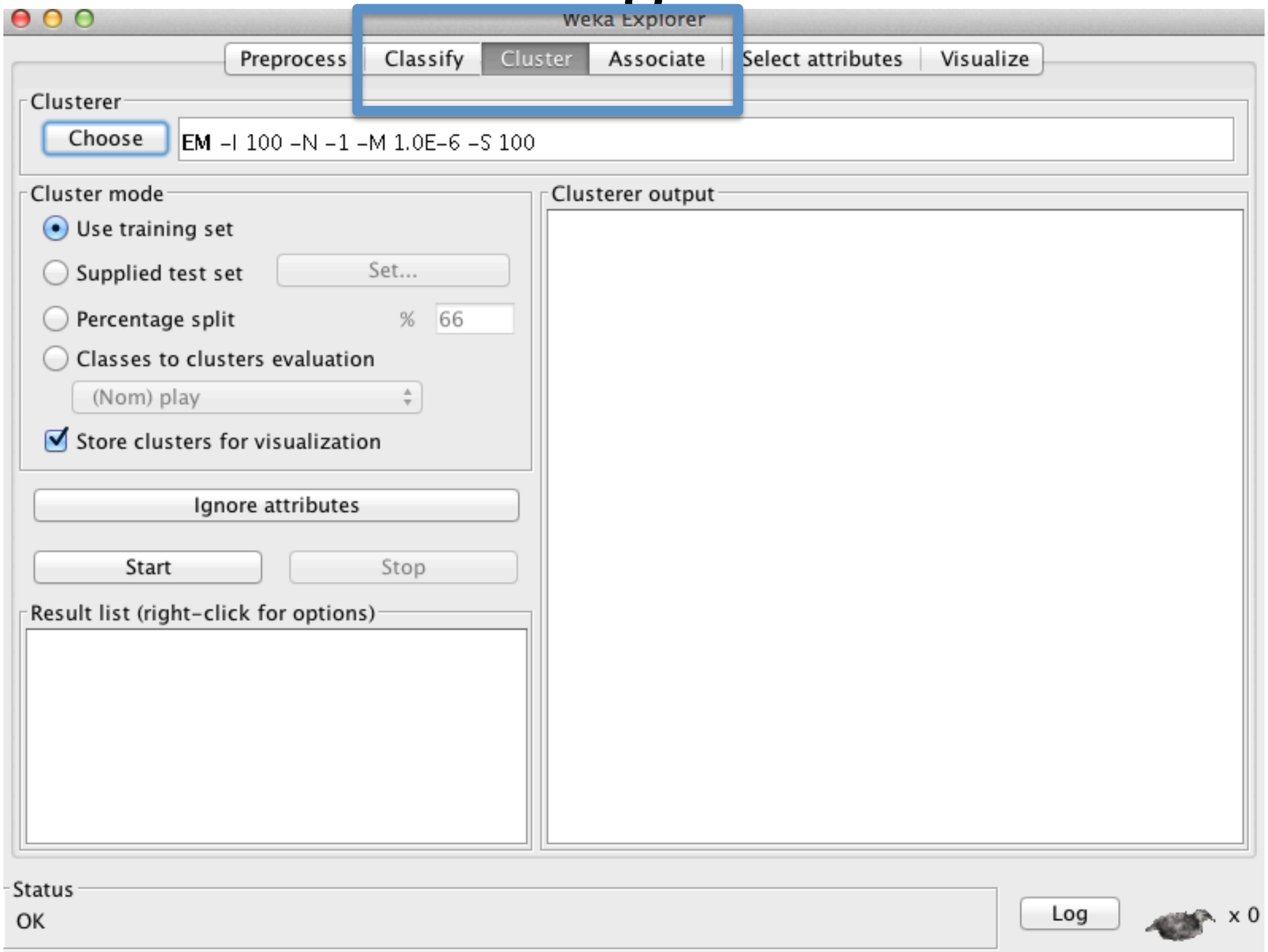
WEKA Explorer

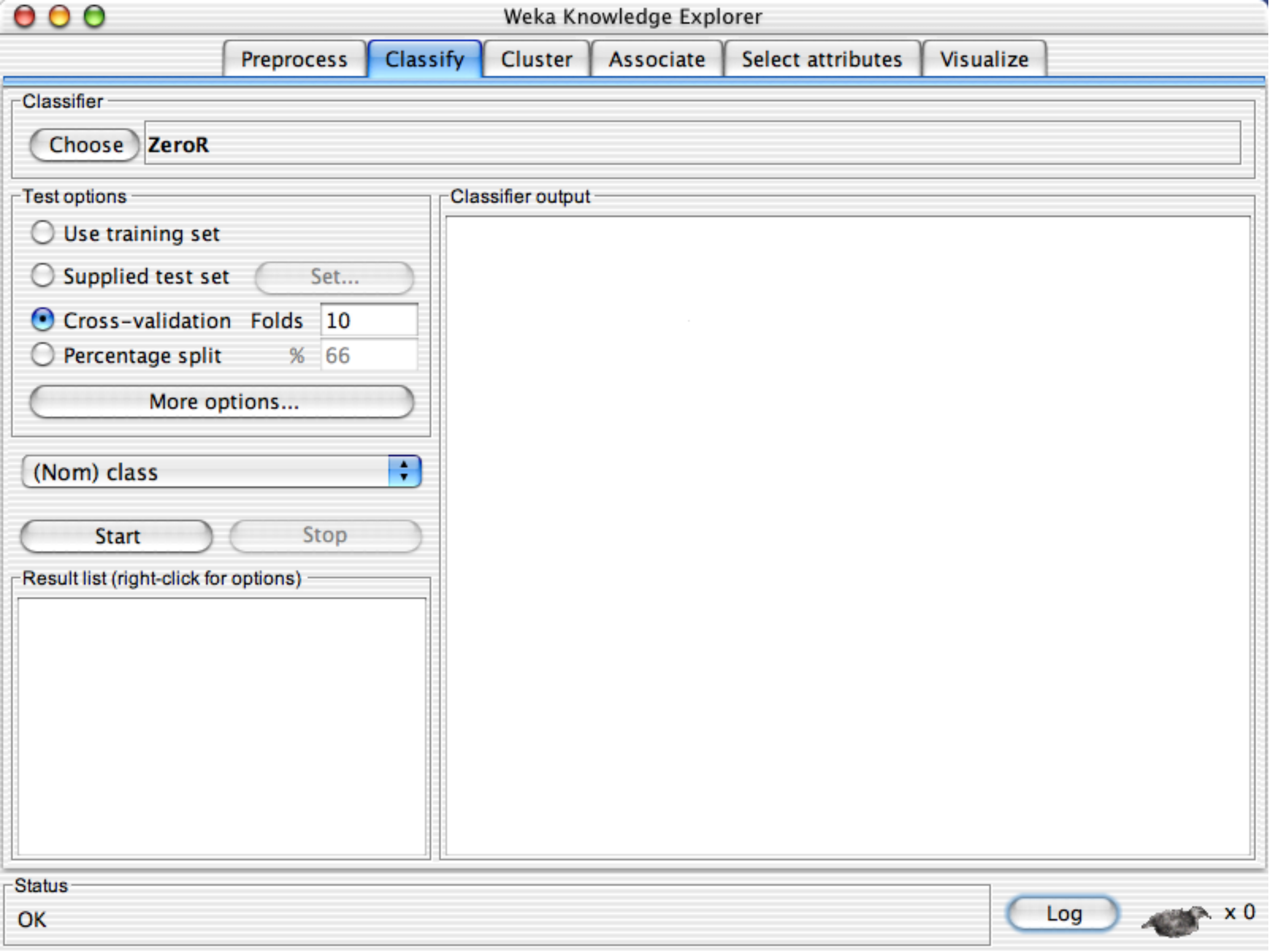
Second part

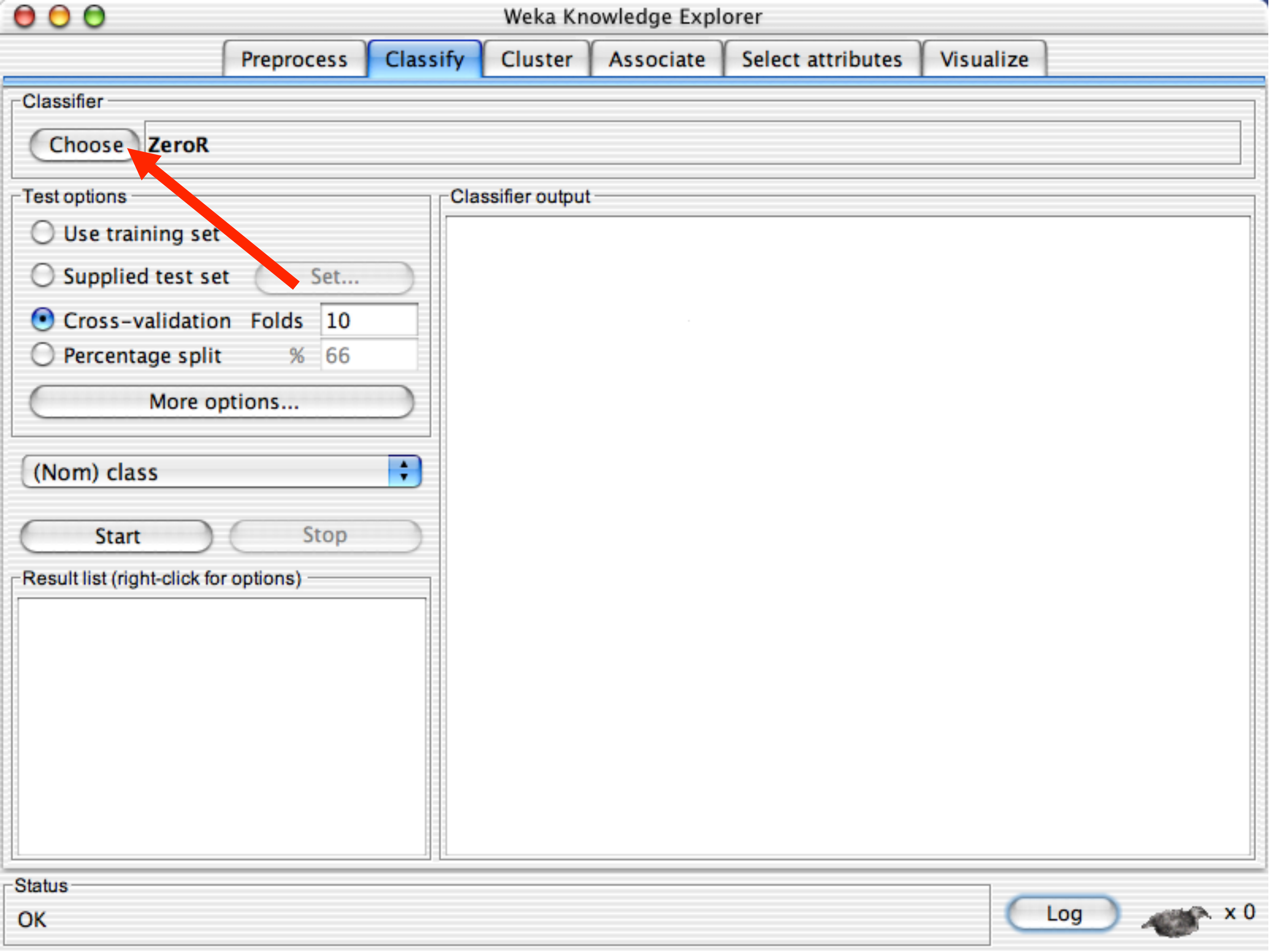
ML algorithms in weka belong to 3 categories



Will see examples in each category (as we learn new algorithms)

1. **Classifiers** (given a set of categories, learn to assign each instance to a category. These are TRAINED methods): Decision Trees, decision tables, conjunctive rules..
2. **Clustering** (given a set of instances, group these instances in clusters according to some similarity function. These are UNTRAINED methods): Hierarchical clustering, DensityBased, etc)
3. **Association rules** (given a set of instances, find frequent patterns, e.g. rules that show dependencies among the data. These are UNTRAINED methods): Apriori, Filtered Associator, ..
4. Additional algorithms can be used, within the Experimenter (will see later)


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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Preprocess
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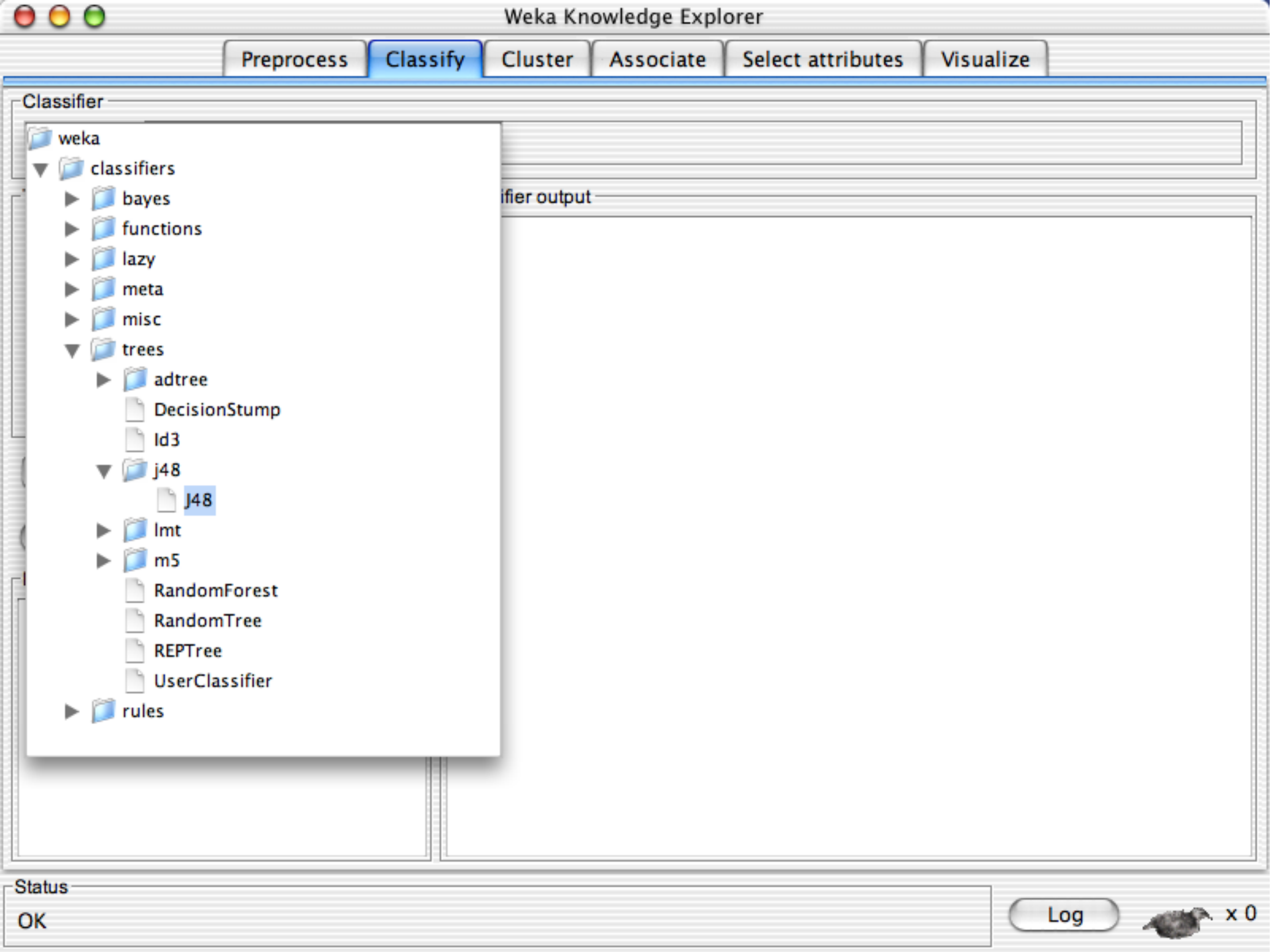
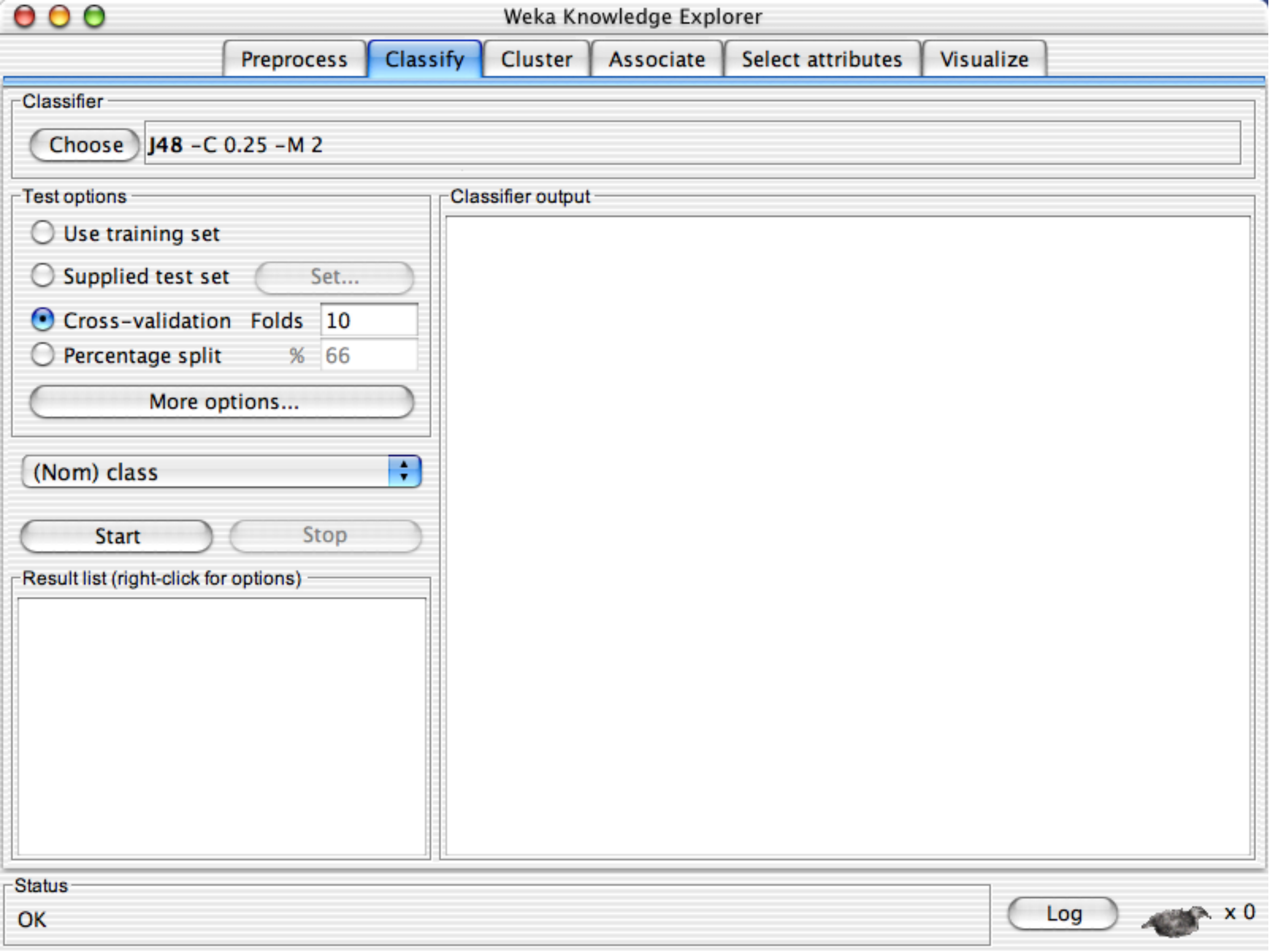


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
lazy
meta
misc
trees
adtree
DecisionStump
Id3
j48
J48
lmt
m5
RandomForest
RandomTree
REPTree
UserClassifier
rules
ifier output
Status
OK
Log
x 0


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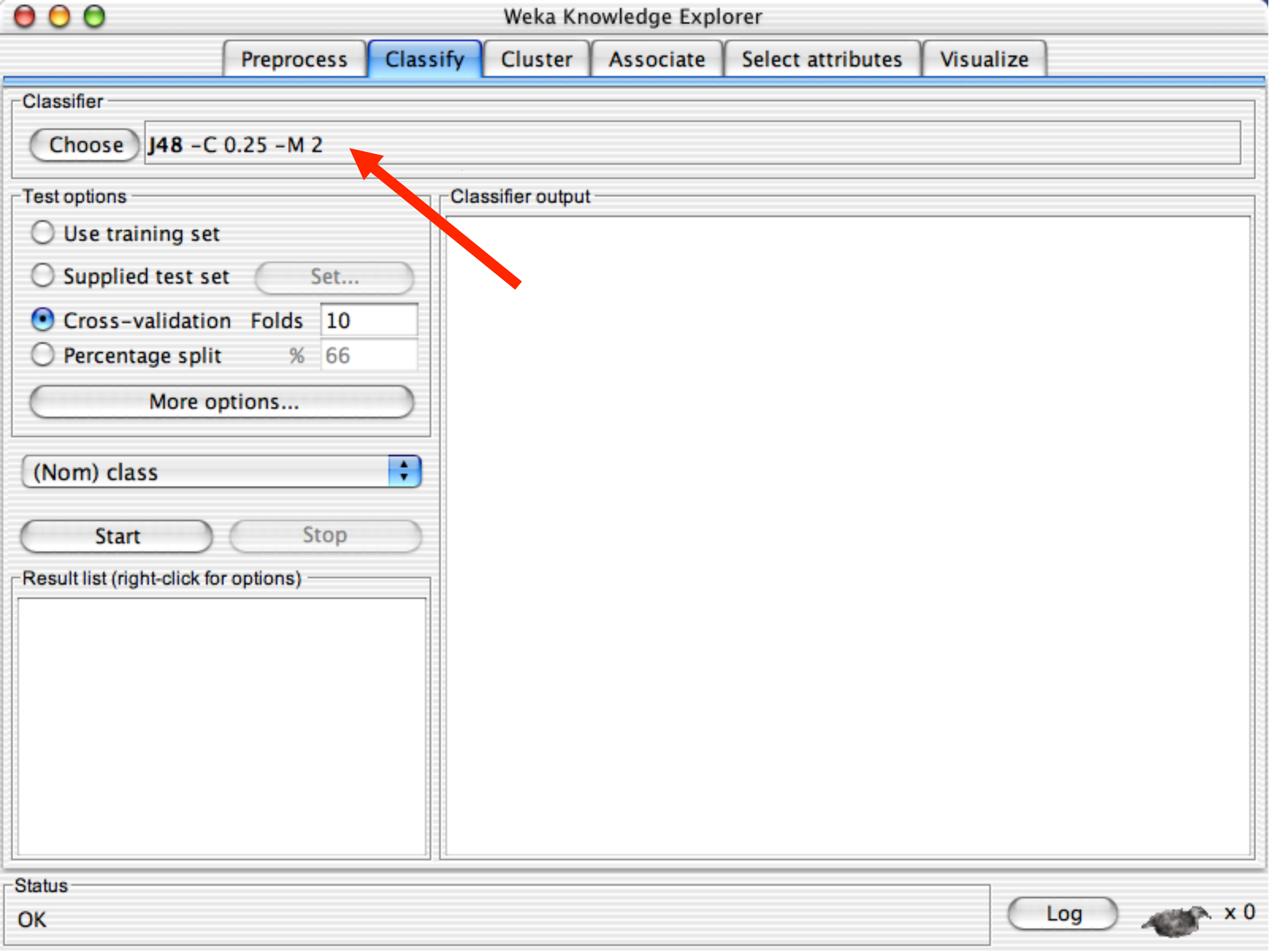
x 0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Choose
J48 -C 0.25 -M 2
Test options
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Percentage split
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Classifier output
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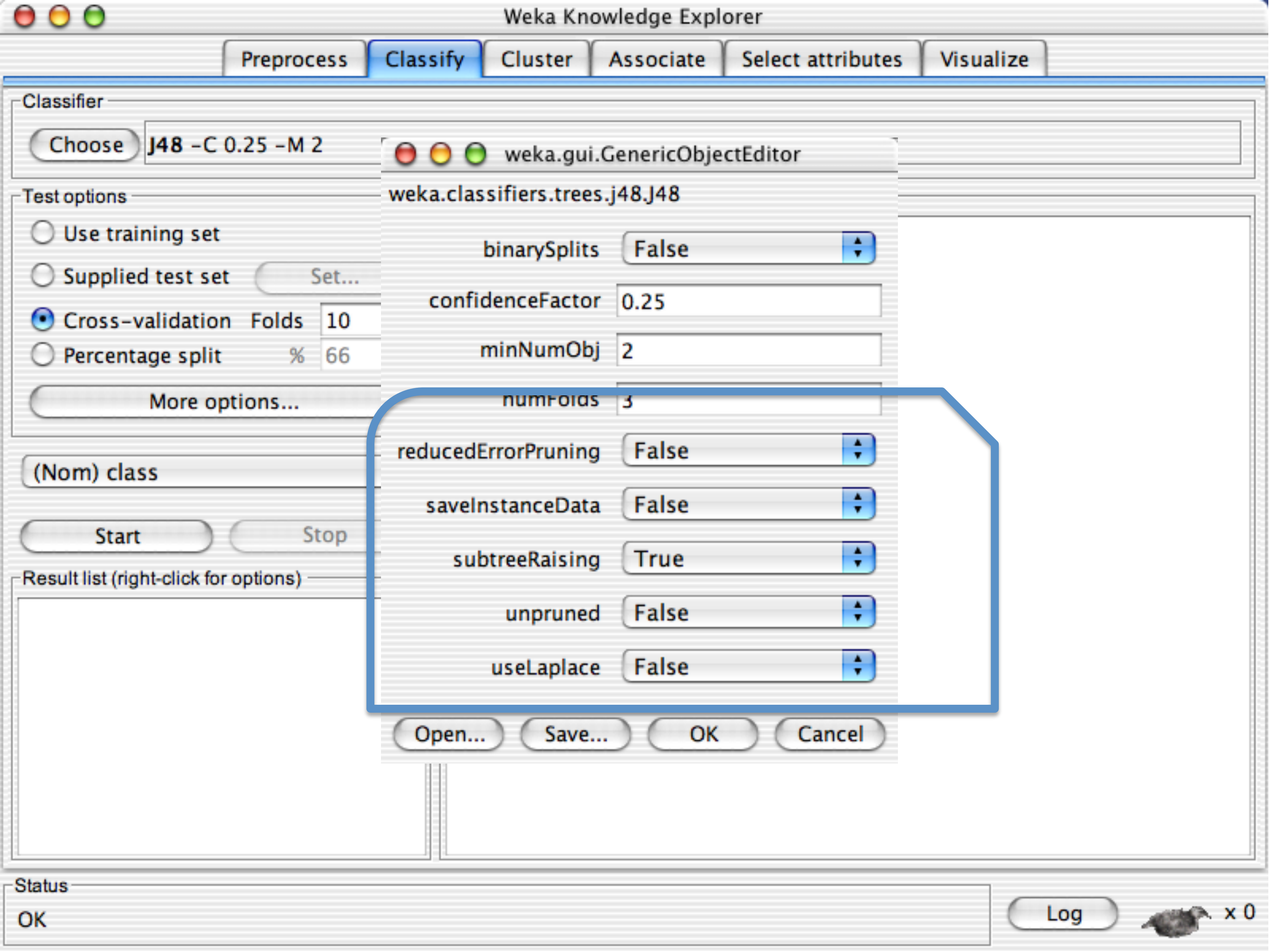
Weka Knowledge Explorer
Preprocess
Classify
Cluster
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Select attributes
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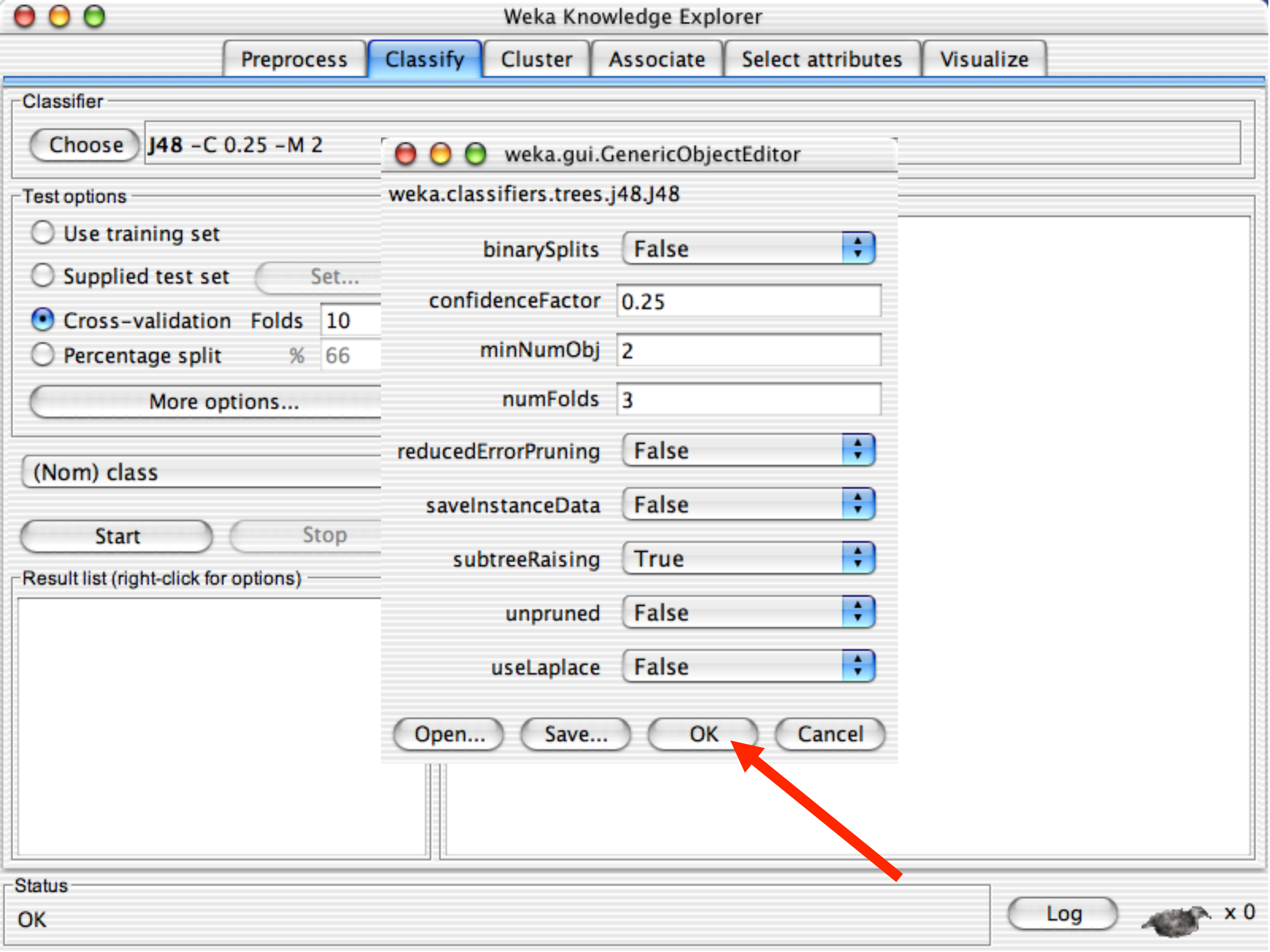
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
weka.gui.GenericObjectEditor
weka.classifiers.trees.j48.J48
binarySplits
False
confidenceFactor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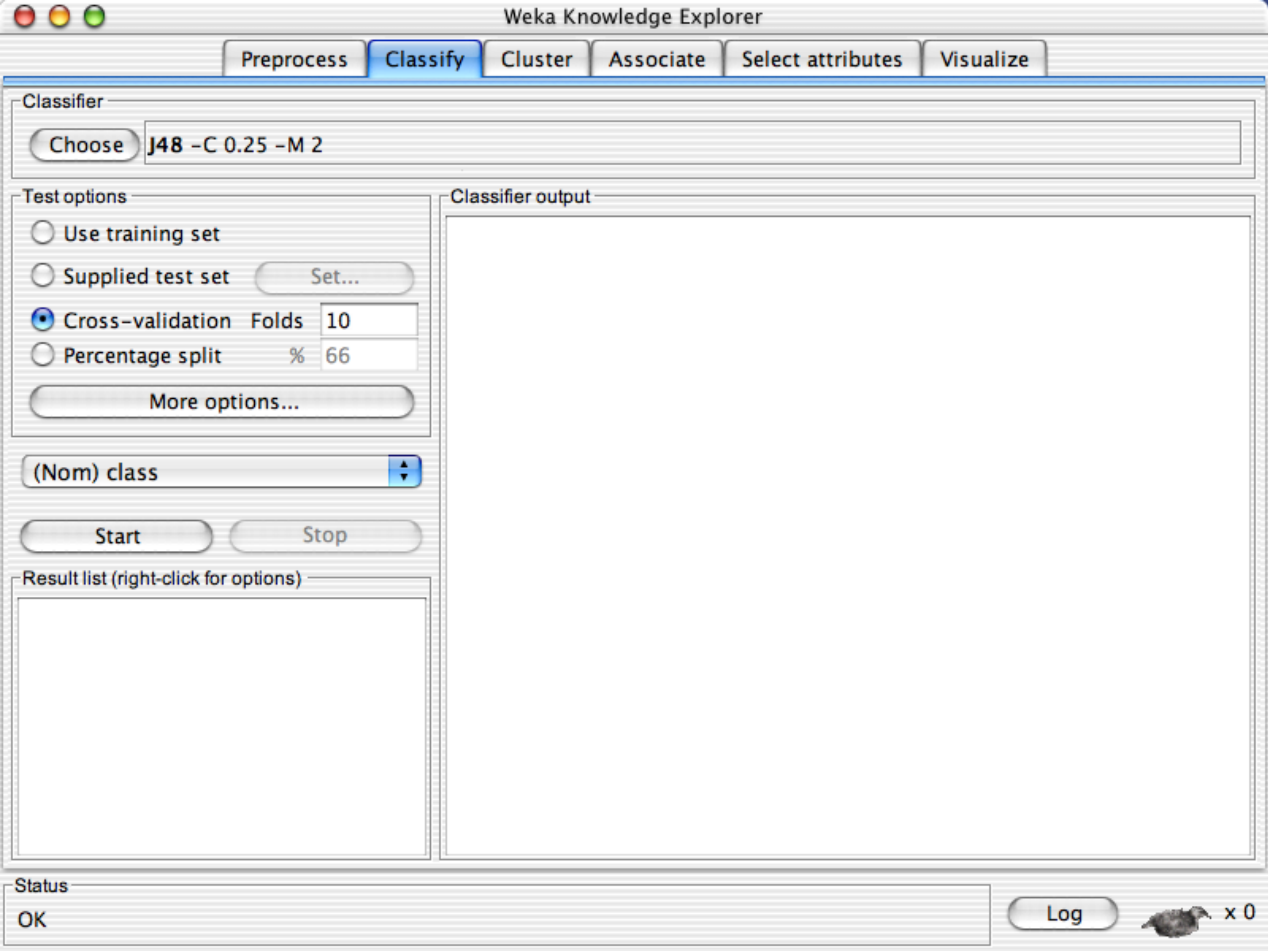
Log
x 0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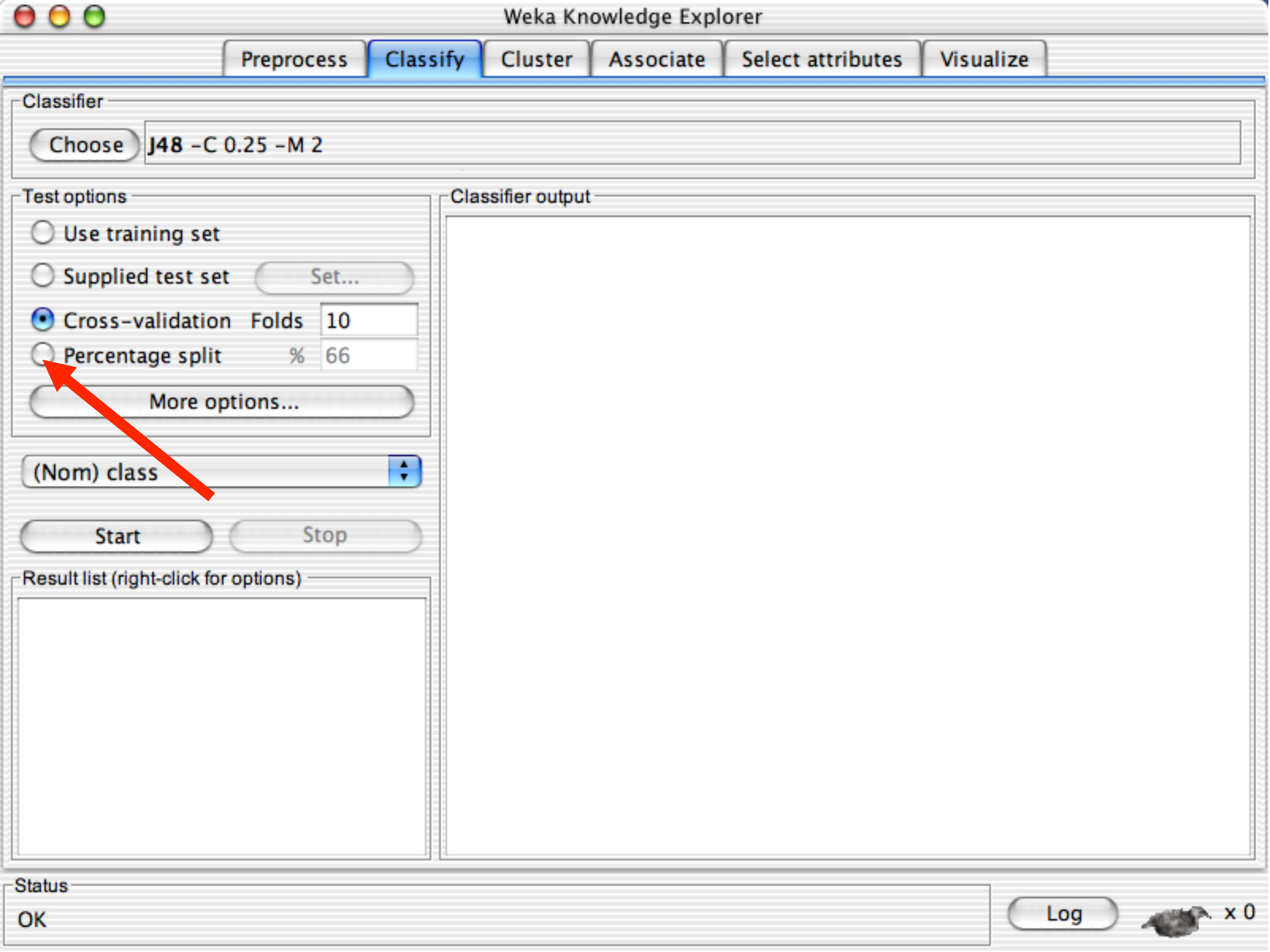
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Classifier output
Status
OK
Log
x 0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Test options
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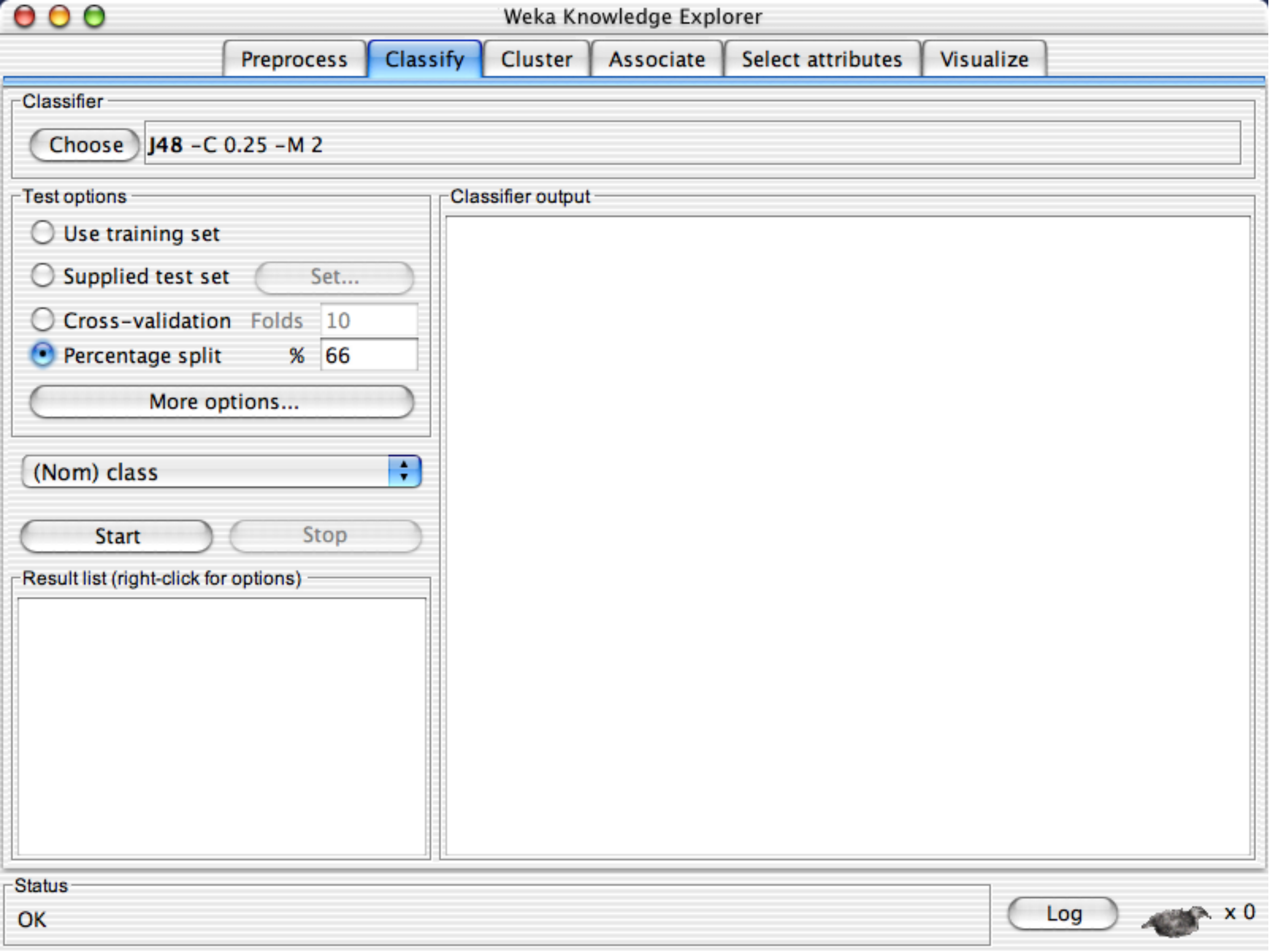
x 0


Weka Knowledge Explorer
Preprocess
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Cluster
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Select attributes
Visualize
Classifier
Choose
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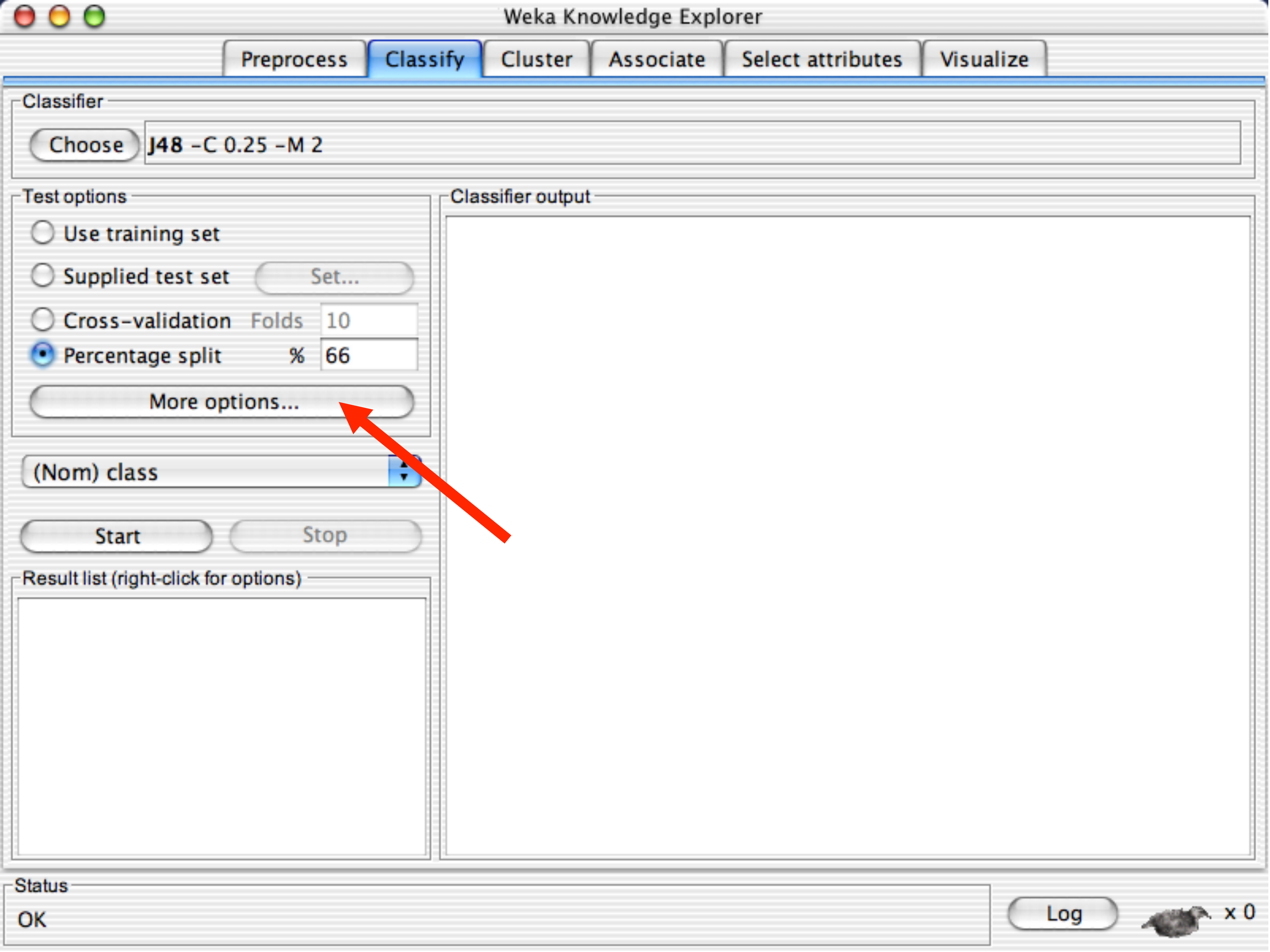
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Preprocess
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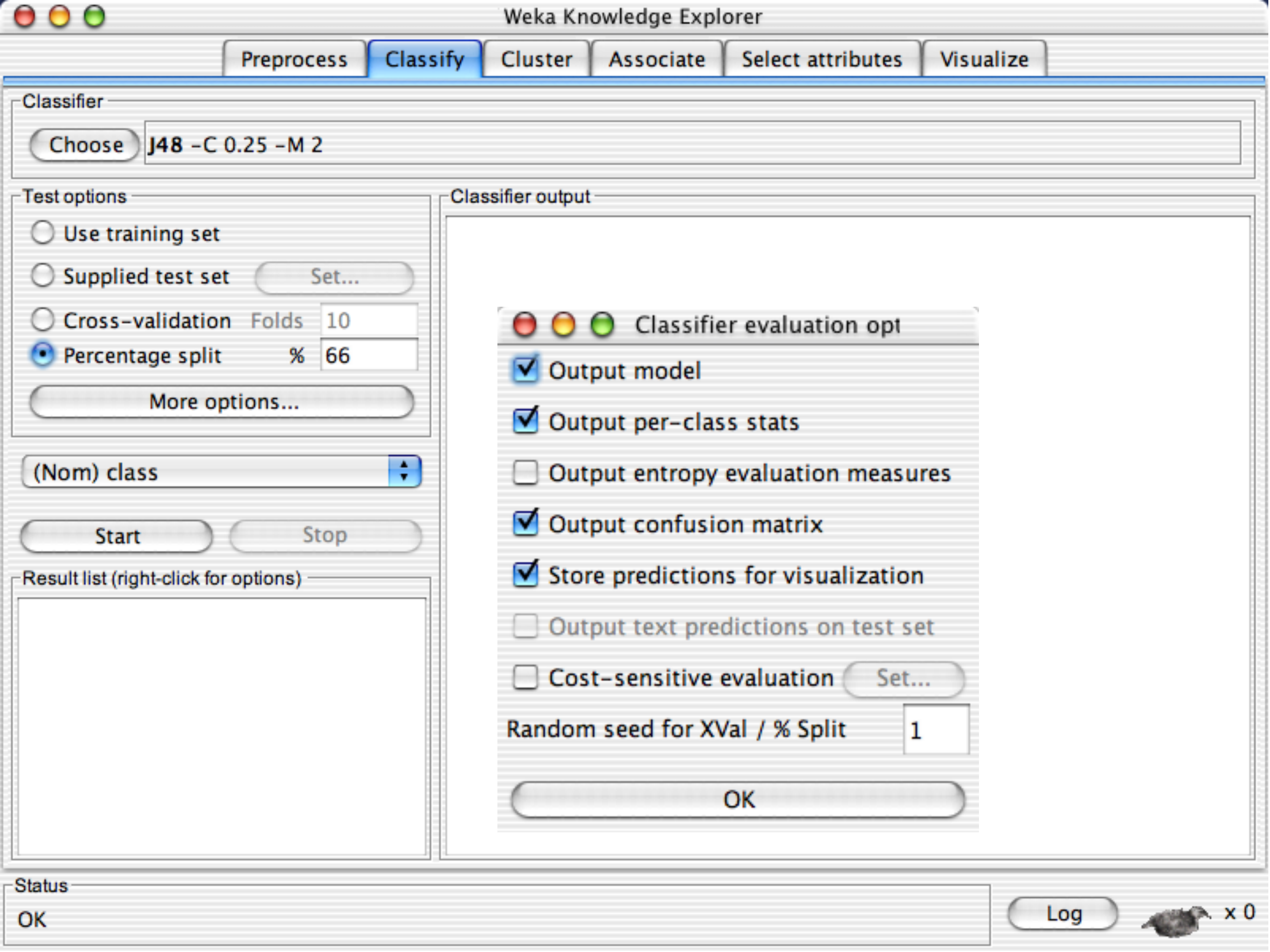
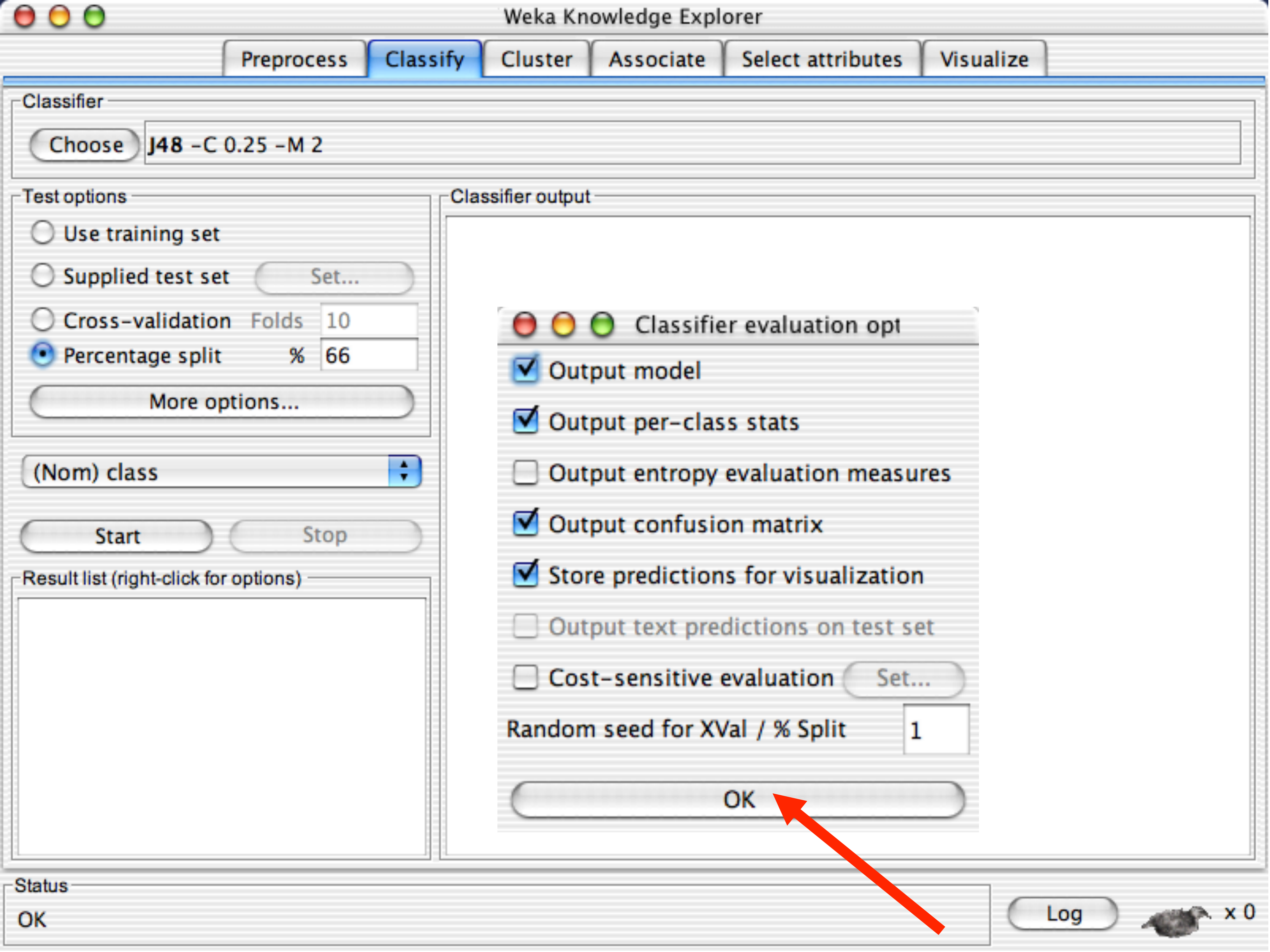

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
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
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J48 -C 0.25 -M 2
Test options
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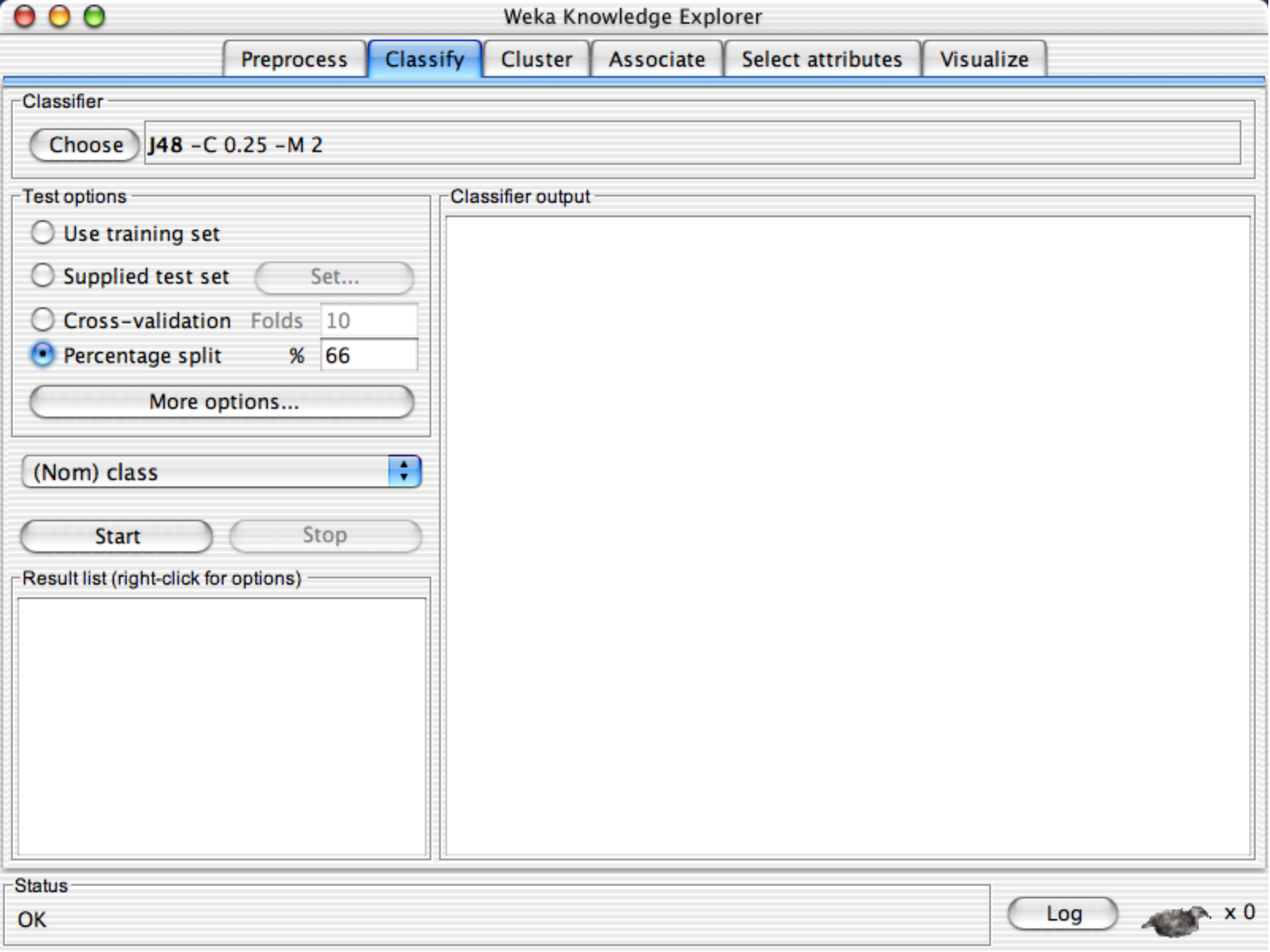
Log
x 0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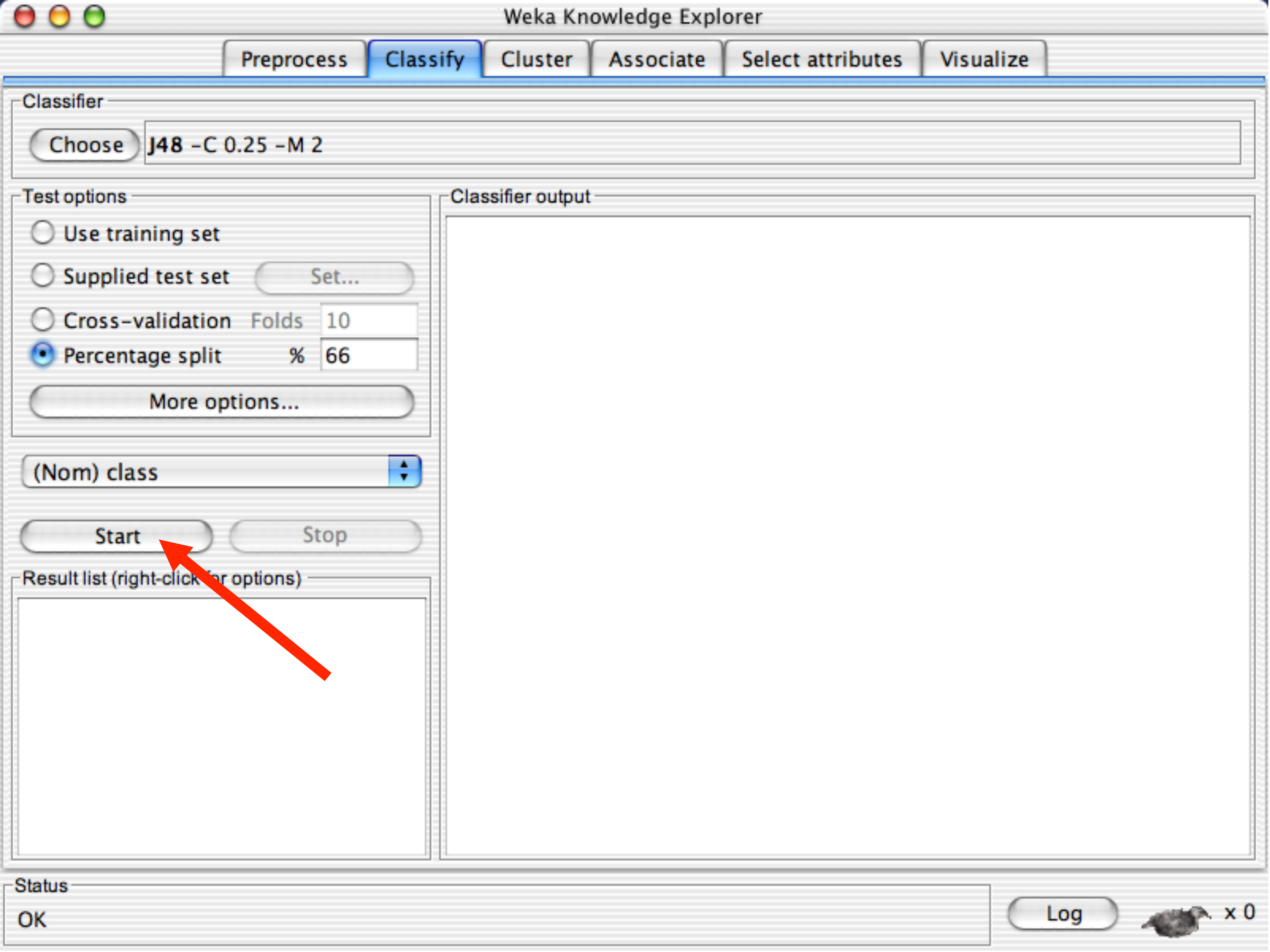
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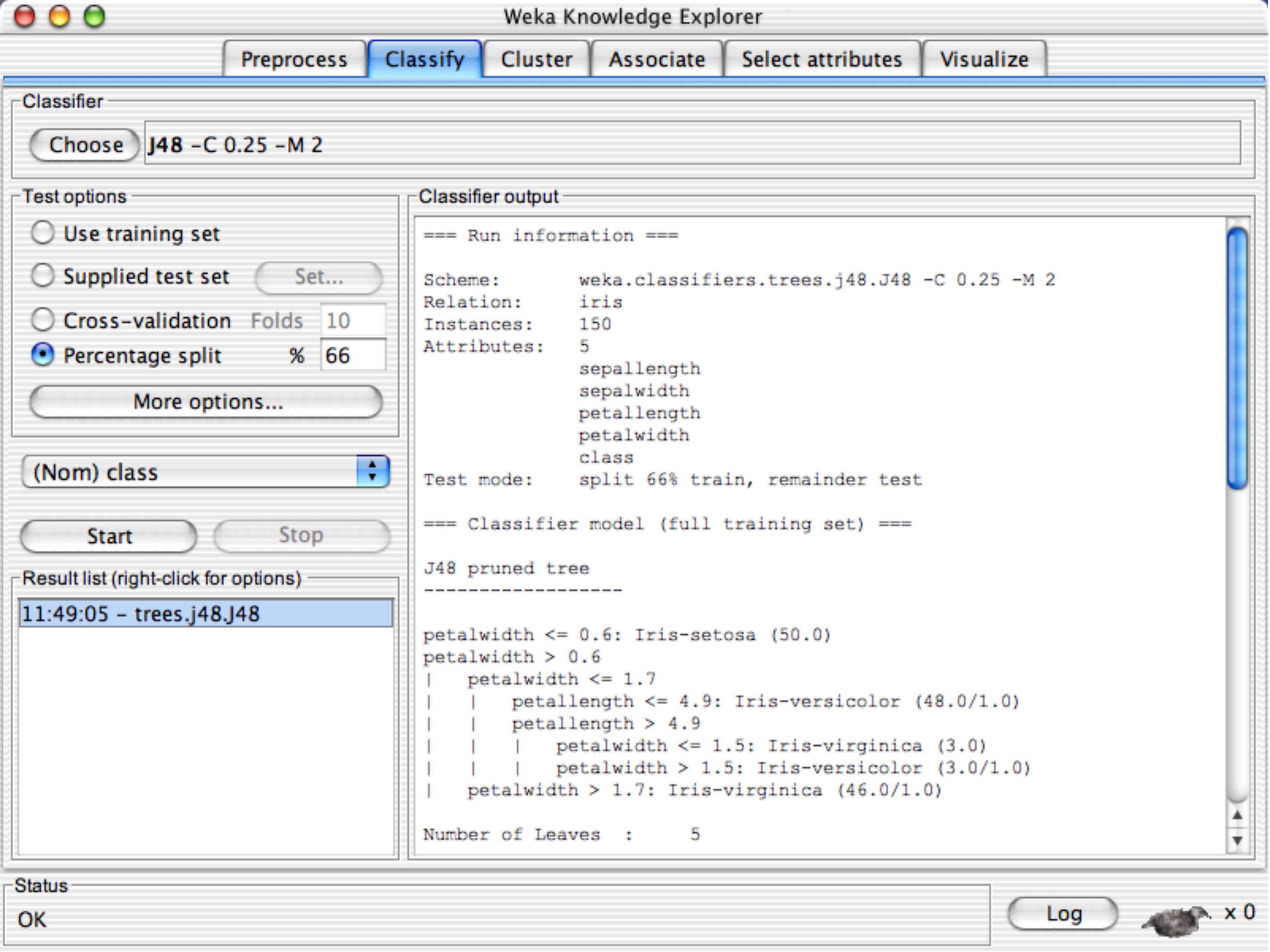
Log
x 0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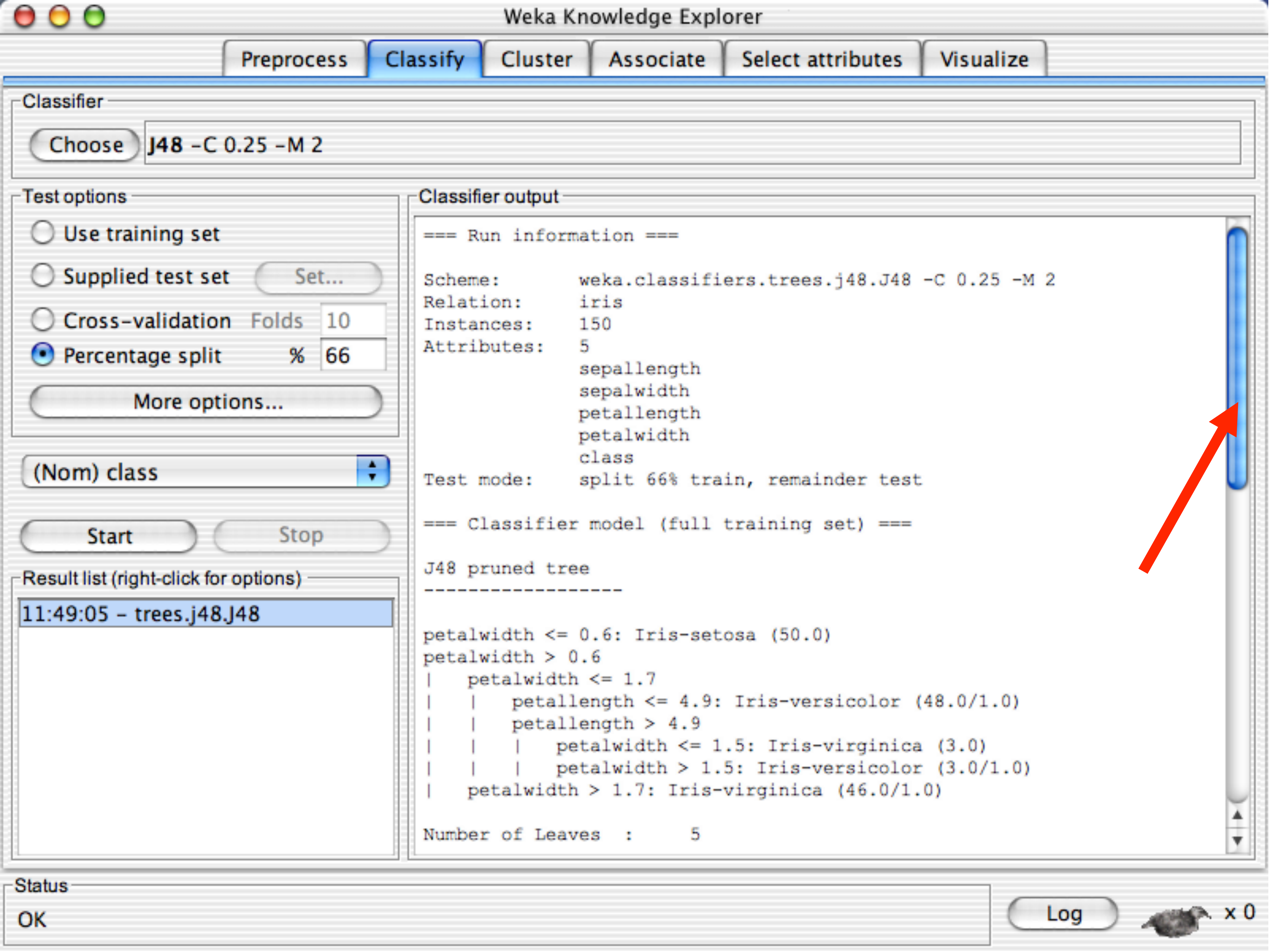
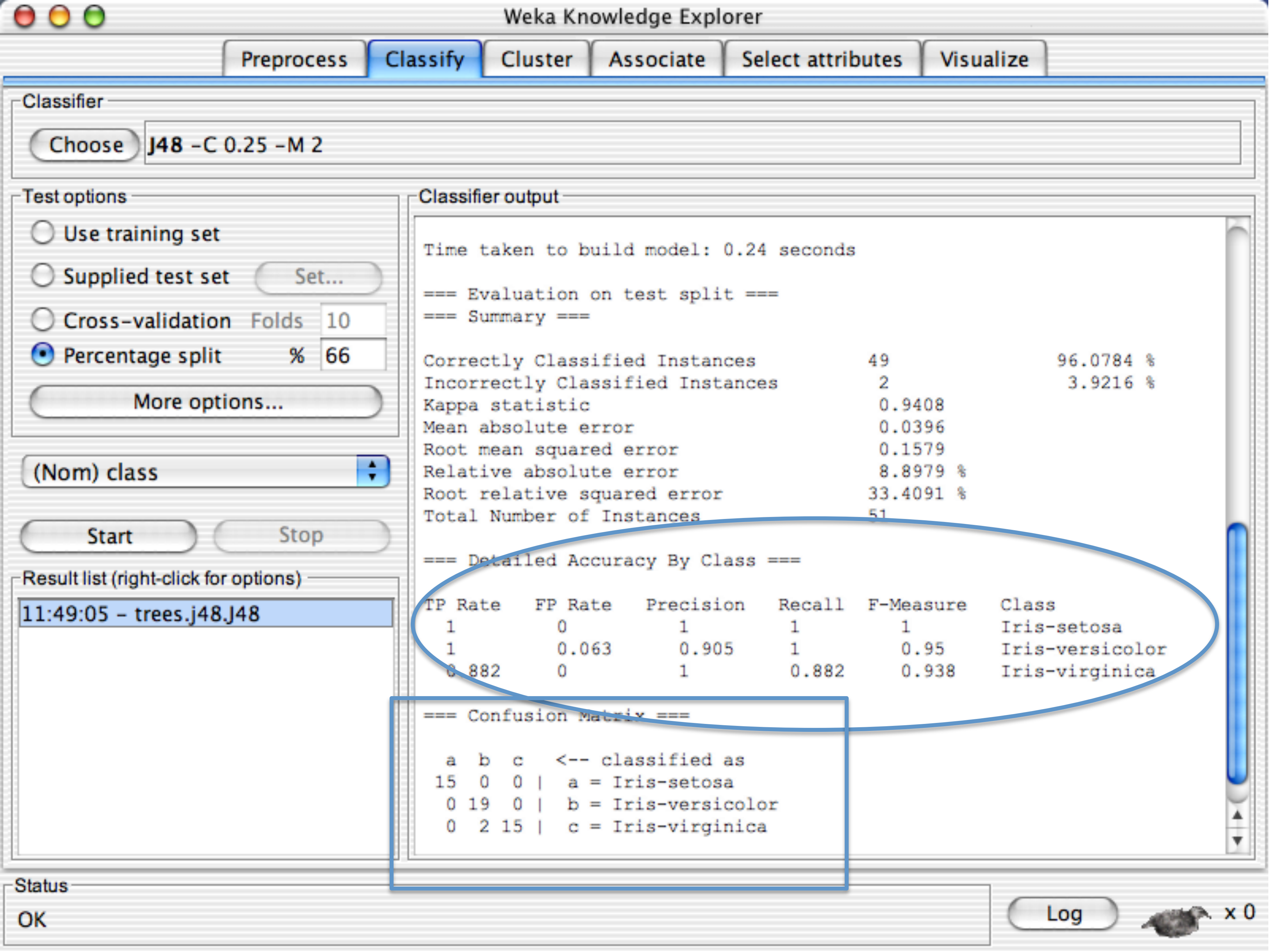
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
=== Run information ===
Scheme: weka.classifiers.trees.j48.J48 -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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Classify
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Classifier
Choose
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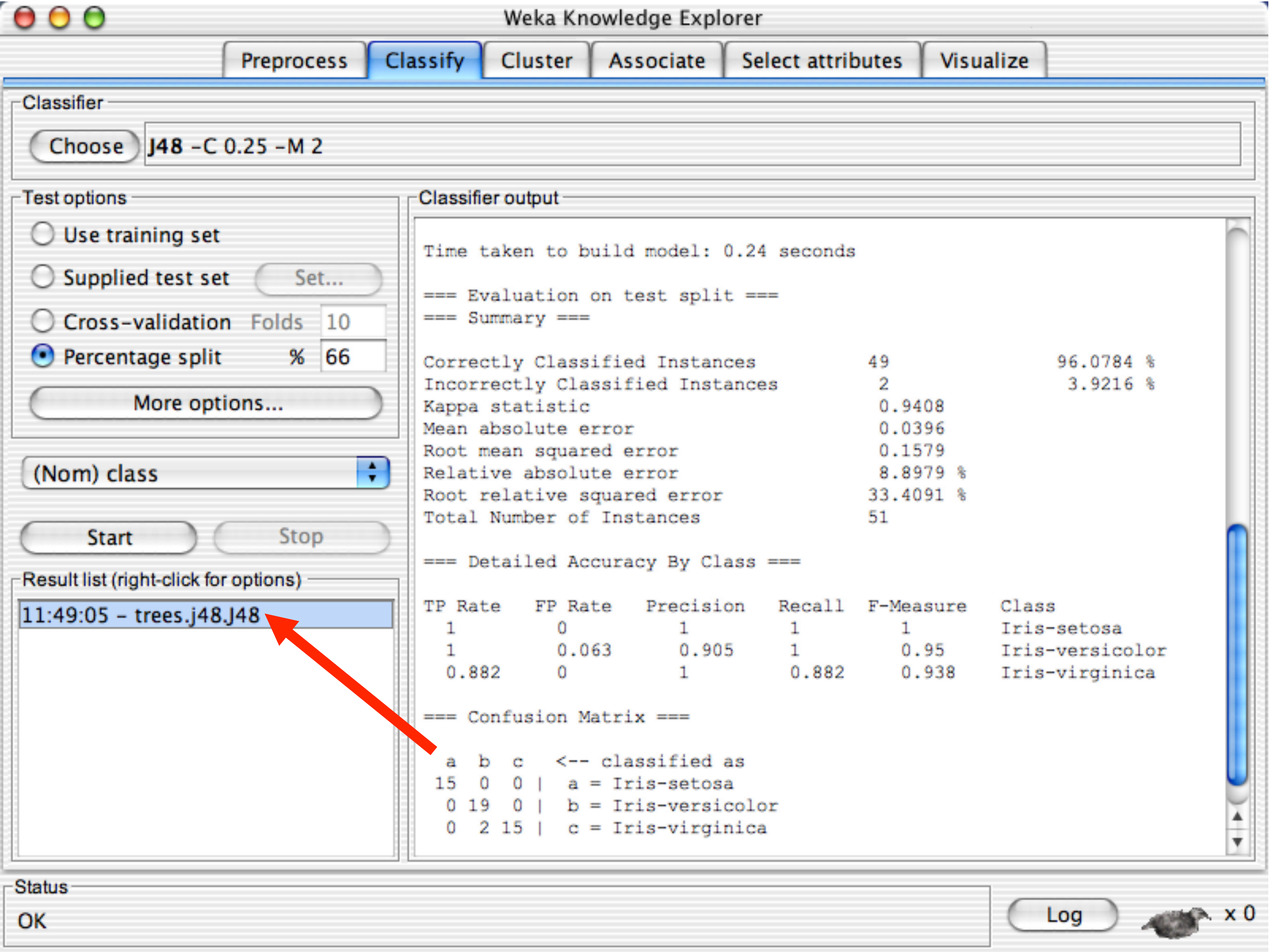
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
% 66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
Time taken to build model: 0.24 seconds
=== Evaluation on test split ===
=== Summary ===
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
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Percentage split
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66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
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Classifier output
Time taken to build model: 0.24 seconds
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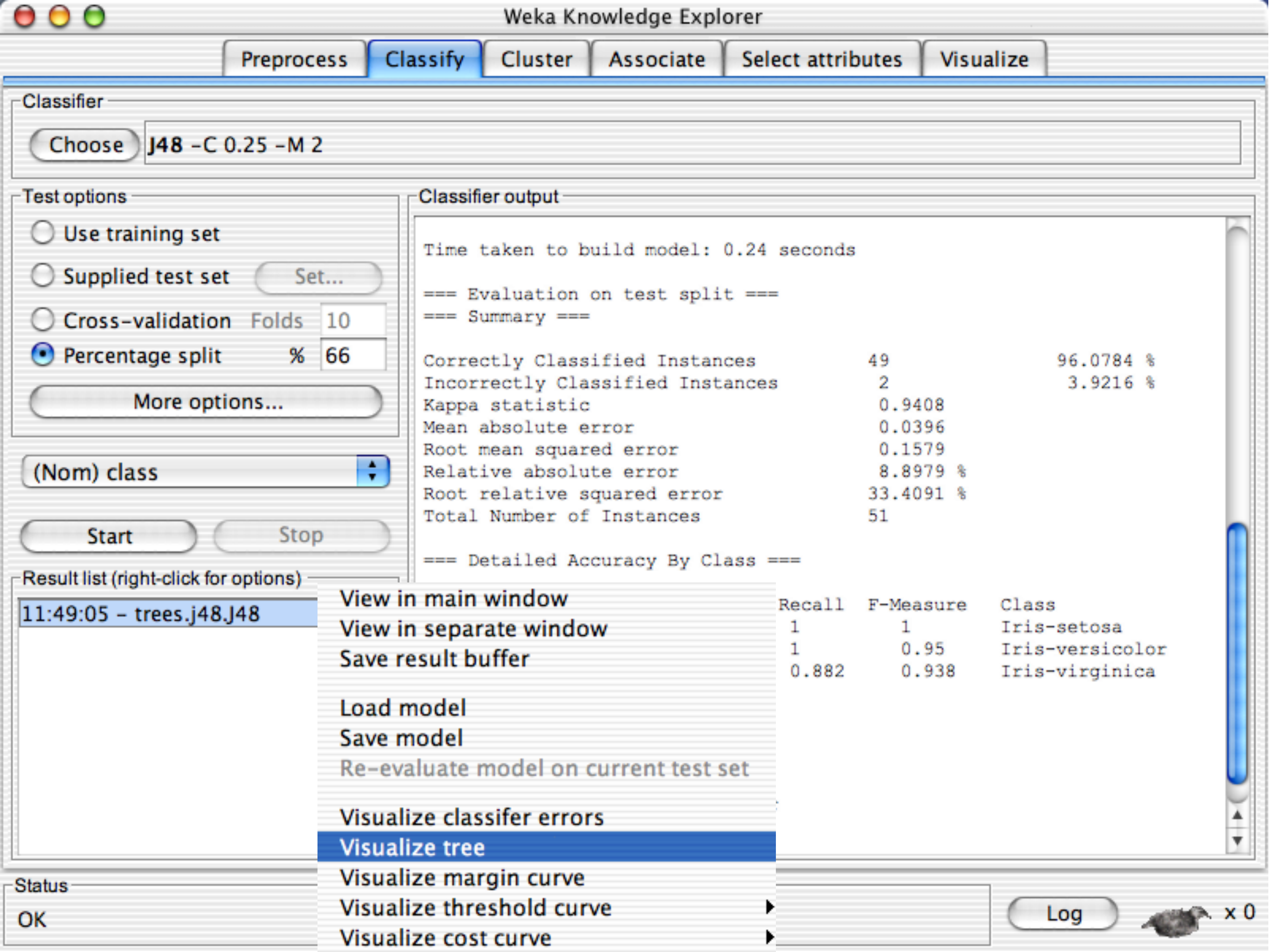
Weka Knowledge Explorer
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Classifier
Choose
J48 -C 0.25 -M 2
Test options
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Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
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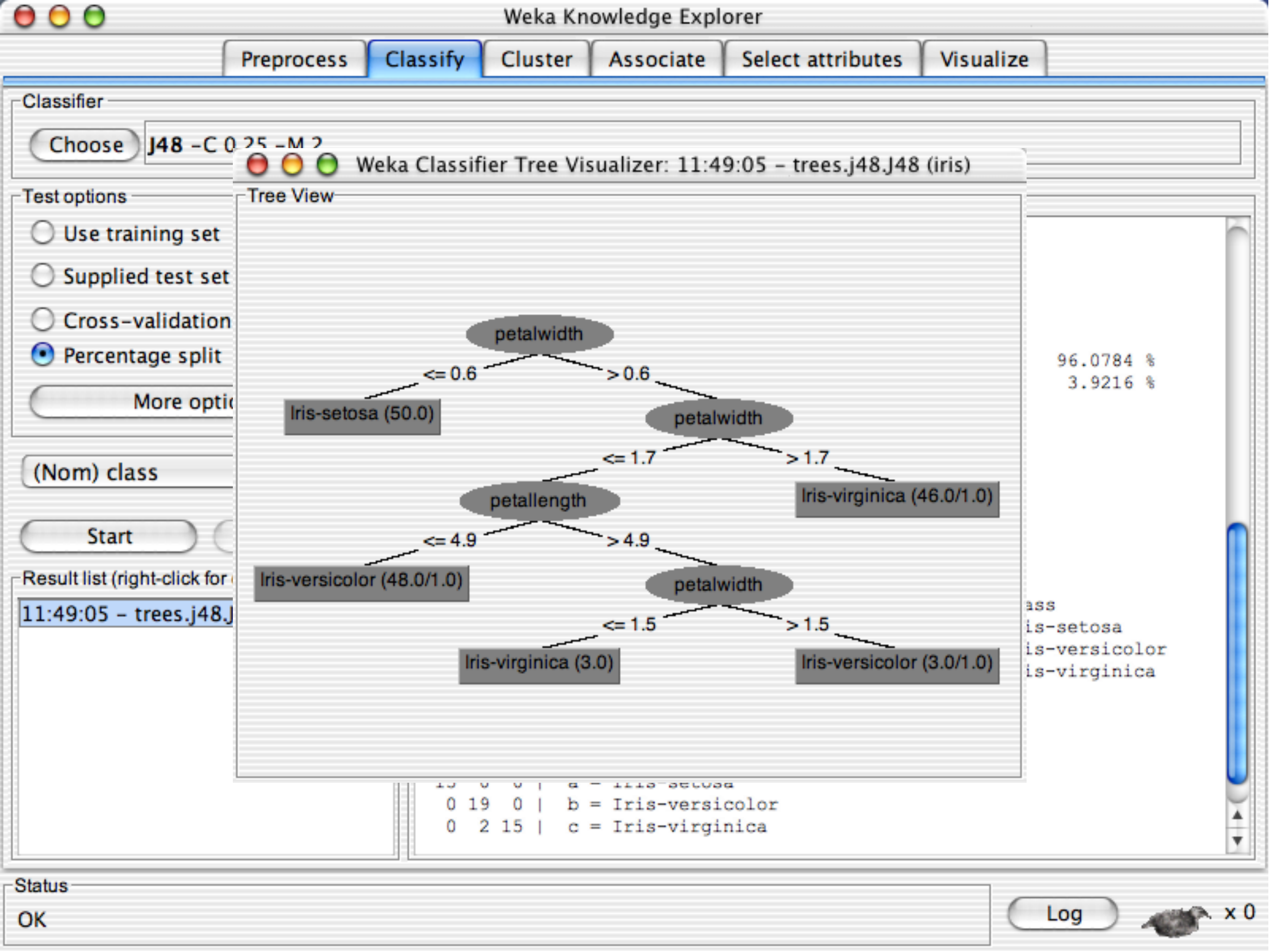
Relative absolute error 8.8979 %
Root relative squared error 33.4091 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
Recall F-Measure Class
1 1 Iris-setosa
1 0.95 Iris-versicolor
0.882 0.938 Iris-virginica
View in main window
View in separate window
Save result buffer
Load model
Save 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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Preprocess
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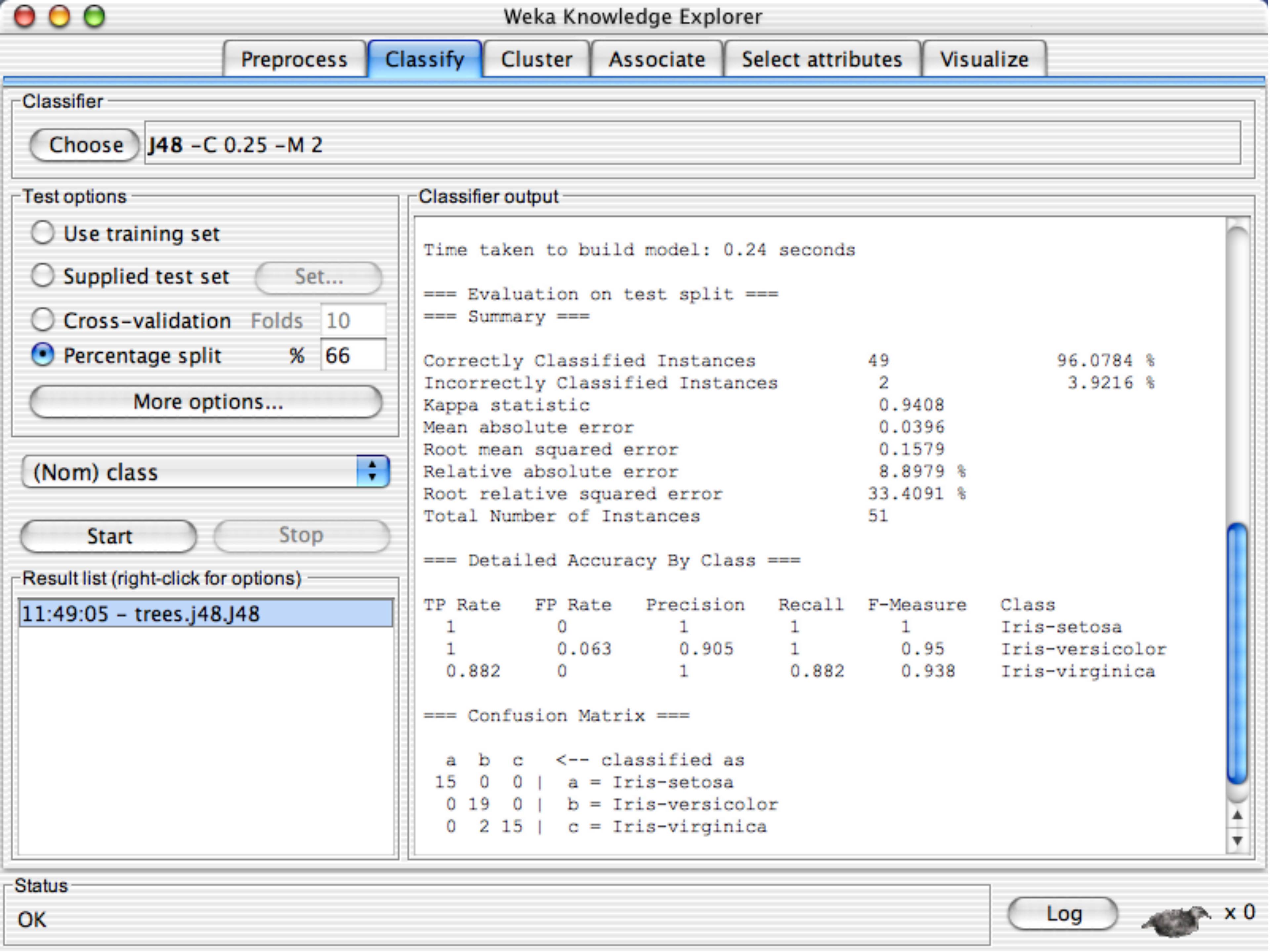
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.J
Weka Classifier Tree Visualizer: 11:49:05 - trees.j48.J48 (iris)
Tree View
petalwidth
<= 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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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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Mean absolute error 0.0396
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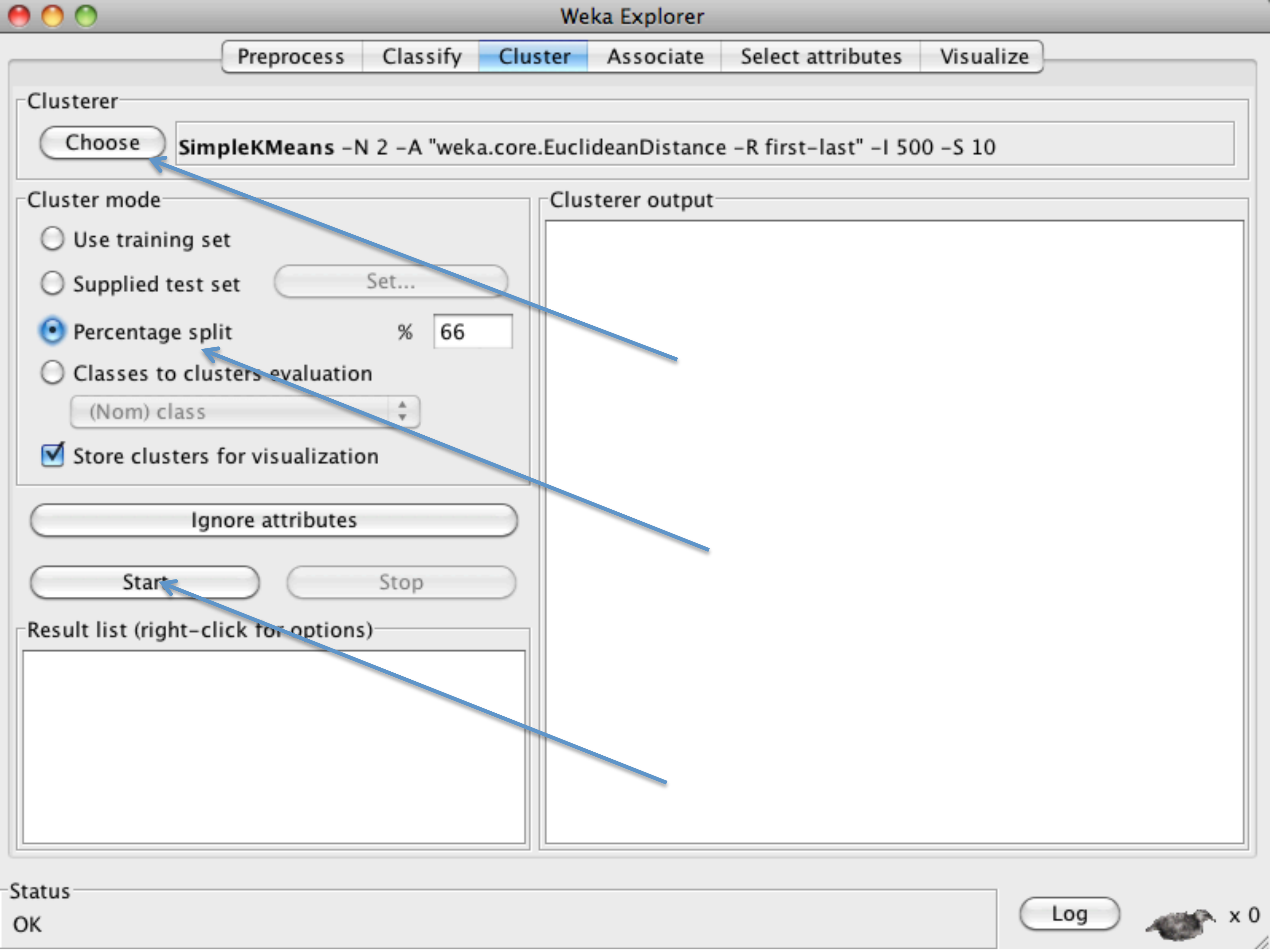
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0

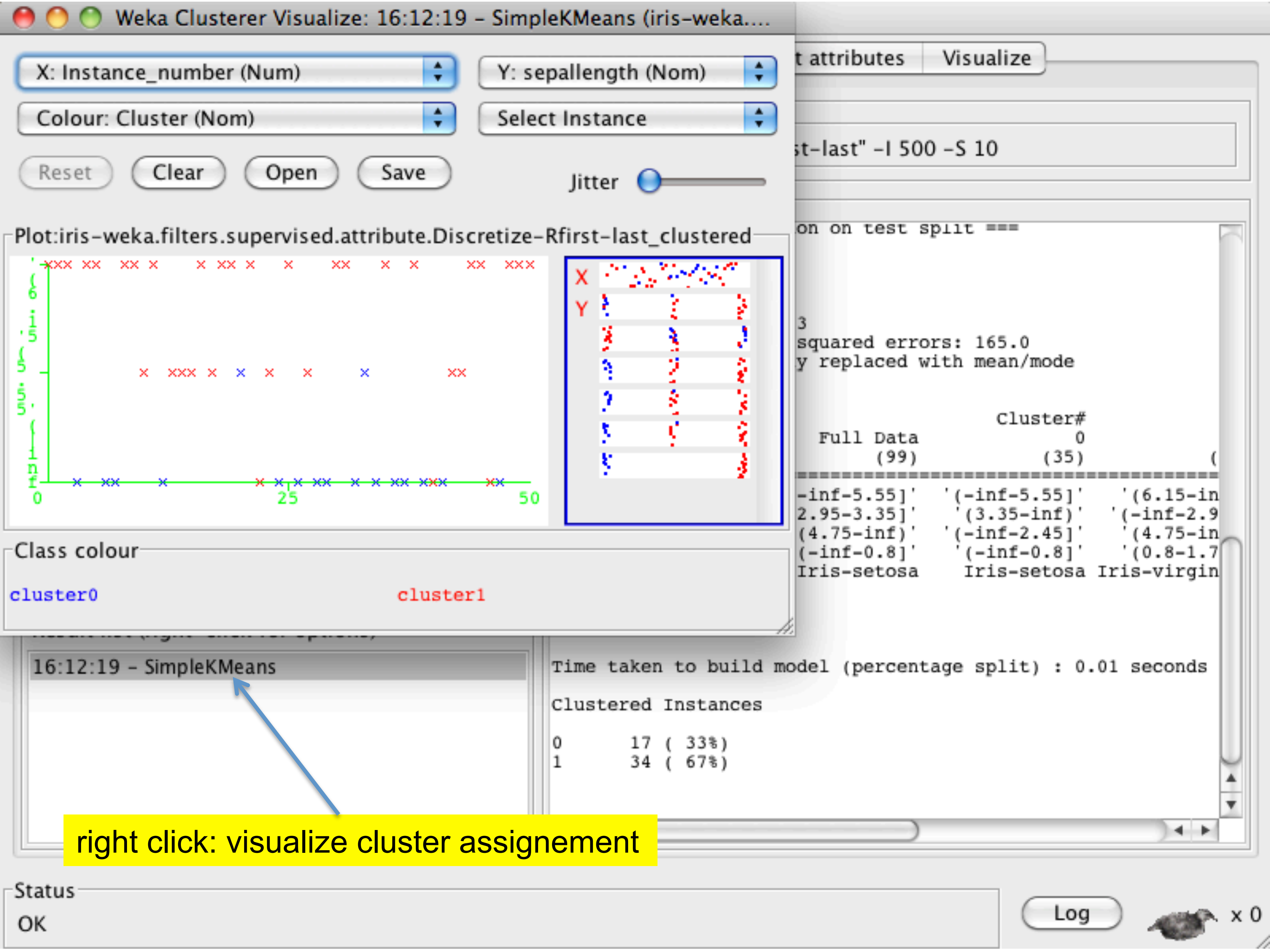
Explorer: clustering data

- 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 "true" clusters (if given)
- Evaluation based on loglikelihood if clustering scheme produces a probability distribution

The K-Means Clustering Method

- Given *k*, the *k-means* algorithm is implemented in four steps:
  - Partition objects into *k* nonempty subsets
  - Compute seed points as the centroids of the clusters of the current partition (the centroid is the center, i.e., *mean point*, of the cluster)
  - Assign each object to the cluster with the nearest seed point
  - Go back to Step 2, stop when no more new assignment


Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
SimpleKMeans -N 2 -A "weka.core.EuclideanDistance -R first-last" -I 500 -S 10
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

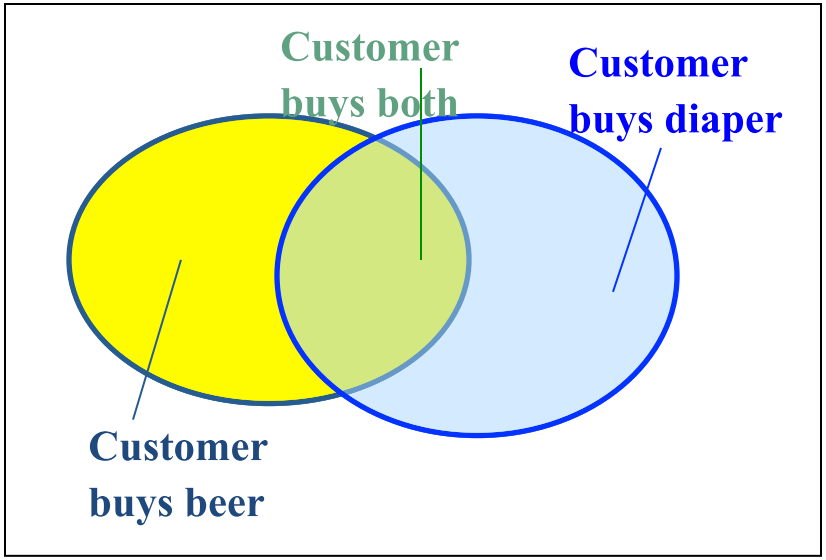

Weka Clusterer Visualize: 16:12:19 - SimpleKMeans (iris-weka....
X: Instance_number (Num)
Y: sepallength (Nom)
Colour: Cluster (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot:iris-weka.filters.supervised.attribute.Discretize-Rfirst-last_clustered
0
25
50
X
Y
Class colour
cluster0
cluster1
t attributes
Visualize
st-last" -I 500 -S 10
on on test split ===
3
squared errors: 165.0
y replaced with mean/mode
Cluster#
Full Data
0
(99)
(35)
16:12:19 - SimpleKMeans
Time taken to build model (percentage split) : 0.01 seconds
Clustered Instances
0 17 (33%)
1 34 (67%)
right click: visualize cluster assignement
Status
OK
Log
x 0

Explorer: finding associations

- WEKA contains an implementation of the Apriori 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 given minimum support and exceed a given confidence

Basic Concepts: Frequent Patterns

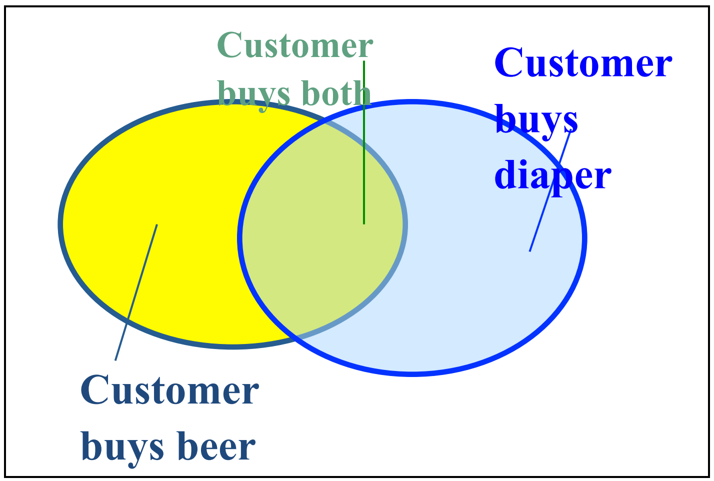
Tid	Items bought
10	Beer, Nuts, Diaper
20	Beer, Coffee, Diaper
30	Beer, Diaper, Eggs
40	Nuts, Eggs, Milk
50	Nuts, Coffee, Diaper, Eggs, Milk



- itemset: A set of one or more items
- k-itemset $X = \{x_1, \ldots, x_k\}$
- *(absolute) support*, or, *support count* of X: Frequency or occurrence of an itemset X
- *(relative) support*, *s*, is the fraction of transactions that contains X (i.e., the probability that a transaction contains X)
- An itemset X is *frequent* if X' s support is no less than a *minsup* threshold

Basic Concepts: Association Rules

Tid	Items bought
10	Beer, Nuts, Diaper
20	Beer, Coffee, Diaper
30	Beer, Diaper, Eggs
40	Nuts, Eggs, Milk
50	Nuts, Coffee, Diaper, Eggs, Milk

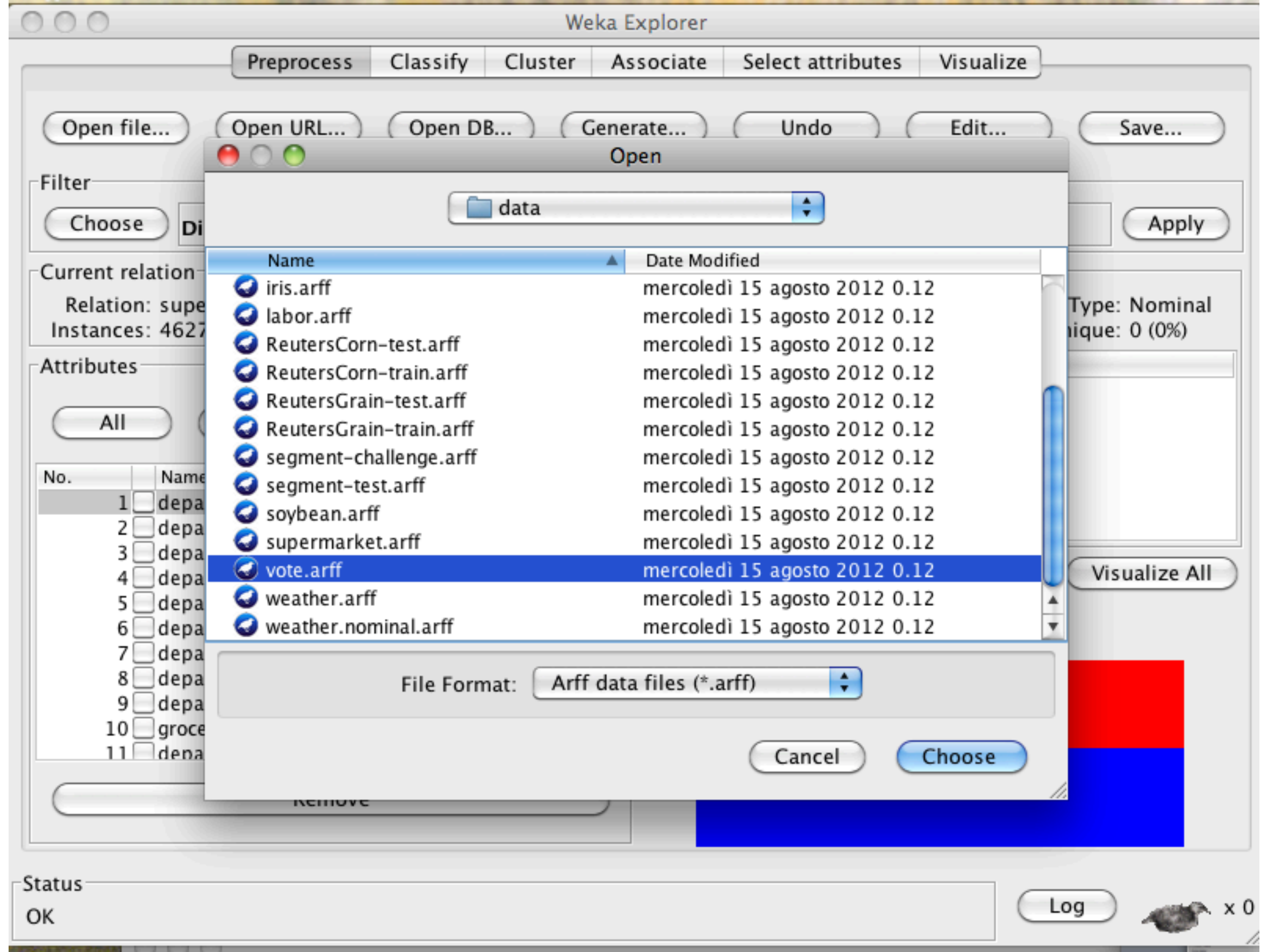


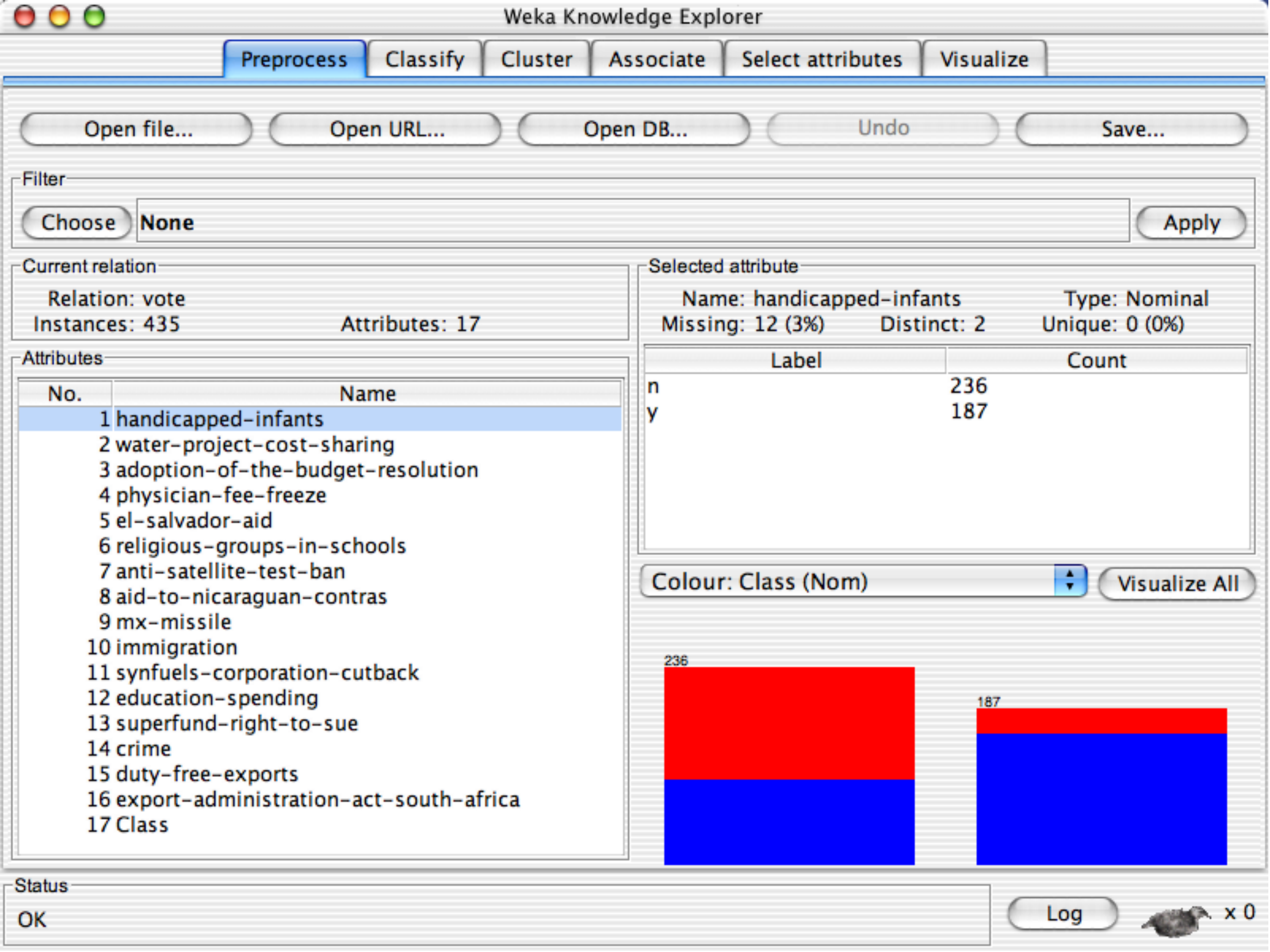
- Find all the rules $X \rightarrow Y$ with minimum support and confidence
  - support, *s*, probability that a transaction contains $X \cup Y$
  - confidence, *c*, conditional probability that a transaction having X also contains *Y*

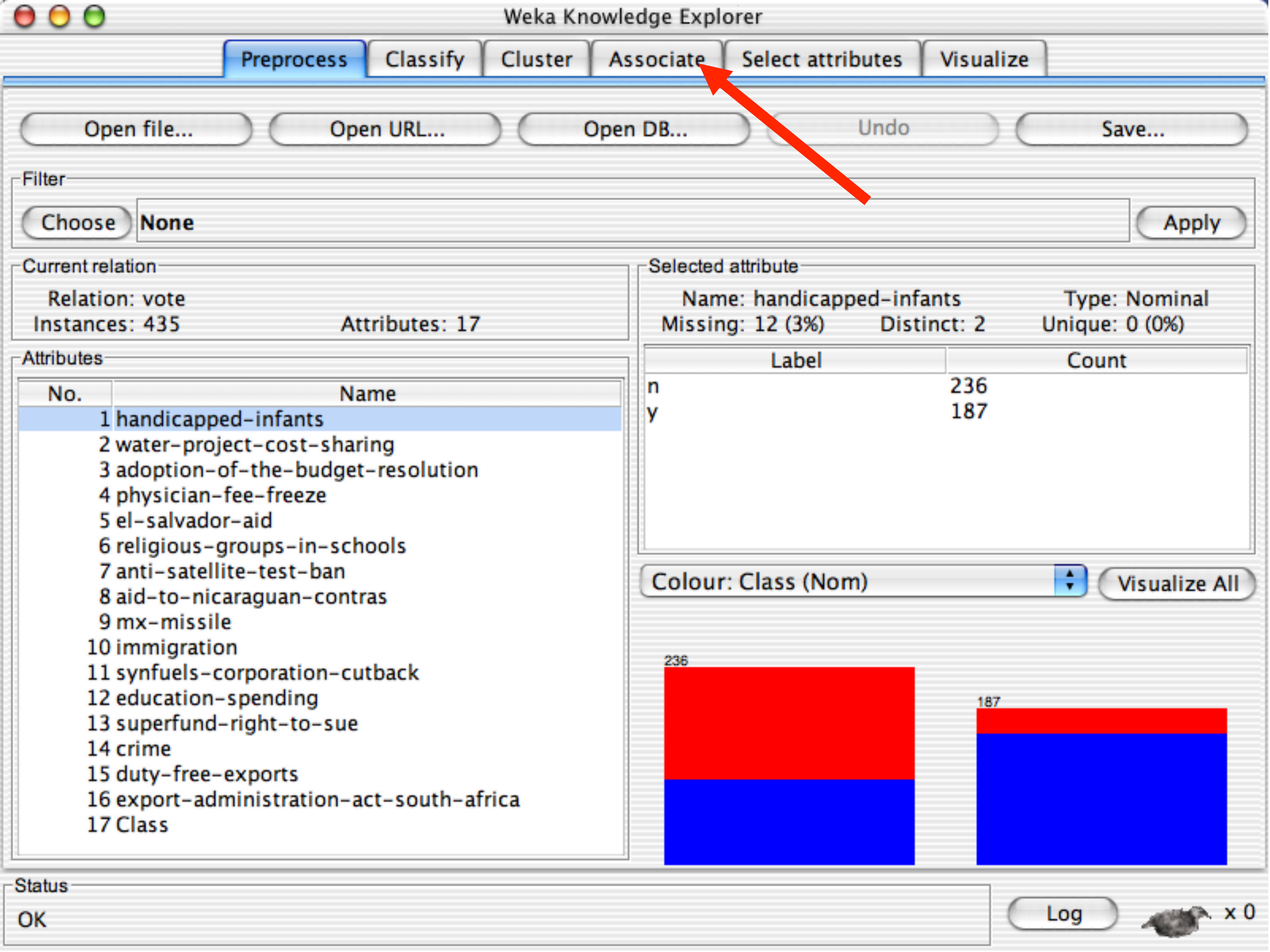
Let minsup = 50%, minconf = 50%

Freq. Pat.: Beer:3, Nuts:3, Diaper:4, Eggs:3, {Beer, Diaper}:3

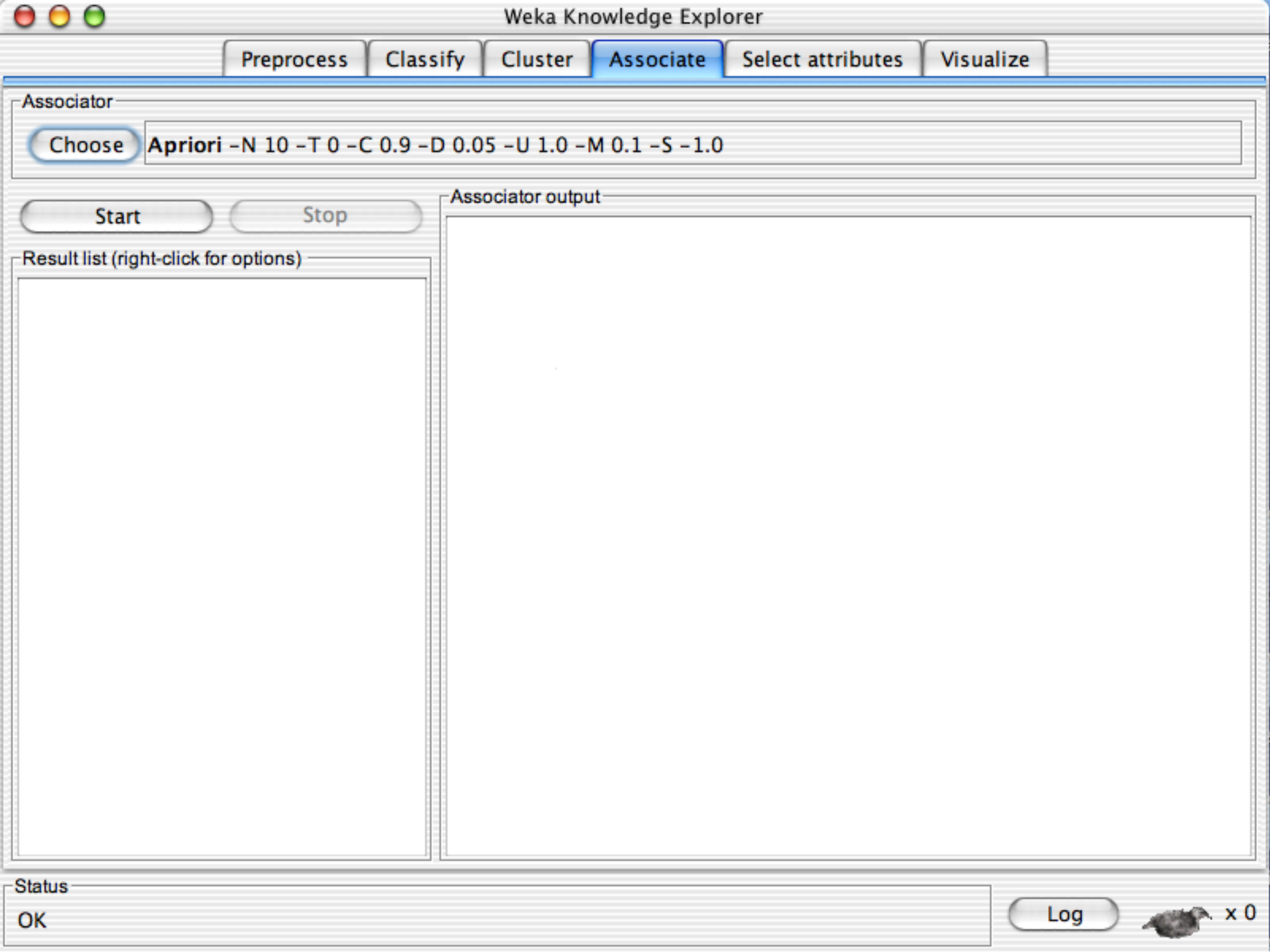
- Association rules: (many more!)
  - *Beer* → *Diaper* (60%, 100%)
  - *Diaper* → *Beer* (60%, 75%)

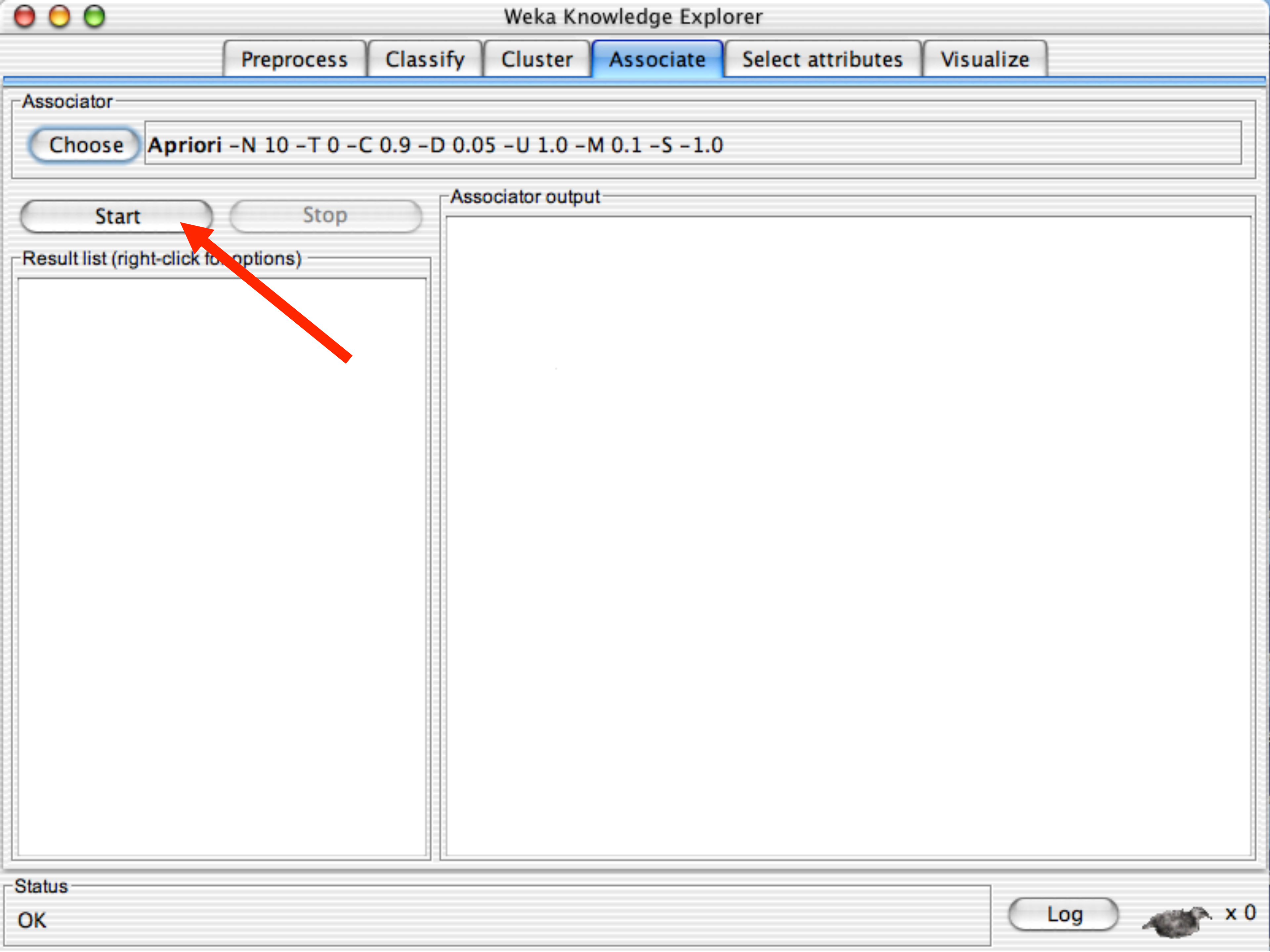

Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Generate...
Undo
Edit...
Save...
Filter
Choose
Apply
Current relation
Relation: supe
Instances: 4627
Type: Nominal
ique: 0 (0%)
Attributes
All
No.
Name
Visualize All
Status
OK
Log
x 0
Open
data
Name
Date Modified
iris.arff mercoledì 15 agosto 2012 0.12
labor.arff mercoledì 15 agosto 2012 0.12
ReutersCorn-test.arff mercoledì 15 agosto 2012 0.12
ReutersCorn-train.arff mercoledì 15 agosto 2012 0.12
ReutersGrain-test.arff mercoledì 15 agosto 2012 0.12
ReutersGrain-train.arff mercoledì 15 agosto 2012 0.12
segment-challenge.arff mercoledì 15 agosto 2012 0.12
segment-test.arff mercoledì 15 agosto 2012 0.12
soybean.arff mercoledì 15 agosto 2012 0.12
supermarket.arff mercoledì 15 agosto 2012 0.12
vote.arff mercoledì 15 agosto 2012 0.12
weather.arff mercoledì 15 agosto 2012 0.12
weather.nominal.arff mercoledì 15 agosto 2012 0.12
File Format:
Arff data files (*.arff)
Cancel
Choose

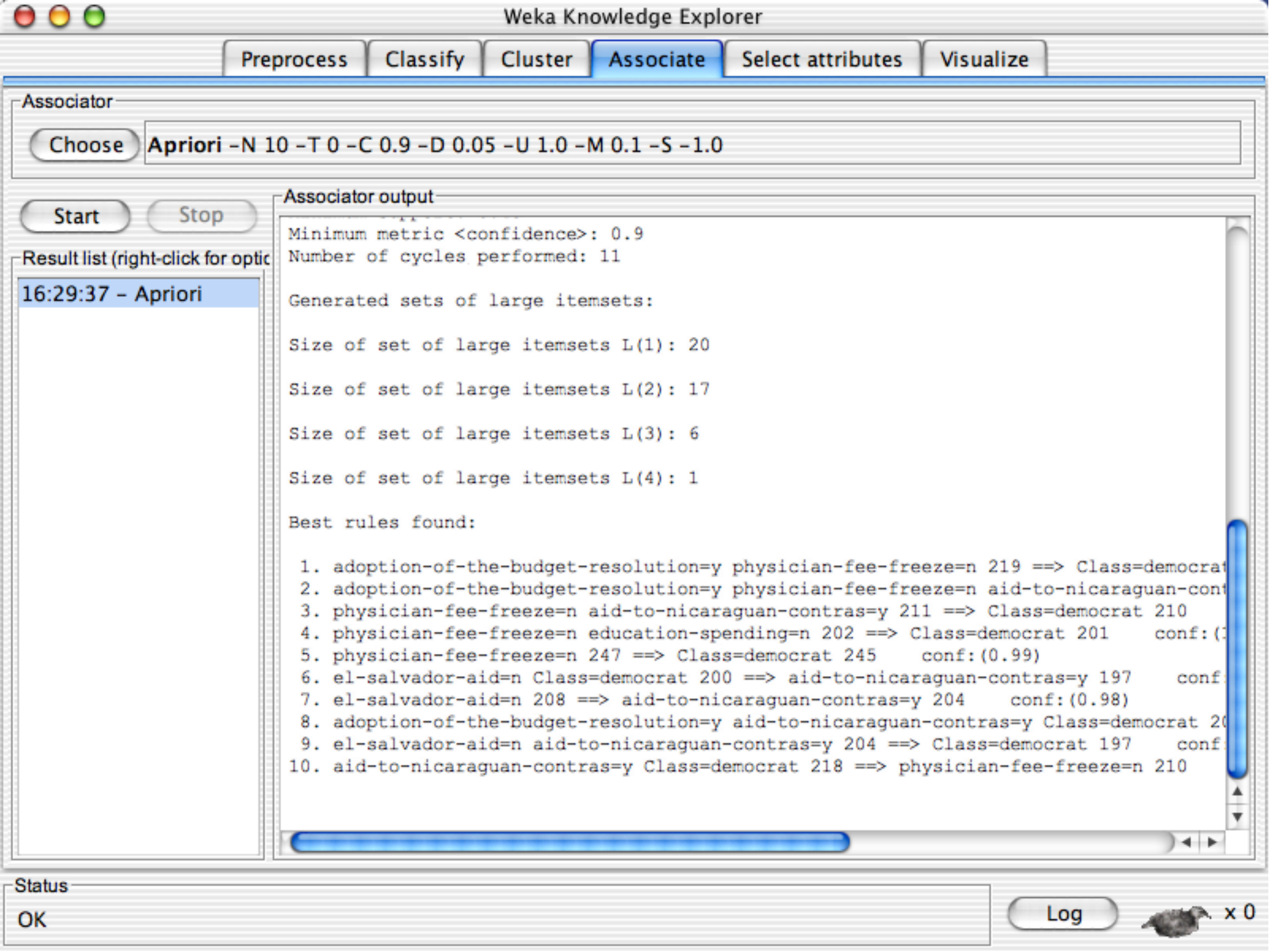

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: vote
Instances: 435
Attributes: 17
Selected attribute
Name: handicapped-infants
Type: Nominal
Missing: 12 (3%)
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



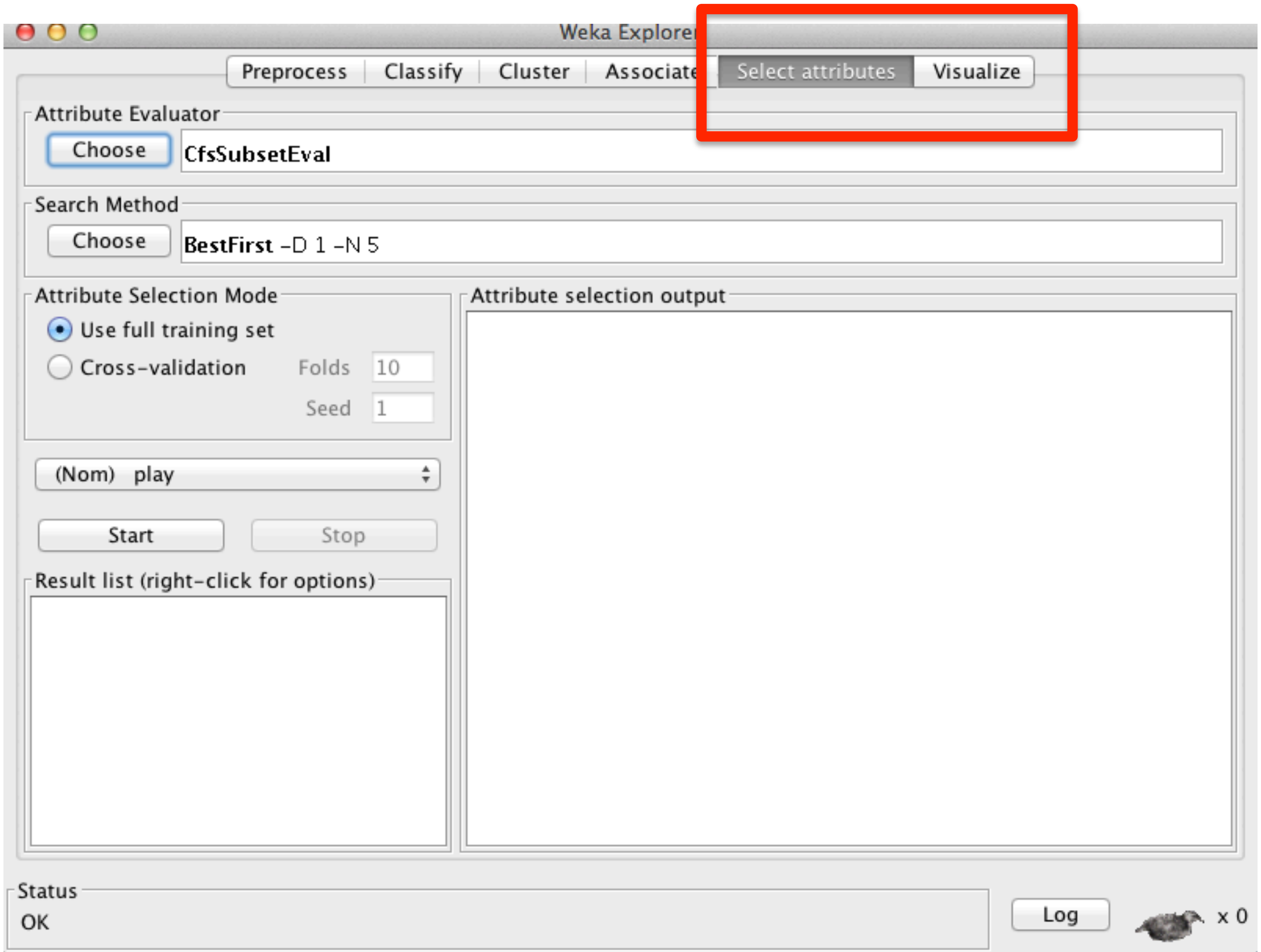
Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: vote
Instances: 435
Attributes: 17
Attributes
No.
Name
1 handicapped-infants
2 water-project-cost-sharing
3 adoption-of-the-budget-resolution
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
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

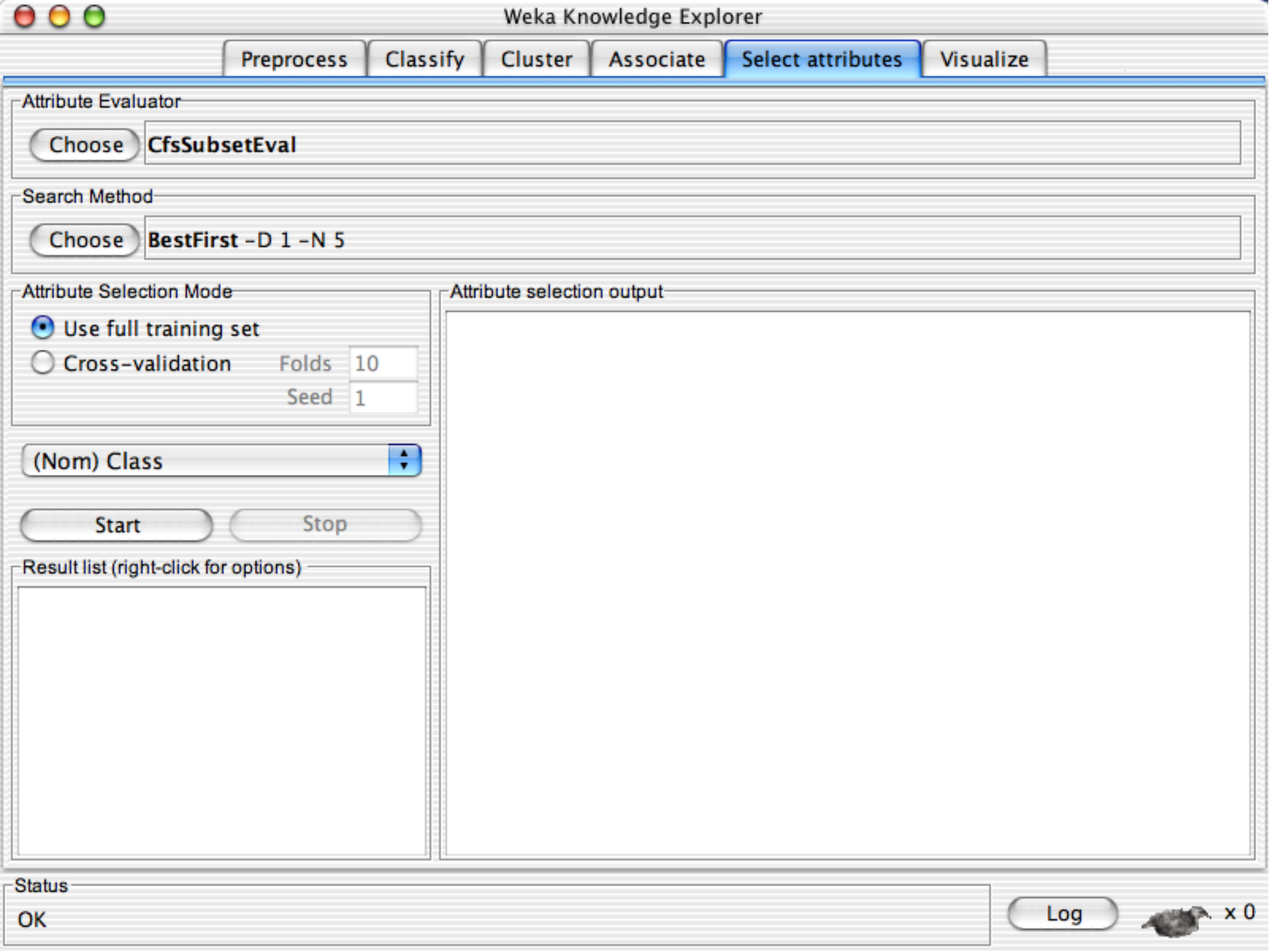

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for optic
16:29:37 - Apriori
Associator output
Minimum metric <confidence>: 0.9
Number of cycles performed: 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-cont
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

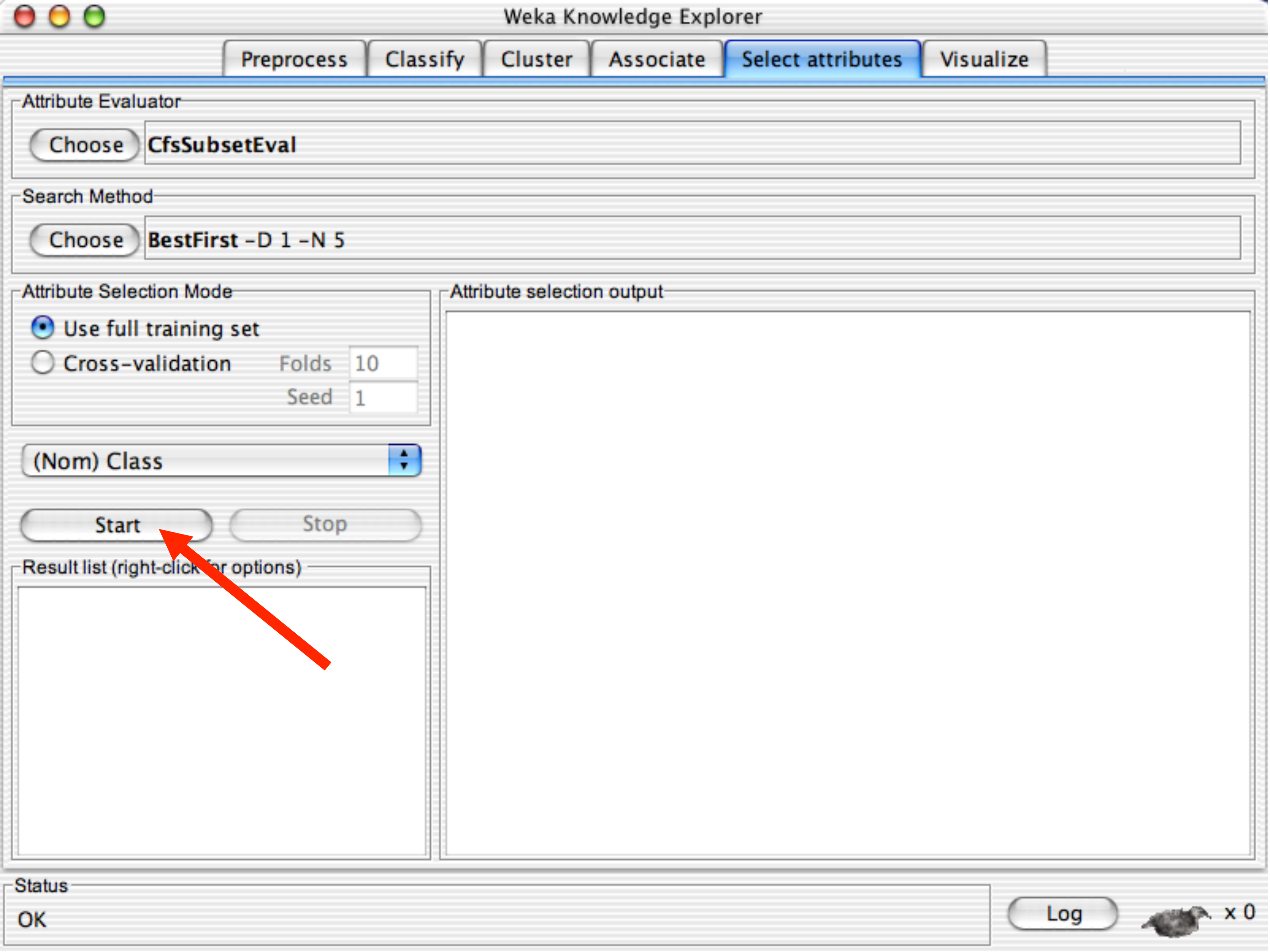
Additional features of Explorer: Attribute Selection and Visualization

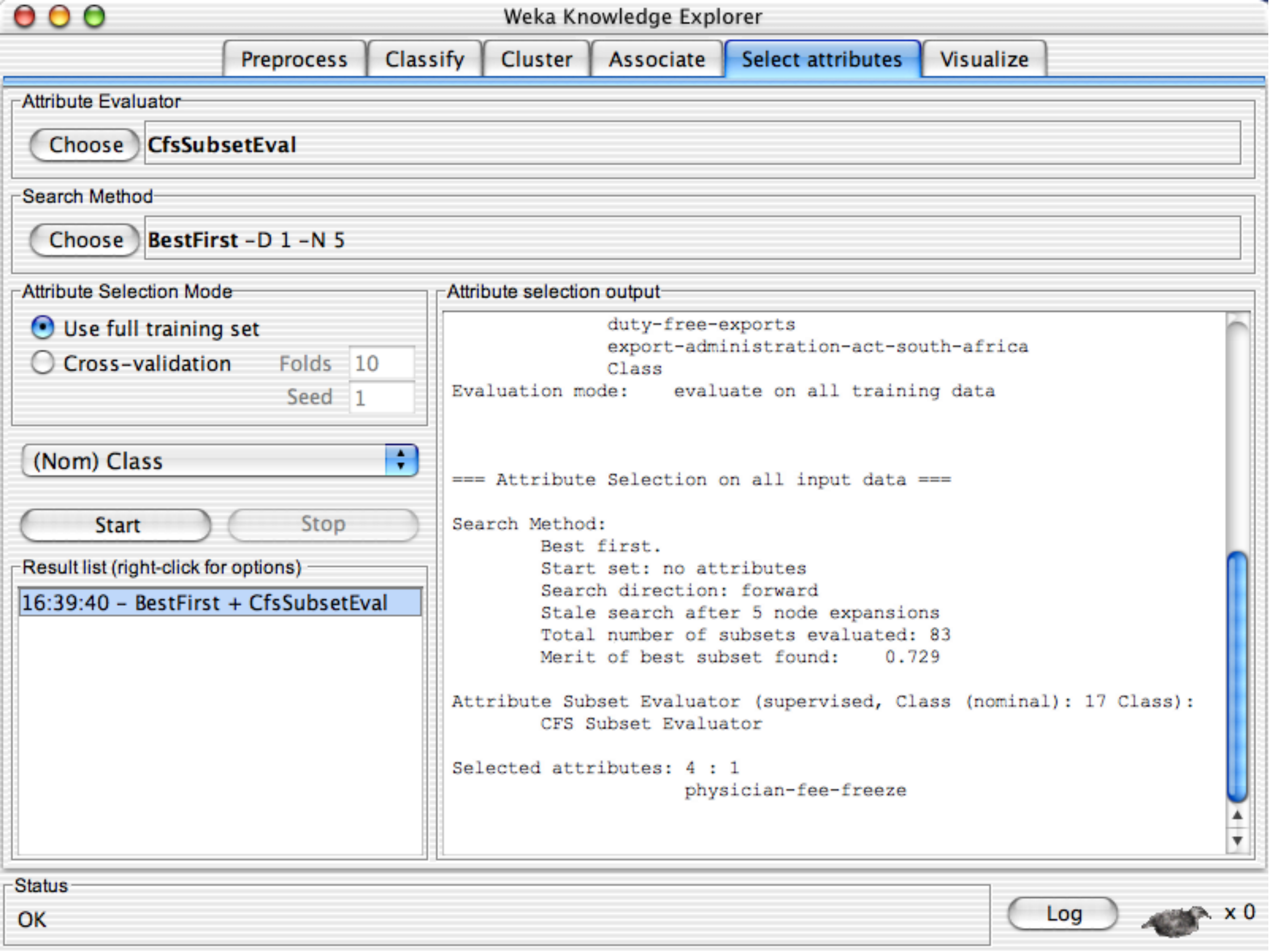


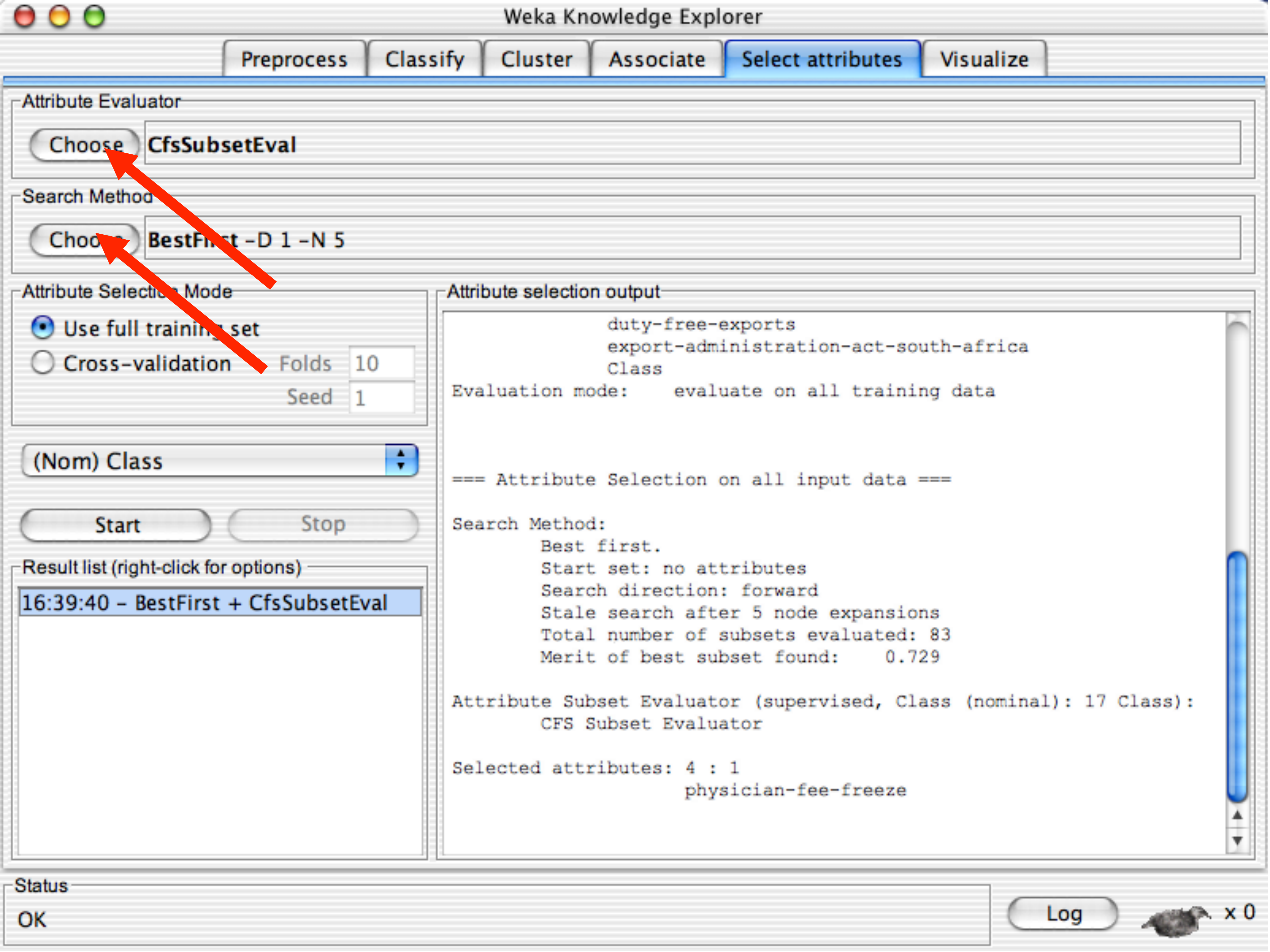
Explorer: attribute selection

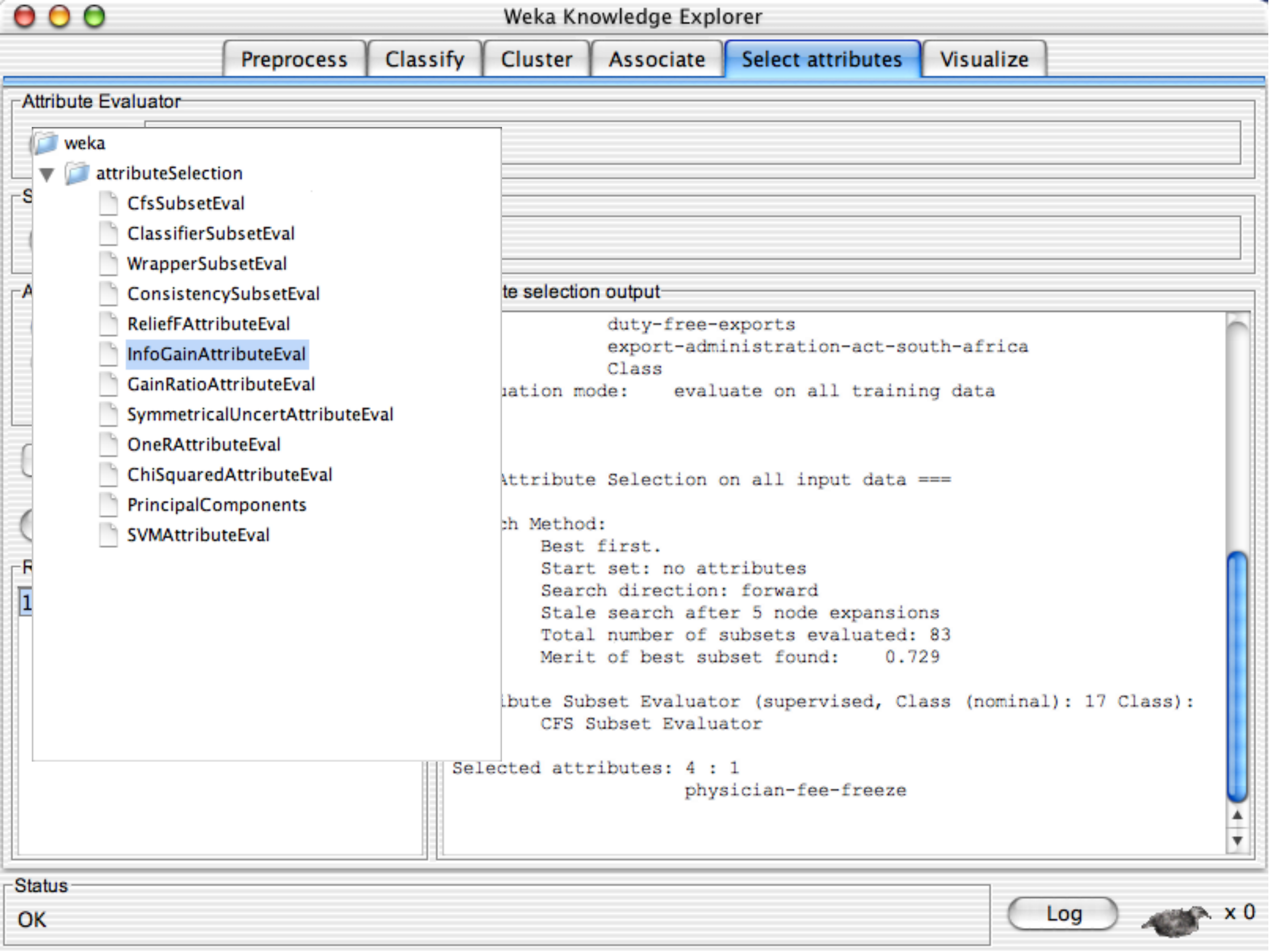
- Panel that can be used to investigate which (subsets of) attributes are the most predictive ones
- Attribute selection methods contain two parts:
  - A search method: best-first, forward selection, random, exhaustive, genetic algorithm, ranking
  - An evaluation method: correlation-based, wrapper,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

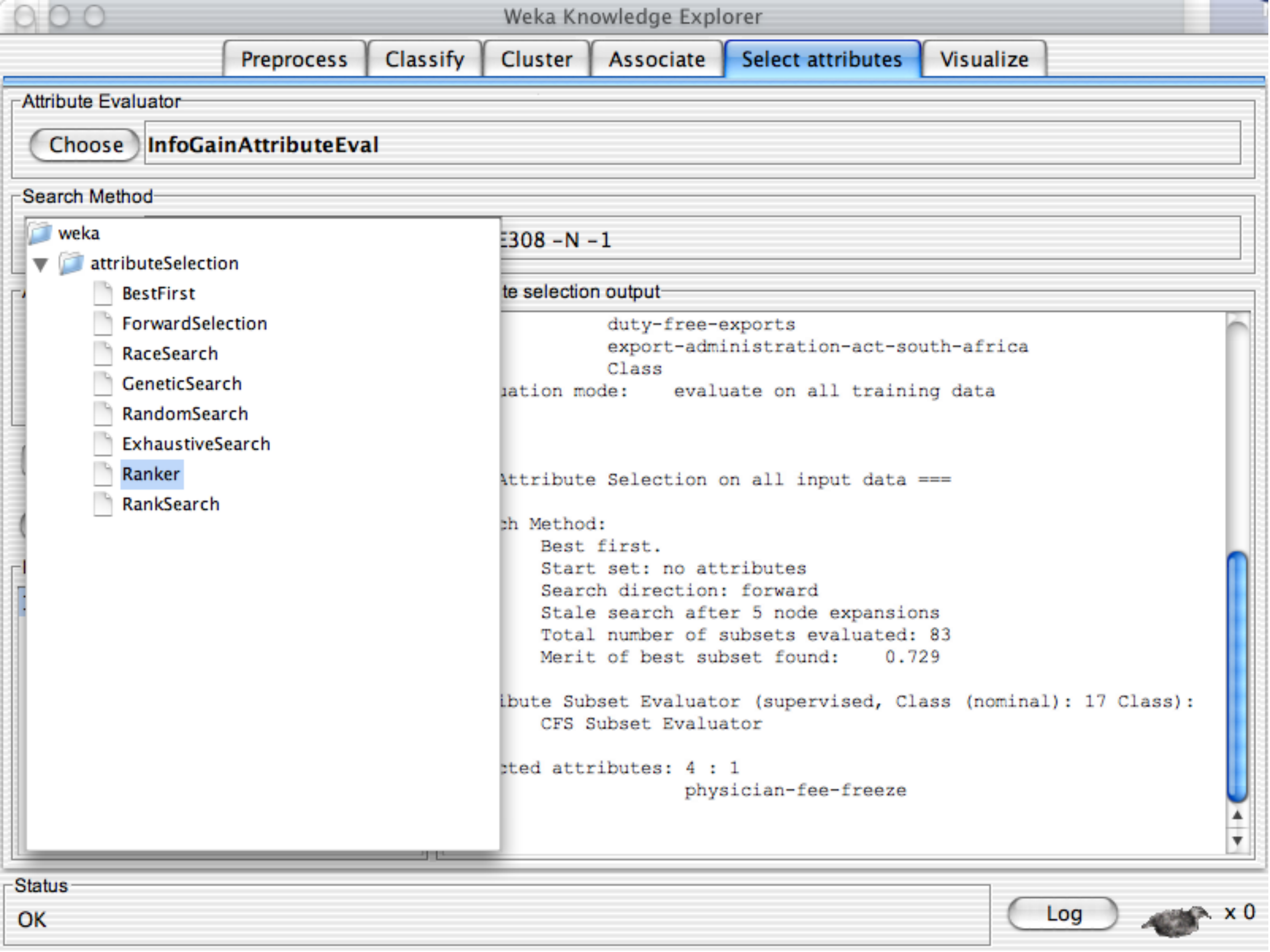

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds
10
Seed
1
(Nom) Class
Start
Stop
Result list (right-click for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

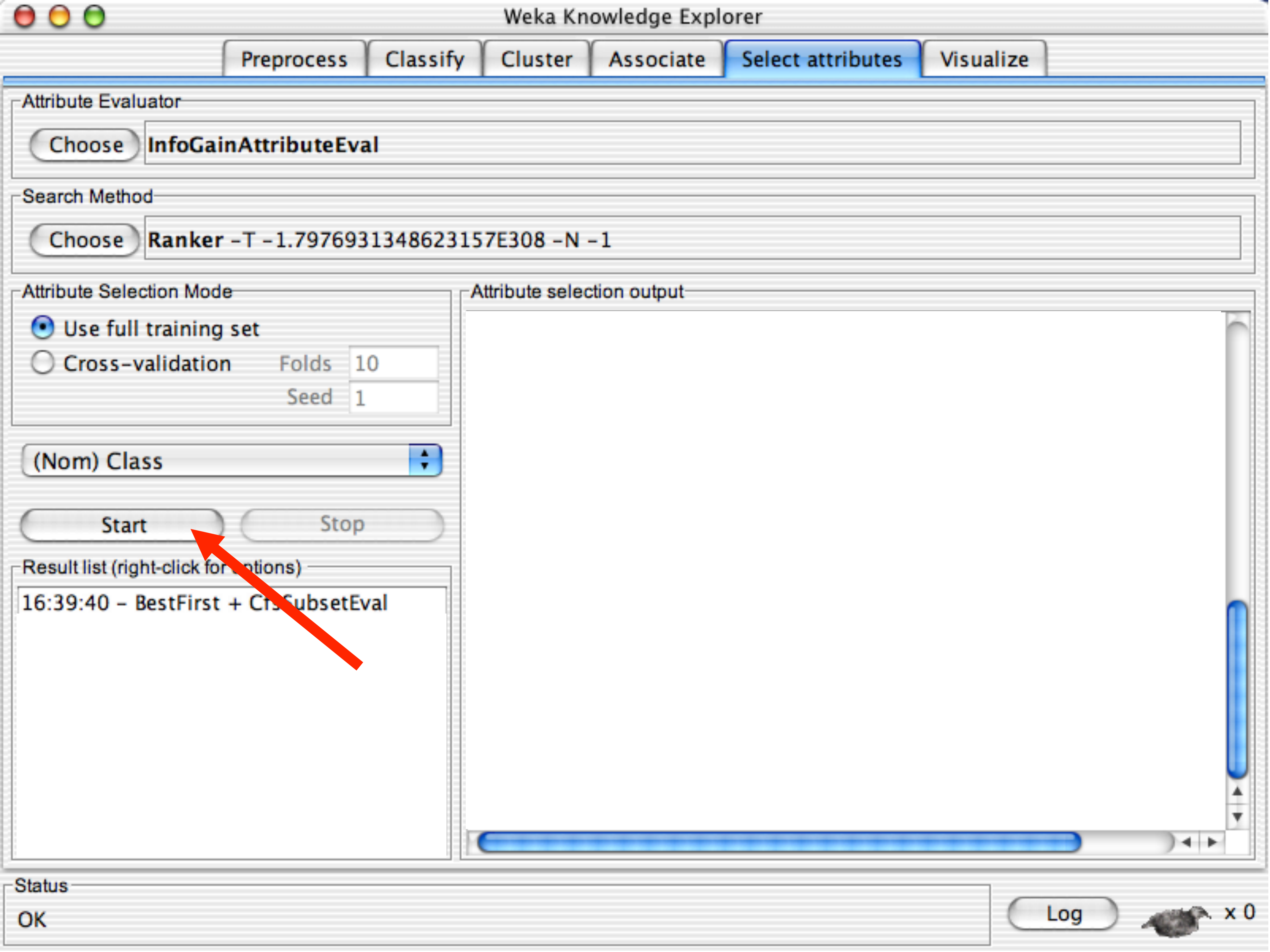

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds
10
Seed
1
(Nom) Class
Start
Stop
Result list (right-click for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

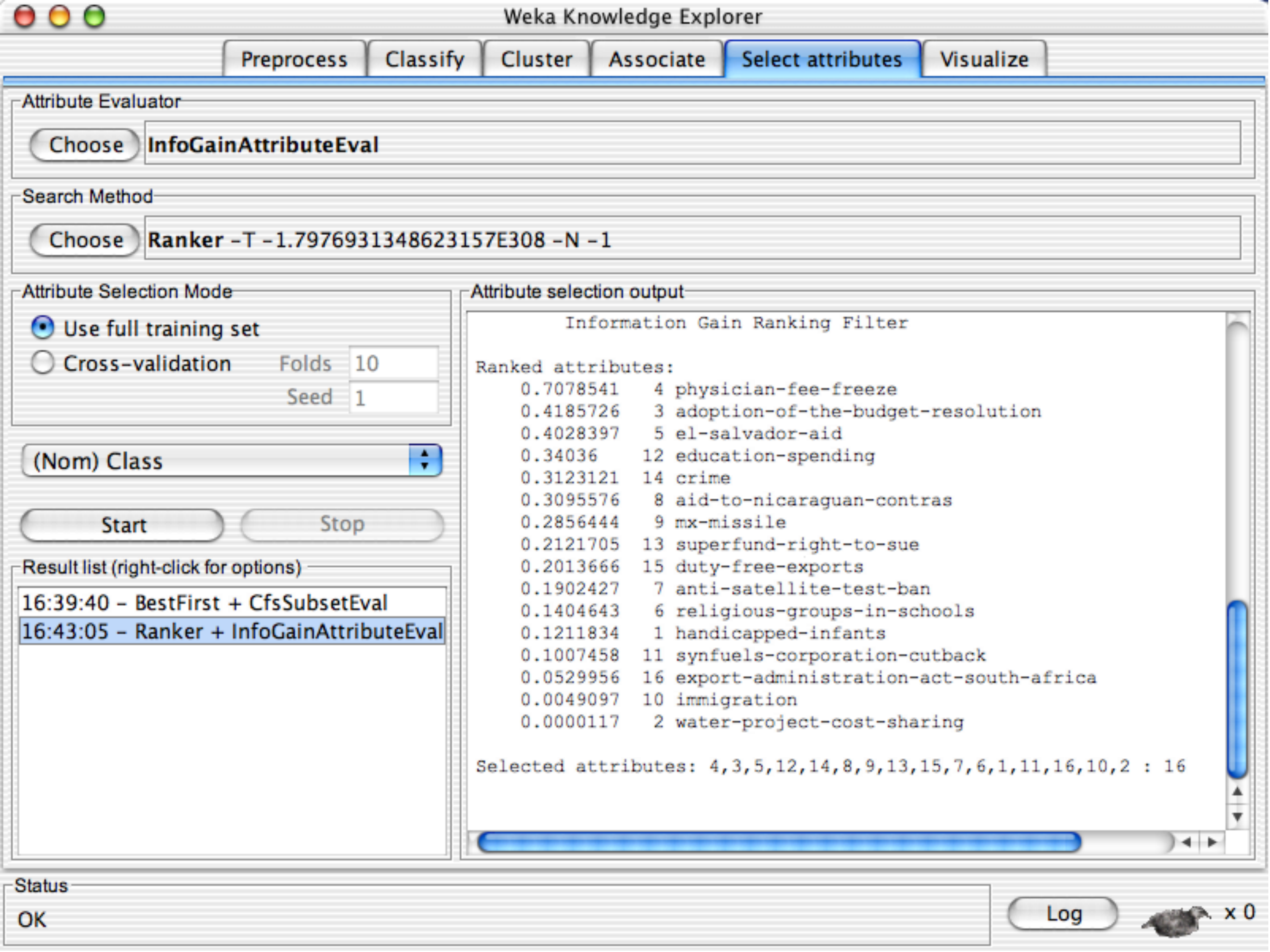

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
CfsSubsetEval
Search Method
Choose
BestFirst -D 1 -N 5
Attribute Selection Mode
Use full training set
Cross-validation
Folds
10
Seed
1
(Nom) Class
Start
Stop
Result list (right-click for 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)
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
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:
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
ibute Subset Evaluator (supervised, Class (nominal): 17 Class):
CFS Subset Evaluator
Selected attributes: 4 : 1
physician-fee-freeze
Status
OK
Log
x 0

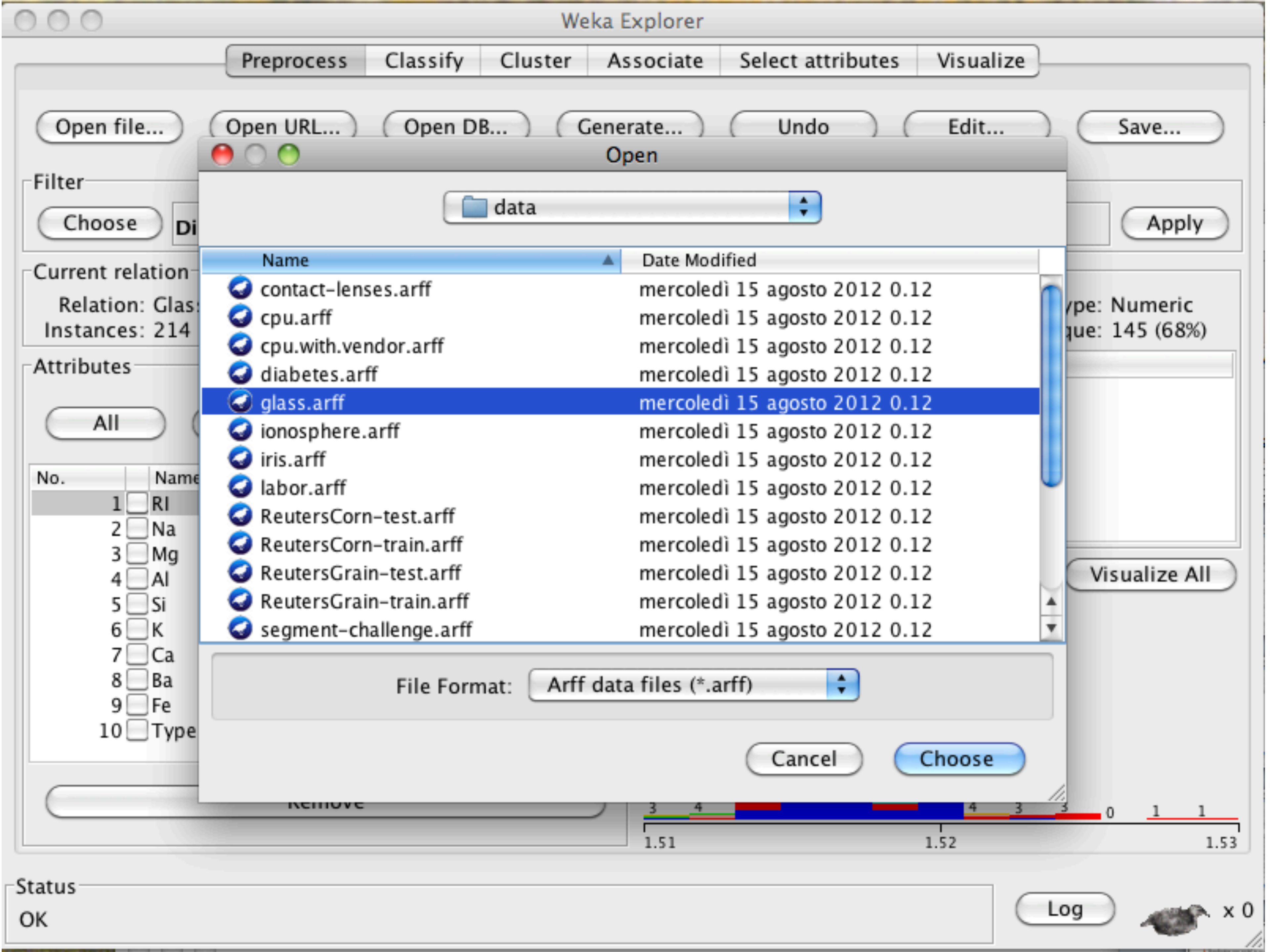

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
InfoGainAttributeEval
Search Method
weka
attributeSelection
BestFirst
ForwardSelection
RaceSearch
GeneticSearch
RandomSearch
ExhaustiveSearch
Ranker
RankSearch
E308 -N -1
te selection 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
Stale search after 5 node expansions
Total number of subsets evaluated: 83
Merit of best subset found: 0.729
ibute Subset Evaluator (supervised, Class (nominal): 17 Class):
CFS Subset Evaluator
cted attributes: 4 : 1
physician-fee-freeze
Status
OK
Log
x 0

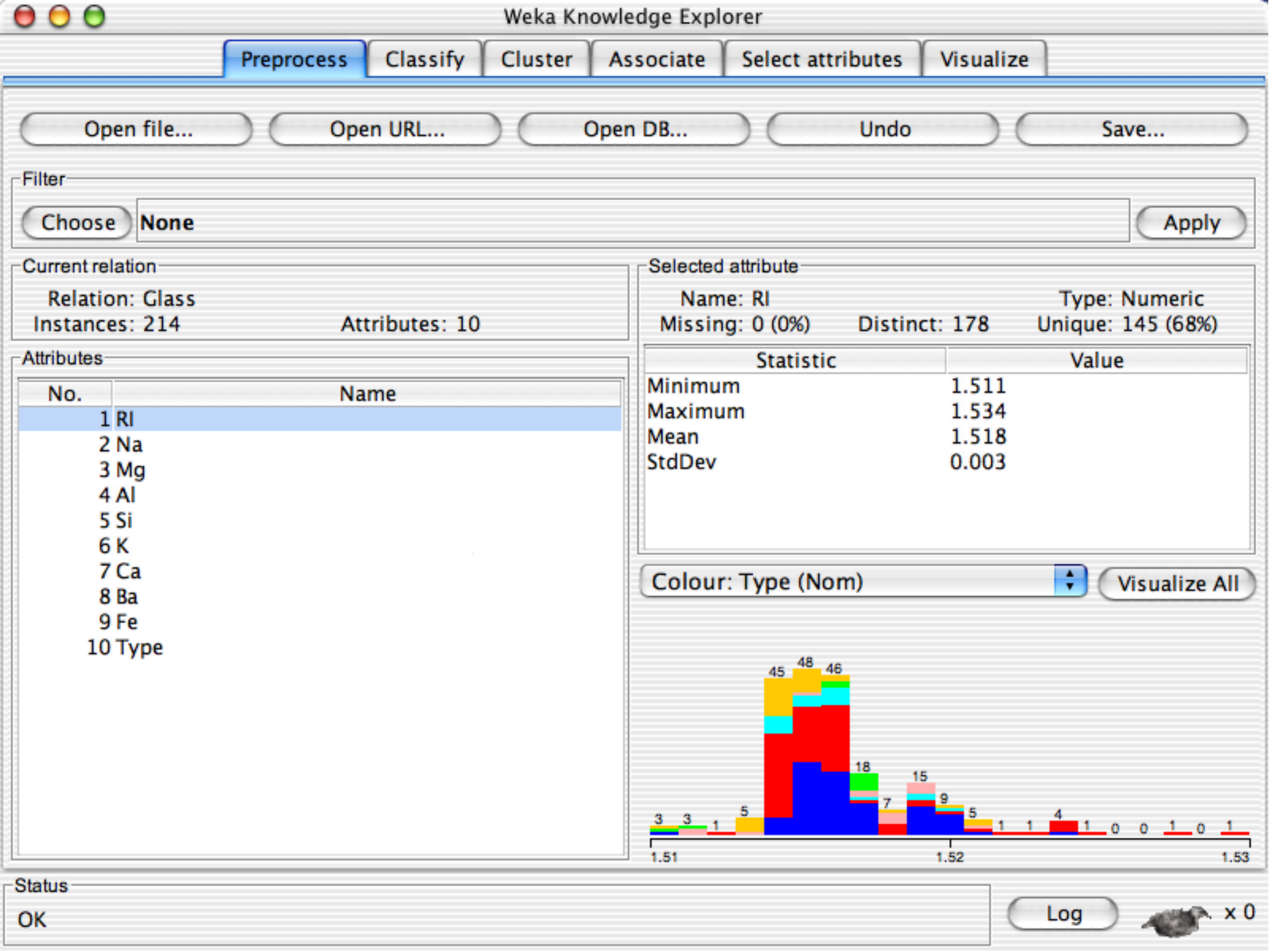

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
InfoGainAttributeEval
Search Method
Choose
Ranker -T -1.7976931348623157E308 -N -1
Attribute Selection Mode
Use full training set
Cross-validation
Folds
10
Seed
1
(Nom) Class
Start
Stop
Result list (right-click for options)
16:39:40 - BestFirst + CfsSubsetEval
Attribute selection output
Status
OK
Log
x 0

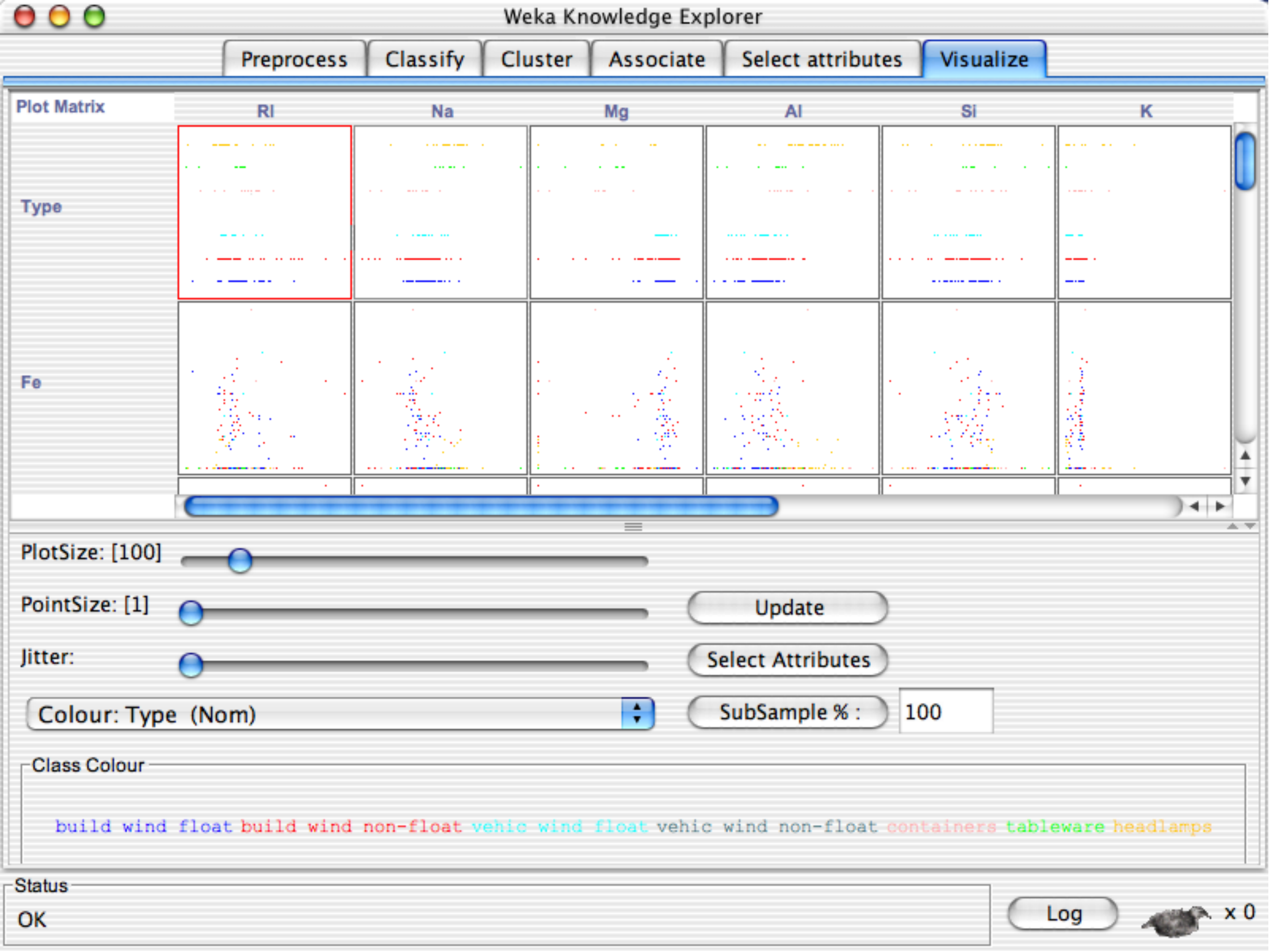

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Attribute Evaluator
Choose
InfoGainAttributeEval
Search Method
Choose
Ranker -T -1.7976931348623157E308 -N -1
Attribute Selection Mode
Use full training set
Cross-validation
Folds
10
Seed
1
(Nom) Class
Start
Stop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

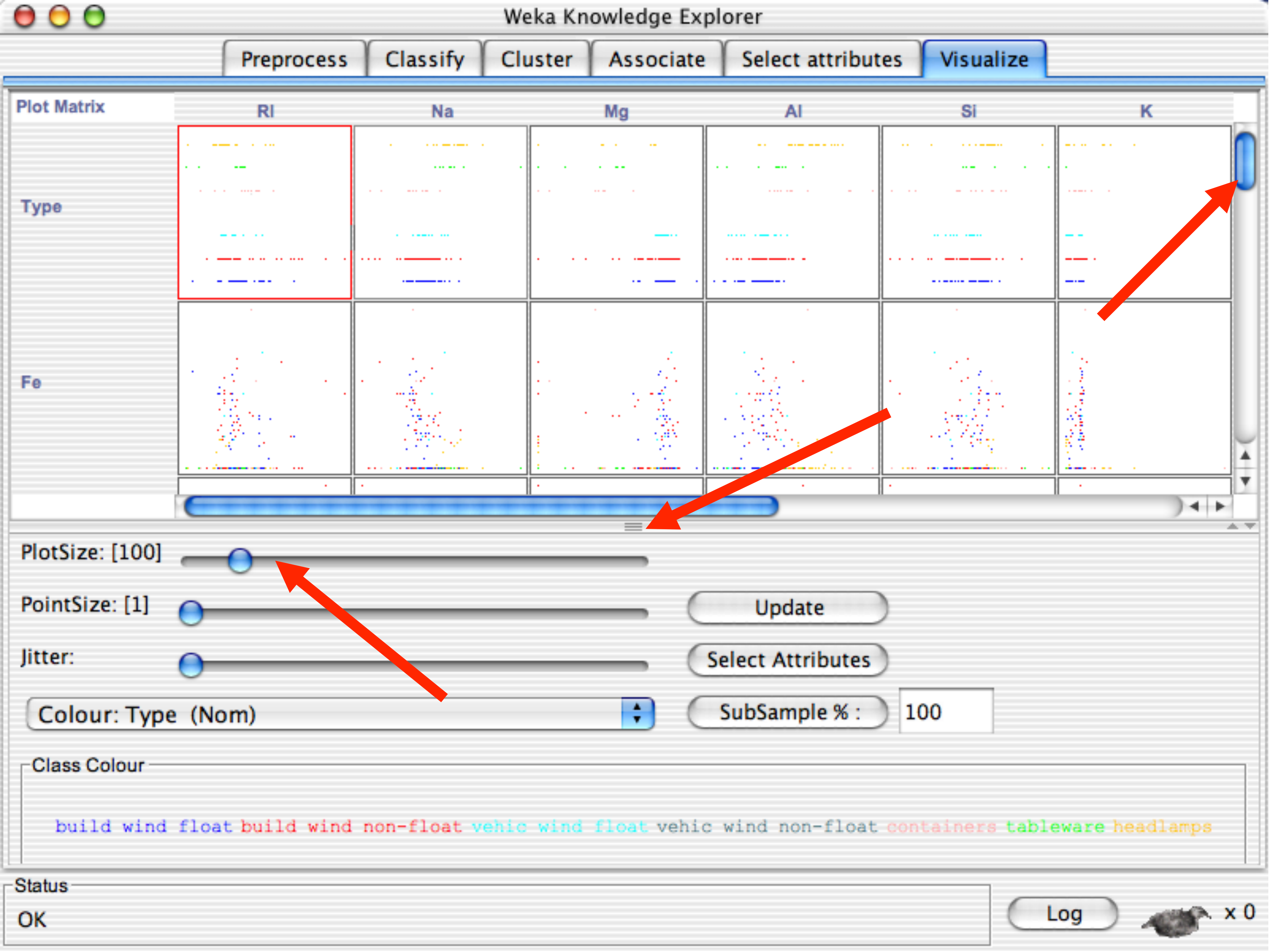
Explorer: data visualization

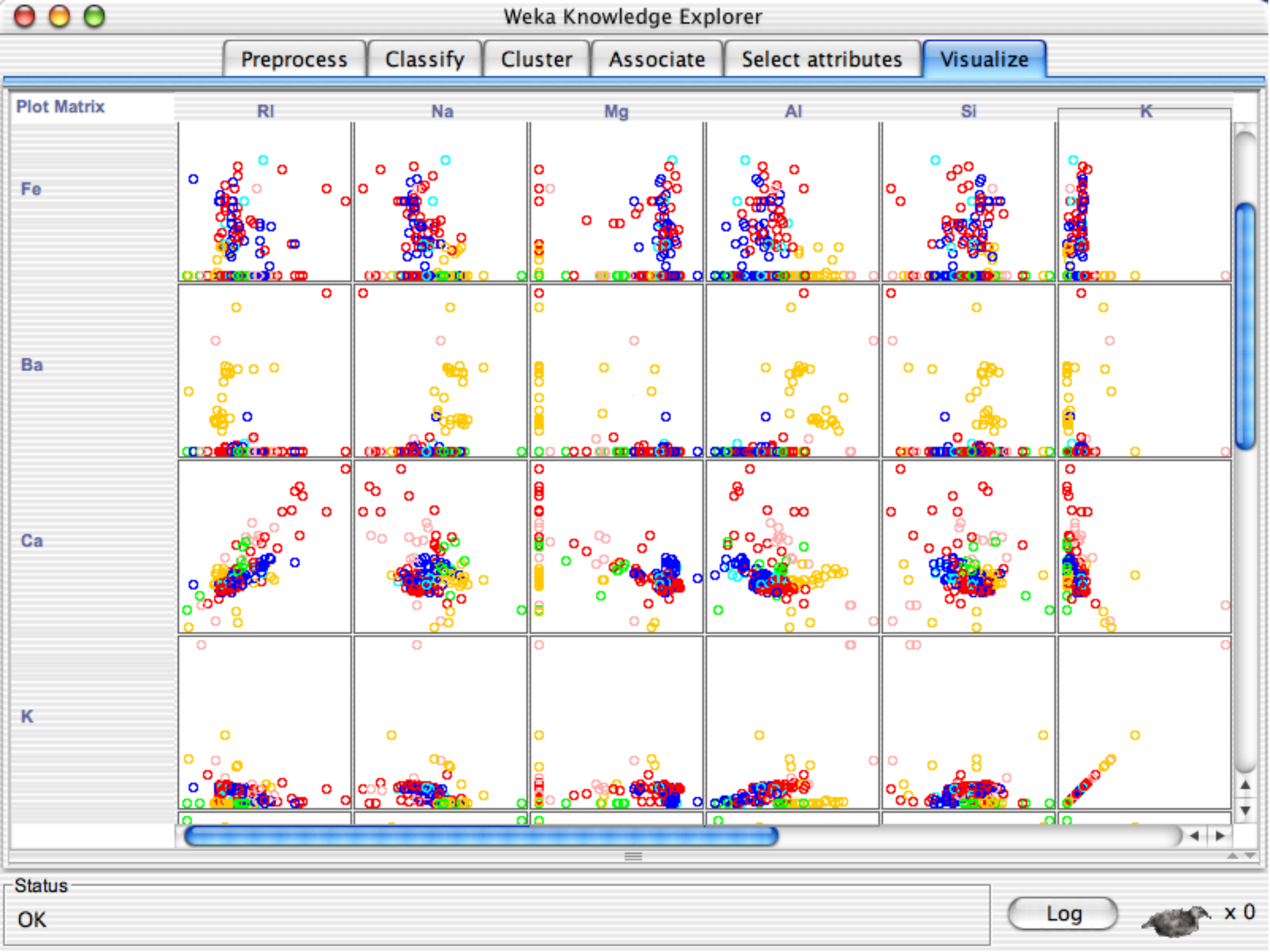
- Visualization very useful in practice: e.g. helps to determine difficulty of the learning problem
- WEKA can visualize single attributes (1-d) and pairs of attributes (2-d)
- Color-coded class values
- "Jitter" option to deal with nominal attributes (and to detect "hidden" data points). (Jittering occurs when you have too many instances placed on the same point, see http://blogs.sas.com/content/iml/2011/07/05/jittering-to-prevent-overplotting-in-statistical-graphics.html)
- "Zoom-in" function

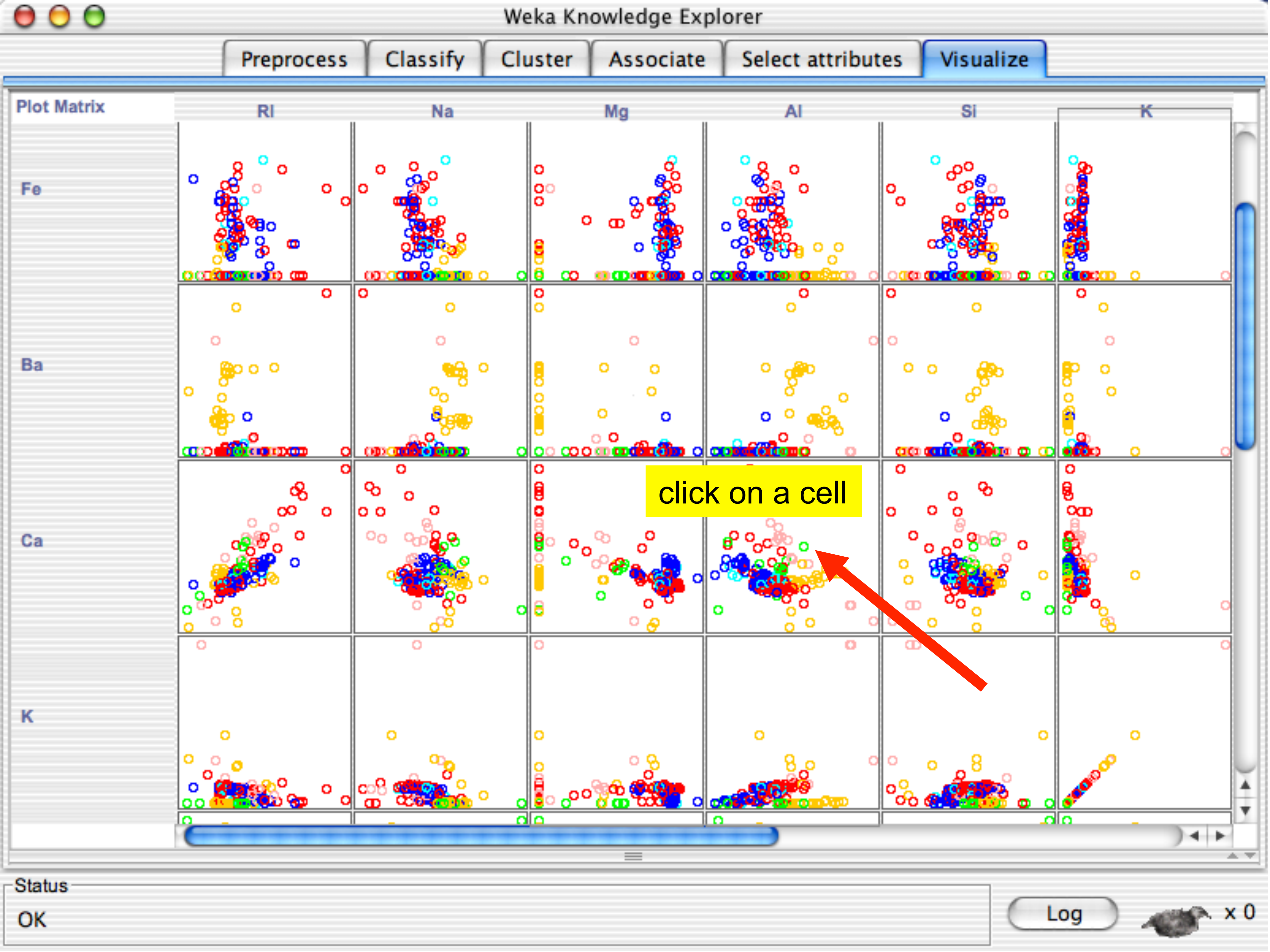

Weka Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Generate...
Undo
Edit...
Save...
Filter
Choose
Apply
Current relation
Instances: 214
Attributes
All
No.
1 RI
2 Na
3 Mg
4 Al
5 Si
6 K
7 Ca
8 Ba
9 Fe
10 Type
Open
data
Name
Date Modified
contact-lenses.arff
cpu.arff
cpu.with.vendor.arff
diabetes.arff
glass.arff
ionosphere.arff
iris.arff
labor.arff
ReutersCorn-test.arff
ReutersCorn-train.arff
ReutersGrain-test.arff
ReutersGrain-train.arff
segment-challenge.arff
mercoledì 15 agosto 2012 0.12
File Format:
Arff data files (*.arff)
Cancel
Choose
Visualize All
1.51
1.52
1.53
Status
OK
Log
x 0

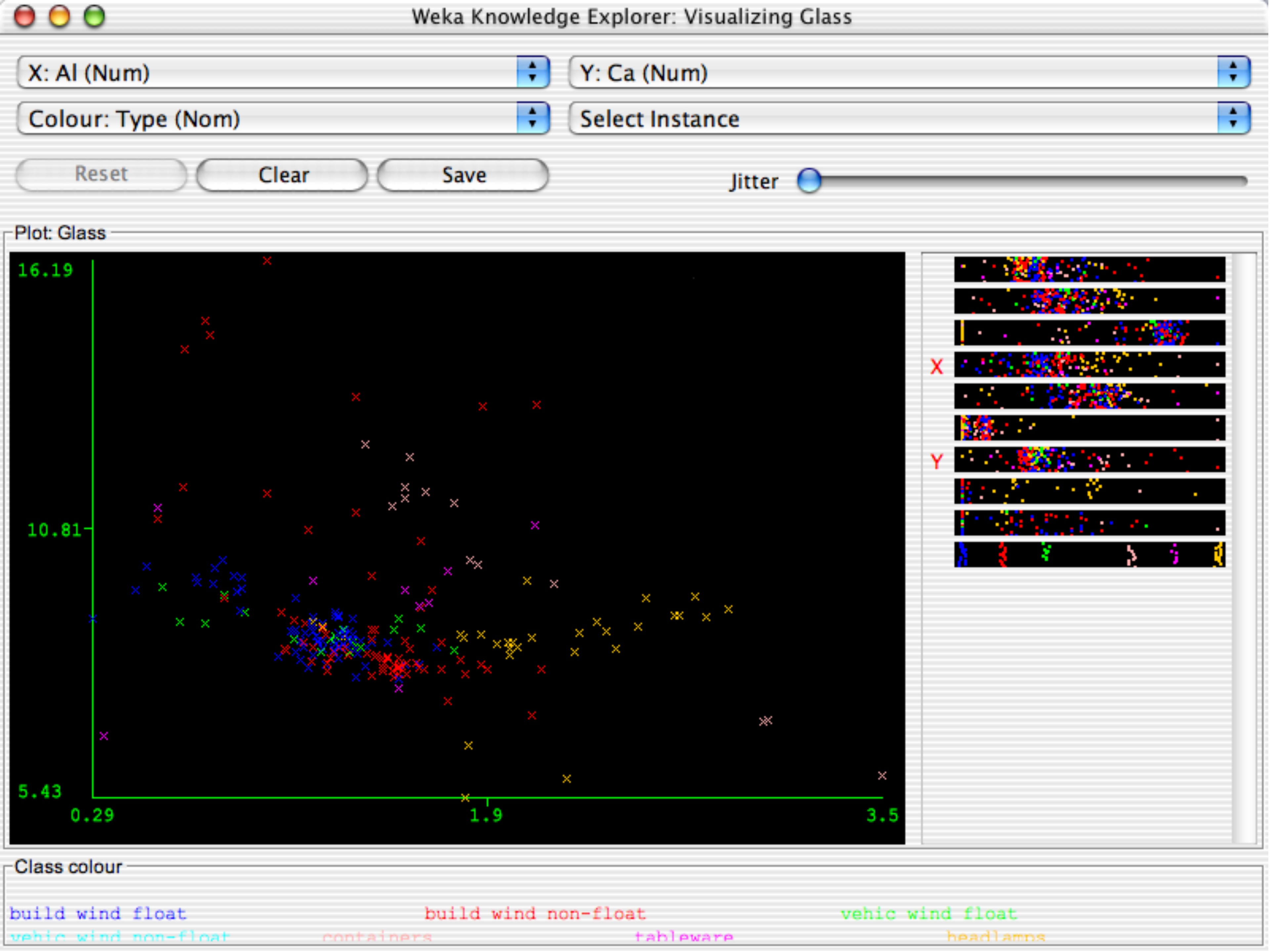

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: Glass
Instances: 214
Attributes: 10
Selected attribute
Name: RI
Type: Numeric
Missing: 0 (0%)
Distinct: 178
Unique: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

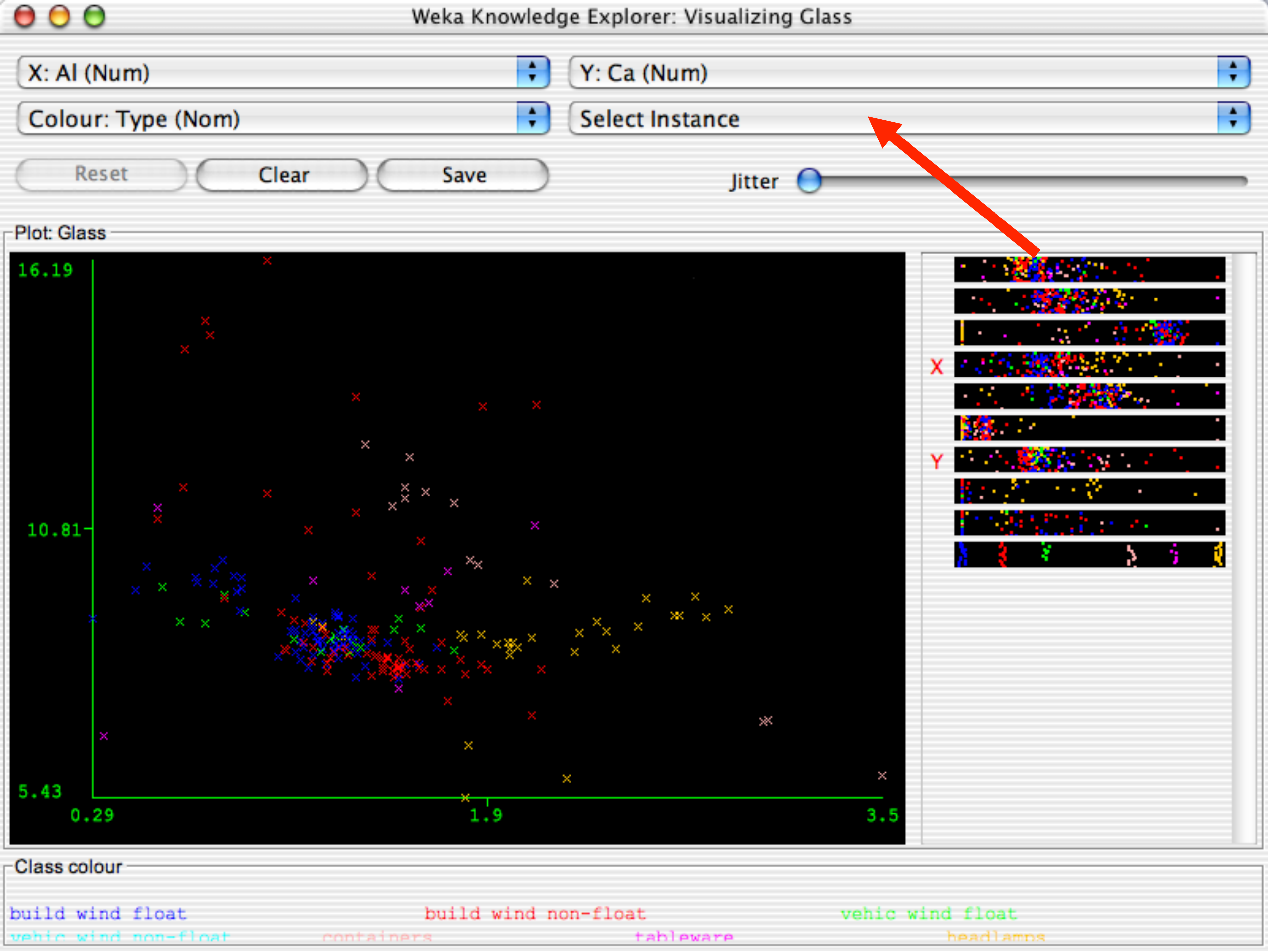

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Type
Fe
PlotSize: [100]
PointSize: [1]
Update
Jitter:
Select Attributes
Colour: Type (Nom)
SubSample % :
100
Class Colour
build wind float build wind non-float vehic wind float vehic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

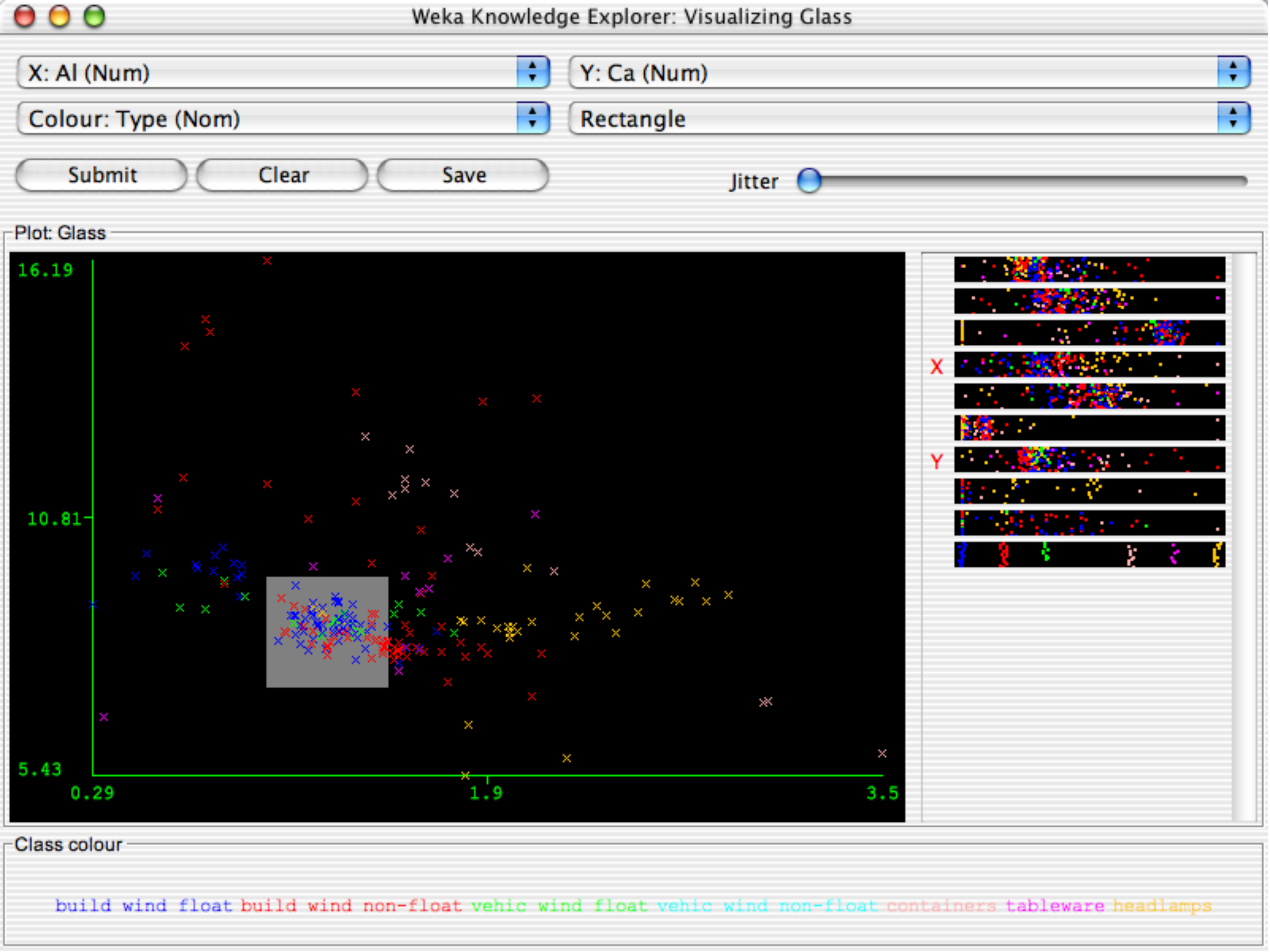

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Type
Fe
PlotSize: [100]
PointSize: [1]
Jitter:
Update
Select Attributes
Colour: Type (Nom)
SubSample % :
100
Class Colour
build wind float build wind non-float vehic wind float vehic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

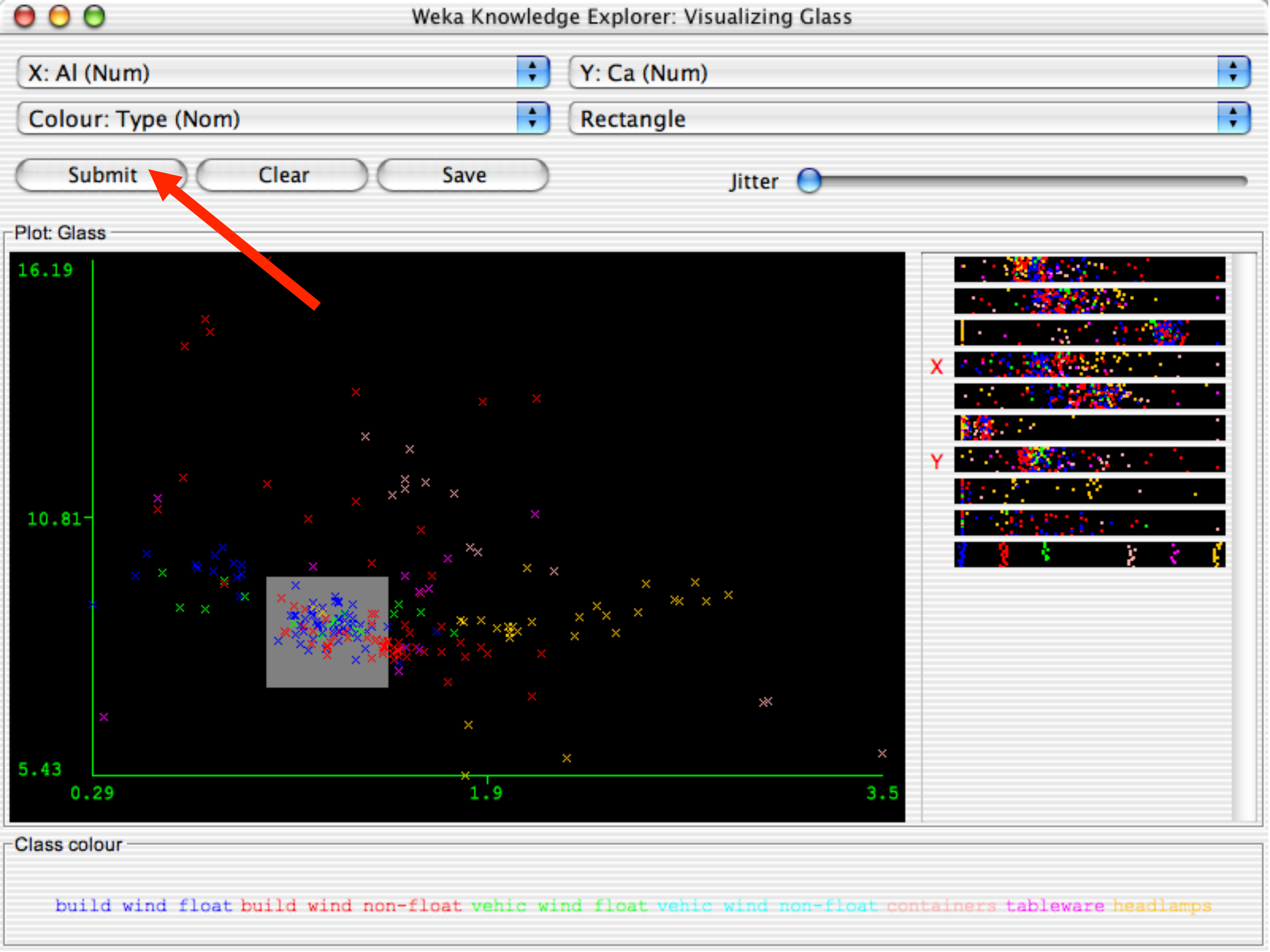

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Fe
Ba
Ca
K
Status
OK
Log
x 0

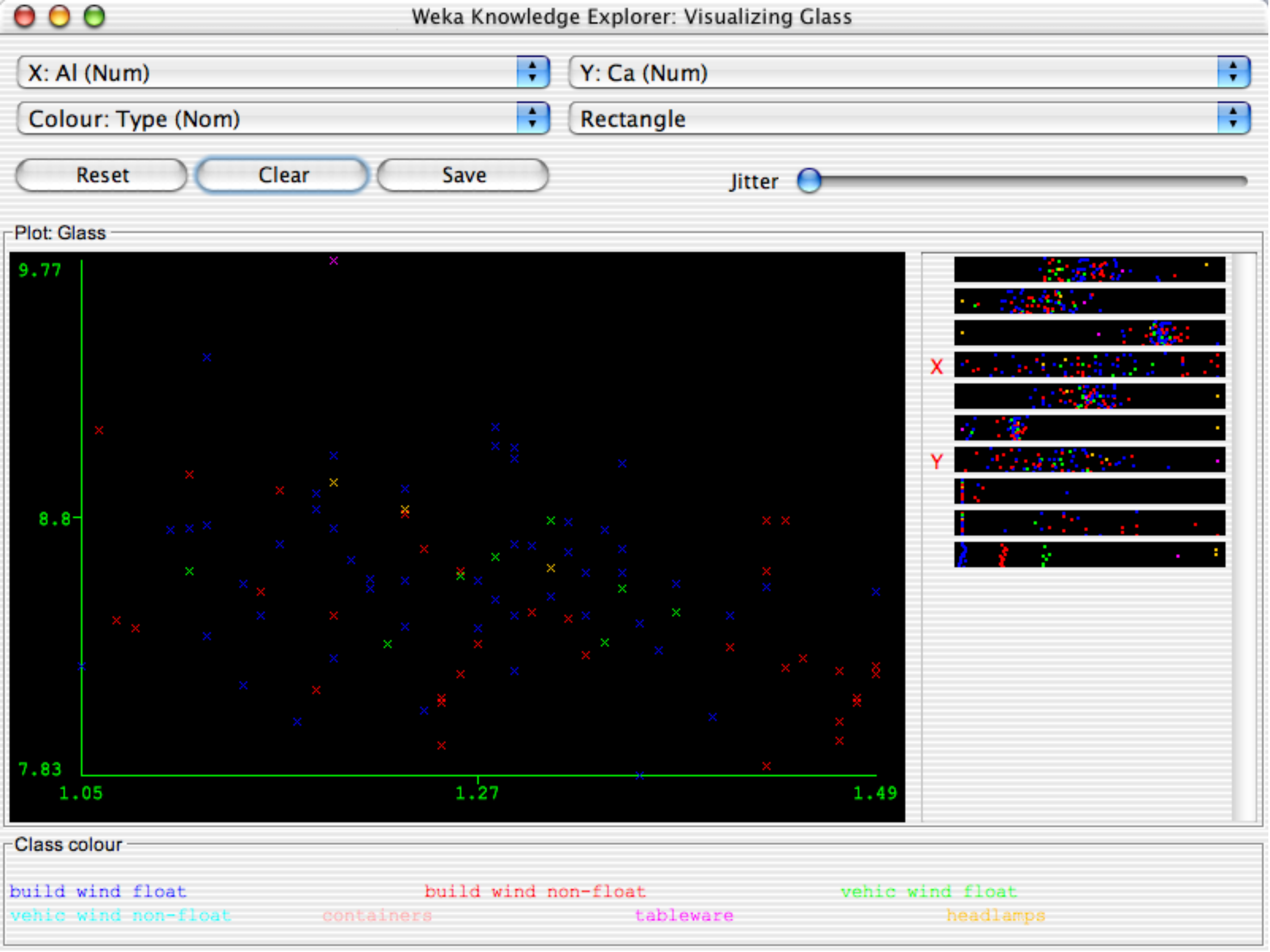

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Fe
Ba
Ca
K
click on a cell
Status
OK
Log
x 0


Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Select Instance
Reset
Clear
Save
Jitter
Plot: Glass
16.19
10.81
5.43
0.29
1.9
3.5
X
Y
Class colour
build wind float
build wind non-float
vehic wind float
vehic wind non-float
containers
tableware
headlamps


Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Select Instance
Reset
Clear
Save
Jitter
Plot: Glass
16.19
10.81
5.43
0.29
1.9
3.5
X
Y
Class colour
build wind float
build wind non-float
vehic wind float
vehic wind non-float
containers
tableware
headlamps


Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Rectangle
Submit
Clear
Save
Jitter
Plot: Glass
16.19
10.81
5.43
0.29
1.9
3.5
X
Y
Class colour
build wind float build wind non-float vehic wind float vehic wind non-float containers tableware headlamps


Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Rectangle
Submit
Clear
Save
Jitter
Plot: Glass
16.19
10.81
5.43
0.29
1.9
3.5
X
Y
Class colour
build wind float build wind non-float vehic wind float vehic wind non-float containers tableware headlamps



Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Rectangle
Reset
Clear
Save
Jitter
Plot: Glass
9.77
8.8
7.83
1.05
1.27
1.49
X
Y
Class colour
build wind float
build wind non-float
vehic wind float
vehic wind non-float
containers
tableware
headlamps

References and Resources

- References:
  - WEKA website: http://www.cs.waikato.ac.nz/~ml/weka/index.html
  - WEKA Tutorial:
    - Machine Learning with WEKA: A presentation demonstrating all graphical user interfaces (GUI) in Weka.
    - A presentation which explains how to use Weka for exploratory data mining.
  - WEKA Data Mining Book:
    - Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition)
  - WEKA Wiki: http://weka.sourceforge.net/wiki/index.php/Main_Page
  - Others:
    - Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, 2nd ed.