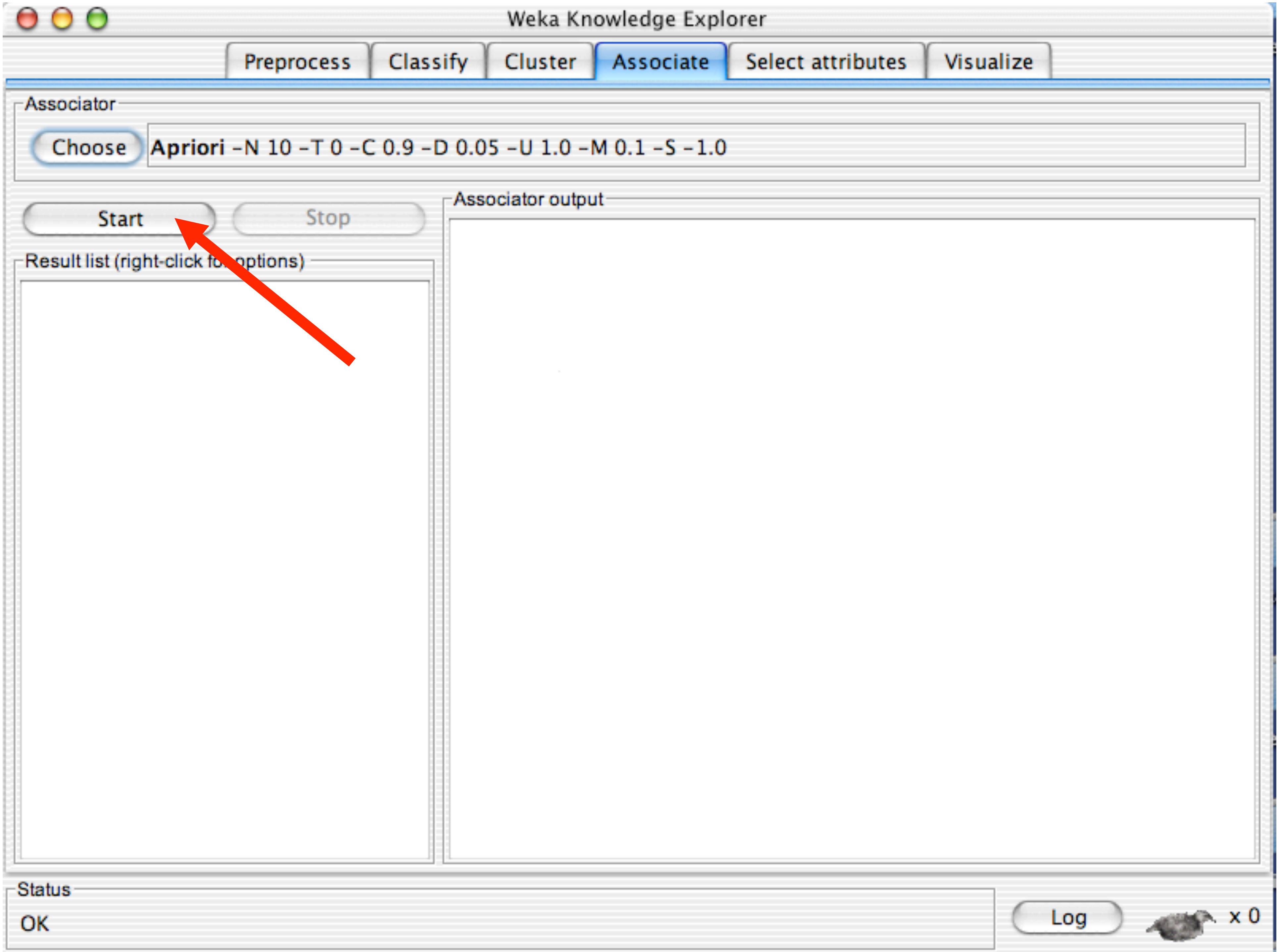

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Associator output
Result list (right-click for options)
Status
OK
Log
x 0


Weka Knowledge Explorer
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
Start
Stop
Associator output
Result list (right-click for options)
Status
OK
Log
x 0

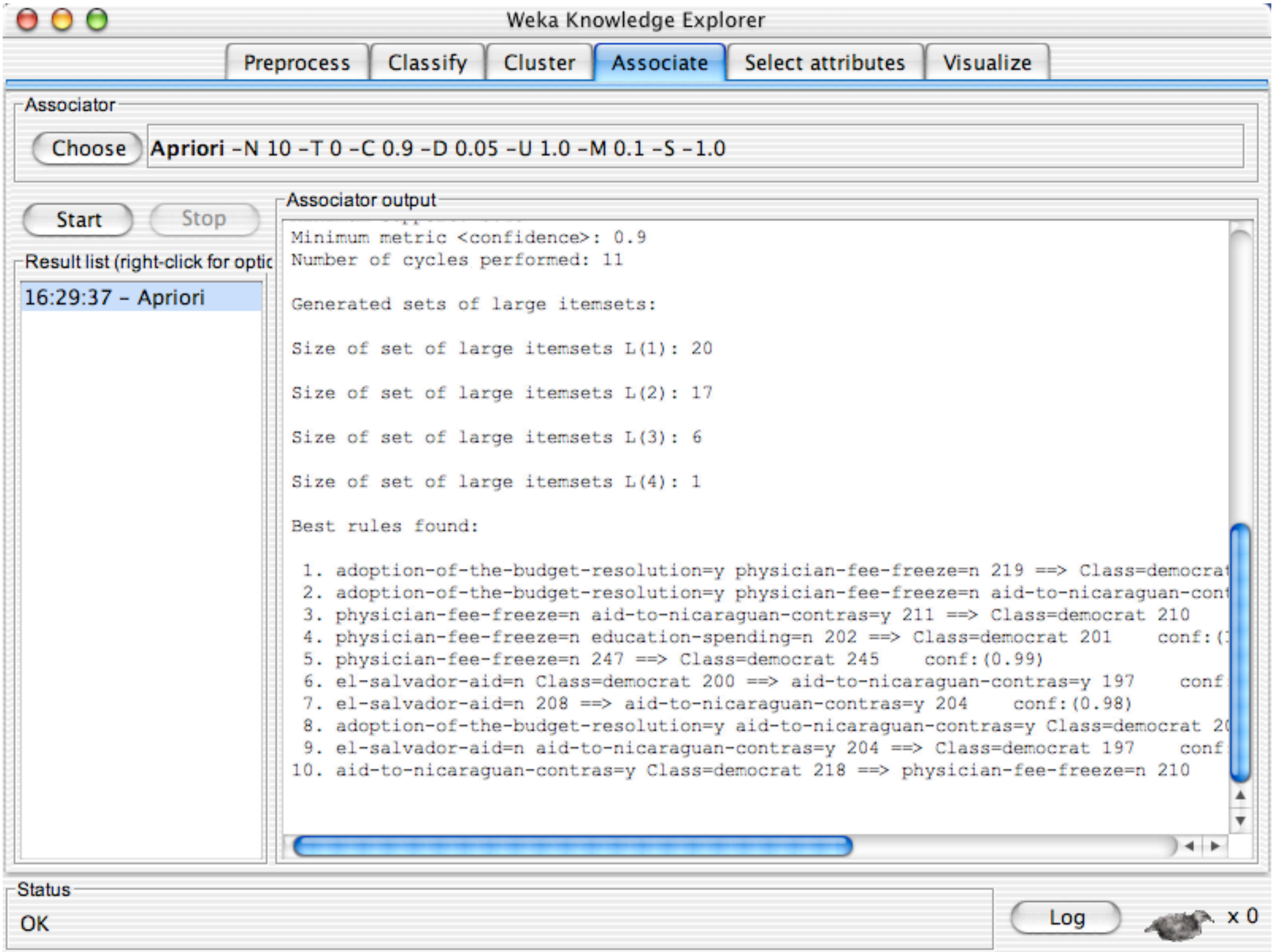

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: vote
Instances: 435
Attributes: 17
Attributes
No.
Name
1 handicapped-infants
2 water-project-cost-sharing
3 adoption-of-the-budget-resolution
4 physician-fee-freeze
5 el-salvador-aid
6 religious-groups-in-schools
7 anti-satellite-test-ban
8 aid-to-nicaraguan-contras
9 mx-missile
10 immigration
11 synfuels-corporation-cutback
12 education-spending
13 superfund-right-to-sue
14 crime
15 duty-free-exports
16 export-administration-act-south-africa
17 Class
Selected attribute
Name: handicapped-infants
Type: Nominal
Missing: 12 (3%)
Distinct: 2
Unique: 0 (0%)
Label
Count
n
236
y
187
Colour: Class (Nom)
Visualize All
236
187
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: vote
Instances: 435
Attributes: 17
Selected attribute
Name: handicapped-infants
Type: Nominal
Missing: 12 (3%)
Distinct: 2
Unique: 0 (0%)
Label
Count
n
236
y
187
Attributes
No.
Name
1 handicapped-infants
2 water-project-cost-sharing
3 adoption-of-the-budget-resolution
4 physician-fee-freeze
5 el-salvador-aid
6 religious-groups-in-schools
7 anti-satellite-test-ban
8 aid-to-nicaraguan-contras
9 mx-missile
10 immigration
11 synfuels-corporation-cutback
12 education-spending
13 superfund-right-to-sue
14 crime
15 duty-free-exports
16 export-administration-act-south-africa
17 Class
Colour: Class (Nom)
Visualize All
236
187
Status
OK
Log
x 0


Weka Knowledge Explorer
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
Start
Stop
Associator output
Result list (right-click for options)
Status
OK
Log
x 0

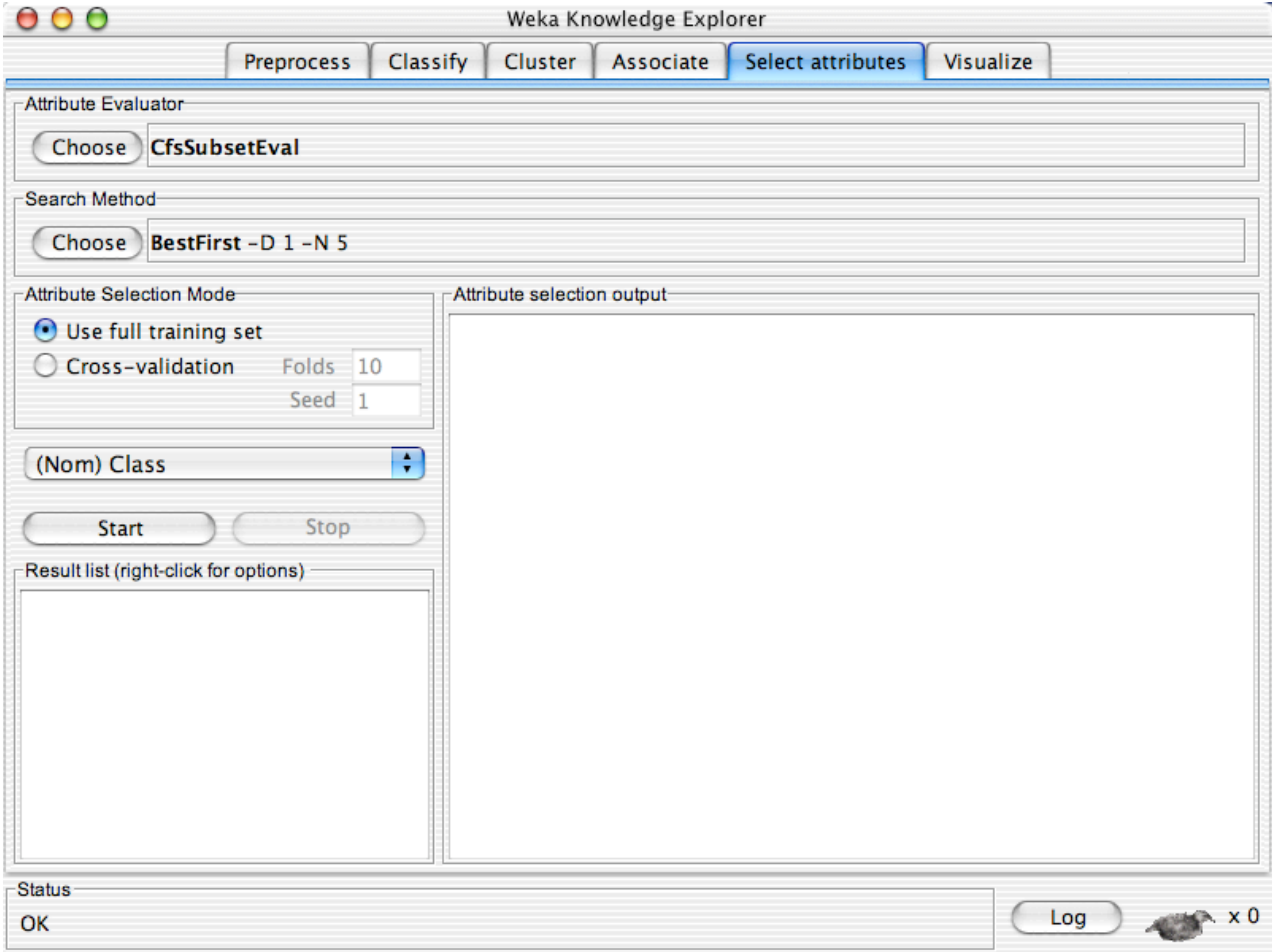


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for options)
Associator output
Status
OK
Log
x 0

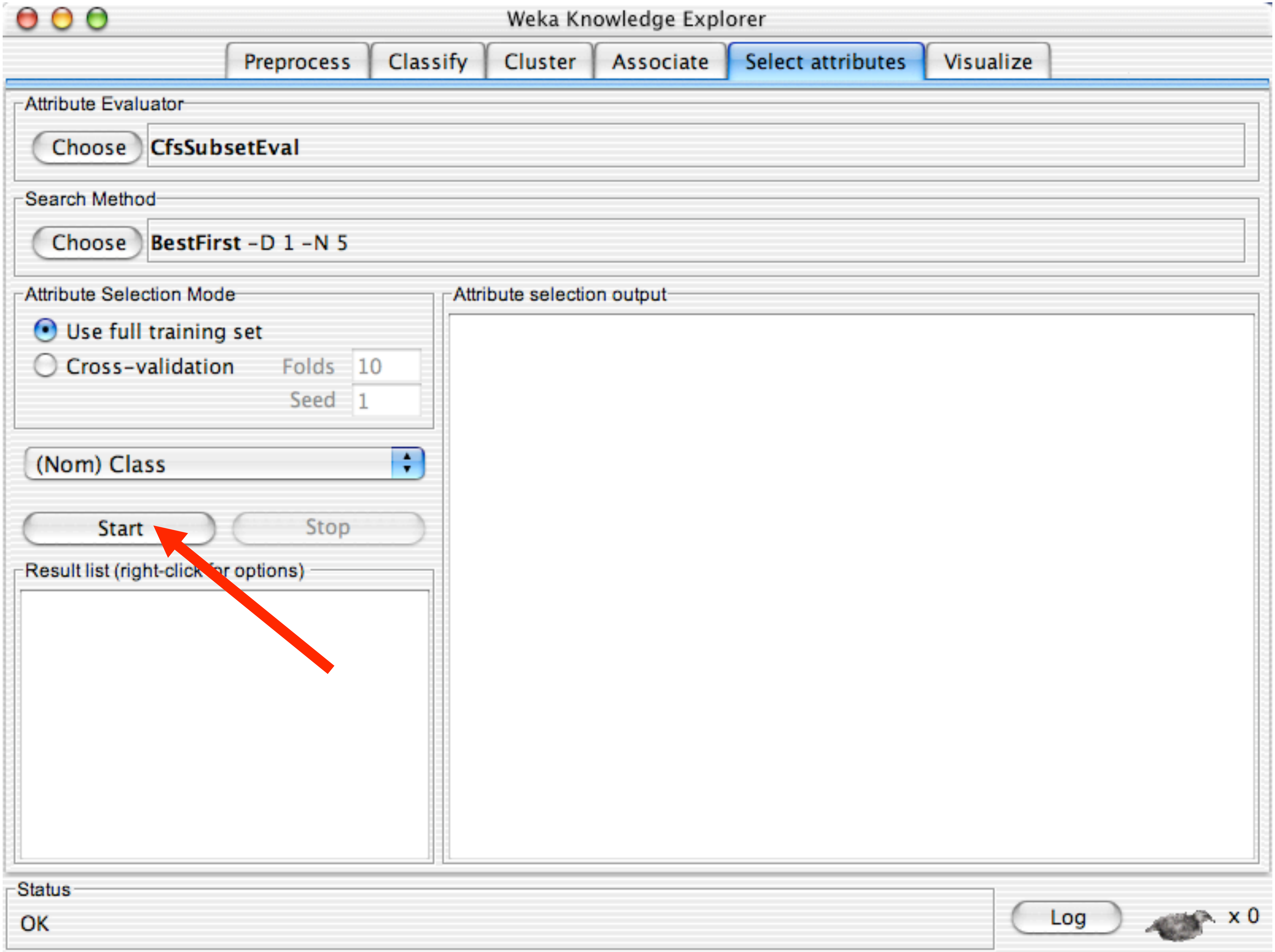

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for optic
16:29:37 - Apriori
Associator output
Minimum metric <confidence>: 0.9
Number of cycles performed: 11
Generated sets of large itemsets:
Size of set of large itemsets L(1): 20
Size of set of large itemsets L(2): 17
Size of set of large itemsets L(3): 6
Size of set of large itemsets L(4): 1
Best rules found:
1. adoption-of-the-budget-resolution=y physician-fee-freeze=n 219 ==> Class=democrat
2. adoption-of-the-budget-resolution=y physician-fee-freeze=n aid-to-nicaraguan-con
3. physician-fee-freeze=n aid-to-nicaraguan-contras=y 211 ==> Class=democrat 210
4. physician-fee-freeze=n education-spending=n 202 ==> Class=democrat 201 conf:(
5. physician-fee-freeze=n 247 ==> Class=democrat 245 conf:(0.99)
6. el-salvador-aid=n Class=democrat 200 ==> aid-to-nicaraguan-contras=y 197 conf
7. el-salvador-aid=n 208 ==> aid-to-nicaraguan-contras=y 204 conf:(0.98)
8. adoption-of-the-budget-resolution=y aid-to-nicaraguan-contras=y Class=democrat 2
9. el-salvador-aid=n aid-to-nicaraguan-contras=y 204 ==> Class=democrat 197 conf
10. aid-to-nicaraguan-contras=y Class=democrat 218 ==> physician-fee-freeze=n 210
Status
OK
Log
x 0

Explorer: attribute selection

- Panel that can be used to investigate which (subsets of) attributes are the most predictive ones
- Attribute selection methods contain two parts:
  - A search method: best-first, forward selection, random, exhaustive, genetic algorithm, ranking
  - An evaluation method: correlation-based, wrapper, information gain, chi-squared, …
- Very flexible: WEKA allows (almost) arbitrary combinations of these two



Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds 10
Seed 1
(Nom) Class
Start
Stop
Result list (right-click for options)
Attribute selection output
Status
OK
Log
x 0


Weka Knowledge Explorer
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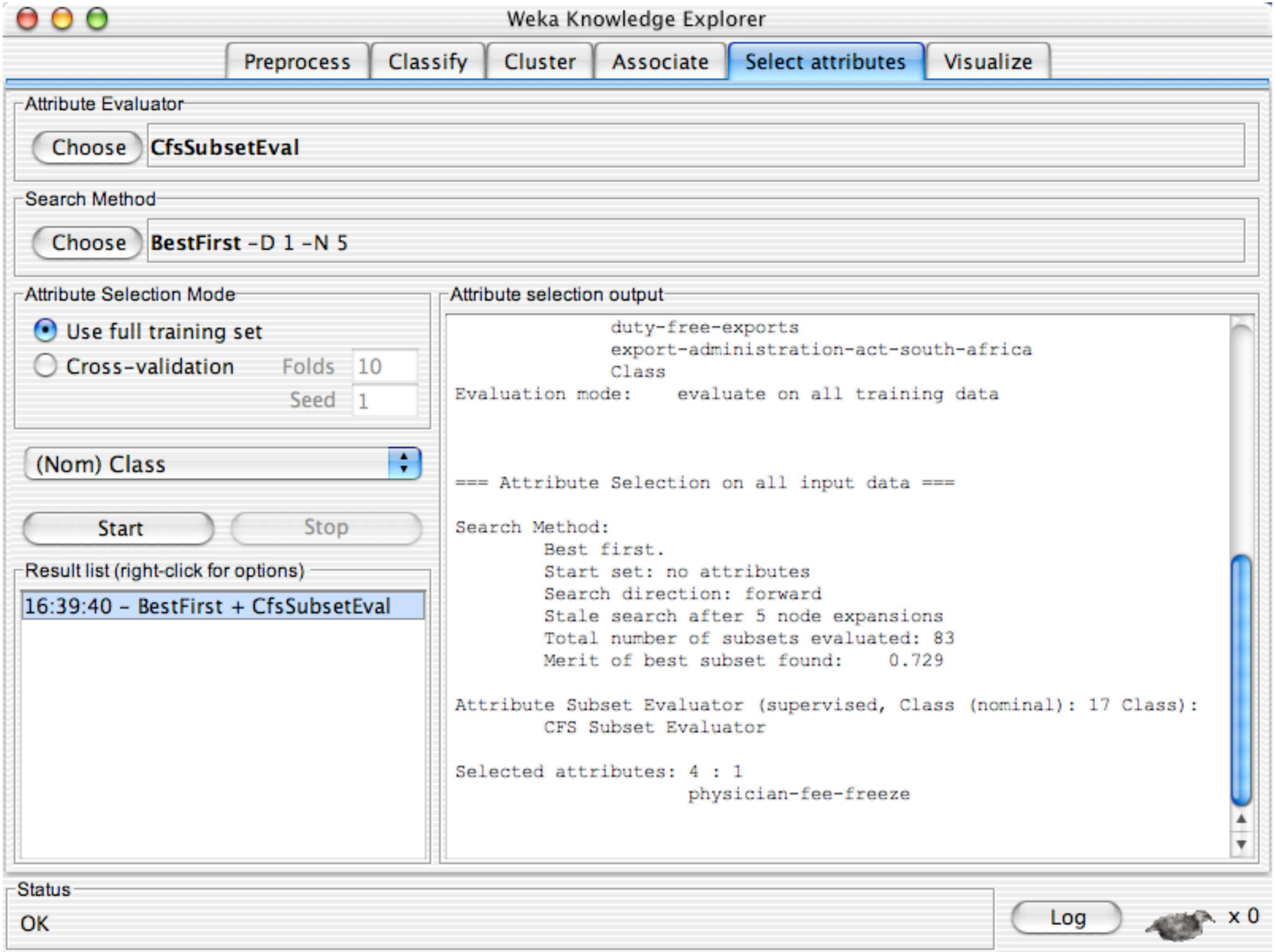
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds
10
Seed
1
(Nom) Class
Start
Stop
Result list (right-click for options)
Attribute selection output
Status
OK
Log
x 0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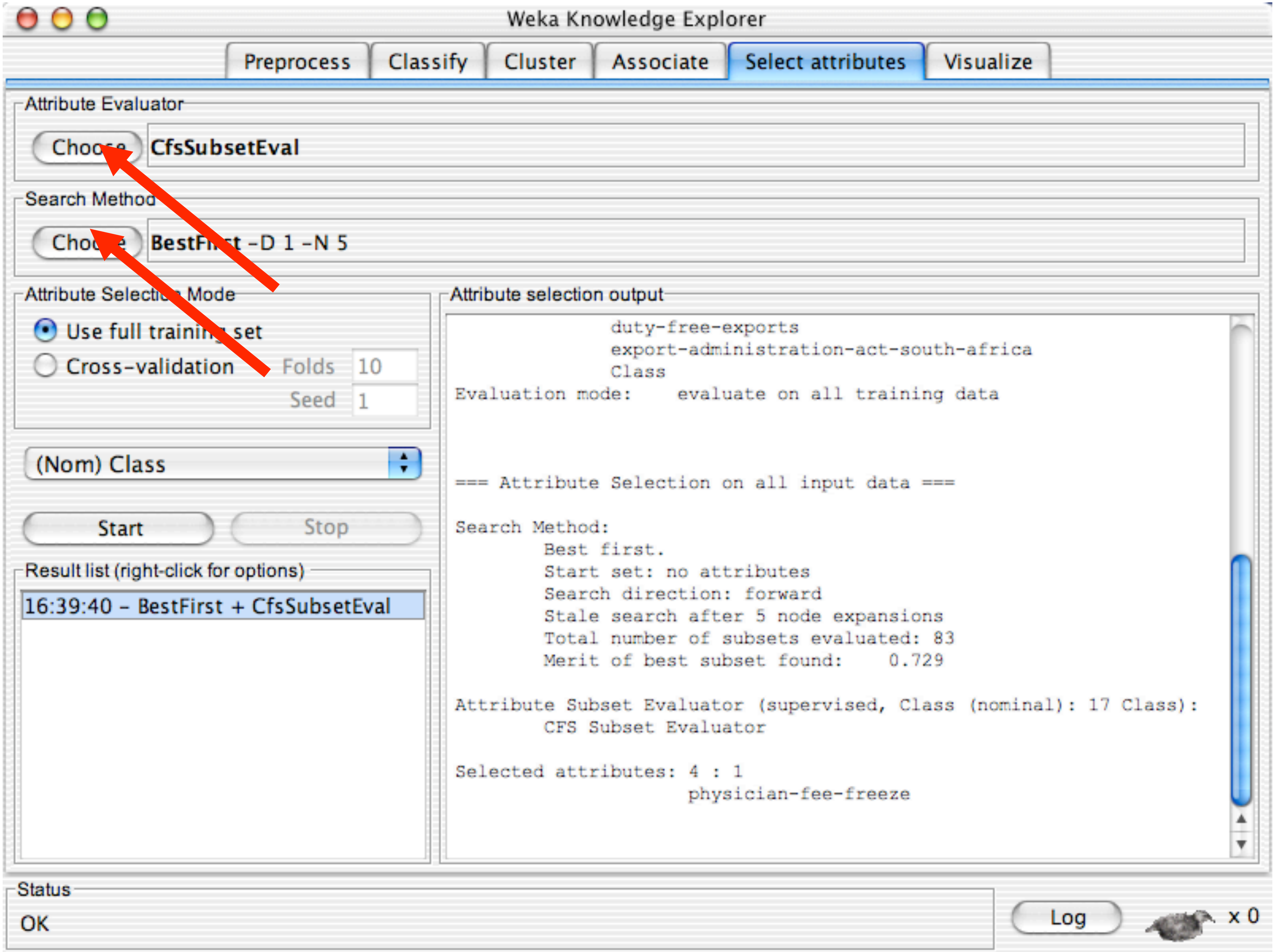
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds 10
Seed 1
(Nom) Class
Start
Stop
Result list (right-click for options)
16:39:40 - BestFirst + CfsSubsetEval
Attribute selection output
duty-free-exports
export-administration-act-south-africa
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: 83
Merit of best subset found: 0.729
Attribute Subset Evaluator (supervised, Class (nominal): 17 Class):
CFS Subset Evaluator
Selected attributes: 4 : 1
physician-fee-freeze
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds 10
Seed 1
(Nom) Class
Start
Stop
Result list (right-click for options)
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export-administration-act-south-africa
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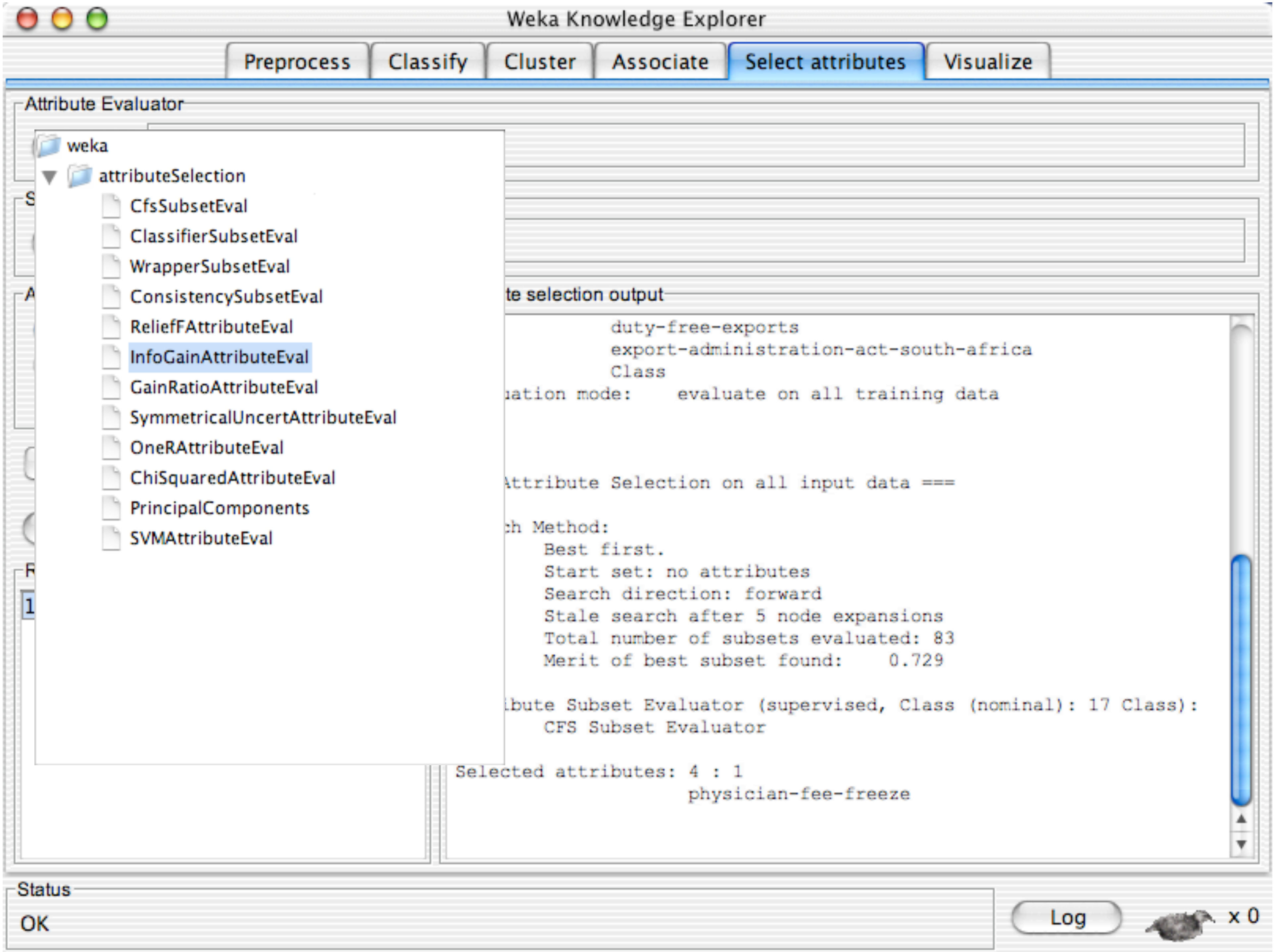
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
weka
attributeSelection
CfsSubsetEval
ClassifierSubsetEval
WrapperSubsetEval
ConsistencySubsetEval
ReliefFAttributeEval
InfoGainAttributeEval
GainRatioAttributeEval
SymmetricalUncertAttributeEval
OneRAttributeEval
ChiSquaredAttributeEval
PrincipalComponents
SVMAttributeEval
te selection output
duty-free-exports
export-administration-act-south-africa
Class
uation mode: evaluate on all training data
Attribute Selection on all input data ===
ch Method:
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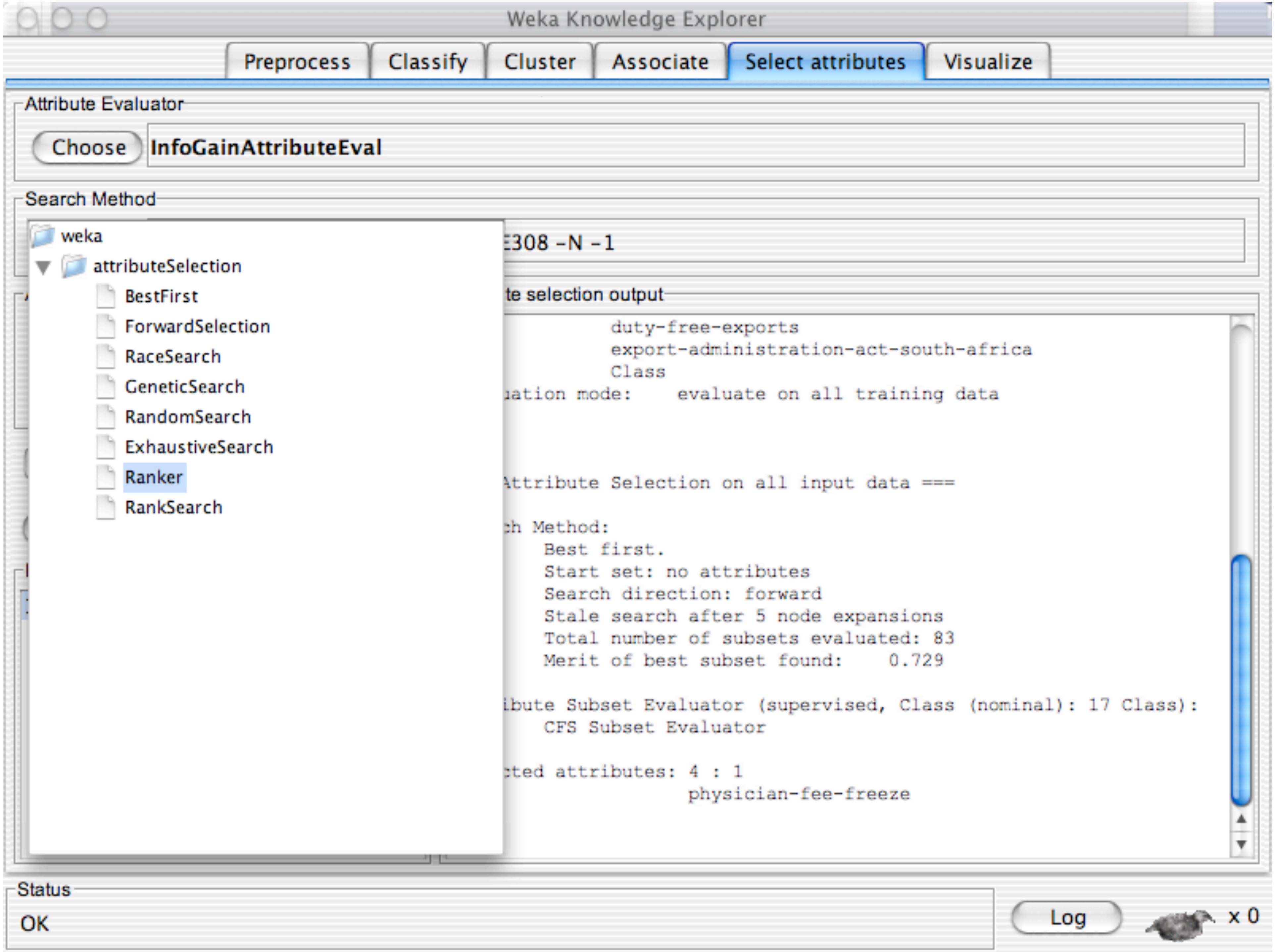
Selected attributes: 4 : 1
physician-fee-freeze
Status
OK
Log
x 0



Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
InfoGainAttributeEval
Search Method
weka
attributeSelection
BestFirst
ForwardSelection
RaceSearch
GeneticSearch
RandomSearch
ExhaustiveSearch
Ranker
RankSearch
308 -N -1
te selection output
duty-free-exports
export-administration-act-south-africa
Class
uation mode: evaluate on all training data
Attribute Selection on all input data ===
ch Method:
Best first.
Start set: no attributes
Search direction: forward
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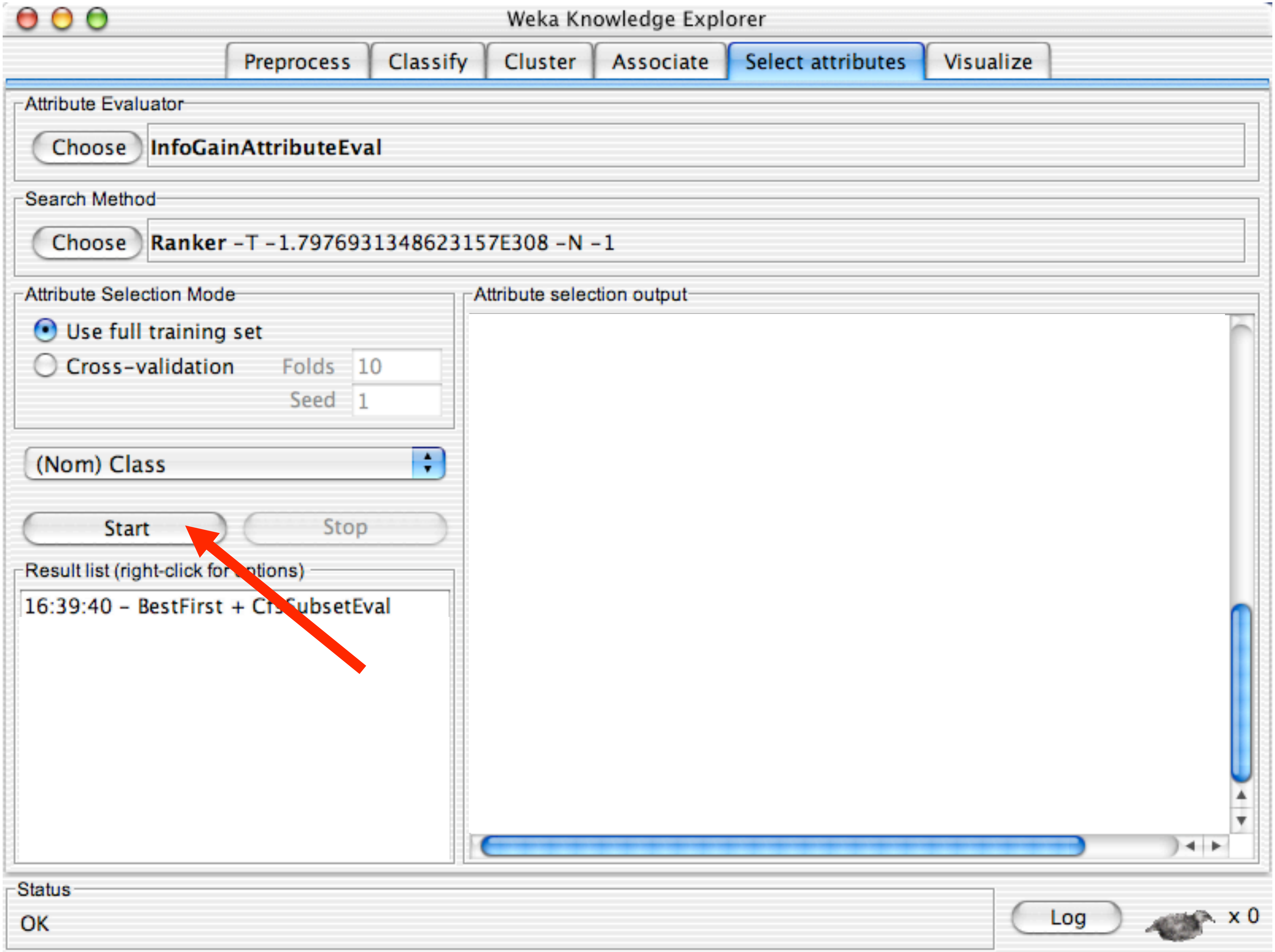
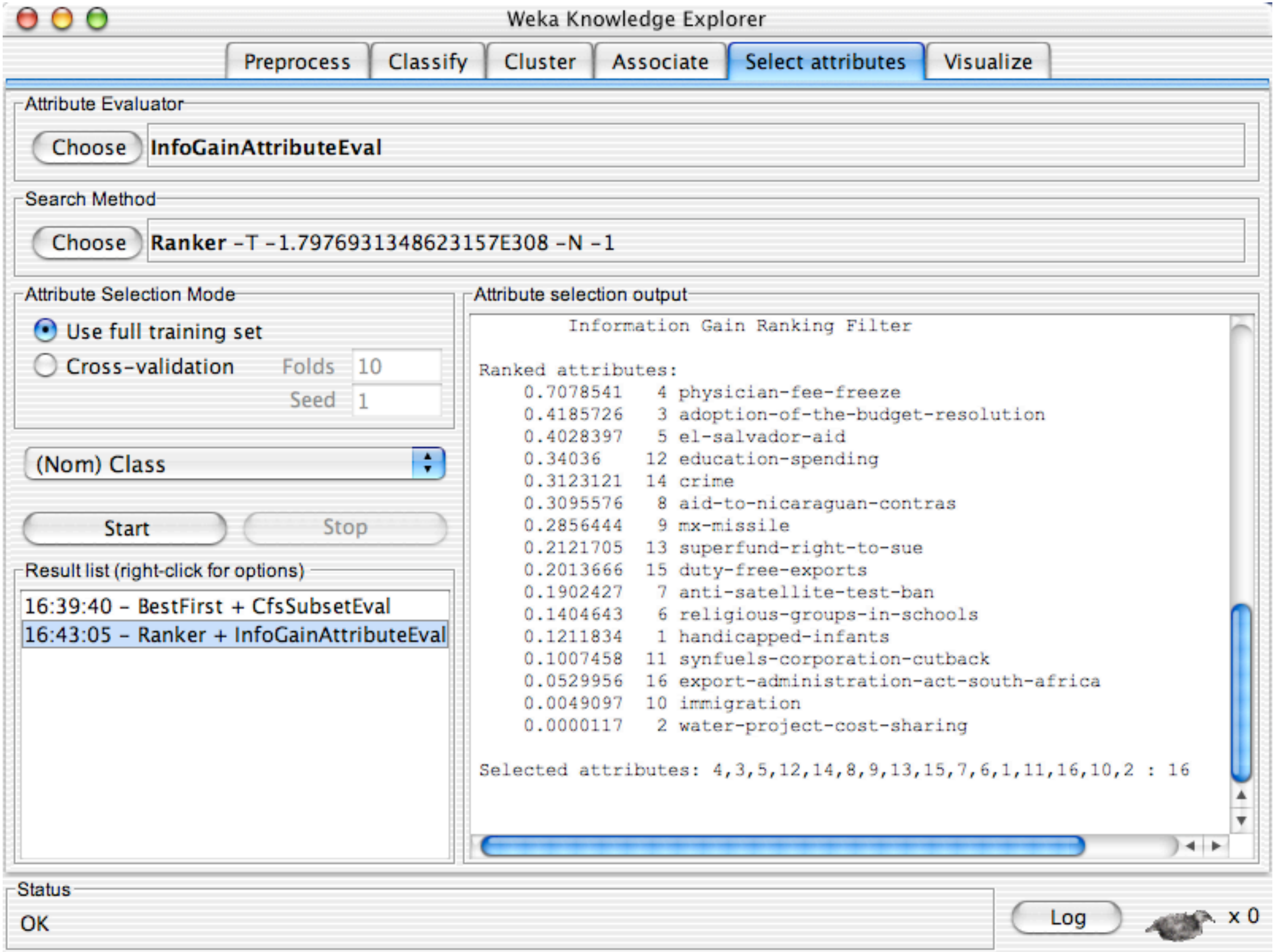
physician-fee-freeze
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
InfoGainAttributeEval
Search Method
Choose
Ranker -T -1.7976931348623157E308 -N -1
Attribute Selection Mode
Use full training set
Cross-validation
Folds
10
Seed
1
(Nom) Class
Start
Stop
Attribute selection output
Status
OK
Log
x 0

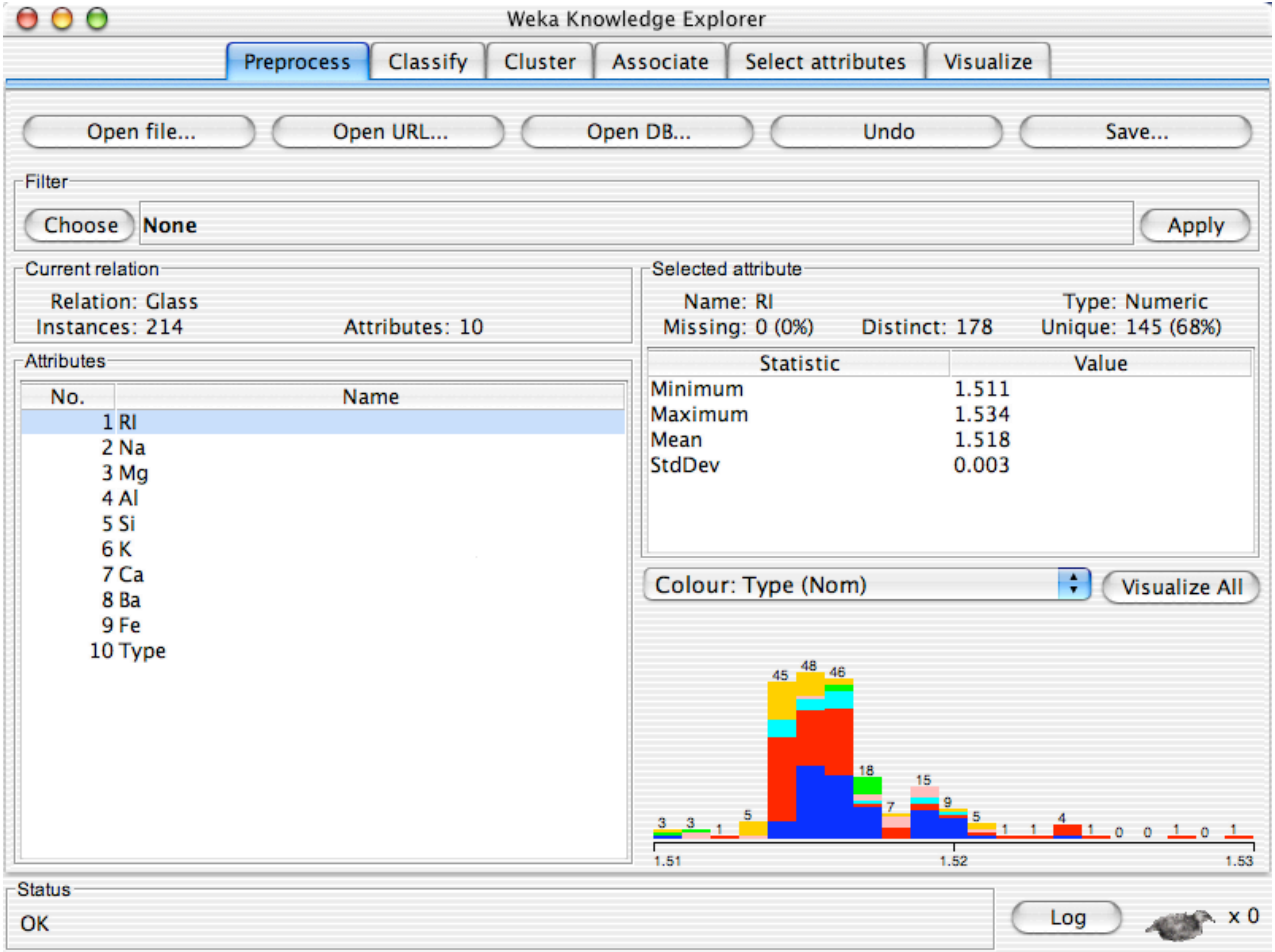

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
InfoGainAttributeEval
Search Method
Choose
Ranker -T -1.7976931348623157E308 -N -1
Attribute Selection Mode
Use full training set
Cross-validation
Folds 10
Seed 1
(Nom) Class
Start
Stop
Result list (right-click for options)
16:39:40 - BestFirst + CfsSubsetEval
16:43:05 - Ranker + InfoGainAttributeEval
Attribute selection output
Information Gain Ranking Filter
Ranked attributes:
0.7078541 4 physician-fee-freeze
0.4185726 3 adoption-of-the-budget-resolution
0.4028397 5 el-salvador-aid
0.34036 12 education-spending
0.3123121 14 crime
0.3095576 8 aid-to-nicaraguan-contras
0.2856444 9 mx-missile
0.2121705 13 superfund-right-to-sue
0.2013666 15 duty-free-exports
0.1902427 7 anti-satellite-test-ban
0.1404643 6 religious-groups-in-schools
0.1211834 1 handicapped-infants
0.1007458 11 synfuels-corporation-cutback
0.0529956 16 export-administration-act-south-africa
0.0049097 10 immigration
0.0000117 2 water-project-cost-sharing
Selected attributes: 4,3,5,12,14,8,9,13,15,7,6,1,11,16,10,2 : 16
Status
OK
Log
x 0

Which attribute selector?

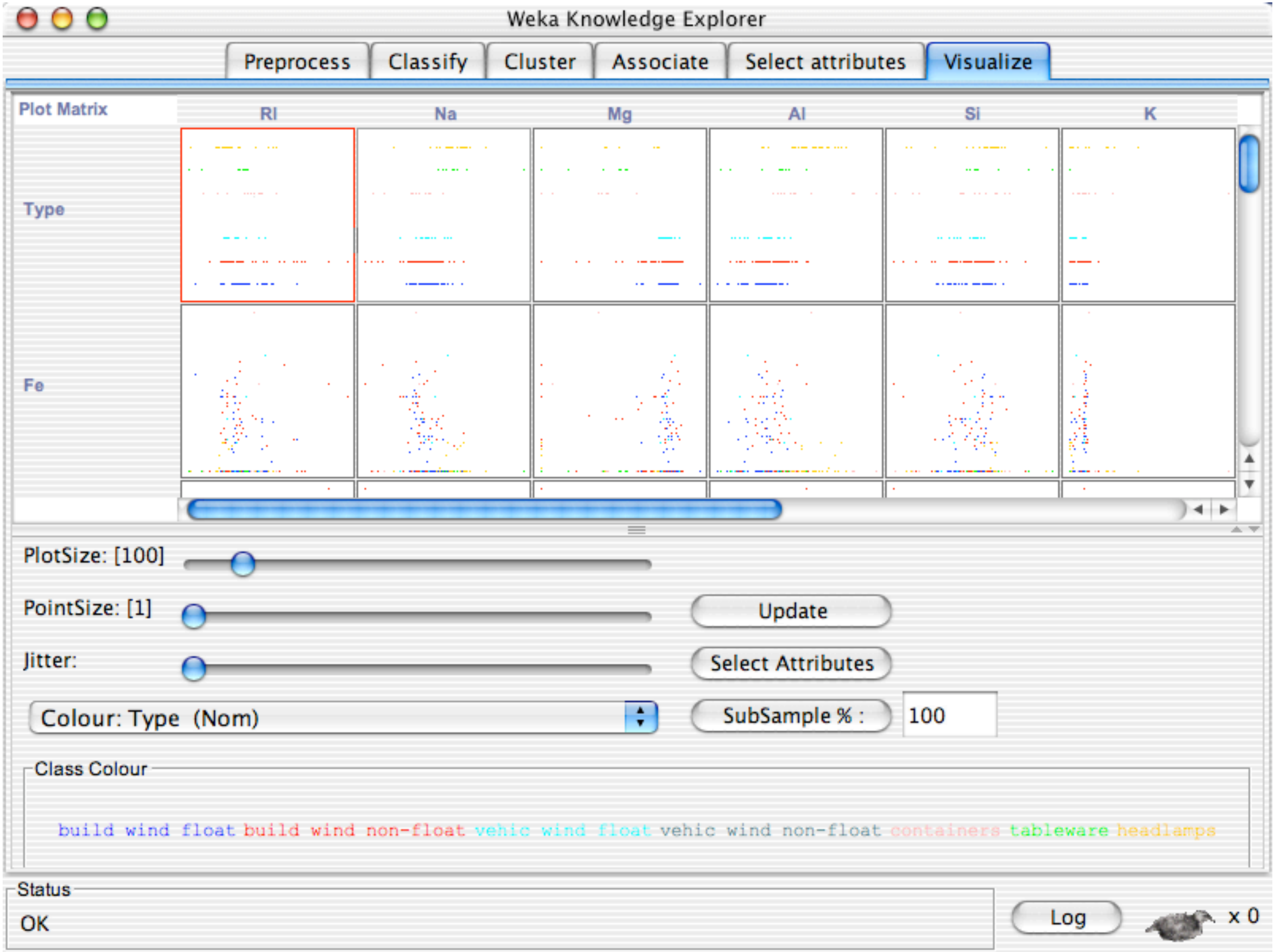
- Best: WRAPPER
  - Slow: O(2^N) search through all attribute combinations
  - The “wrapped” learner called to assess each combination
  - Some heuristics to prune the search; but does not scale
- If not WRAPPER
  - Use InfoGain / OneR for very big datasets
  - Use CFS otherwise
- Don’t use PCA
  - This is an unsupervised selector
  - So it is uninformed on how dimensions help classification

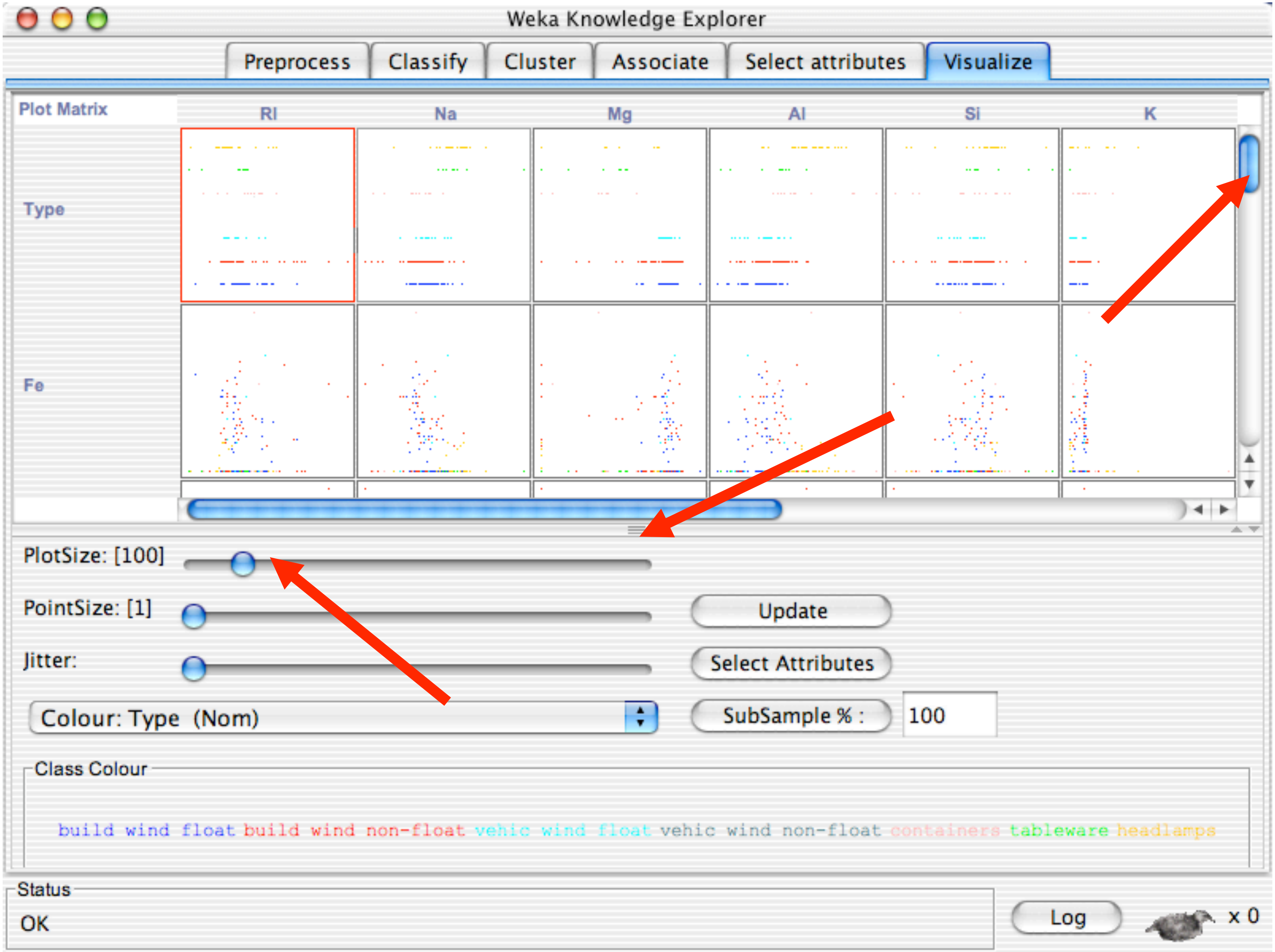
Explorer: data visualization

- Visualization very useful in practice: e.g. helps to determine difficulty of the learning problem
- WEKA can visualize single attributes (1-d) and pairs of attributes (2-d)
  - To do: rotating 3-d visualizations (Xgobi-style)
- Color-coded class values
- "Jitter" option to deal with nominal attributes (and to detect "hidden" data points)
- "Zoom-in" function

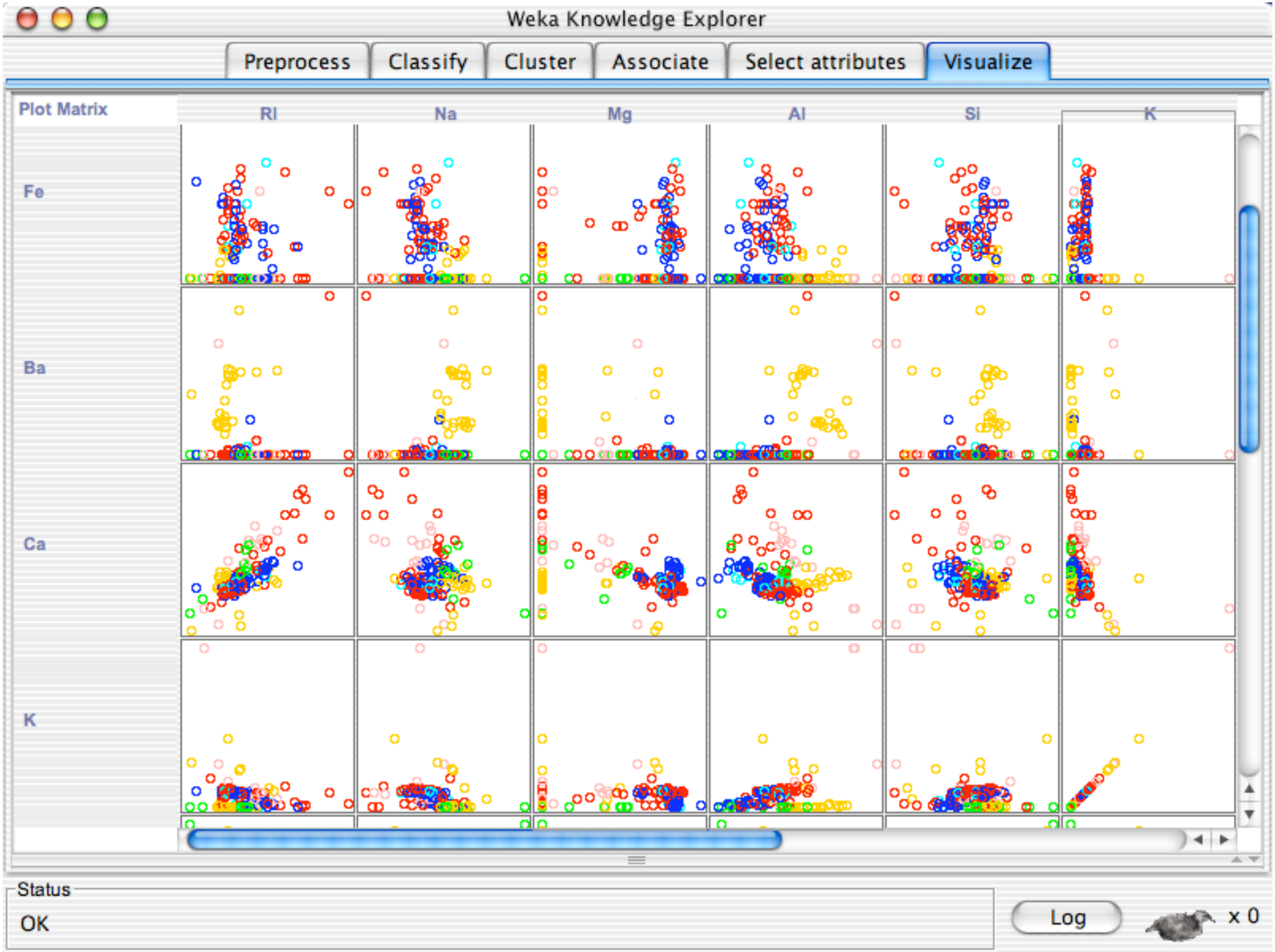


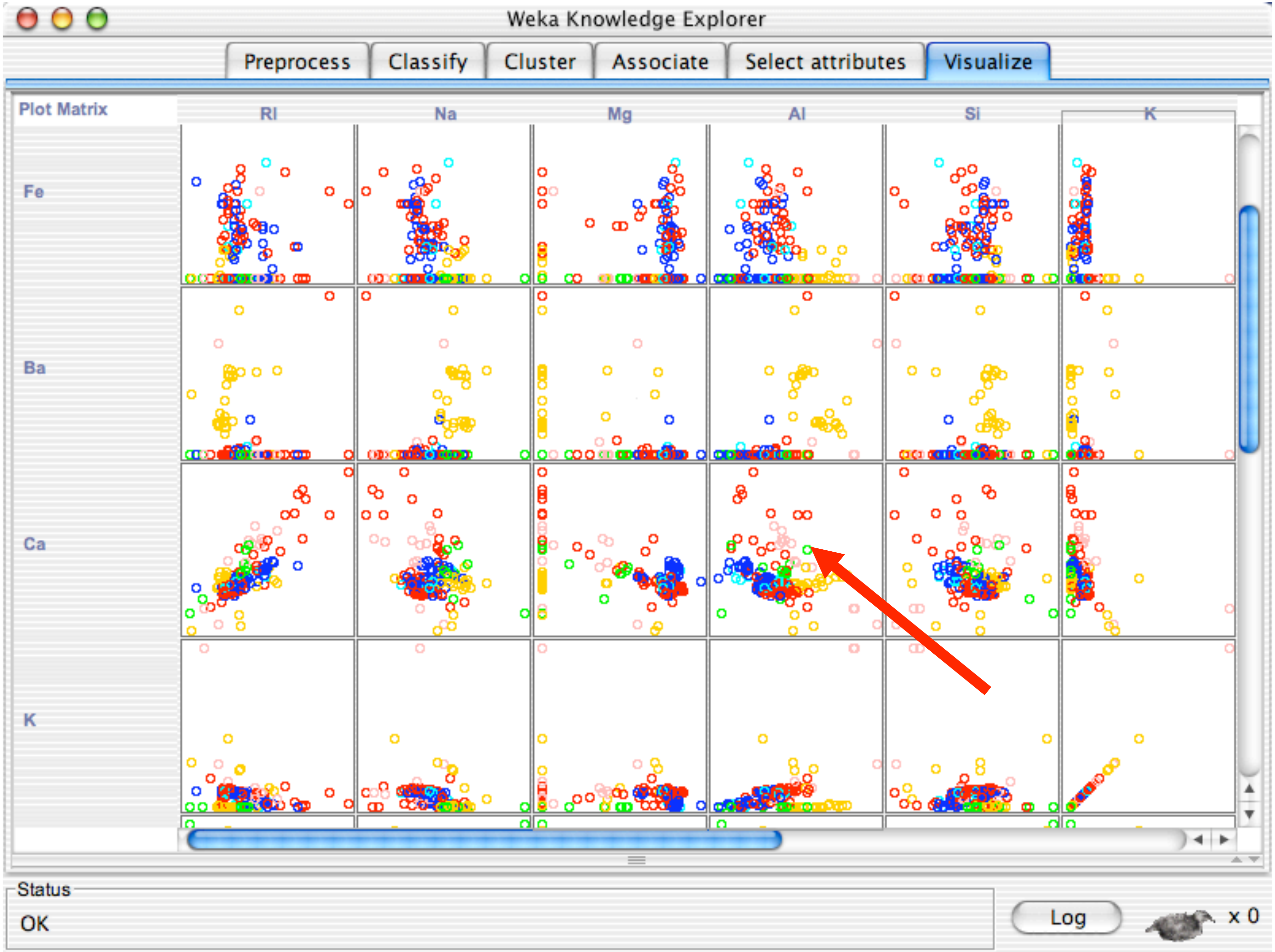
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: Glass
Instances: 214
Attributes: 10
Attributes
No.
Name
1 RI
2 Na
3 Mg
4 Al
5 Si
6 K
7 Ca
8 Ba
9 Fe
10 Type
Selected attribute
Name: RI
Type: Numeric
Missing: 0 (0%)
Distinct: 178
Unique: 145 (68%)
Statistic
Value
Minimum 1.511
Maximum 1.534
Mean 1.518
StdDev 0.003
Colour: Type (Nom)
Visualize All
3 3 1 5 45 48 46 18 7 15 9 5 1 1 4 1 0 0 1 0 1
1.51
1.52
1.53
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Type
Fe
PlotSize: [100]
PointSize: [1]
Jitter:
Update
Select Attributes
Colour: Type (Nom)
SubSample % :
100
Class Colour
build wind float build wind non-float vehic wind float vehic wind non-float containers tableware headlamps
Status
OK
Log
x 0



Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Type
Fe
PlotSize: [100]
PointSize: [1]
Jitter:
Update
Select Attributes
Colour: Type (Nom)
SubSample % :
100
Class Colour
build wind float build wind non-float vehic wind float vehic wind non-float containers tableware headlamps
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Fe
Ba
Ca
K
Status
OK
Log
x 0



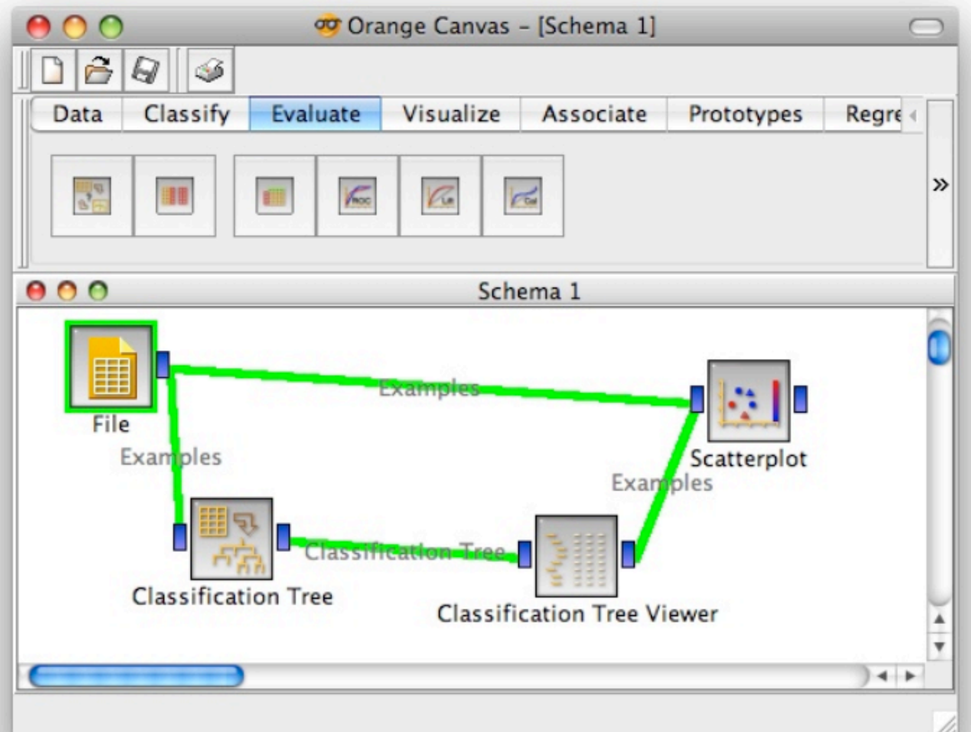
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Fe
Ba
Ca
K
Status
OK
Log
x 0

Evaluation

Limitations

- Loads all data into ram prior to learning
  - Problem for large data sets
- Not good for complex experiments
- IMHO, discourages experimentation with new learners
  - The "WEKA effect"
    - Try every learner till something works
- Still, very useful for
  - Initial investigations
  - Learning data mining
  - Or as a sub-routine of other systems

Alternate tools: Orange

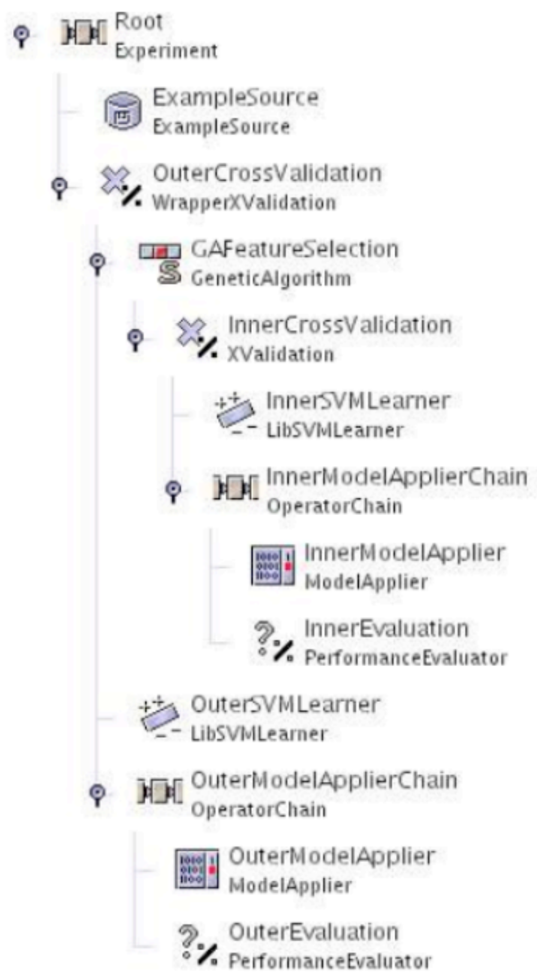


Written in Python

Simpler specification (but see WEKA's KnowledgeFlow Environment).

Also, less community support/ debugging. So sometimes frustrated by random bugs

Alternate tools: RapidMiner



Experiments specified in an XML tree syntax

In theory, possible to share experimental descriptions

Alternate tools: OurMine

```
Java=$Base/lib/java
Weka="java -Xmx2048M -cp $Java/weka.jar "
Clusterers="java -Xmx1024M -jar $Java/Clusterers.jar "
Reducers="java -Xmx1024M -jar $Java/Reduce.jar "

nb() {
   local learner=weka.classifiers.bayes.NaiveBayes
   $Weka $learner -p 0 -t $1 -T $2
}

nb10() {
   local learner=weka.classifiers.bayes.NaiveBayes
   $Weka $learner -i -t $1
}

j48() {
   local learner=weka.classifiers.trees.J48
   $Weka $learner -p 0 -C 0.25 -M 2 -t $1 -T $2
}
```

Forget the visuals.

Make WEKA a sub-routine inside Bash script

Now you can mix WEKA's JAVA with learners written in your favorite language.

But how do you find the magic command strings?

Why go to all that trouble?

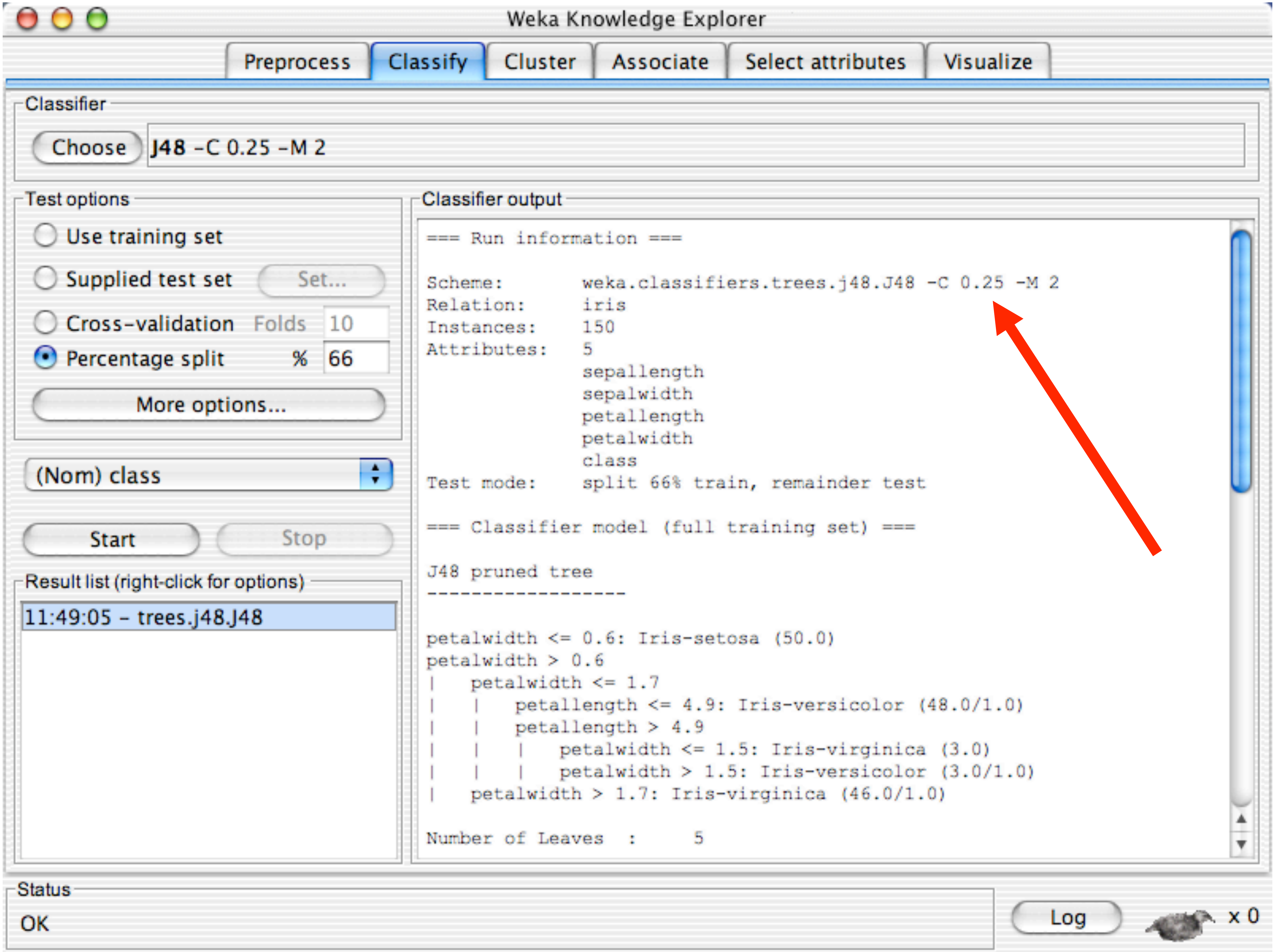
```
analysis1(){
   local origdata=$1
   local outstats=$2
   local nattrs="2 4 6 8 10 12 14 16 18 20"
   local learners="nb10 j4810 zeror10 oner10 adtree10"
   local reducers="infogain chisquared oneR"
   local tmpred=$Tmp/red
   echo "n,reducer,learner,accuracy" > $outstats

   for n in $nattrs; do
      for reducer in $reducers; do
           $reducer $origdata $n $tmpred
           for learner in $learners; do
              accur=`$learner $tmpred.arff | acc
              out="$n,$reducer,$learner,$accur"
              blabln $out
             echo $out >> $outstats
          done
      done
   done
}
```

Complex experiments, specifie d succinctly.

Experiments can now be revie wed, audited, by others.

Also, in 12 months time when Reviewer2 wants a tiny extension to the old paper, you don't have to remember all that clicking you did: just rerun the script.


Weka Knowledge 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) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
=== Run information ===
Scheme: weka.classifiers.trees.j48.J48 -C 0.25 -M 2
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
class
Test mode: split 66% train, remainder test
=== Classifier model (full training set) ===
J48 pruned tree
----
petalwidth <= 0.6: Iris-setosa (50.0)
petalwidth > 0.6
| petalwidth <= 1.7
| | petallength <= 4.9: Iris-versicolor (48.0/1.0)
| | petallength > 4.9
| | | petalwidth <= 1.5: Iris-virginica (3.0)
| | | petalwidth > 1.5: Iris-versicolor (3.0/1.0)
| petalwidth > 1.7: Iris-virginica (46.0/1.0)
Number of Leaves : 5
Status
OK
Log
x 0