Machine Learning with WEKA

Eibe Frank

Department of Computer Science,
University of Waikato, New Zealand

- WEKA: A Machine Learning Toolkit
- The Explorer
  - Classification and Regression
  - Clustering
  - Association Rules
  - Attribute Selection
  - Data Visualization
- The Experimenter
- The Knowledge Flow GUI
- Conclusions

WEKA: the bird

Copyright: Martin Kramer (mkramer@wxs.nl)

WEKA: the software

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

History

- Project funded by the NZ government since 1993

FRST App Number: 93-WKT-23-719

7. **PROGRAMME GOAL** (State the overall goal of the programme in a maximum of 5 lines).

The programme aims to build a state-of-the-art facility for developing techniques of machine learning and investigating their application in key areas of the New Zealand economy. Specifically we will create a workbench for machine learning, determine the factors that contribute towards its successful application in the agricultural industries, and develop new methods of machine learning and ways of assessing their effectiveness.

- Develop state-of-the art workbench of data mining tools
- Explore fielded applications
- Develop new fundamental methods

History (2)

- Late 1992 - funding was applied for by Ian Witten
- 1993 - development of the interface and infrastructure
  - WEKA acronym coined by Geoff Holmes
  - WEKA's file format "ARFF" was created by Andrew Donkin
    ARFF was rumored to stand for **A**ndrew's **R**idiculous **F**ile **F**ormat
- Sometime in 1994 - first internal release of WEKA
  - TCL/TK user interface + learning algorithms written mostly in C
  - Very much beta software
  - Changes for the b1 release included (among others):
    "`Ambiguous and Unsupported menu commands removed.`"
    "`Crashing processes handled (in most cases :-)`"
- October 1996 - first public release: WEKA 2.1

History (3)

- July 1997 - WEKA 2.2
  - Schemes: 1R, T2, K*, M5, M5Class, IB1-4, FOIL, PEBLS, support for C5
  - Included a facility (based on Unix makefiles) for configuring and running large scale experiments
- Early 1997 - decision was made to rewrite WEKA in Java
  - Originated from code written by Eibe Frank for his PhD
  - Originally codenamed **JAWS** (**JA**va **W**eka **S**ystem)
- May 1998 - WEKA 2.3
  - Last release of the TCL/TK-based system
- Mid 1999 - WEKA 3 (100% Java) released
  - Version to complement the Data Mining book
  - Development version (including GUI)

WEKA: versions

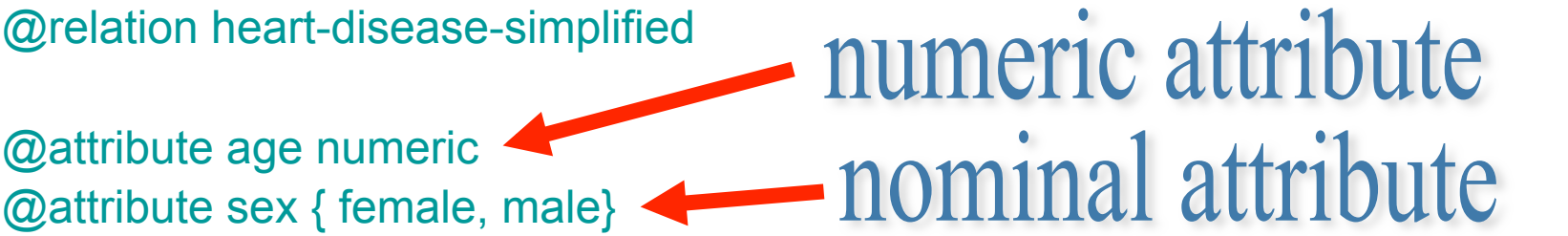
- There are several versions of WEKA:
  - WEKA 3.0: “book version” compatible with description in data mining book
  - WEKA 3.2: “GUI version” adds graphical user interfaces (book version is command-line only)
  - WEKA 3.3: “development version” with lots of improvements
- This talk is based on the latest snapshot of WEKA 3.3 (soon to be WEKA 3.4)

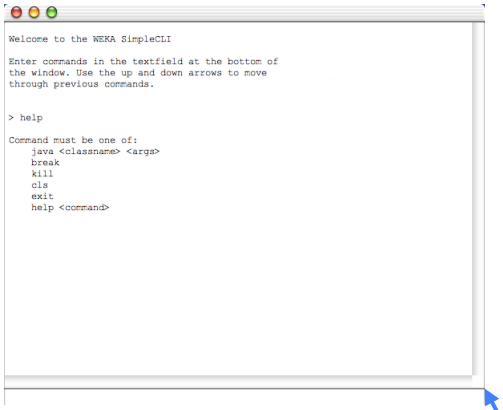
WEKA only deals with "flat" files

```
@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
...
```

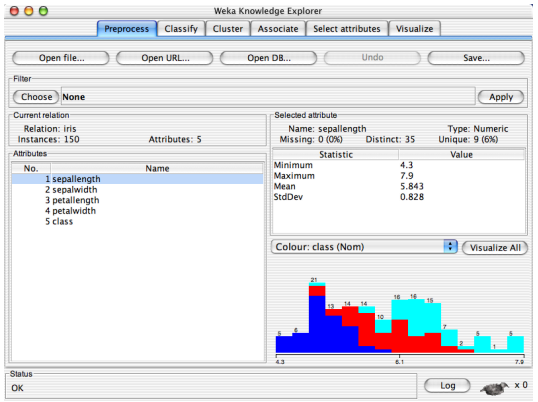
Flat file in ARFF format

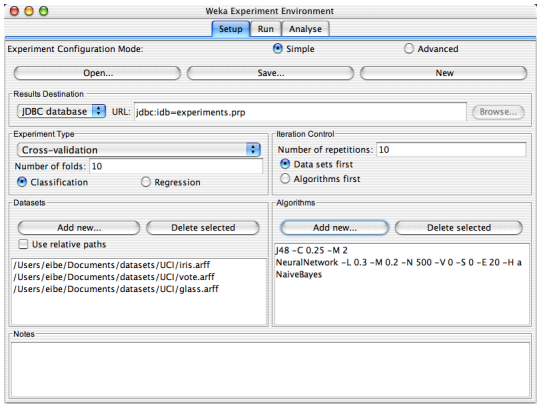
WEKA only deals with "flat" files

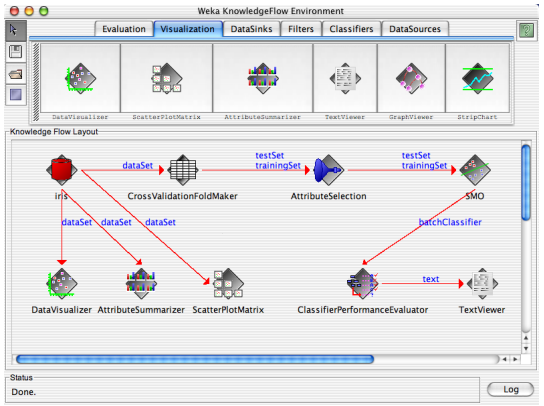



Welcome to the WEKA SimpleCLI
Enter commands in the textfield at the bottom of the window. Use the up and down arrows to move through previous commands.
> help
Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>

Weka GUI Chooser
Waikato Environment for Knowledge Analysis
(c) 1999 - 2003
University of Waikato
New Zealand
GUI
Simple CLI
Explorer
Experimenter
KnowledgeFlow


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: iris
Instances: 150
Attributes: 5
Selected attribute
Name: sepallength
Missing: 0 (0%)
Distinct: 35
Type: Numeric
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
x 0


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

Welcome to the WEKA SimpleCLI
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Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>

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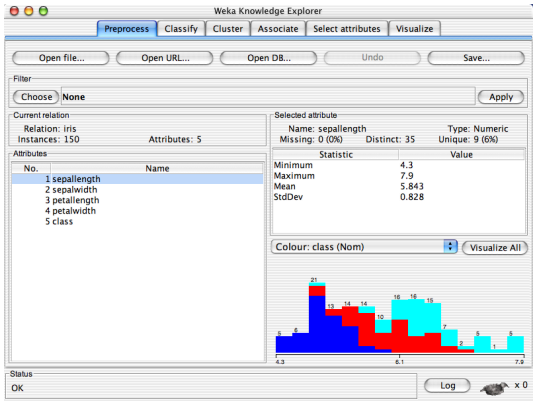
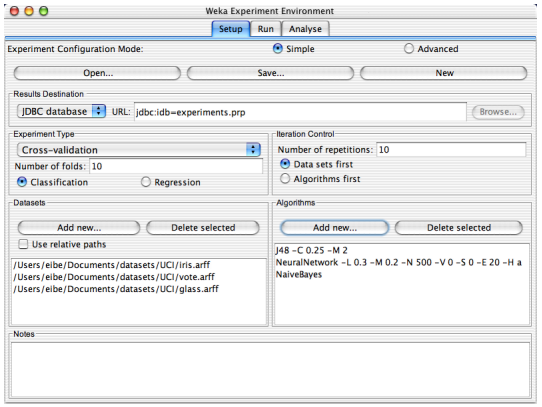

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Selected attribute
Name: sepallength
Missing: 0 (0%)
Distinct: 35
Type: Numeric
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
x 0


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
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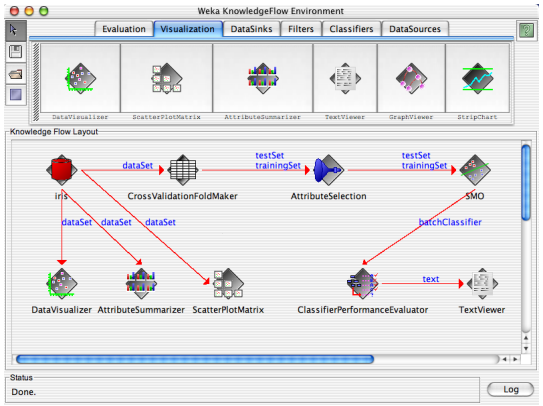
NaiveBayes
Notes


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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> help
Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>

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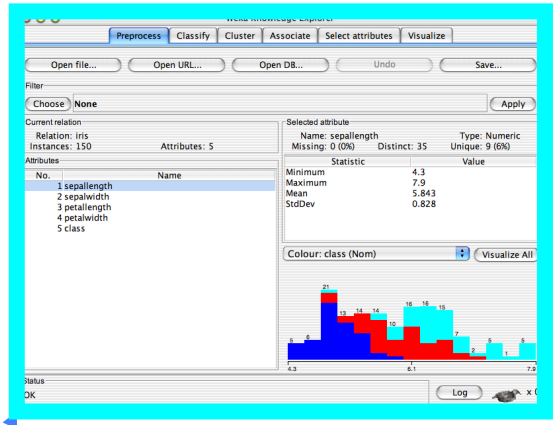
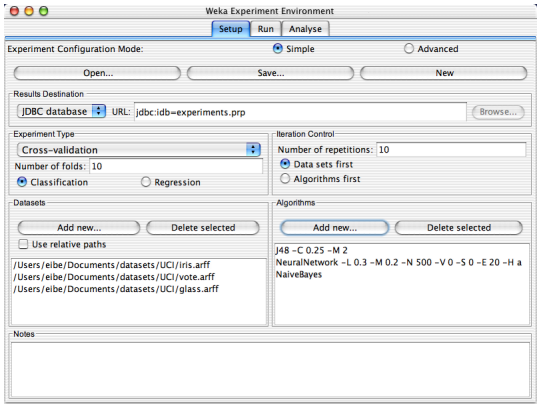

Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Selected attribute
Name: sepallength
Missing: 0 (0%)
Distinct: 35
Type: Numeric
Unique: 9 (6%)
Attributes
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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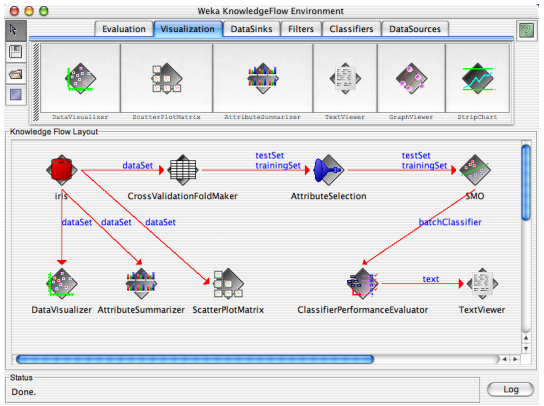
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trainingSet
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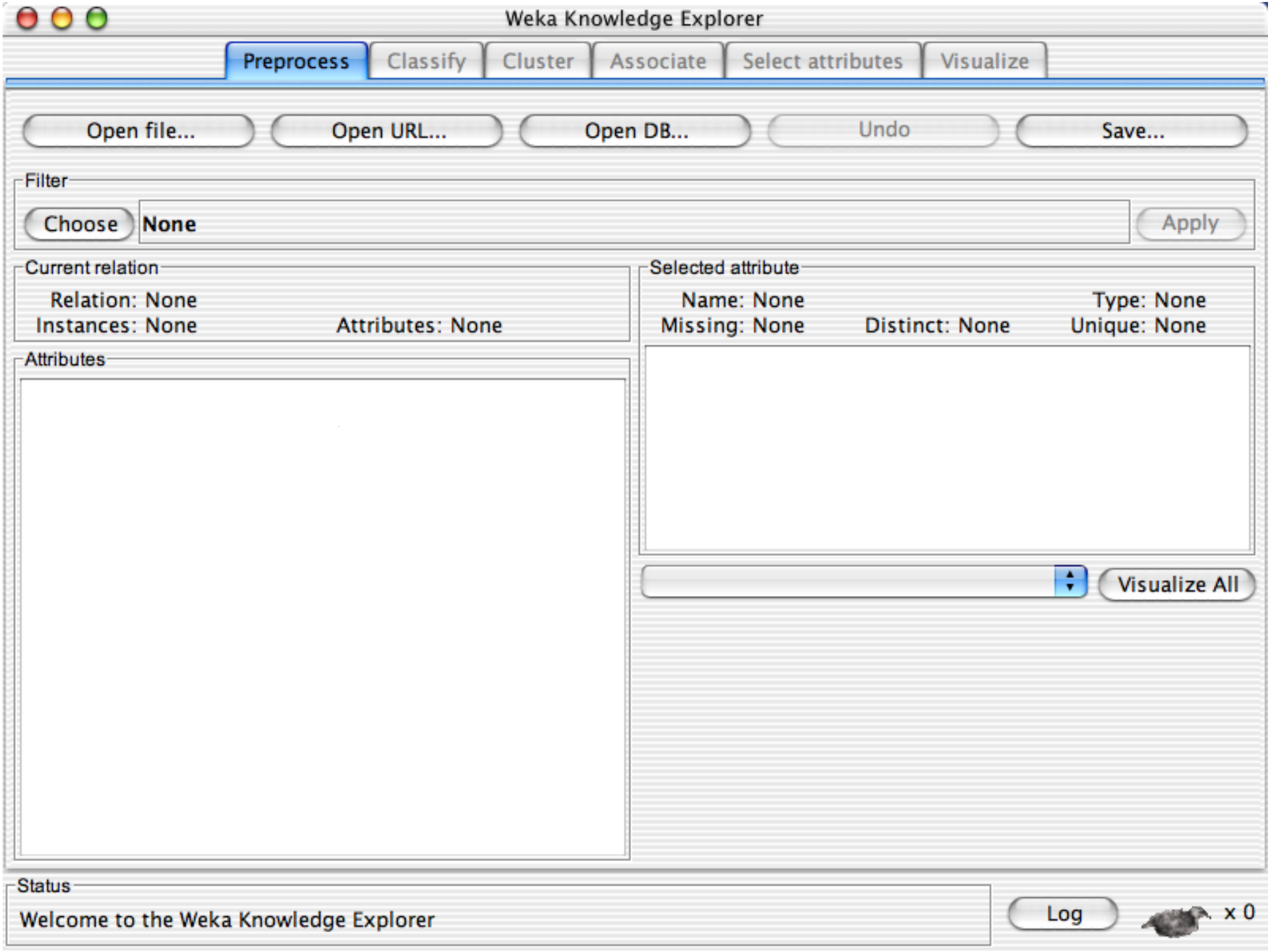
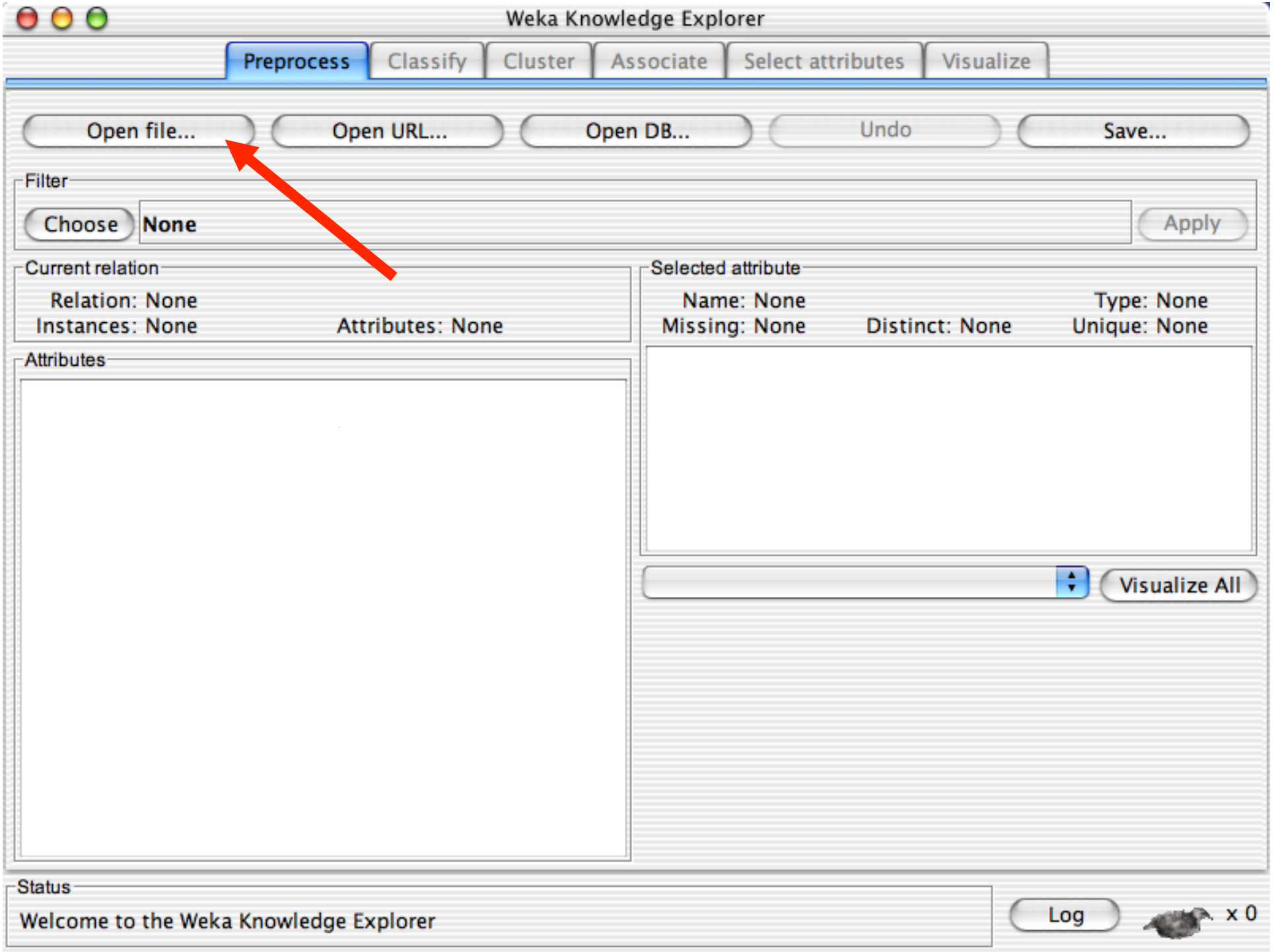
batchClassifier
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
text
TextViewer
Status
Done.
Log

Explorer: pre-processing the data

- 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 in WEKA are called “filters”
- WEKA contains filters for:
  - 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


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

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: iris
Instances: 150 Attributes: 5

Attributes

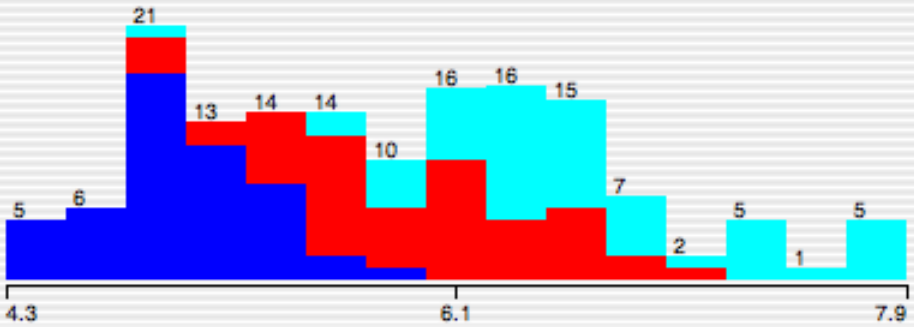
No.	Name
1	sepallength
2	sepalwidth
3	petallength
4	petalwidth
5	class

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

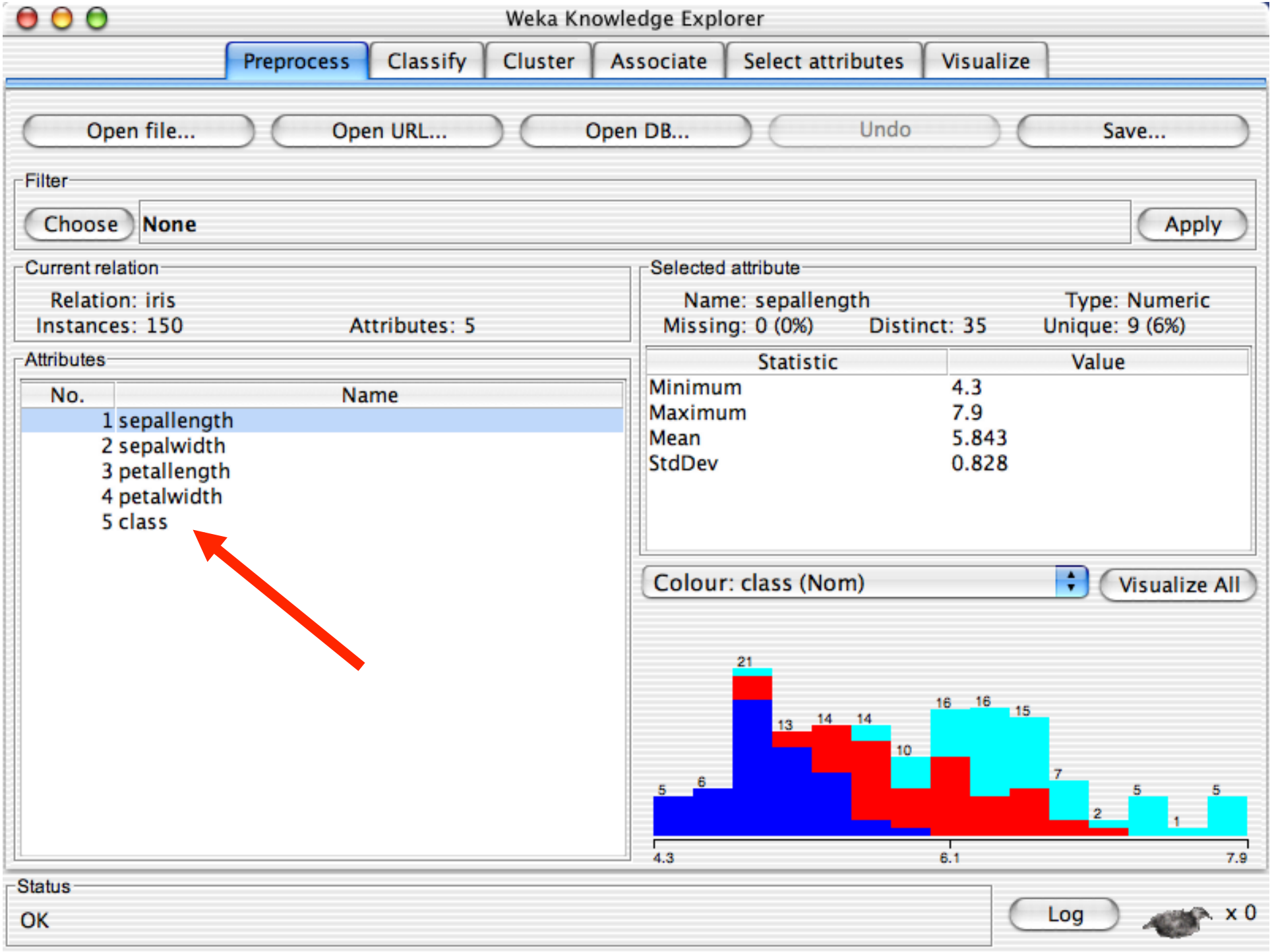
Colour: class (Nom) | Visualize All

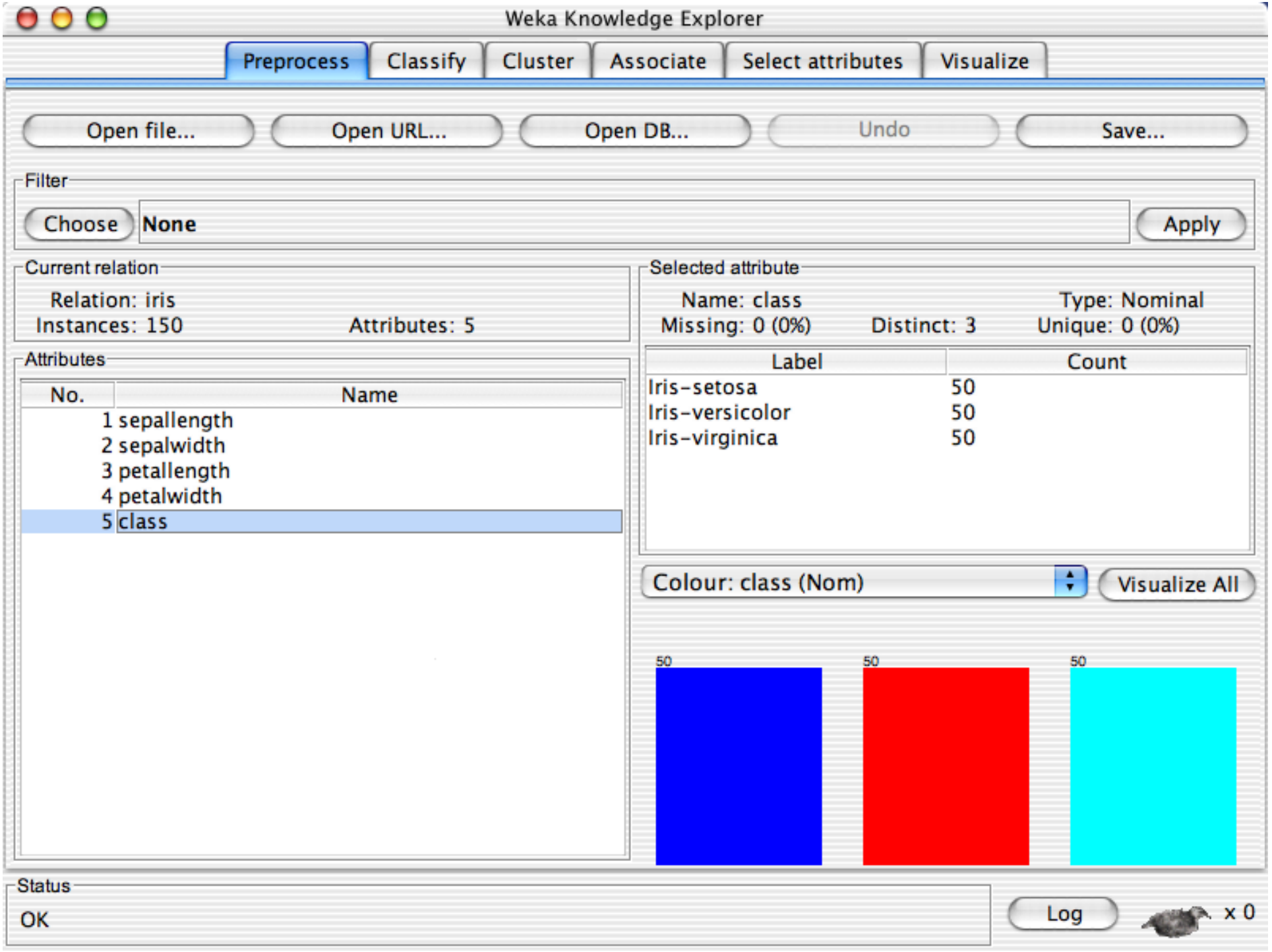


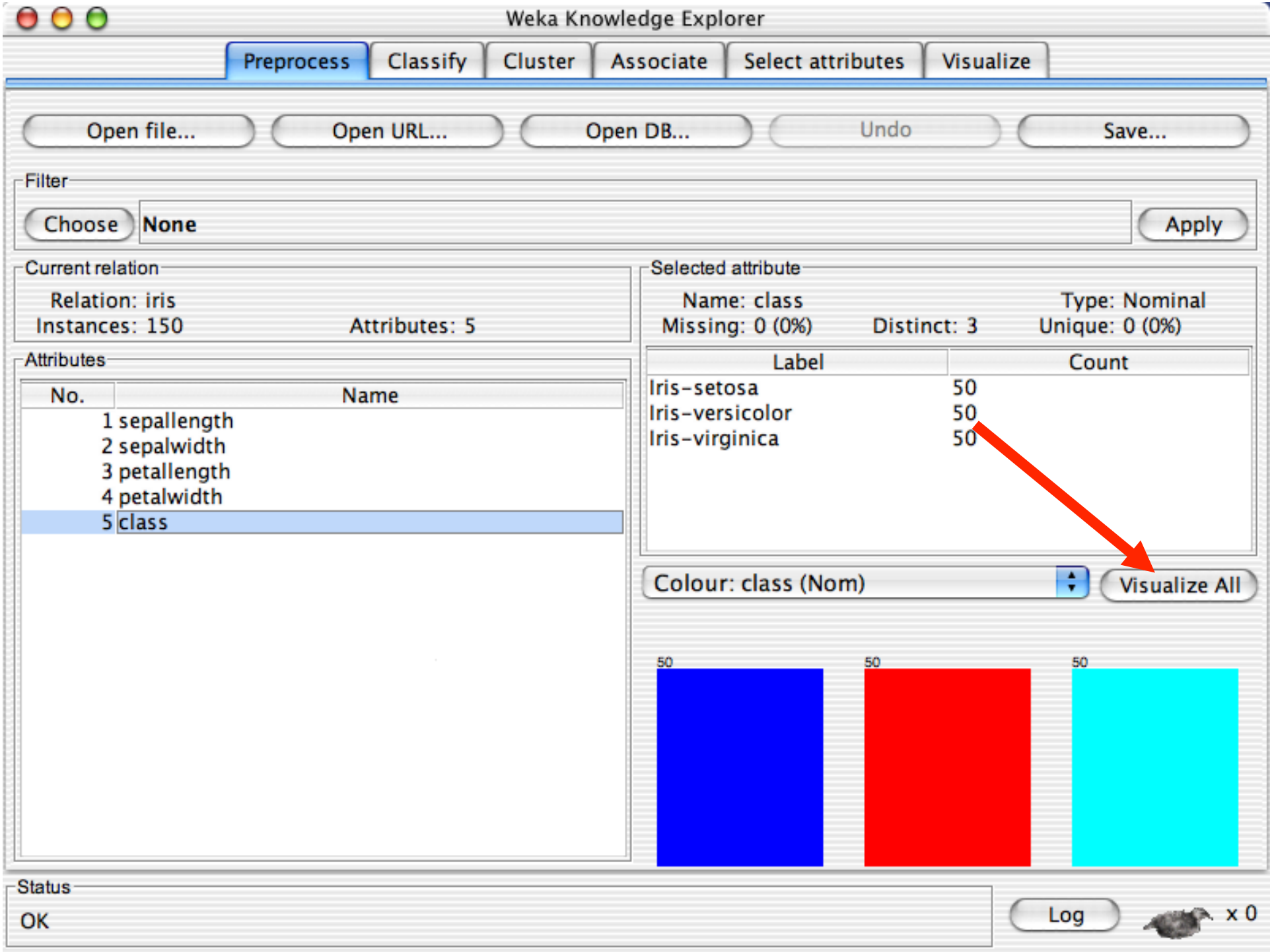
Status

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: 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
5
6
13
14
14
10
16
16
15
7
2
5
1
5
4.3
6.1
7.9
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
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: 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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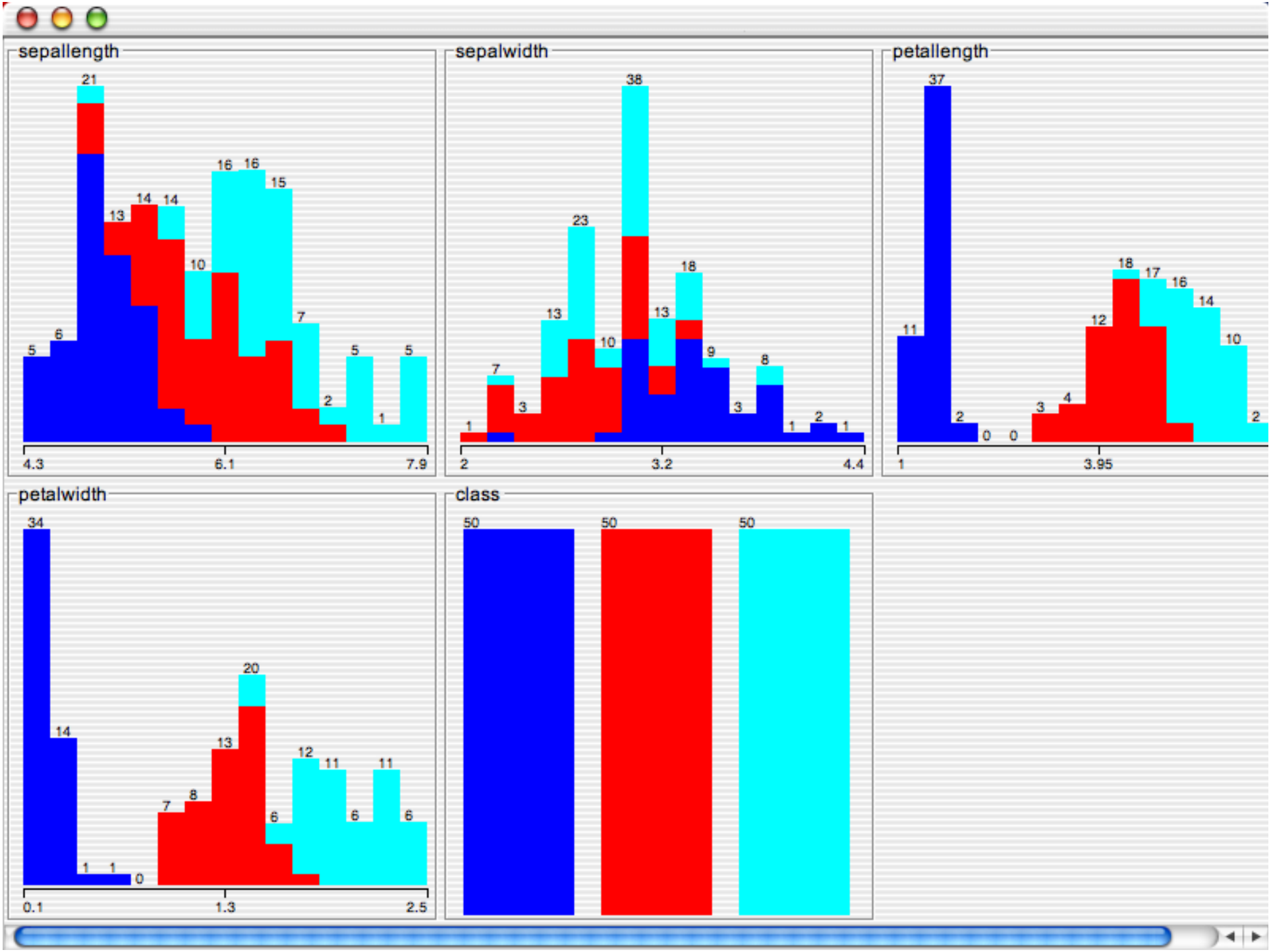
Save...
Filter
Choose
None
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Selected attribute
Name: class
Type: Nominal
Missing: 0 (0%)
Distinct: 3
Unique: 0 (0%)
Label
Count
Iris-setosa
50
Iris-versicolor
50
Iris-virginica
50
Colour: class (Nom)
Visualize All
50
50
50
Status
OK
Log
x 0


sepallength
21
16 16
15
14 14
13
10
7
6
5
5 5
2
1
4.3
6.1
7.9
sepalwidth
38
23
18
13 13
10
9
8
7
3
3
1 2 1
2
3.2
4.4
petallength
37
18
17
16
14
12
11
10
3 4
2
2
0 0
1
3.95
petalwidth
34
20
14
13
12 11 11
8
7
6 6 6
1 1
0
0.1
1.3
2.5
class
50
50
50

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: iris
Instances: 150 Attributes: 5

Attributes

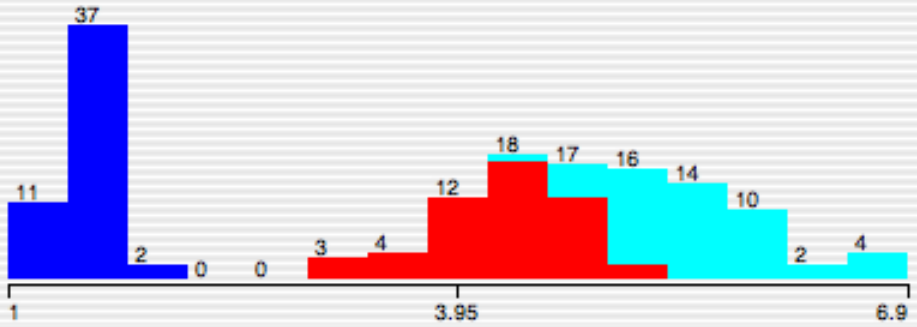
No.	Name
1	sepallength
2	sepalwidth
3	petallength
4	petalwidth
5	class

Selected attribute

Name: petallength Type: Numeric
Missing: 0 (0%) Distinct: 43 Unique: 10 (7%)

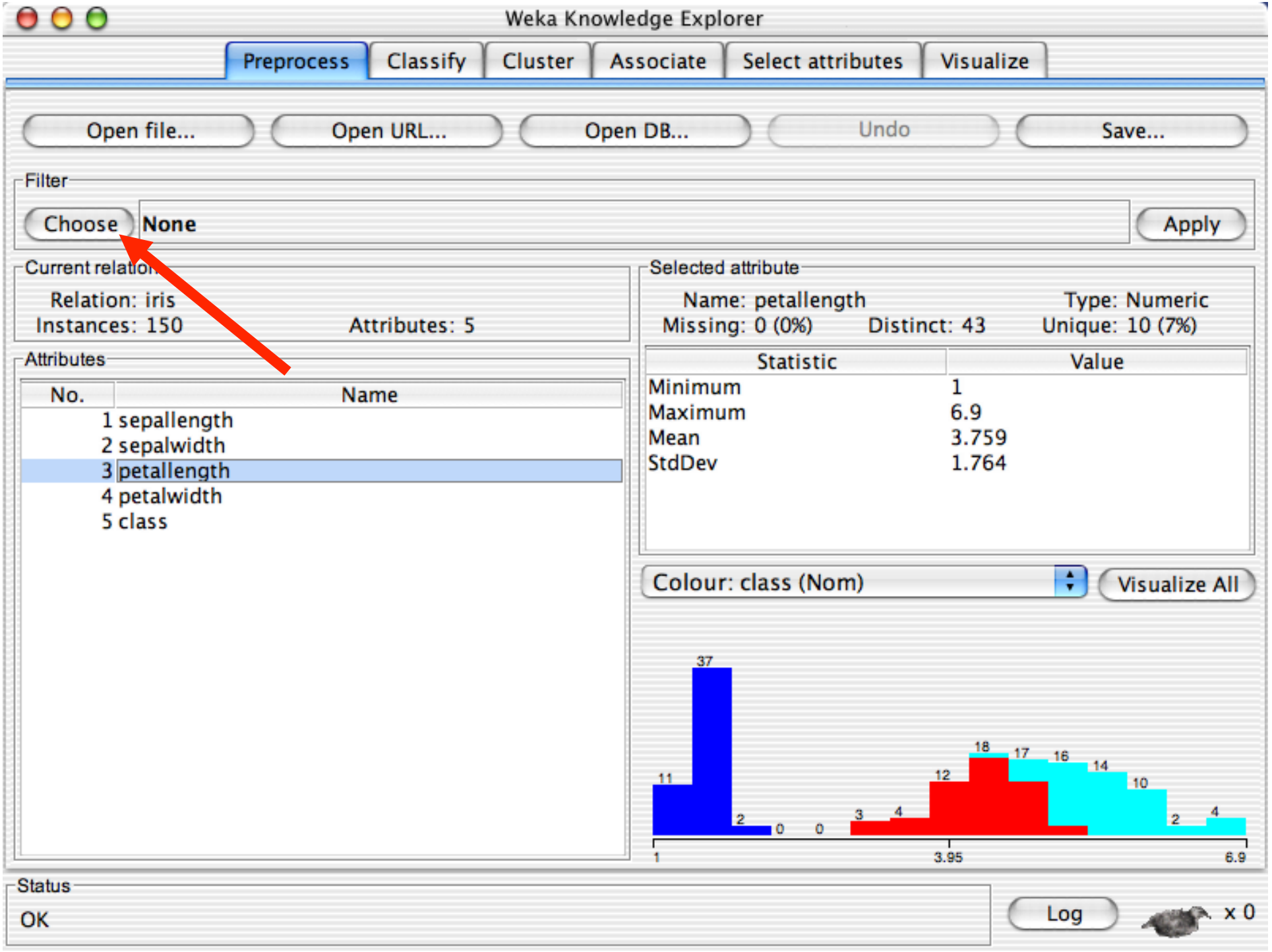
Statistic	Value
Minimum	1
Maximum	6.9
Mean	3.759
StdDev	1.764

Colour: class (Nom) | Visualize All



Status

OK | Log | x 0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Associate
Select attributes
Visualize
Open file...
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Undo
Save...
Filter
Choose
None
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Current relation
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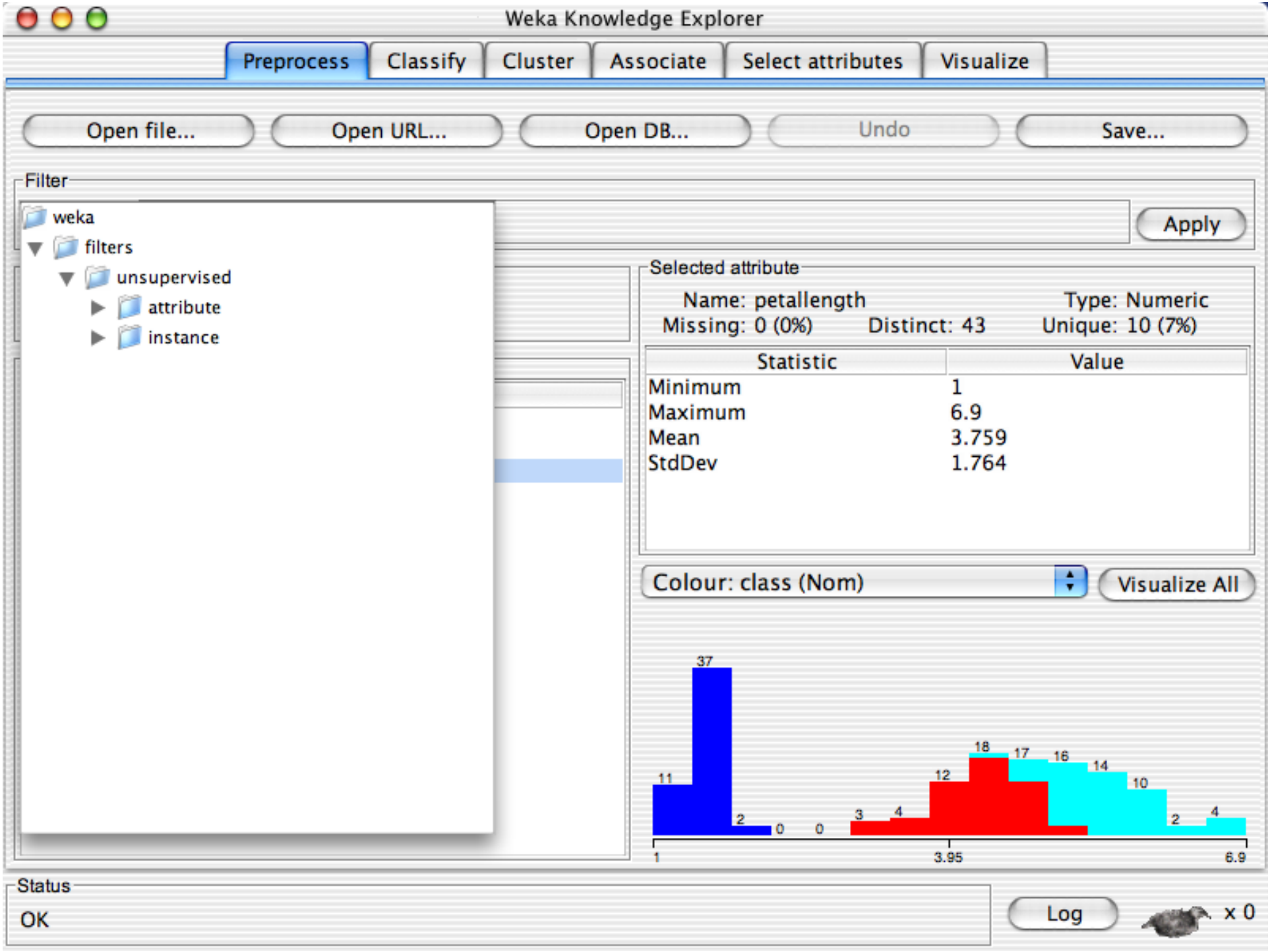
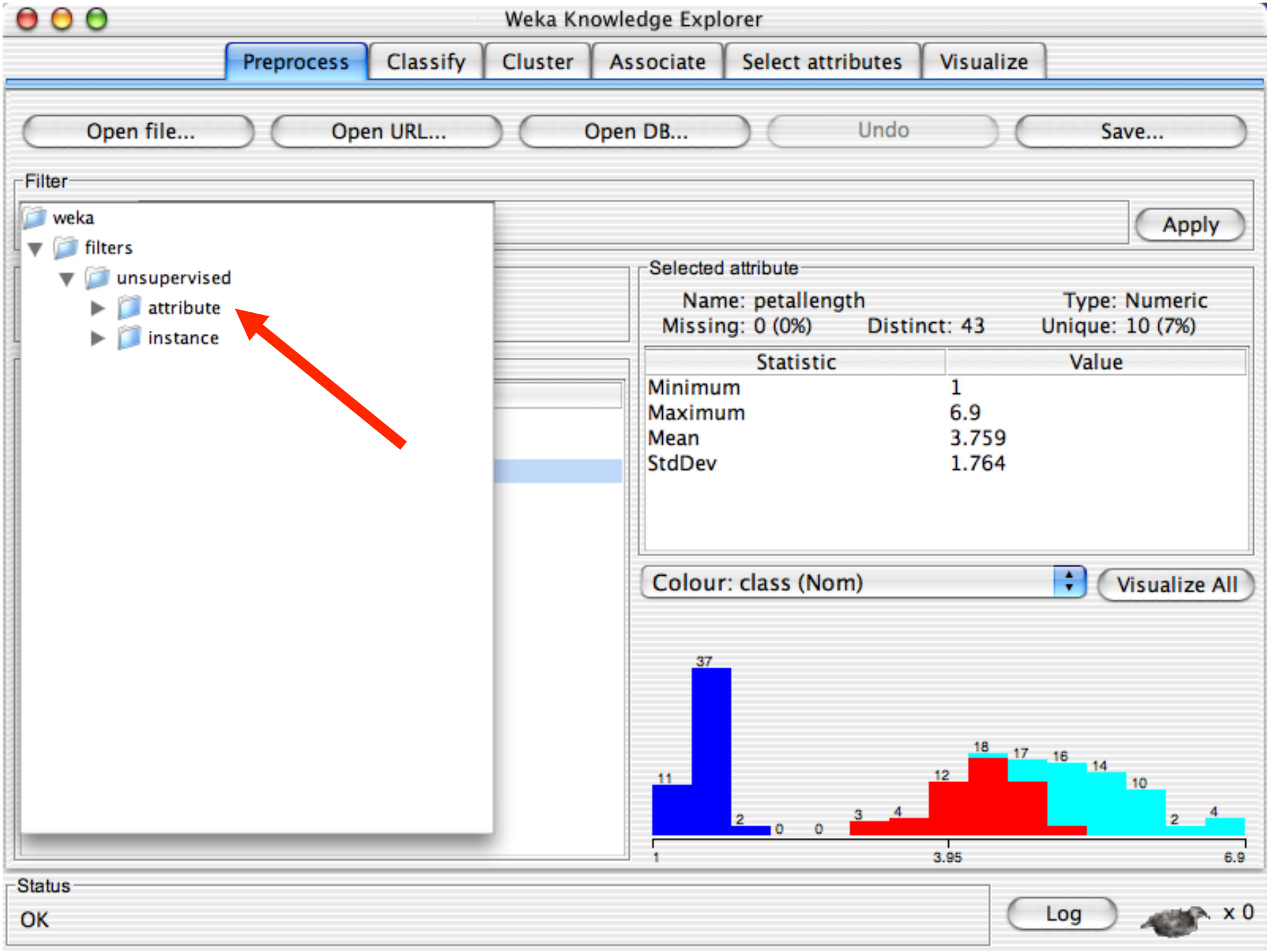
Statistic
Value
Minimum
1
Maximum
6.9
Mean
3.759
StdDev
1.764
Colour: class (Nom)
Visualize All
37
11
2
0
0
3
4
12
18
17
16
14
10
2
4
1
3.95
6.9
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
weka
filters
unsupervised
attribute
instance
Apply
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
37
11
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
weka
filters
unsupervised
attribute
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Apply
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37
11
2
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3
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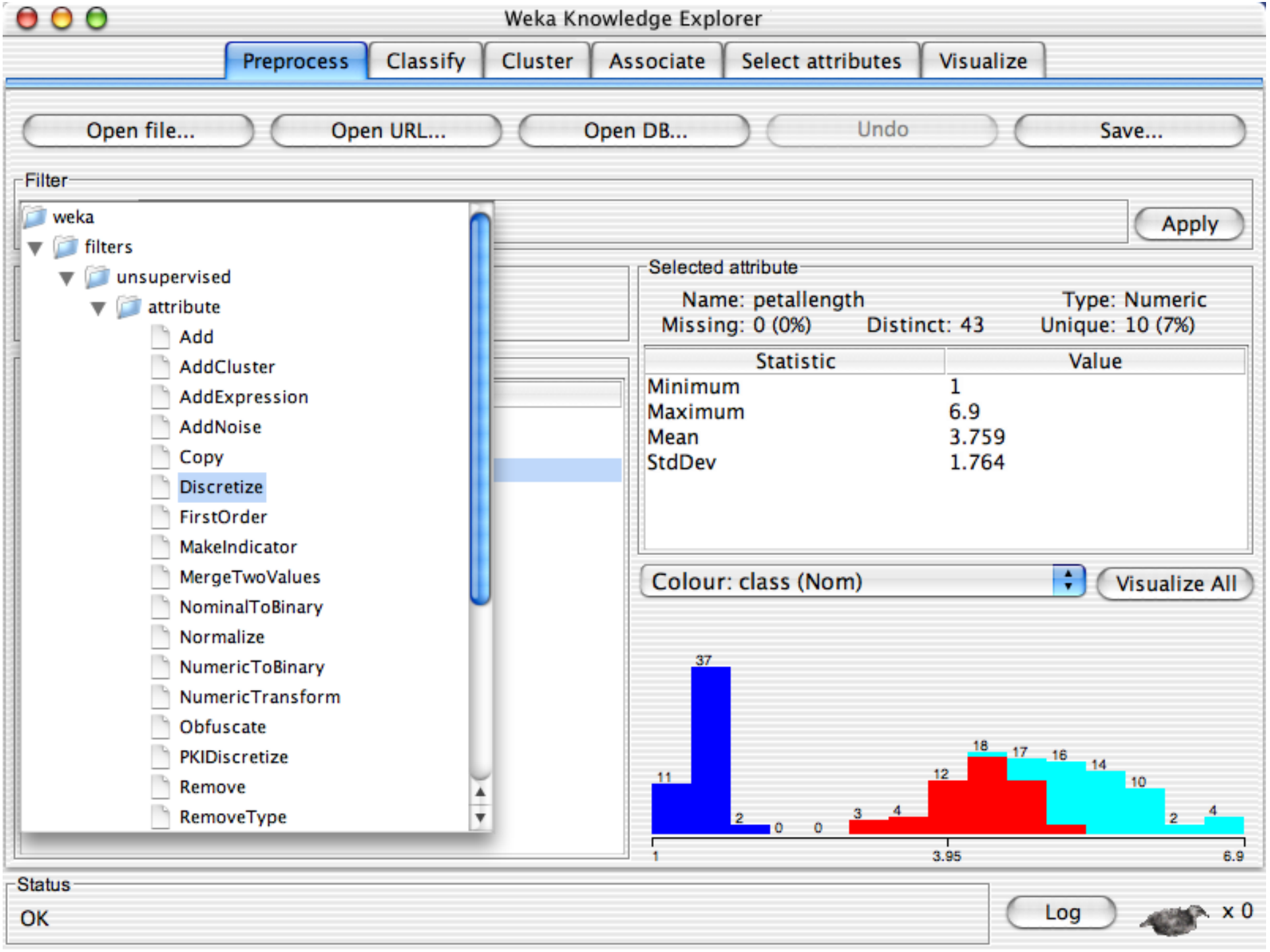
12
18
17
16
14
10
2
4
1
3.95
6.9
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
weka
filters
unsupervised
attribute
Add
AddCluster
AddExpression
AddNoise
Copy
Discretize
FirstOrder
MakeIndicator
MergeTwoValues
NominalToBinary
Normalize
NumericToBinary
NumericTransform
Obfuscate
PKIDiscretize
Remove
RemoveType
Apply
Selected attribute
Name: petallength
Type: Numeric
Missing: 0 (0%)
Distinct: 43
Unique: 10 (7%)
Statistic
Value
Minimum
1
Maximum
6.9
Mean
3.759
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37
11
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** -B 10 -R first-last | Apply

Current relation

Relation: iris
Instances: 150 Attributes: 5

Attributes

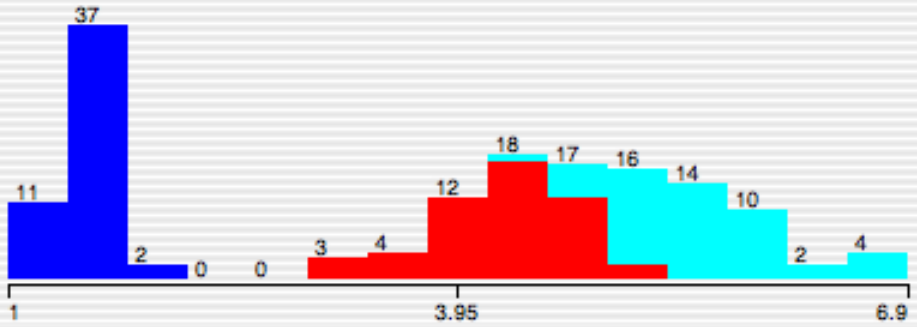
No.	Name
1	sepallength
2	sepalwidth
3	petallength
4	petalwidth
5	class

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

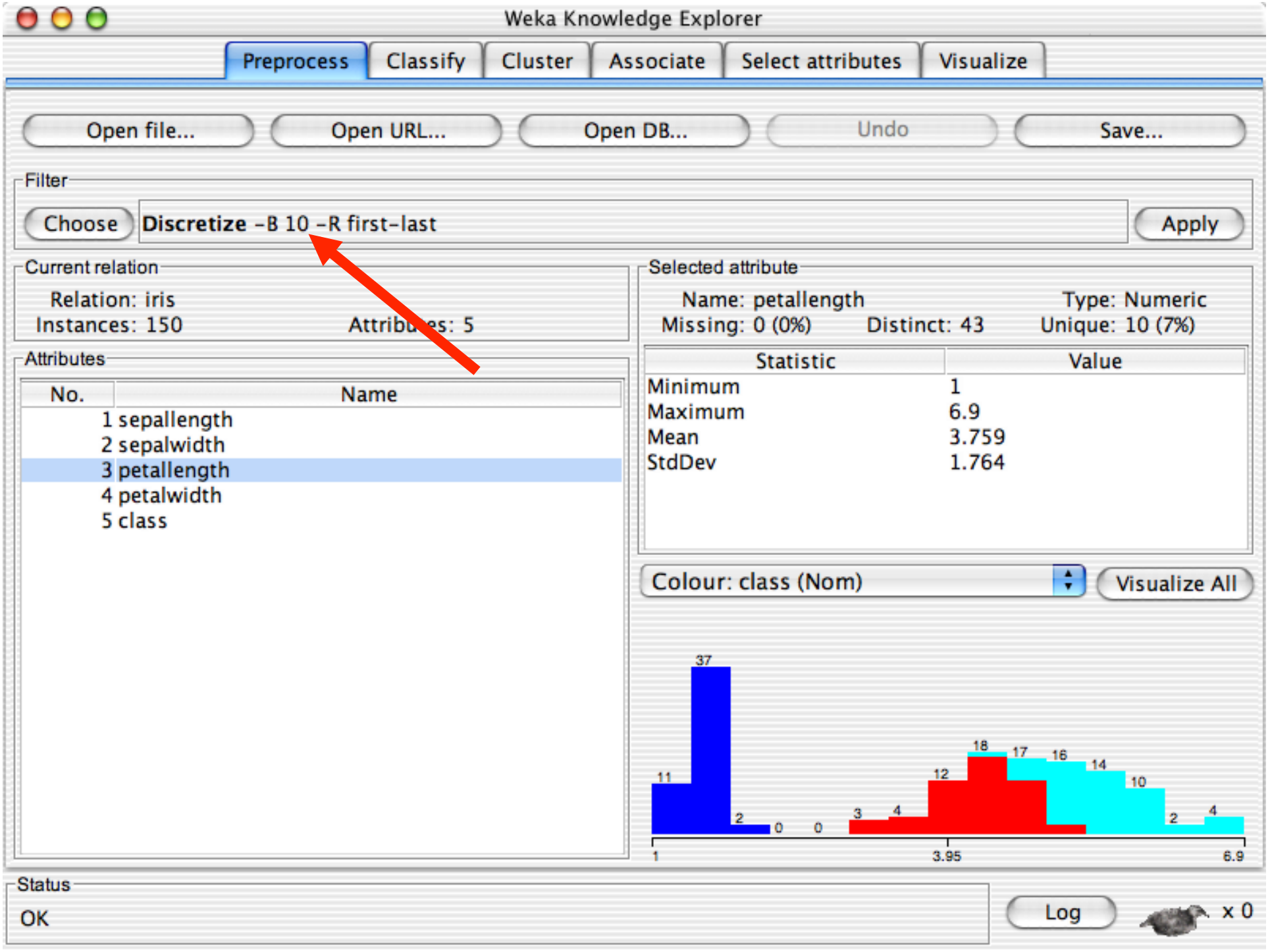
Colour: class (Nom) | Visualize All

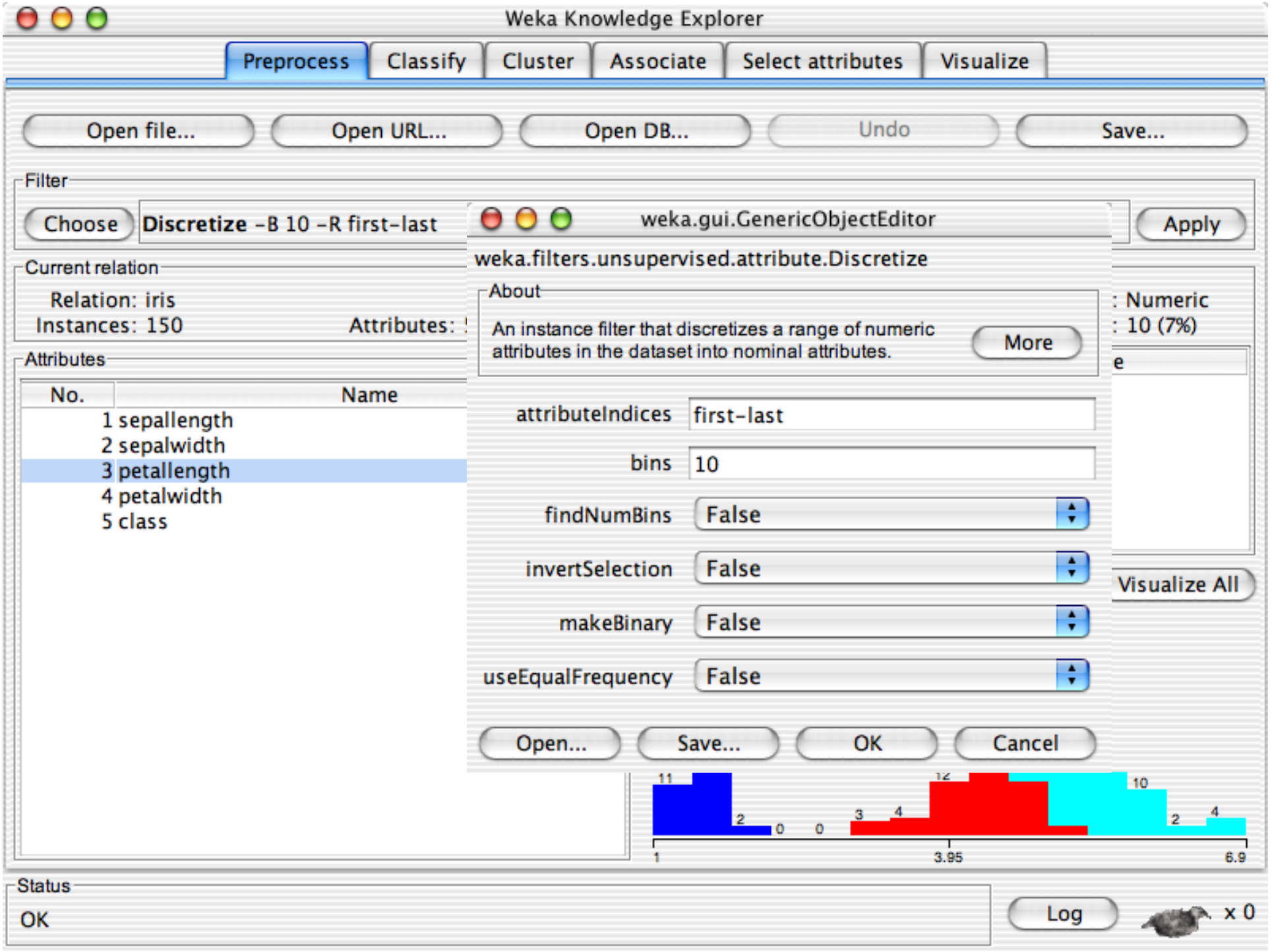


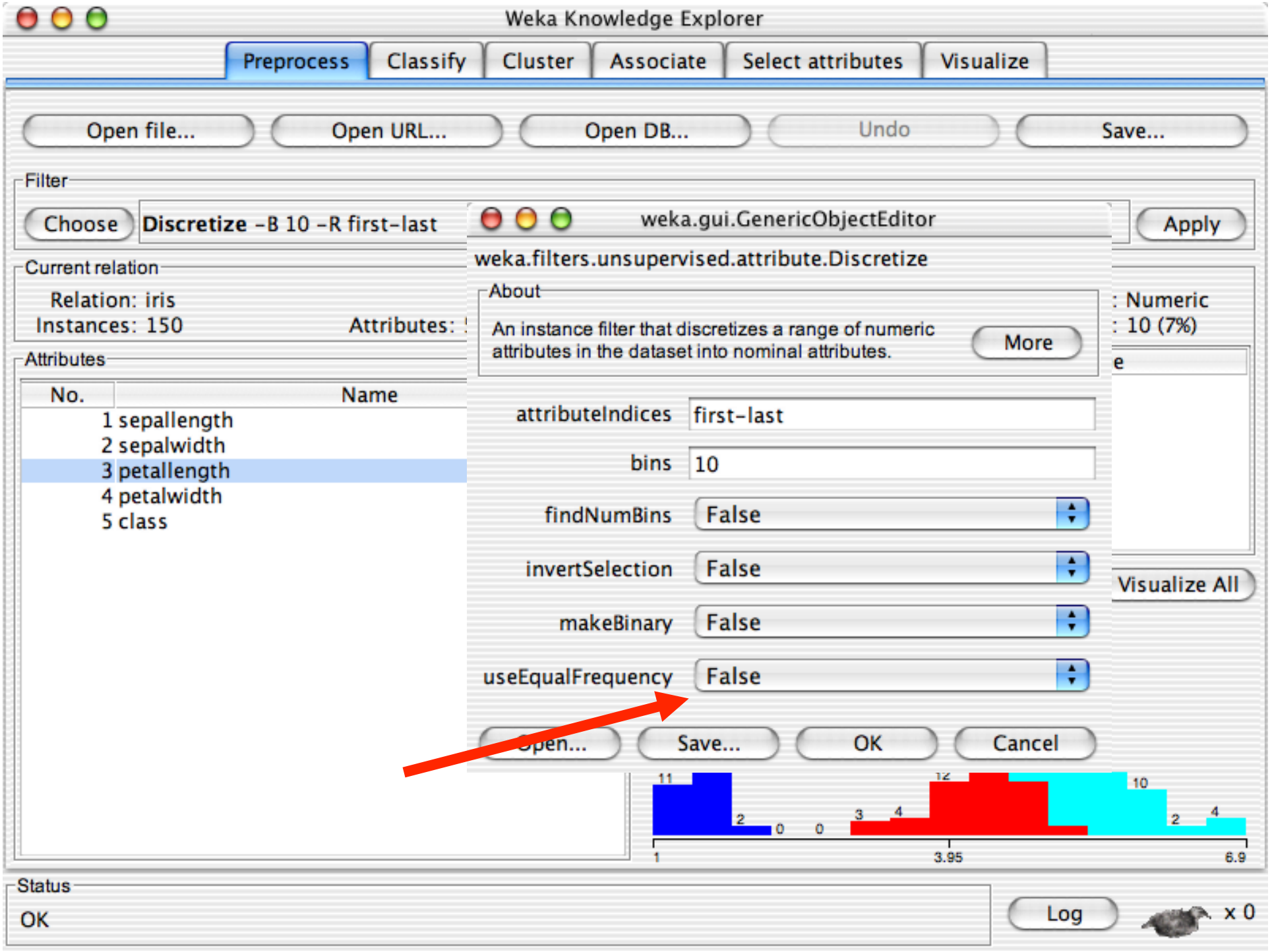
Status

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 -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
37
11
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 -B 10 -R first-last
Apply
Current relation
Relation: iris
Instances: 150
Attributes:
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
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
: Numeric
: 10 (7%)
Visualize All
11
2
0
0
3
4
12
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 -B 10 -R first-last
Apply
Current relation
Relation: iris
Instances: 150
Attributes:
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
weka.gui.GenericObjectEditor
weka.filters.unsupervised.attribute.Discretize
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findNumBins
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invertSelection
False
makeBinary
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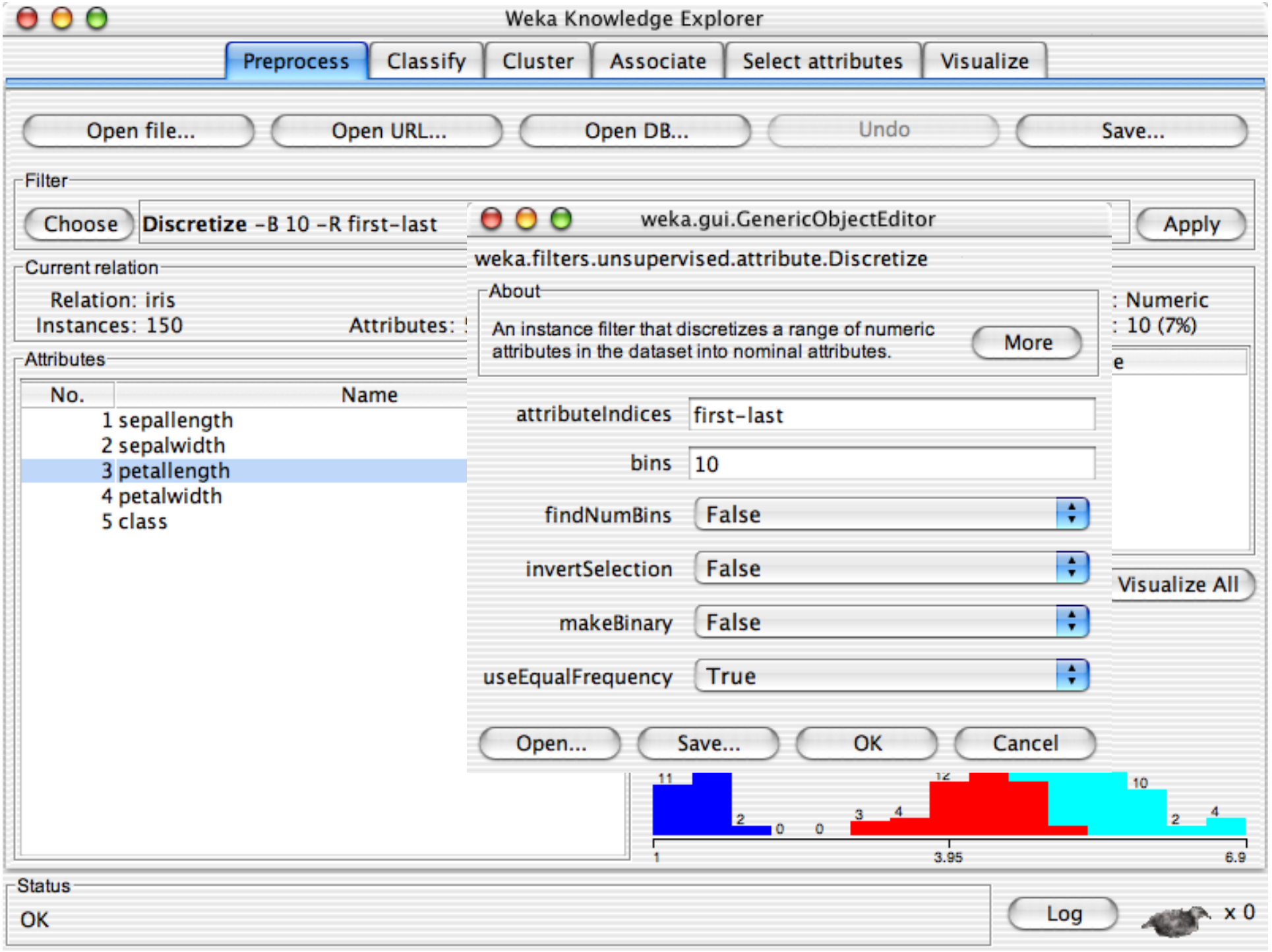
useEqualFrequency
False
Open...
Save...
OK
Cancel
: Numeric
: 10 (7%)
Visualize All
11
2
0
0
3
4
12
10
2
4
1
3.95
6.9
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
Discretize -B 10 -R first-last
Apply
Current relation
Relation: iris
Instances: 150
Attributes:
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
weka.gui.GenericObjectEditor
weka.filters.unsupervised.attribute.Discretize
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An instance filter that discretizes a range of numeric attributes in the dataset into nominal attributes.
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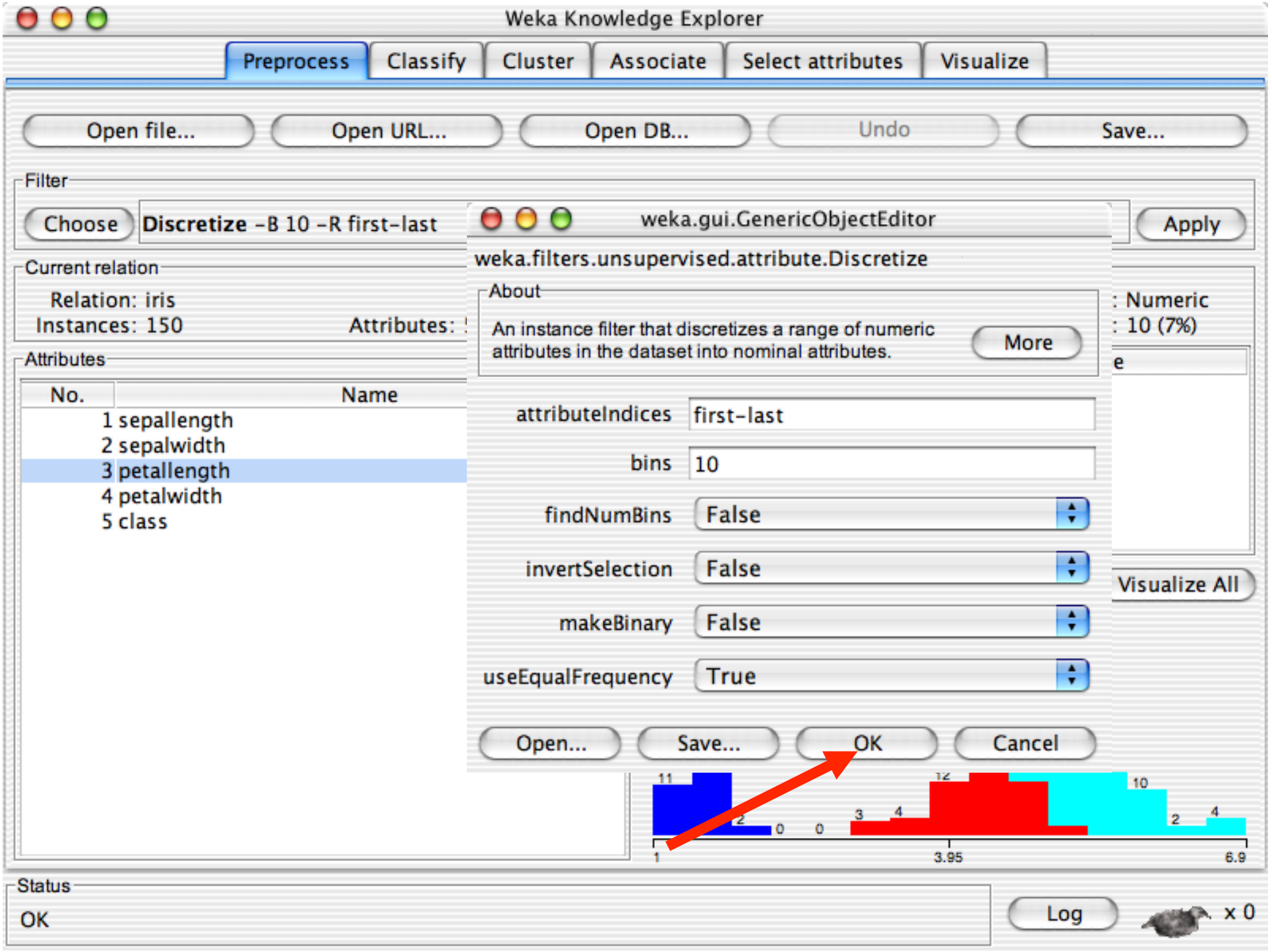
attributeIndices
first-last
bins
10
findNumBins
False
invertSelection
False
makeBinary
False
useEqualFrequency
True
Open...
Save...
OK
Cancel
: Numeric
: 10 (7%)
Visualize All
11
2
0
0
3
4
12
10
2
4
1
3.95
6.9
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
Discretize -B 10 -R first-last
Apply
Current relation
Relation: iris
Instances: 150
Attributes:
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
weka.gui.GenericObjectEditor
weka.filters.unsupervised.attribute.Discretize
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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
True
Open...
Save...
OK
Cancel
: Numeric
: 10 (7%)
Visualize All
11
2
0
0
3
4
12
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

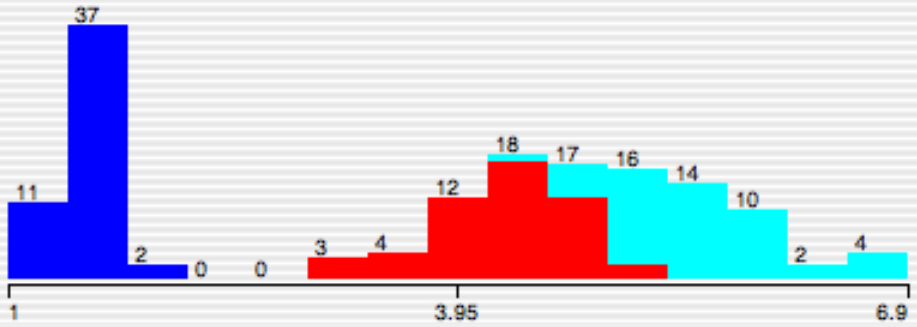
No.	Name
1	sepallength
2	sepalwidth
3	petallength
4	petalwidth
5	class

Selected attribute

Name: petallength Type: Numeric
Missing: 0 (0%) Distinct: 43 Unique: 10 (7%)

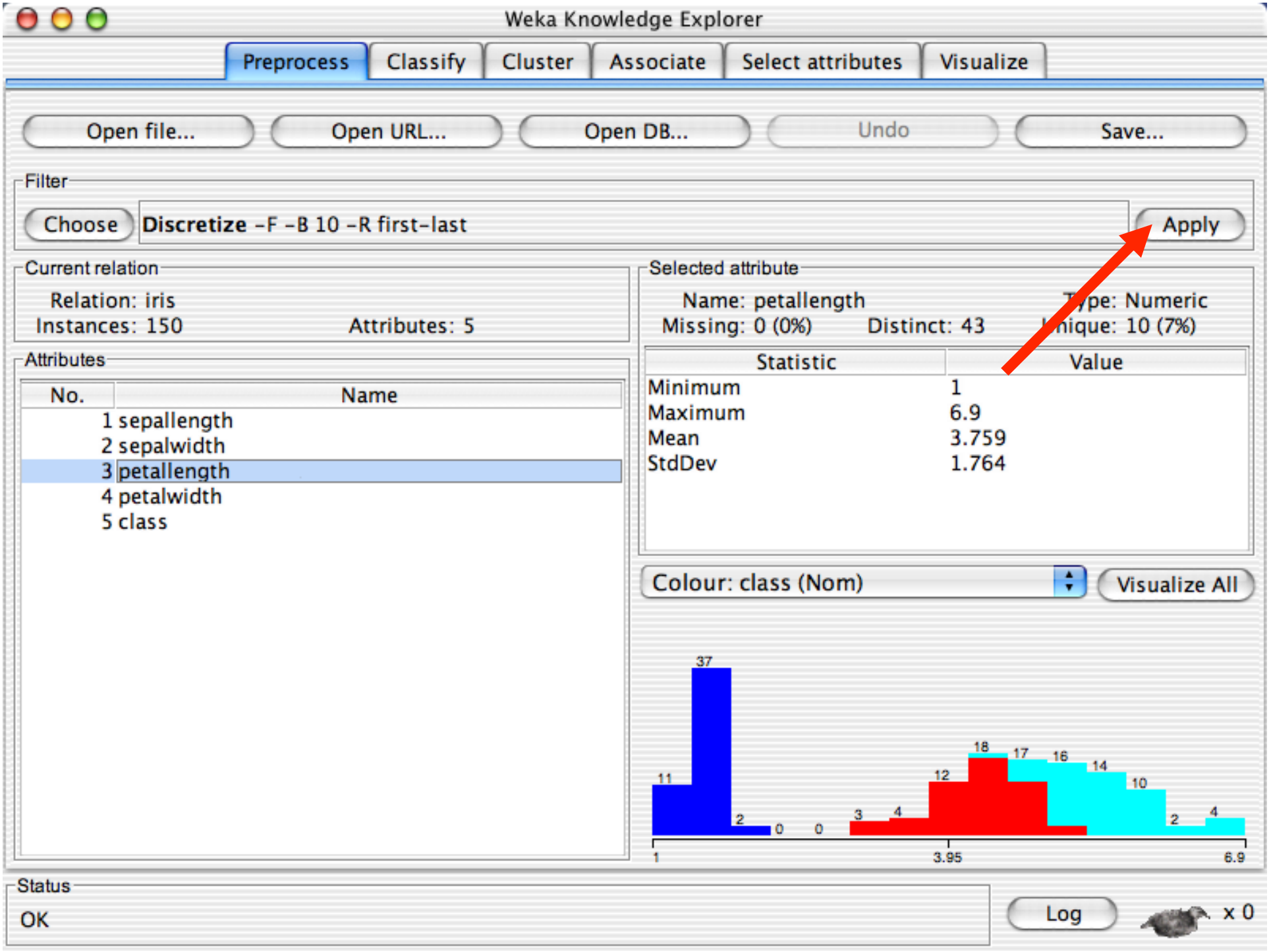
Statistic	Value
Minimum	1
Maximum	6.9
Mean	3.759
StdDev	1.764

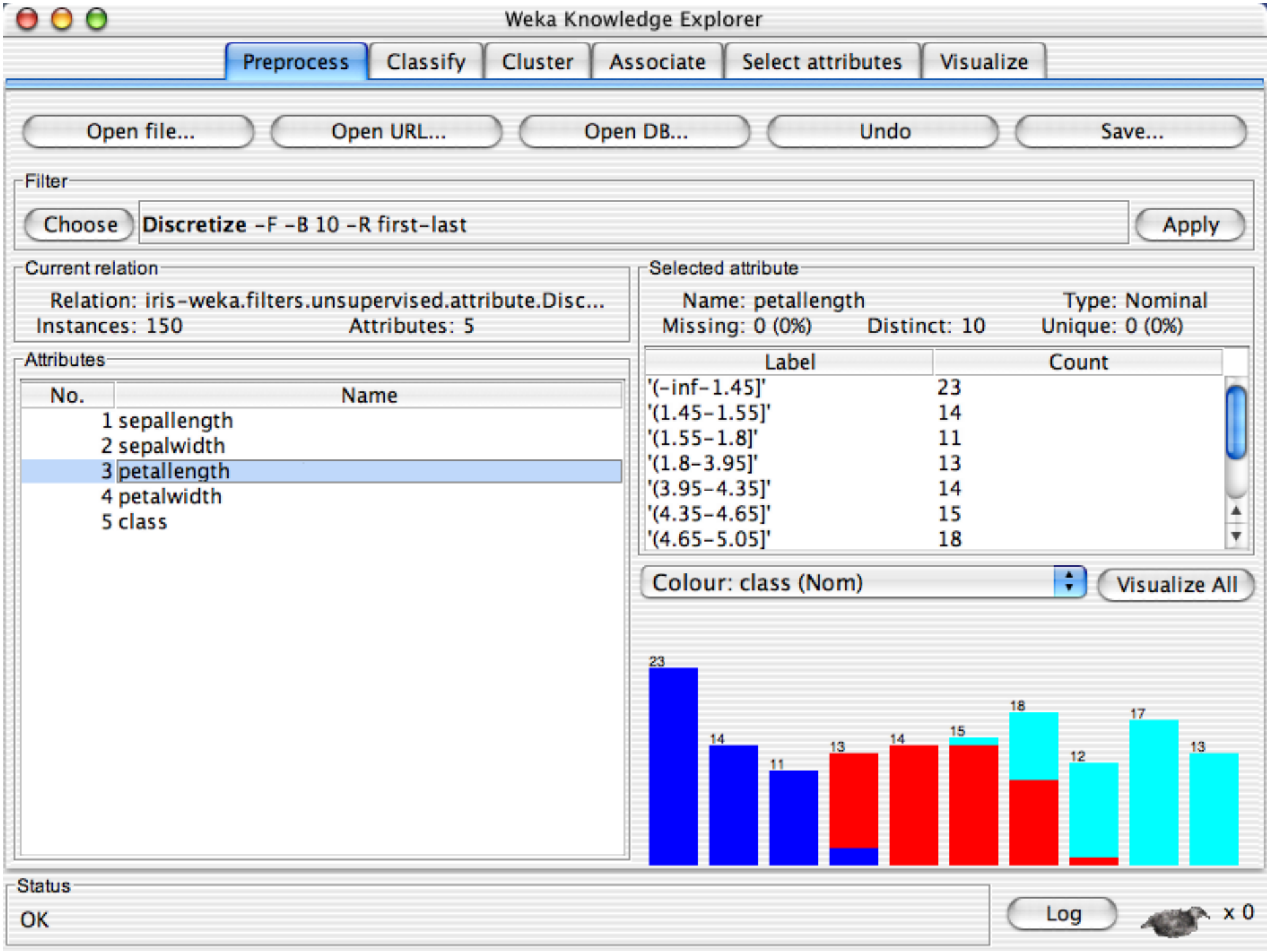
Colour: class (Nom) | Visualize All



Status

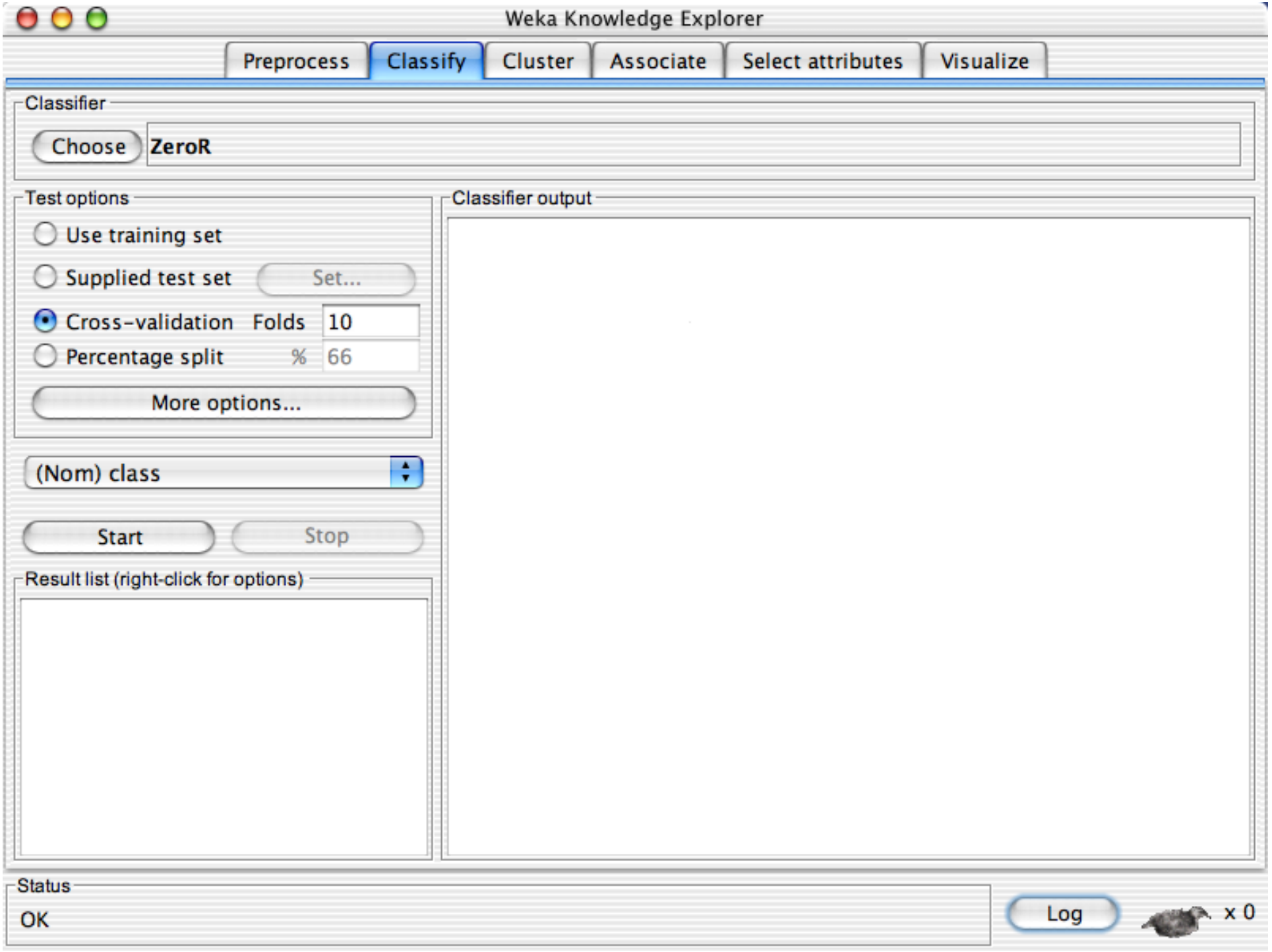
OK | Log | x 0

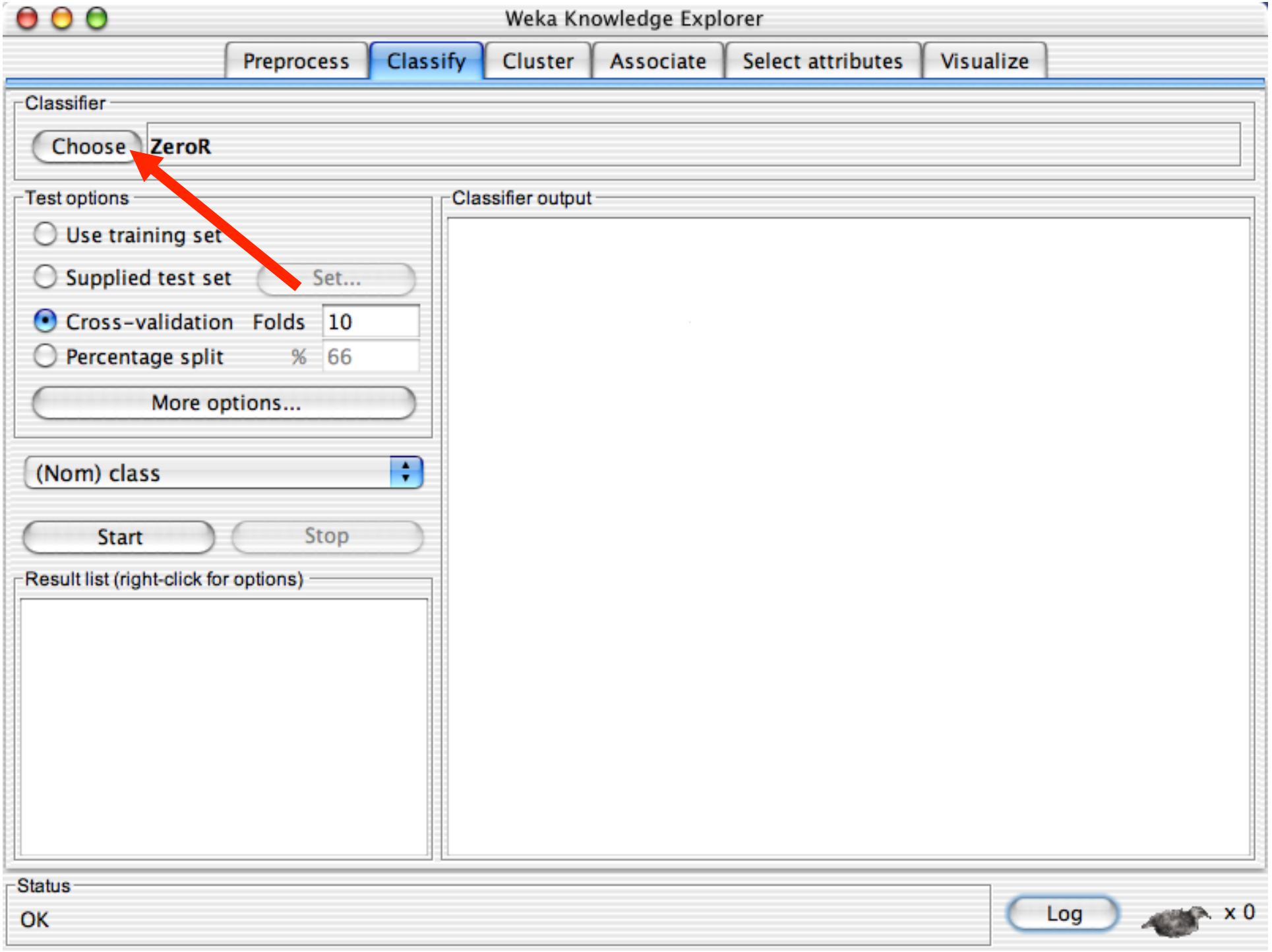

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
Discretize -F -B 10 -R first-last
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Selected attribute
Name: petallength
Type: Numeric
Missing: 0 (0%)
Distinct: 43
Unique: 10 (7%)
Attributes
No.
Name
1 sepallength
2 sepalwidth
3 petallength
4 petalwidth
5 class
Statistic
Value
Minimum
1
Maximum
6.9
Mean
3.759
StdDev
1.764
Colour: class (Nom)
Visualize All
37
11
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-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 vector machines, multi-layer perceptrons, logistic regression, Bayes' nets, …
- "Meta"-classifiers include:
  - Bagging, boosting, stacking, error-correcting output codes, locally 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...
Classifier output
(Nom) class
Start
Stop
Result list (right-click for options)
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
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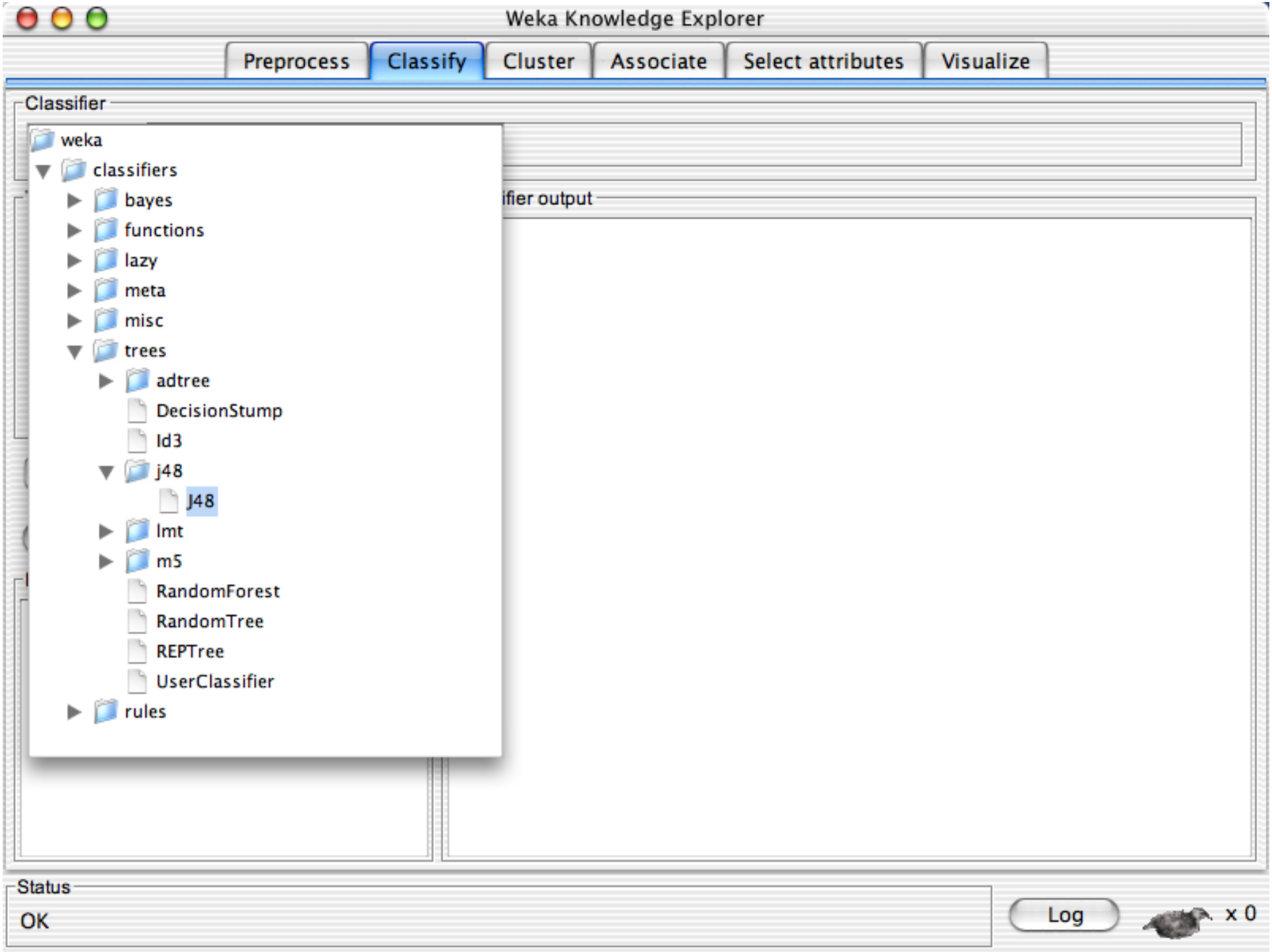
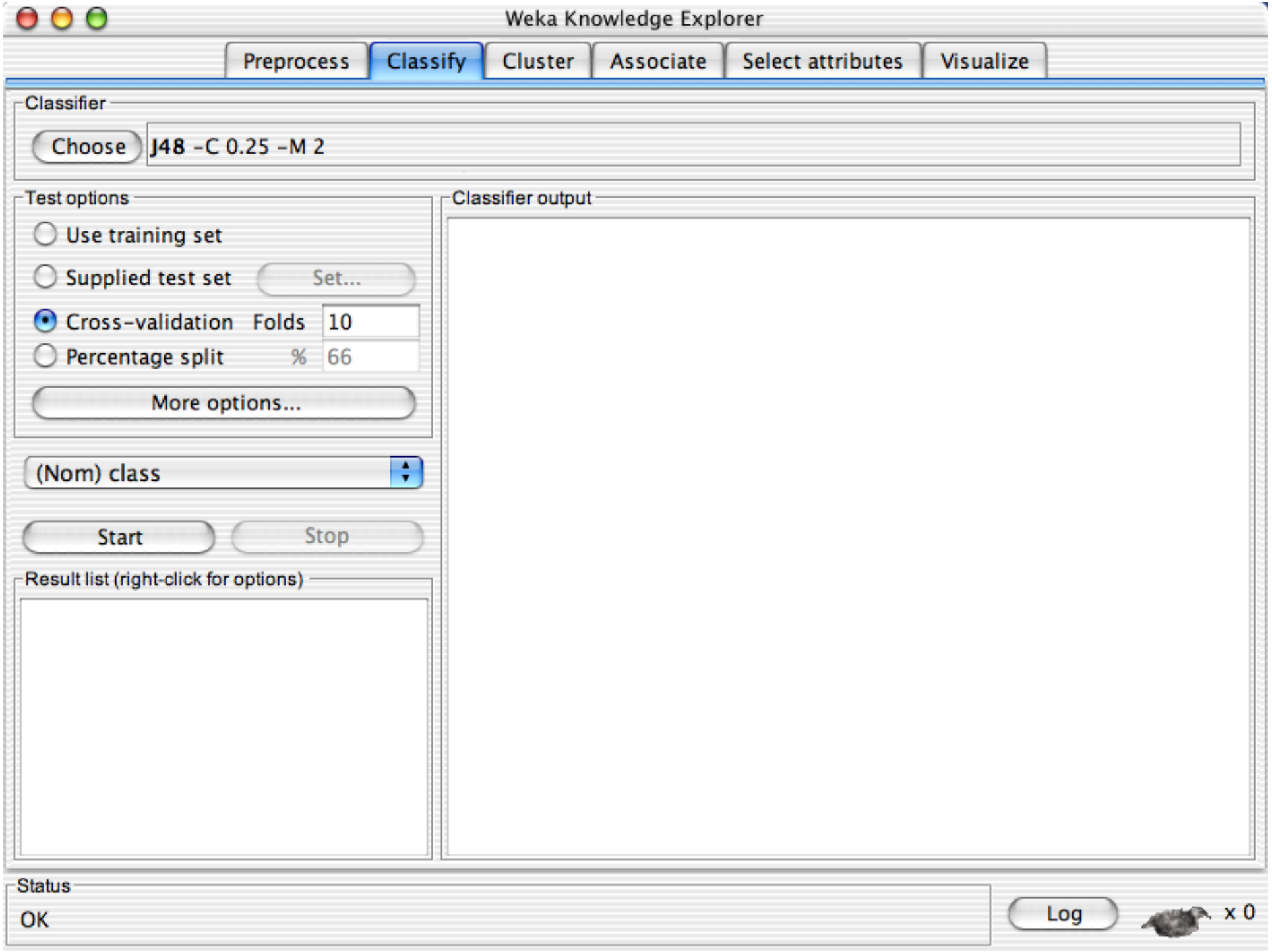
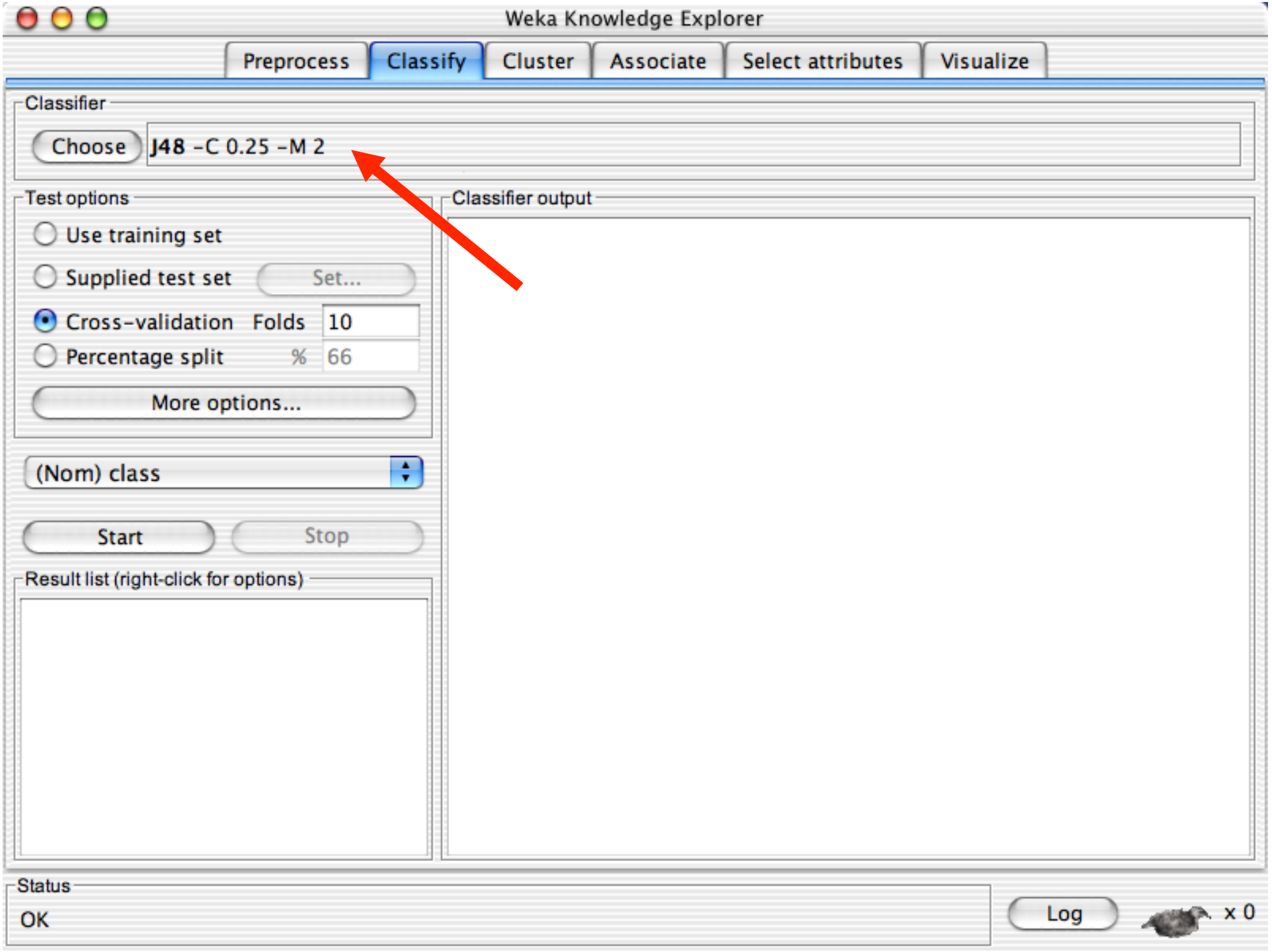
66
More options...
Classifier output
(Nom) class
Start
Stop
Result list (right-click for options)
Status
OK
Log
x 0


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


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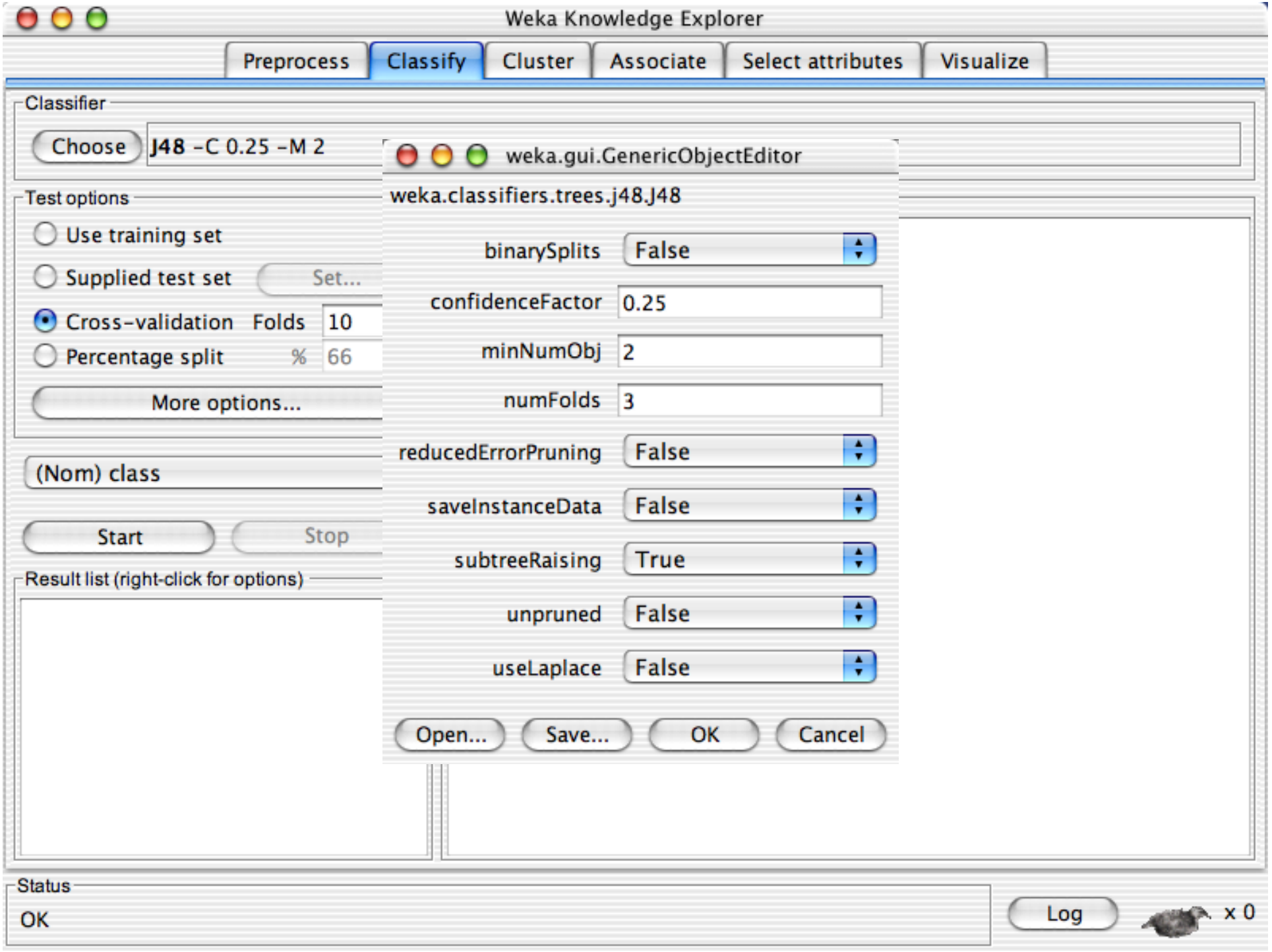
66
More options...
Classifier output
(Nom) class
Start
Stop
Result list (right-click for options)
Status
OK
Log
x 0


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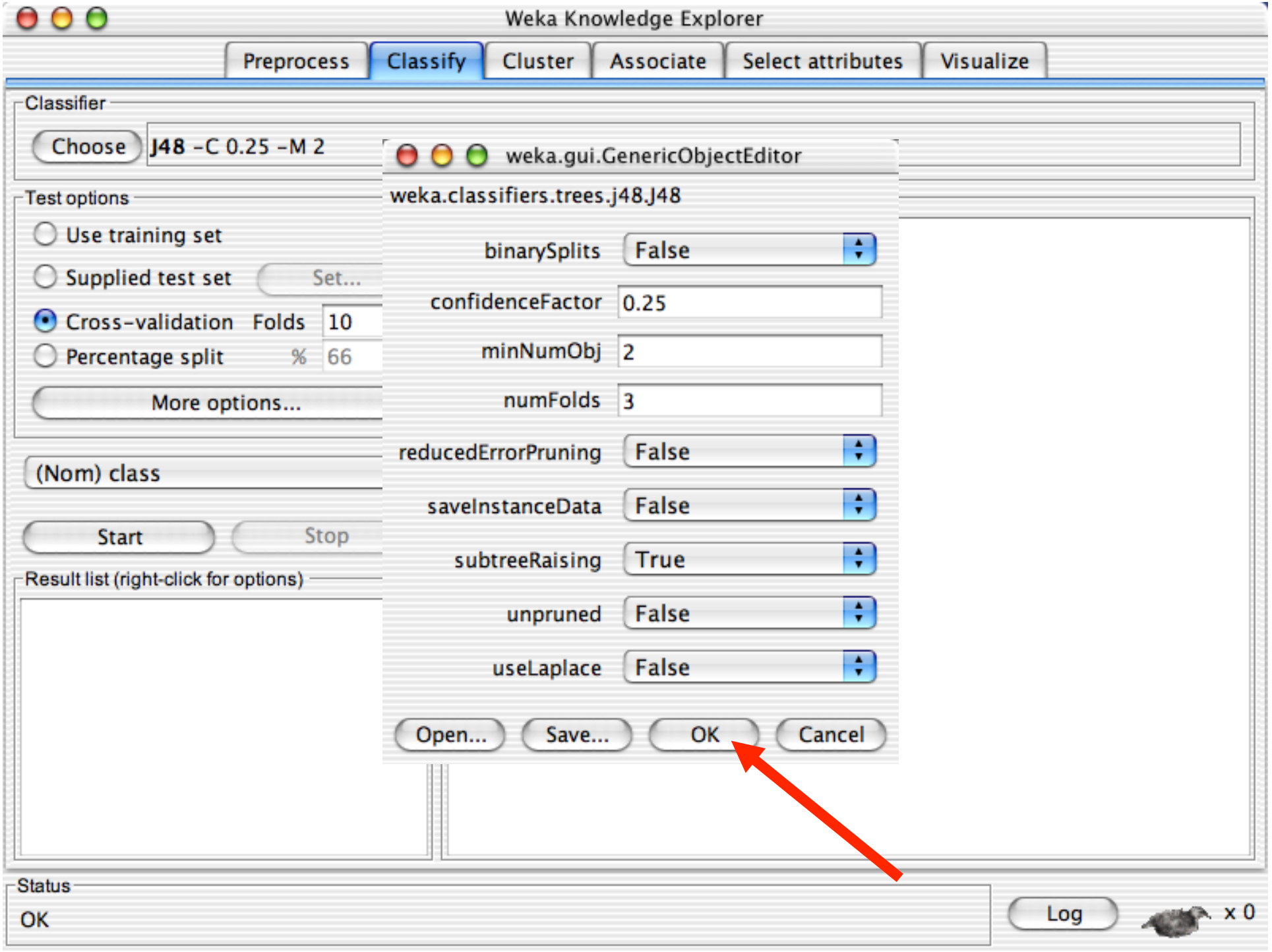
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
Status
OK
Log
x 0
weka.gui.GenericObjectEditor
weka.classifiers.trees.j48.J48
binarySplits
False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


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
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Folds
10
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(Nom) class
Start
Stop
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weka.gui.GenericObjectEditor
weka.classifiers.trees.j48.J48
binarySplits
False
confidenceFactor
0.25
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reducedErrorPruning
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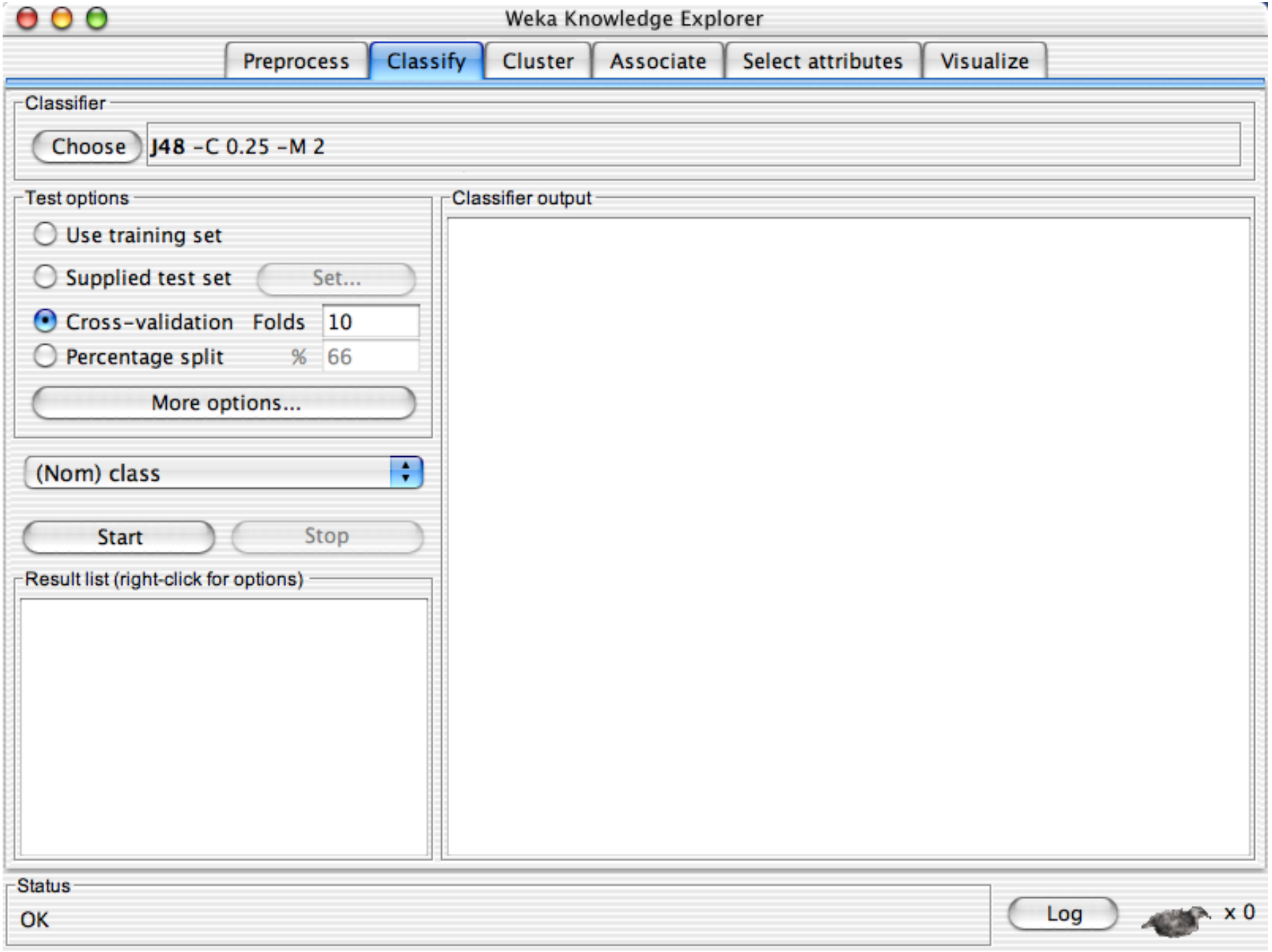
True
unpruned
False
useLaplace
False
Open...
Save...
OK
Cancel
Status
OK
Log
x 0


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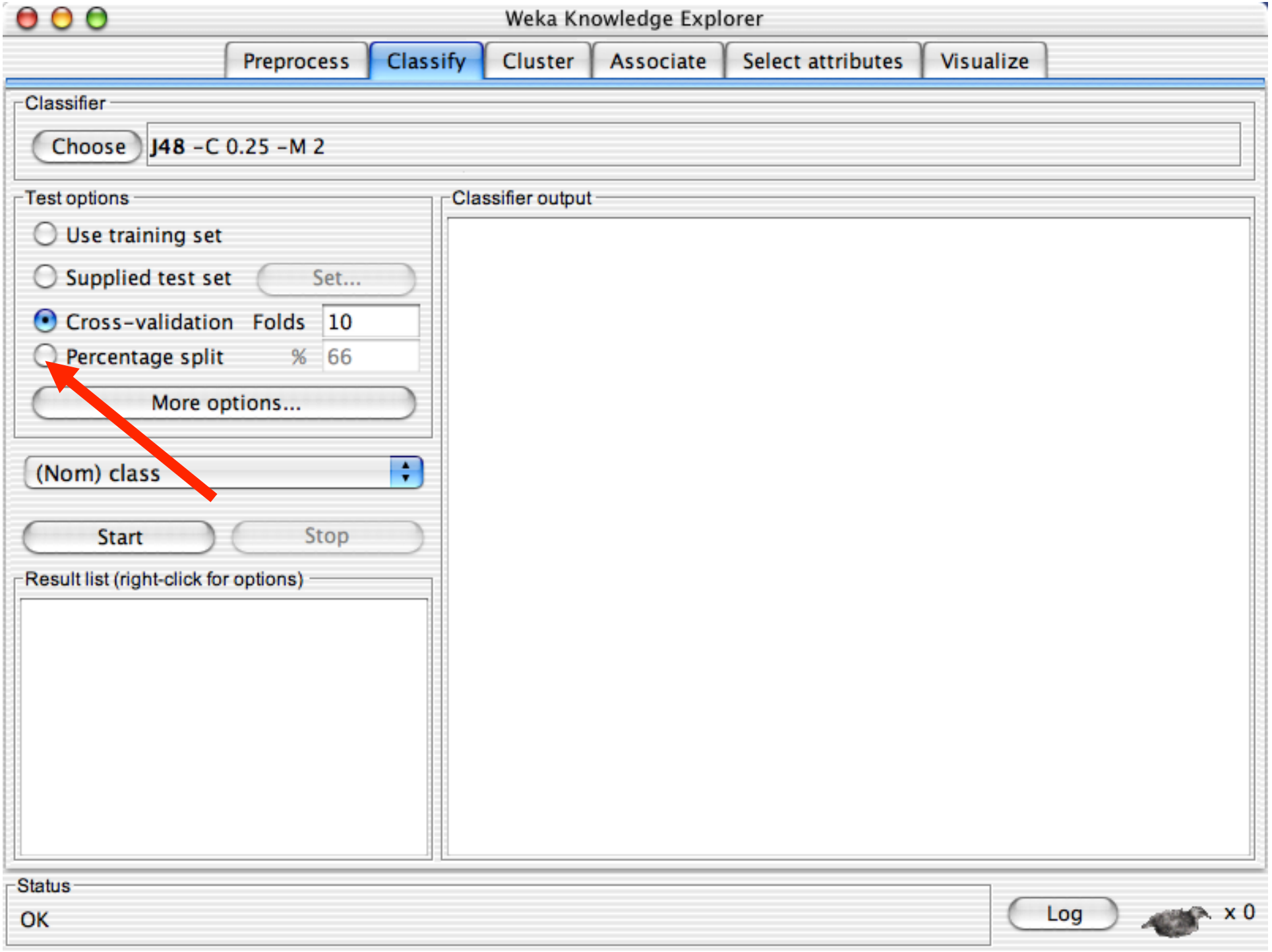
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
Classifier output
(Nom) class
Start
Stop
Result list (right-click for options)
Status
OK
Log
x 0


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
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66
More options...
Classifier output
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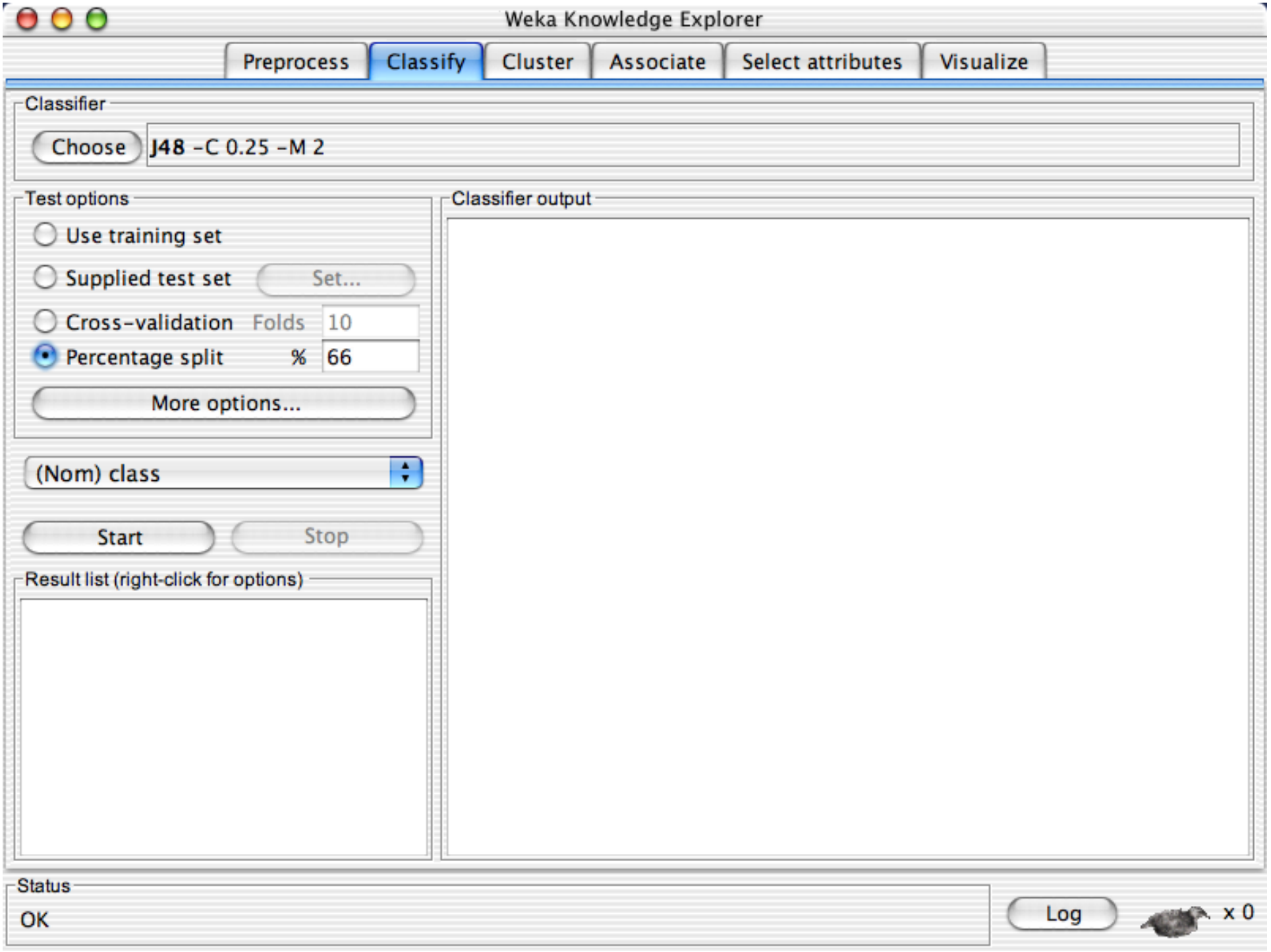
OK
Log
x 0


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
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Cross-validation
Folds
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Percentage split
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66
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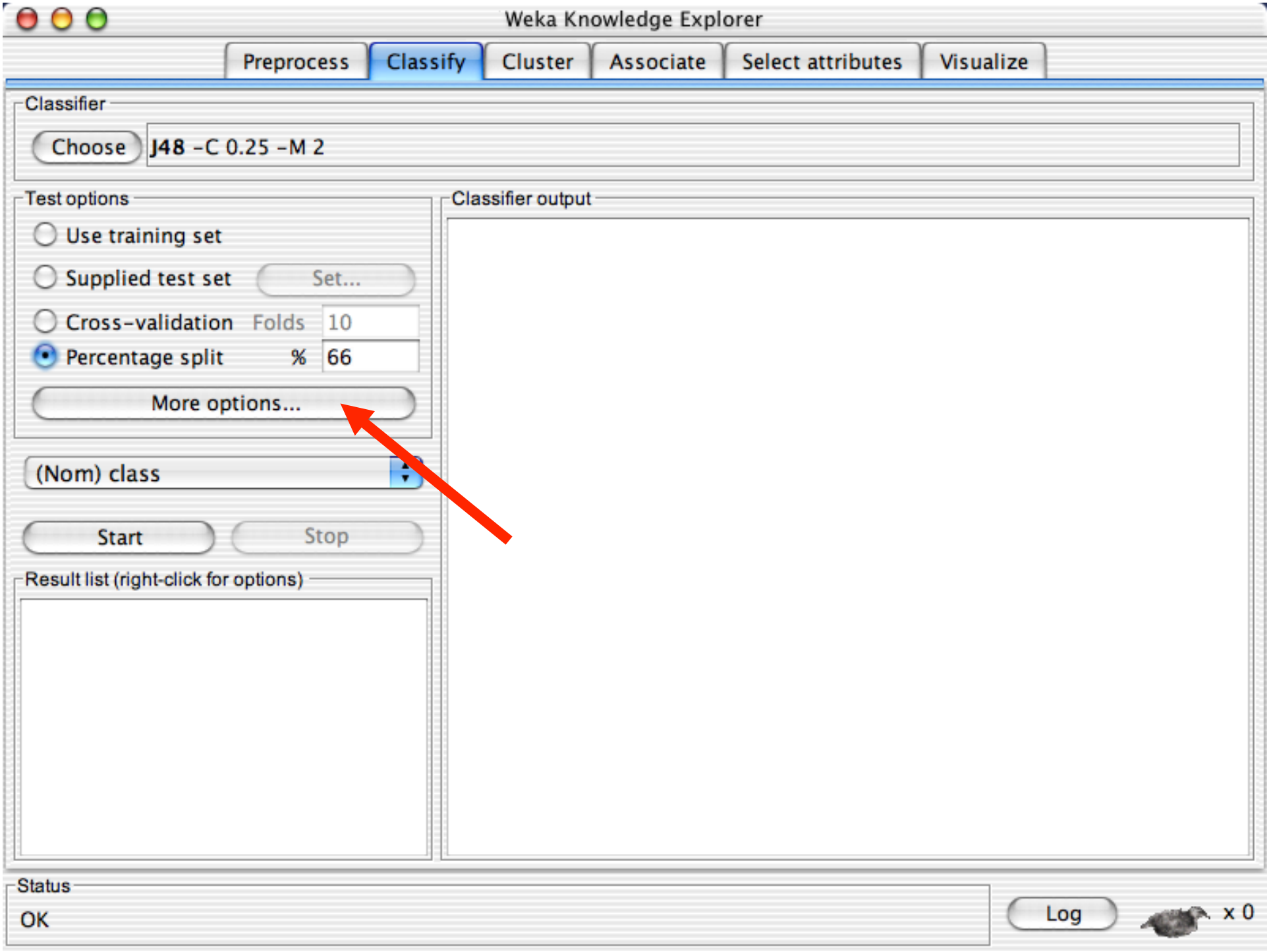
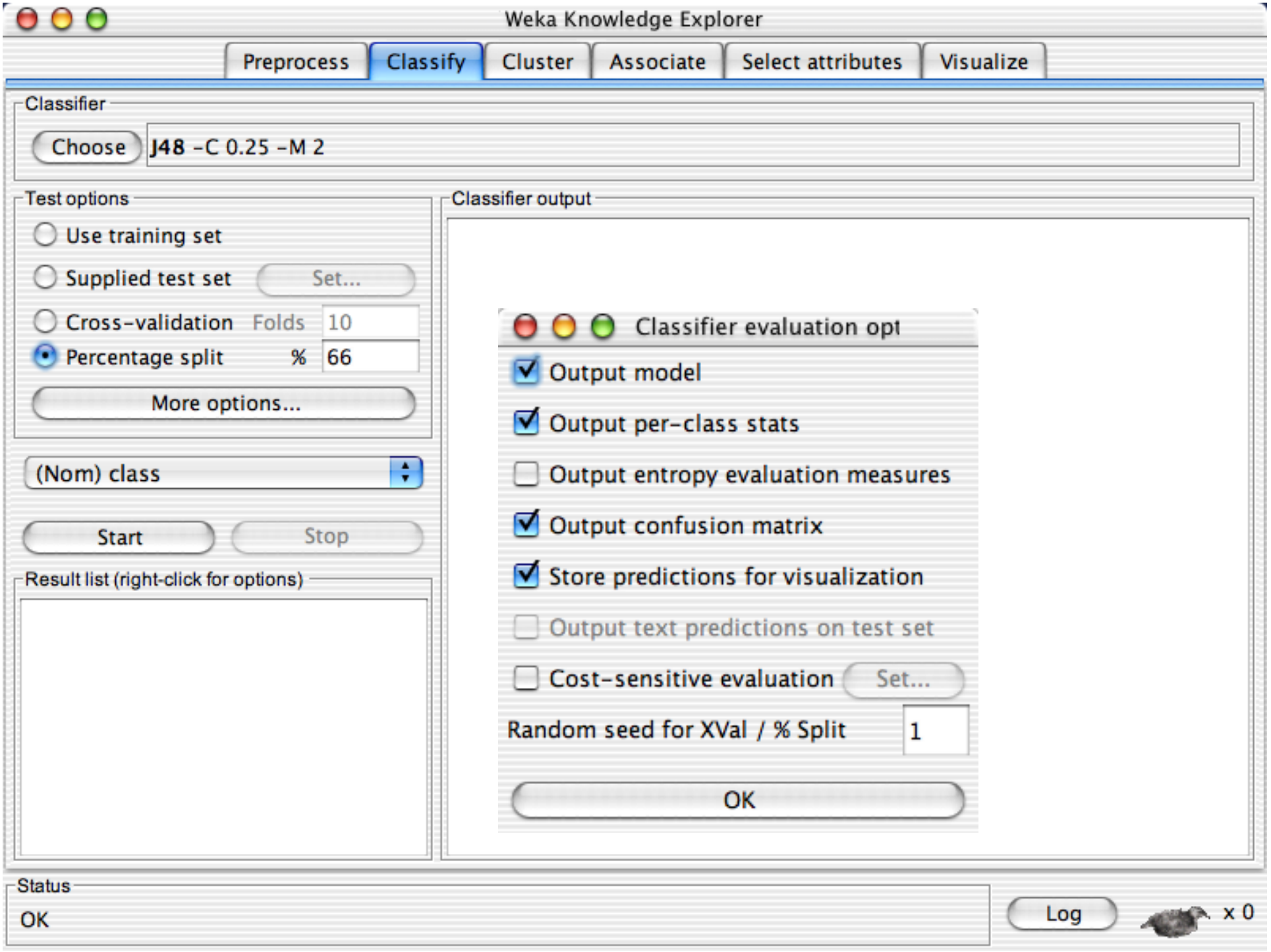
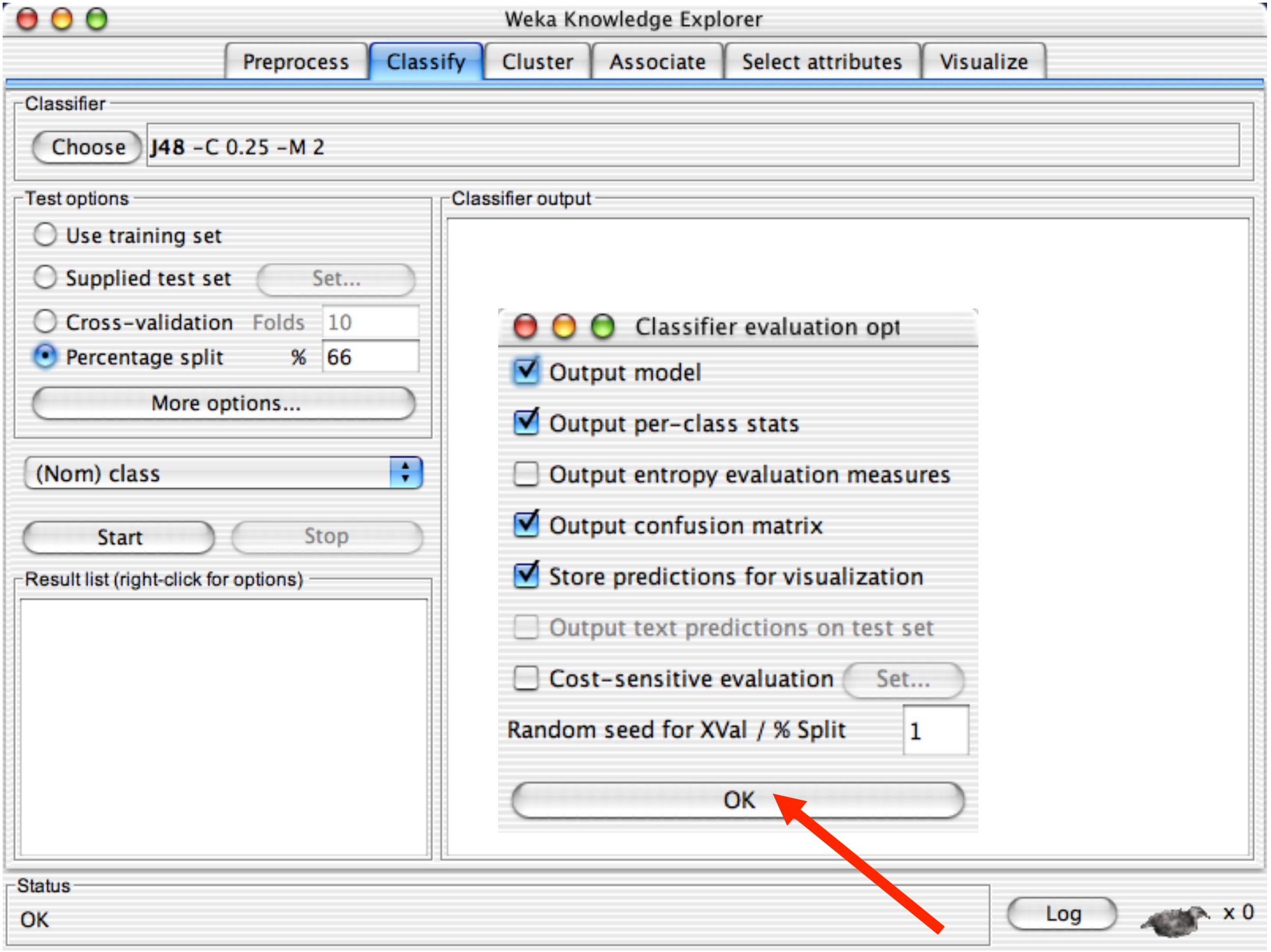
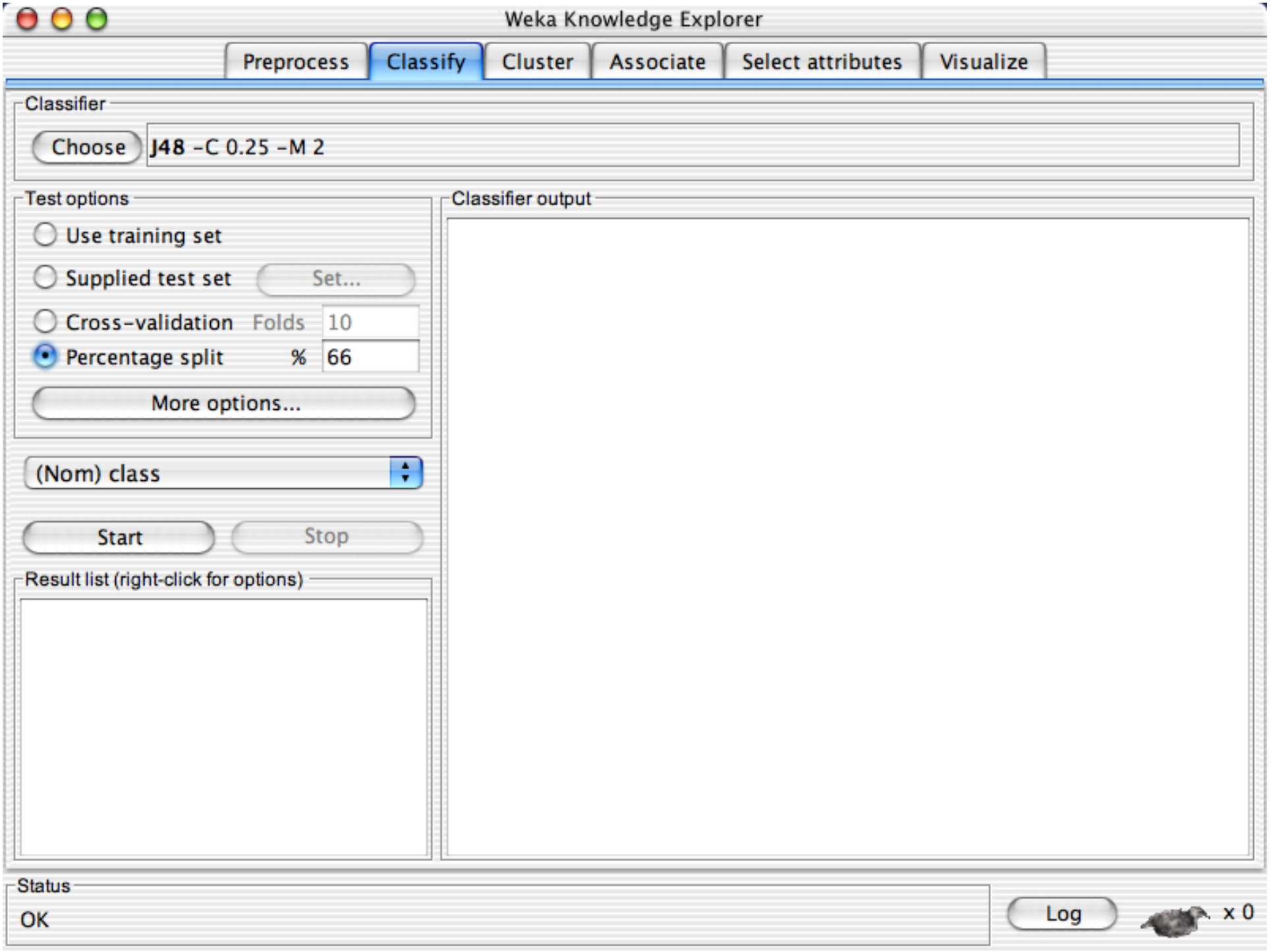
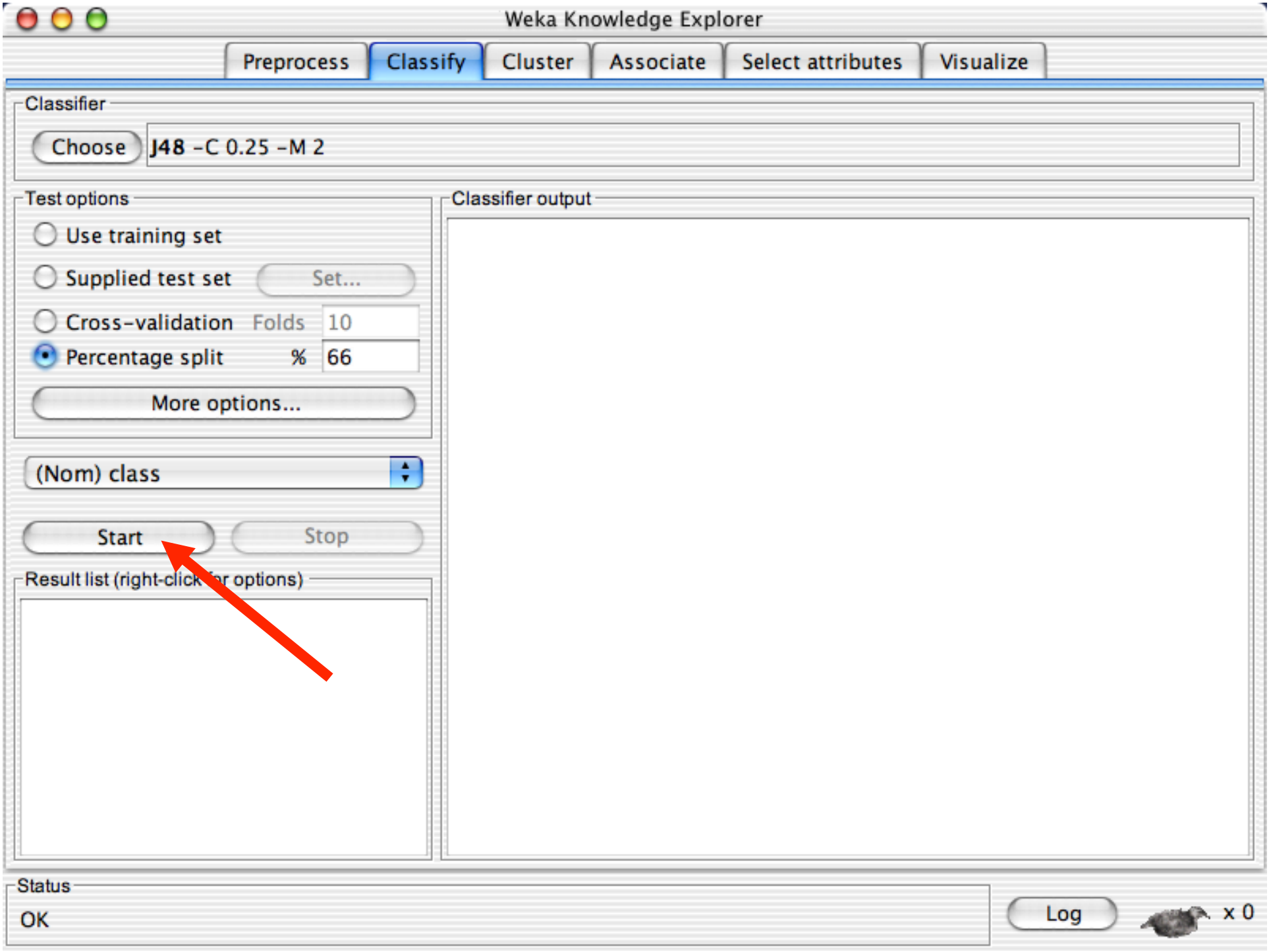
Classifier output
(Nom) class
Start
Stop
Result list (right-click for options)
Status
OK
Log
x 0

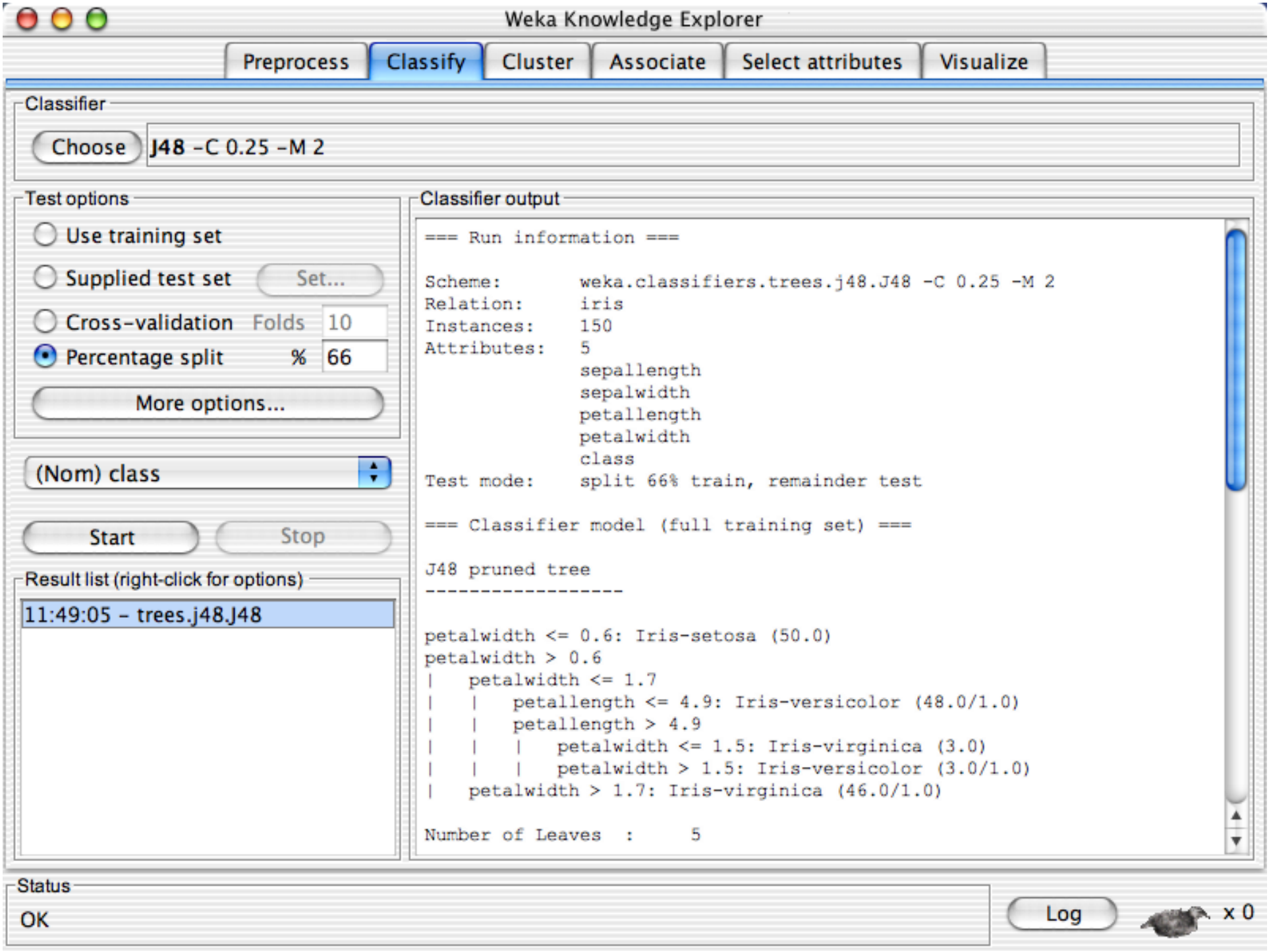

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
Classifier output
(Nom) class
Start
Stop
Result list (right-click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

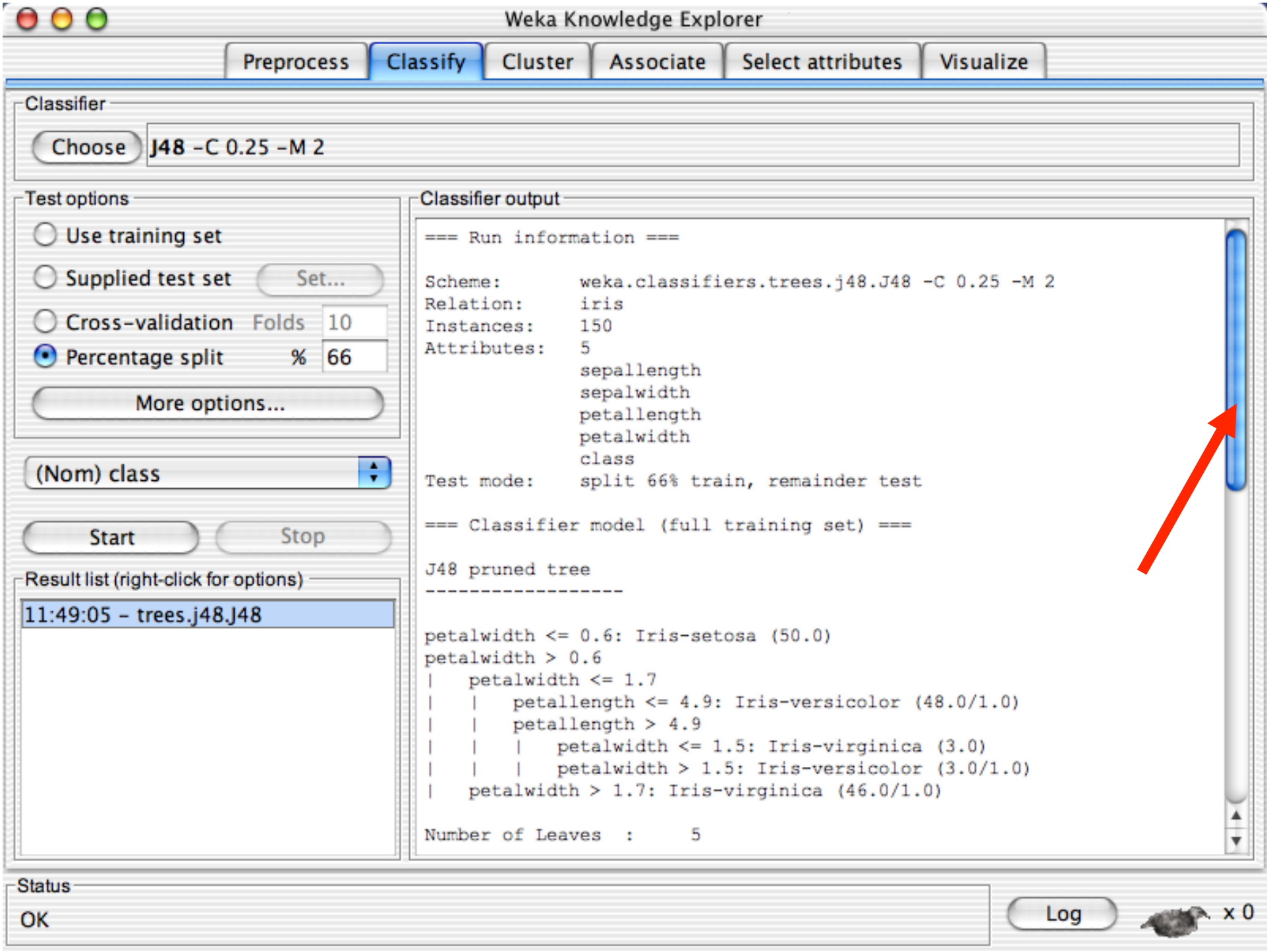

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

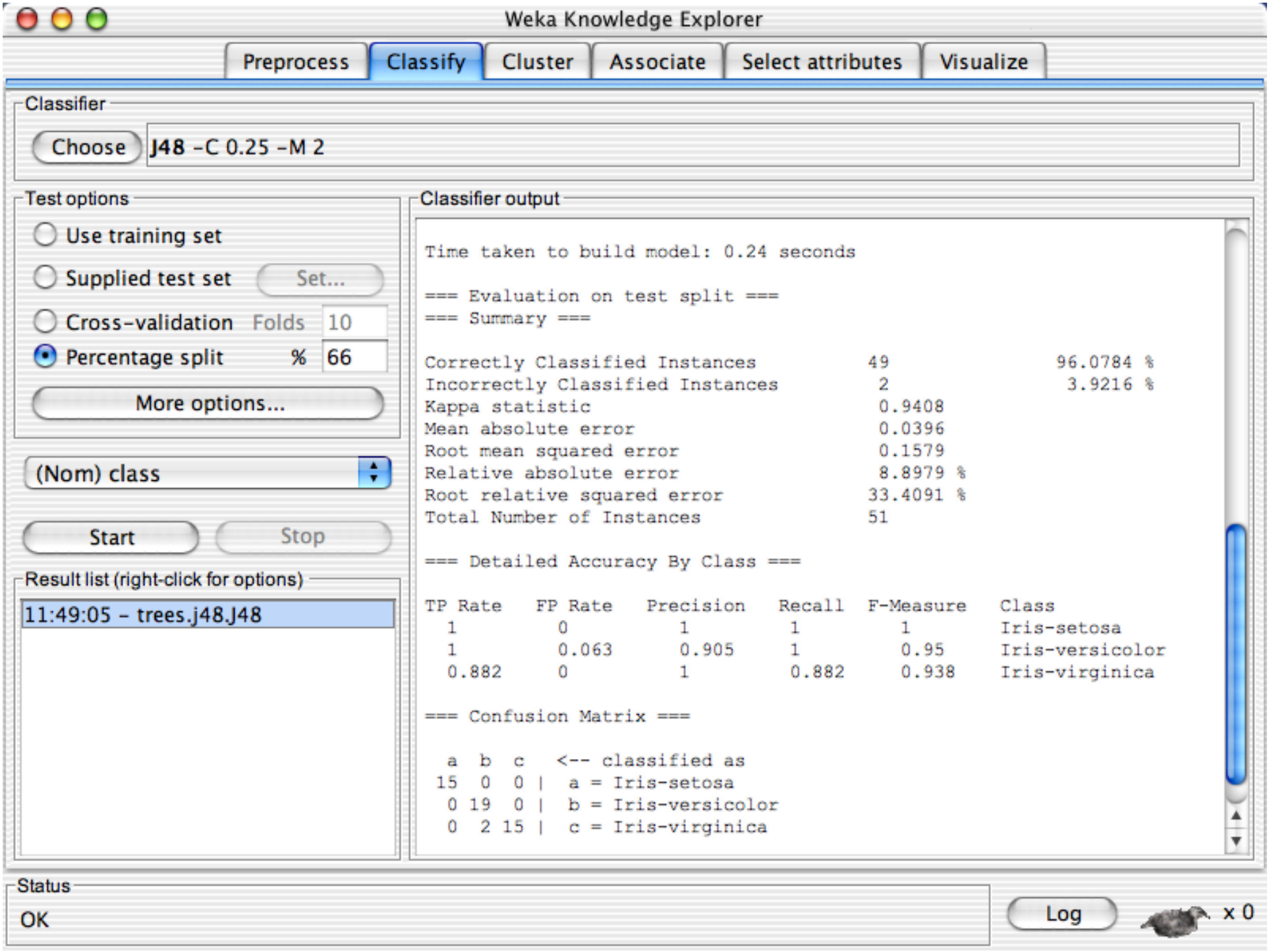

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

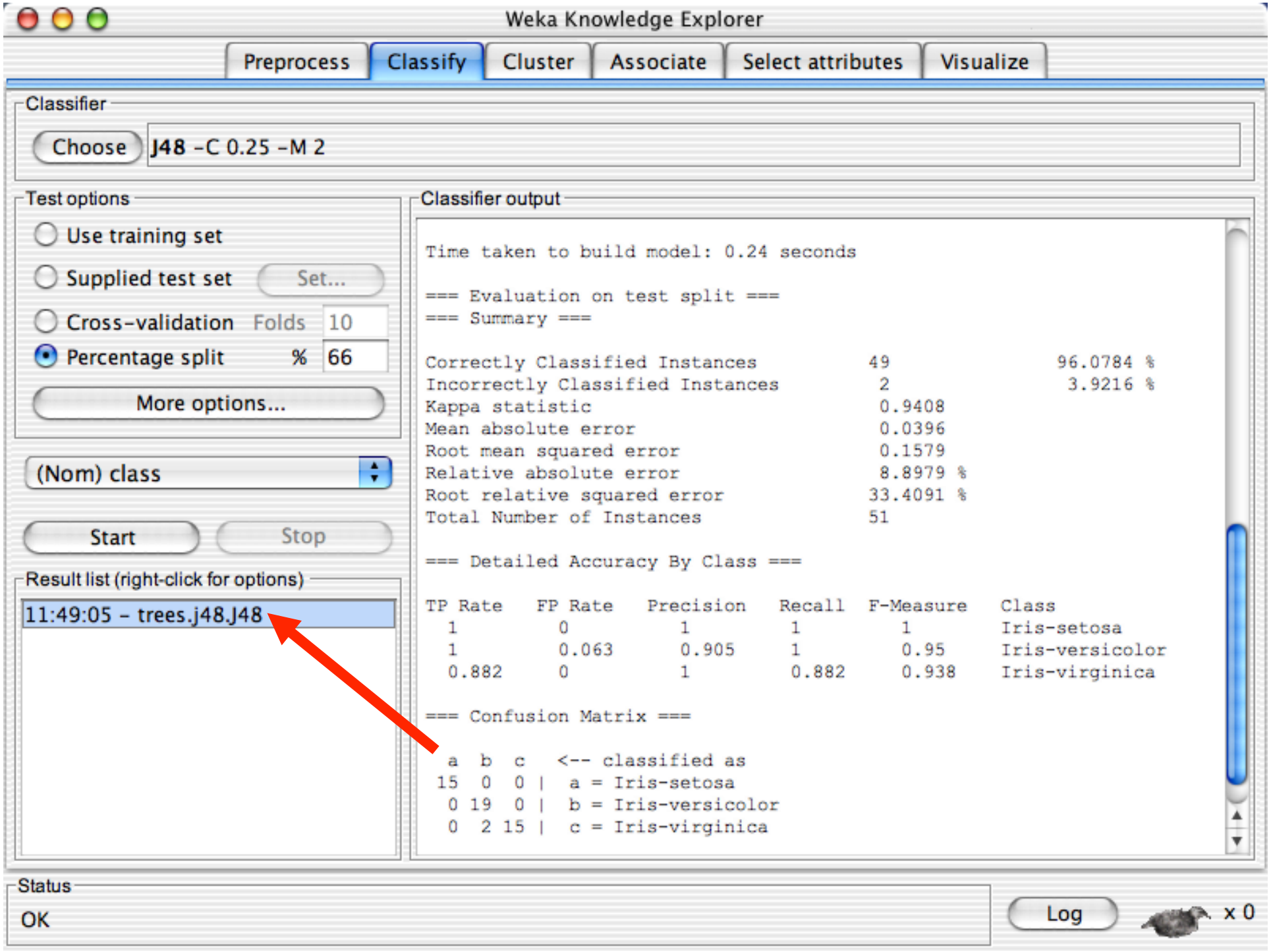

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
Classifier output
(Nom) class
Start
Stop
Result list (right-click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

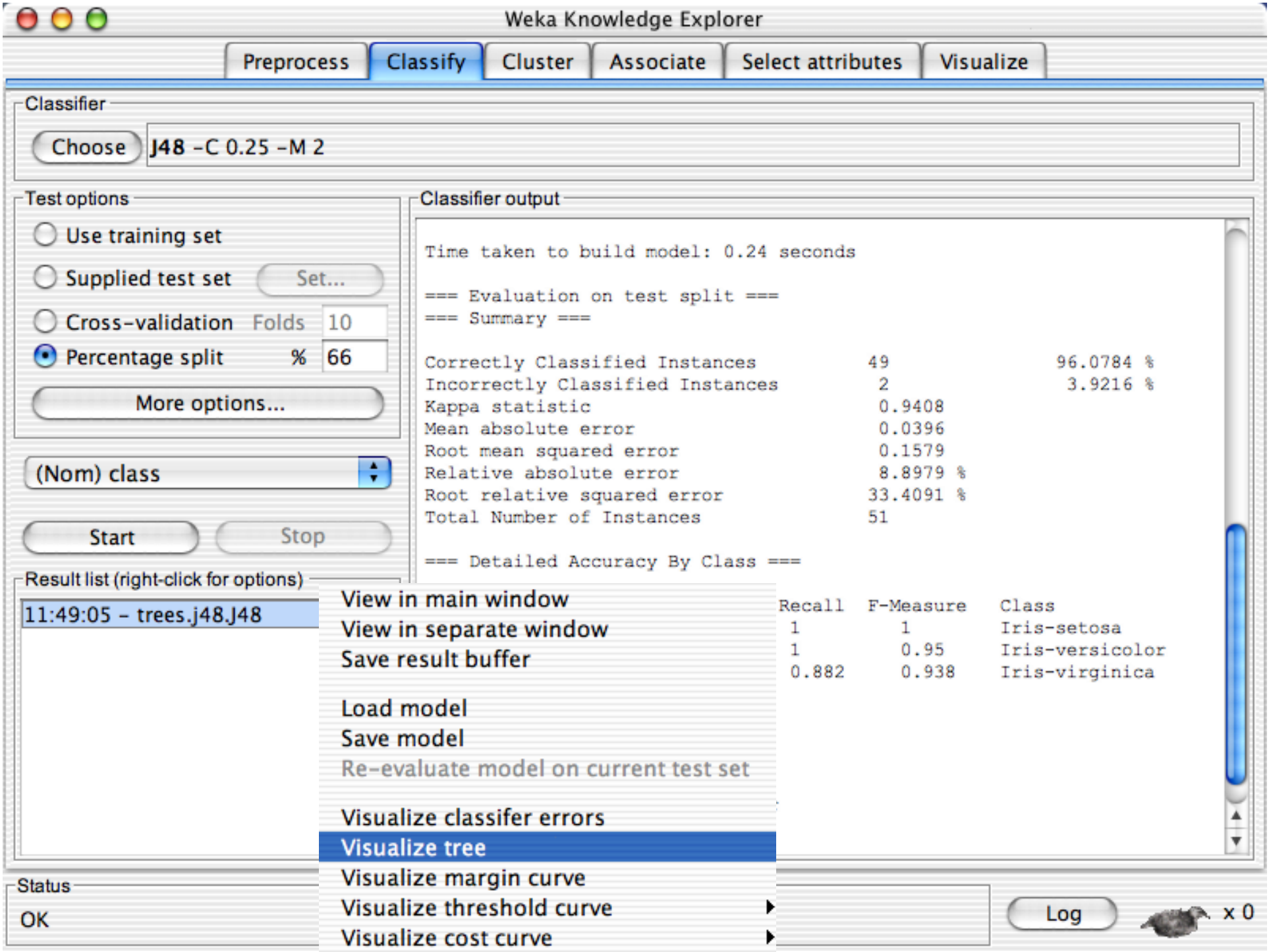

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
Classifier output
(Nom) class
Start
Stop
Result list (right-click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

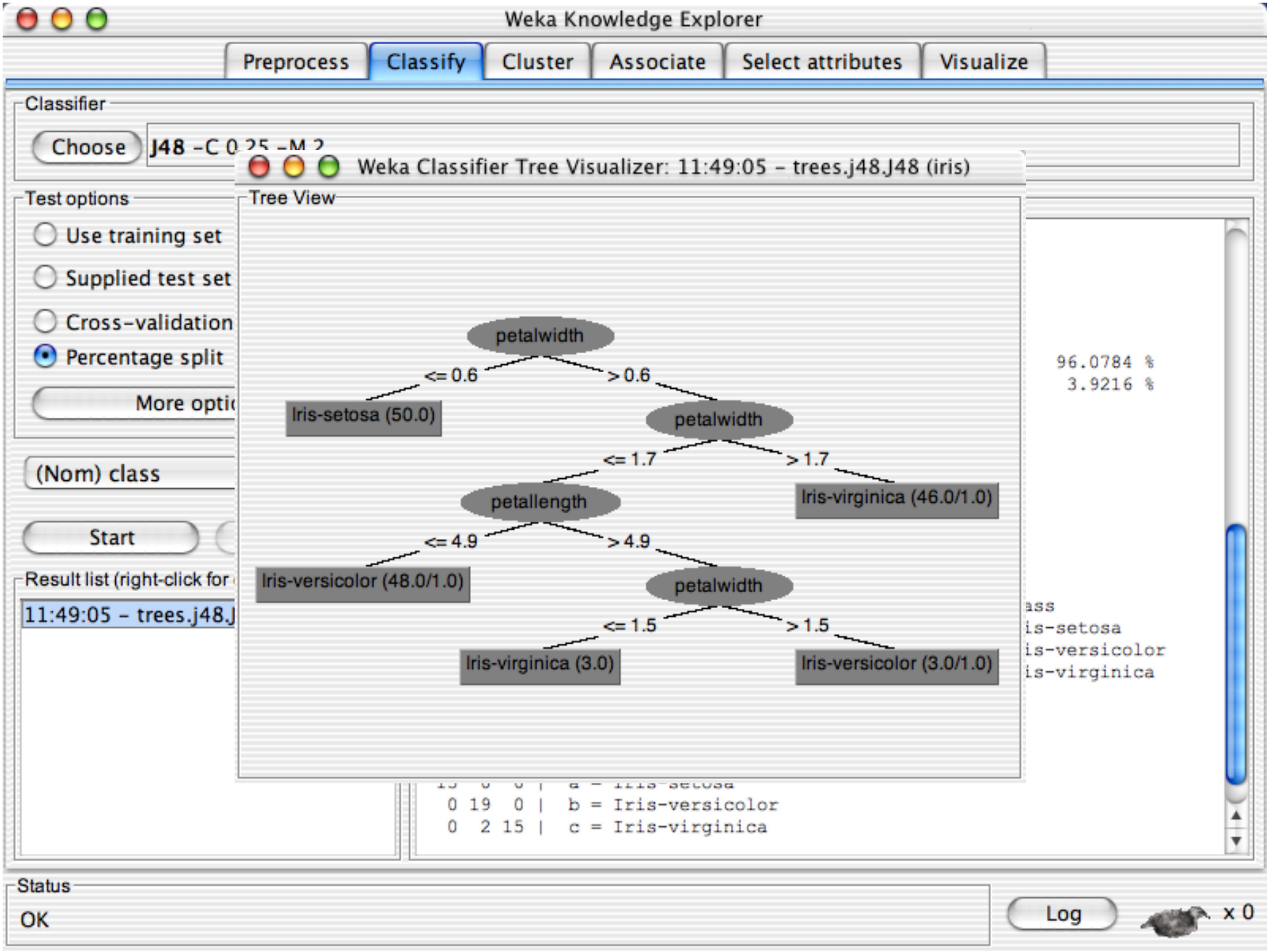

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

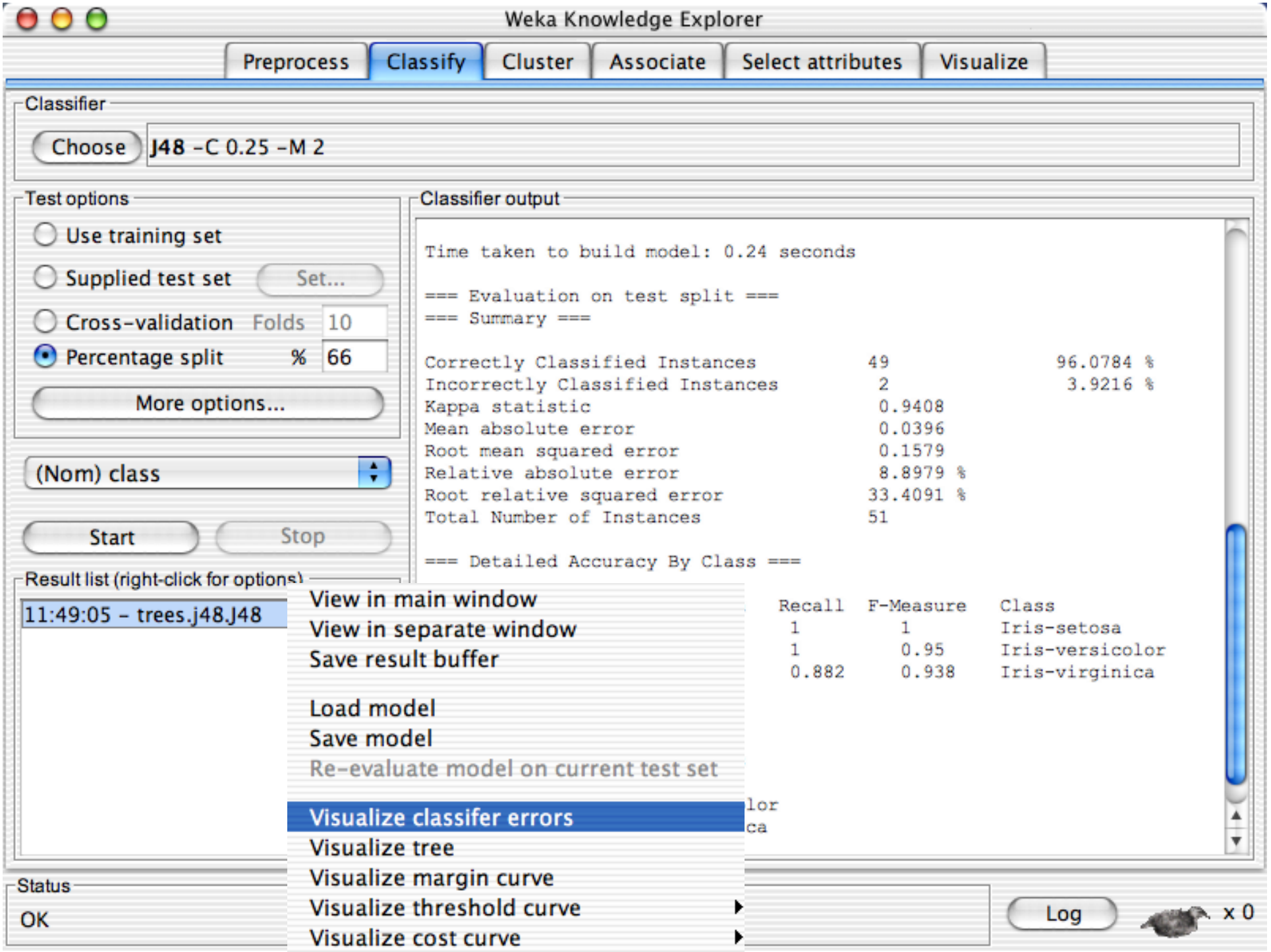

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

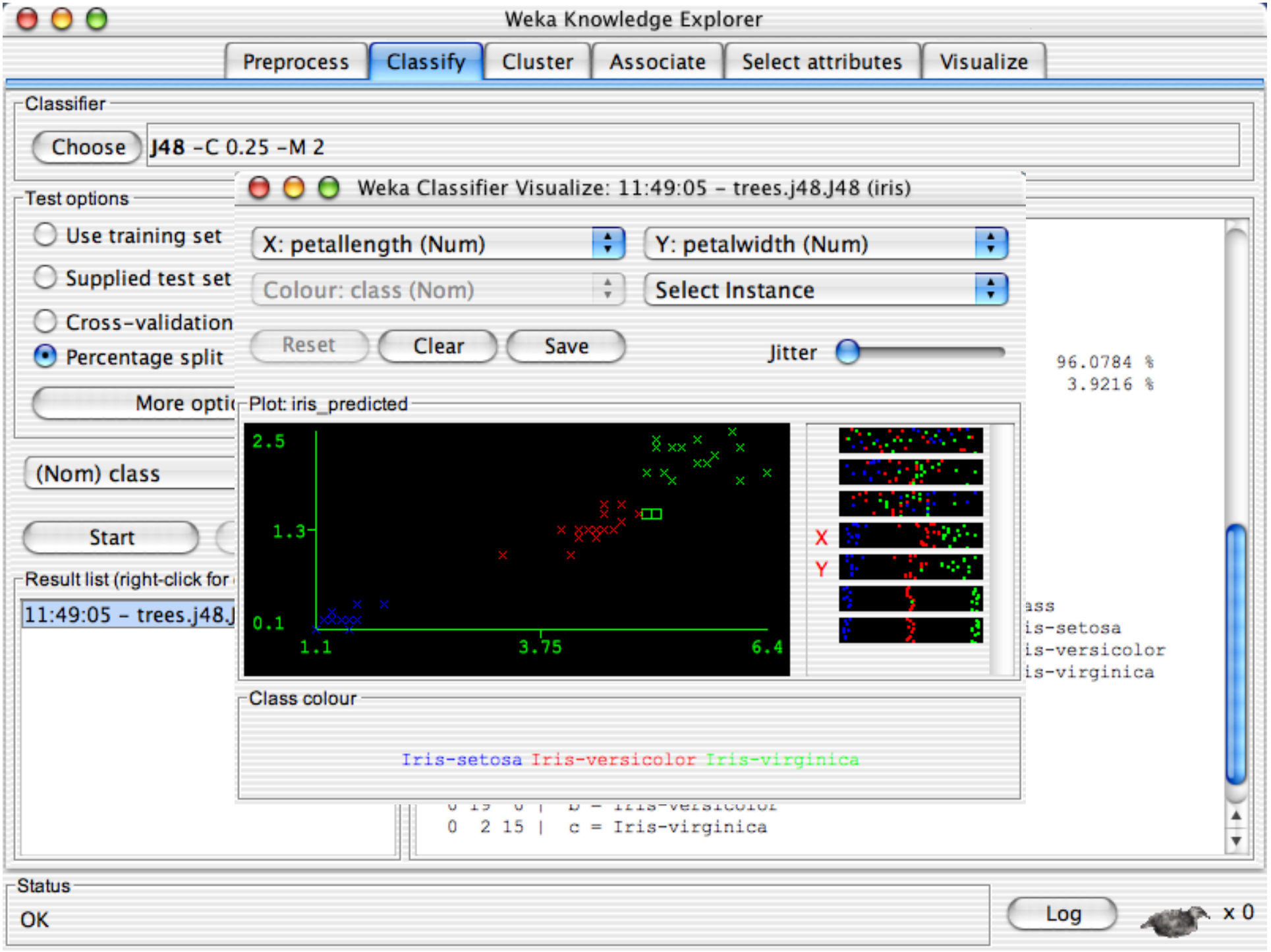

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
Classifier output
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

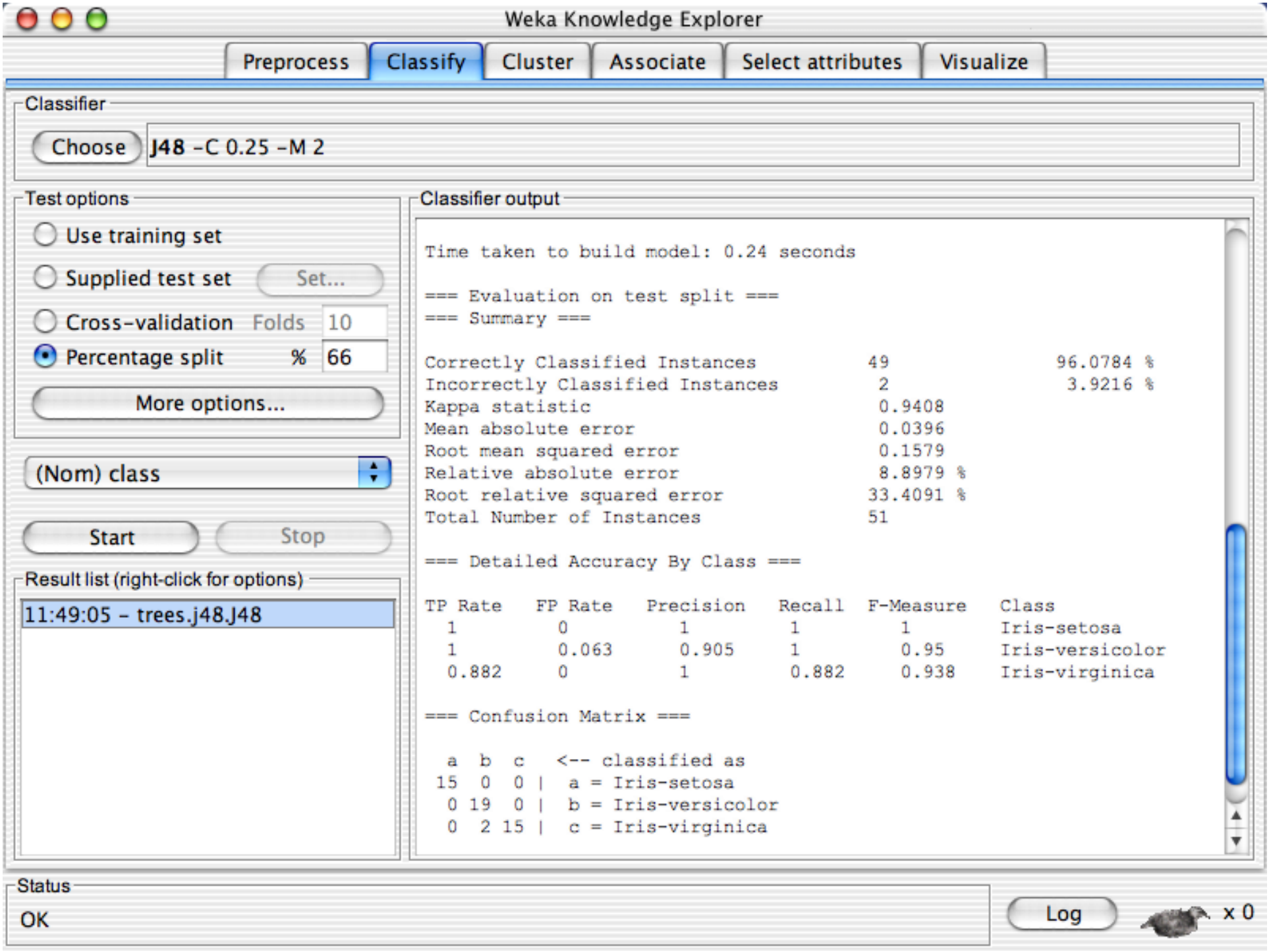

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

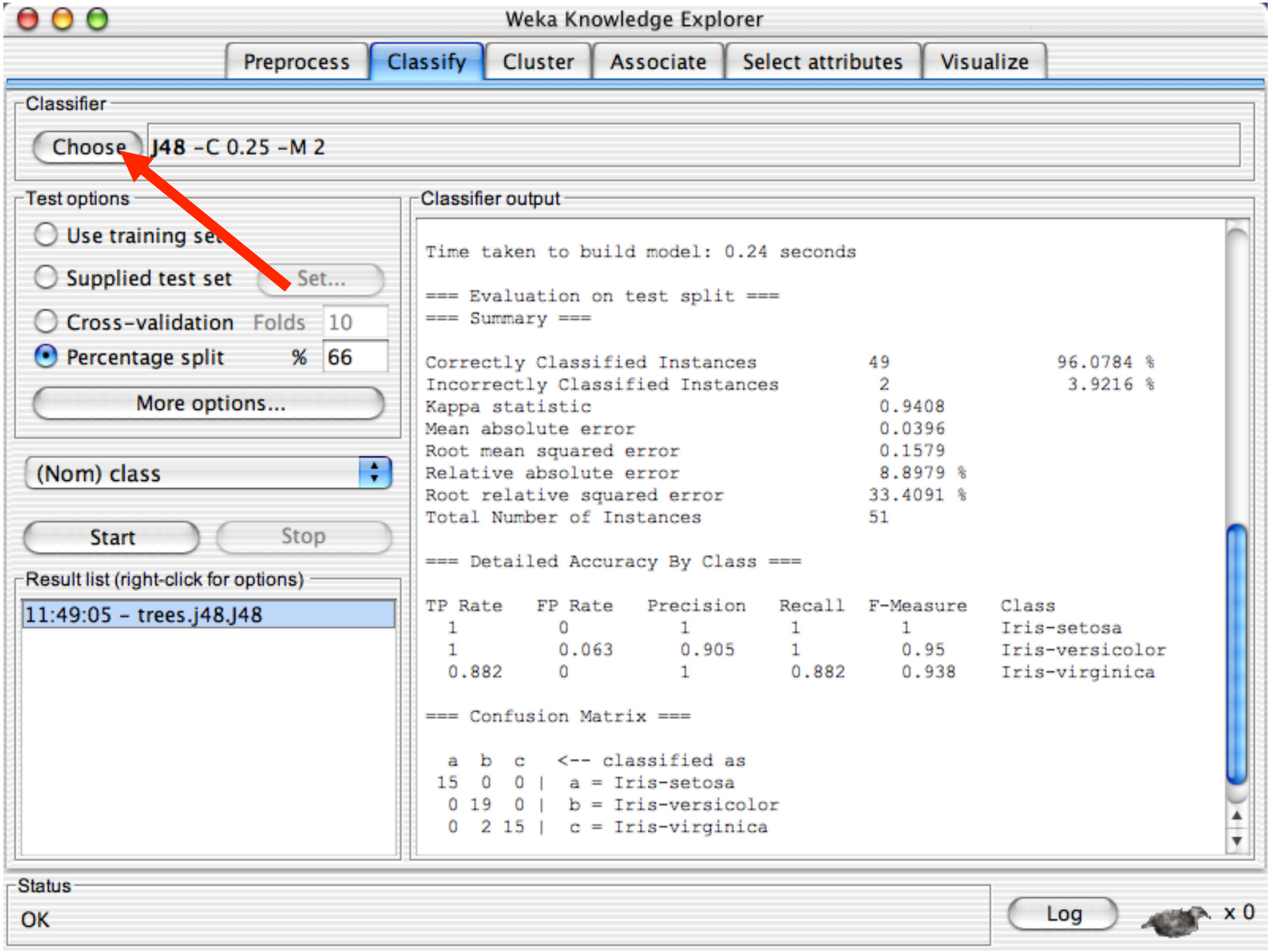

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

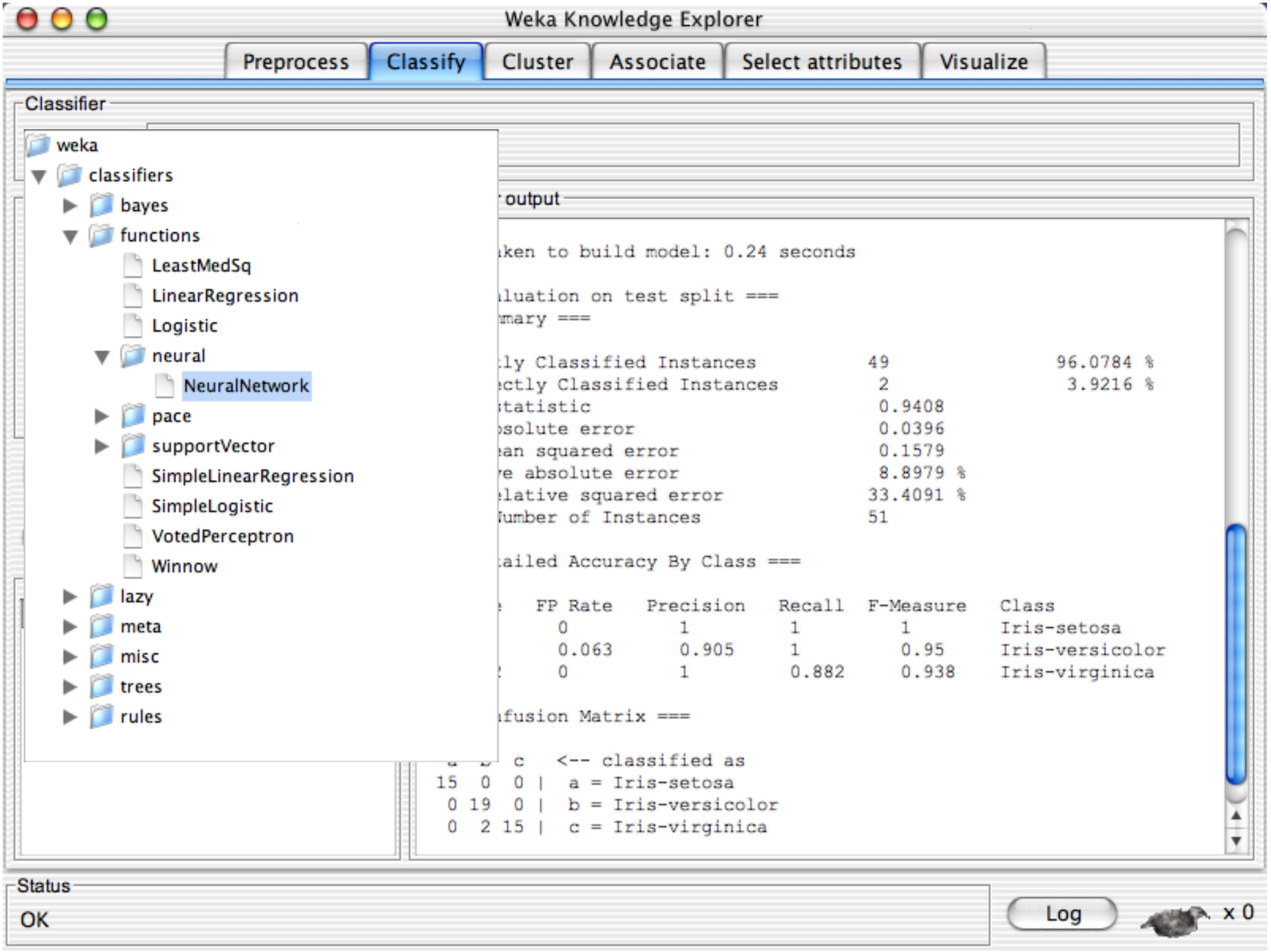

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More optio
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.J
Weka Classifier 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 %
ass
is-setosa
is-versicolor
is-virginica
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0

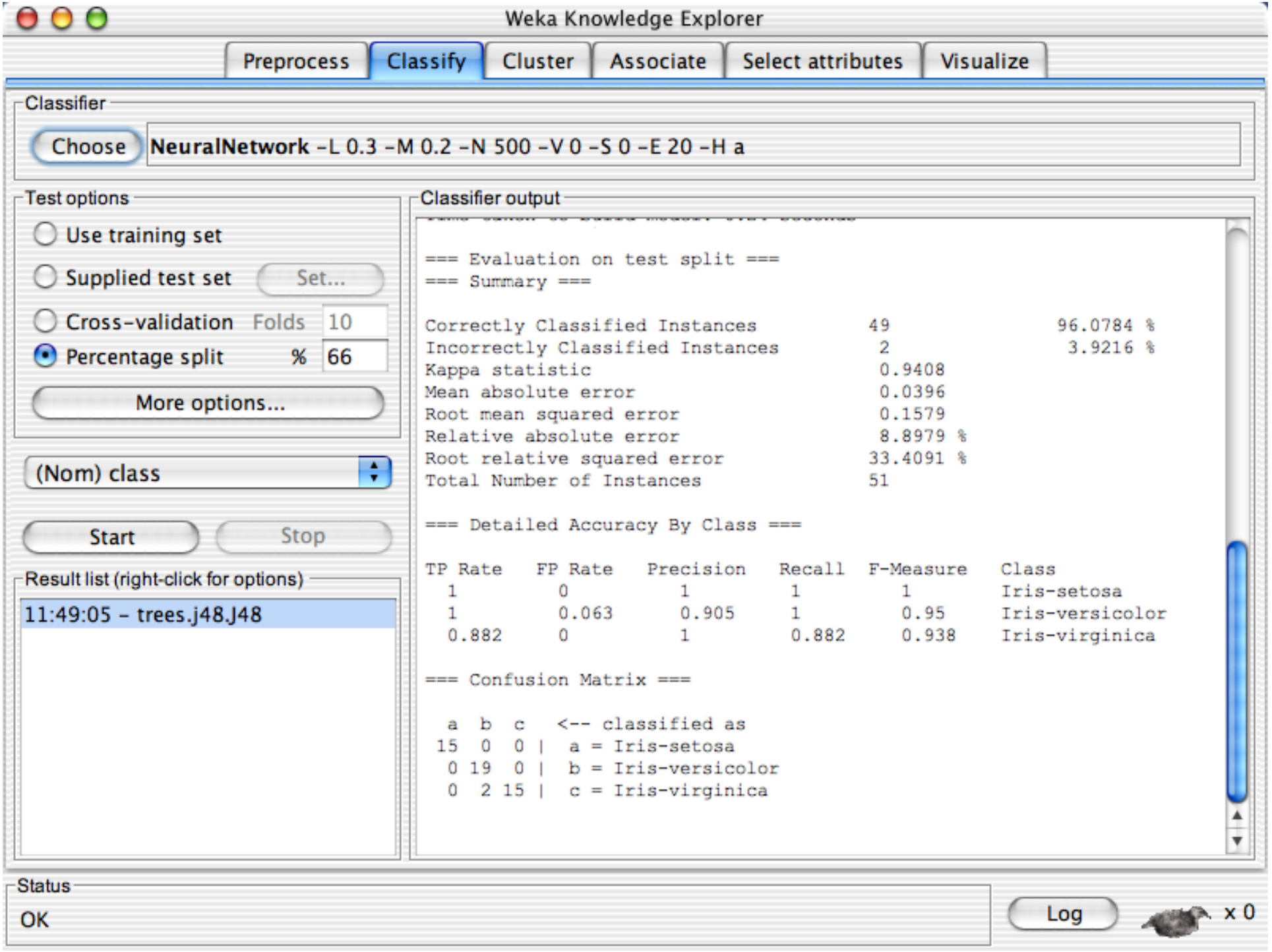

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

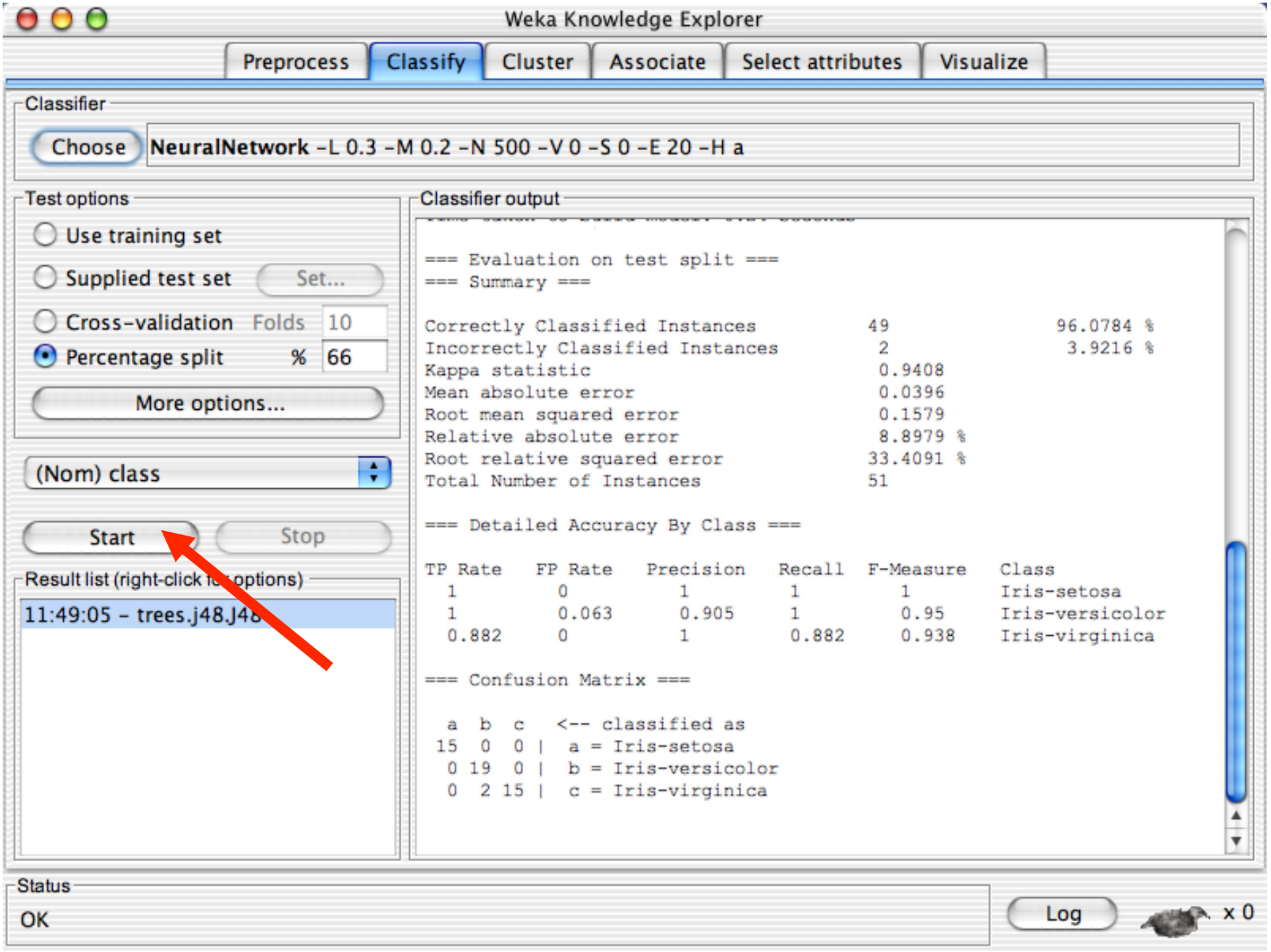

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More opti
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.J
Weka Classifier Visualize: 11:49:05 - trees.j48.J48 (iris)
X: petallength (Num)
Y: petalwidth (Num)
Colour: class (Nom)
Select Instance
Reset
Clear
Save
Jitter
Plot: iris_predicted
2.5
1.3
0.1
1.1
3.75
6.4
X
Y
Class colour
Iris-setosa Iris-versicolor Iris-virginica
96.0784 %
3.9216 %
ass
is-setosa
is-versicolor
is-virginica
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0

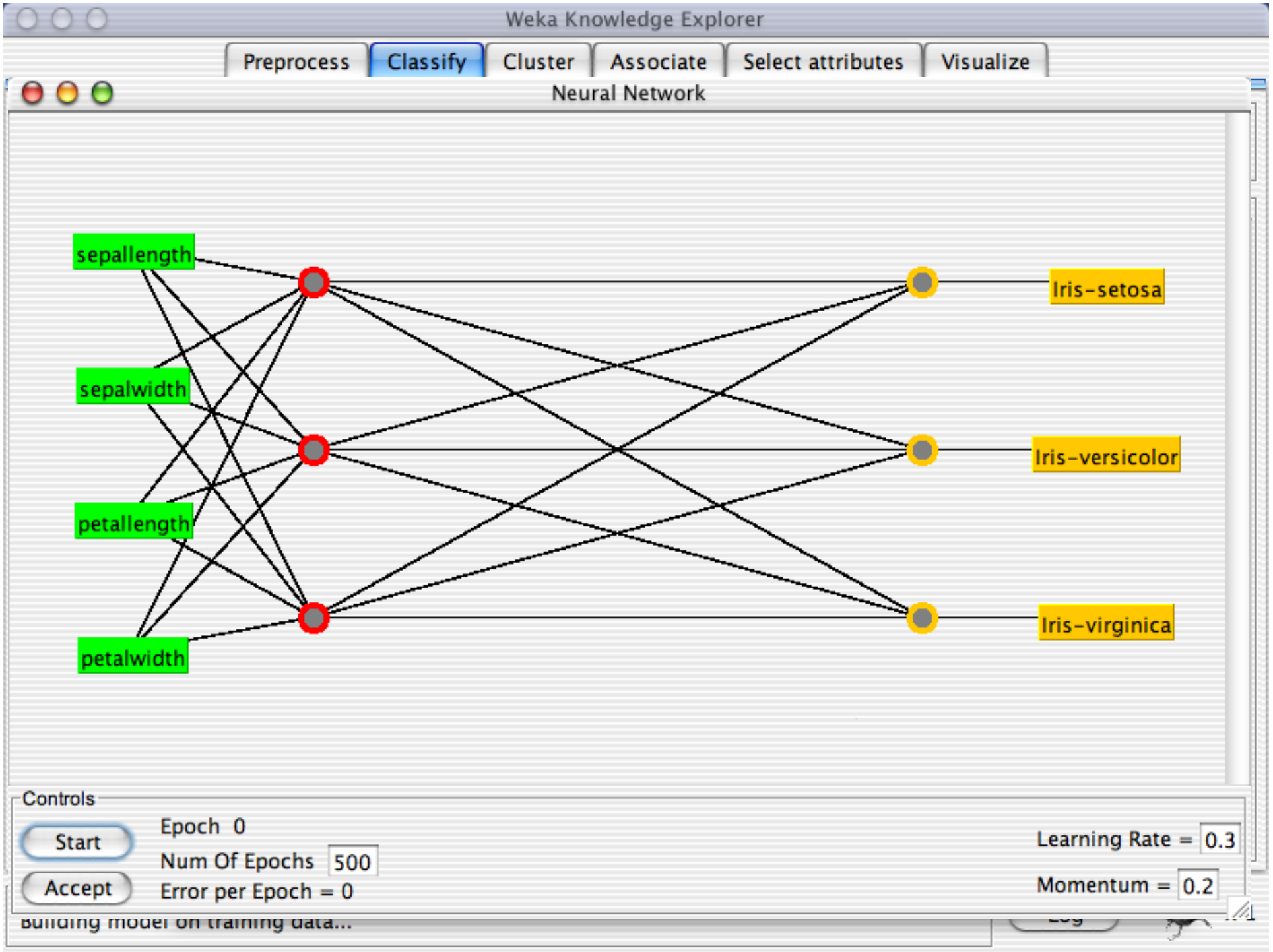

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

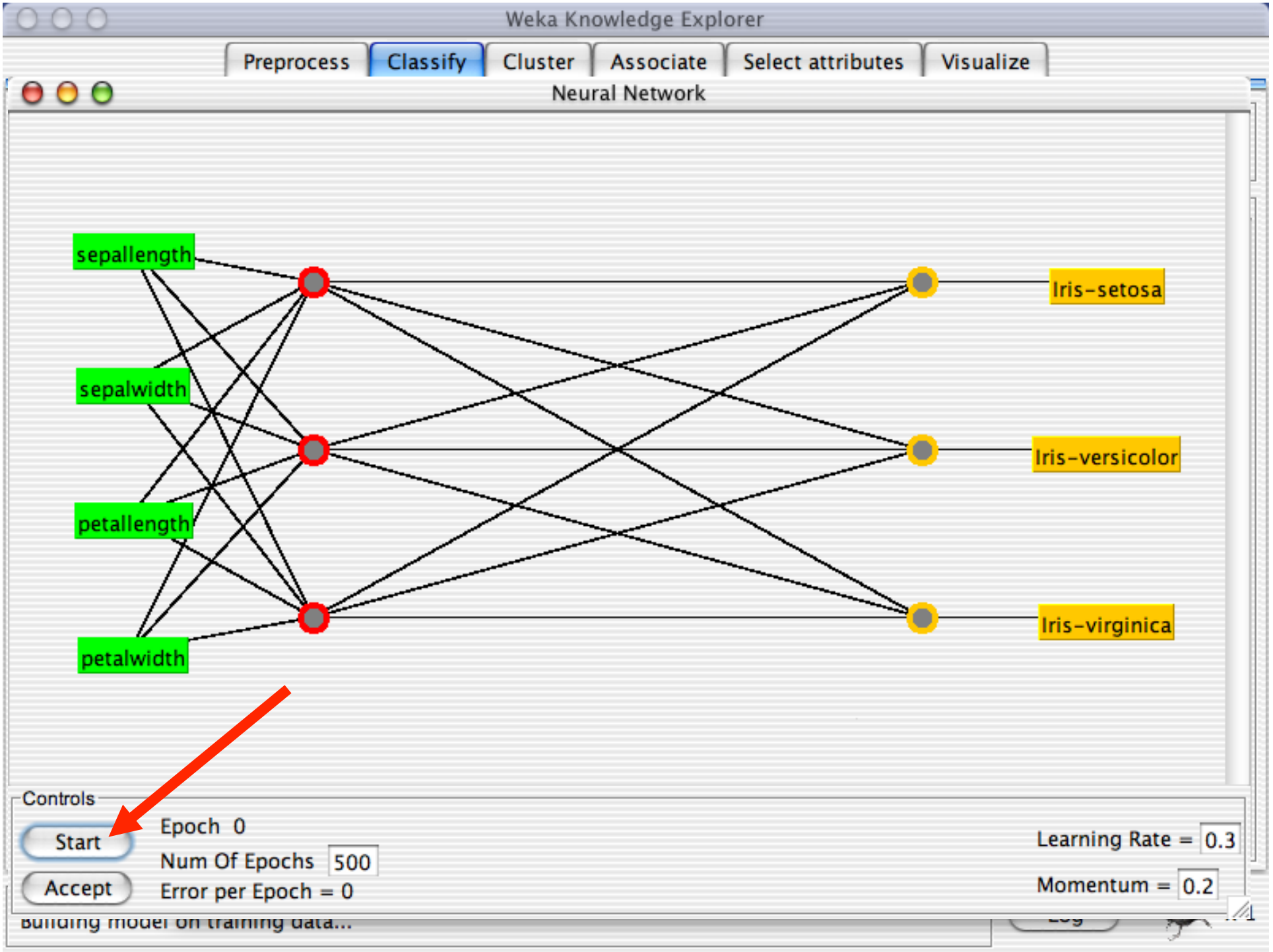

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
J48 -C 0.25 -M 2
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
Stop
Result list (right-click for options)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

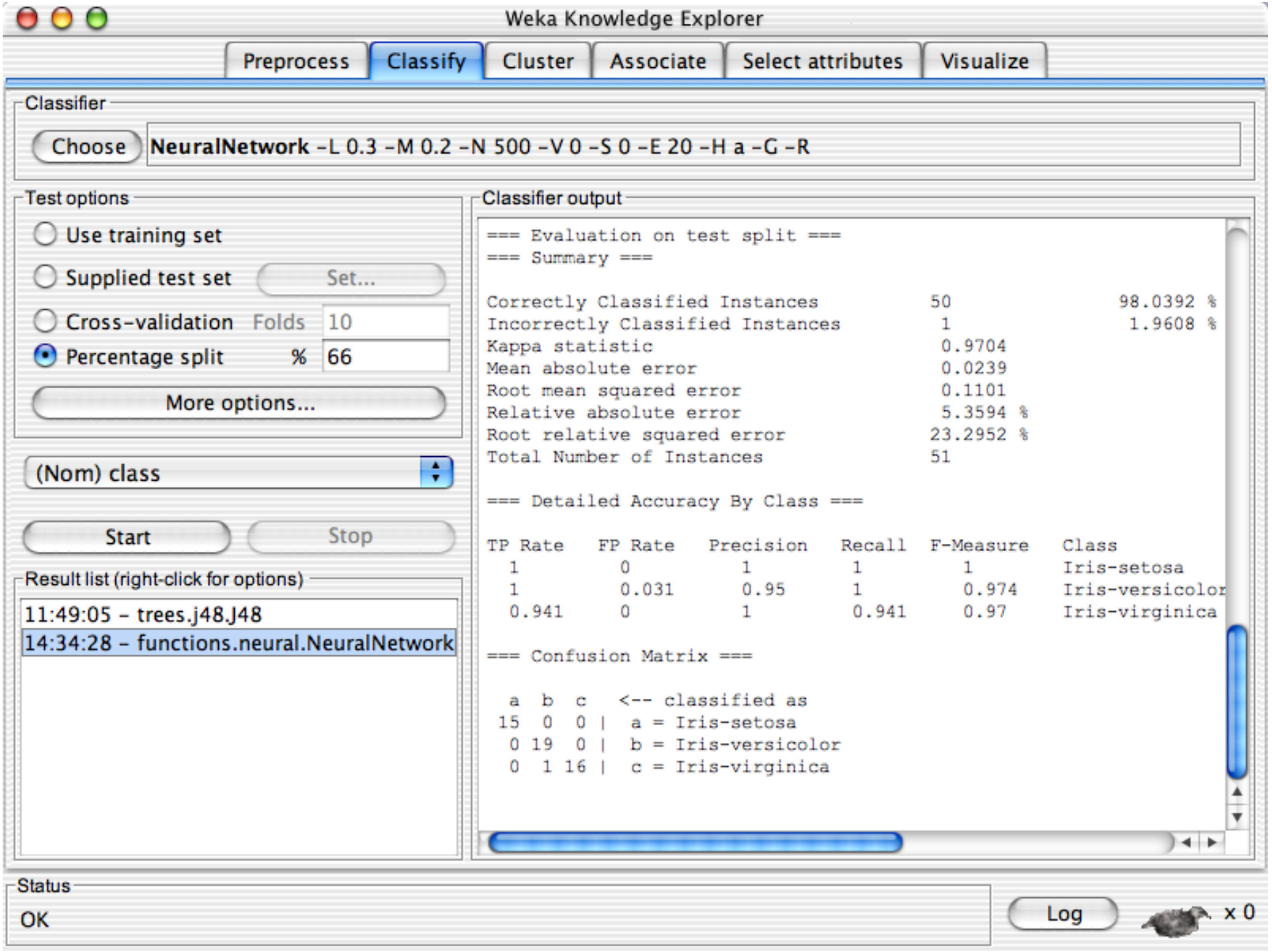

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
LeastMedSq
LinearRegression
Logistic
neural
NeuralNetwork
pace
supportVector
SimpleLinearRegression
SimpleLogistic
VotedPerceptron
Winnow
lazy
meta
misc
trees
rules
output
ken to build model: 0.24 seconds
luation on test split ===
mary ===
ly Classified Instances 49 96.0784 %
ctly Classified Instances 2 3.9216 %
statistic 0.9408
solute error 0.0396
an squared error 0.1579
e absolute error 8.8979 %
lative squared error 33.4091 %
Number of Instances 51
ailed Accuracy By Class ===
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
fusion Matrix ===
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

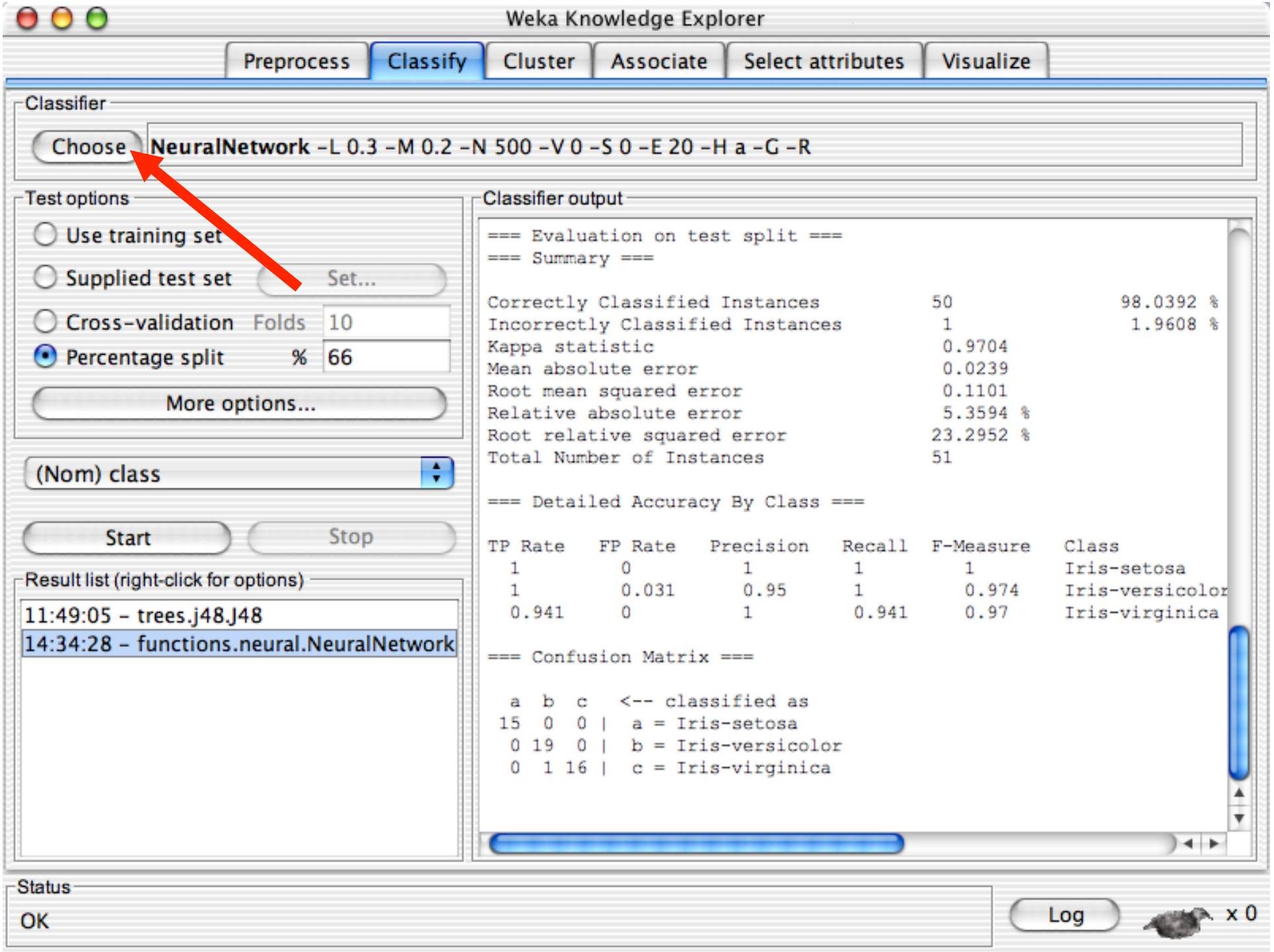

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
NeuralNetwork -L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Nom) class
Start
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 %
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
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
Building model on training data...


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
Building model on training data...


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
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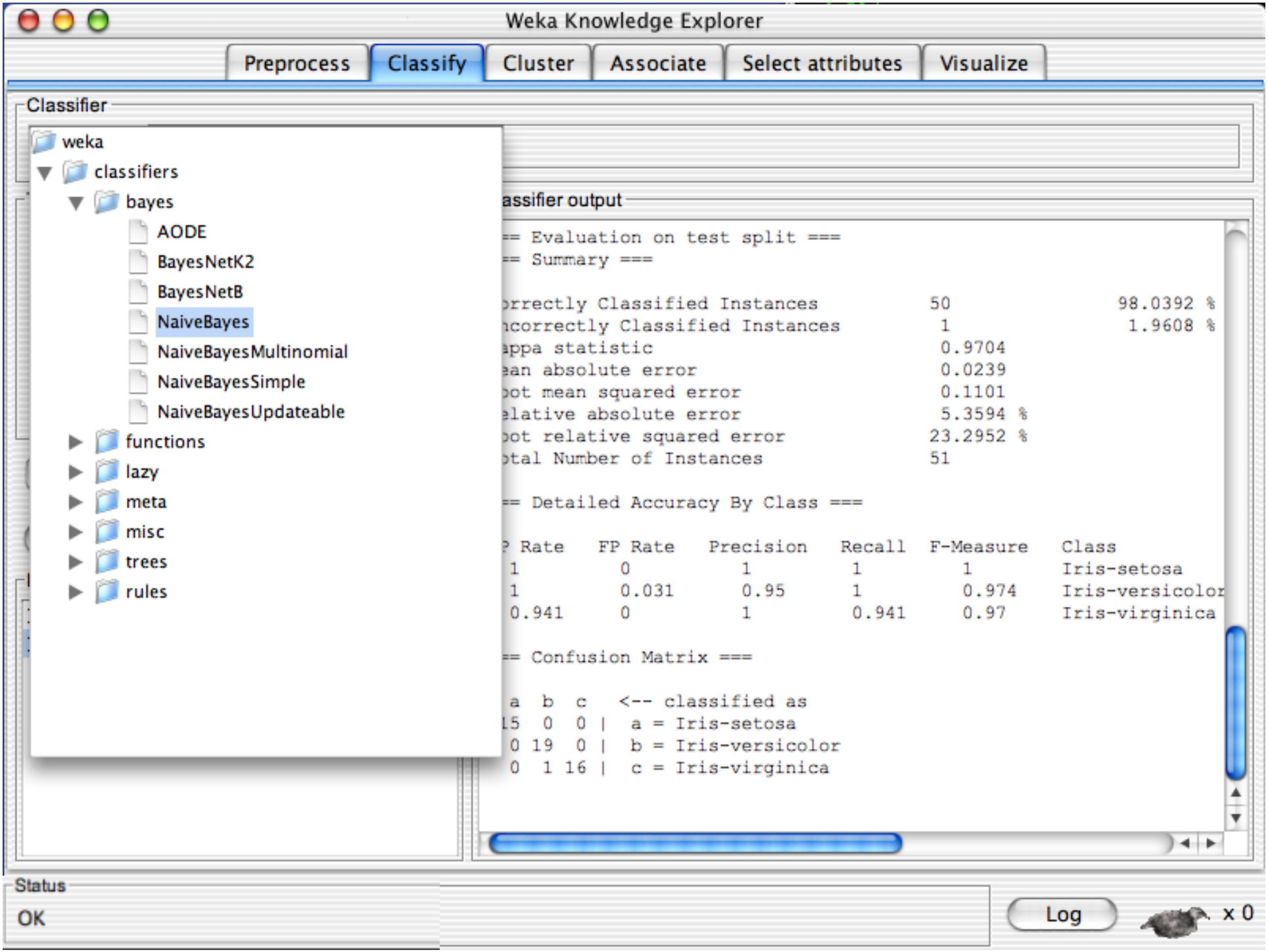
1 0.031 0.95 1 0.974 Iris-versicolor
0.941 0 1 0.941 0.97 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 1 16 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
AODE
BayesNetK2
BayesNetB
NaiveBayes
NaiveBayesMultinomial
NaiveBayesSimple
NaiveBayesUpdateable
functions
lazy
meta
misc
trees
rules
assifier output
== Evaluation on test split ===
== Summary ===
orrectly Classified Instances 50 98.0392 %
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a b c <-- classified as
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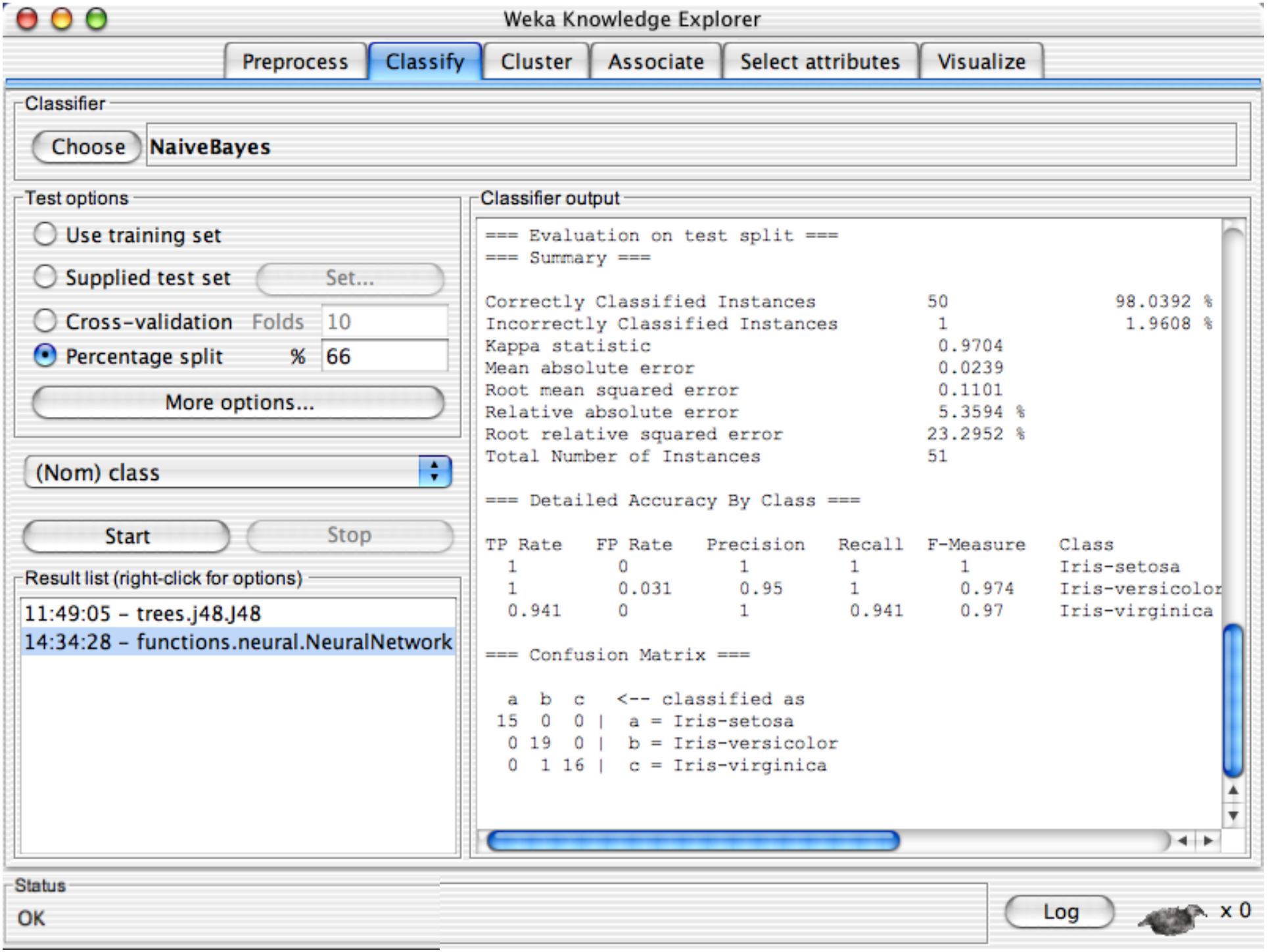
0 19 0 | b = Iris-versicolor
0 1 16 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
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
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Root relative squared error 23.2952 %
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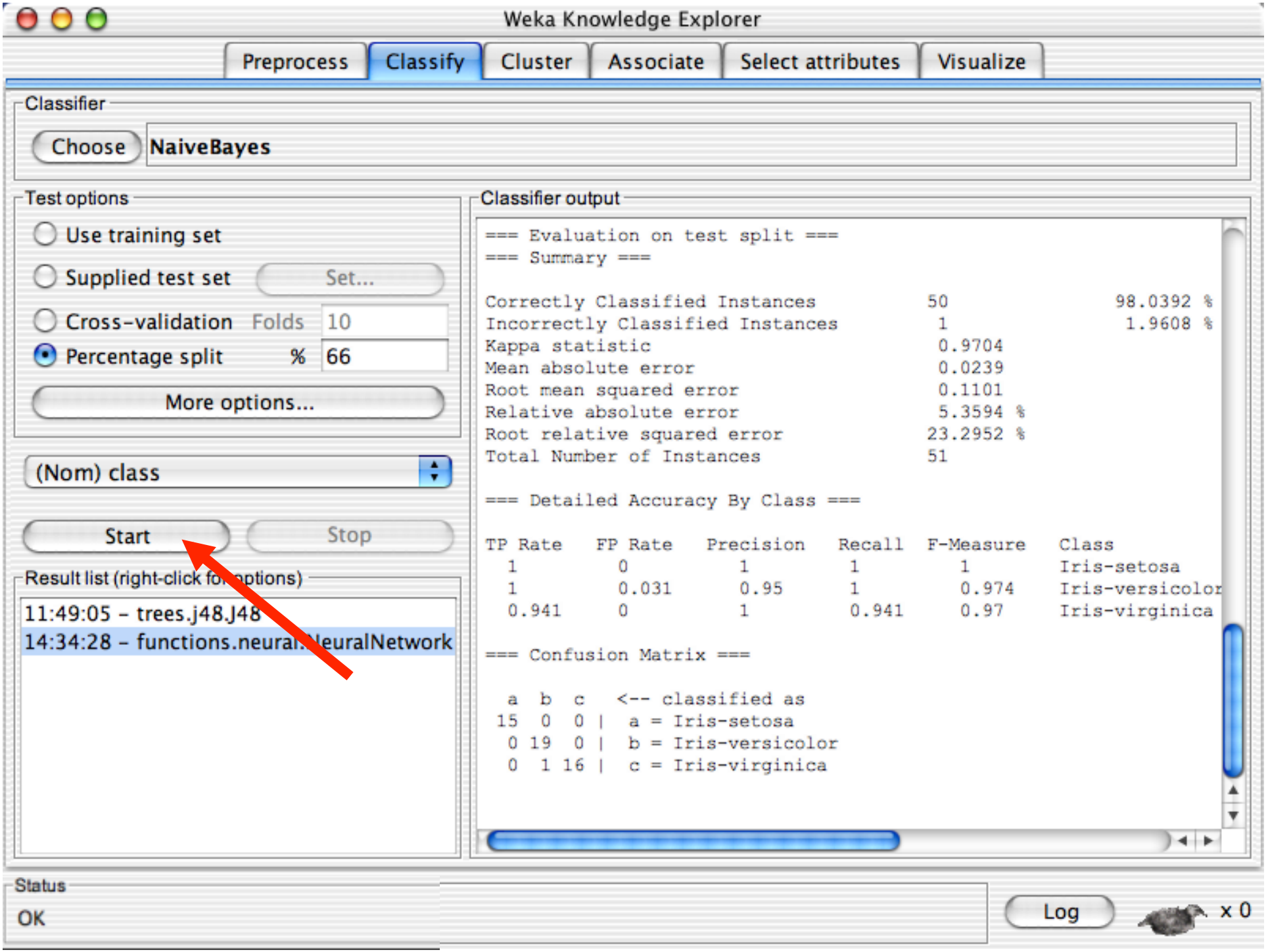
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 1 16 | c = Iris-virginica
Status
OK
Log
x 0


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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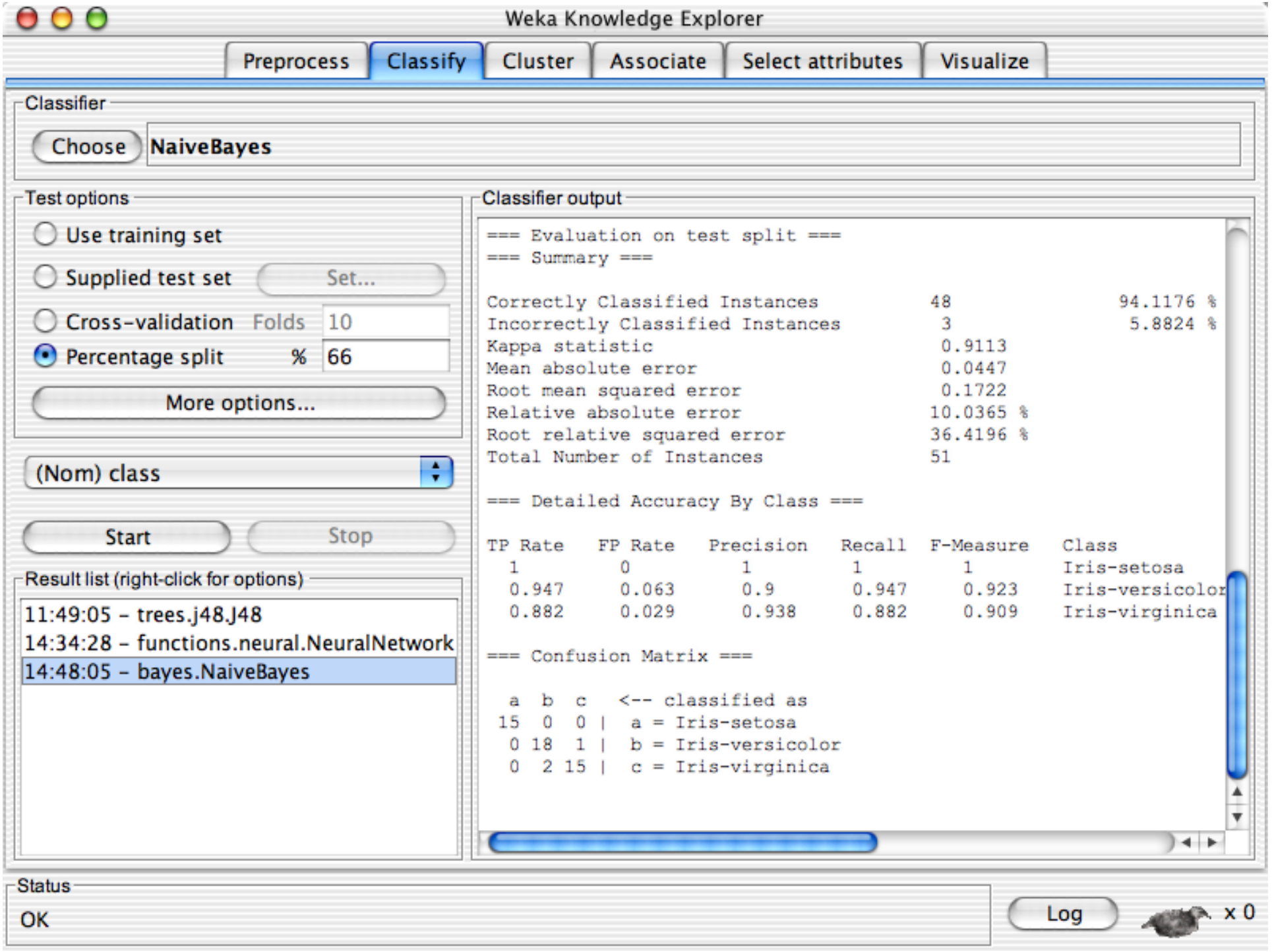
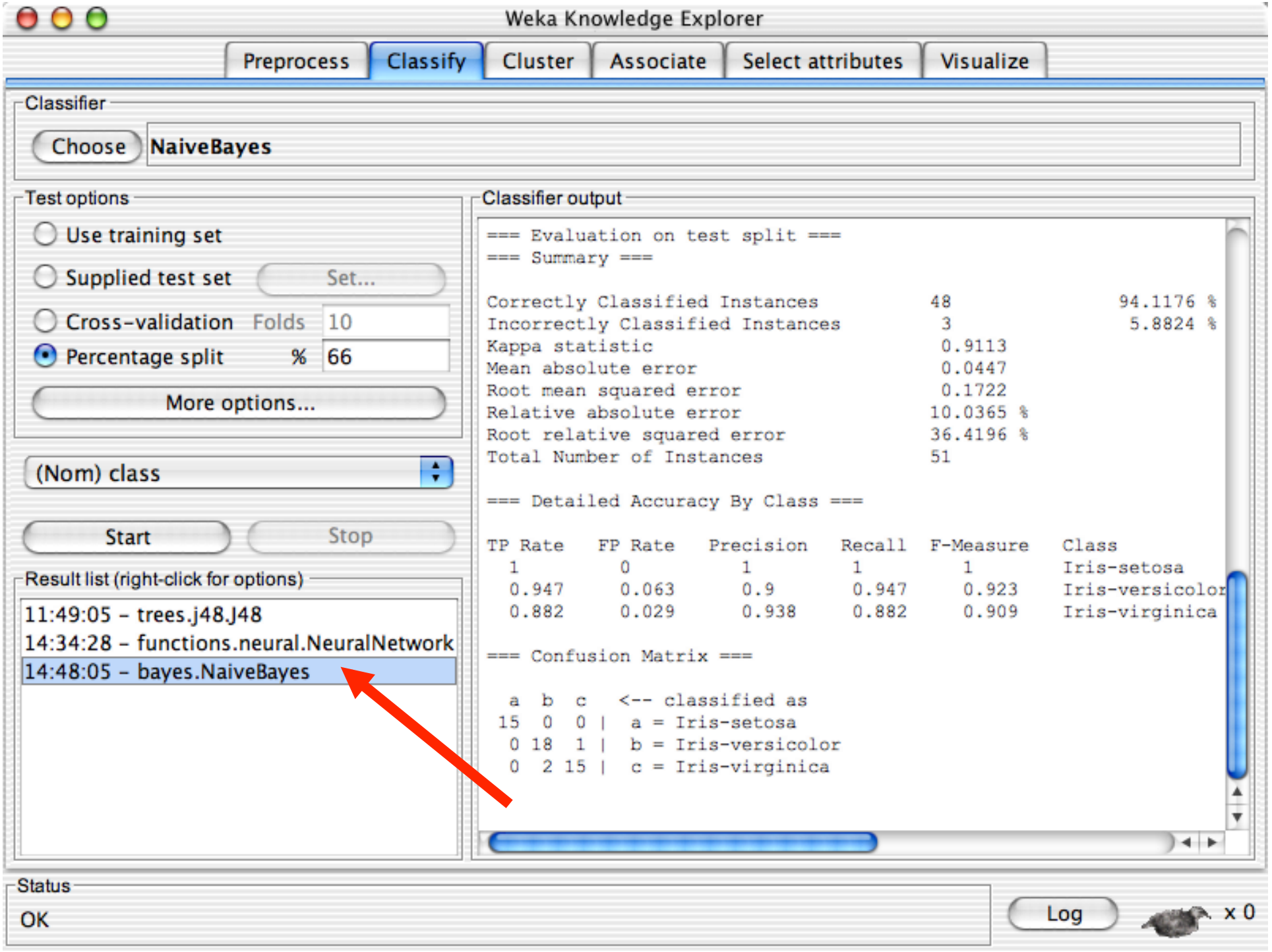
0 19 0 | b = Iris-versicolor
0 1 16 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
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
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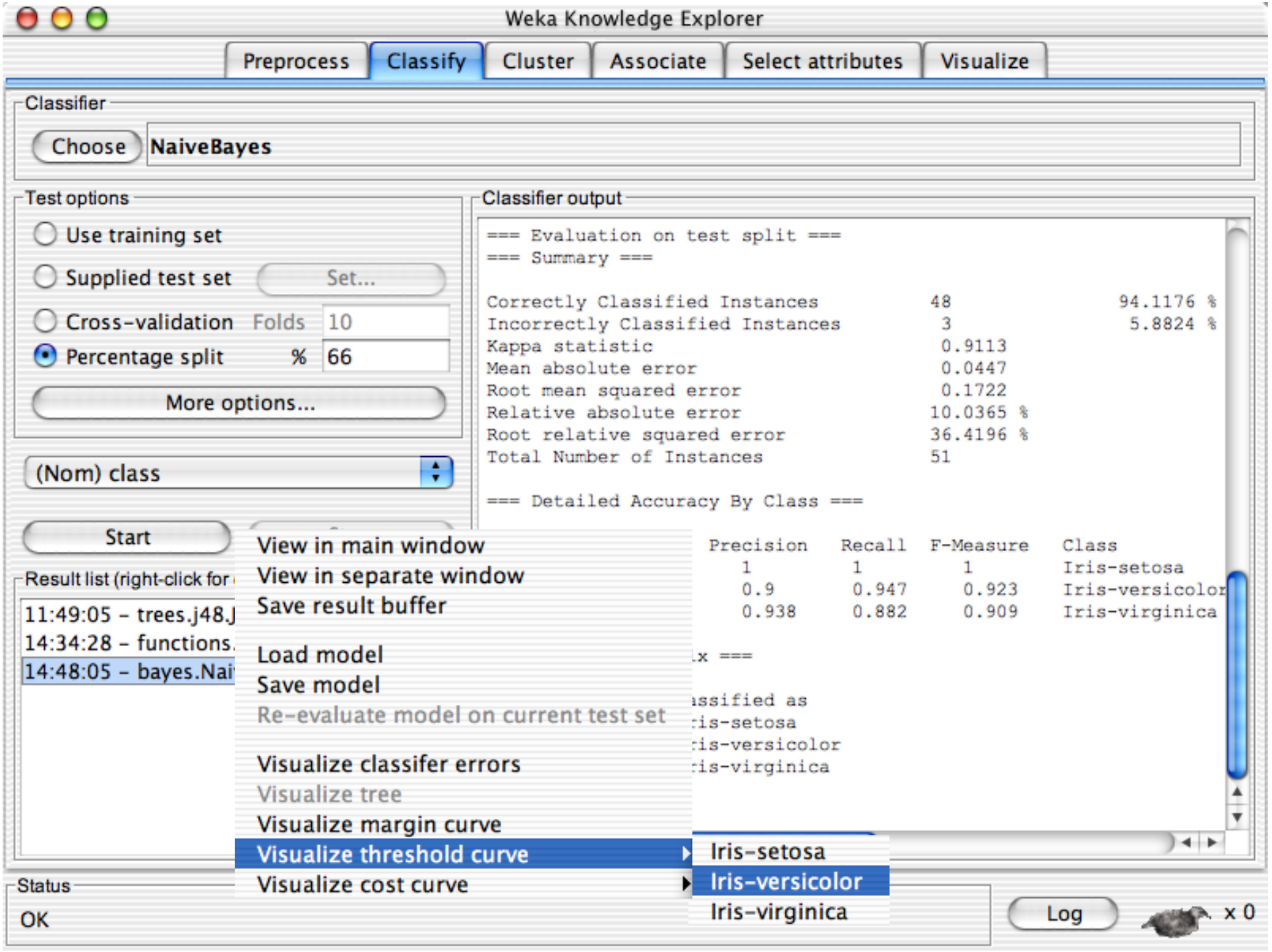
0.947 0.063 0.9 0.947 0.923 Iris-versicolor
0.882 0.029 0.938 0.882 0.909 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


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...
Classifier output
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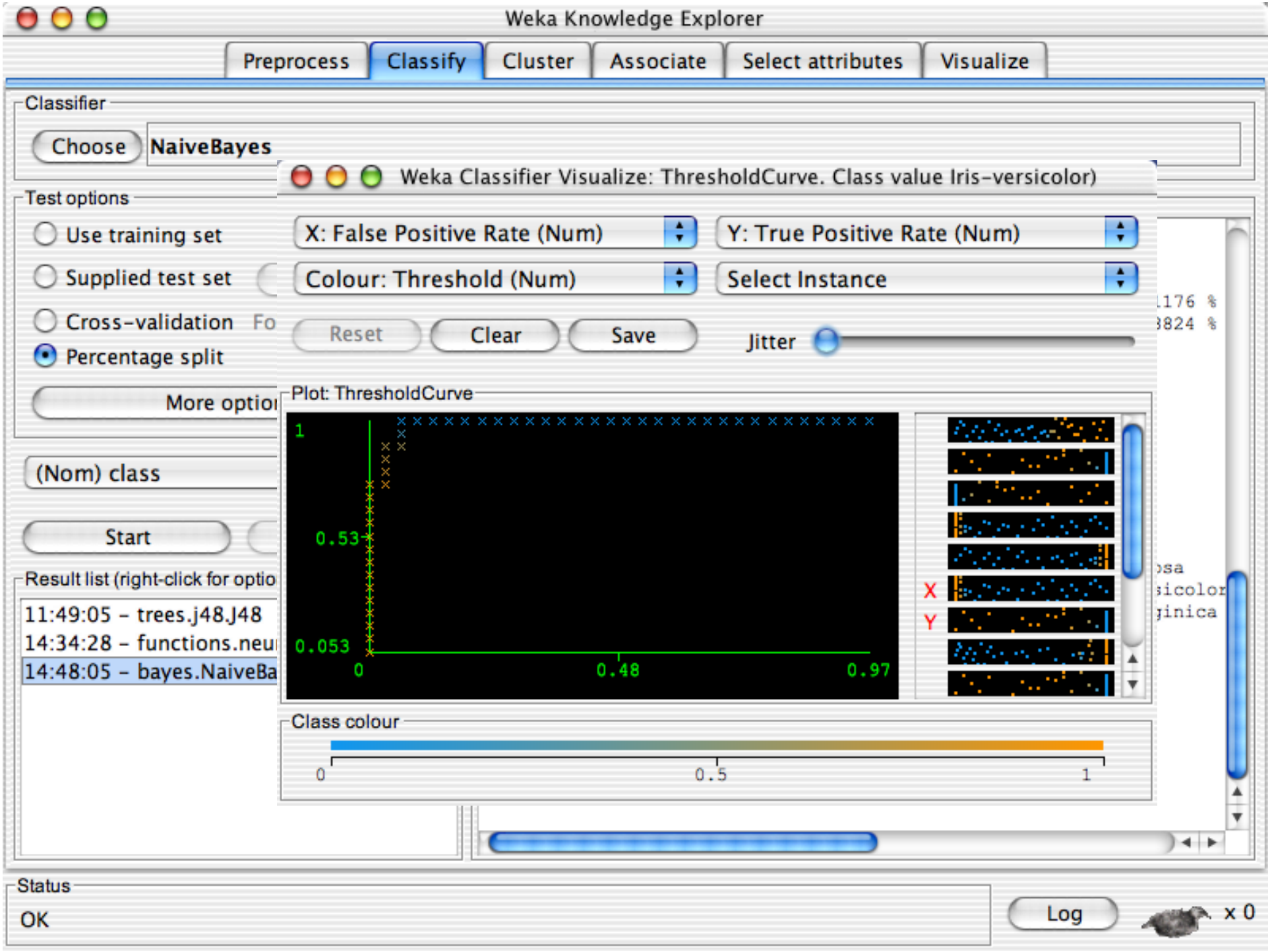
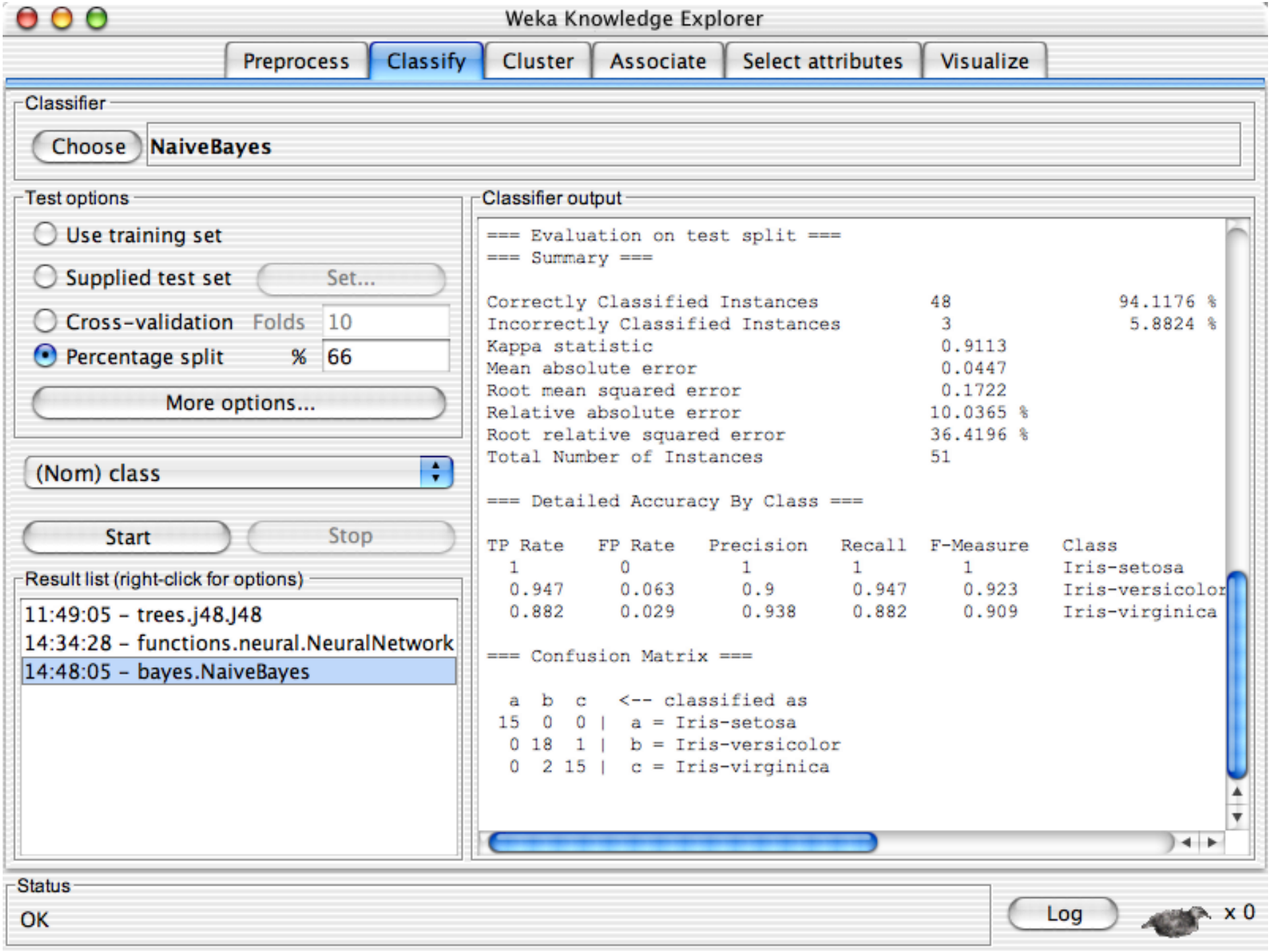
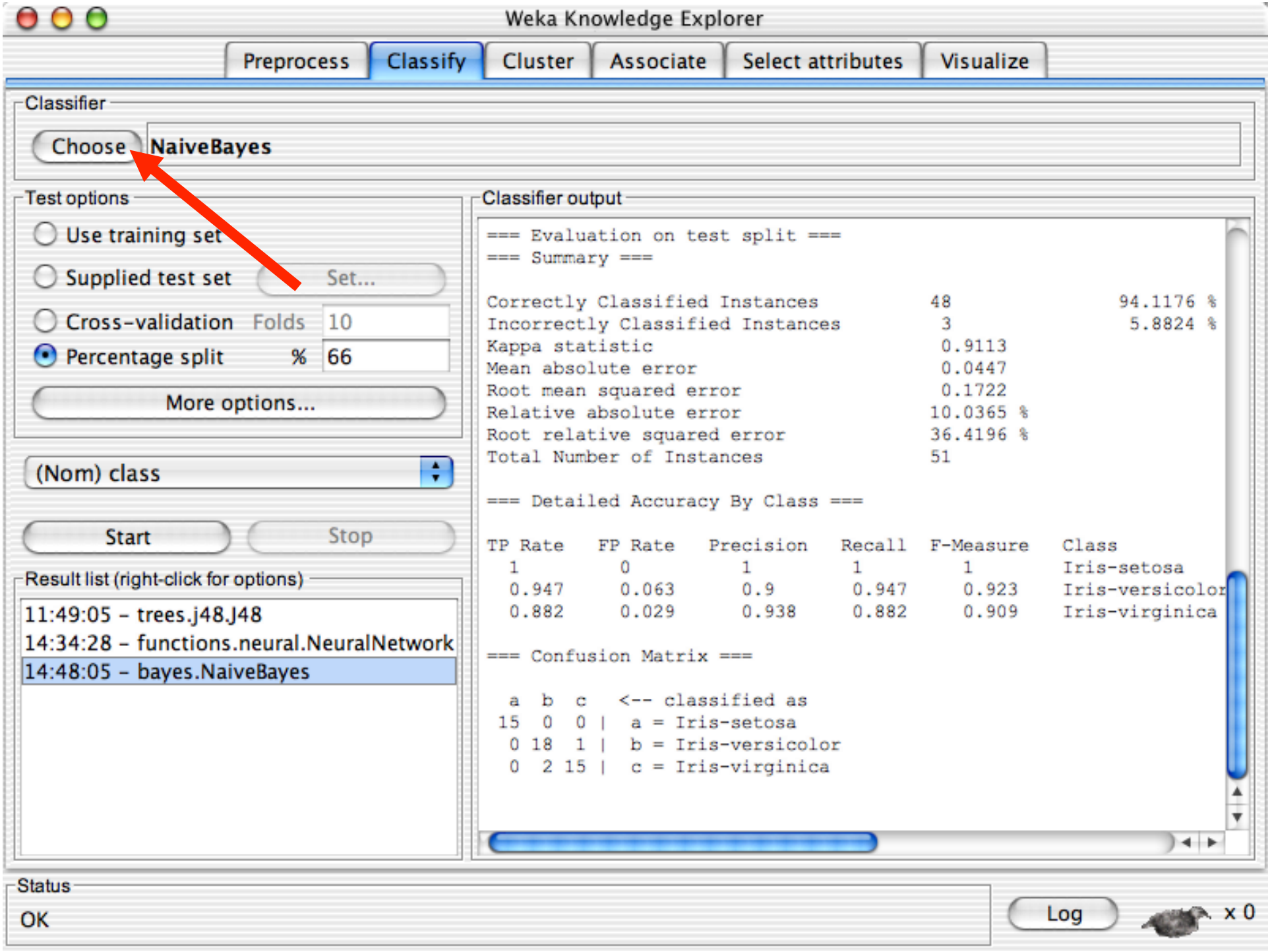
Precision Recall F-Measure Class
1 1 1 Iris-setosa
0.9 0.947 0.923 Iris-versicolor
0.938 0.882 0.909 Iris-virginica
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.J
14:34:28 - functions.
14:48:05 - bayes.Nai
View in main window
View in separate window
Save result buffer
Load model
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
Weka Classifier Visualize: ThresholdCurve. Class value Iris-versicolor)
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More optio
X: False Positive Rate (Num)
Y: True Positive Rate (Num)
Colour: Threshold (Num)
Select Instance
Reset
Clear
Save
Jitter
Plot: ThresholdCurve
1
0.53
0.053
0
0.48
0.97
X
Y
(Nom) class
Start
Result list (right-click for optio
11:49:05 - trees.j48.J48
14:34:28 - functions.neu
14:48:05 - bayes.NaiveBa
Class colour
0
0.5
1
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
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
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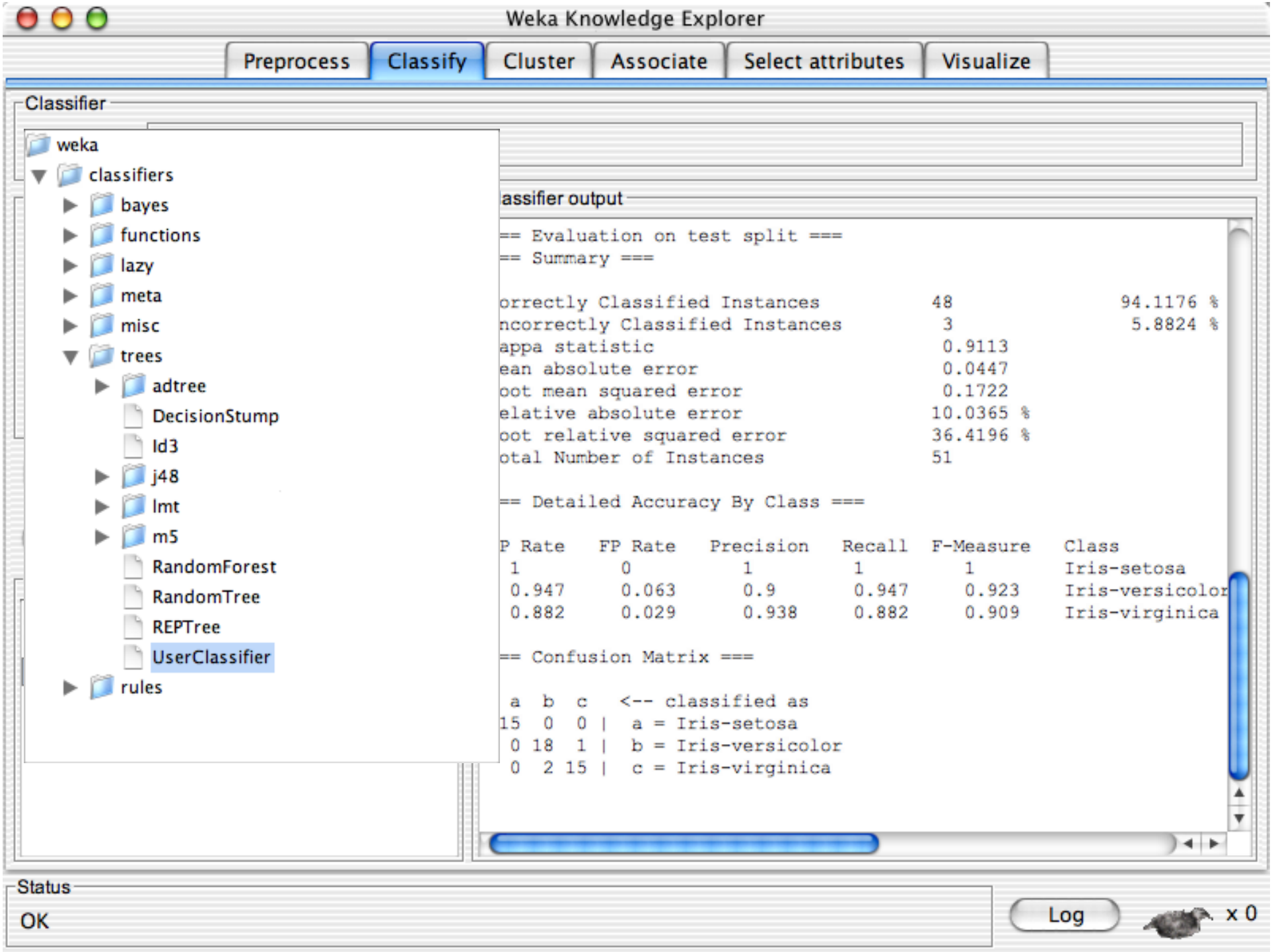
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
lazy
meta
misc
trees
adtree
DecisionStump
Id3
j48
lmt
m5
RandomForest
RandomTree
REPTree
UserClassifier
rules
assifier output
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== Summary ===
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0.947 0.063 0.9 0.947 0.923 Iris-versicolor
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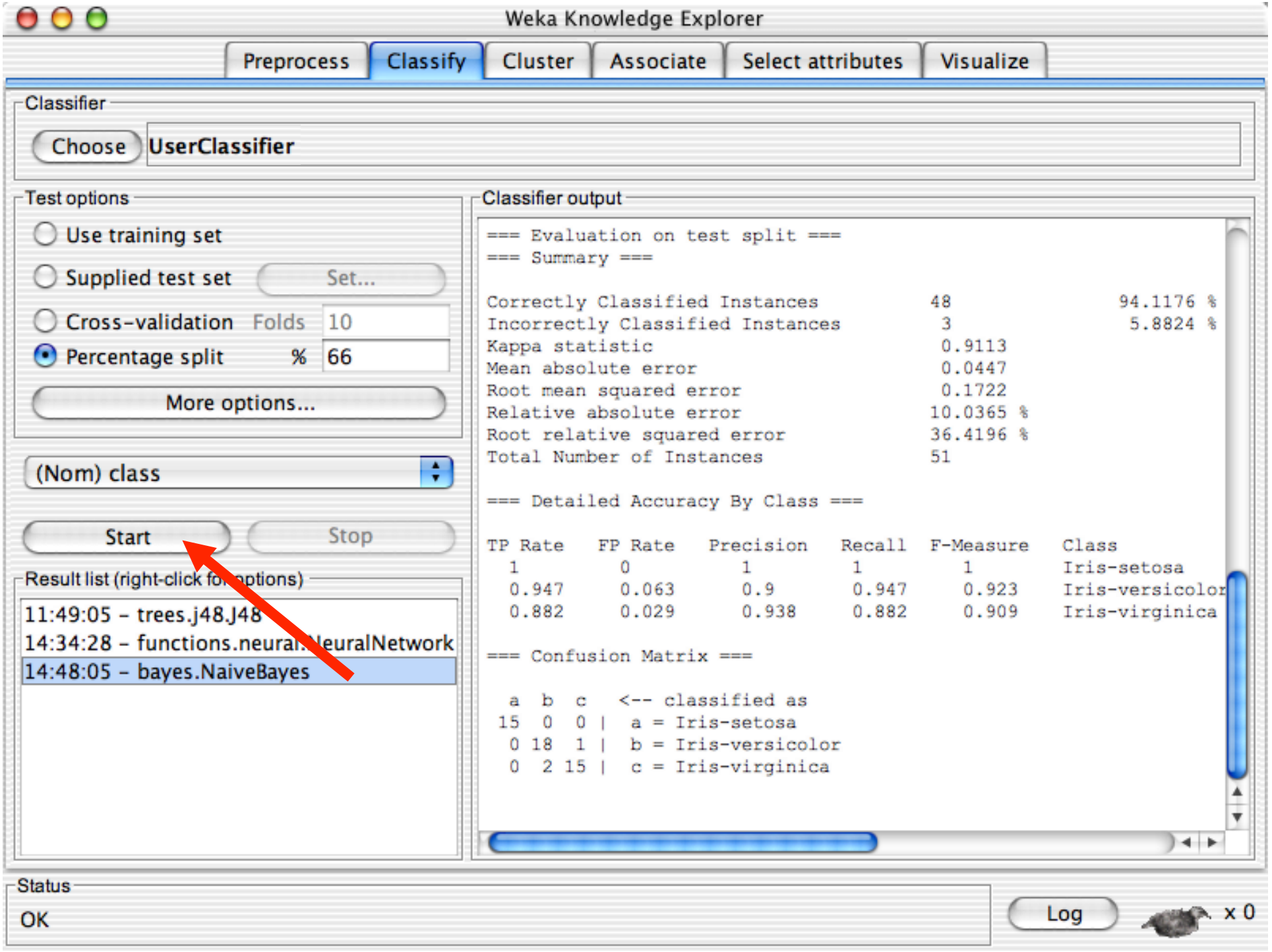
== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
UserClassifier
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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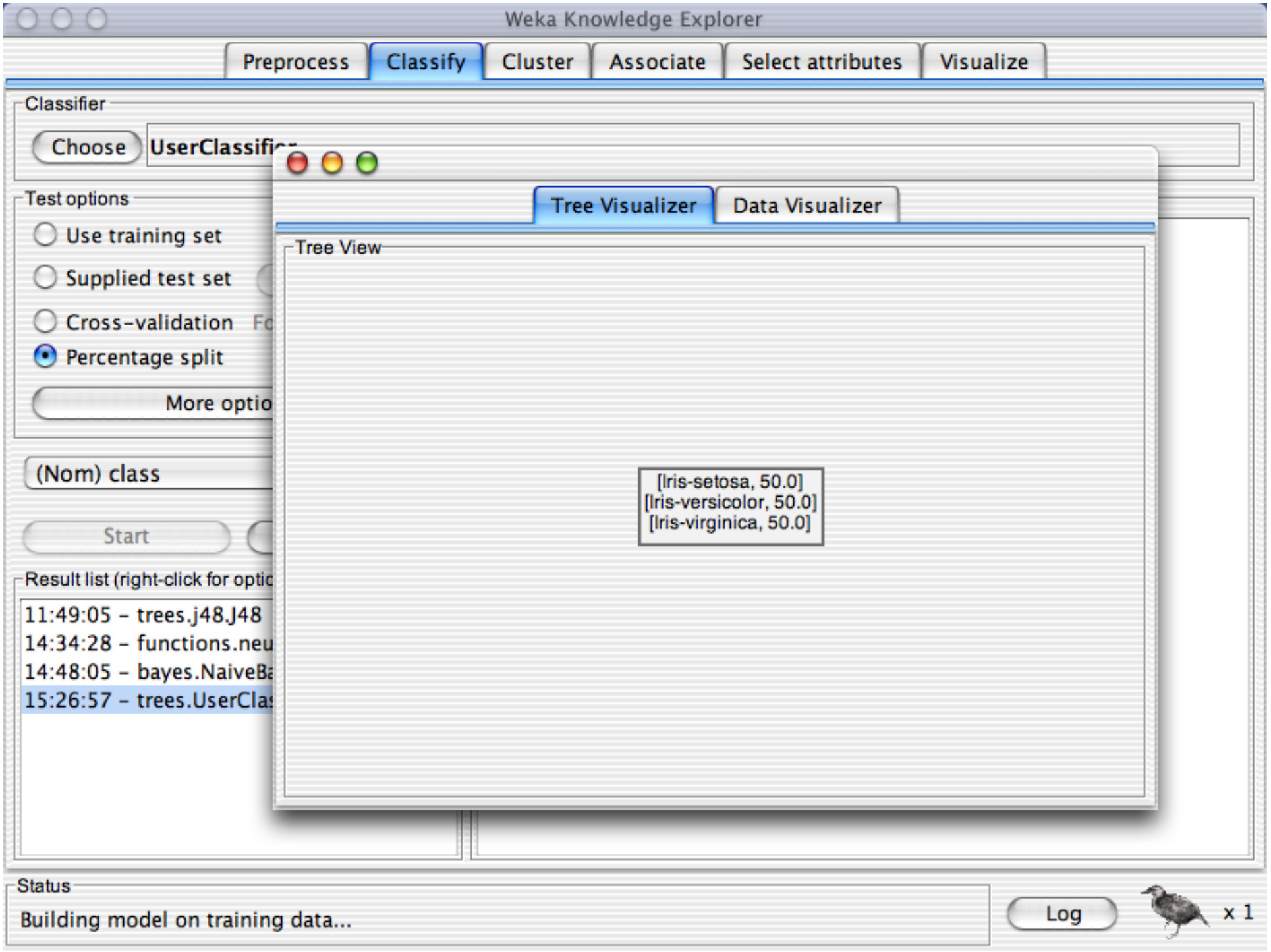
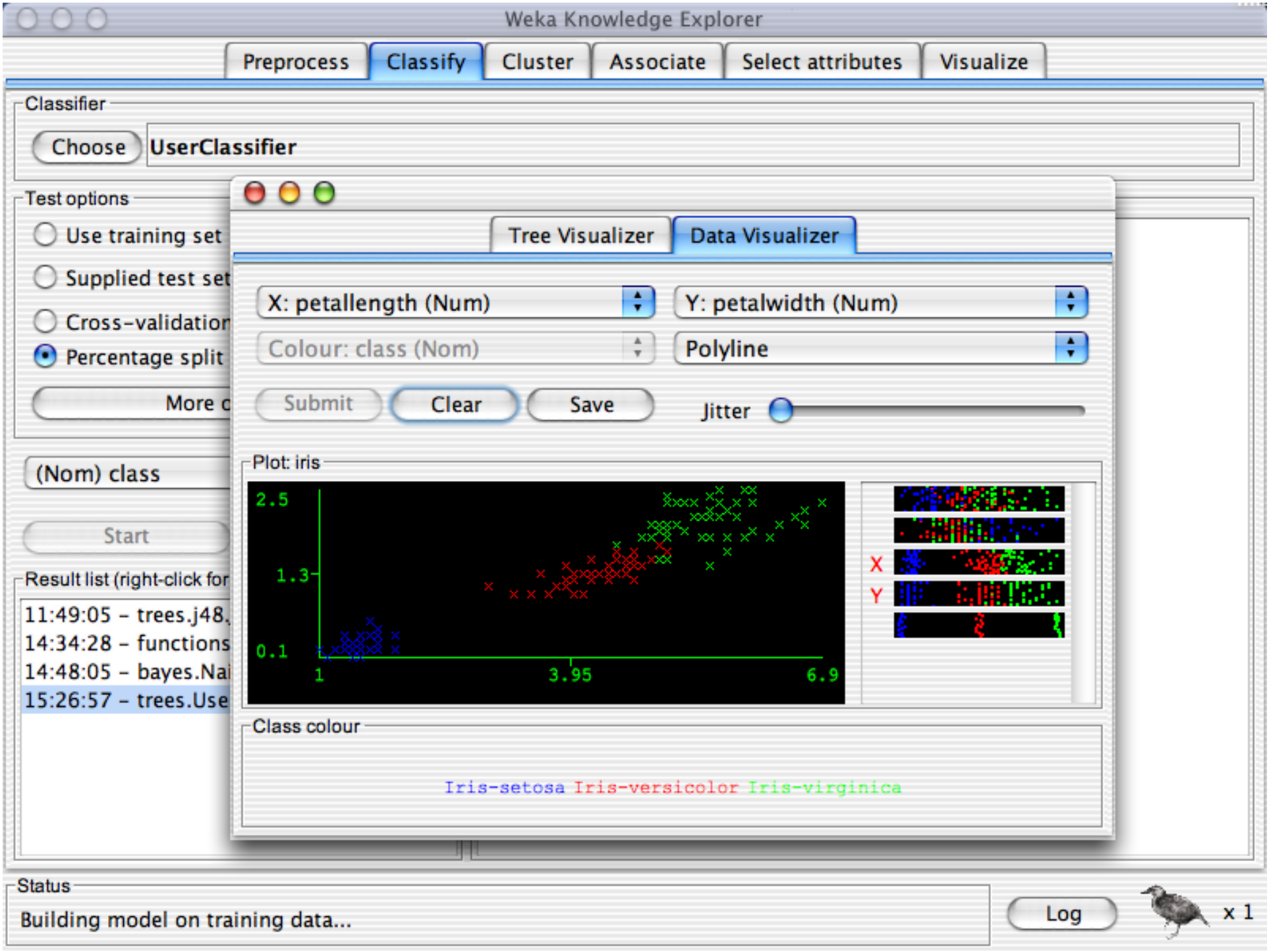
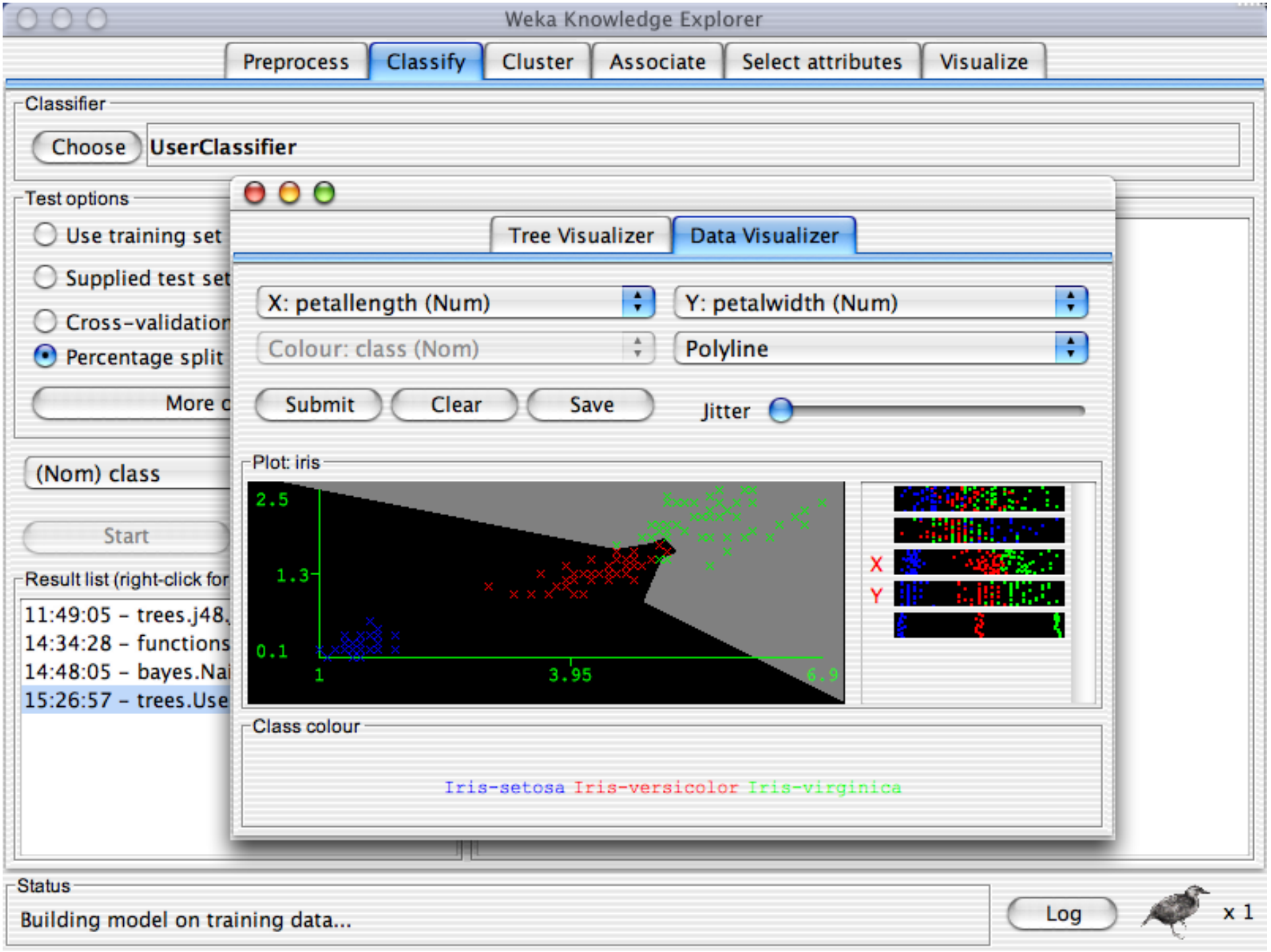
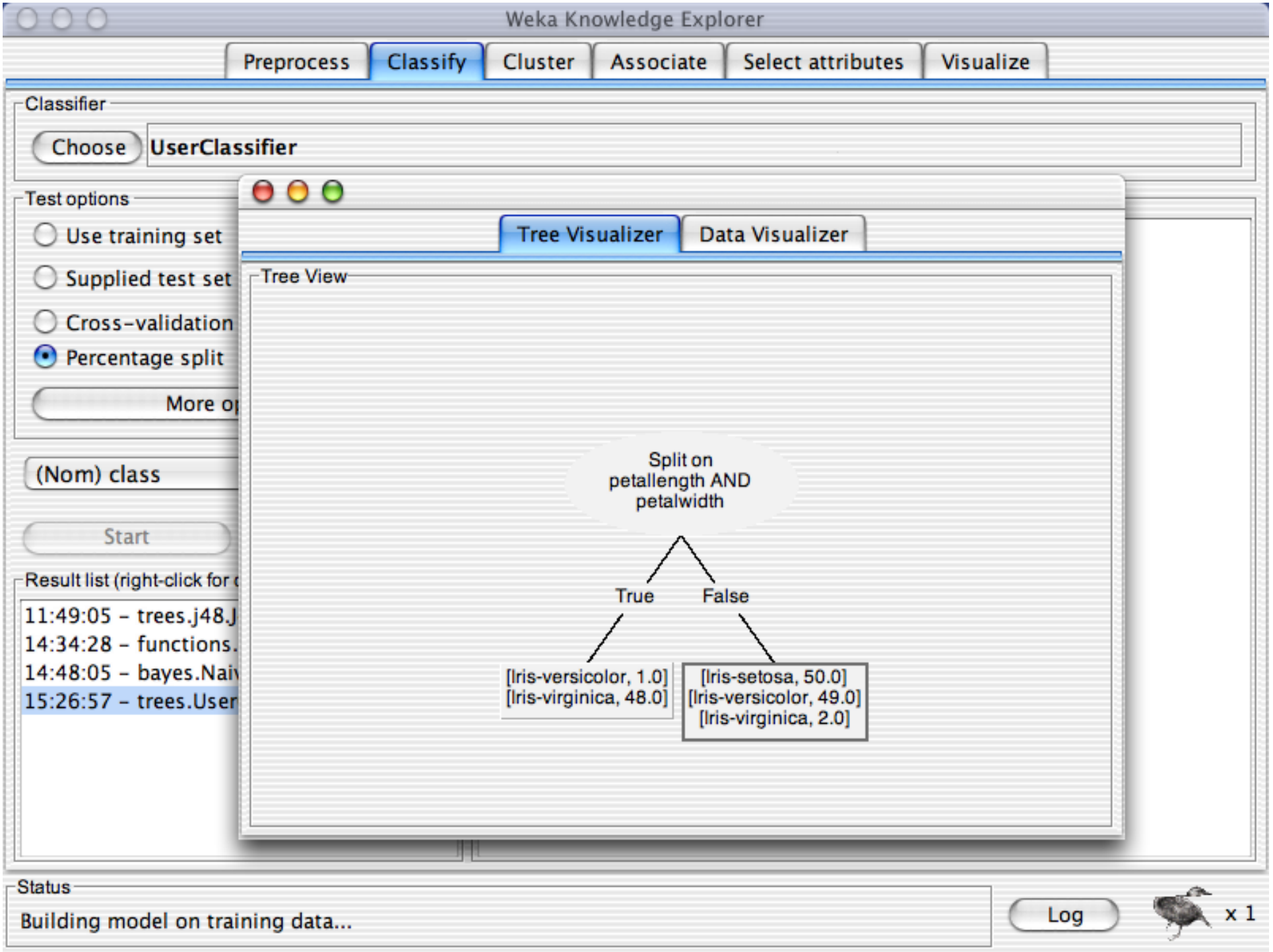
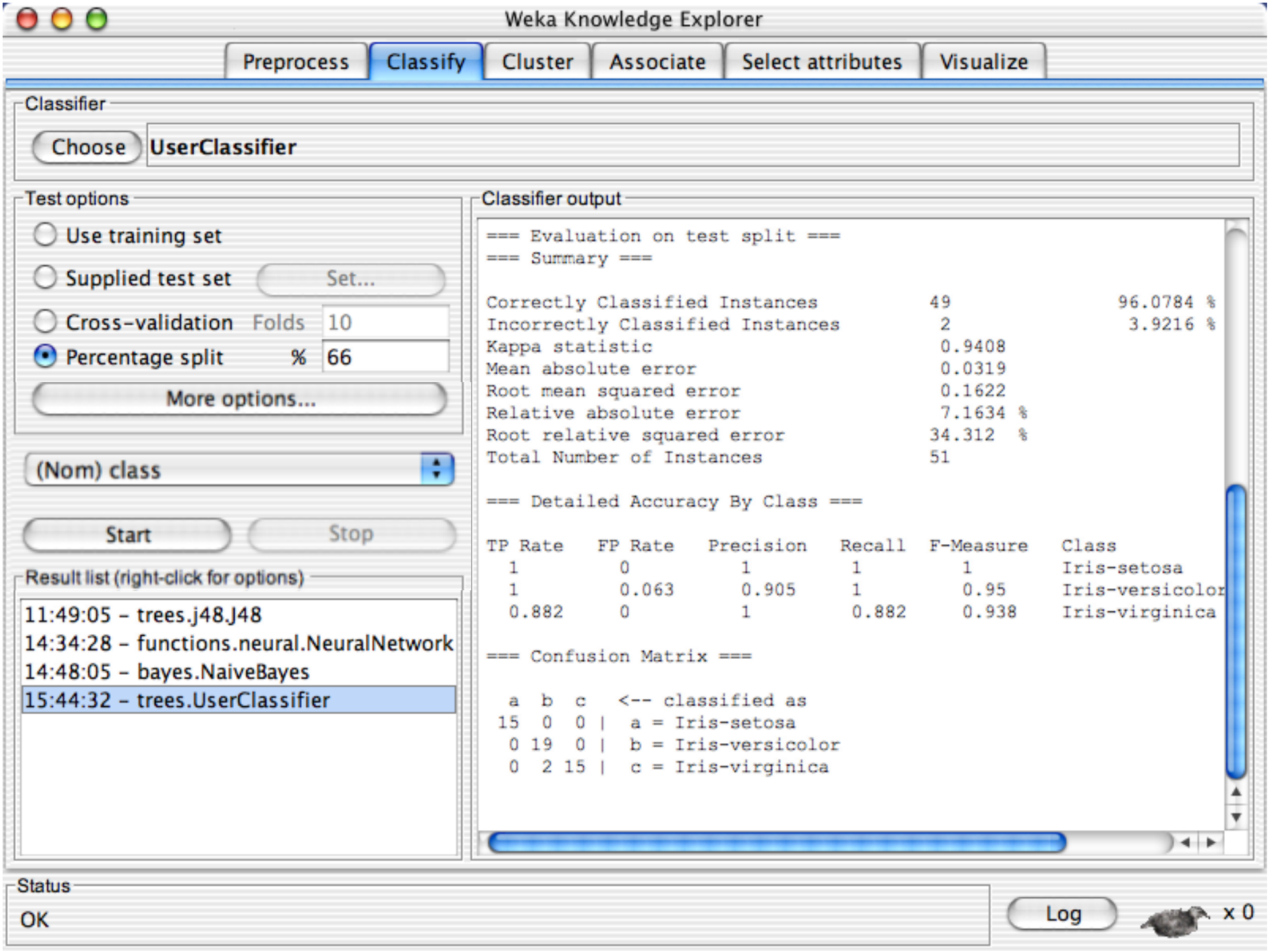
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 18 1 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0

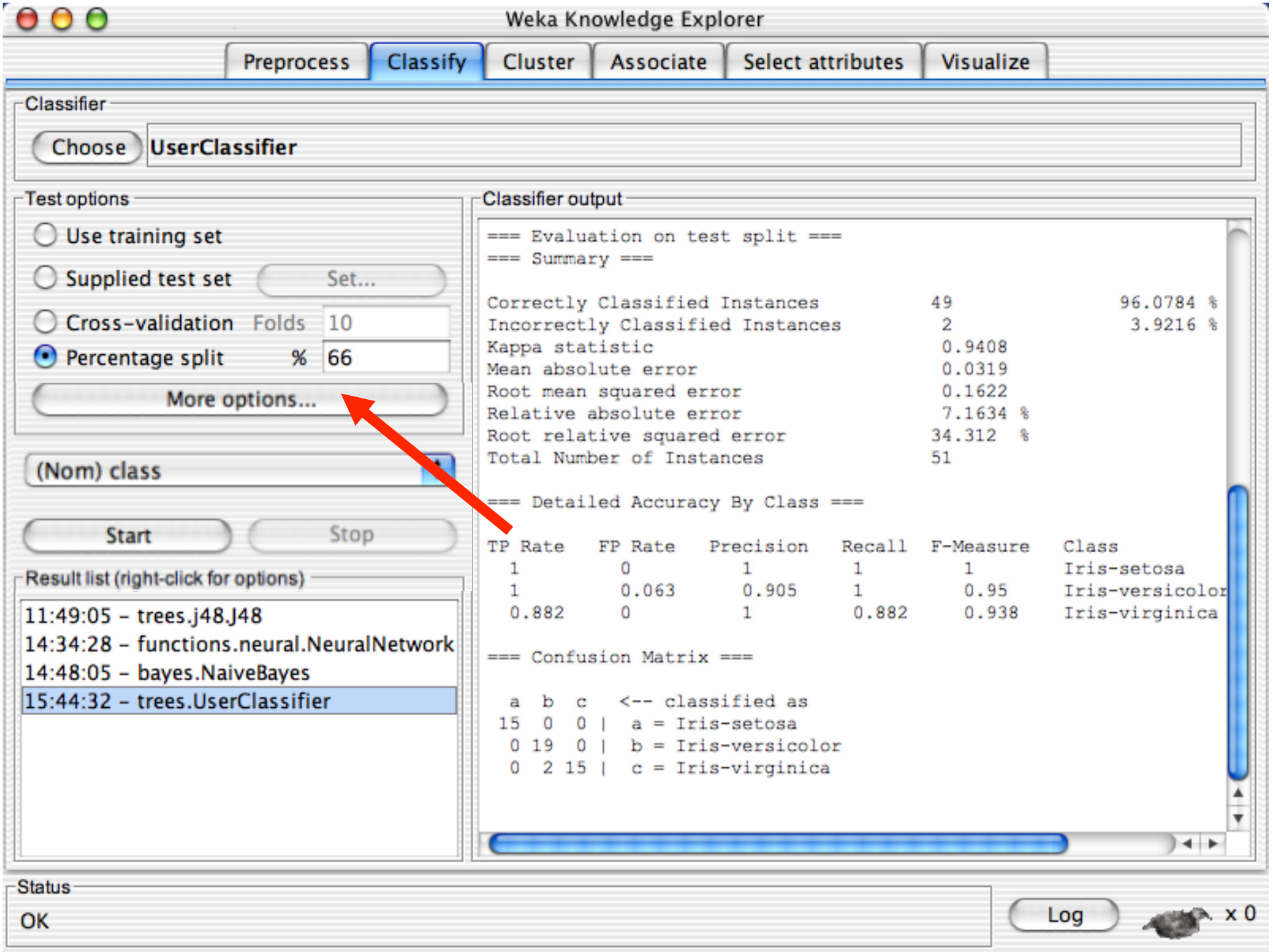

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More optio
(Nom) class
Start
Result list (right-click for optic
11:49:05 - trees.j48.J48
14:34:28 - functions.neu
14:48:05 - bayes.NaiveBa
15:26:57 - trees.UserCla
Tree Visualizer
Data Visualizer
Tree View
[Iris-setosa, 50.0]
[Iris-versicolor, 50.0]
[Iris-virginica, 50.0]
Status
Building model on training data...
Log
x 1


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
UserClassifier
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More c
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.
14:34:28 - functions
14:48:05 - bayes.Nai
15:26:57 - trees.Use
Tree Visualizer
Data Visualizer
X: petallength (Num)
Y: petalwidth (Num)
Colour: class (Nom)
Polyline
Submit
Clear
Save
Jitter
Plot: iris
2.5
1.3
0.1
1
3.95
6.9
X
Y
Class colour
Iris-setosa Iris-versicolor Iris-virginica
Status
Building model on training data...
Log
x 1


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
UserClassifier
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More c
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.
14:34:28 - functions
14:48:05 - bayes.Nai
15:26:57 - trees.Use
Tree Visualizer
Data Visualizer
X: petallength (Num)
Y: petalwidth (Num)
Colour: class (Nom)
Polyline
Submit
Clear
Save
Jitter
Plot: iris
2.5
1.3
0.1
1
3.95
6.9
X
Y
Class colour
Iris-setosa Iris-versicolor Iris-virginica
Status
Building model on training data...
Log
x 1


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
UserClassifier
Test options
Use training set
Supplied test set
Cross-validation
Percentage split
More o
(Nom) class
Start
Result list (right-click for
11:49:05 - trees.j48.J
14:34:28 - functions.
14:48:05 - bayes.Naiv
15:26:57 - trees.User
Tree Visualizer
Data Visualizer
Tree View
Split on
petallength AND
petalwidth
True
False
[Iris-versicolor, 1.0]
[Iris-virginica, 48.0]
[Iris-setosa, 50.0]
[Iris-versicolor, 49.0]
[Iris-virginica, 2.0]
Status
Building model on training data...
Log
x 1


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
UserClassifier
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
15:44:32 - trees.UserClassifier
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 0.0319
Root mean squared error 0.1622
Relative absolute error 7.1634 %
Root relative squared error 34.312 %
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
UserClassifier
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
15:44:32 - trees.UserClassifier
Classifier output
=== Evaluation on test split ===
=== Summary ===
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Total Number of Instances 51
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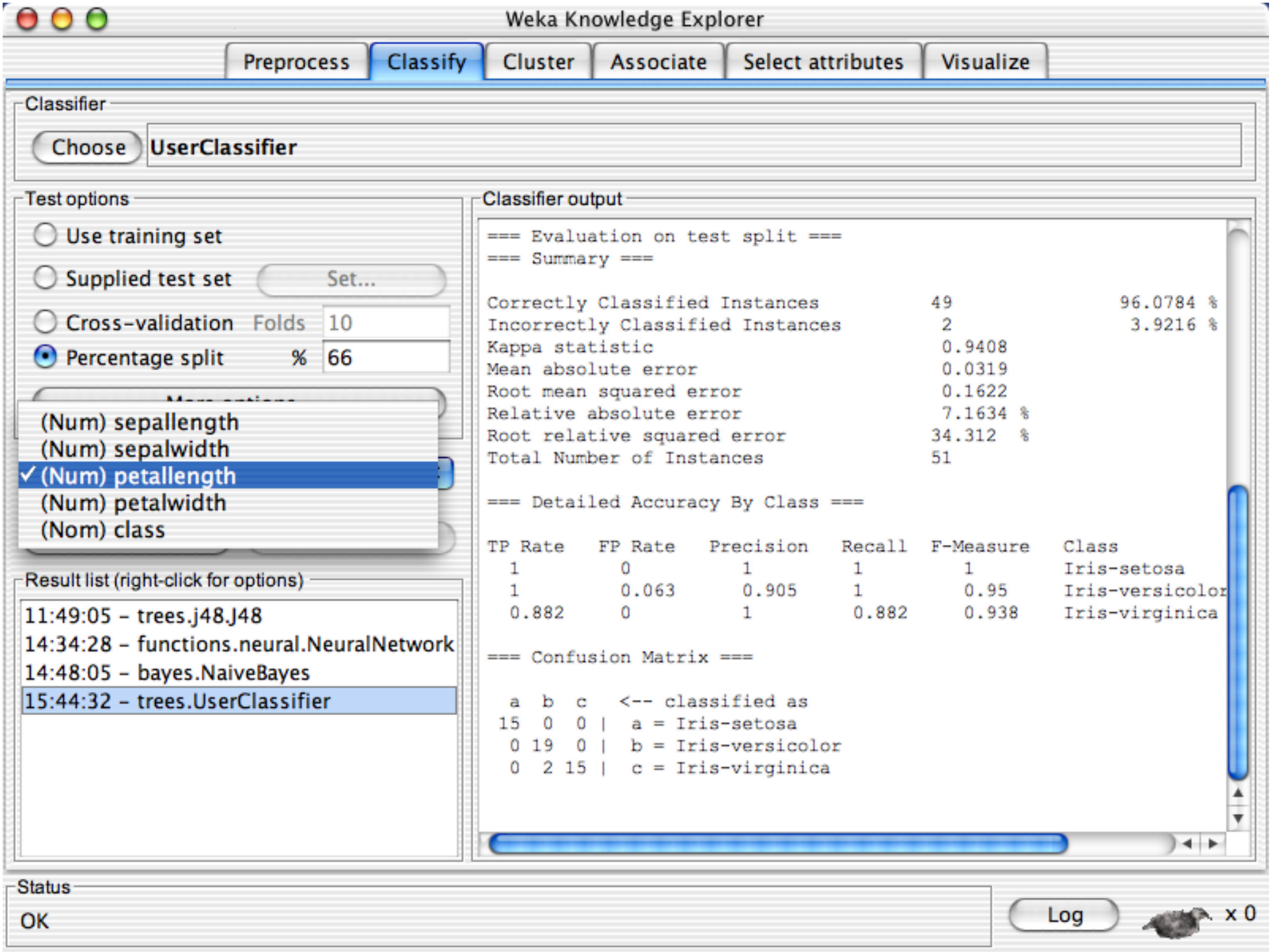
1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
UserClassifier
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
(Num) sepallength
(Num) sepalwidth
(Num) petallength
(Num) petalwidth
(Nom) class
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
14:48:05 - bayes.NaiveBayes
15:44:32 - trees.UserClassifier
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 0.0319
Root mean squared error 0.1622
Relative absolute error 7.1634 %
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Total Number of Instances 51
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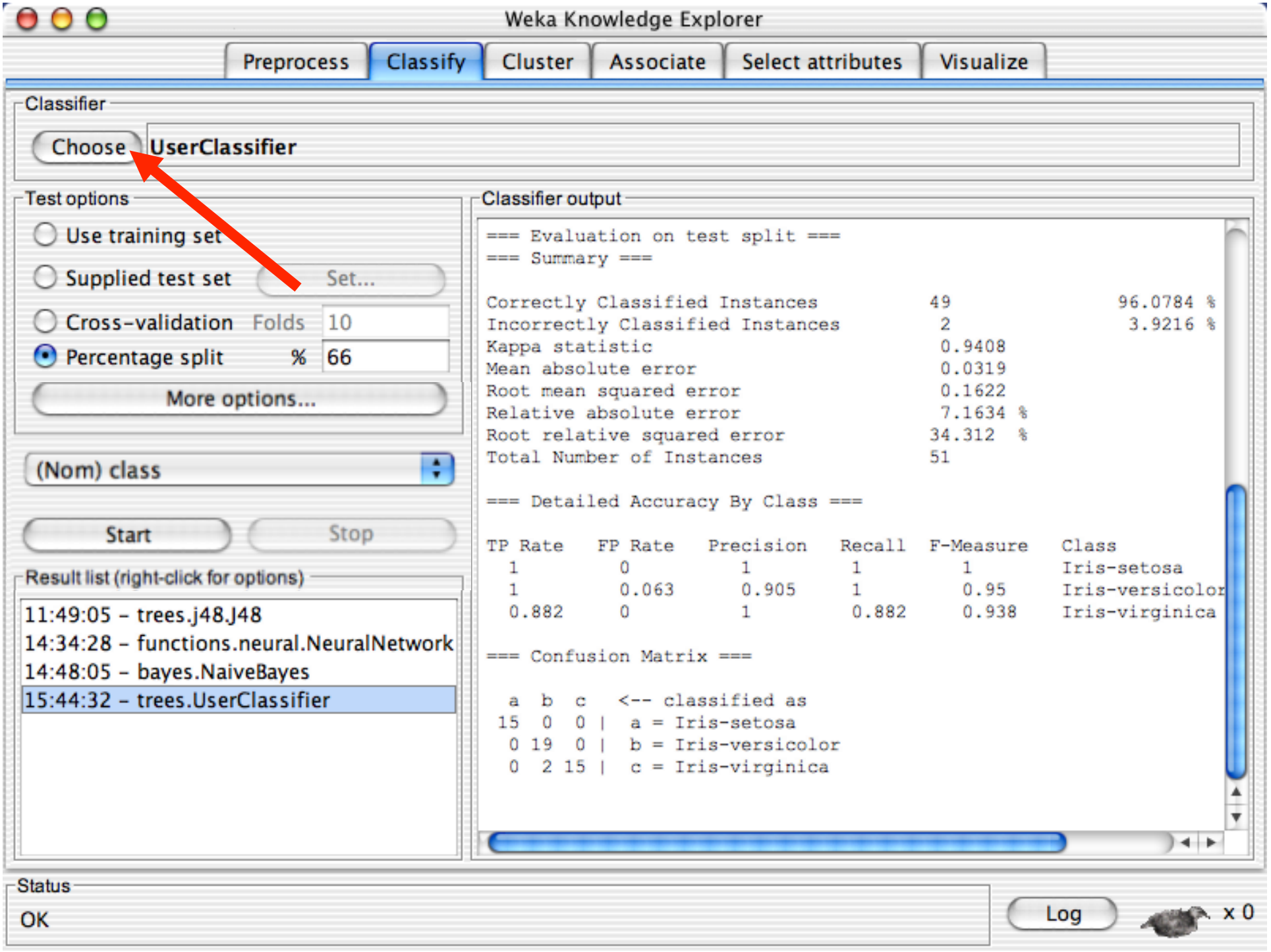
1 0 1 1 1 Iris-setosa
1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
=== Confusion Matrix ===
a b c <-- classified as
15 0 0 | a = Iris-setosa
0 19 0 | b = Iris-versicolor
0 2 15 | c = Iris-virginica
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
UserClassifier
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
15:44:32 - trees.UserClassifier
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 0.0319
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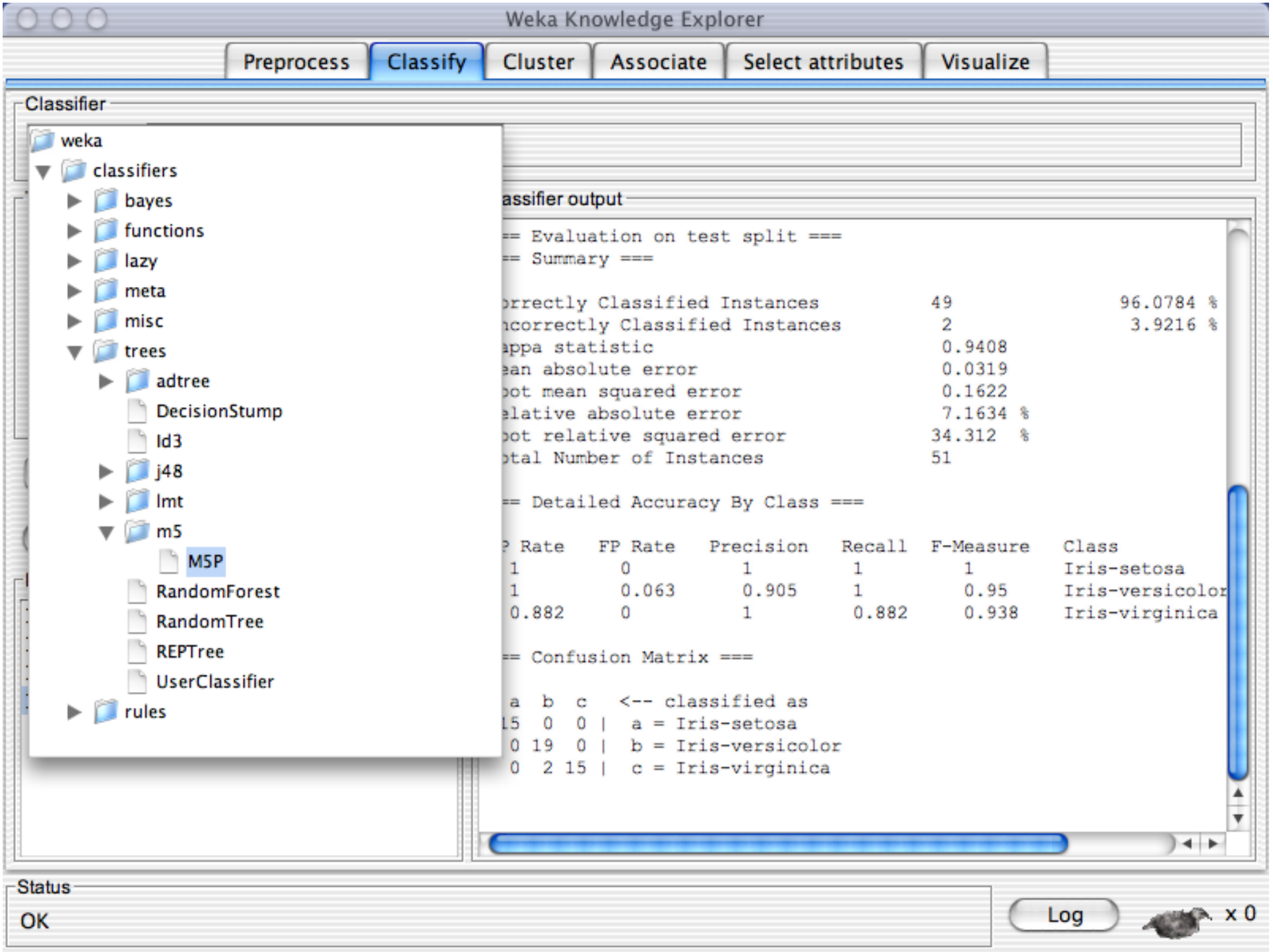
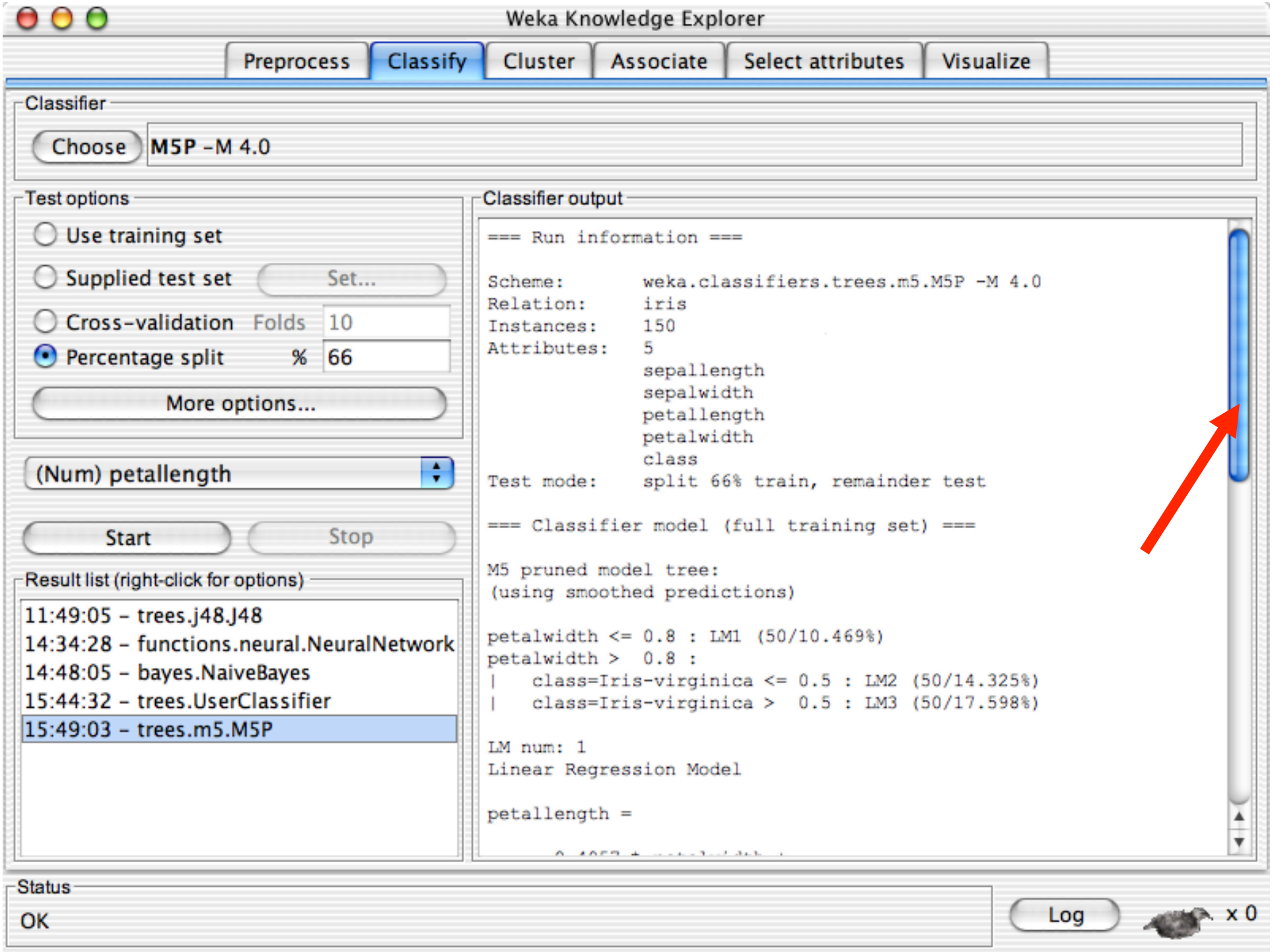
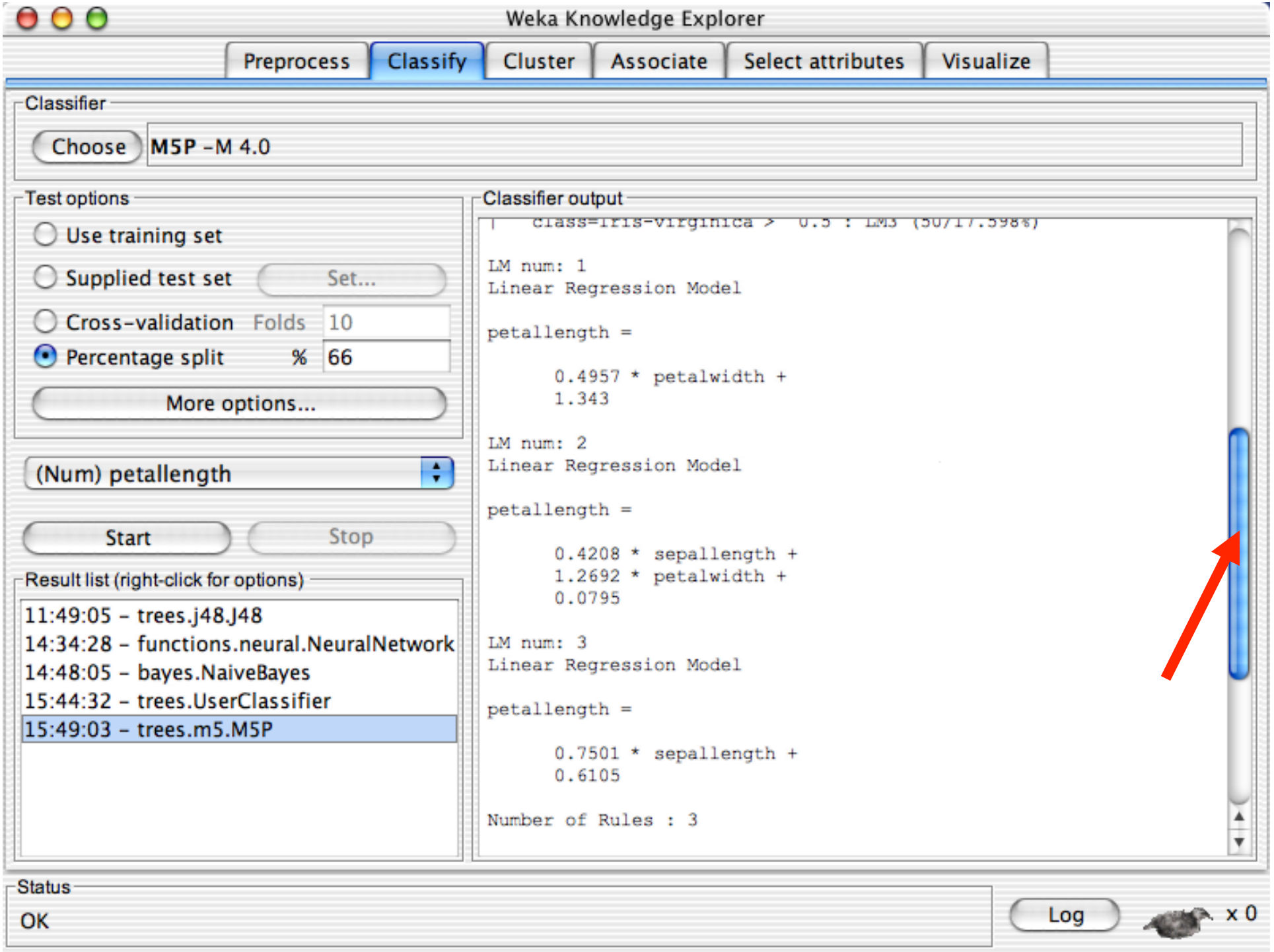
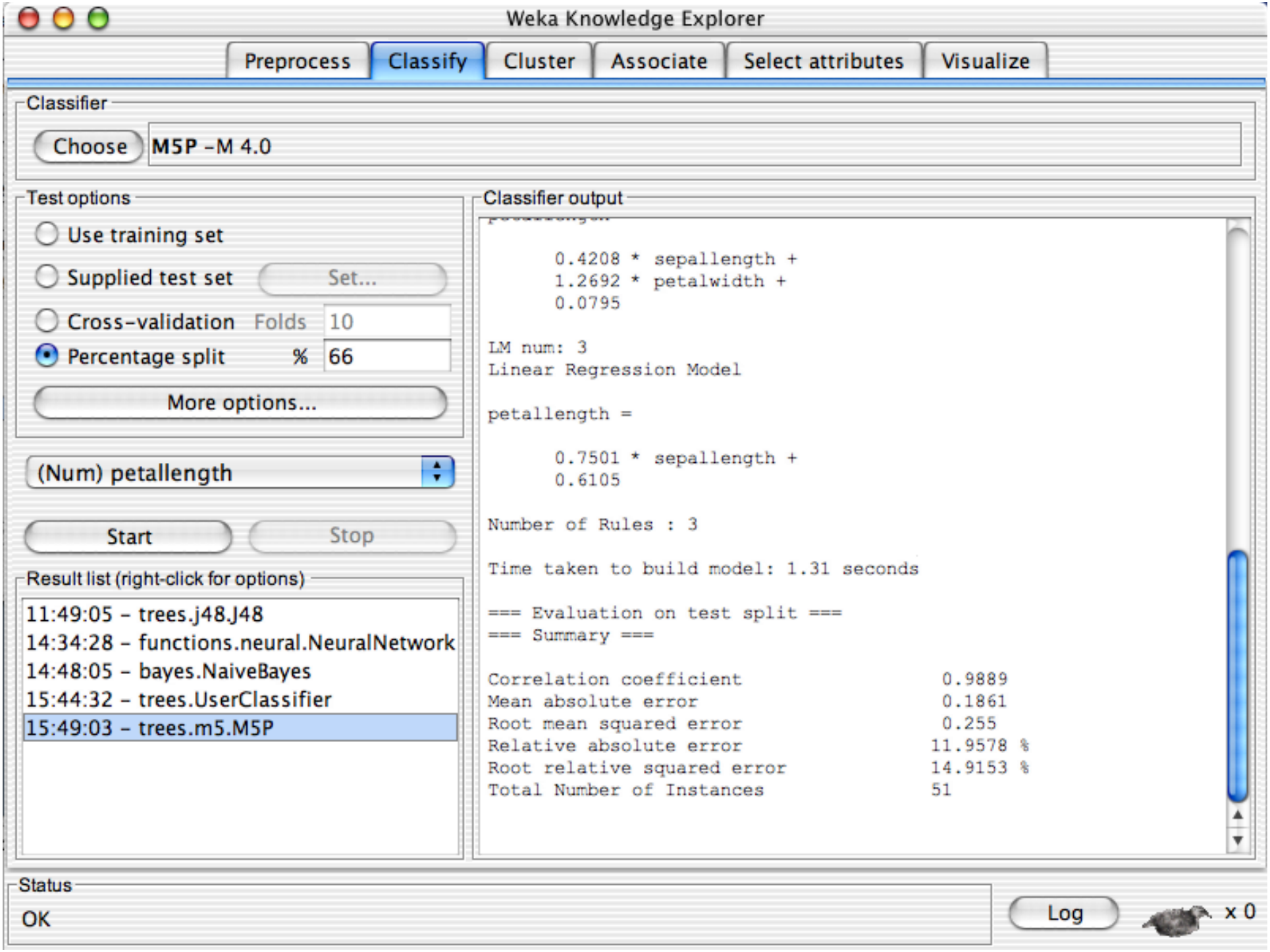
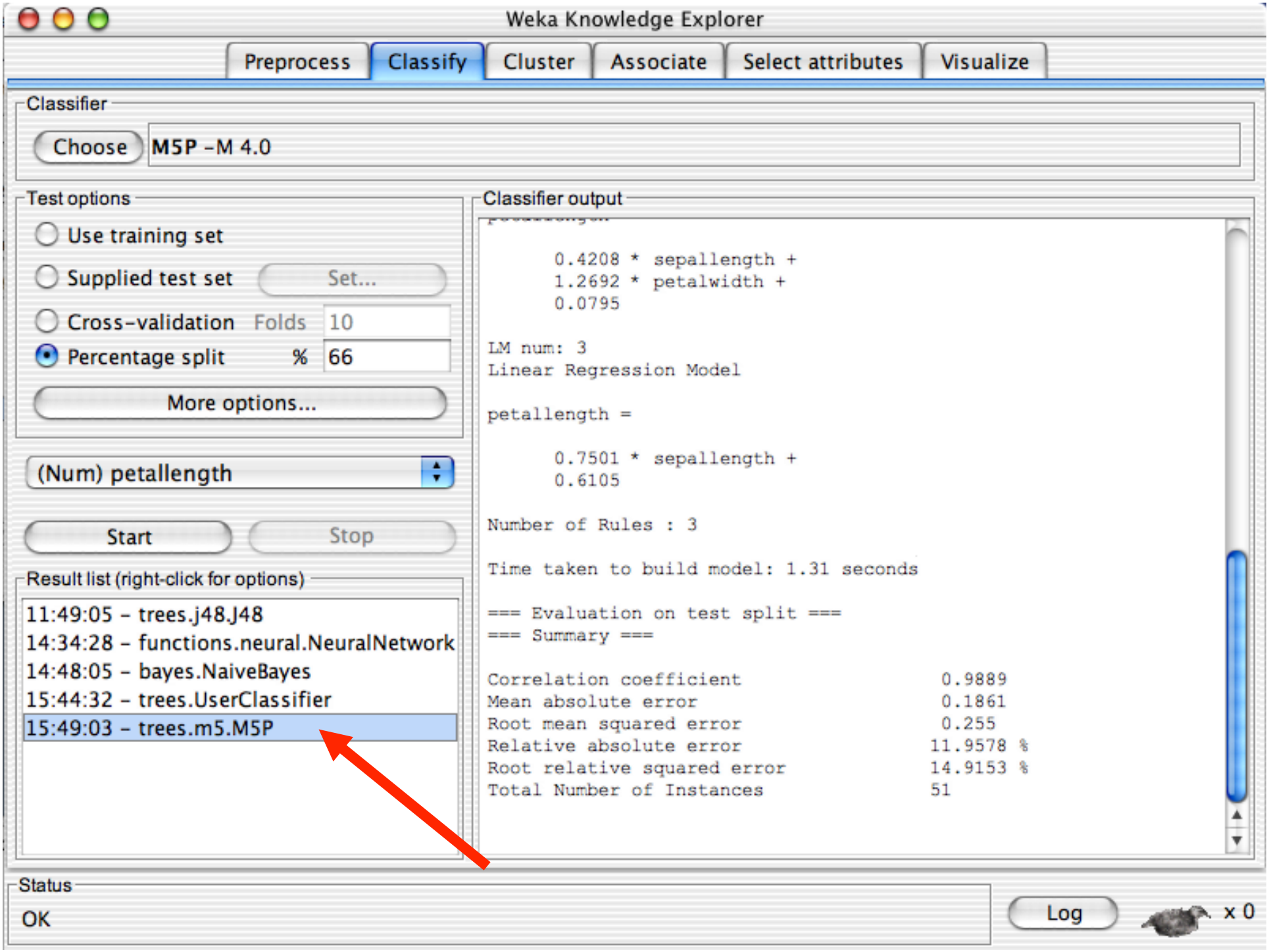
Relative absolute error 7.1634 %
Root relative squared error 34.312 %
Total Number of Instances 51
=== Detailed Accuracy By Class ===
TP Rate FP Rate Precision Recall F-Measure Class
1 0 1 1 1 Iris-setosa
1 0.063 0.905 1 0.95 Iris-versicolor
0.882 0 1 0.882 0.938 Iris-virginica
=== Confusion Matrix ===
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

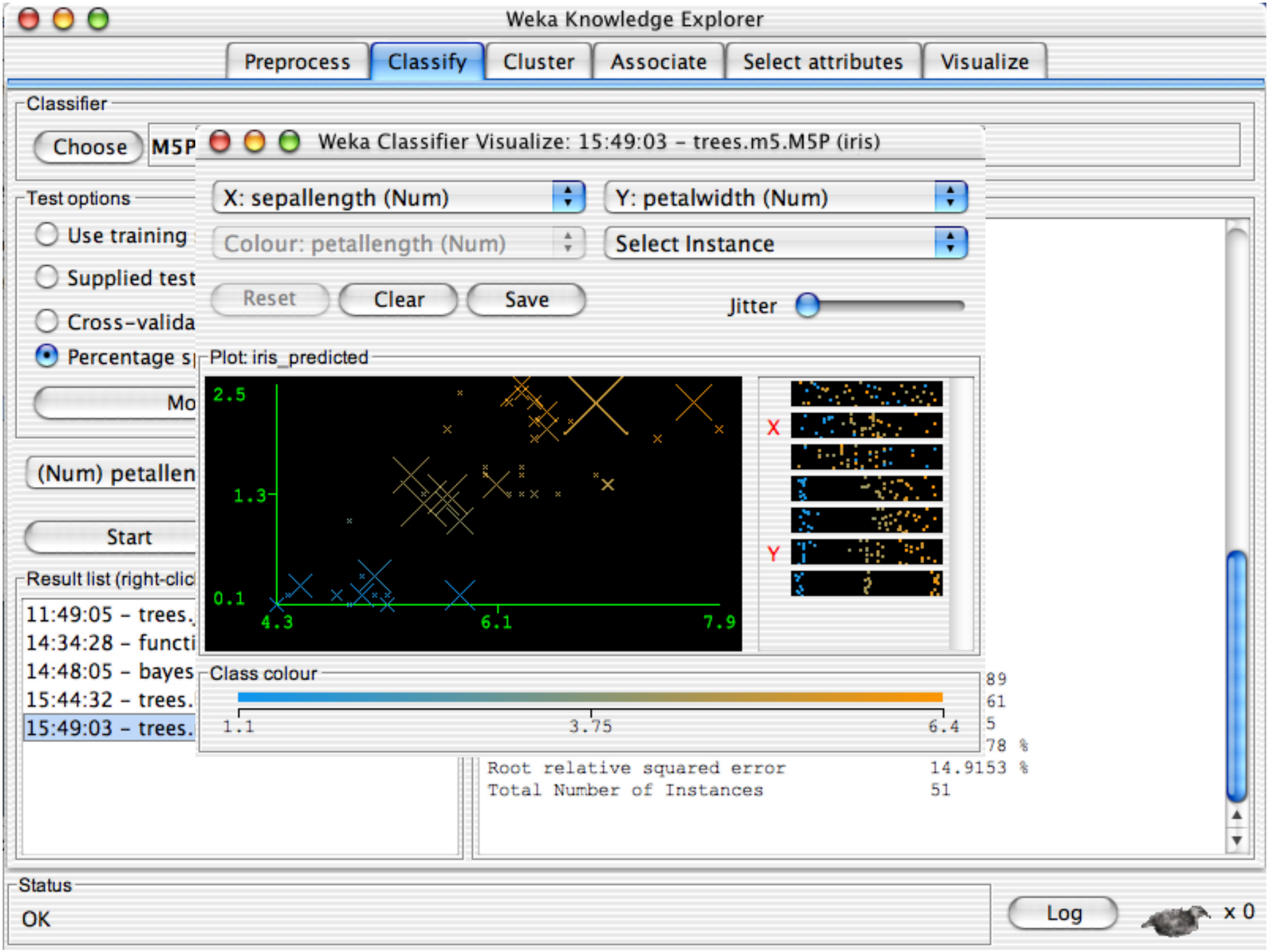

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
weka
classifiers
bayes
functions
lazy
meta
misc
trees
adtree
DecisionStump
Id3
j48
lmt
m5
M5P
RandomForest
RandomTree
REPTree
UserClassifier
rules
assifier output
== Evaluation on test split ===
== Summary ===
orrectly Classified Instances 49 96.0784 %
ncorrectly Classified Instances 2 3.9216 %
appa statistic 0.9408
ean absolute error 0.0319
oot mean squared error 0.1622
elative absolute error 7.1634 %
oot relative squared error 34.312 %
otal Number of Instances 51
== Detailed Accuracy By Class ===
P 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

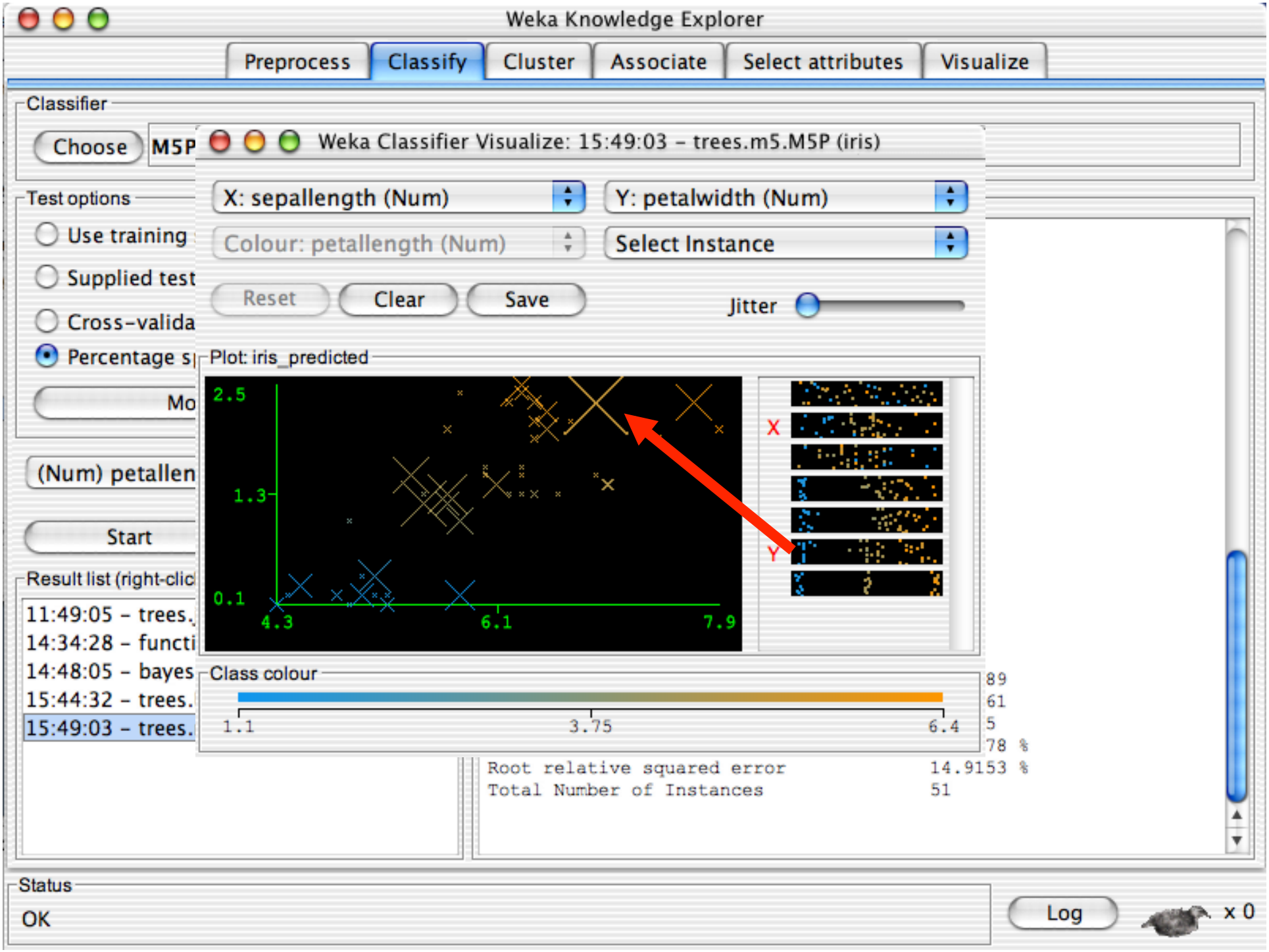

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
M5P -M 4.0
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Num) petallength
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
14:48:05 - bayes.NaiveBayes
15:44:32 - trees.UserClassifier
15:49:03 - trees.m5.M5P
Classifier output
=== Run information ===
Scheme: weka.classifiers.trees.m5.M5P -M 4.0
Relation: iris
Instances: 150
Attributes: 5
sepallength
sepalwidth
petallength
petalwidth
class
Test mode: split 66% train, remainder test
=== Classifier model (full training set) ===
M5 pruned model tree:
(using smoothed predictions)
petalwidth <= 0.8 : LM1 (50/10.469%)
petalwidth > 0.8 :
| class=Iris-virginica <= 0.5 : LM2 (50/14.325%)
| class=Iris-virginica > 0.5 : LM3 (50/17.598%)
LM num: 1
Linear Regression Model
petallength =
Status
OK
Log
x 0

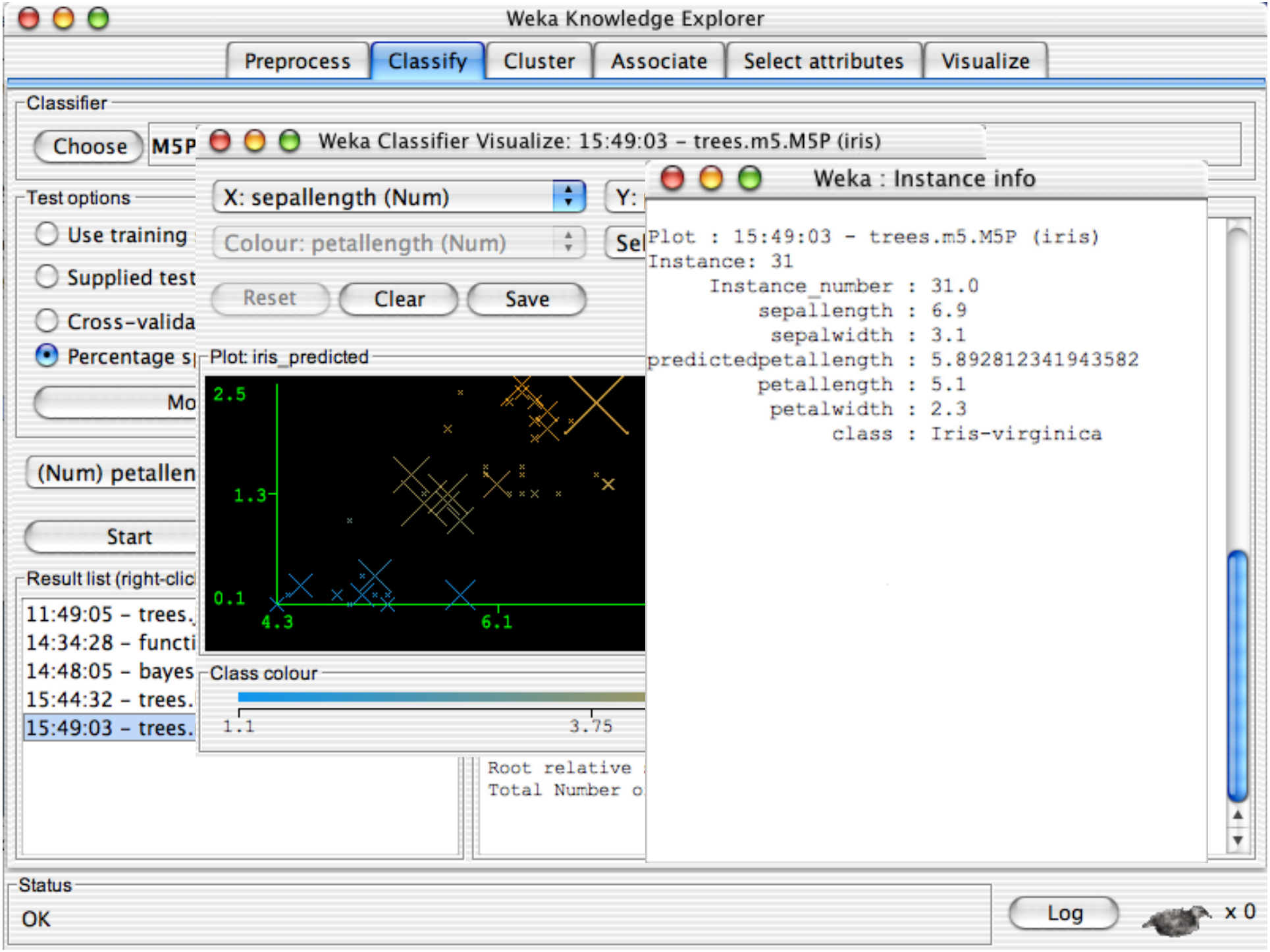

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
M5P -M 4.0
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Num) petallength
Start
Stop
Result list (right-click for options)
11:49:05 - trees.j48.J48
14:34:28 - functions.neural.NeuralNetwork
14:48:05 - bayes.NaiveBayes
15:44:32 - trees.UserClassifier
15:49:03 - trees.m5.M5P
Classifier output
LM num: 1
Linear Regression Model
petallength =
0.4957 * petalwidth +
1.343
LM num: 2
Linear Regression Model
petallength =
0.4208 * sepallength +
1.2692 * petalwidth +
0.0795
LM num: 3
Linear Regression Model
petallength =
0.7501 * sepallength +
0.6105
Number of Rules : 3
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
M5P -M 4.0
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Num) petallength
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
15:44:32 - trees.UserClassifier
15:49:03 - trees.m5.M5P
Classifier output
0.4208 * sepallength +
1.2692 * petalwidth +
0.0795
LM num: 3
Linear Regression Model
petallength =
0.7501 * sepallength +
0.6105
Number of Rules : 3
Time taken to build model: 1.31 seconds
=== Evaluation on test split ===
=== Summary ===
Correlation coefficient 0.9889
Mean absolute error 0.1861
Root mean squared error 0.255
Relative absolute error 11.9578 %
Root relative squared error 14.9153 %
Total Number of Instances 51
Status
OK
Log
x 0


Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
M5P -M 4.0
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Num) petallength
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
15:44:32 - trees.UserClassifier
15:49:03 - trees.m5.M5P
Classifier output
0.4208 * sepallength +
1.2692 * petalwidth +
0.0795
LM num: 3
Linear Regression Model
petallength =
0.7501 * sepallength +
0.6105
Number of Rules : 3
Time taken to build model: 1.31 seconds
=== Evaluation on test split ===
=== Summary ===
Correlation coefficient 0.9889
Mean absolute error 0.1861
Root mean squared error 0.255
Relative absolute error 11.9578 %
Root relative squared error 14.9153 %
Total Number of Instances 51
Status
OK
Log
x 0

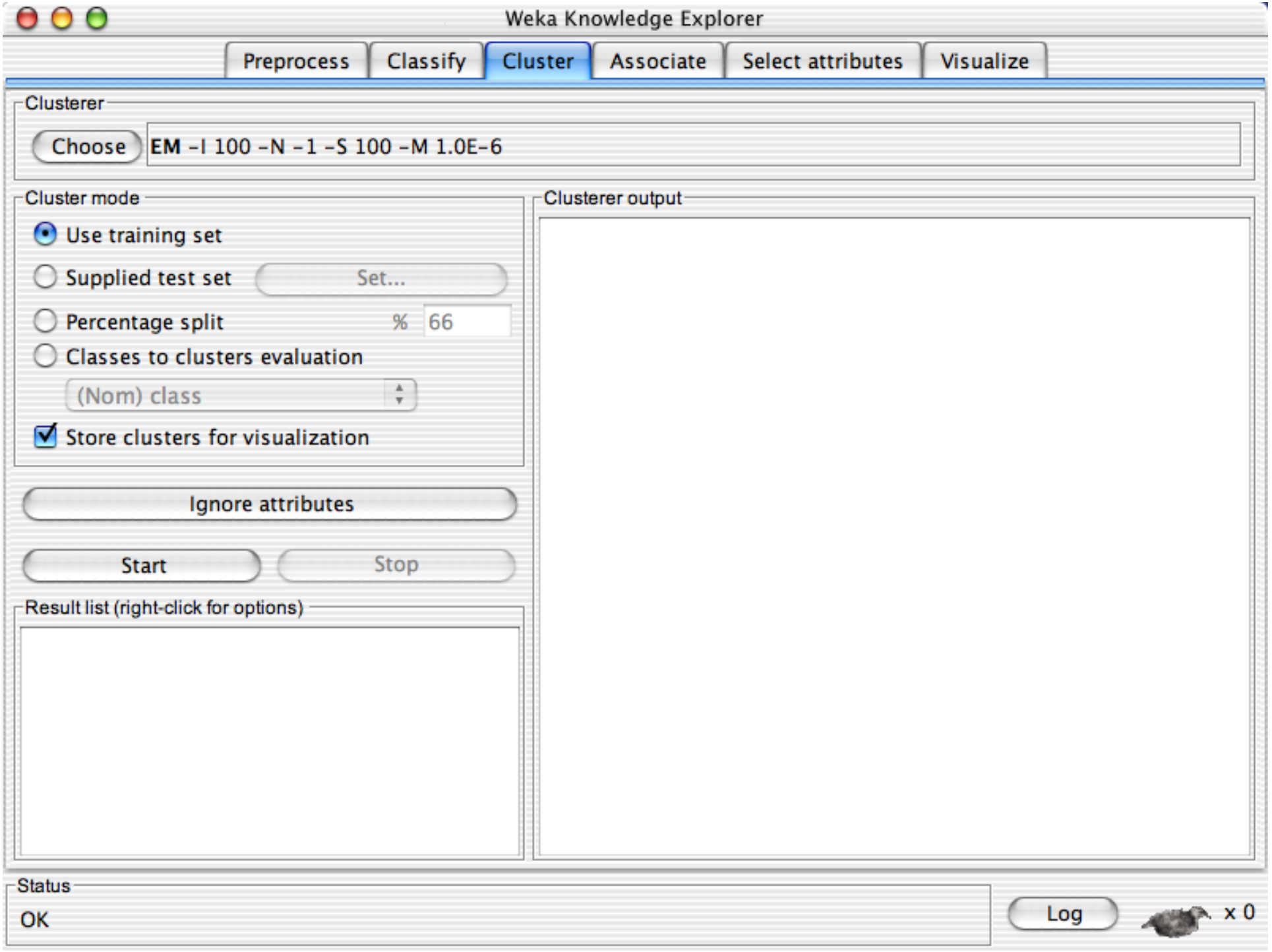

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
M5P
Weka Classifier Visualize: 15:49:03 - trees.m5.M5P (iris)
X: sepallength (Num)
Y: petalwidth (Num)
Colour: petallength (Num)
Select Instance
Reset
Clear
Save
Jitter
Test options
Use training
Supplied test
Cross-valida
Percentage s
Mo
Plot: iris_predicted
2.5
1.3
0.1
4.3
6.1
7.9
X
Y
(Num) petallen
Start
Result list (right-clic
11:49:05 - trees.
14:34:28 - functi
14:48:05 - bayes
15:44:32 - trees.
15:49:03 - trees.
Class colour
1.1
3.75
6.4
89
61
5
78 %
Root relative squared error 14.9153 %
Total Number of Instances 51
Status
OK
Log
x 0

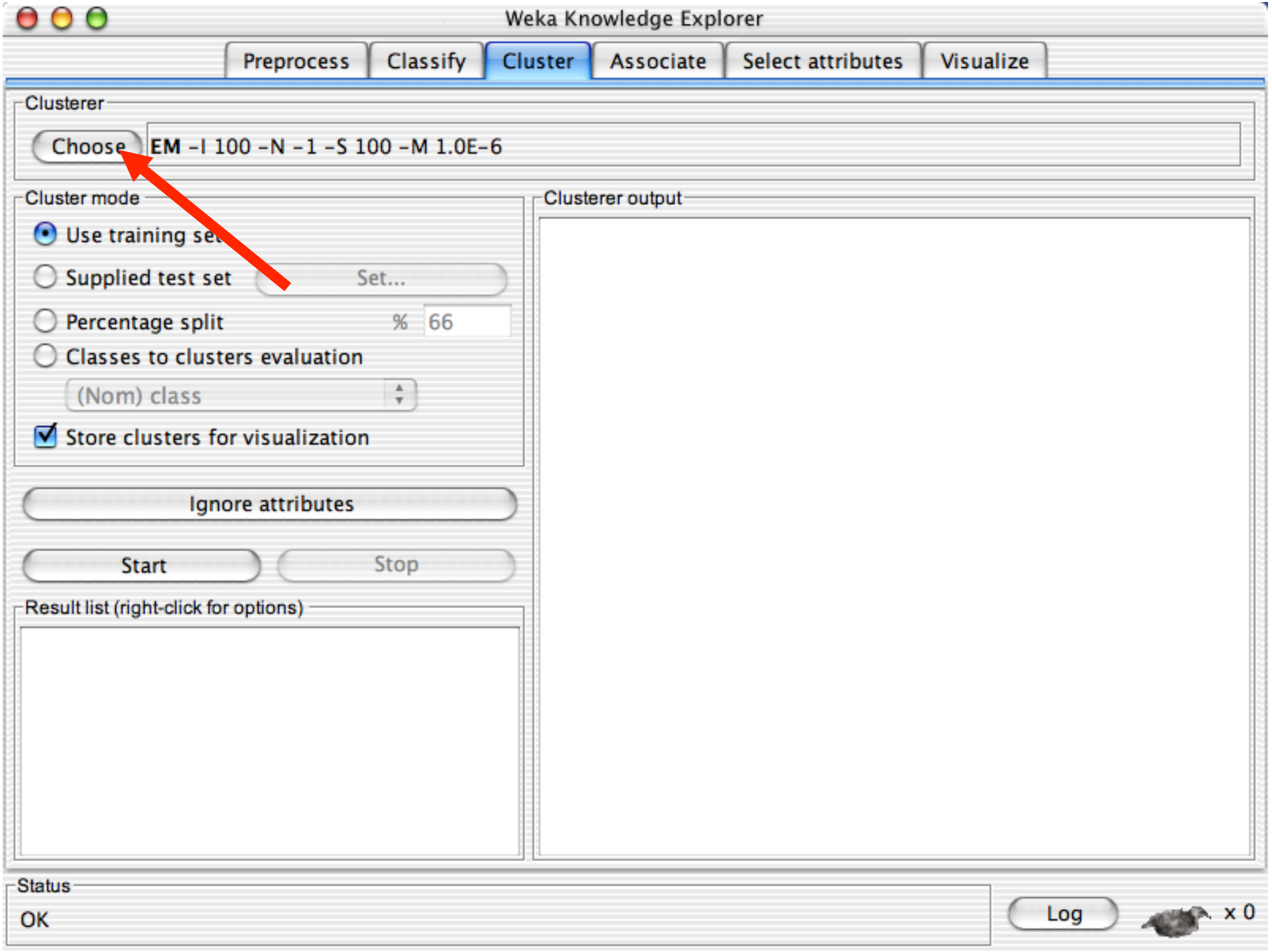

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
M5P
Weka Classifier Visualize: 15:49:03 - trees.m5.M5P (iris)
X: sepallength (Num)
Y: petalwidth (Num)
Colour: petallength (Num)
Select Instance
Reset
Clear
Save
Jitter
Test options
Use training
Supplied test
Cross-valida
Percentage s
Mo
Plot: iris_predicted
2.5
1.3
0.1
4.3
6.1
7.9
X
Y
(Num) petallen
Start
Result list (right-clic
11:49:05 - trees.
14:34:28 - functi
14:48:05 - bayes
15:44:32 - trees.
15:49:03 - trees.
Class colour
1.1
3.75
6.4
89
61
5
78 %
Root relative squared error 14.9153 %
Total Number of Instances 51
Status
OK
Log
x 0

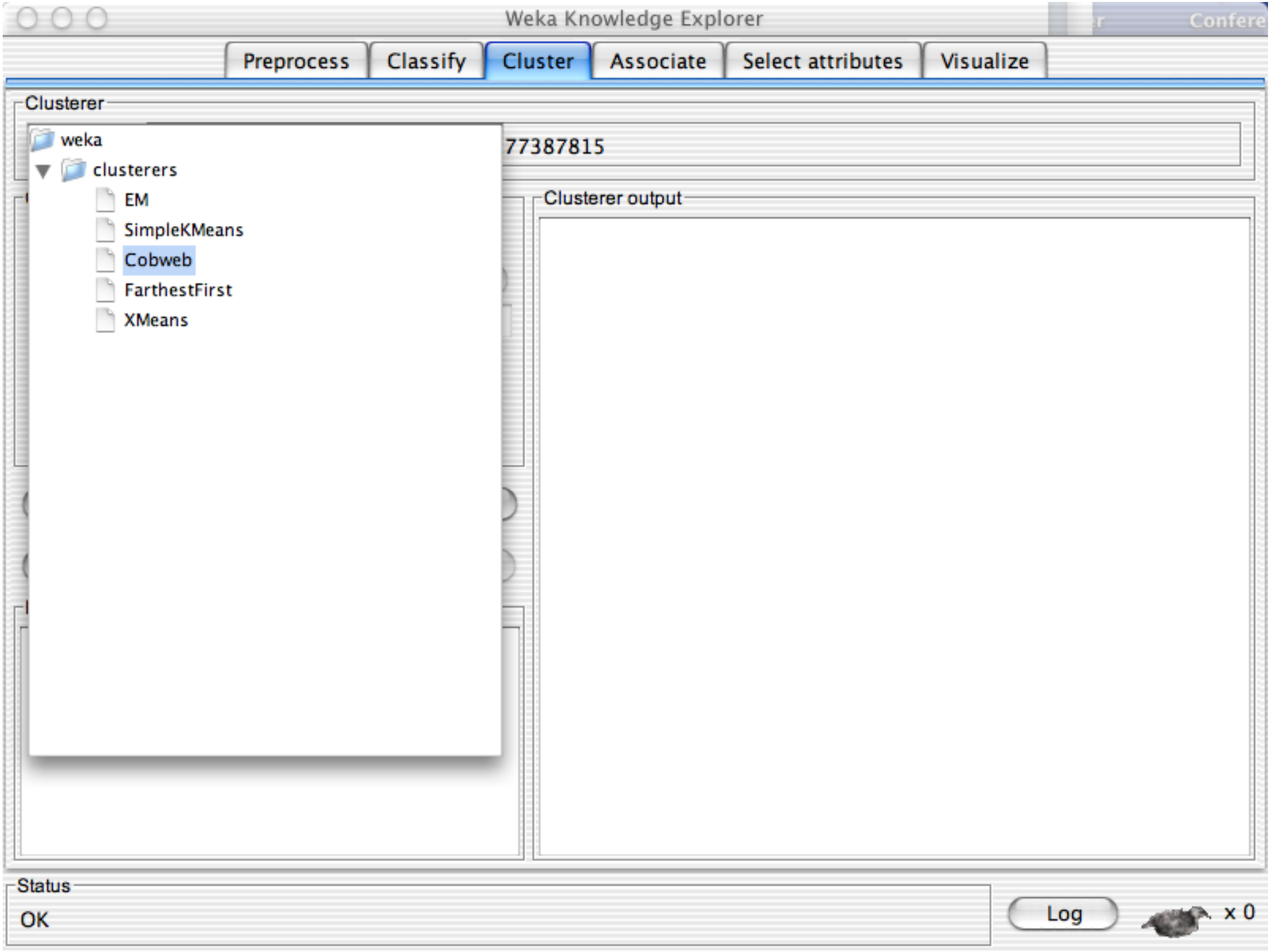

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
M5P
Weka Classifier Visualize: 15:49:03 - trees.m5.M5P (iris)
X: sepallength (Num)
Y:
Colour: petallength (Num)
Sel
Reset
Clear
Save
Test options
Use training
Supplied test
Cross-valida
Percentage s
Mo
Plot: iris_predicted
2.5
1.3
0.1
4.3
6.1
(Num) petallen
Start
Result list (right-clic
11:49:05 - trees.
14:34:28 - functi
14:48:05 - bayes
15:44:32 - trees.
15:49:03 - trees.
Class colour
1.1
3.75
Root relative
Total Number o
Weka : Instance info
Plot : 15:49:03 - trees.m5.M5P (iris)
Instance: 31
Instance_number : 31.0
sepallength : 6.9
sepalwidth : 3.1
predictedpetallength : 5.892812341943582
petallength : 5.1
petalwidth : 2.3
class : Iris-virginica
Status
OK
Log
x 0

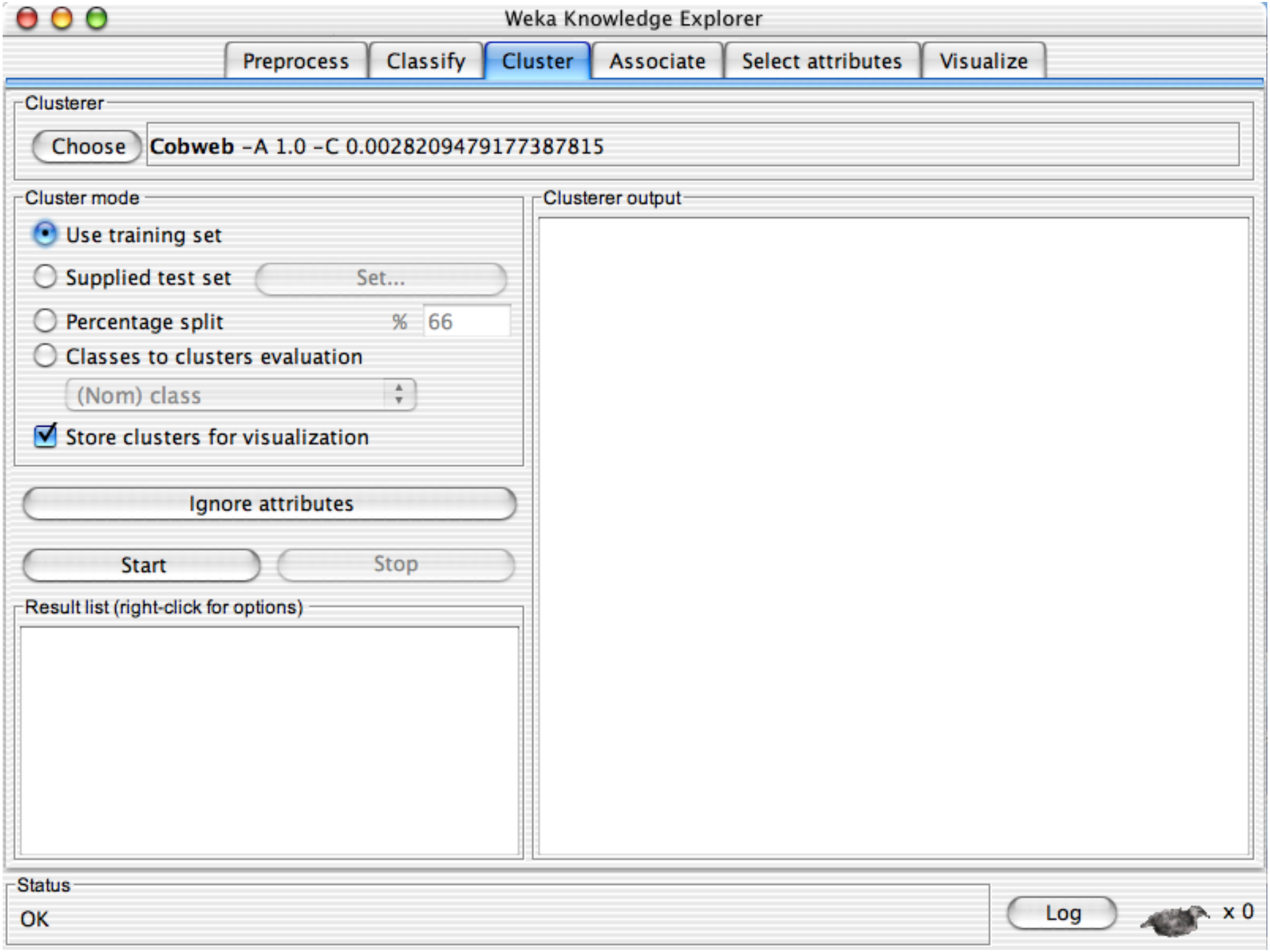
Explorer: clustering data

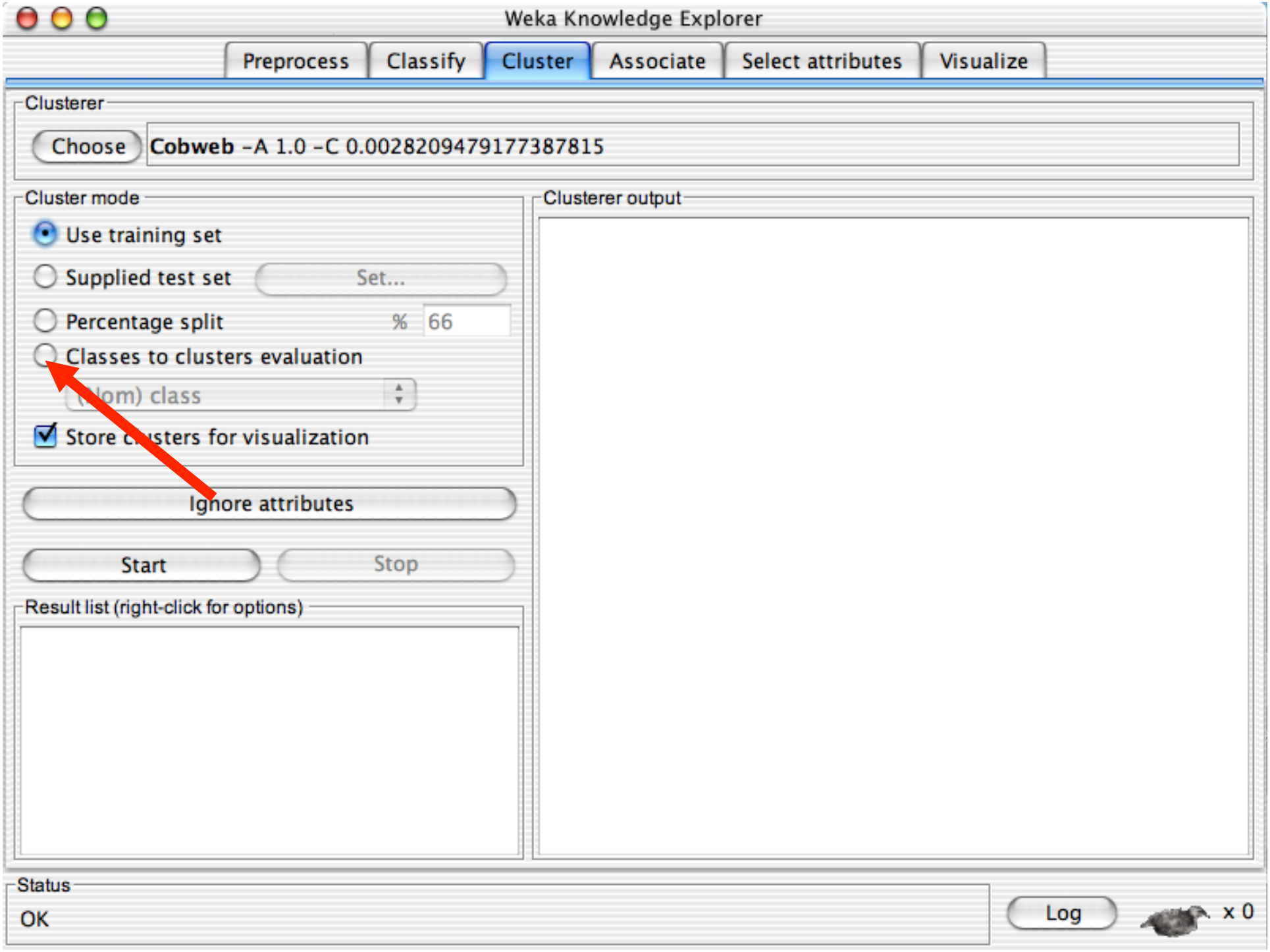
- WEKA contains "clusterers" for finding groups of similar instances in a dataset
- Implemented schemes are:
  - *k*-Means, EM, Cobweb, *X*-means, FarthestFirst
- Clusters can be visualized and compared to "true" clusters (if given)
- Evaluation based on loglikelihood if clustering scheme produces a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

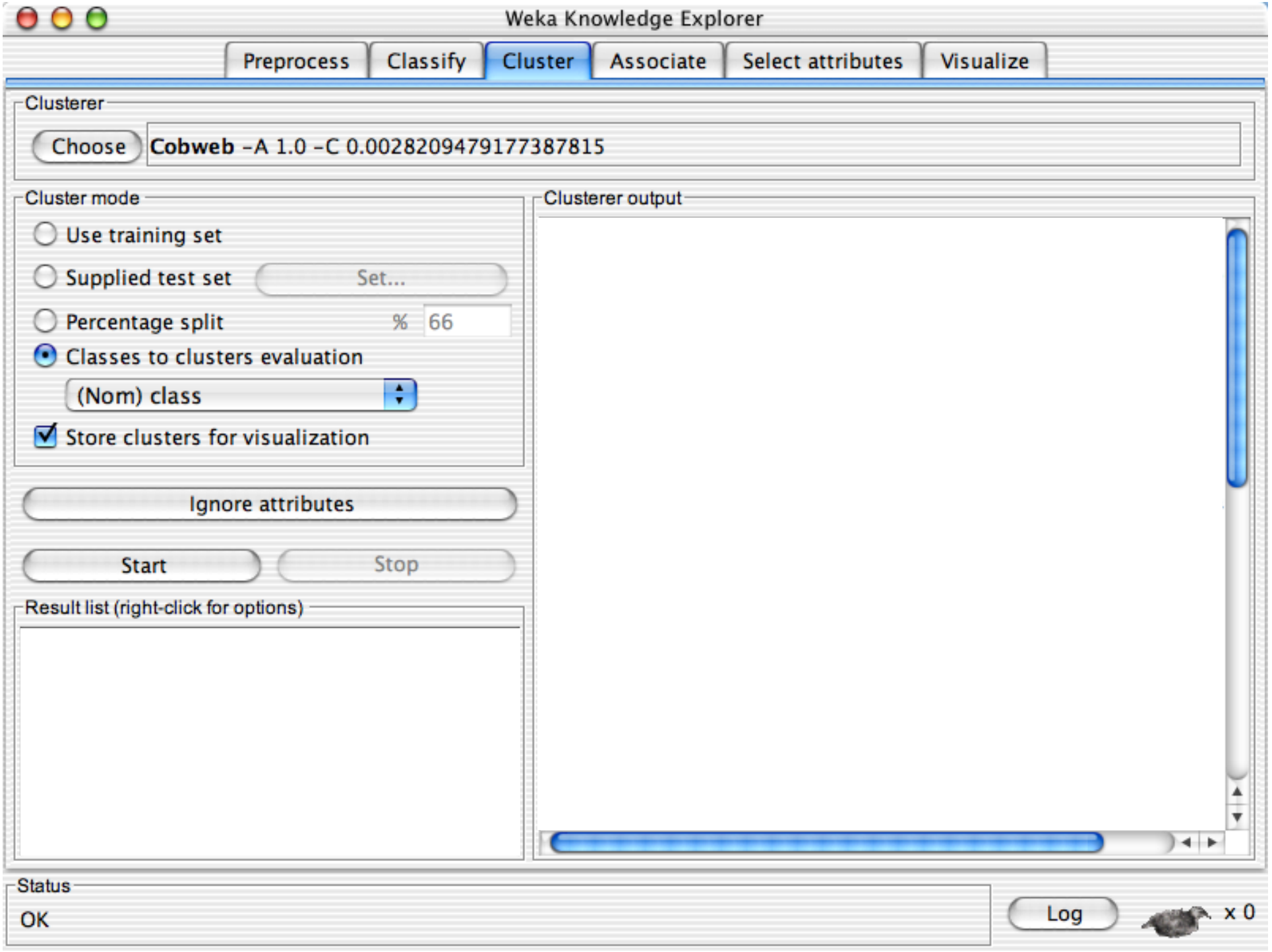

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
EM -I 100 -N -1 -S 100 -M 1.0E-6
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes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

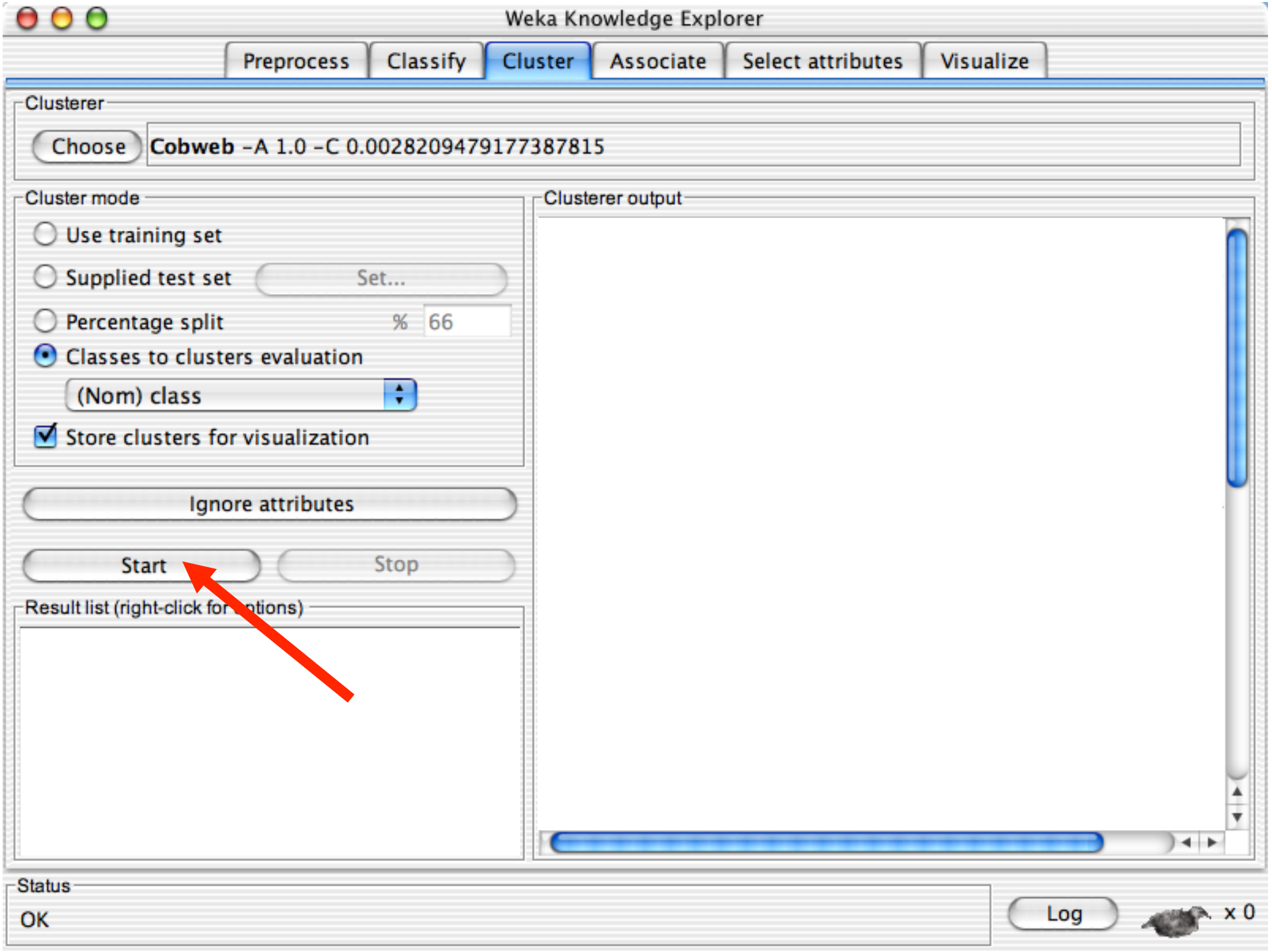

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
EM -I 100 -N -1 -S 100 -M 1.0E-6
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore attributes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

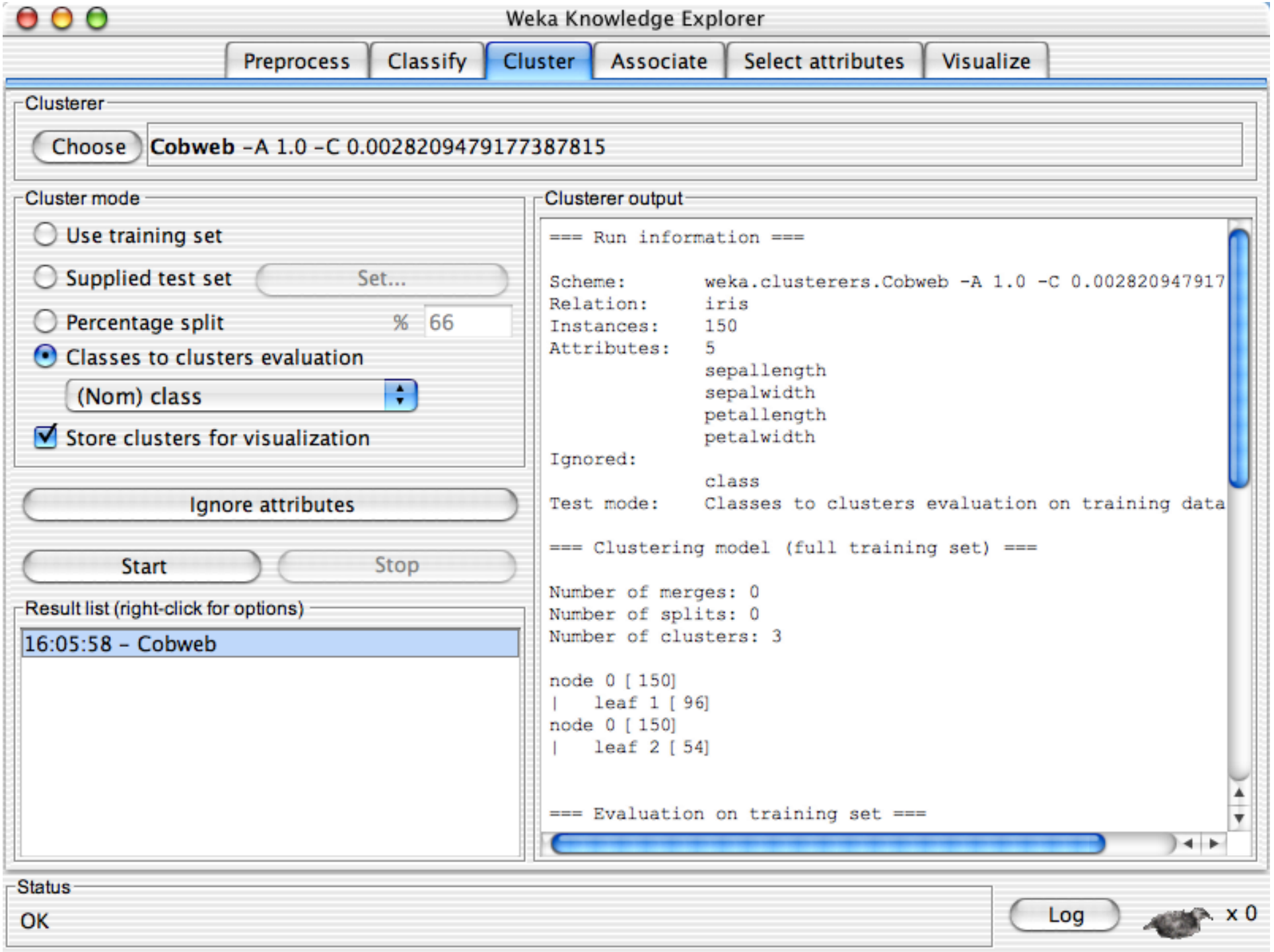

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
77387815
weka
clusterers
EM
SimpleKMeans
Cobweb
FarthestFirst
XMeans
Clusterer output
Status
OK
Log
x 0

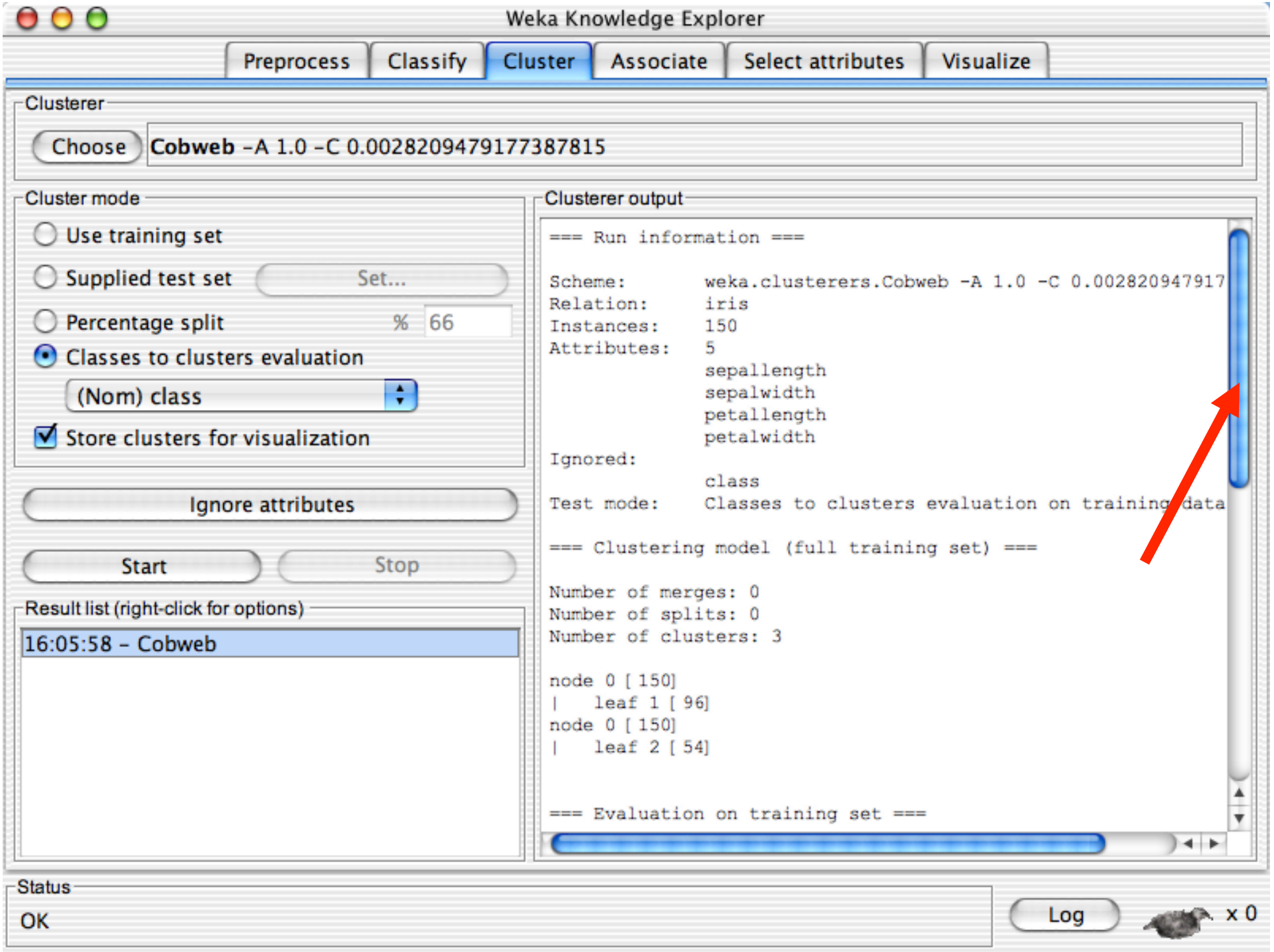

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore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

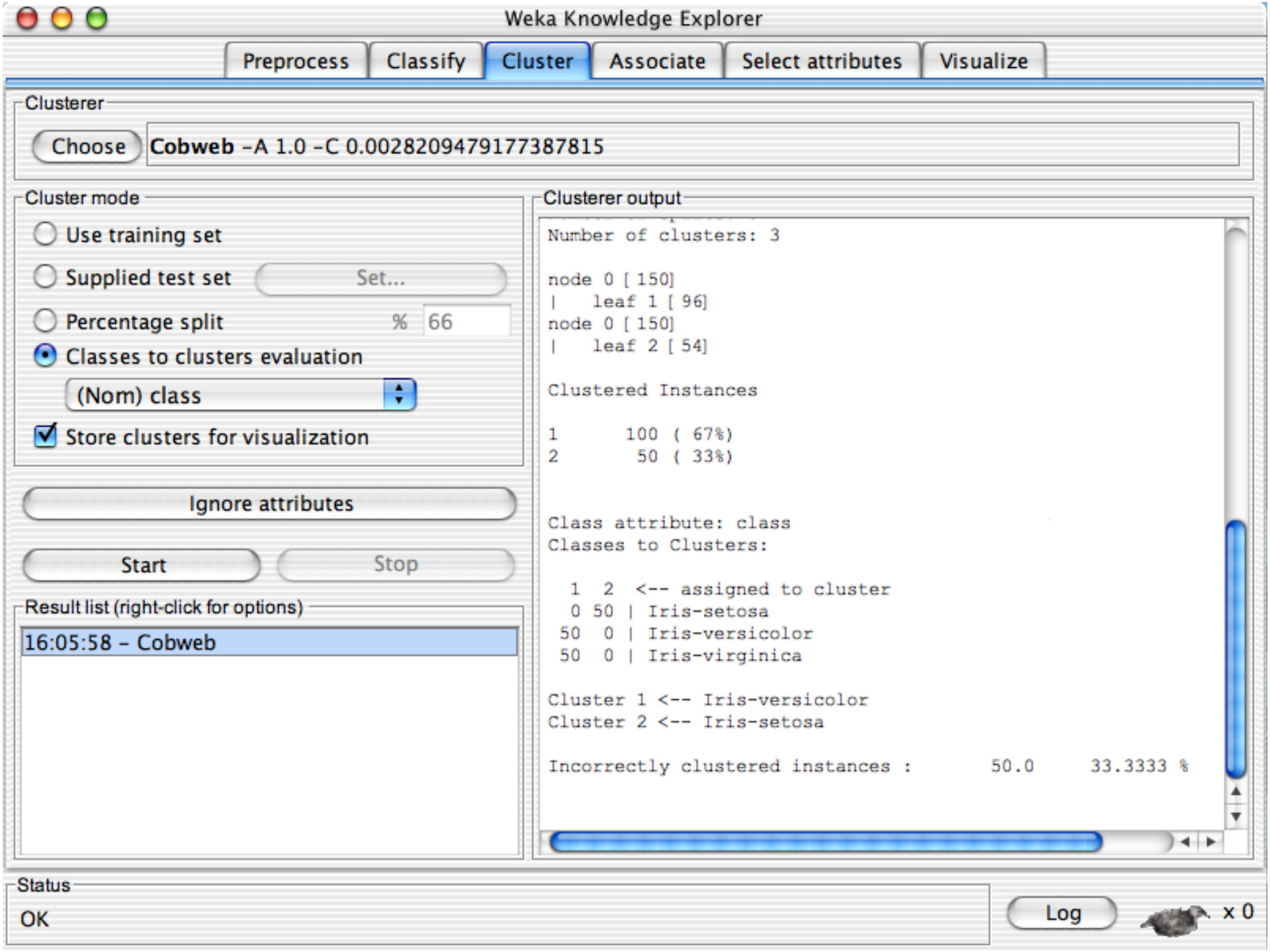

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore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

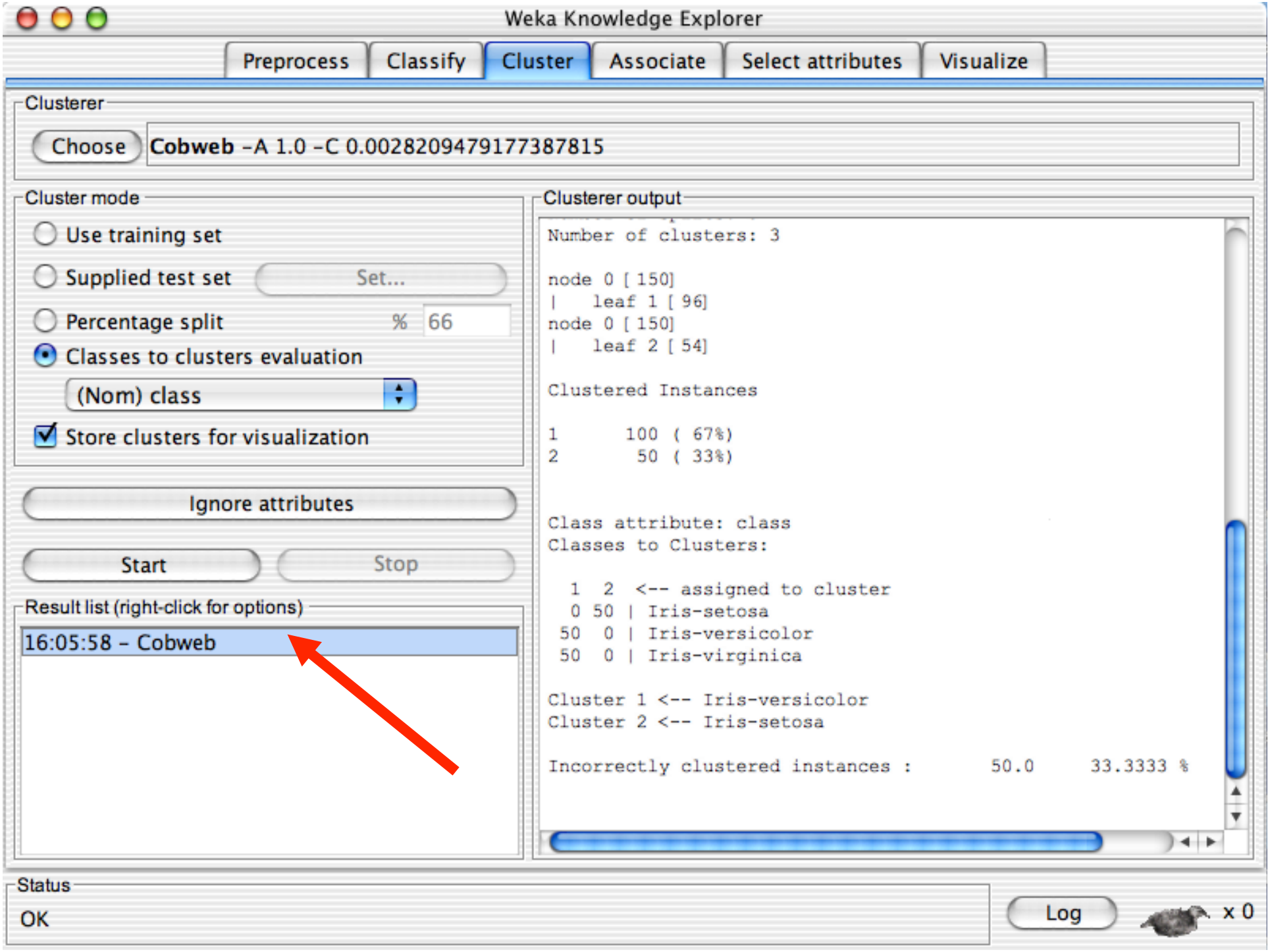

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore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

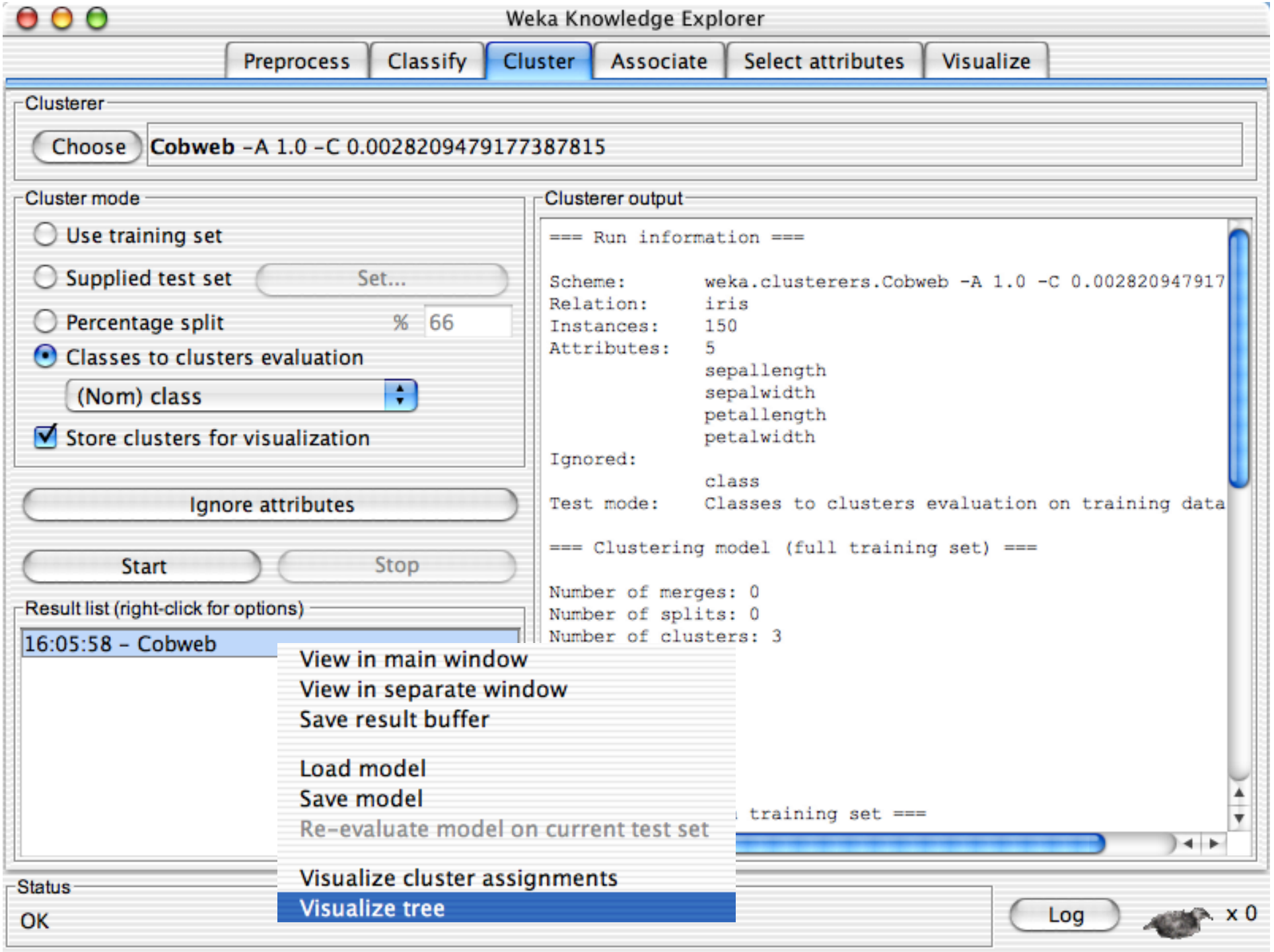

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
%
66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore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

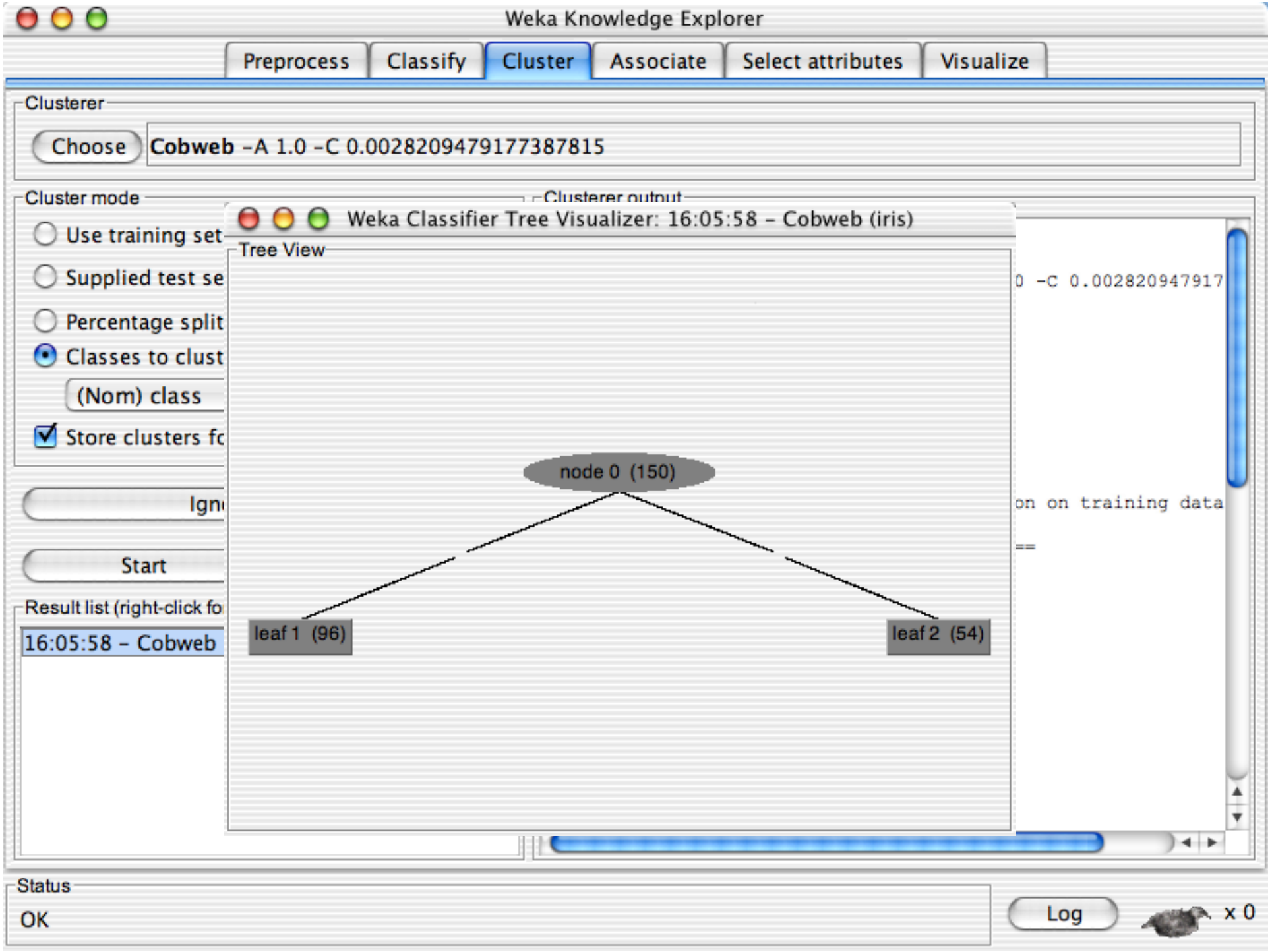

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore 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

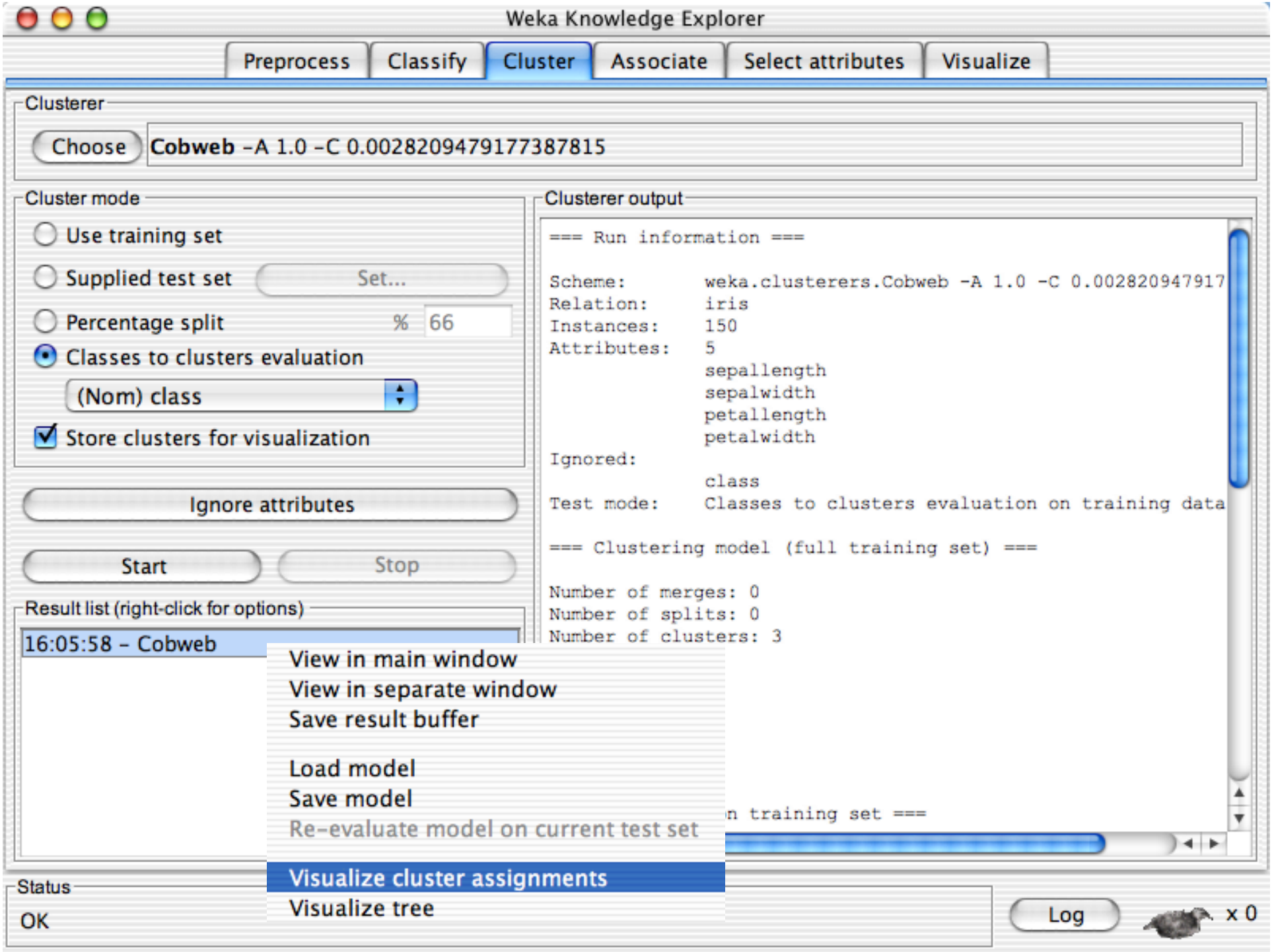

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore 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

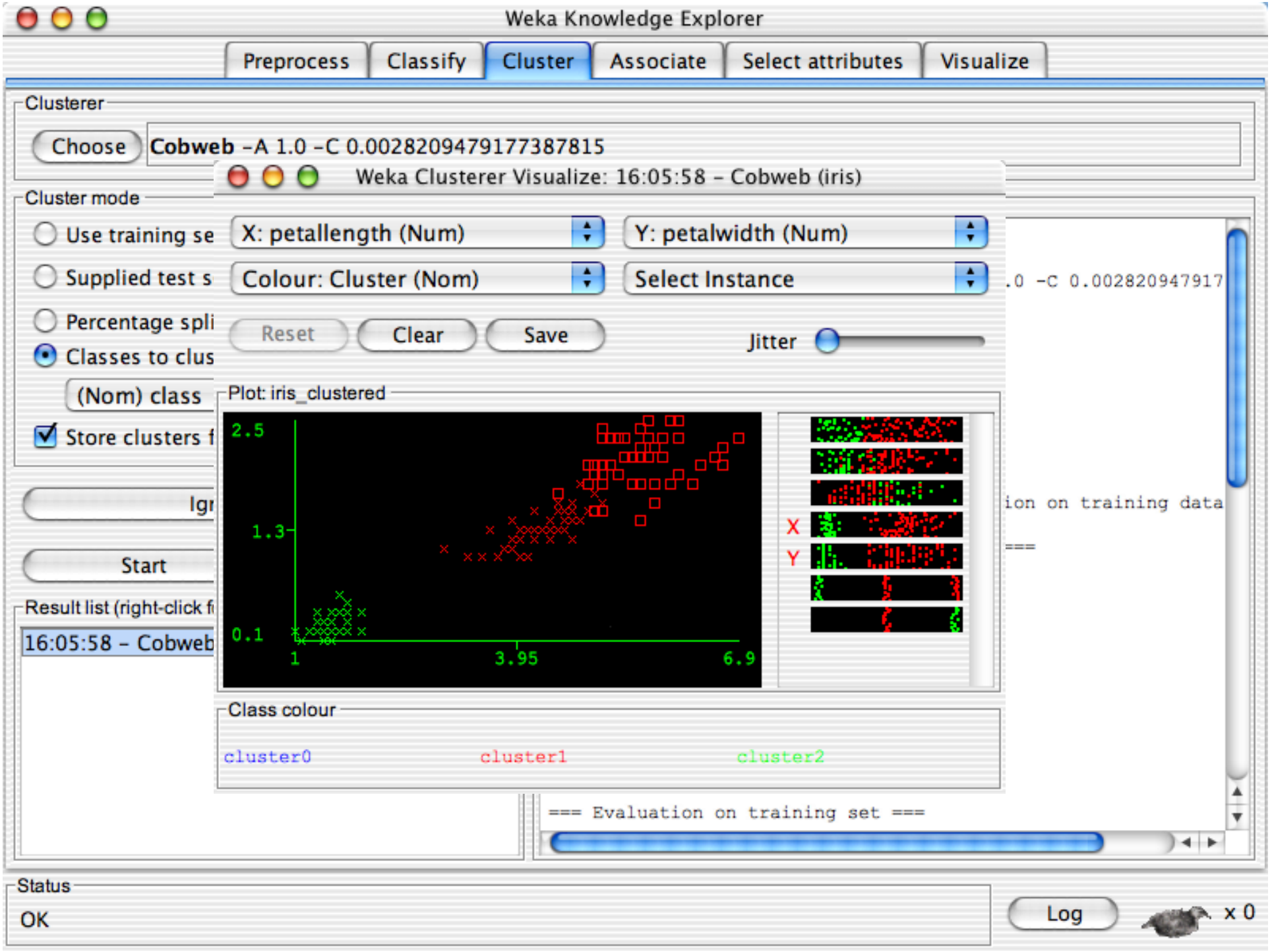

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore 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

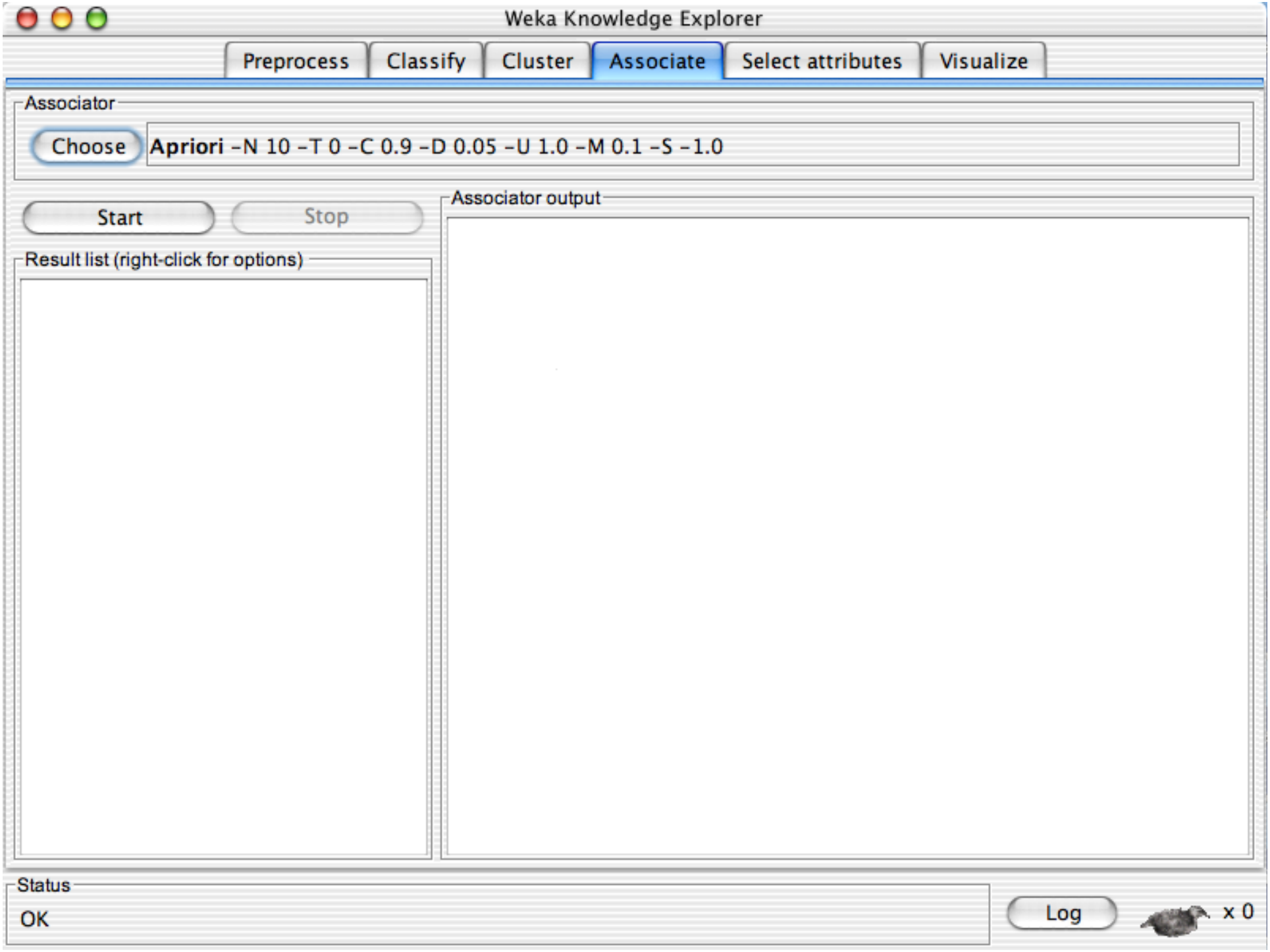

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test se
Percentage split
Classes to clust
(Nom) class
Store clusters fo
Ign
Start
Result list (right-click fo
16:05:58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

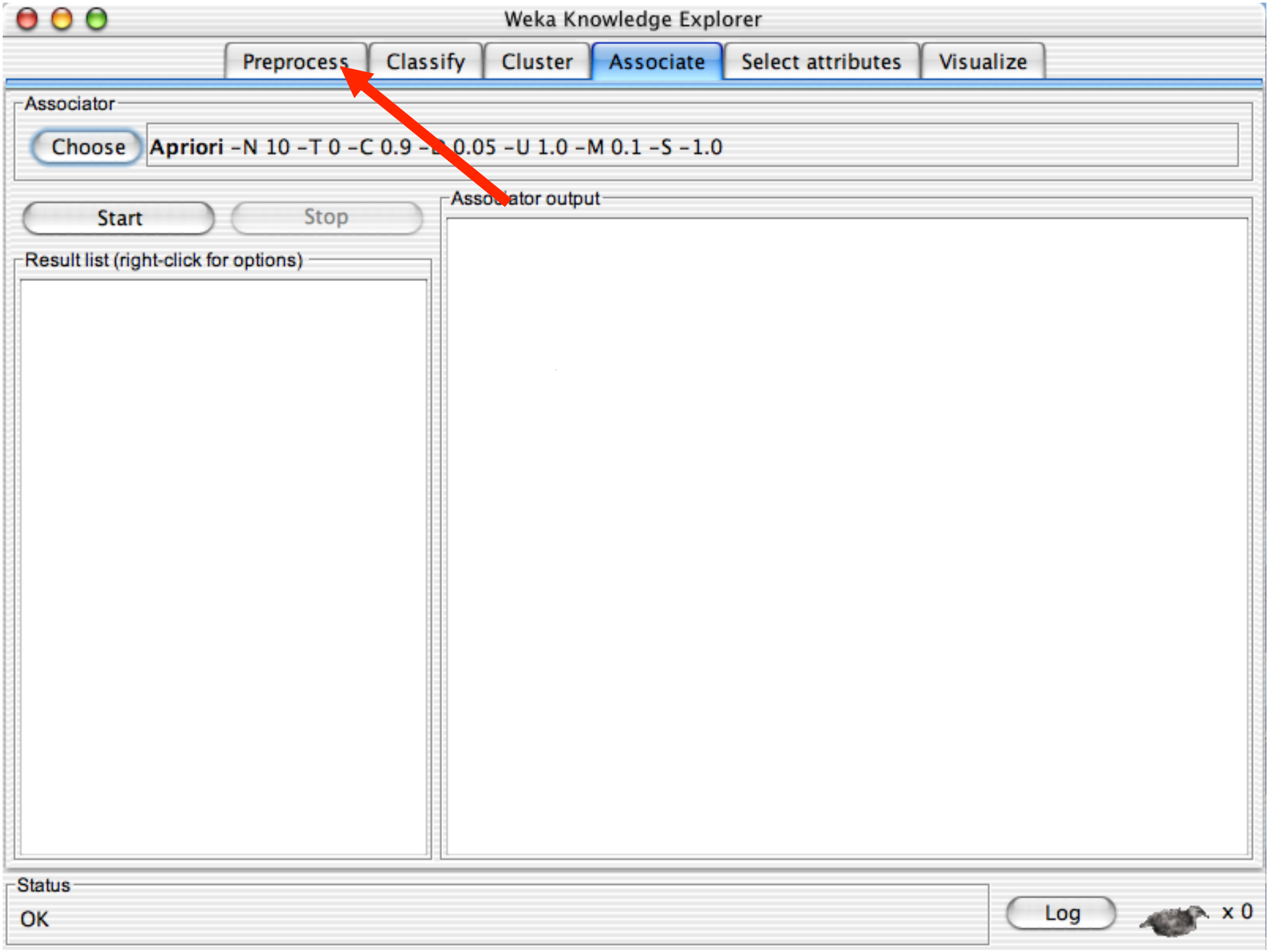

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Cluster mode
Use training set
Supplied test set
Set...
Percentage split
% 66
Classes to clusters evaluation
(Nom) class
Store clusters for visualization
Ignore 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
n 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

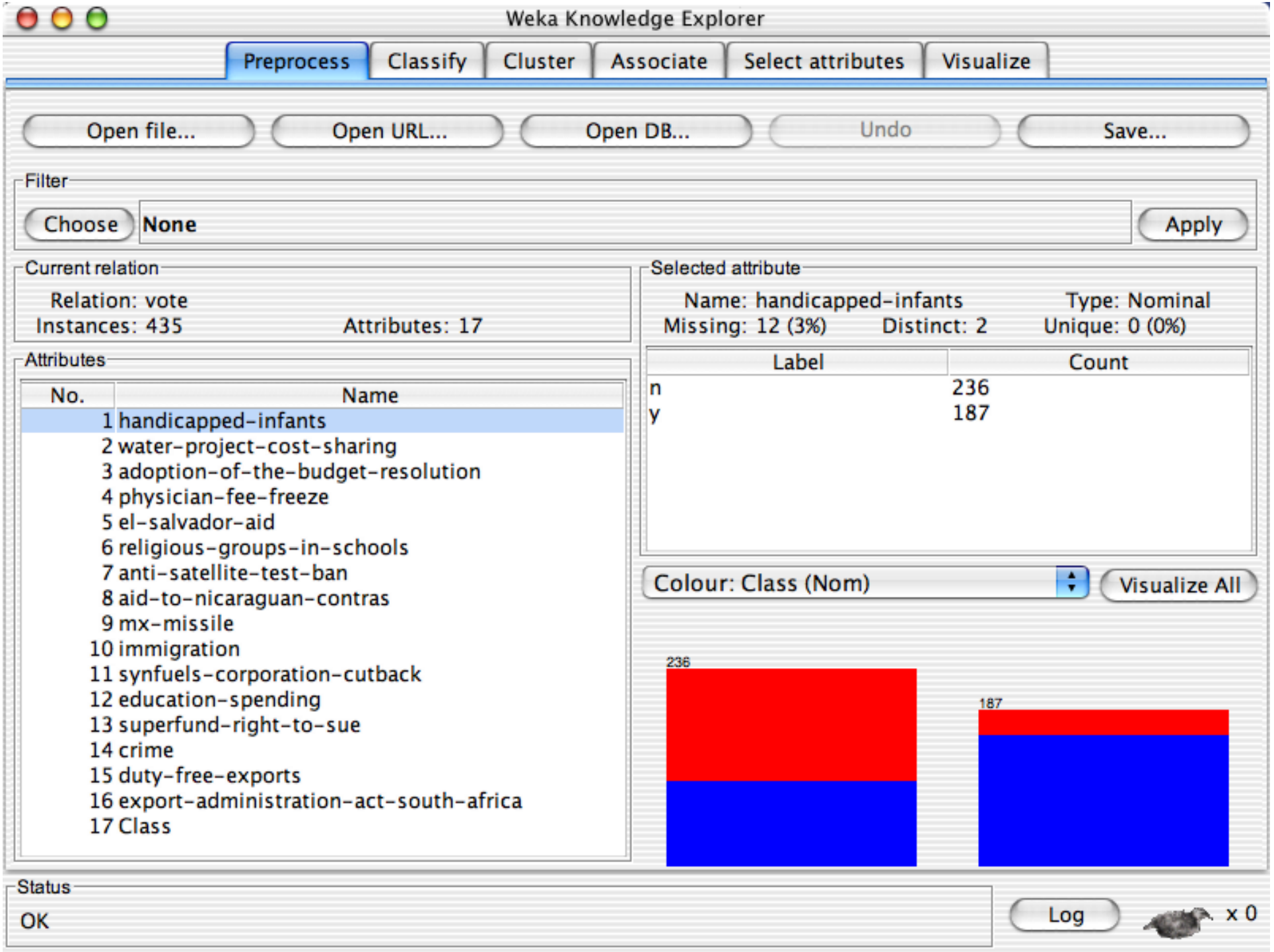

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Clusterer
Choose
Cobweb -A 1.0 -C 0.0028209479177387815
Weka Clusterer Visualize: 16:05:58 - Cobweb (iris)
Cluster mode
Use training se
Supplied test s
Percentage spli
Classes to clus
(Nom) class
Store clusters f
X: petallength (Num)
Y: petalwidth (Num)
Colour: Cluster (Nom)
Select Instance
Reset
Clear
Save
Jitter
Plot: iris_clustered
2.5
1.3
0.1
1
3.95
6.9
X
Y
Class colour
cluster0
cluster1
cluster2
Start
Result list (right-click f
16:05:58 - Cobweb
.0 -C 0.002820947917
ion on training data
===
=== Evaluation on training set ===
Status
OK
Log
x 0

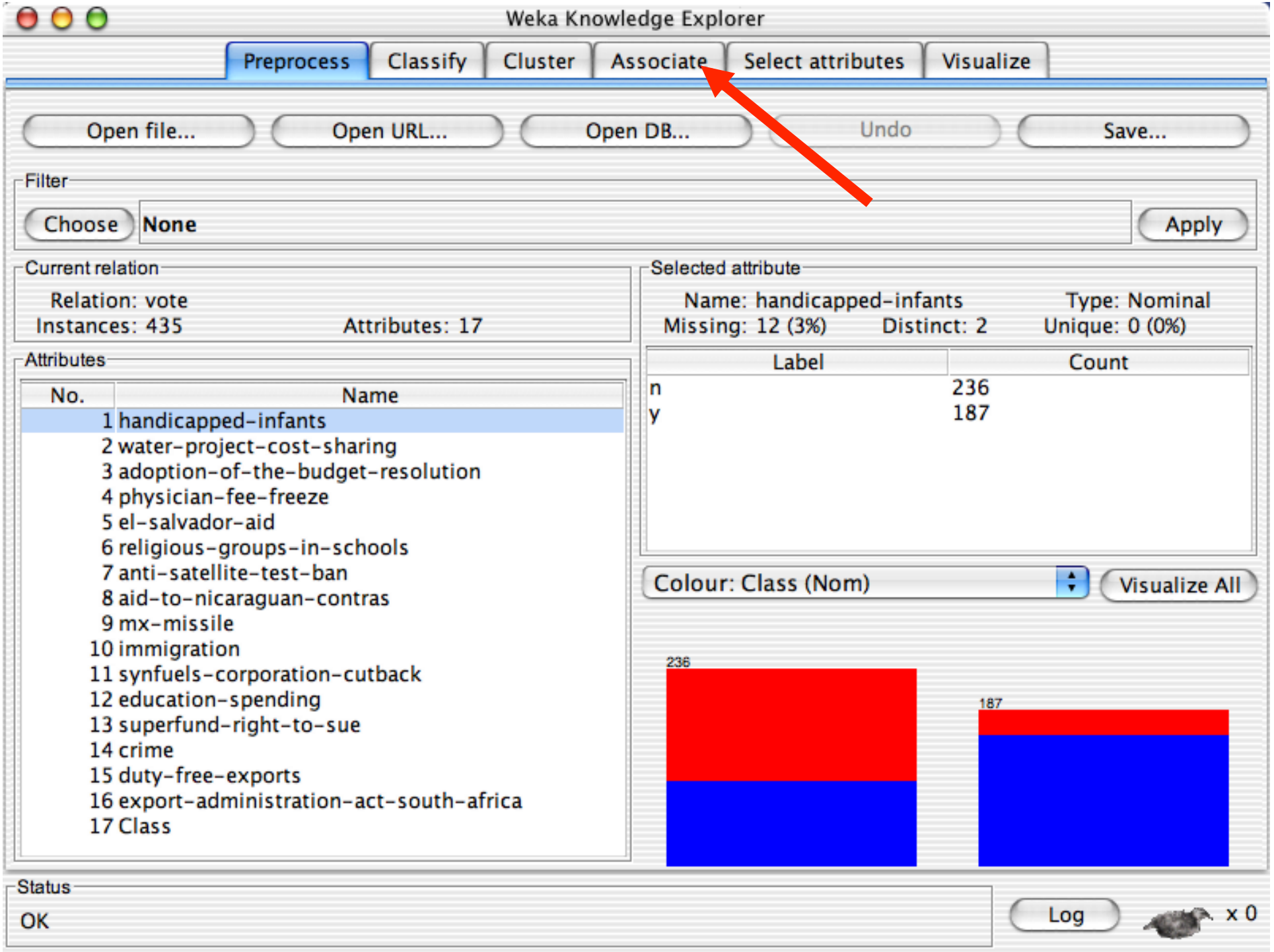
Explorer: finding associations

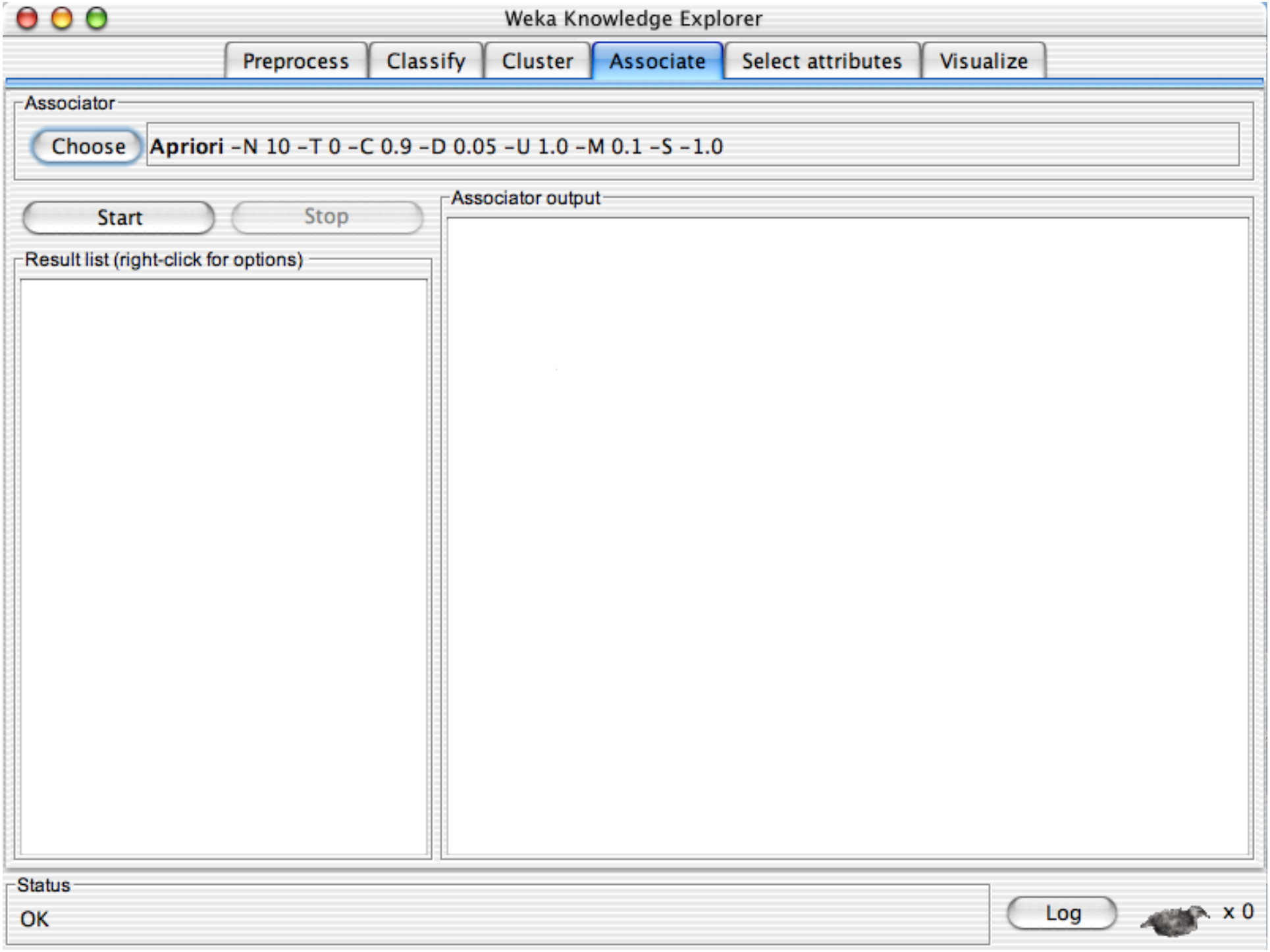
- WEKA contains an implementation of the Apriori algorithm for learning association rules
  - Works only with discrete data
- Can identify statistical dependencies between groups of attributes:
  - milk, butter ⇒ bread, eggs (with confidence 0.9 and support 2000)
- Apriori can compute all rules that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

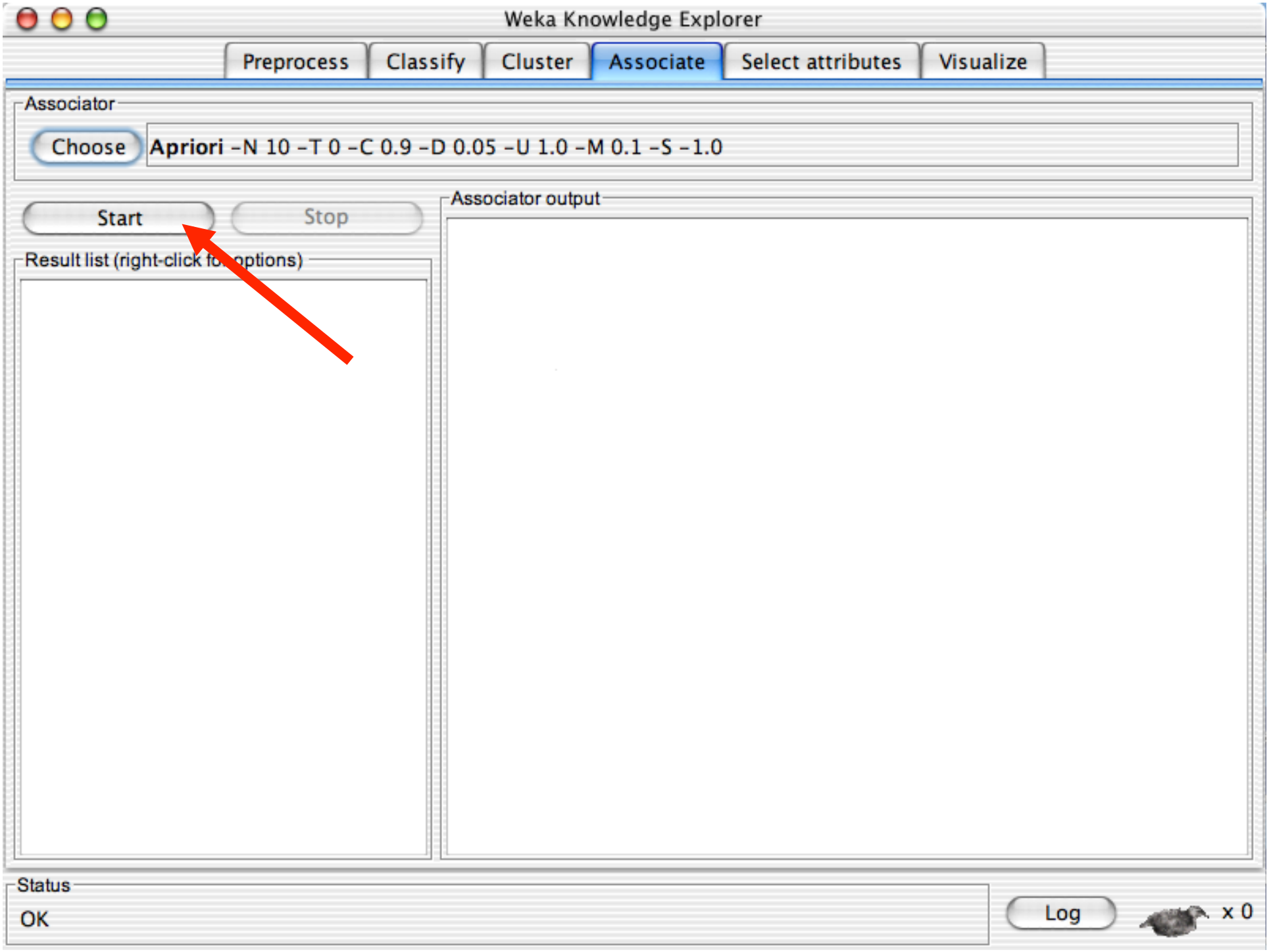

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for options)
Associator output
Status
OK
Log
x 0

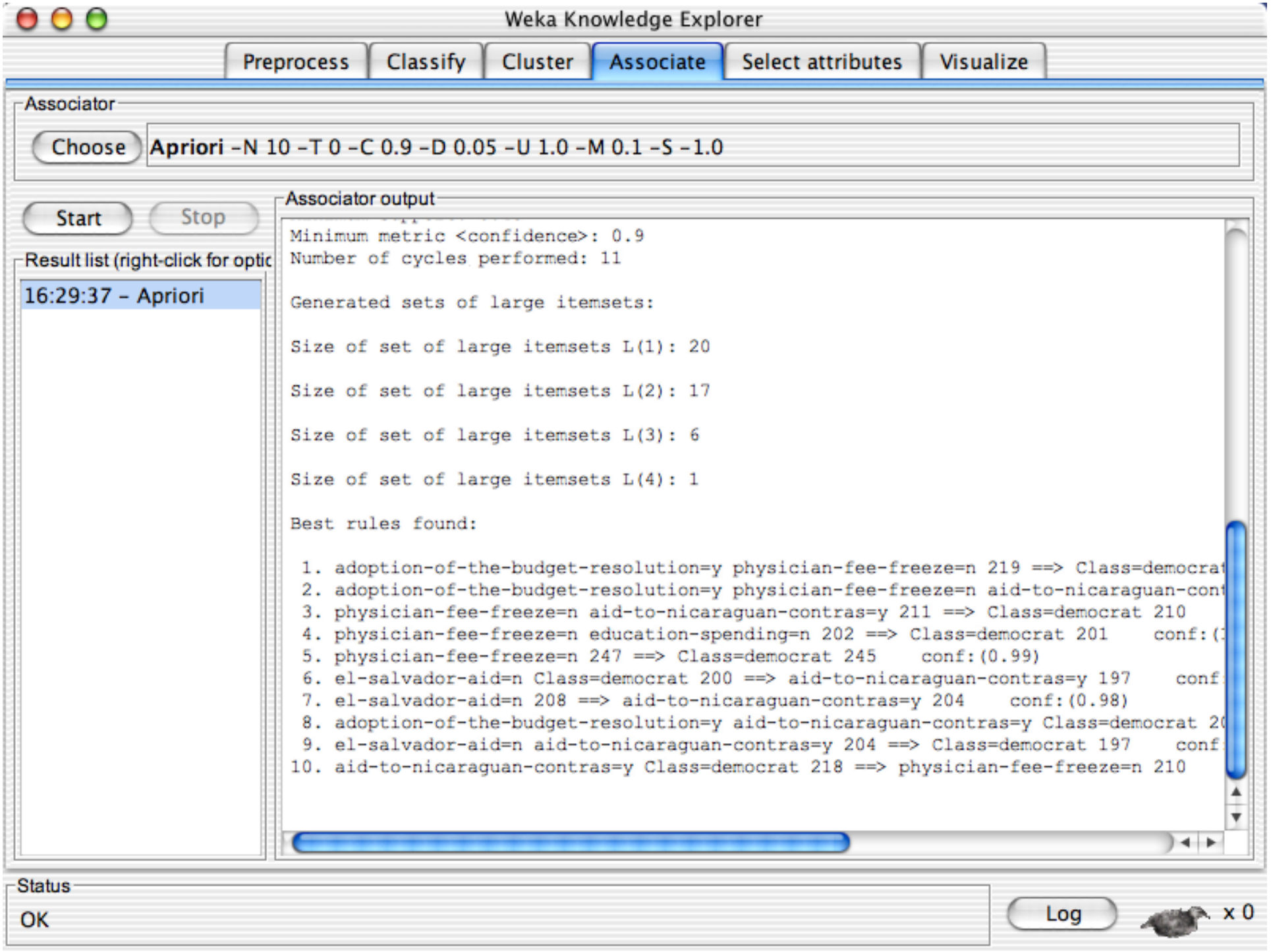

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for options)
Associator output
Status
OK
Log
x 0


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
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

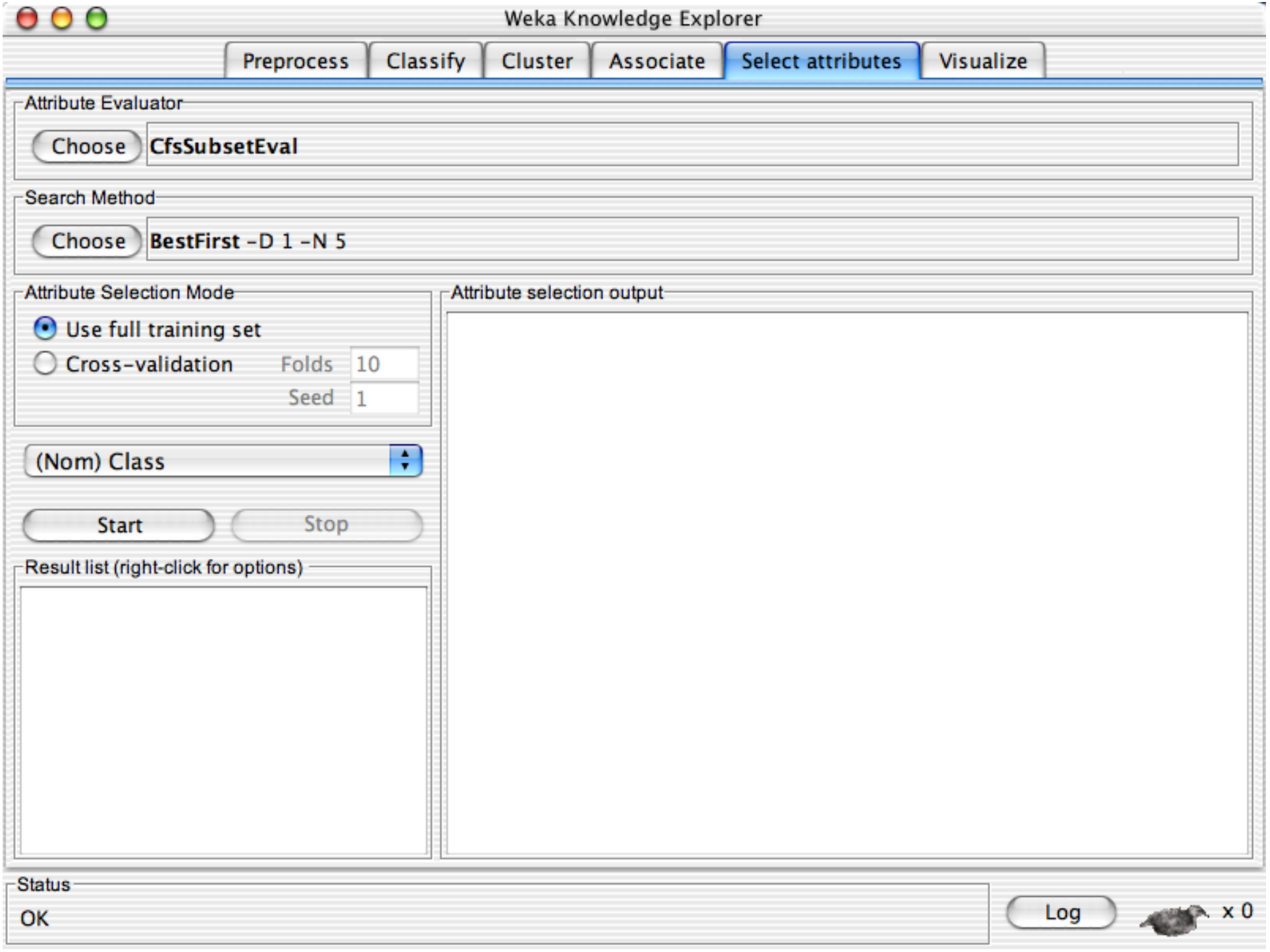

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for options)
Associator output
Status
OK
Log
x 0

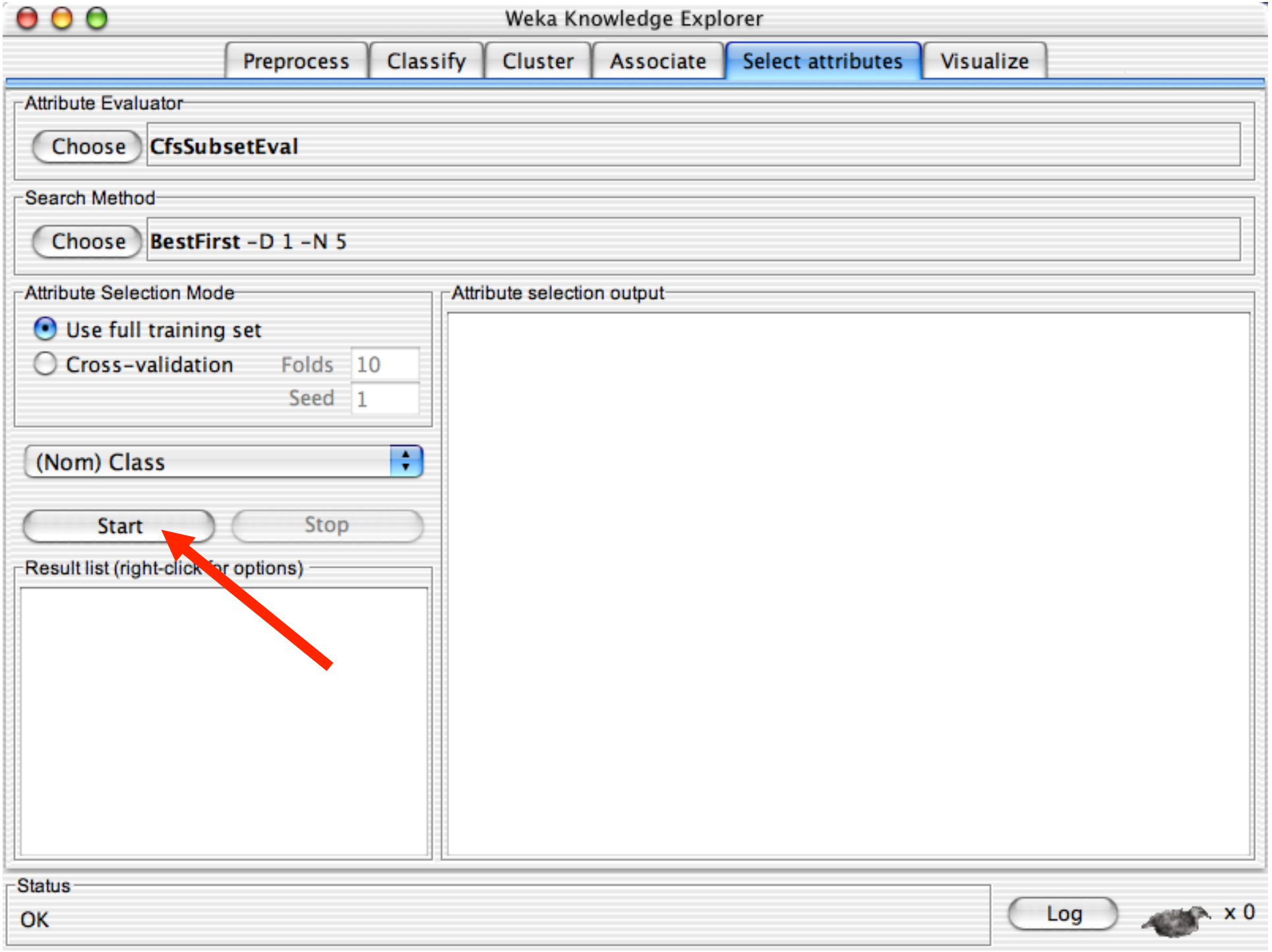

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for options)
Associator output
Status
OK
Log
x 0

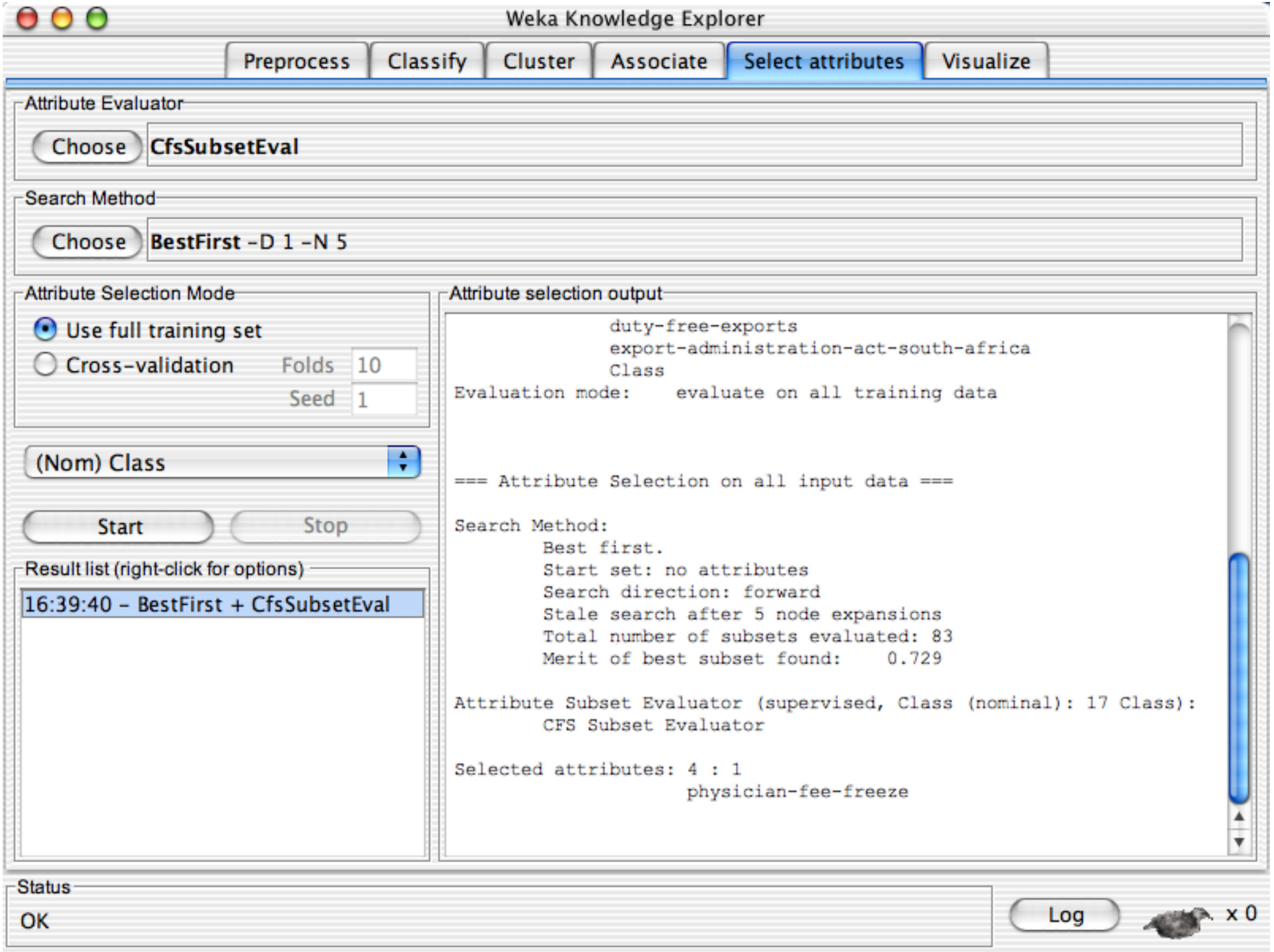

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Associator
Choose
Apriori -N 10 -T 0 -C 0.9 -D 0.05 -U 1.0 -M 0.1 -S -1.0
Start
Stop
Result list (right-click for optic
16:29:37 - Apriori
Associator output
Minimum metric <confidence>: 0.9
Number of cycles performed: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

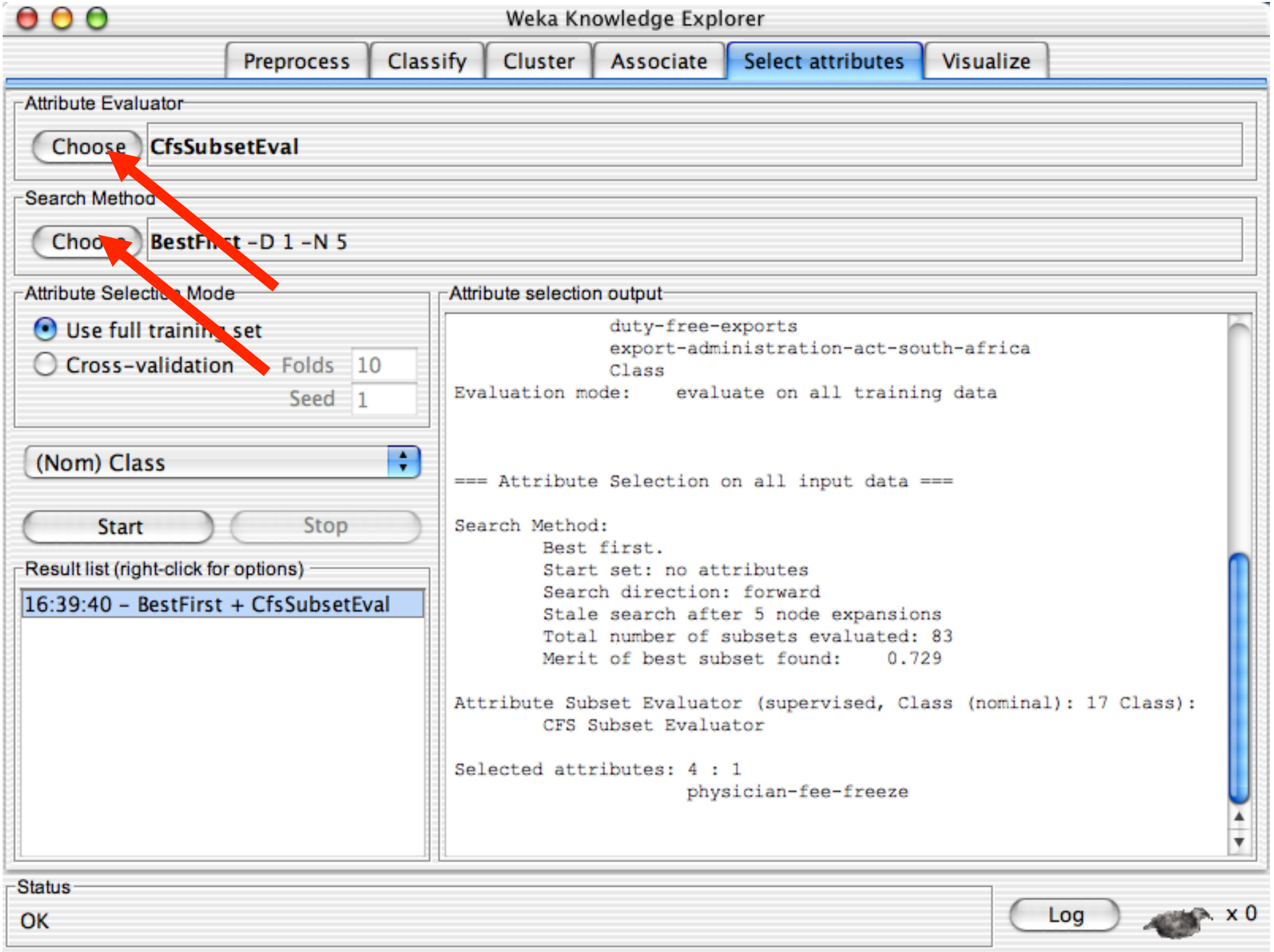
Explorer: attribute selection

- 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
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
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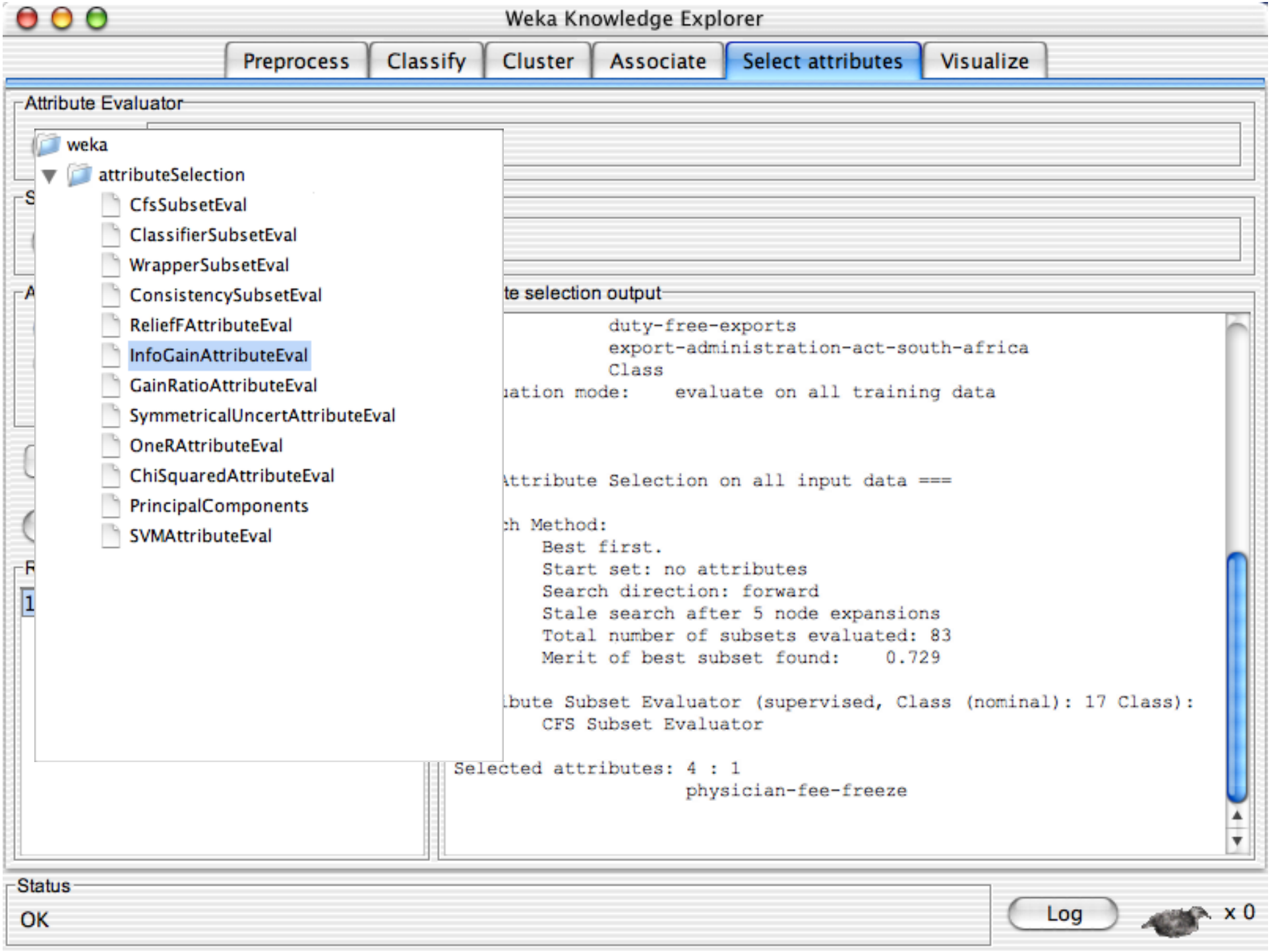
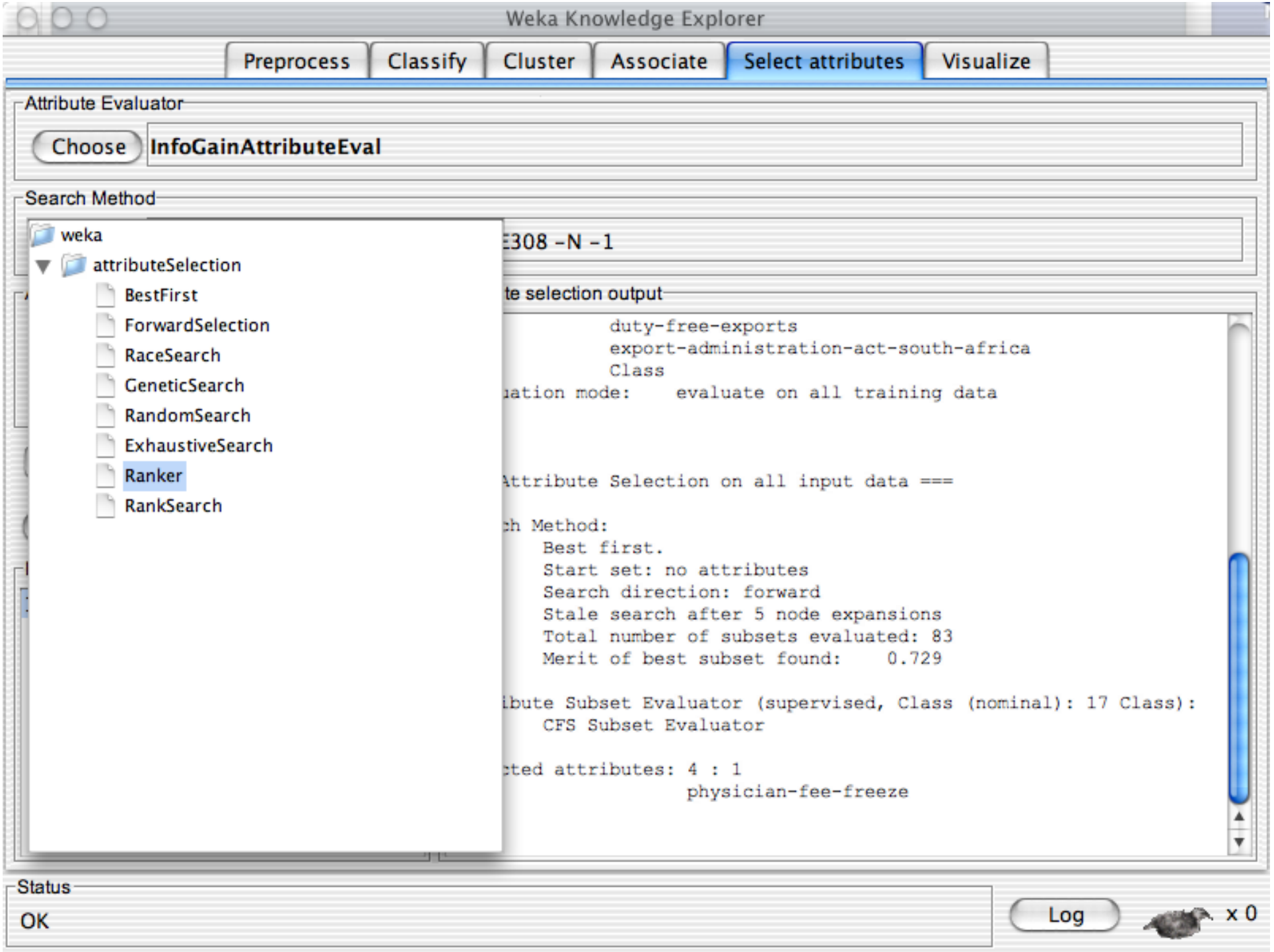
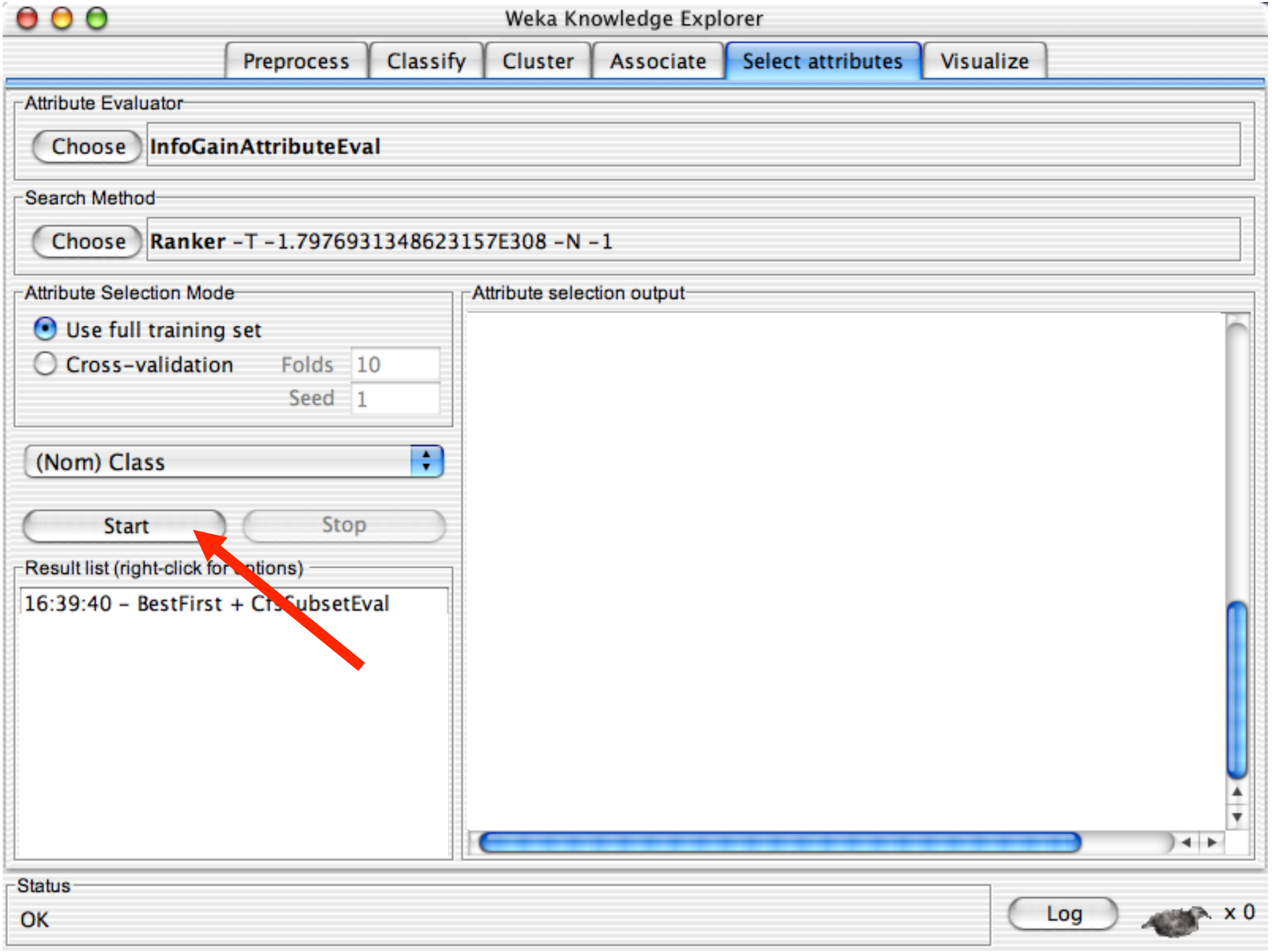
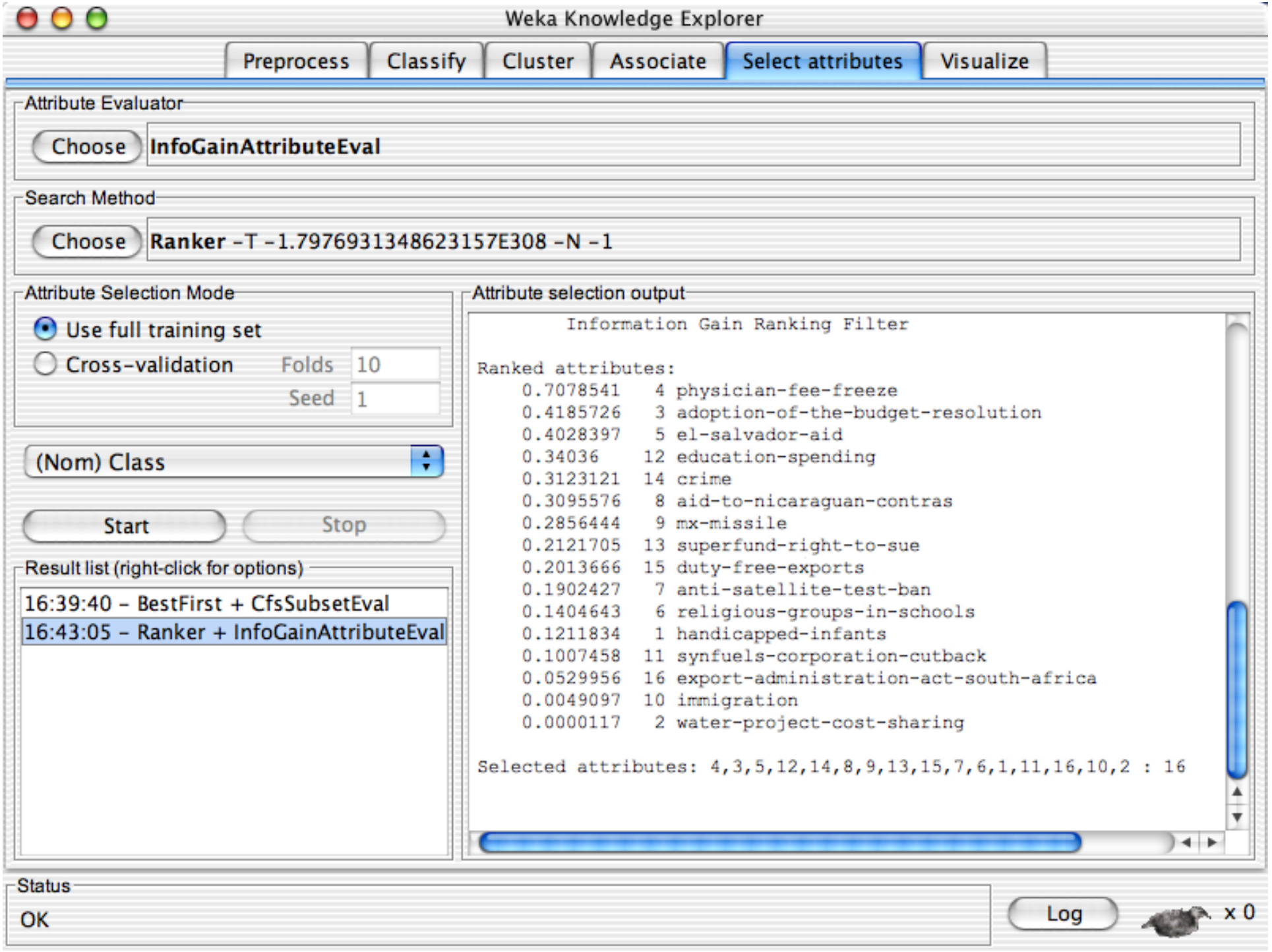
Attribute Subset Evaluator (supervised, Class (nominal): 17 Class):
CFS Subset Evaluator
Selected attributes: 4 : 1
physician-fee-freeze
Status
OK
Log
x 0


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
bute 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)
  - 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

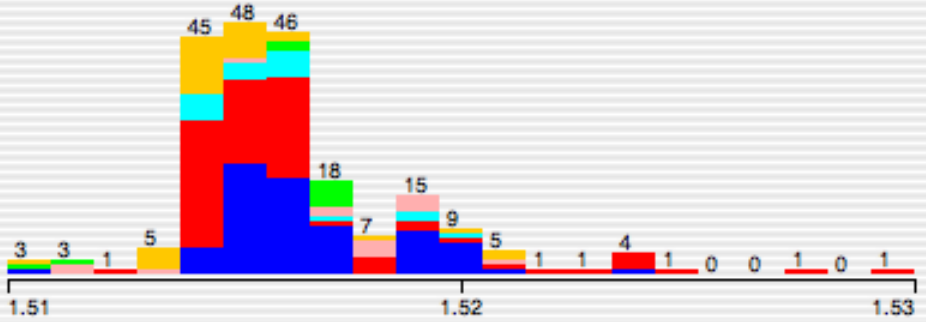
No.	Name
1	RI
2	Na
3	Mg
4	Al
5	Si
6	K
7	Ca
8	Ba
9	Fe
10	Type

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

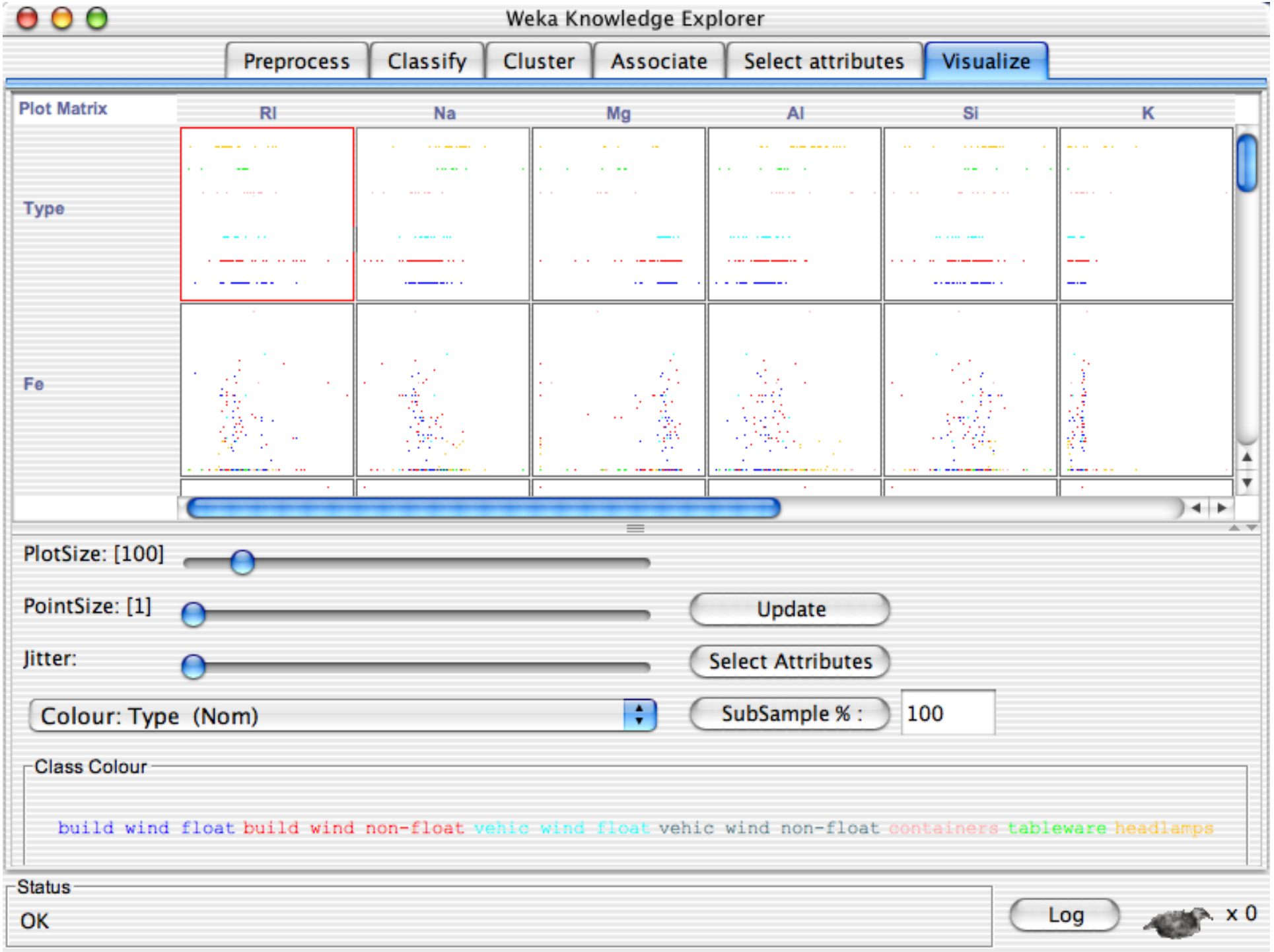
Colour: Type (Nom) | Visualize All

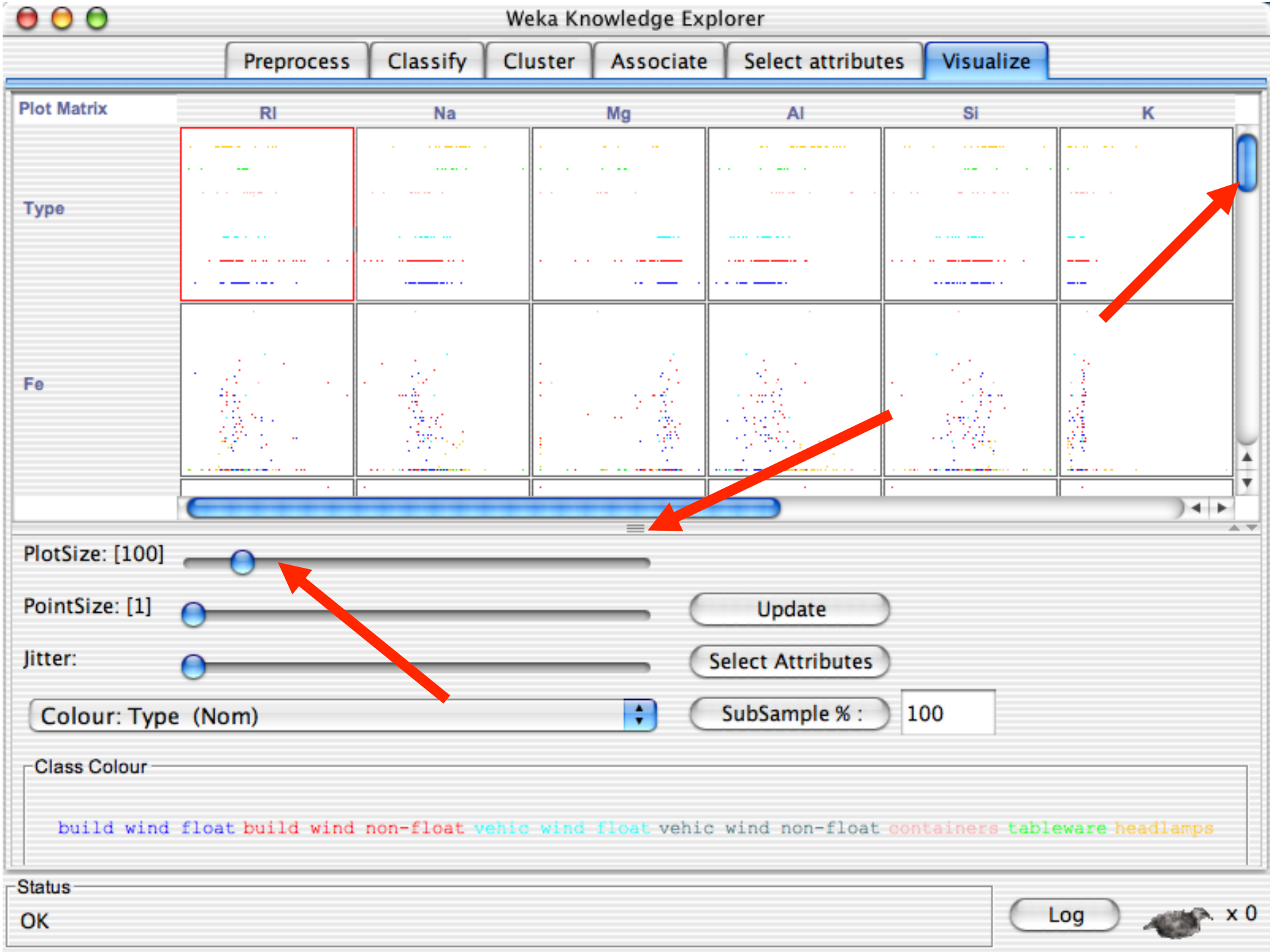


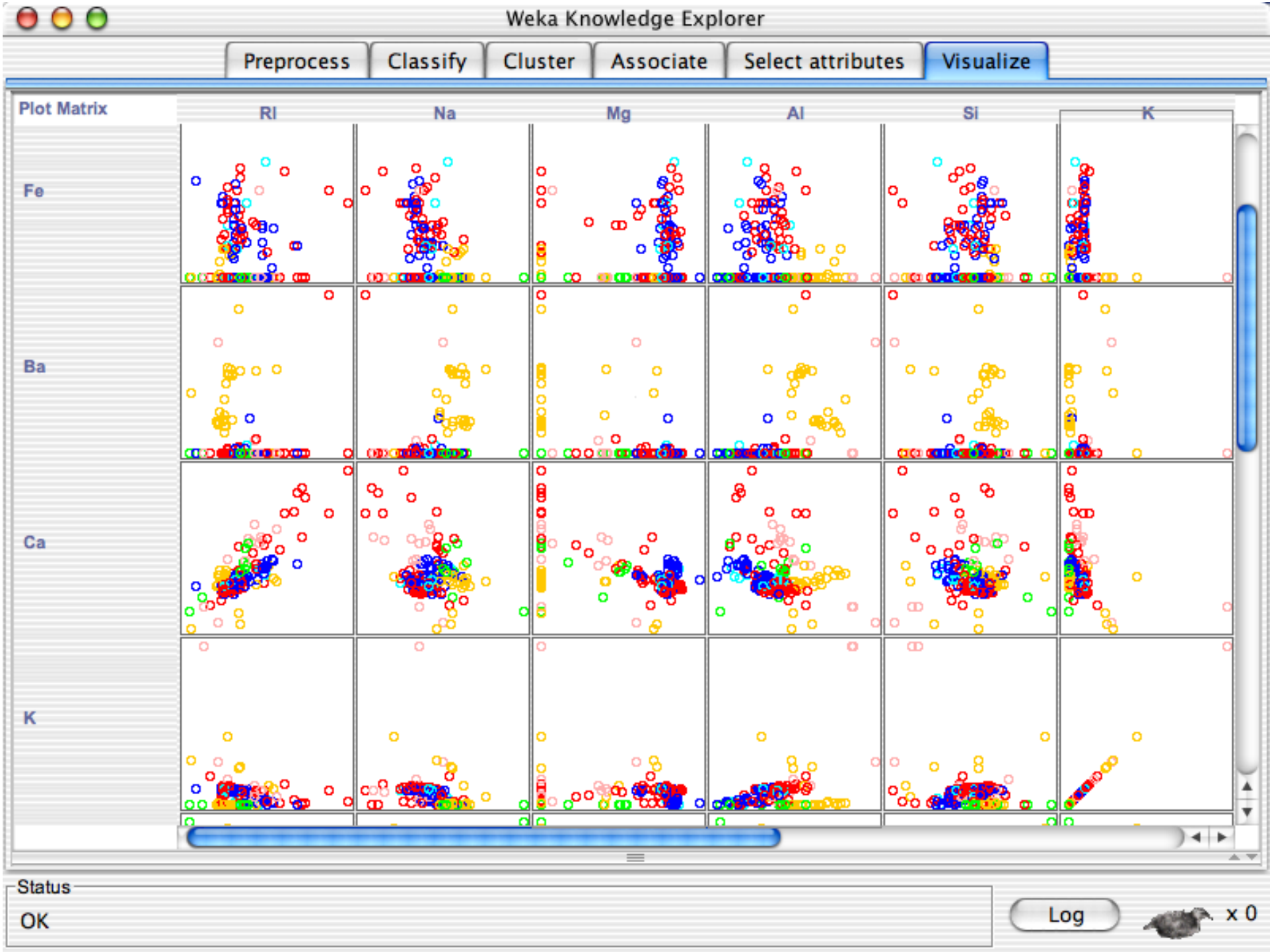
Status

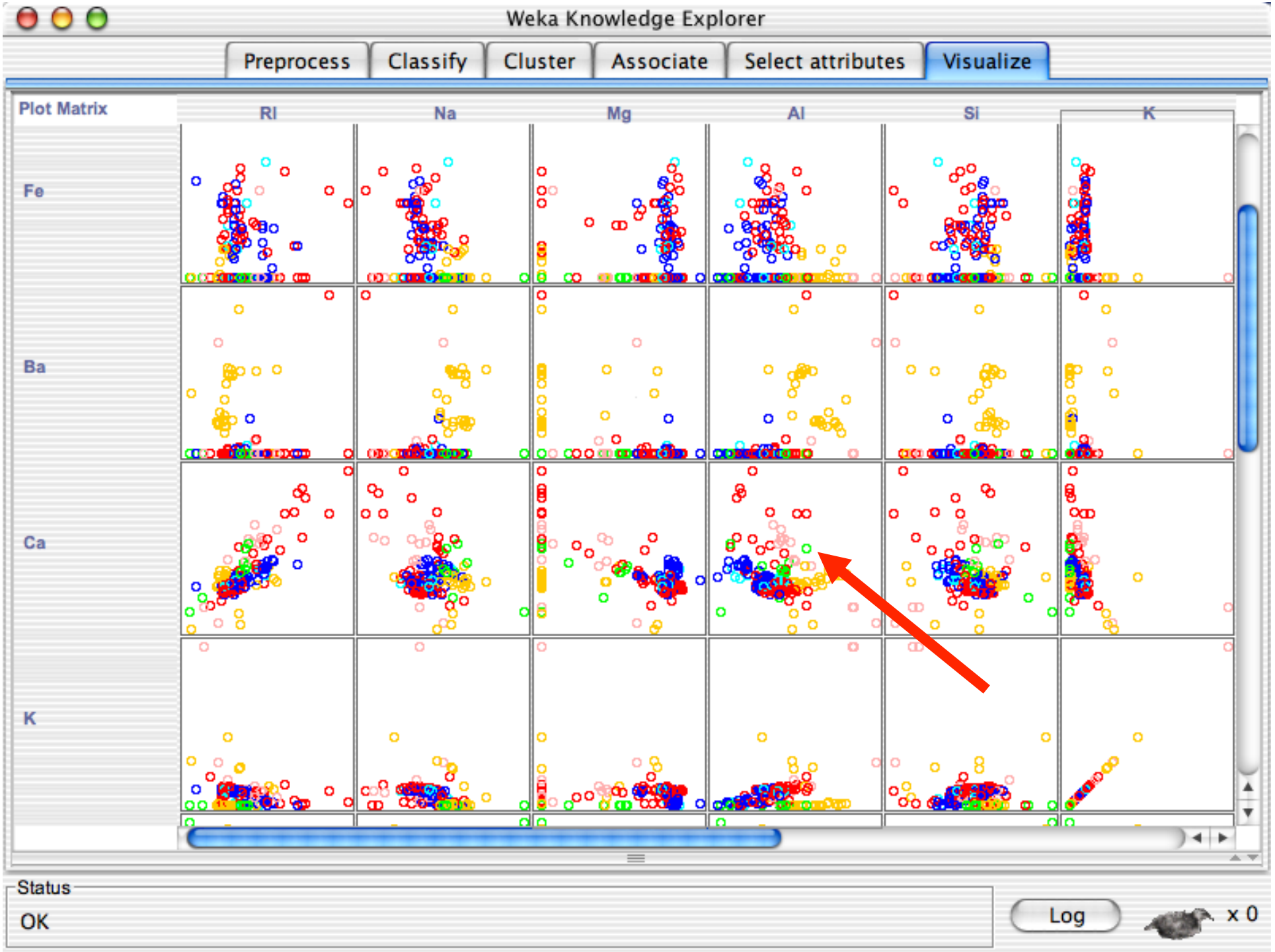
OK

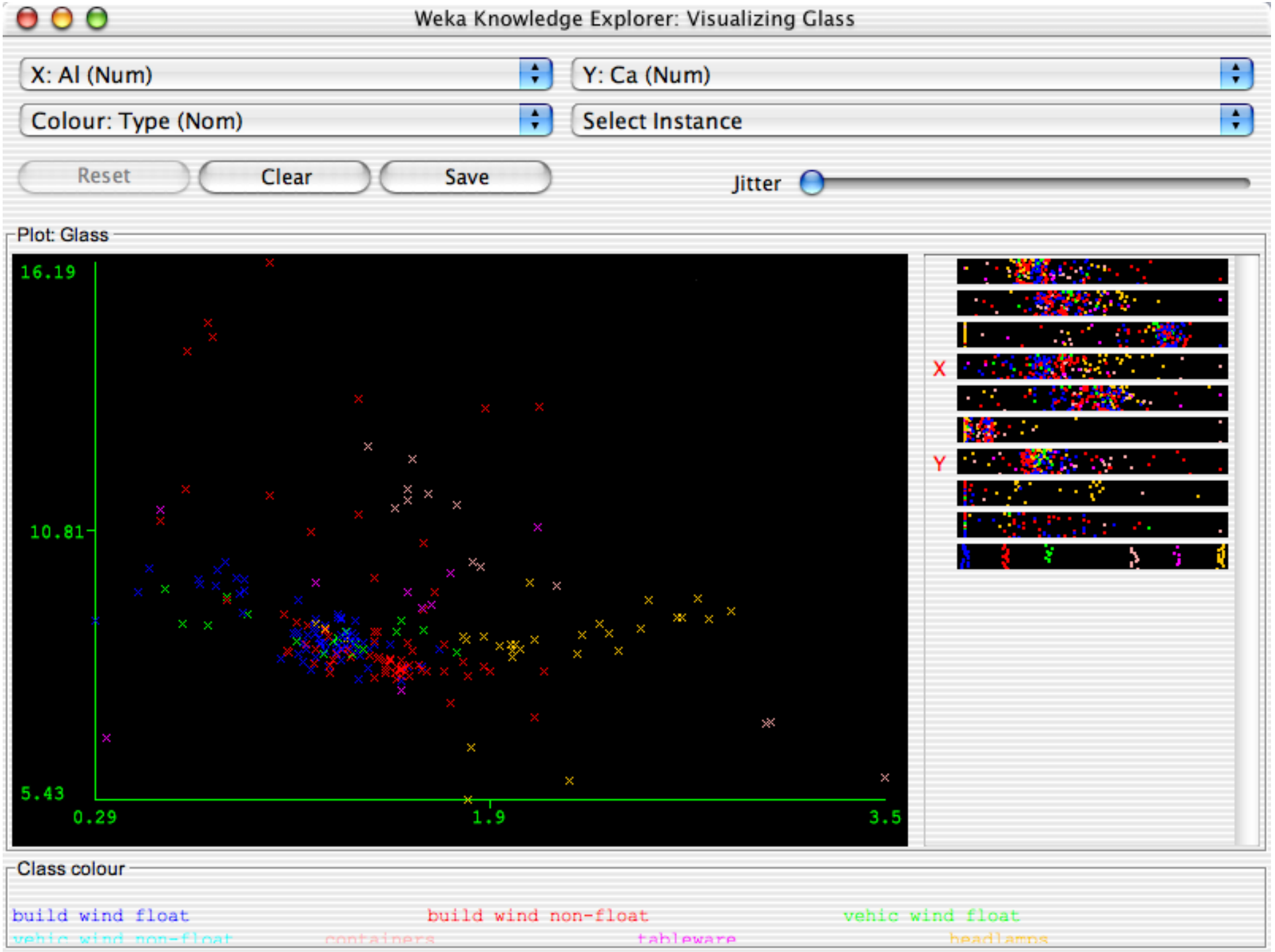
Log | x 0

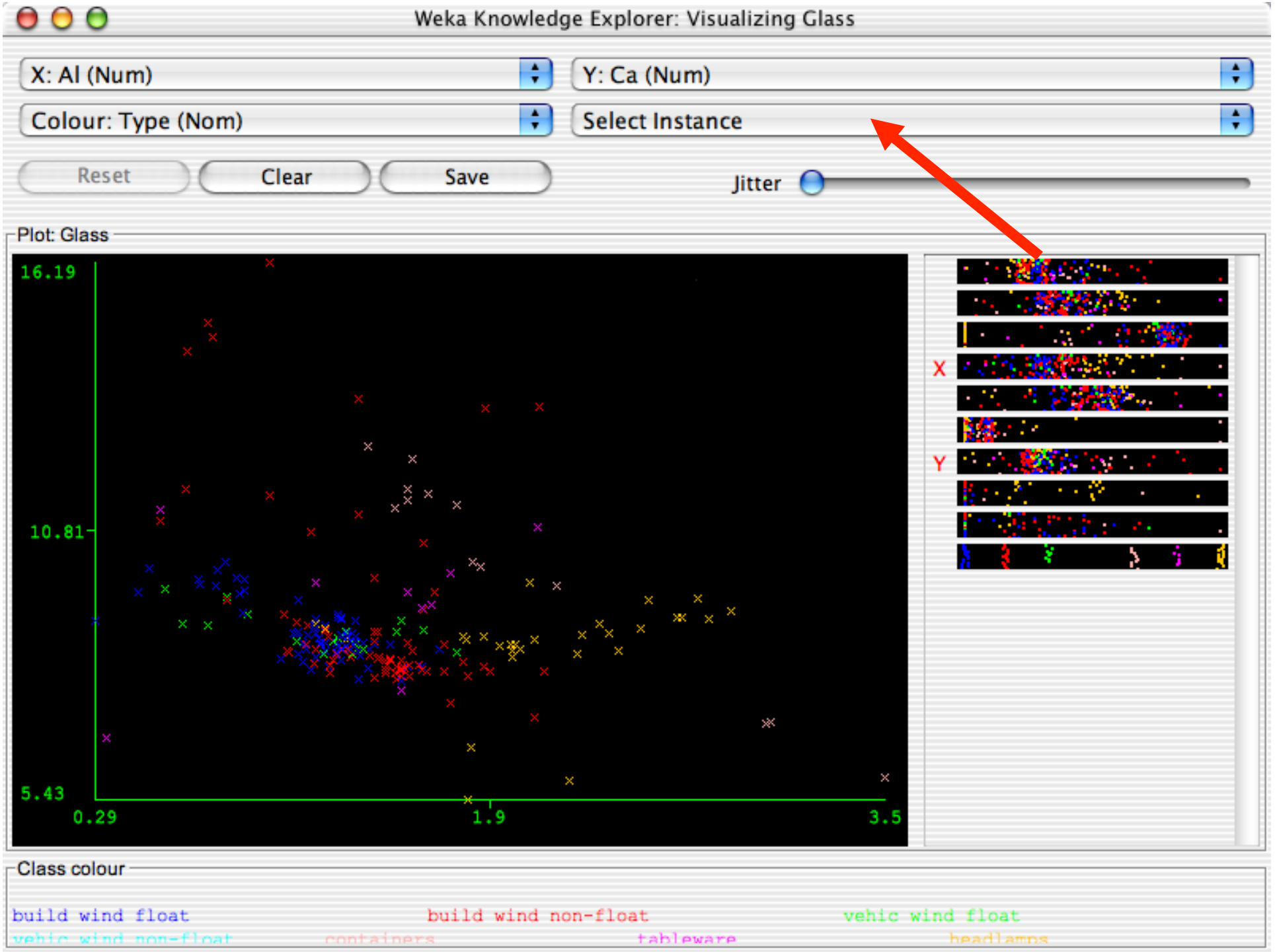

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Type
Fe
PlotSize: [100]
PointSize: [1]
Jitter:
Update
Select Attributes
Colour: Type (Nom)
SubSample % :
100
Class Colour
build wind float
build wind non-float
vehic wind float
vehic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

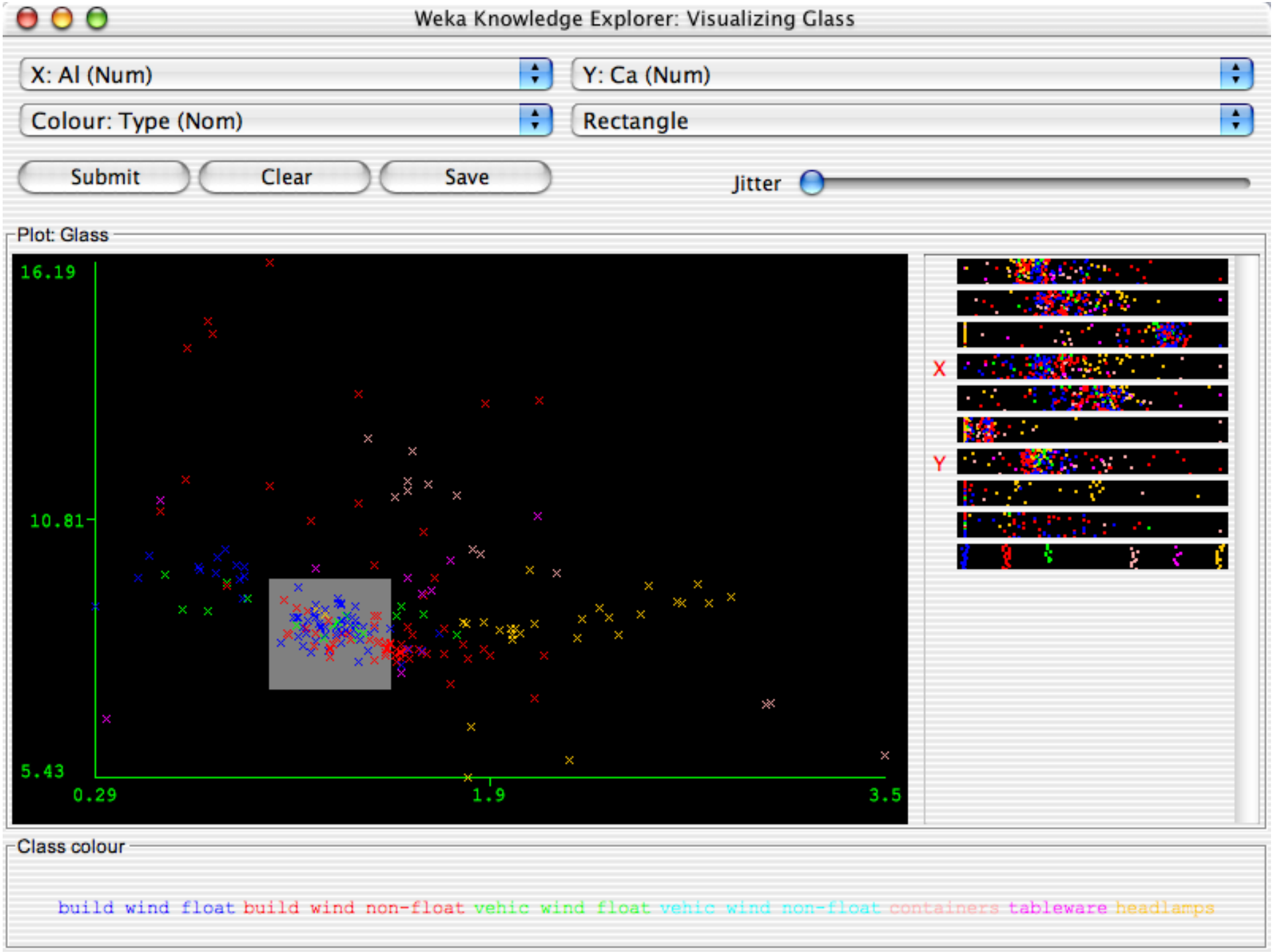

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Type
Fe
PlotSize: [100]
PointSize: [1]
Jitter:
Update
Select Attributes
Colour: Type (Nom)
SubSample % :
100
Class Colour
build wind float build wind non-float vehic wind float vehic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

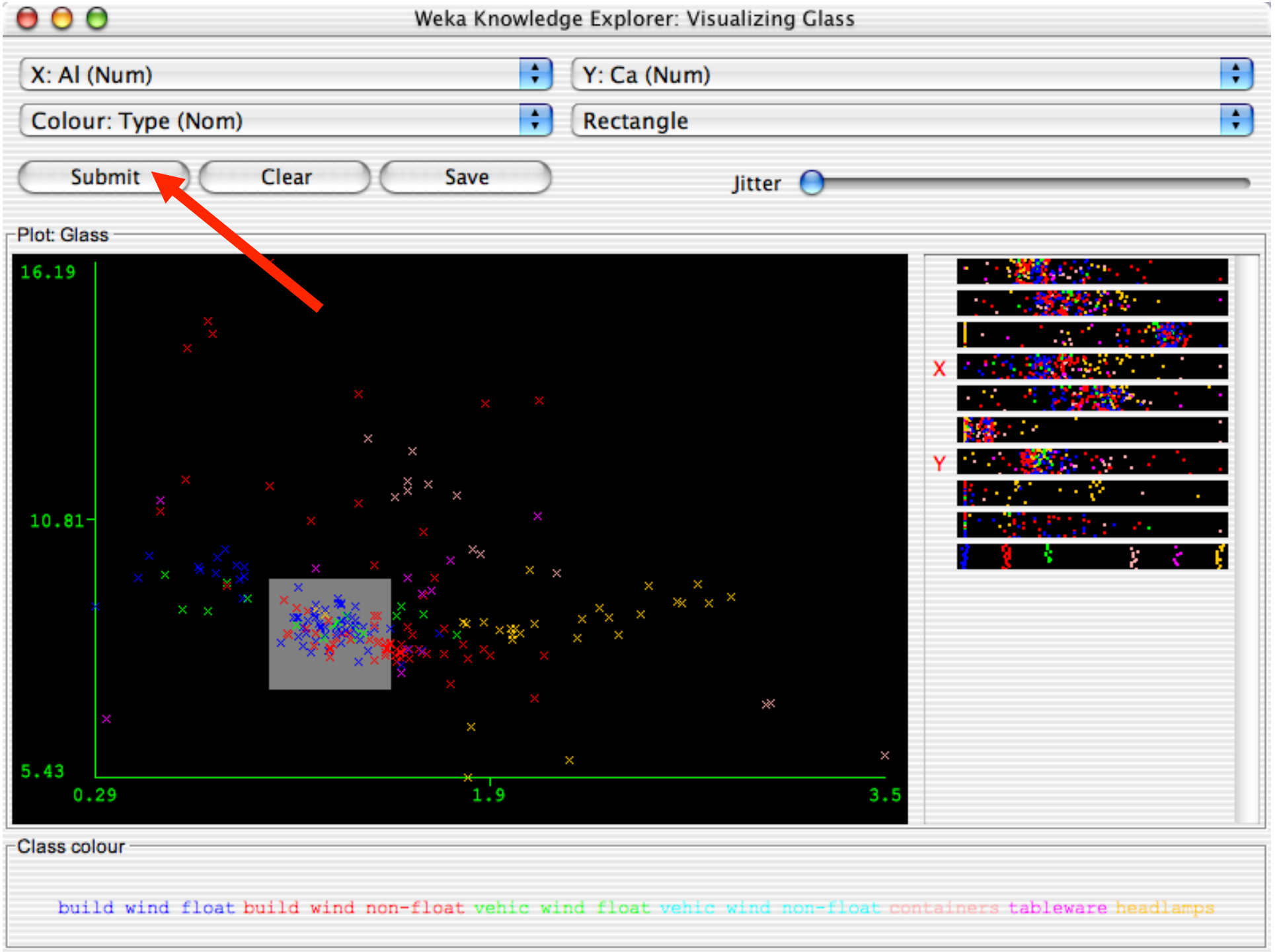

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Fe
Ba
Ca
K
Status
OK
Log
x 0

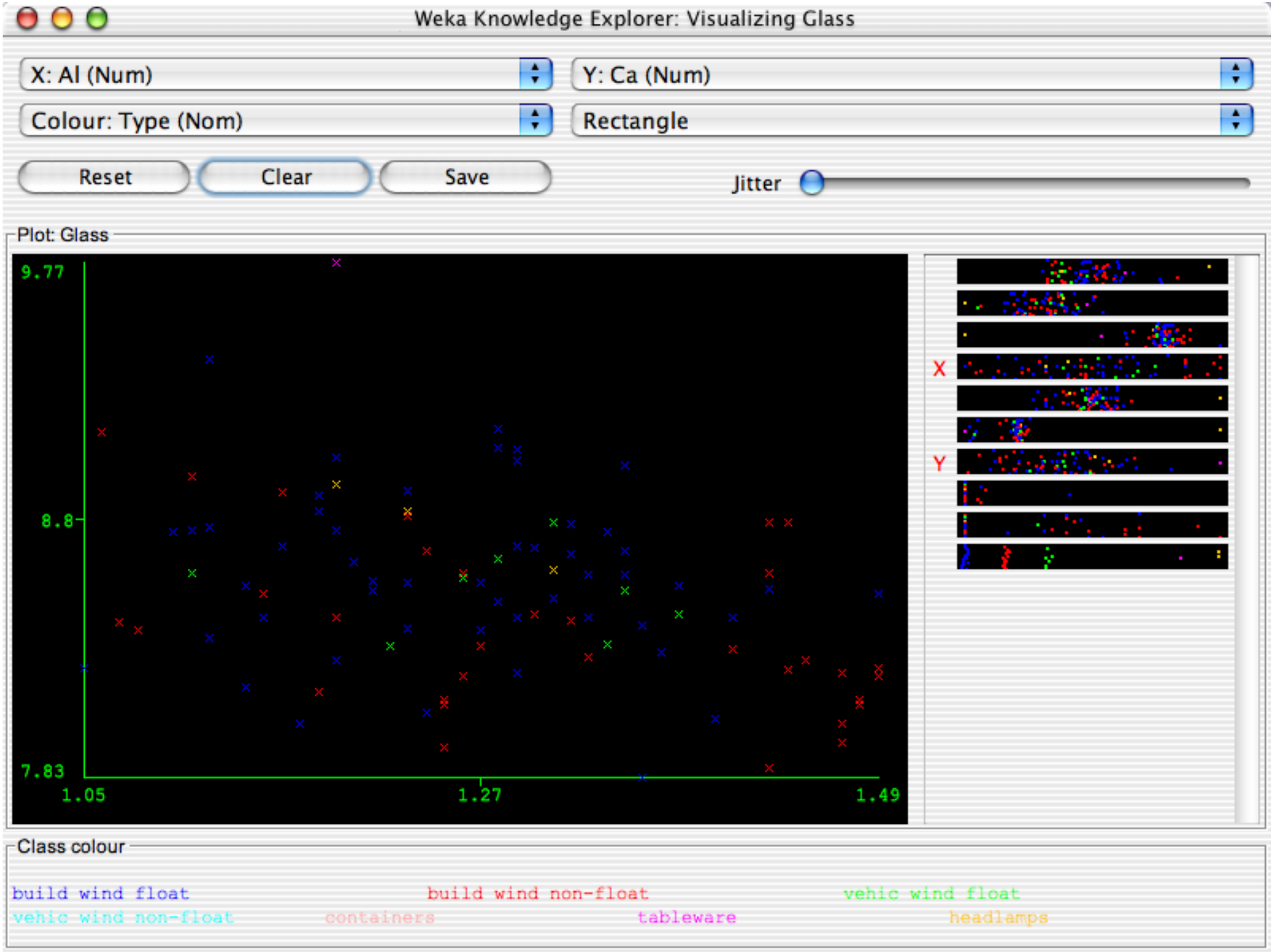

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Plot Matrix
RI
Na
Mg
Al
Si
K
Fe
Ba
Ca
K
Status
OK
Log
x 0


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

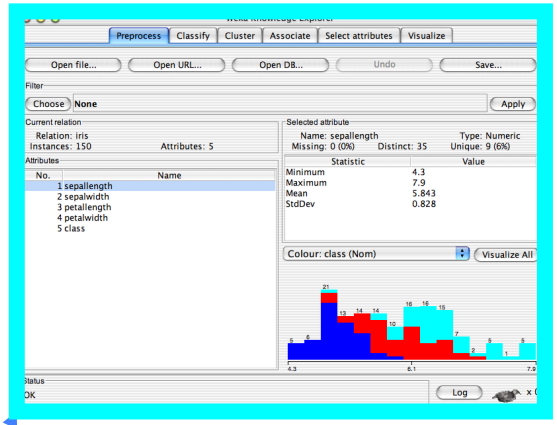

Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Rectangle
Submit
Clear
Save
Jitter
Plot: Glass
16.19
10.81
5.43
0.29
1.9
3.5
X
Y
Class colour
build wind float
build wind non-float
vehic wind float
vehic wind non-float
containers
tableware
headlamps

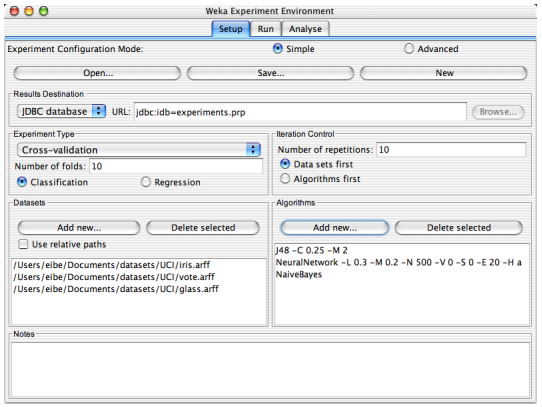

Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Rectangle
Submit
Clear
Save
Jitter
Plot: Glass
16.19
10.81
5.43
0.29
1.9
3.5
X
Y
Class colour
build wind float
build wind non-float
vehic wind float
vehic wind non-float
containers
tableware
headlamps

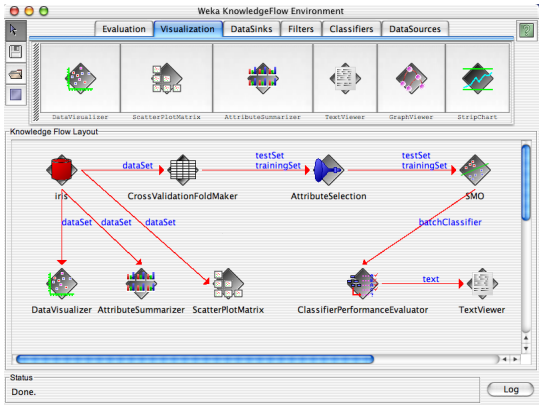

Weka Knowledge Explorer: Visualizing Glass
X: Al (Num)
Y: Ca (Num)
Colour: Type (Nom)
Rectangle
Reset
Clear
Save
Jitter
Plot: Glass
9.77
8.8
7.83
1.05
1.27
1.49
X
Y
Class colour
build wind float
build wind non-float
vehic wind float
vehic wind non-float
containers
tableware
headlamps

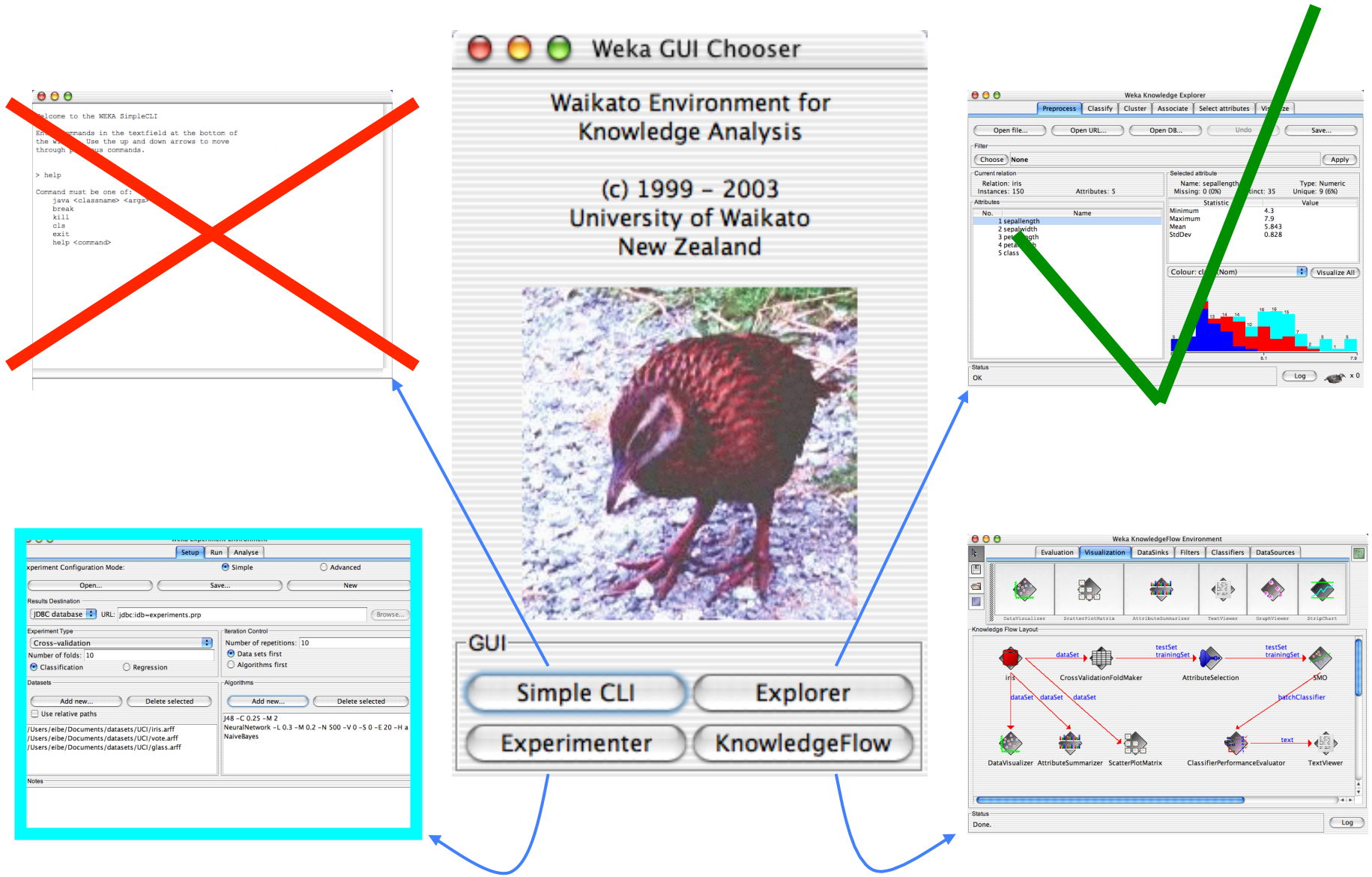
Welcome to the WEKA SimpleCLI
> help
Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>

Weka GUI Chooser
Waikato Environment for Knowledge Analysis
(c) 1999 - 2003
University of Waikato
New Zealand
GUI
Simple CLI
Explorer
Experimenter
KnowledgeFlow


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
Missing: 0 (0%)
Distinct: 35
Type: Numeric
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

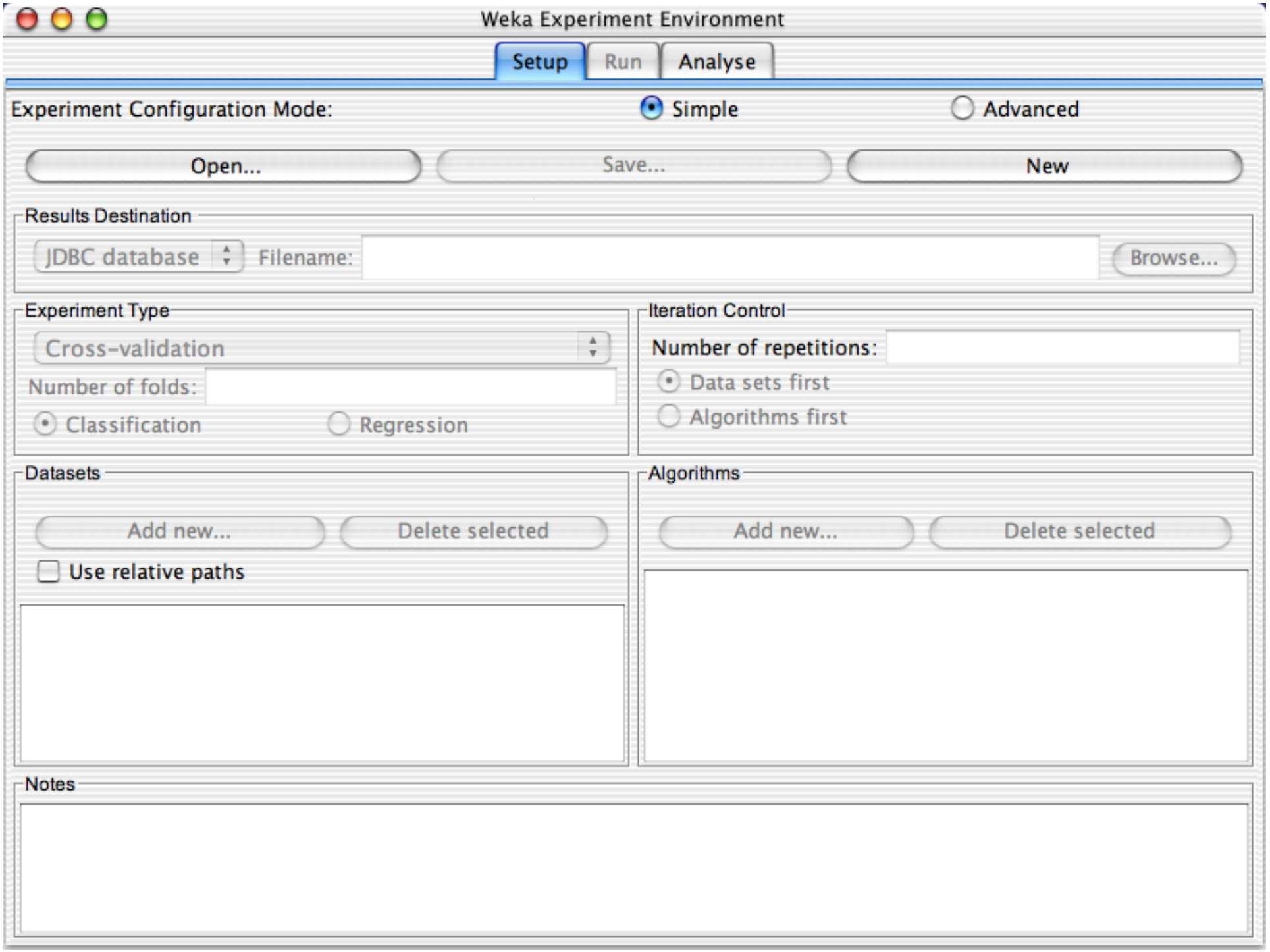

Weka Experiment Environment
Setup
Run
Analyse
Experiment Configuration Mode:
Simple
Advanced
Open...
Save...
New
Results Destination
JDBC database
URL: jdbc:idb=experiments.prp
Browse...
Experiment Type
Cross-validation
Number of folds: 10
Classification
Regression
Iteration Control
Number of repetitions: 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

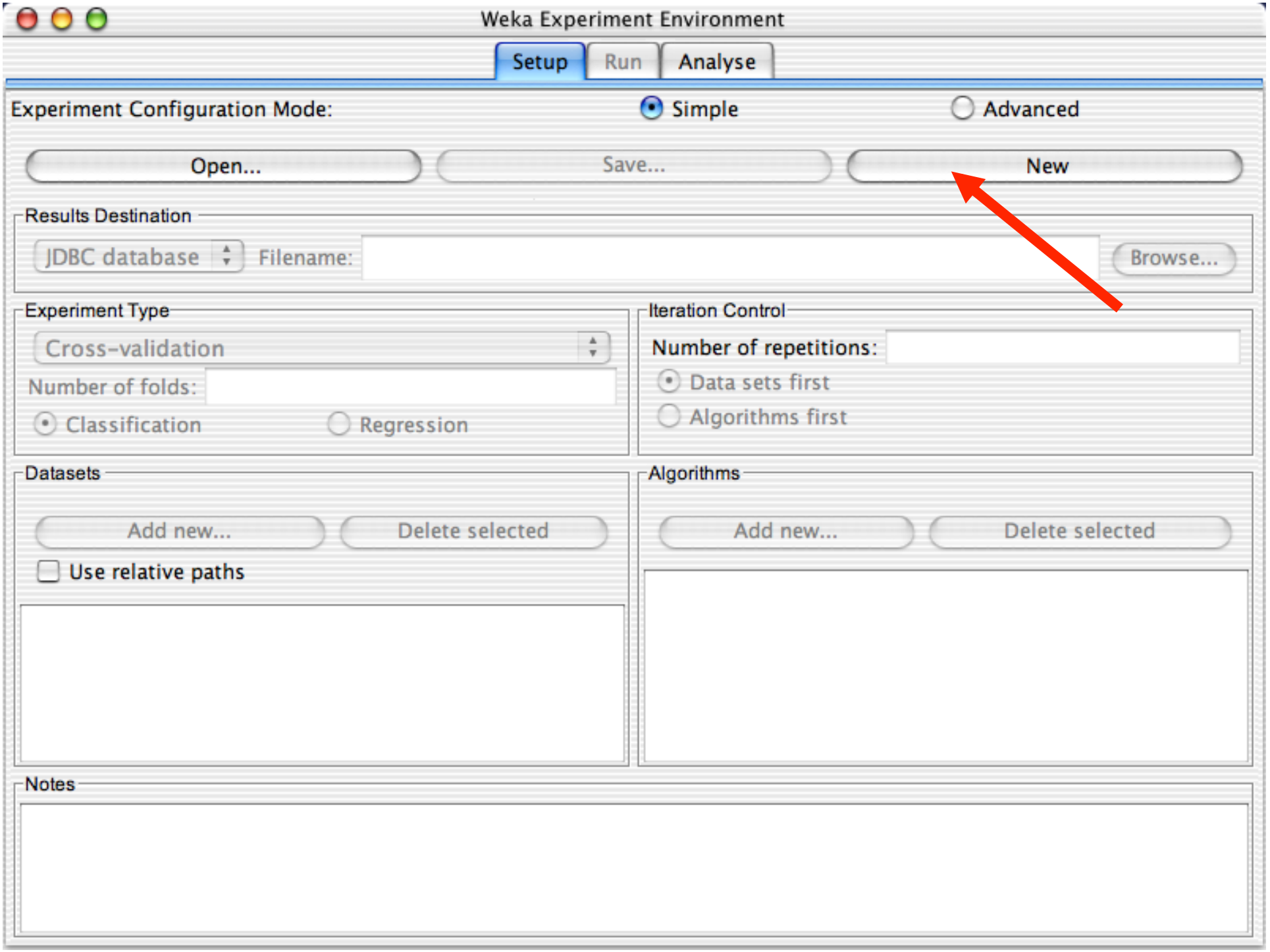

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
Knowledge Flow Layout
iris
dataSet
CrossValidationFoldMaker
testSet
trainingSet
AttributeSelection
SMO
batchClassifier
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
text
TextViewer
Status
Done.
Log

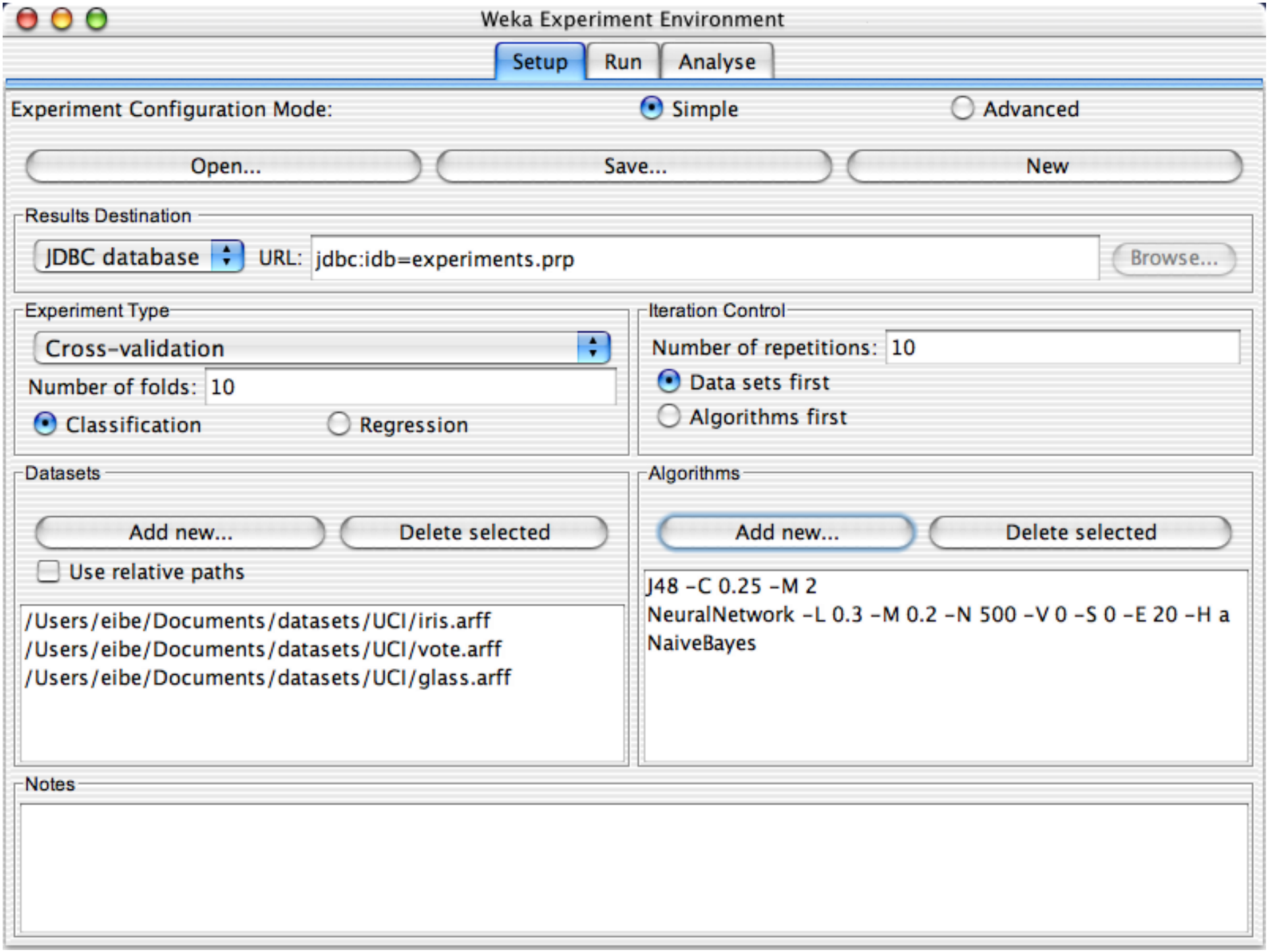

Weka GUI Chooser
Waikato Environment for Knowledge Analysis
(c) 1999 - 2003
University of Waikato
New Zealand
GUI
Simple CLI
Explorer
Experimenter
KnowledgeFlow

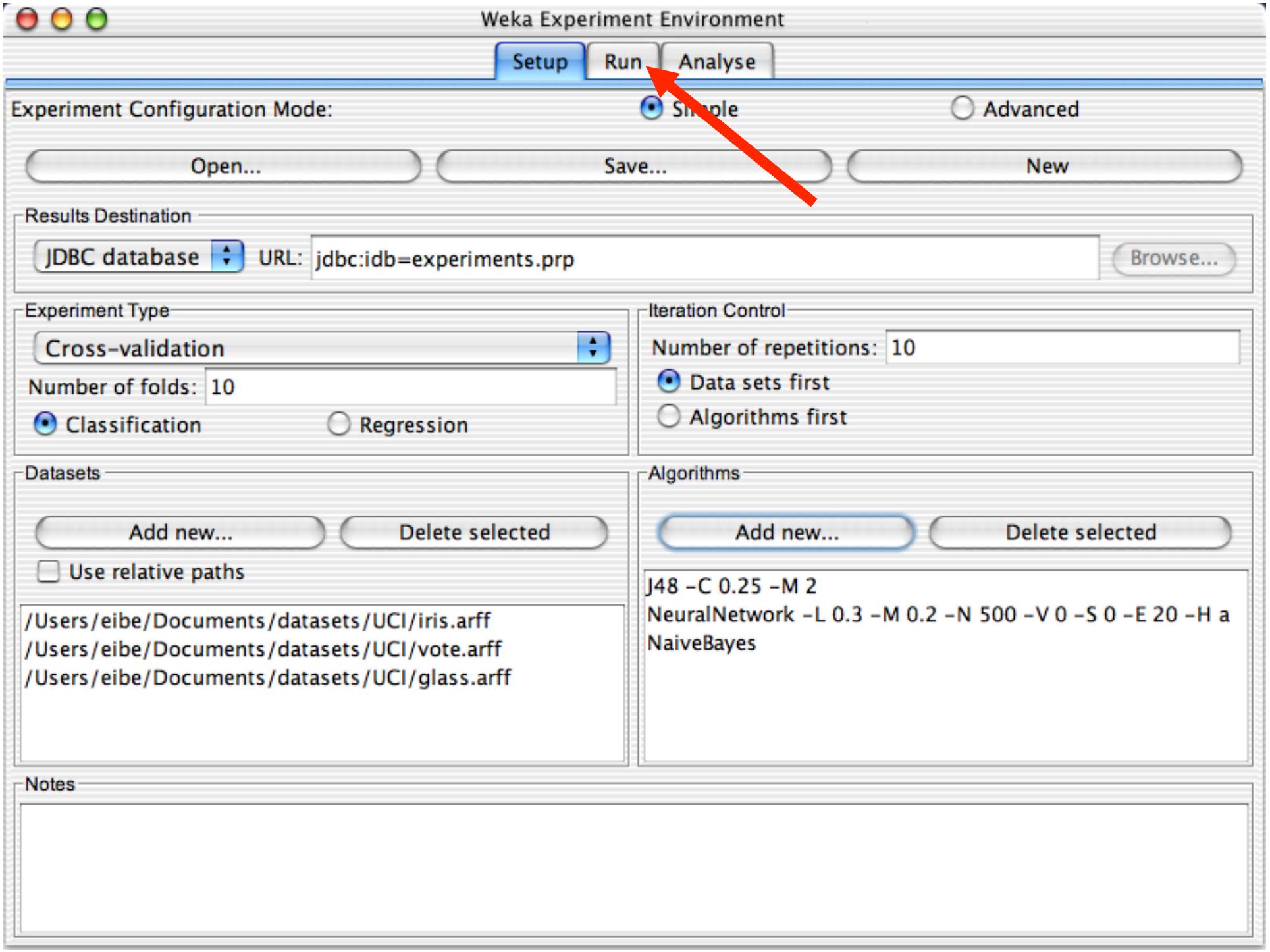
Performing experiments

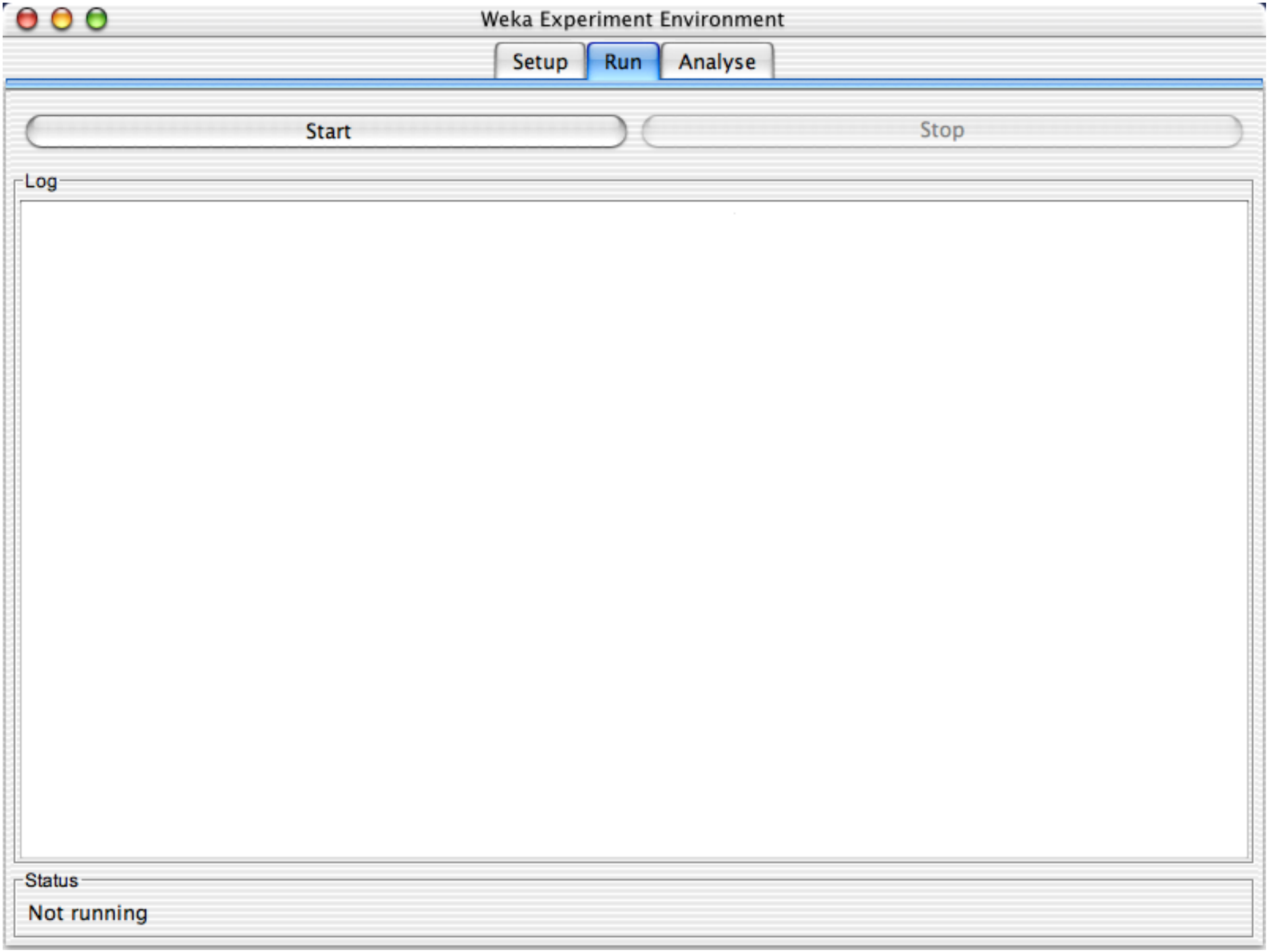
- Experimenter makes it easy to compare the performance of different learning schemes
- For classification and regression problems
- Results can be written into file or database
- Evaluation options: cross-validation, learning curve, hold-out
- Can also iterate over different parameter settings
- Significance-testing built in!

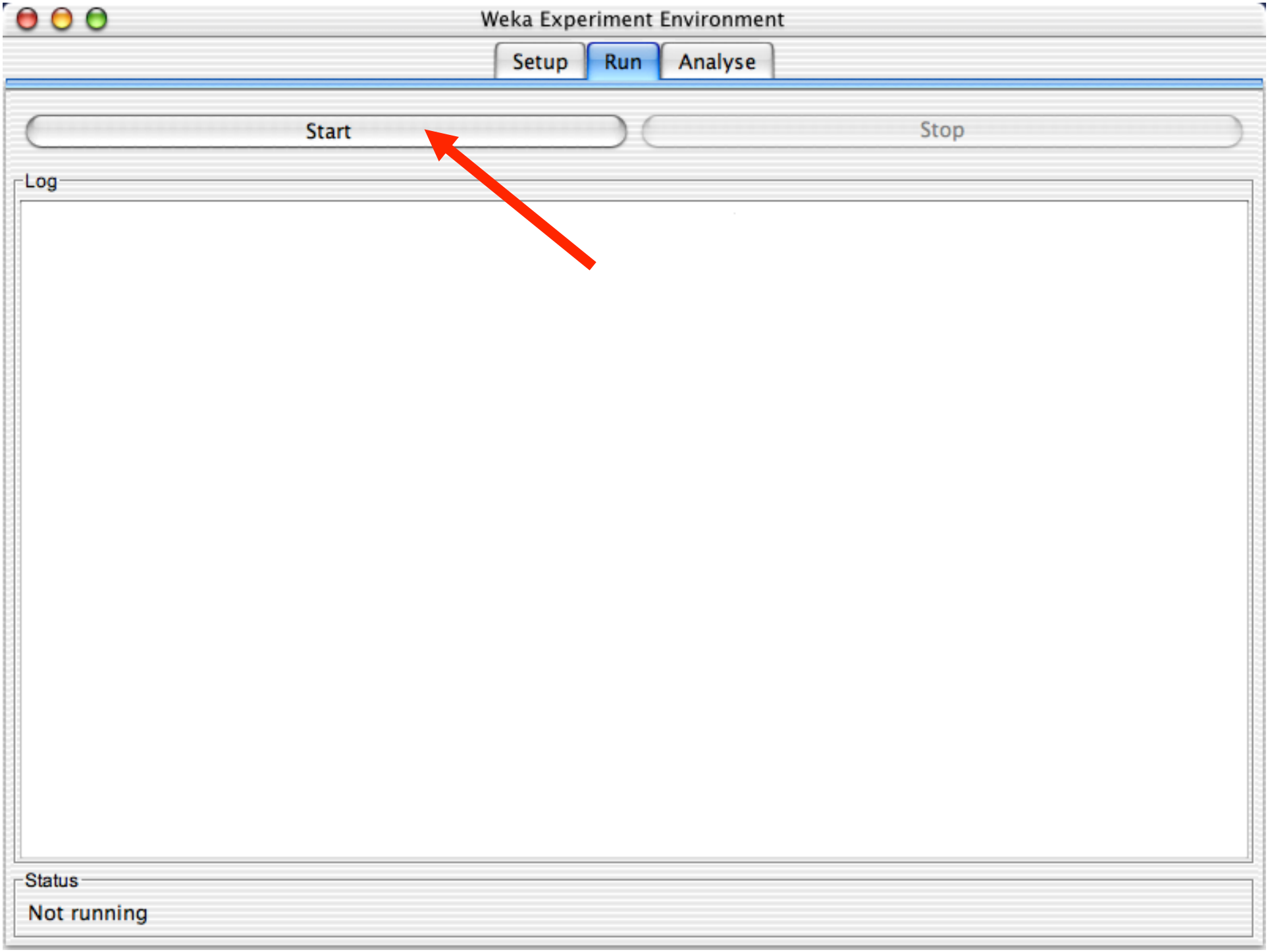

Weka Experiment Environment
Setup
Run
Analyse
Experiment Configuration Mode:
Simple
Advanced
Open...
Save...
New
Results Destination
JDBC database
Filename:
Browse...
Experiment Type
Cross-validation
Number of folds:
Classification
Regression
Iteration Control
Number of repetitions:
Data sets first
Algorithms first
Datasets
Add new...
Delete selected
Use relative paths
Algorithms
Add new...
Delete selected
Notes

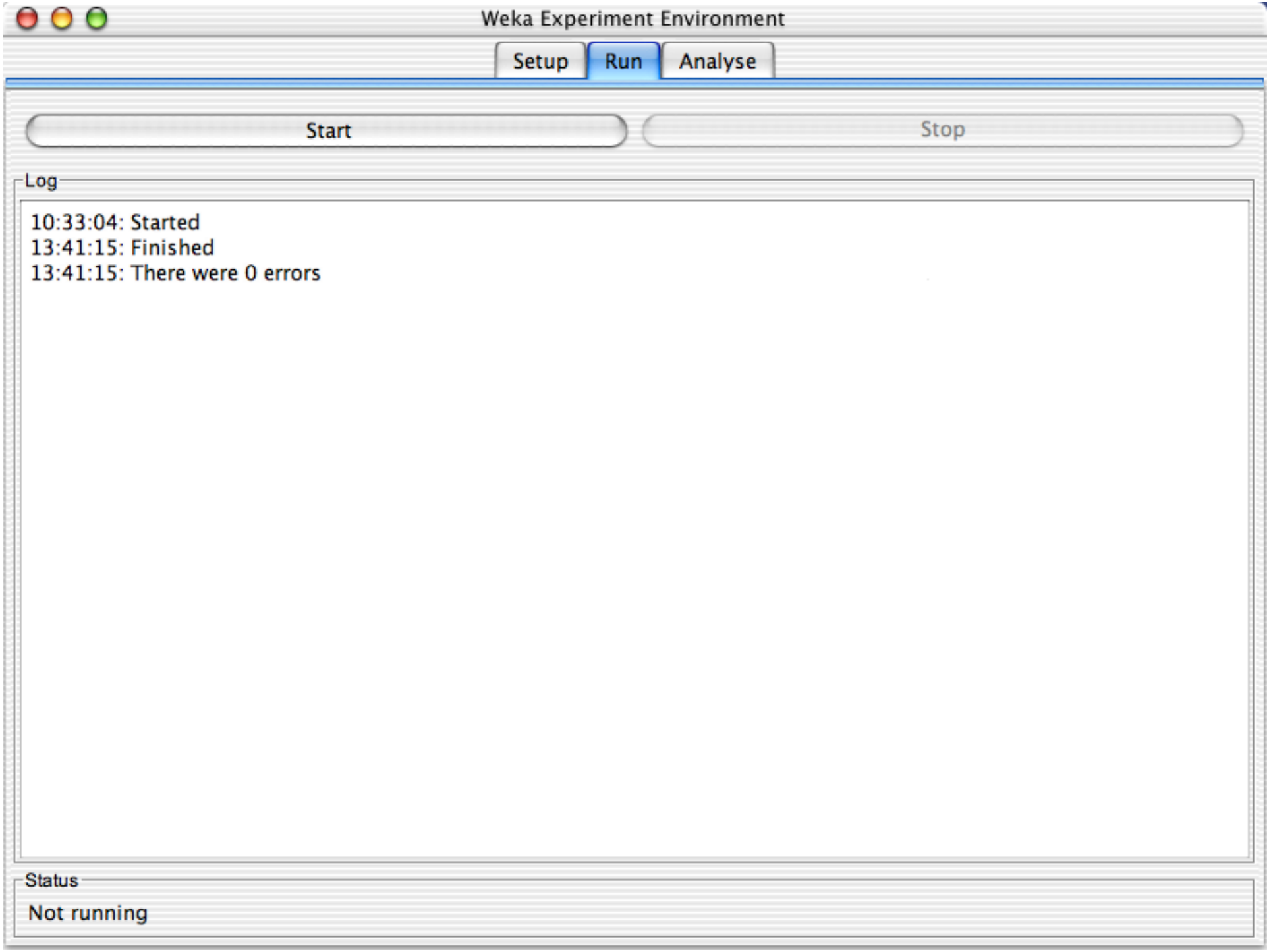

Weka Experiment Environment
Setup
Run
Analyse
Experiment Configuration Mode:
Simple
Advanced
Open...
Save...
New
Results Destination
JDBC database
Filename:
Browse...
Experiment Type
Cross-validation
Number of folds:
Classification
Regression
Iteration Control
Number of repetitions:
Data sets first
Algorithms first
Datasets
Add new...
Delete selected
Use relative paths
Algorithms
Add new...
Delete selected
Notes

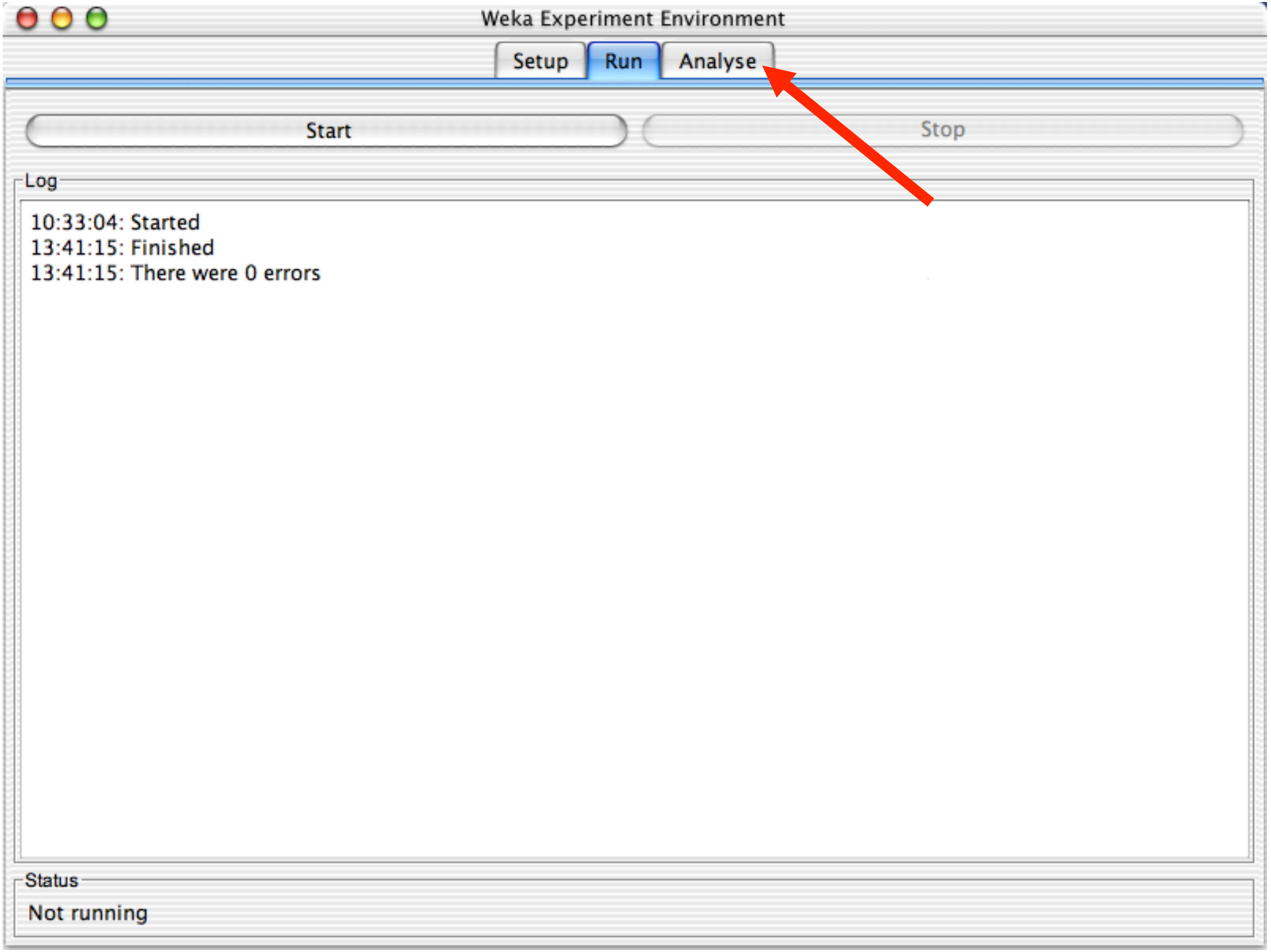

Weka Experiment Environment
Setup
Run
Analyse
Experiment Configuration Mode:
Simple
Advanced
Open...
Save...
New
Results Destination
JDBC database
URL:
jdbc:idb=experiments.prp
Browse...
Experiment Type
Cross-validation
Number of folds:
10
Classification
Regression
Iteration Control
Number of repetitions:
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

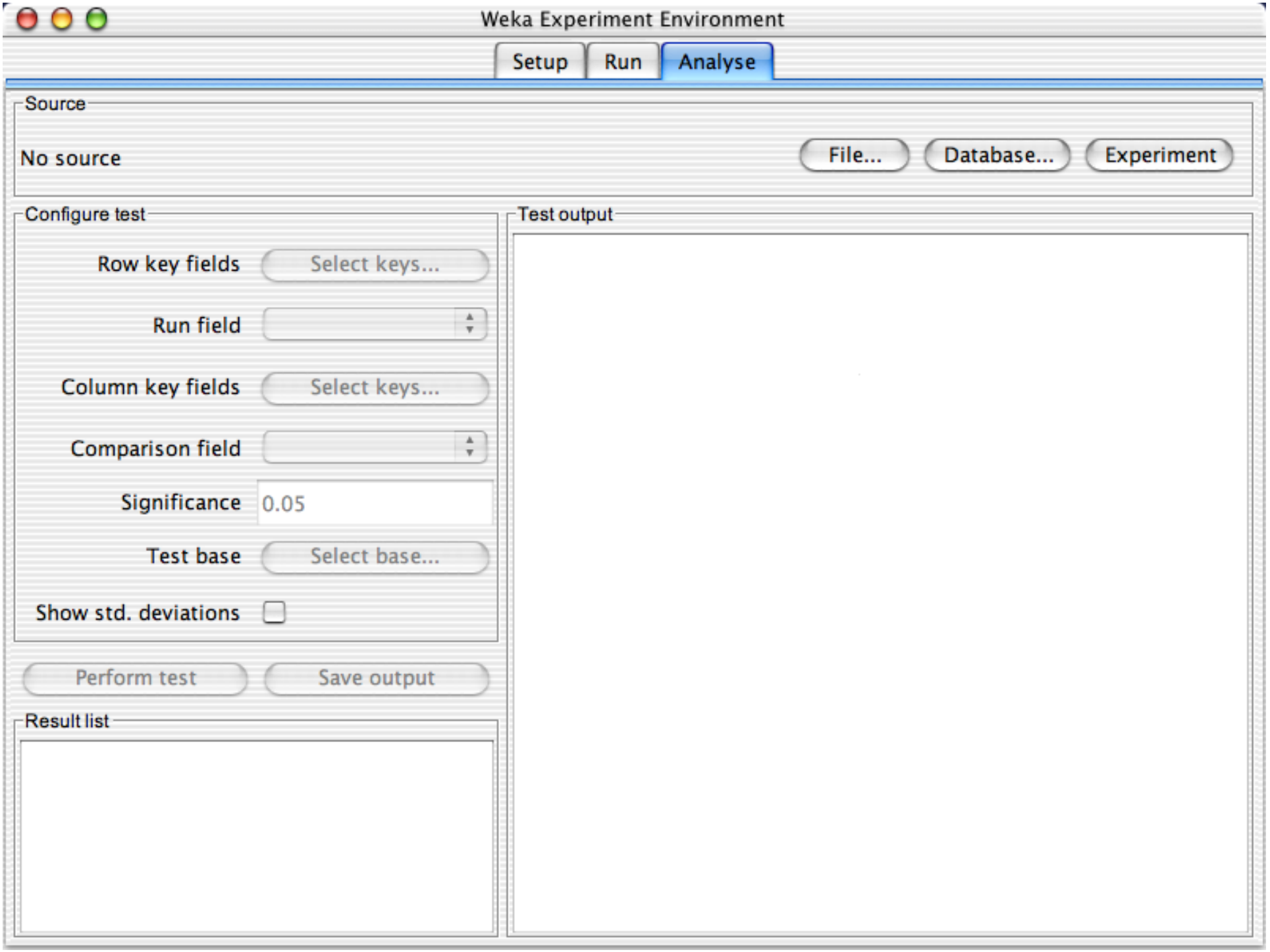

Weka Experiment Environment
Setup
Run
Analyse
Experiment Configuration Mode:
Simple
Advanced
Open...
Save...
New
Results Destination
JDBC database
URL:
jdbc:idb=experiments.prp
Browse...
Experiment Type
Cross-validation
Number of folds:
10
Classification
Regression
Iteration Control
Number of repetitions:
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

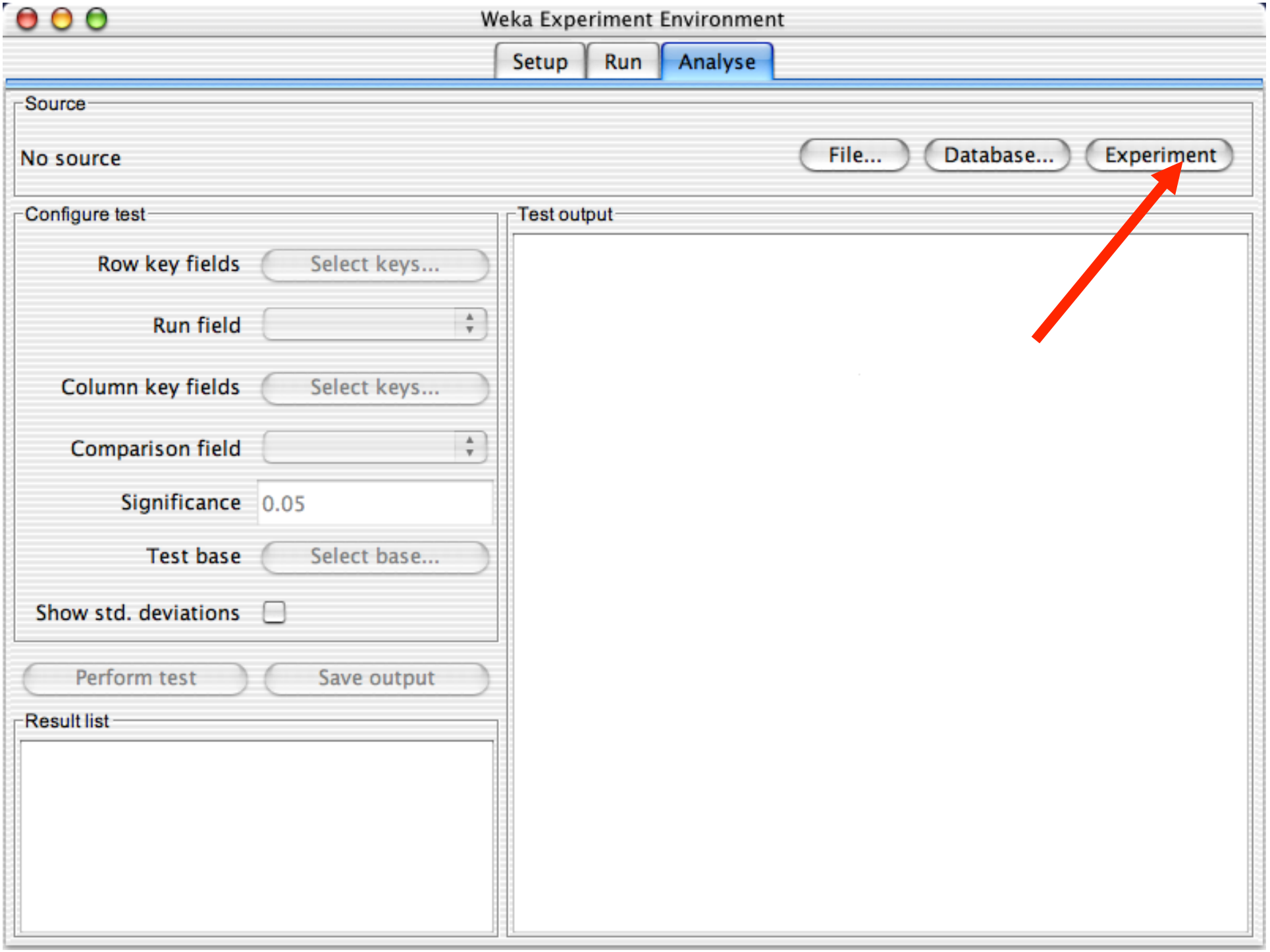

Weka Experiment Environment
Setup
Run
Analyse
Start
Stop
Log
Status
Not running

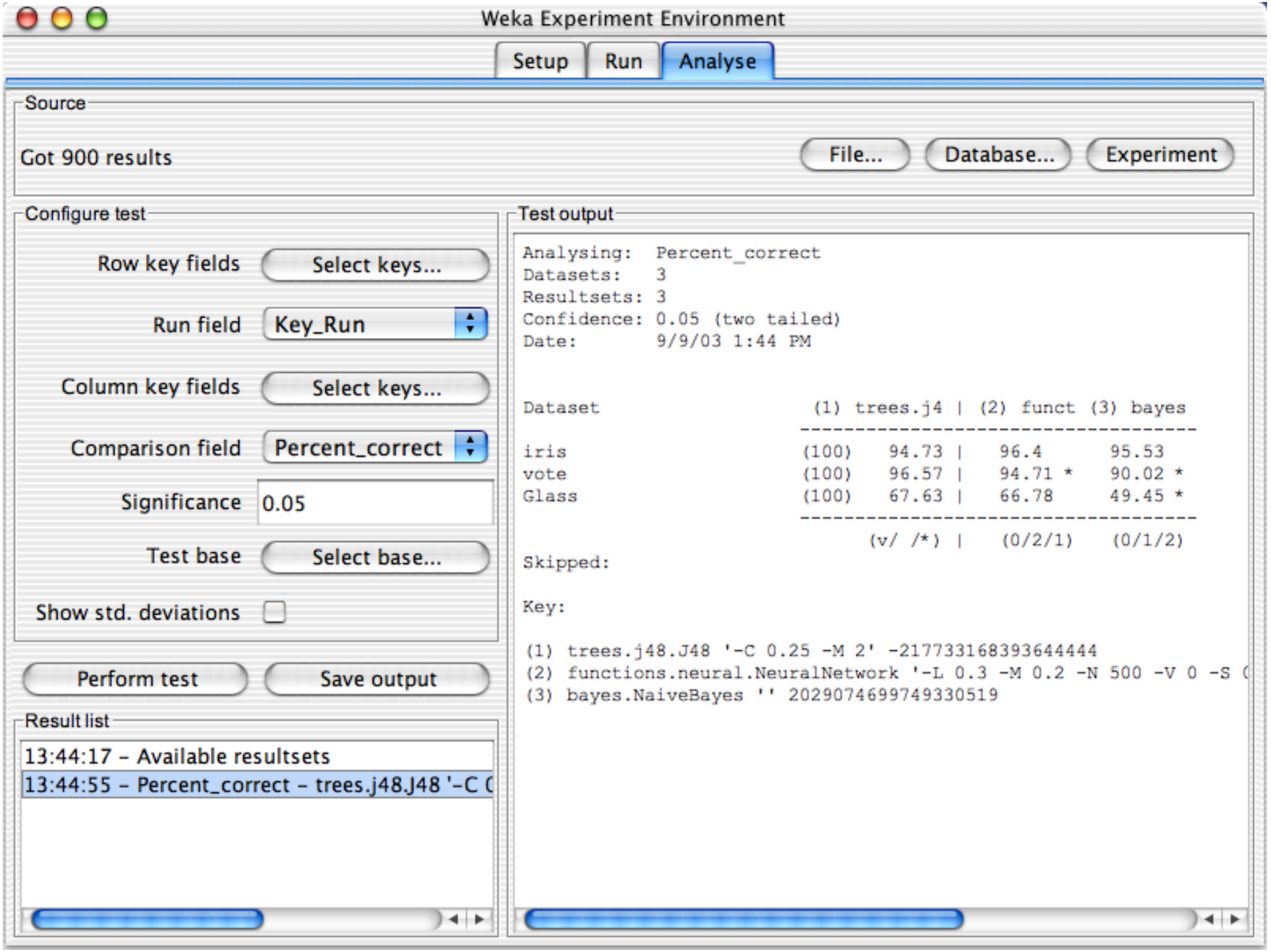

Weka Experiment Environment
Setup
Run
Analyse
Start
Stop
Log
Status
Not running

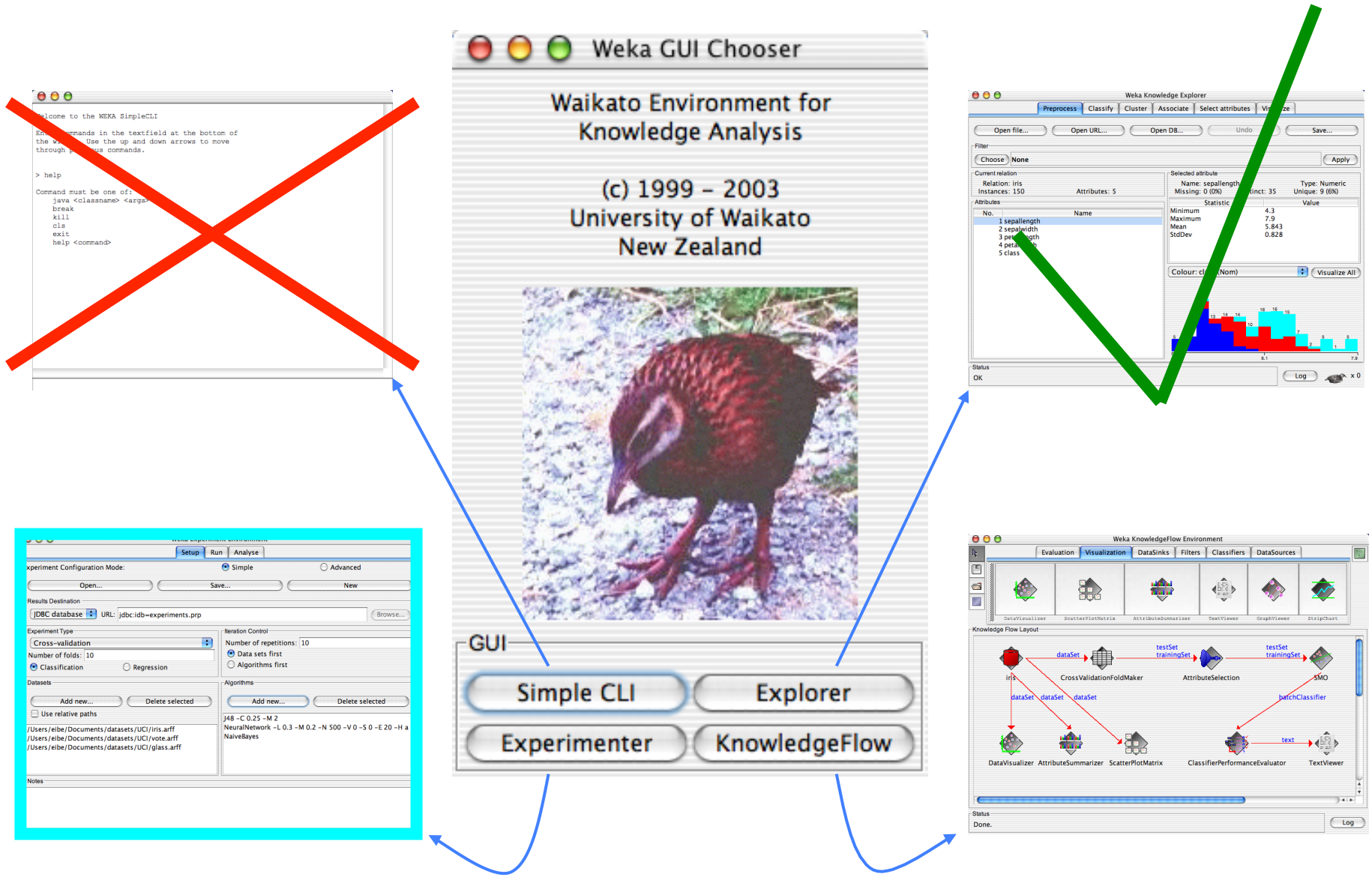

Weka Experiment Environment
Setup
Run
Analyse
Start
Stop
Log
10:33:04: Started
13:41:15: Finished
13:41:15: There were 0 errors
Status
Not running


Weka Experiment Environment
Setup
Run
Analyse
Start
Stop
Log
10:33:04: Started
13:41:15: Finished
13:41:15: There were 0 errors
Status
Not running


Weka Experiment Environment
Setup
Run
Analyse
Source
No source
File...
Database...
Experiment
Configure test
Row key fields
Select keys...
Run field
Column key fields
Select keys...
Comparison field
Significance
0.05
Test base
Select base...
Show std. deviations
Perform test
Save output
Result list
Test output


Weka Experiment Environment
Setup
Run
Analyse
Source
No source
File...
Database...
Experiment
Configure test
Row key fields
Select keys...
Run field
Column key fields
Select keys...
Comparison field
Significance
0.05
Test base
Select base...
Show std. deviations
Perform test
Save output
Result list
Test output


Weka Experiment Environment
Setup
Run
Analyse
Source
Got 900 results
File...
Database...
Experiment
Configure test
Row key fields
Select keys...
Run field
Key_Run
Column key fields
Select keys...
Comparison field
Percent_correct
Significance
0.05
Test base
Select base...
Show std. deviations
Perform test
Save output
Result list
13:44:17 - Available resultsets
13:44:55 - Percent_correct - trees.j48.J48 '-C 0
Test output
Analysing: Percent_correct
Datasets: 3
Resultsets: 3
Confidence: 0.05 (two tailed)
Date: 9/9/03 1:44 PM
Dataset (1) trees.j4 | (2) funct (3) bayes
iris (100) 94.73 | 96.4 95.53
vote (100) 96.57 | 94.71 * 90.02 *
Glass (100) 67.63 | 66.78 49.45 *
(v/ /*) | (0/2/1) (0/1/2)
Skipped:
Key:
(1) trees.j48.J48 '-C 0.25 -M 2' -217733168393644444
(2) functions.neural.NeuralNetwork '-L 0.3 -M 0.2 -N 500 -V 0 -S 0
(3) bayes.NaiveBayes '' 2029074699749330519


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
> help
Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>

Weka GUI Chooser
Waikato Environment for Knowledge Analysis
(c) 1999 - 2003
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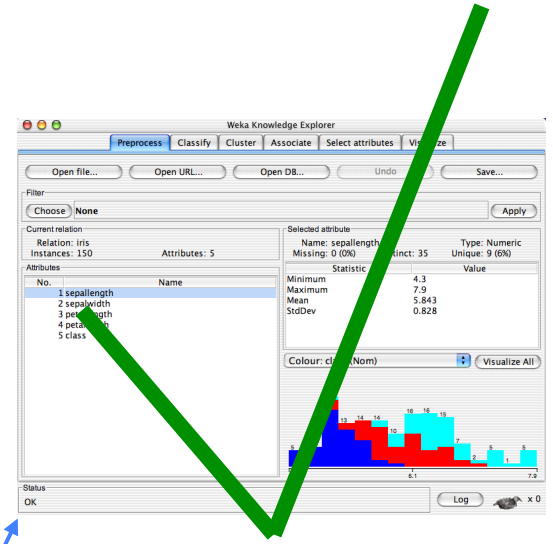
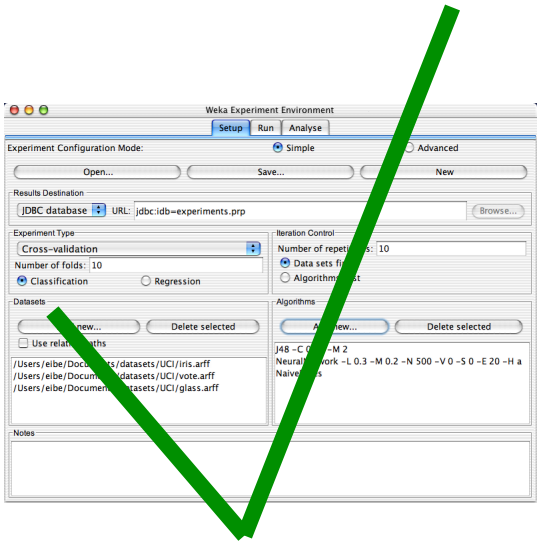
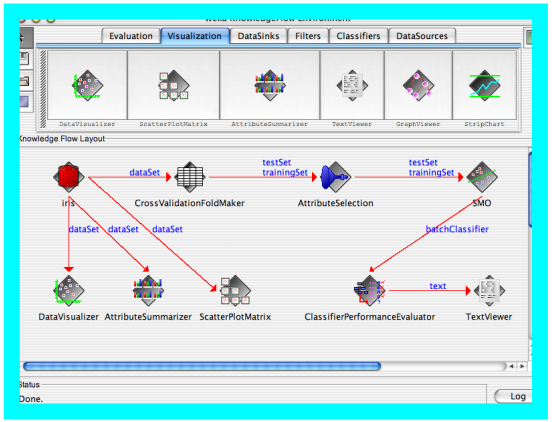
New Zealand
GUI
Simple CLI
Explorer
Experimenter
KnowledgeFlow

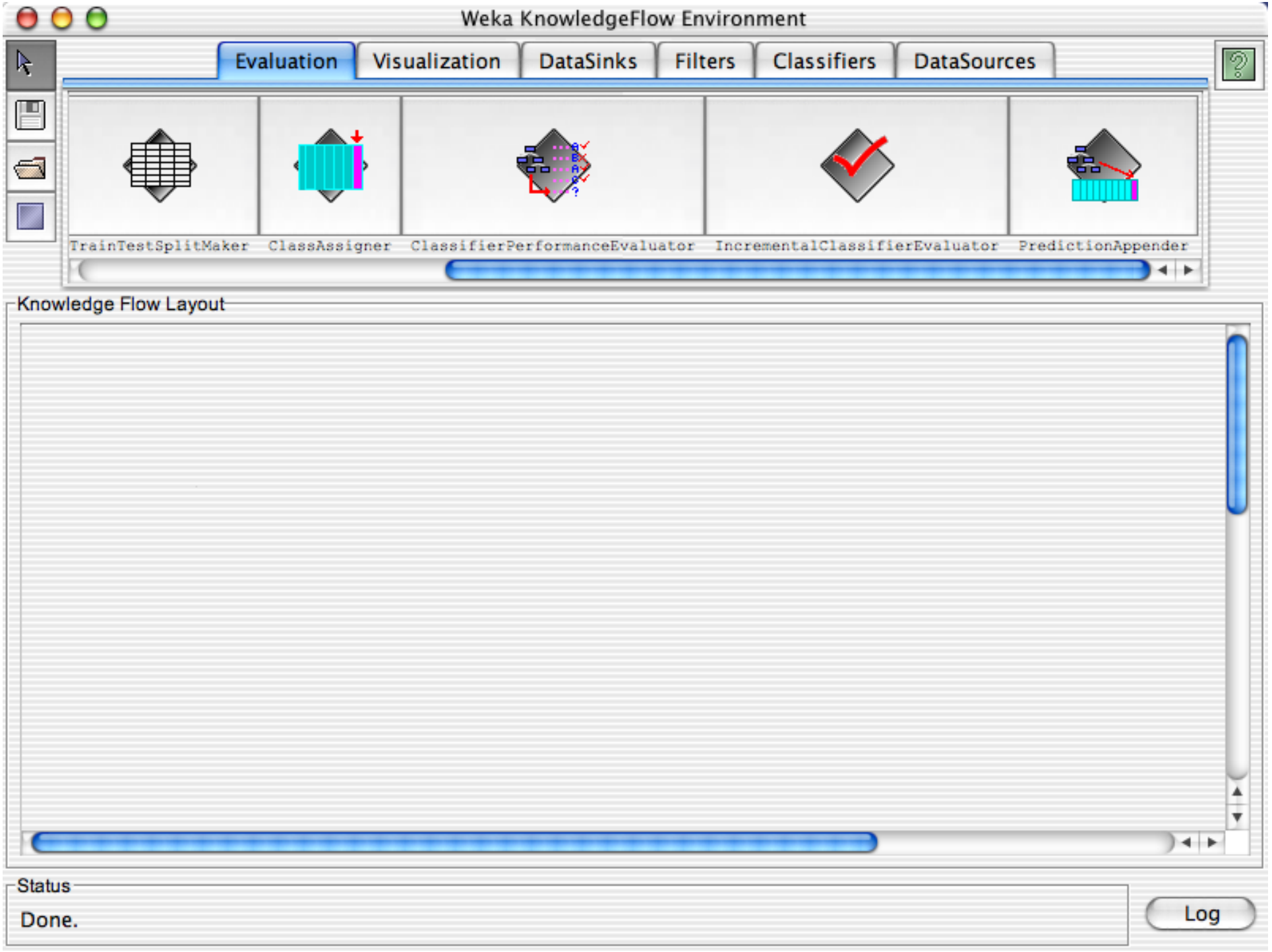

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Selected attribute
Attributes
No.
Name
1 sepallength
2 sepalwidth
5 class
Statistic
Value
Minimum 4.3
Maximum 7.9
Mean 5.843
StdDev 0.828
Visualize All
Status
OK
Log

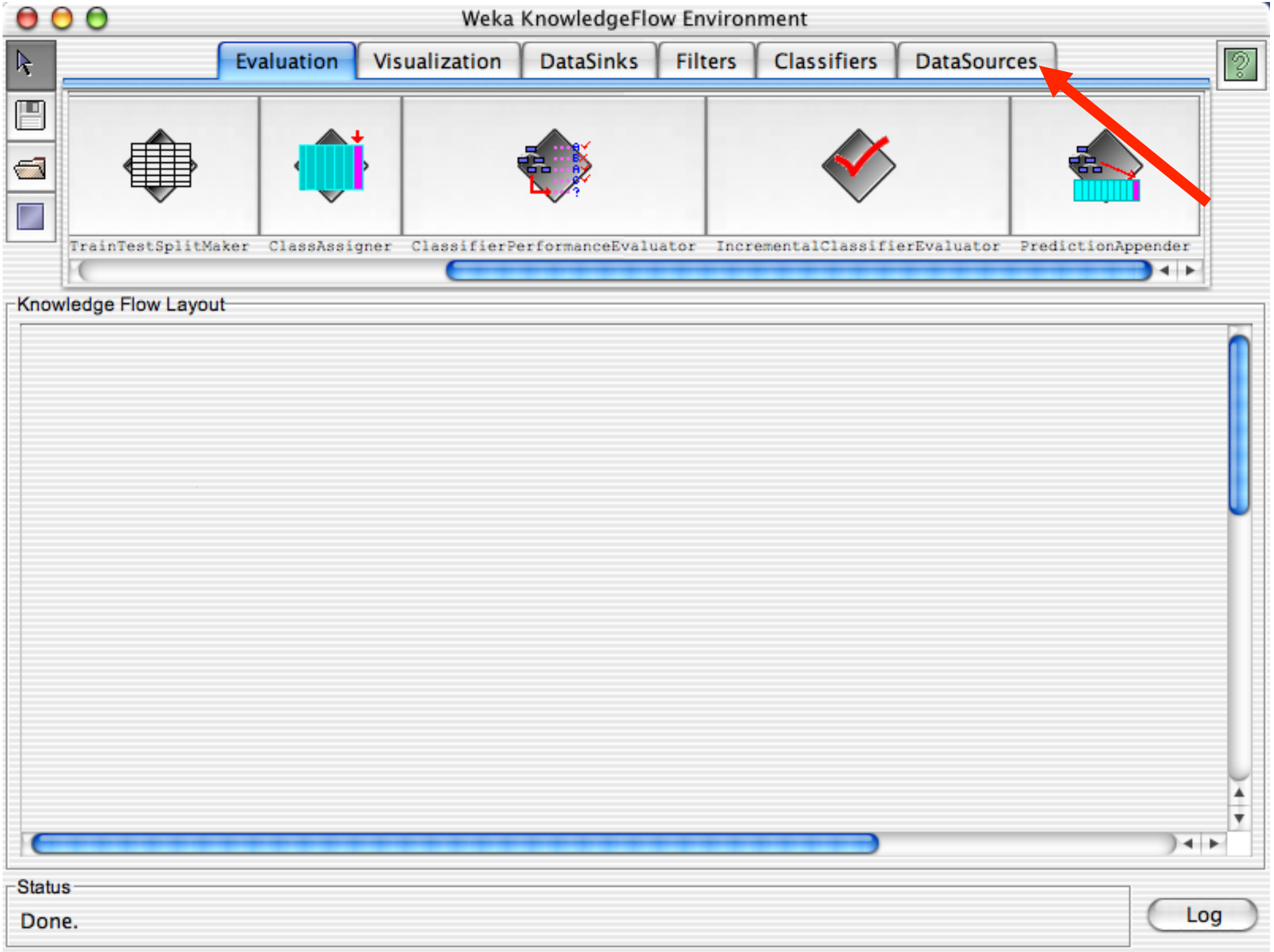

Weka Experiment Environment
Setup
Run
Analyse
Experiment Configuration Mode:
Simple
Advanced
Open...
Save...
New
Results Destination
JDBC database
URL: jdbc:idb=experiments.prp
Browse...
Experiment Type
Cross-validation
Number of folds: 10
Classification
Regression
Iteration Control
Datasets
Delete selected
Algorithms
Delete selected
/Users/eibe/Documents/datasets/UCI/iris.arff
/Users/eibe/Documents/datasets/UCI/vote.arff
/Users/eibe/Documents/datasets/UCI/glass.arff
Notes

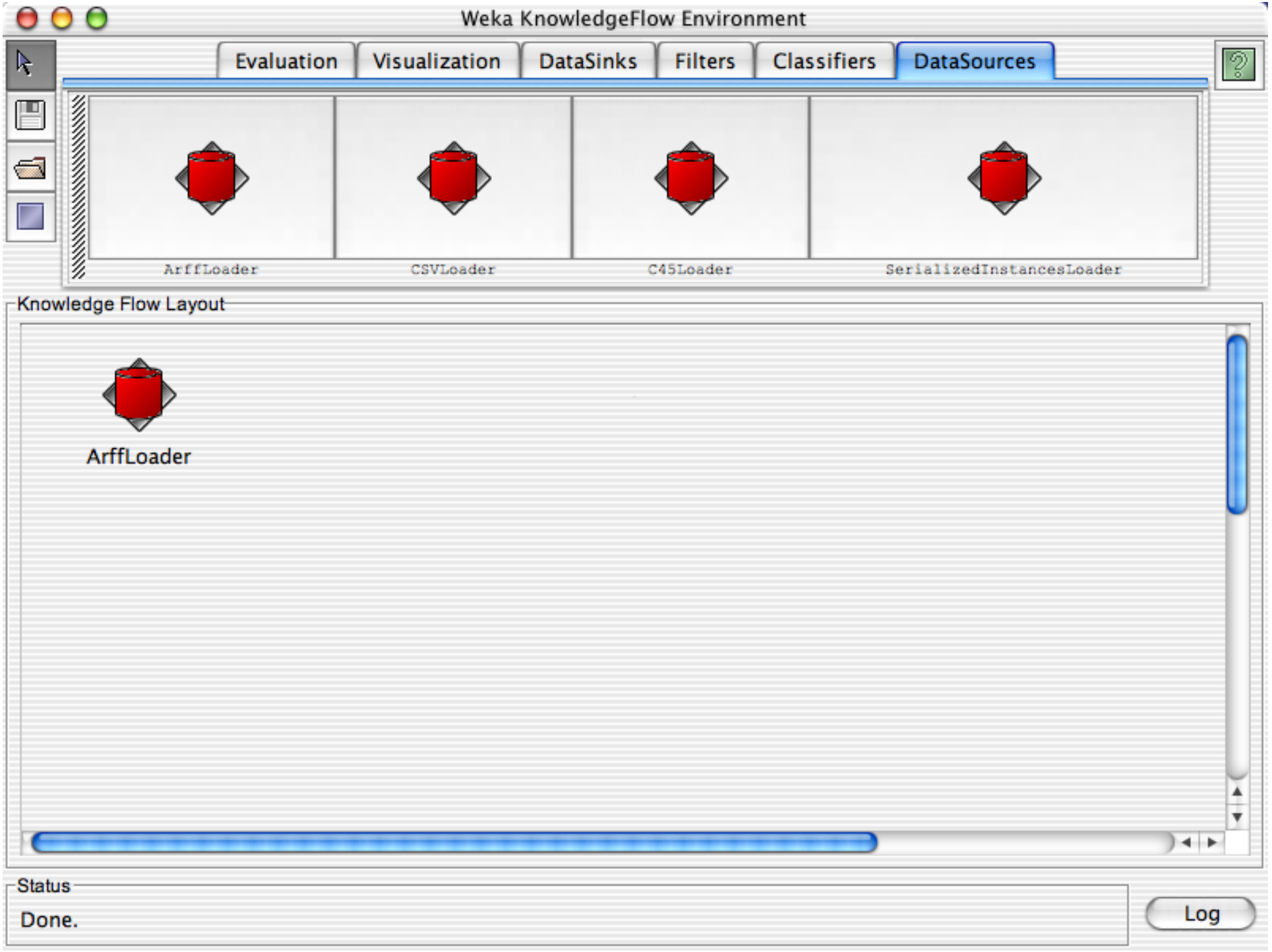

Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
Knowledge Flow Layout
iris
CrossValidationFoldMaker
AttributeSelection
SMO
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
TextViewer
dataSet
testSet
trainingSet
batchClassifier
text
Status
Done.
Log

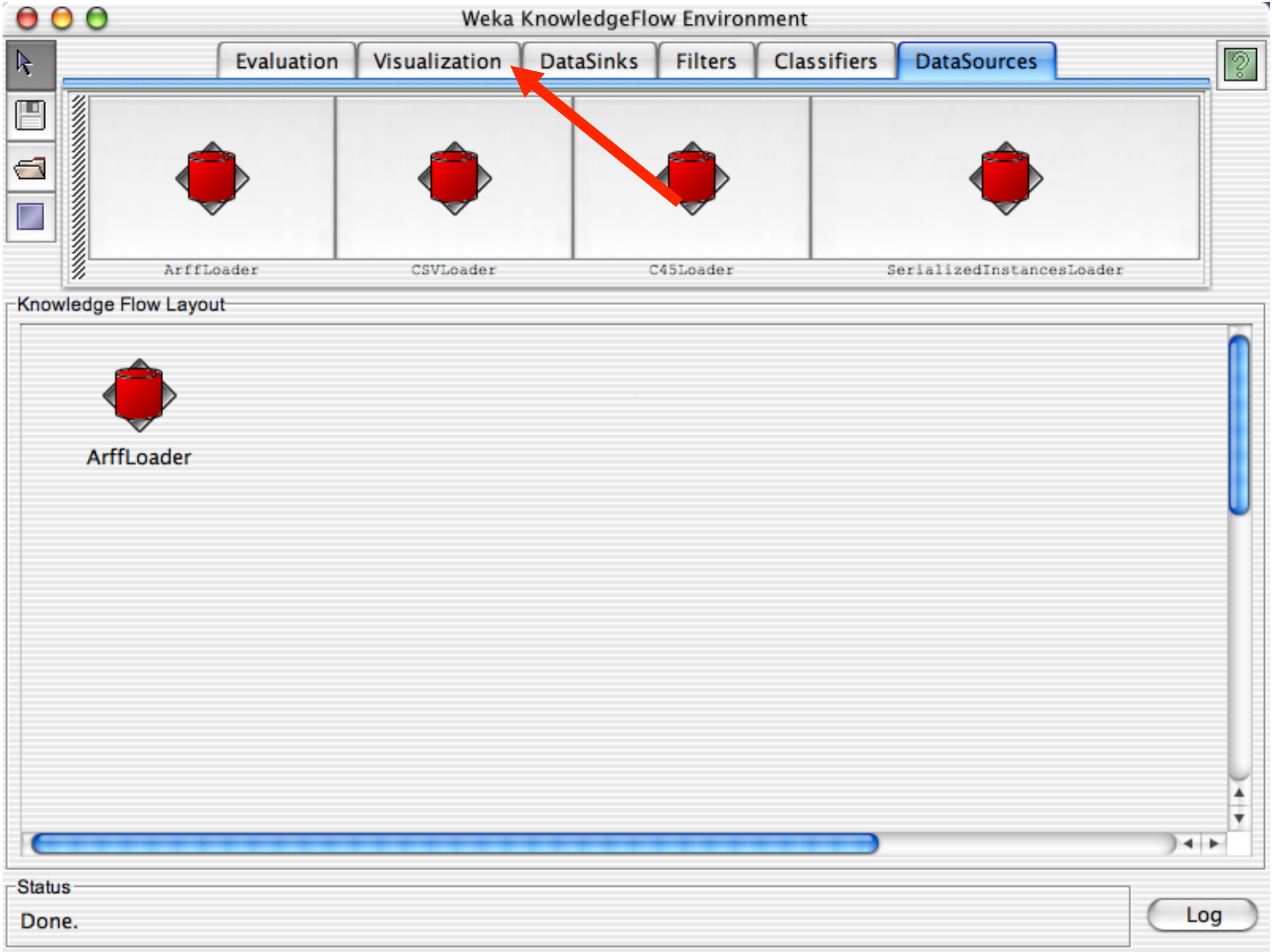
The Knowledge Flow GUI

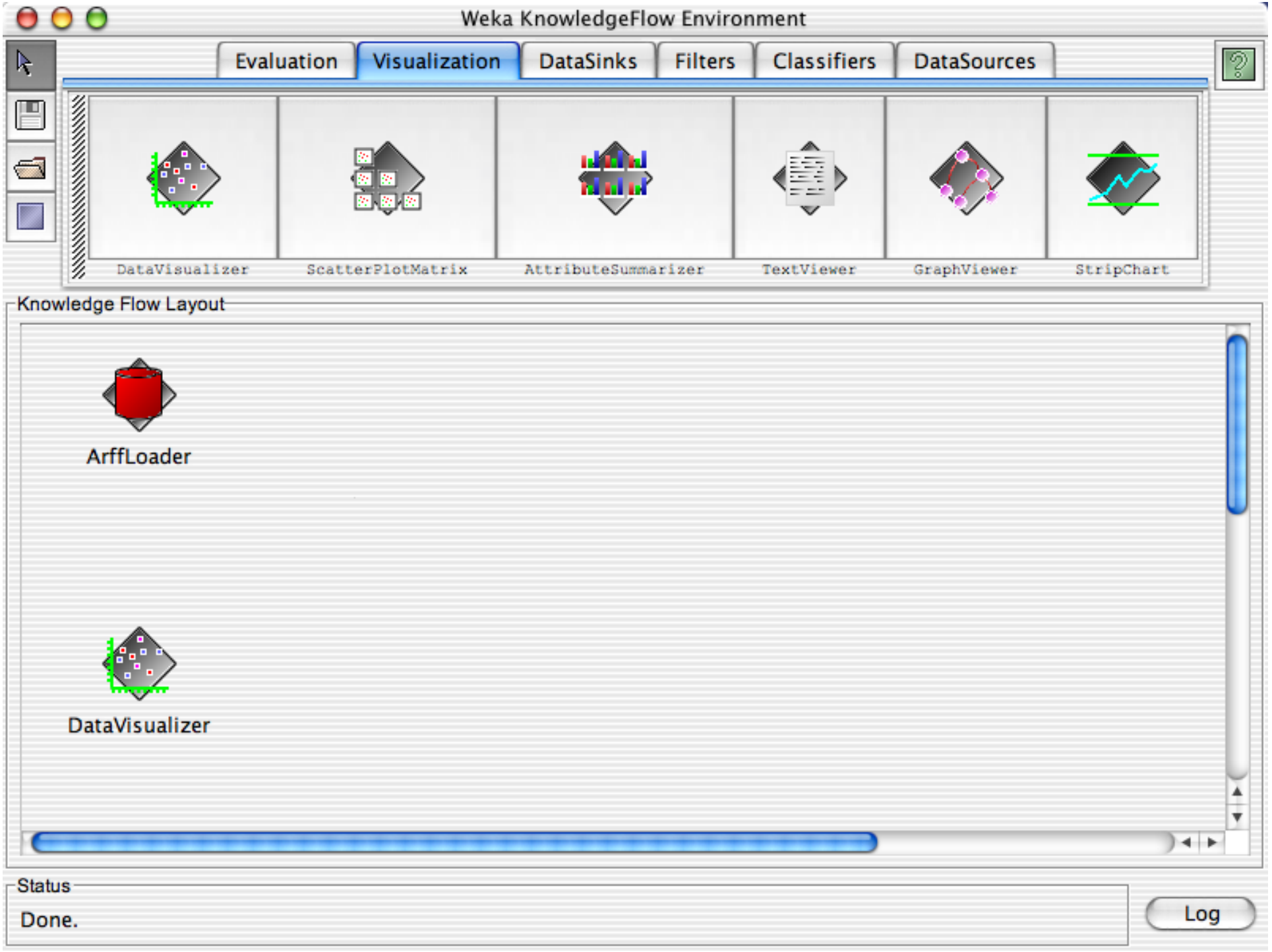
- New graphical user interface for WEKA
- Java-Beans-based interface for setting up and running machine learning experiments
- Data sources, classifiers, etc. are beans and can be connected graphically
- Data "flows" through components: e.g., "data source" -> "filter" -> "classifier" -> "evaluator"
- Layouts can be saved and loaded again later

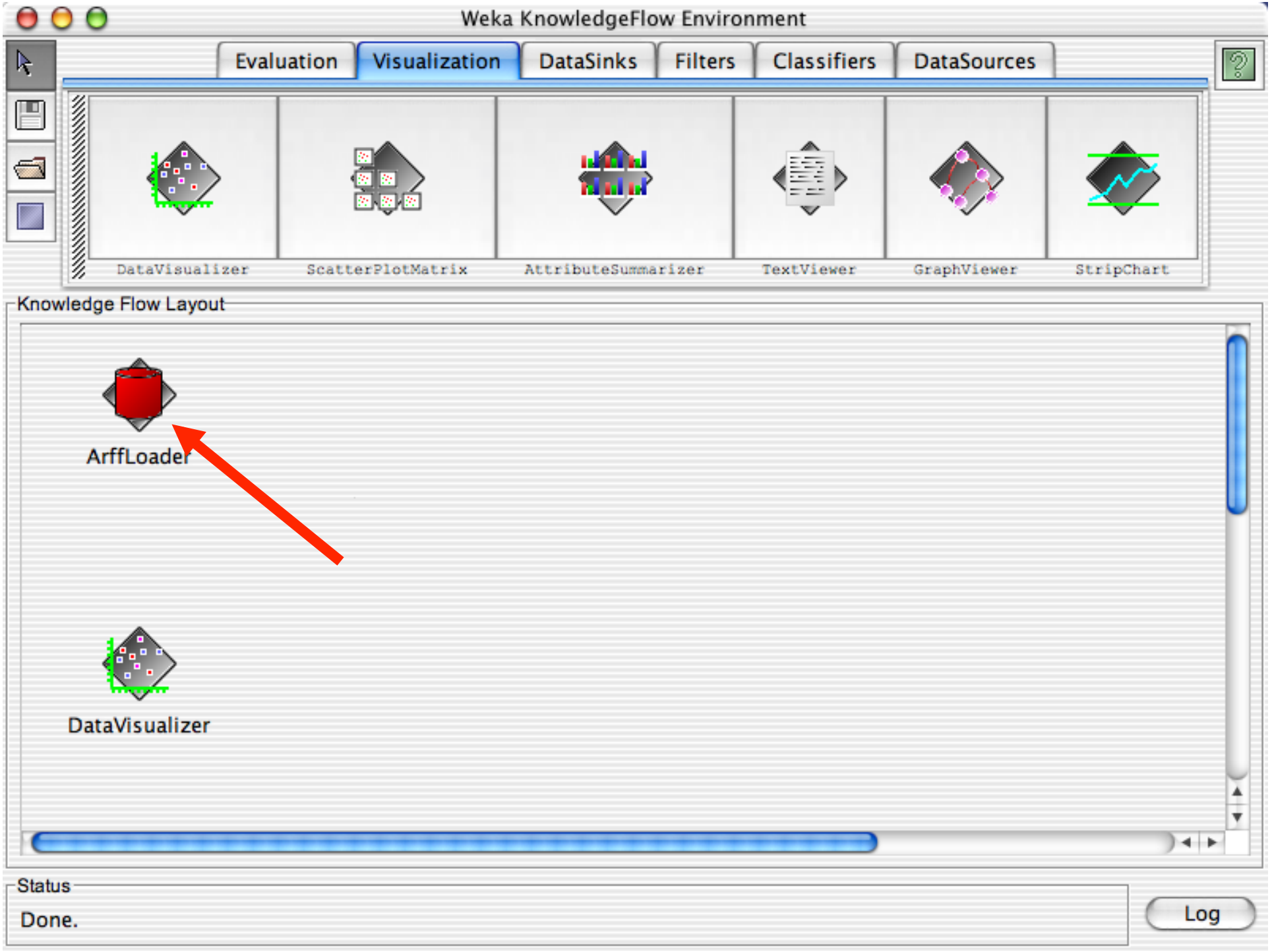

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
TrainTestSplitMaker
ClassAssigner
ClassifierPerformanceEvaluator
IncrementalClassifierEvaluator
PredictionAppender
Knowledge Flow Layout
Status
Done.
Log

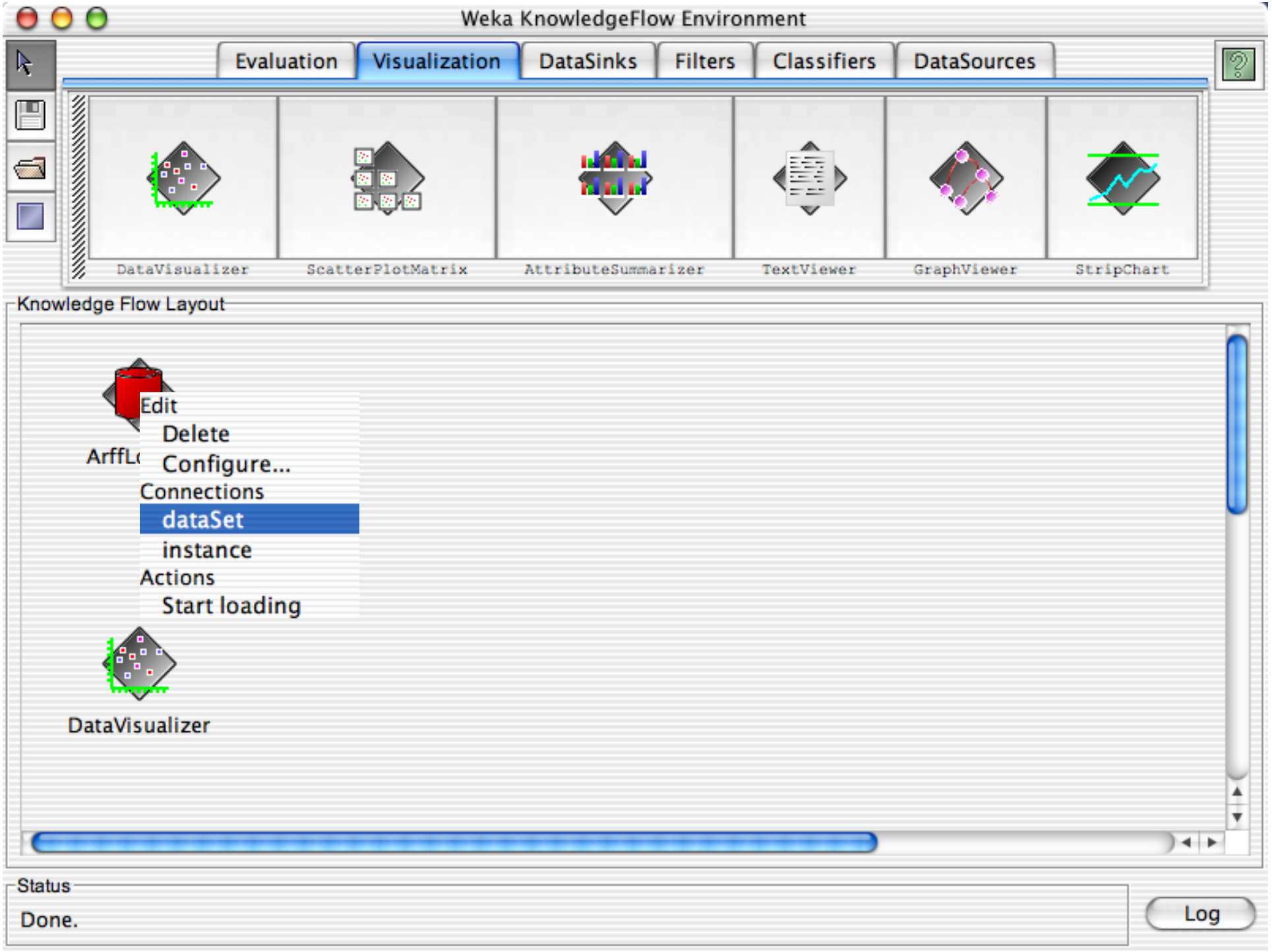

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
TrainTestSplitMaker
ClassAssigner
ClassifierPerformanceEvaluator
IncrementalClassifierEvaluator
PredictionAppender
Knowledge Flow Layout
Status
Done.
Log

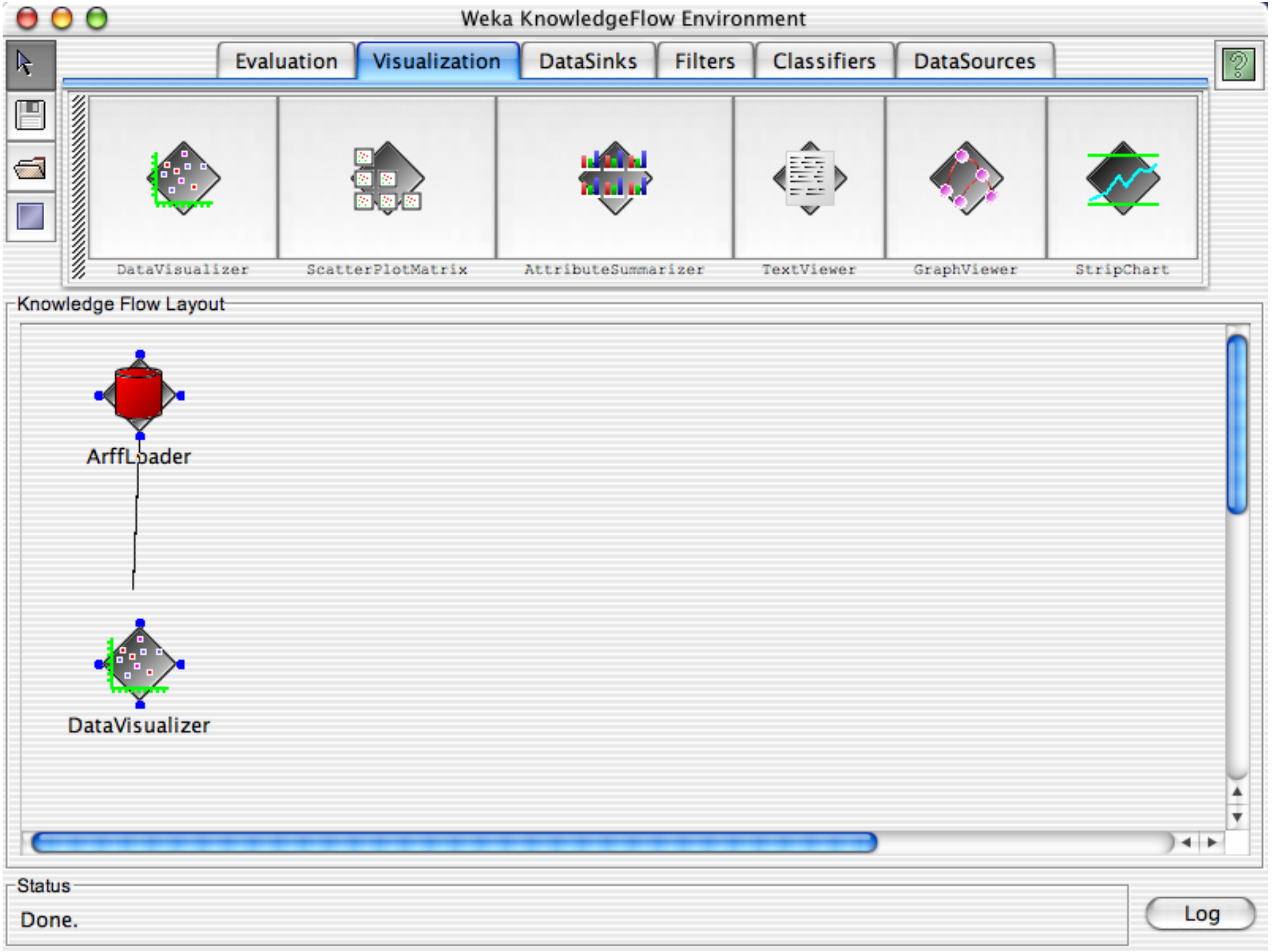

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
ArffLoader
CSVLoader
C45Loader
SerializedInstancesLoader
Knowledge Flow Layout
ArffLoader
Status
Done.
Log

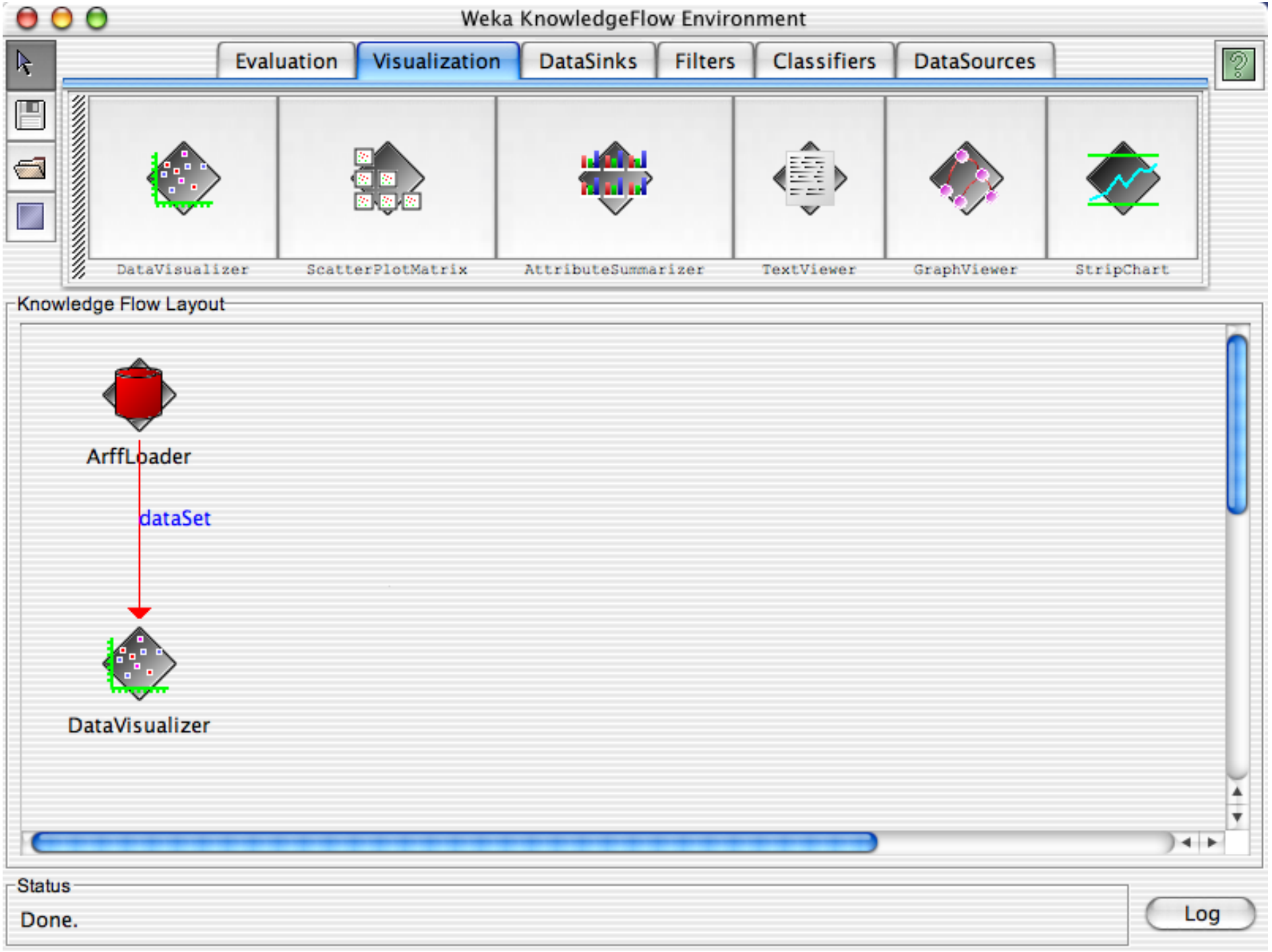

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
ArffLoader
CSVLoader
C45Loader
SerializedInstancesLoader
Knowledge Flow Layout
ArffLoader
Status
Done.
Log

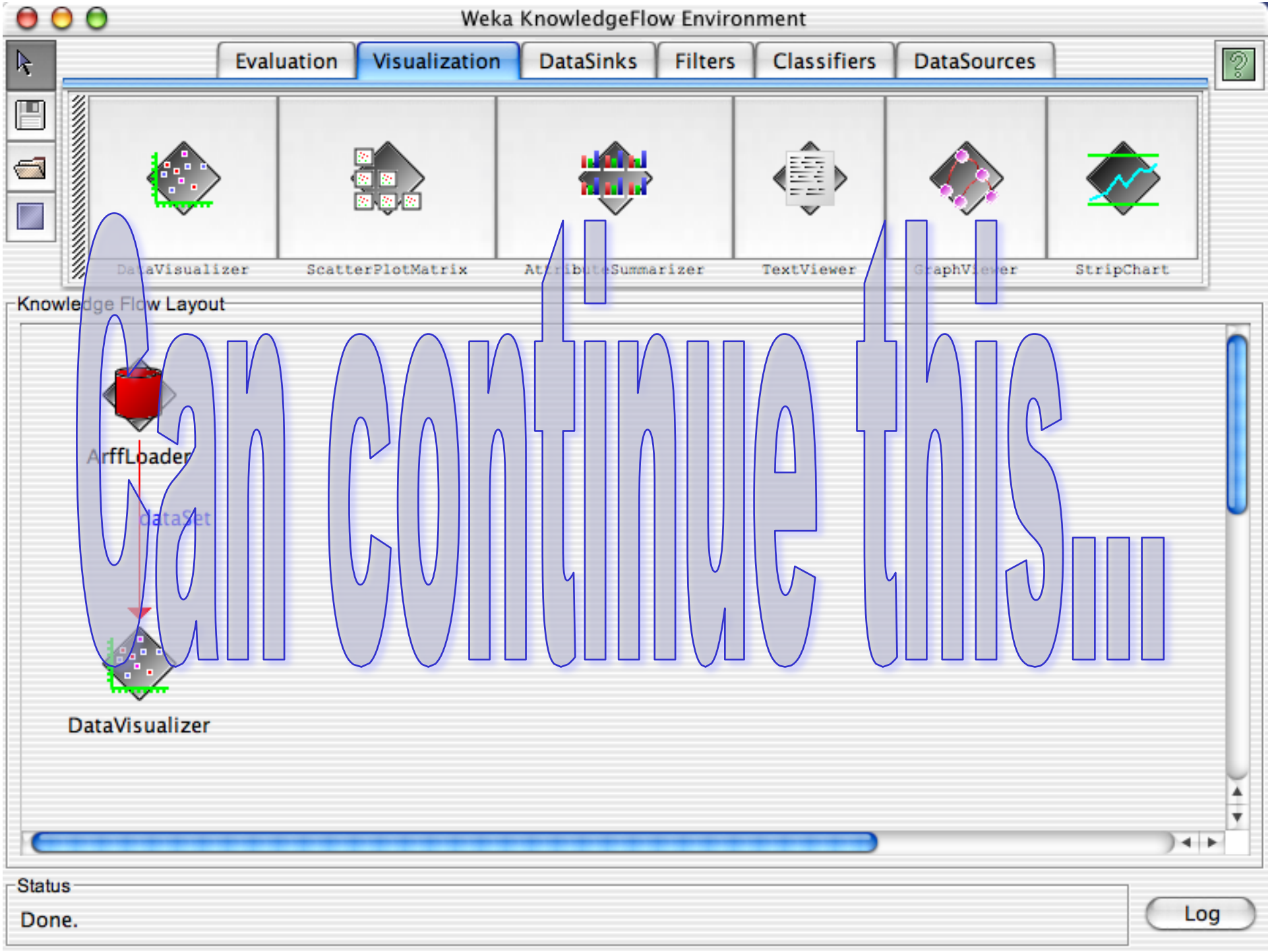

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
ArffLoader
DataVisualizer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
ArffLoader
DataVisualizer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
Edit
Delete
Configure...
Connections
dataSet
instance
Actions
Start loading
DataVisualizer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
ArffLoader
DataVisualizer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
ArffLoader
dataSet
DataVisualizer
Status
Done.
Log


Weka KnowledgeFlow Environment
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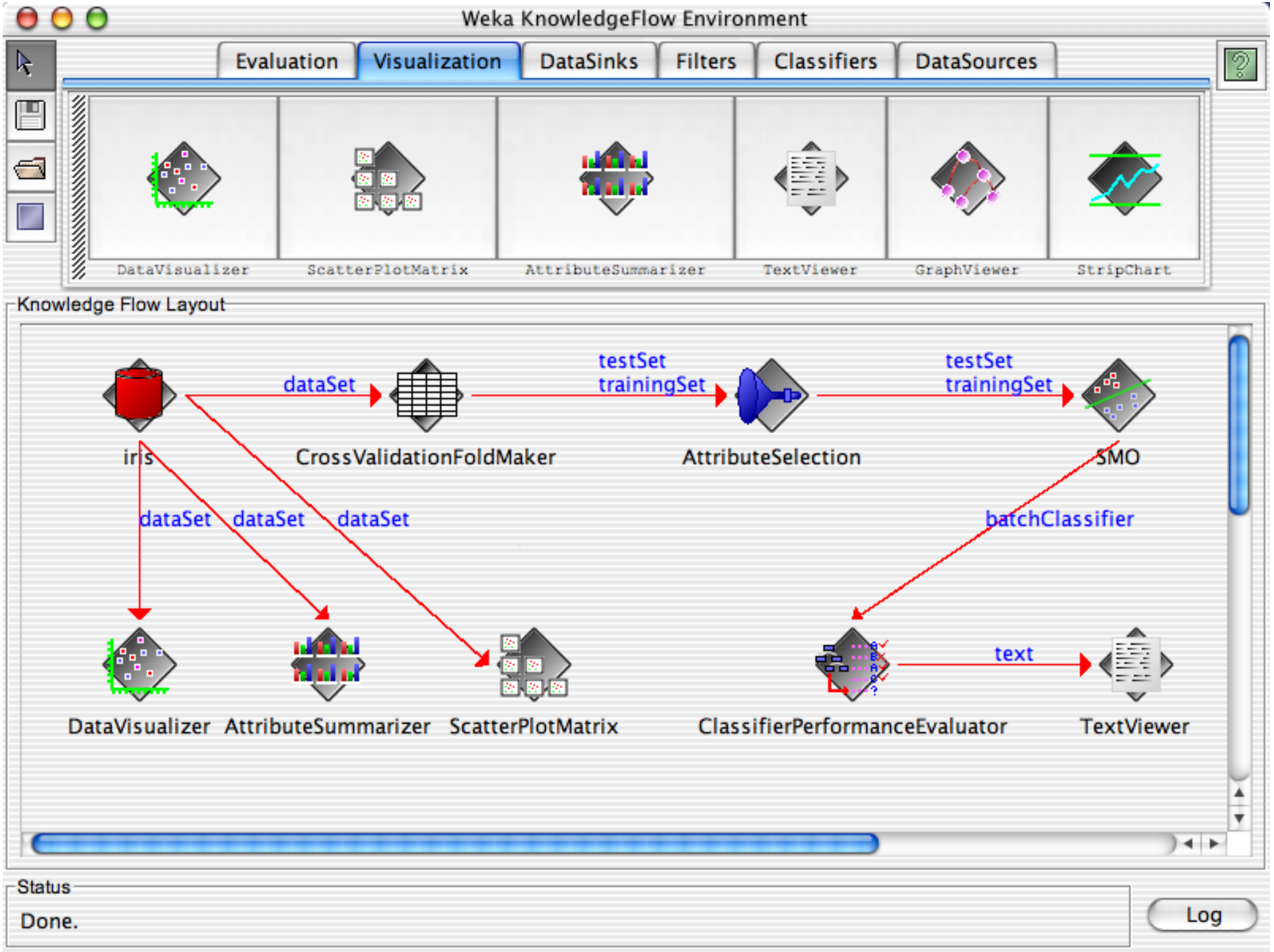
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
ArffLoader
dataSet
DataVisualizer
Can continue this...
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
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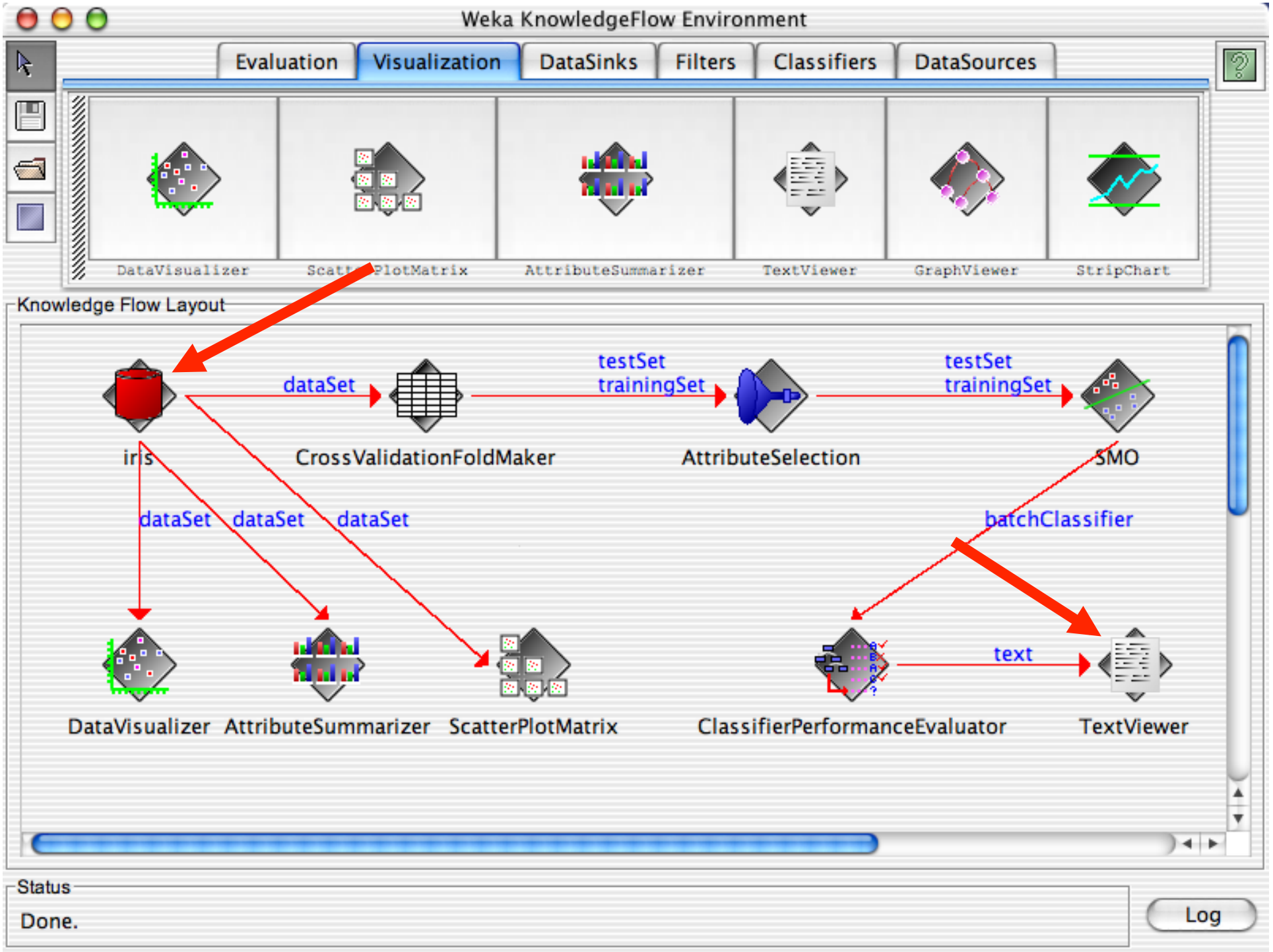
testSet
trainingSet
testSet
trainingSet
iris
CrossValidationFoldMaker
AttributeSelection
SMO
dataSet
dataSet
dataSet
batchClassifier
text
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
TextViewer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
iris
dataSet
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testSet
trainingSet
AttributeSelection
testSet
trainingSet
SMO
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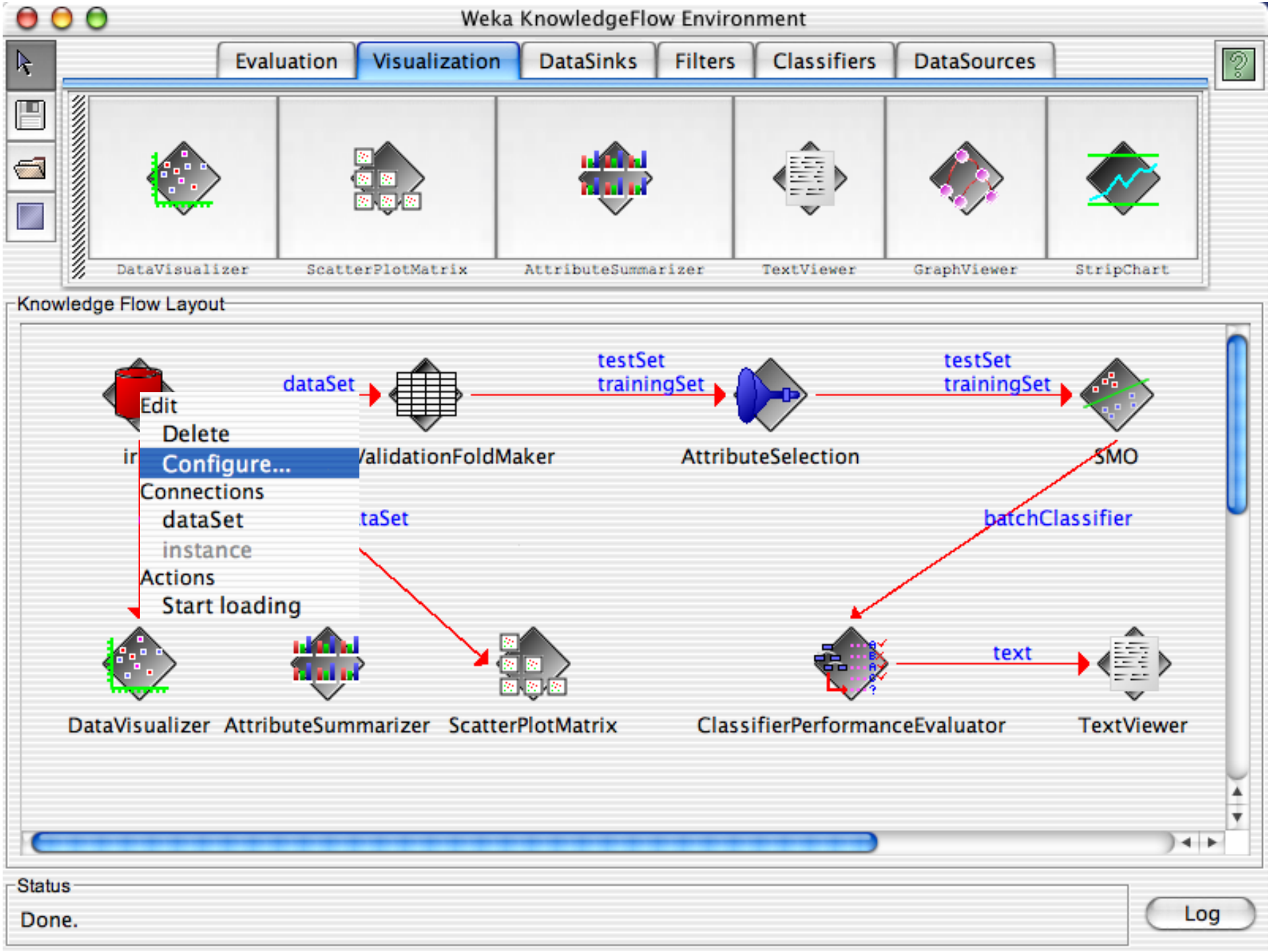
batchClassifier
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
text
TextViewer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
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DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
dataSet
testSet
trainingSet
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trainingSet
Edit
Delete
Configure...
Connections
dataSet
instance
Actions
Start loading
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batchClassifier
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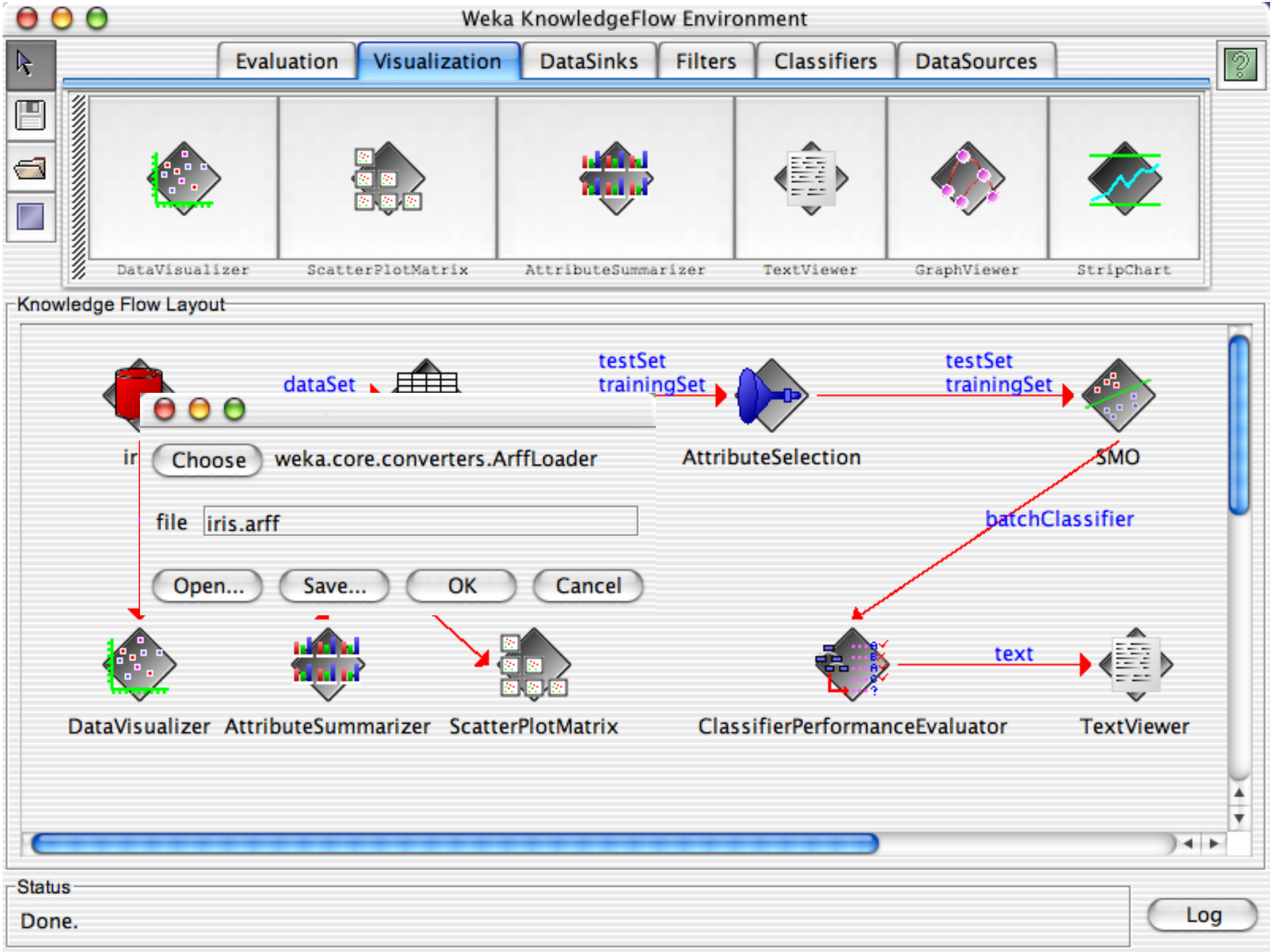
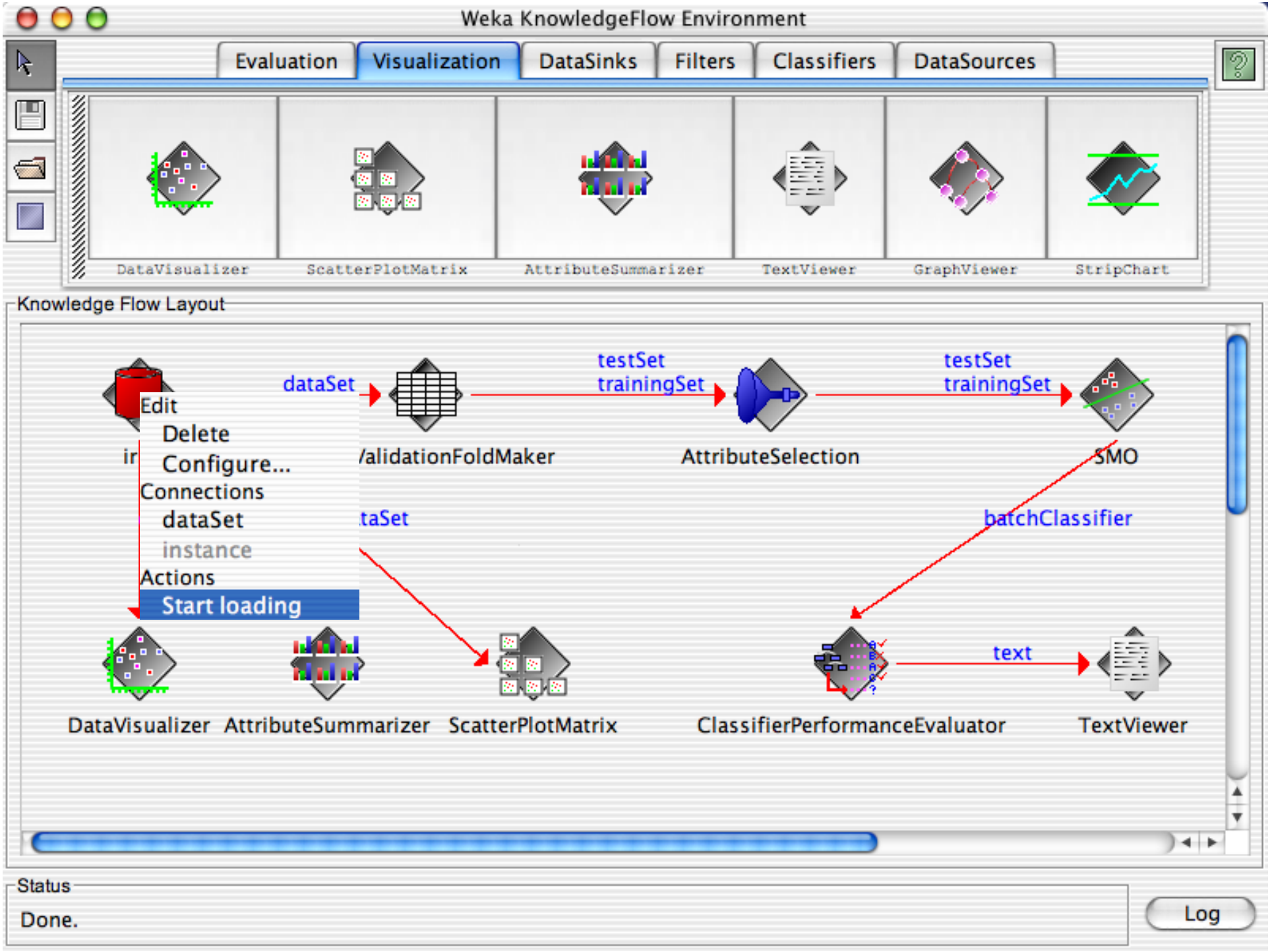
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
TextViewer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
dataSet
testSet
trainingSet
testSet
trainingSet
ir
Choose
weka.core.converters.ArffLoader
AttributeSelection
SMO
file
iris.arff
batchClassifier
Open...
Save...
OK
Cancel
text
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
TextViewer
Status
Done.
Log


Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
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DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
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testSet
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Edit
Delete
Configure...
Connections
dataSet
instance
Actions
Start loading
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alidationFoldMaker
AttributeSelection
SMO
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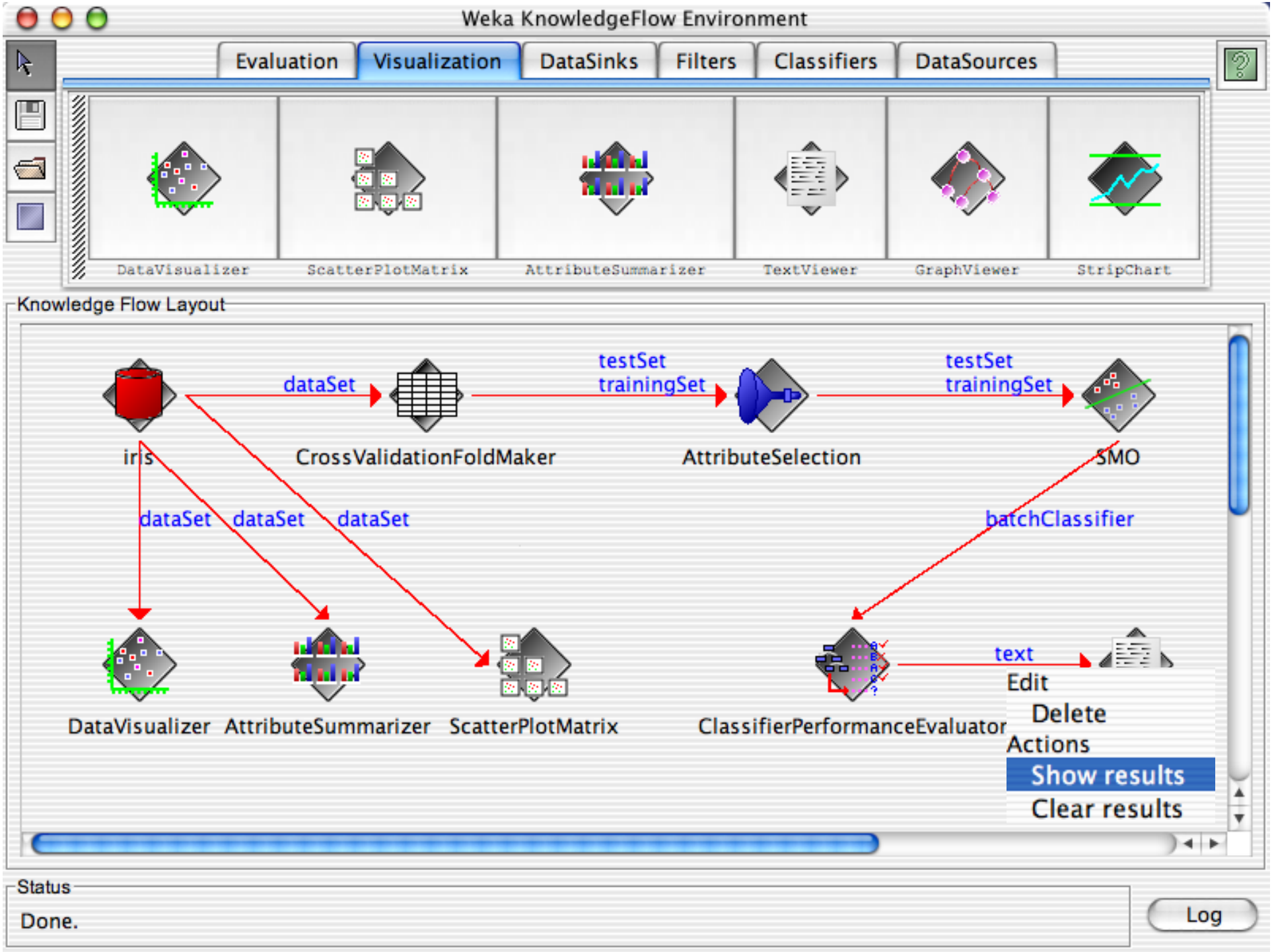
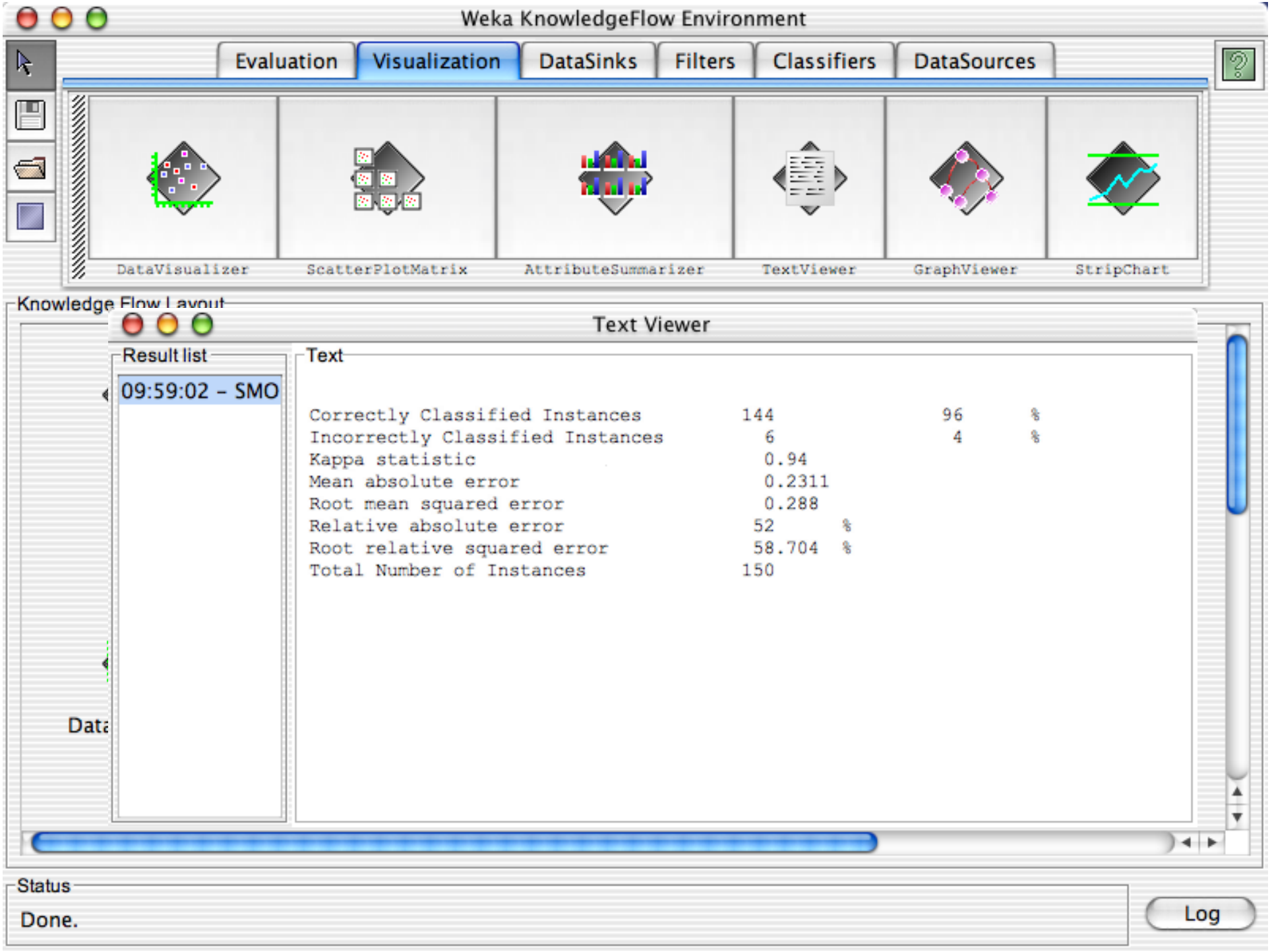
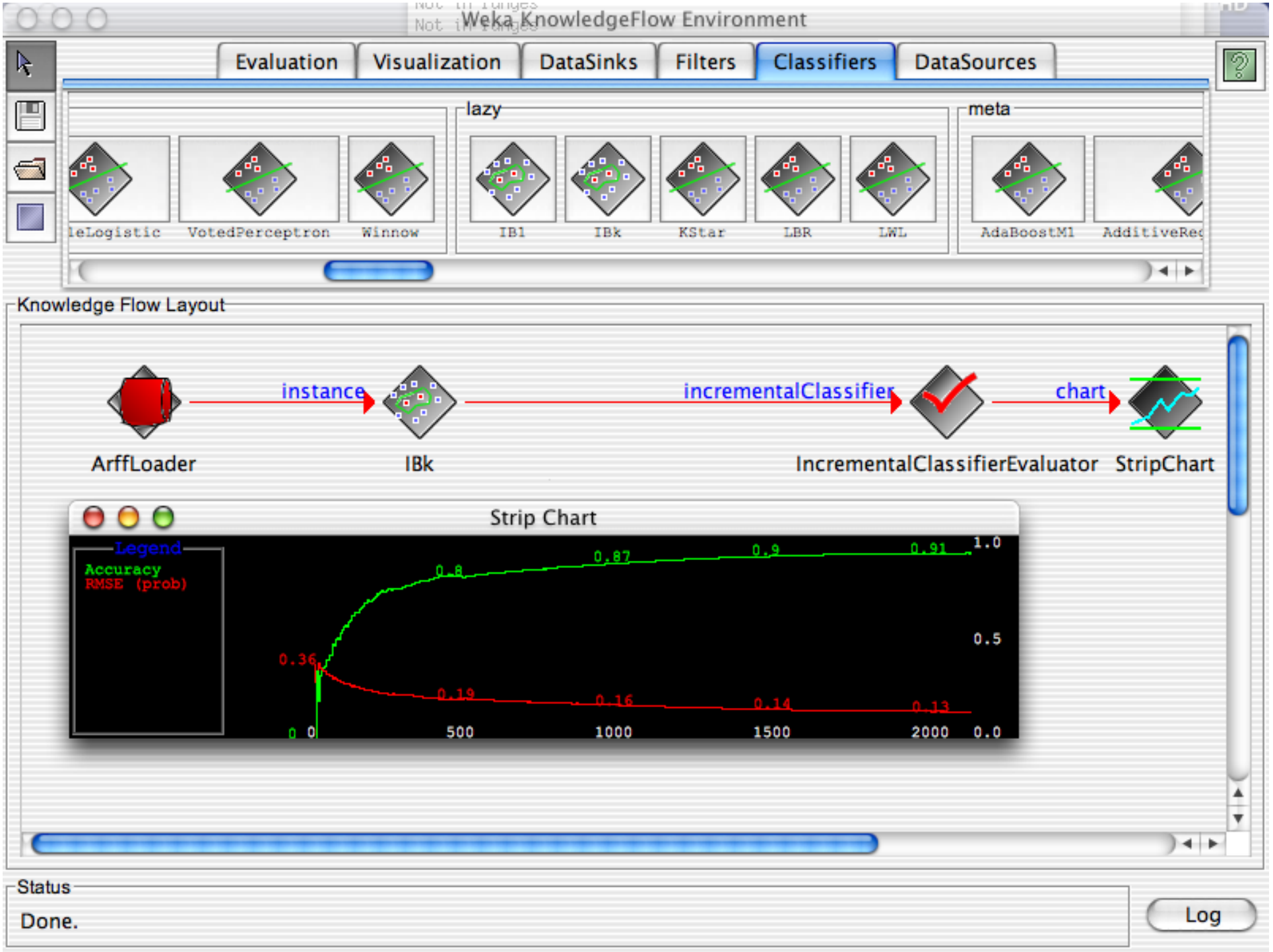
batchClassifier
text
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
TextViewer
Status
Done.
Log

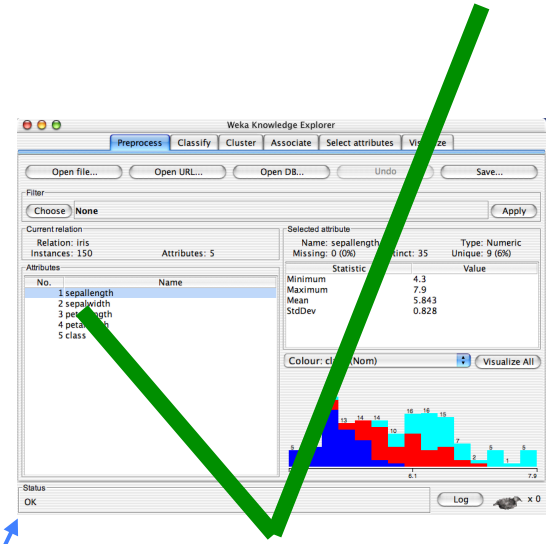

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
dataSet
testSet
trainingSet
testSet
trainingSet
iris
CrossValidationFoldMaker
AttributeSelection
SMO
dataSet
dataSet
dataSet
batchClassifier
text
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
Edit
Delete
Actions
Show results
Clear results
Status
Done.
Log

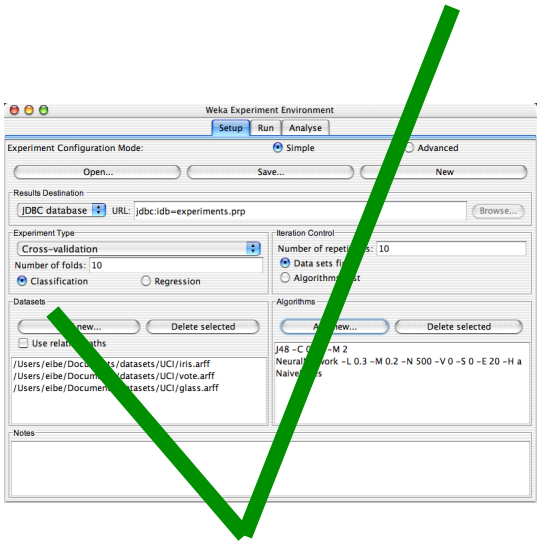

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
DataVisualizer
ScatterPlotMatrix
AttributeSummarizer
TextViewer
GraphViewer
StripChart
Knowledge Flow Layout
Text Viewer
Result list
09:59:02 - SMO
Text
Correctly Classified Instances 144 96 %
Incorrectly Classified Instances 6 4 %
Kappa statistic 0.94
Mean absolute error 0.2311
Root mean squared error 0.288
Relative absolute error 52 %
Root relative squared error 58.704 %
Total Number of Instances 150
Data
Status
Done.
Log

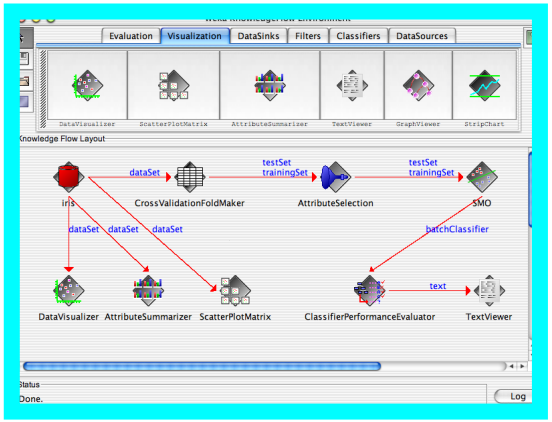

Weka KnowledgeFlow Environment
Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
lazy
meta
leLogistic
VotedPerceptron
Winnow
IB1
IBk
KStar
LBR
LWL
AdaBoostM1
AdditiveReg
Knowledge Flow Layout
instance
incrementalClassifier
chart
ArffLoader
IBk
IncrementalClassifierEvaluator
StripChart
Strip Chart
Legend
Accuracy
RMSE (prob)
0.8
0.87
0.9
0.91
0.36
0.19
0.16
0.14
0.13
1.0
0.5
0.0
0 0
500
1000
1500
2000
Status
Done.
Log

Welcome to the WEKA SimpleCLI
> help
Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>

Weka GUI Chooser
Waikato Environment for Knowledge Analysis
(c) 1999 - 2003
University of Waikato
New Zealand
GUI
Simple CLI
Explorer
Experimenter
KnowledgeFlow

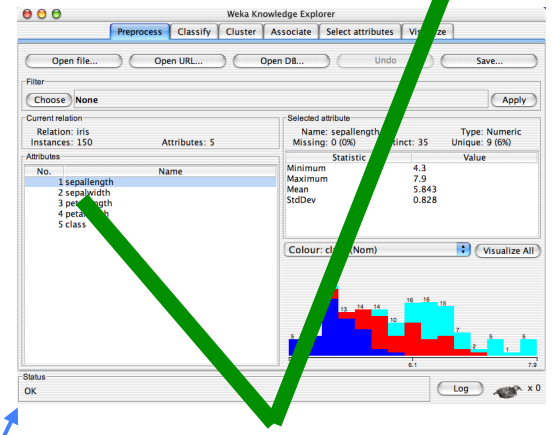

Weka Knowledge Explorer
Preprocess
Classify
Cluster
Associate
Select attributes
Open file...
Open URL...
Open DB...
Undo
Save...
Filter
Choose
None
Apply
Current relation
Relation: iris
Instances: 150
Attributes: 5
Selected attribute
Name: sepallength
Missing: 0 (0%)
Type: Numeric
Unique: 9 (6%)
Attributes
No.
Name
1 sepallength
2 sepalwidth
5 class
Statistic
Value
Minimum 4.3
Maximum 7.9
Mean 5.843
StdDev 0.828
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
Datasets
Delete selected
Algorithms
Delete selected
/Users/eibe/Documents/datasets/UCI/iris.arff
/Users/eibe/Documents/datasets/UCI/vote.arff
/Users/eibe/Documents/datasets/UCI/glass.arff
Notes


Evaluation
Visualization
DataSinks
Filters
Classifiers
DataSources
Knowledge Flow Layout
iris
CrossValidationFoldMaker
AttributeSelection
SMO
DataVisualizer
AttributeSummarizer
ScatterPlotMatrix
ClassifierPerformanceEvaluator
TextViewer
dataSet
testSet
trainingSet
batchClassifier
text
Status
Done.
Log

Welcome to the WEKA SimpleCLI
> help
Command must be one of:
java <classname> <args>
break
kill
cls
exit
help <command>

Weka GUI Chooser
Waikato Environment for Knowledge Analysis
(c) 1999 - 2003
University of Waikato
New Zealand
GUI
Simple CLI
Explorer
Experimenter
KnowledgeFlow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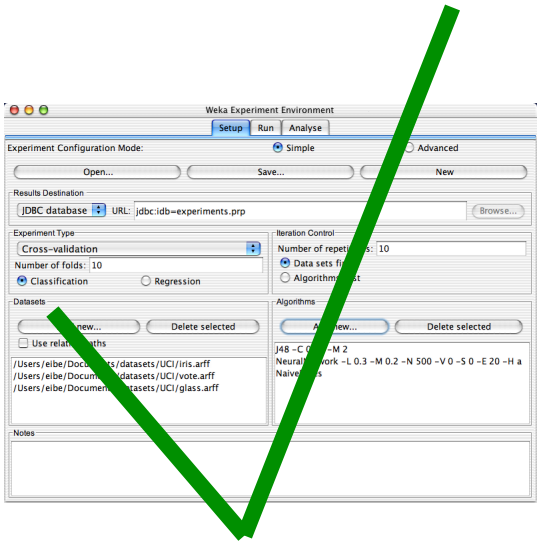
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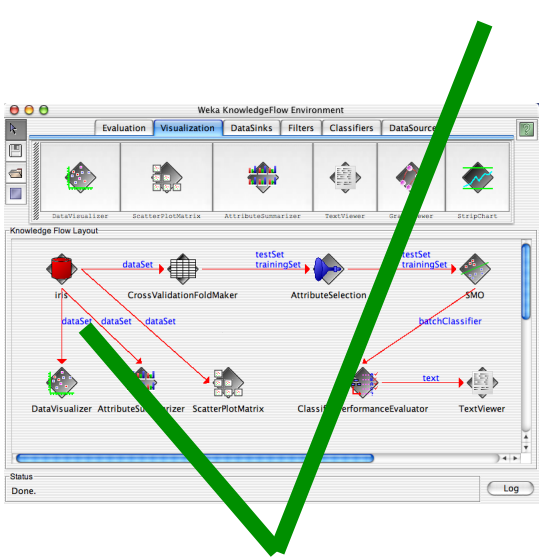
/Users/eibe/Documents/datasets/UCI/glass.arff
Notes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TextViewer
dataSet
testSet
trainingSet
batchClassifier
text
Status
Done.
Log

Conclusion: try it yourself!

- 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