Data Mining
(Mining Knowledge from Data)

Data Preprocessing

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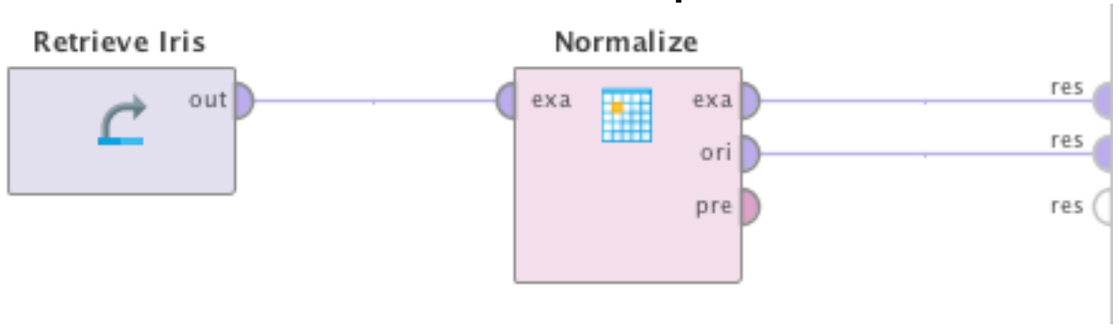
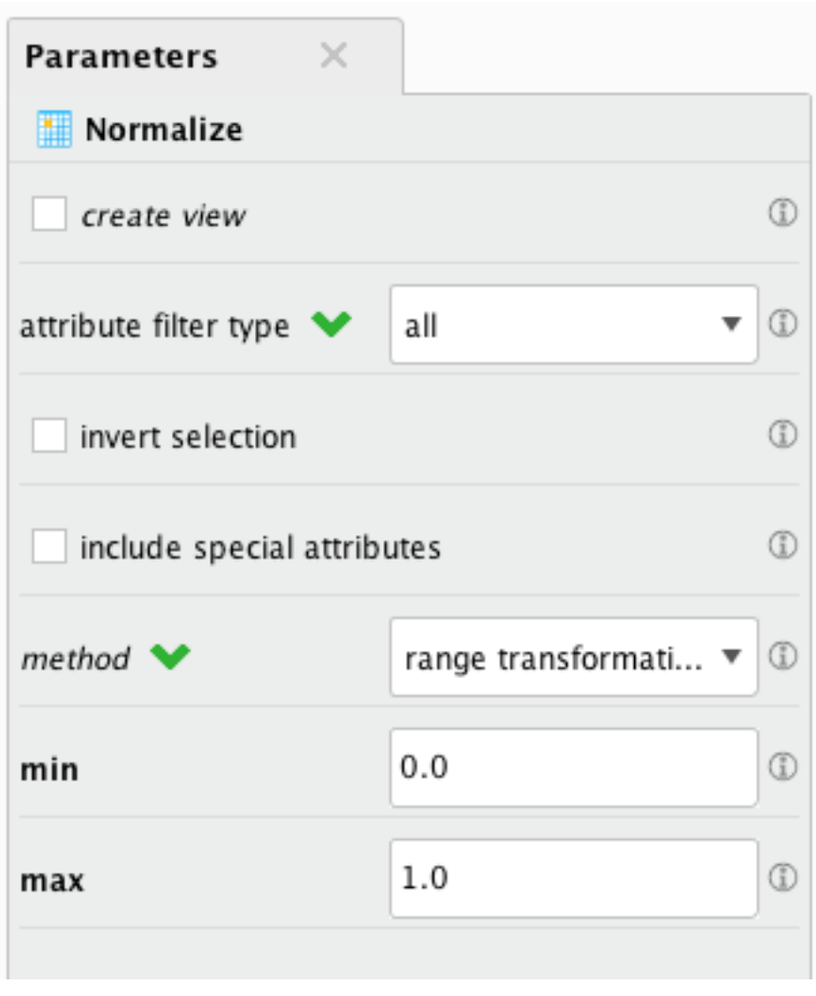
Exercise Outline

- Normalization
- Types of attributes
- Transformation of attributes
- Selection of attributes

Normalization

- Import Iris dataset from the repository.
- Add the Normalize operator.

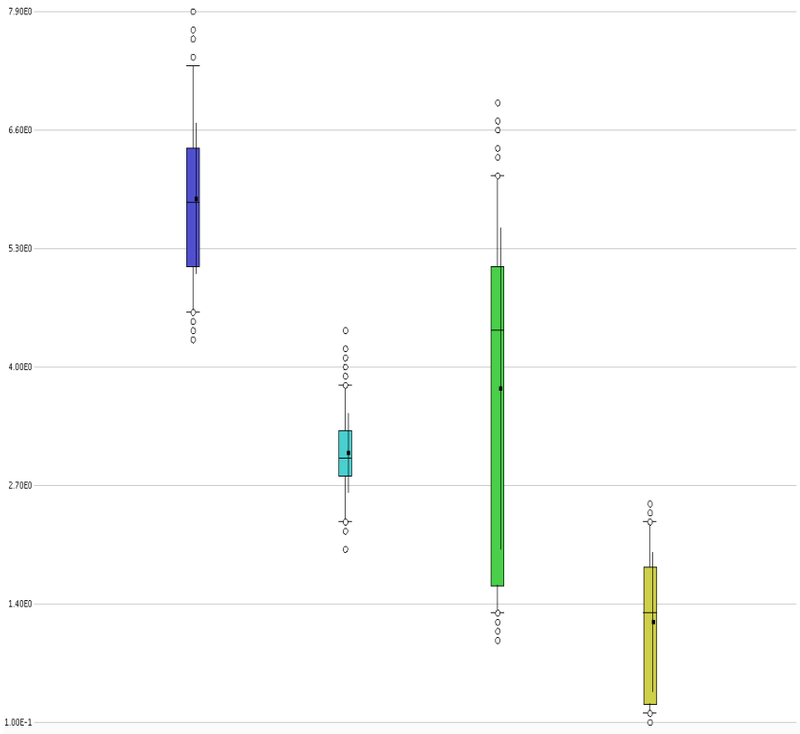


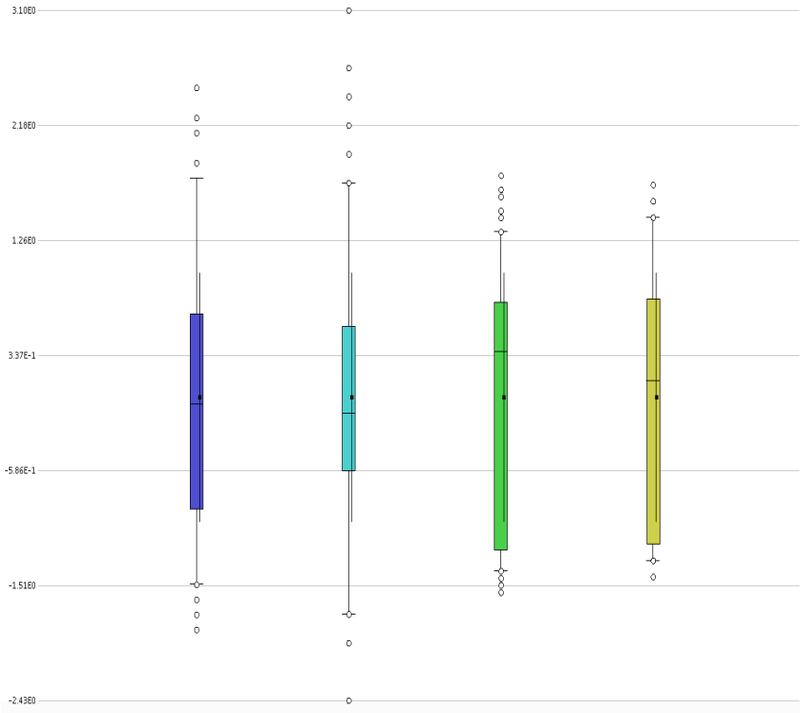


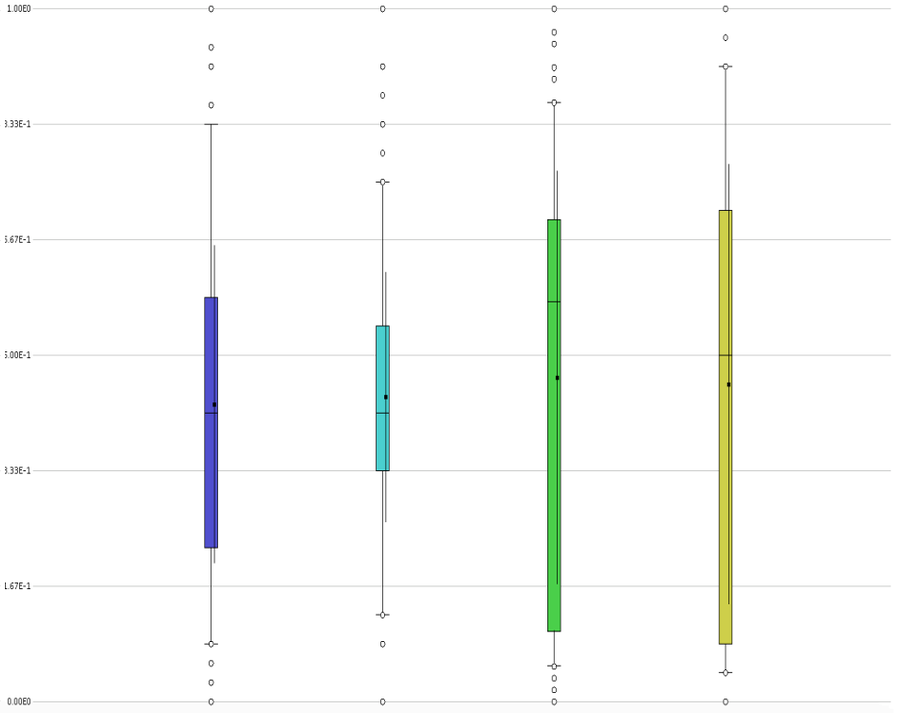
- Try the Range transformation.
- Try the Z-transformation.

Results

- Original
- Z-transform
- 0 - 1





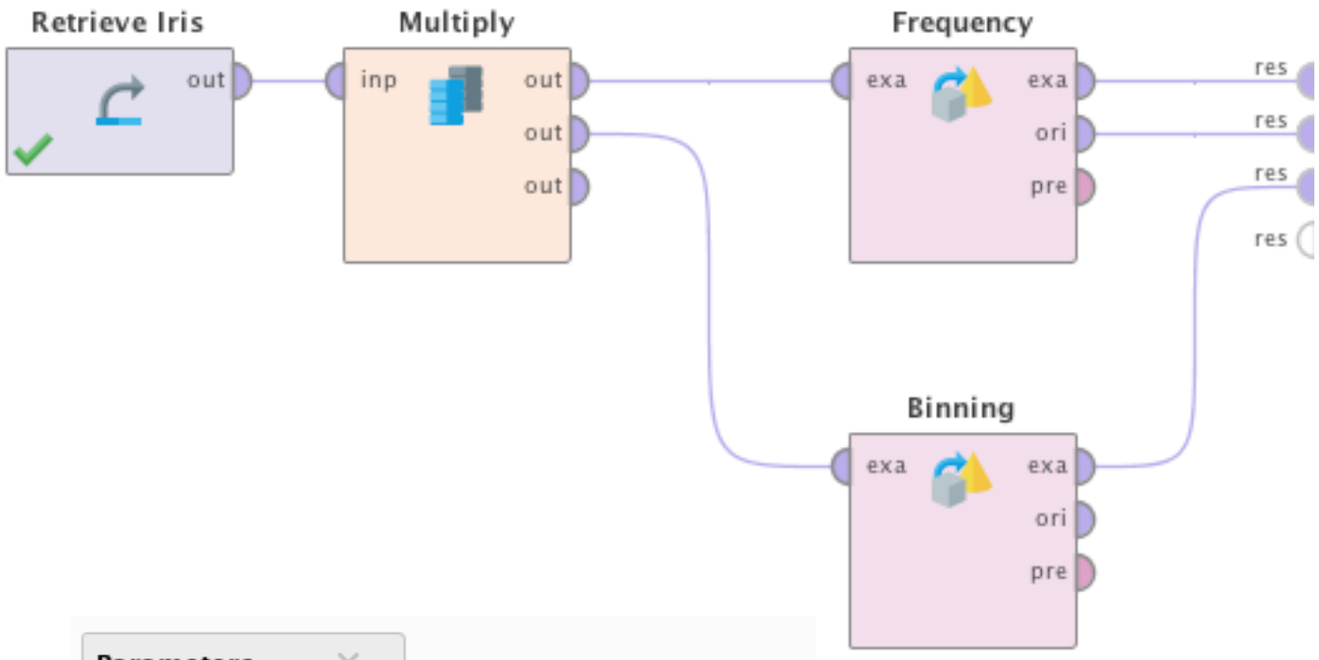


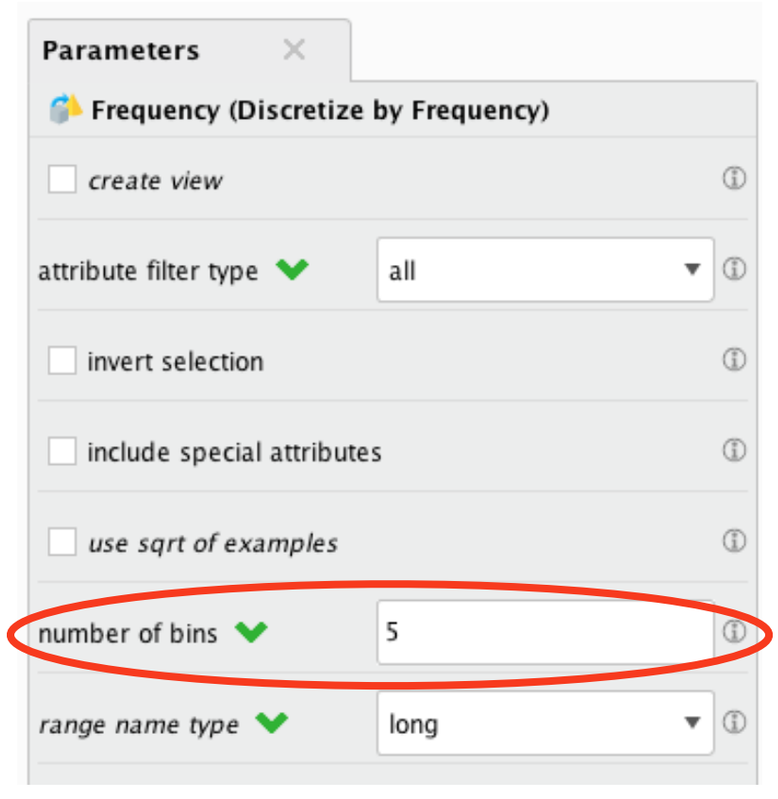
Types of Attributes

- Some models work only with certain types of attributes:
  - Neural Network - numerical
  - Decision Tree - nominal
  - Association Rules - binominal
  - etc.

Discretization

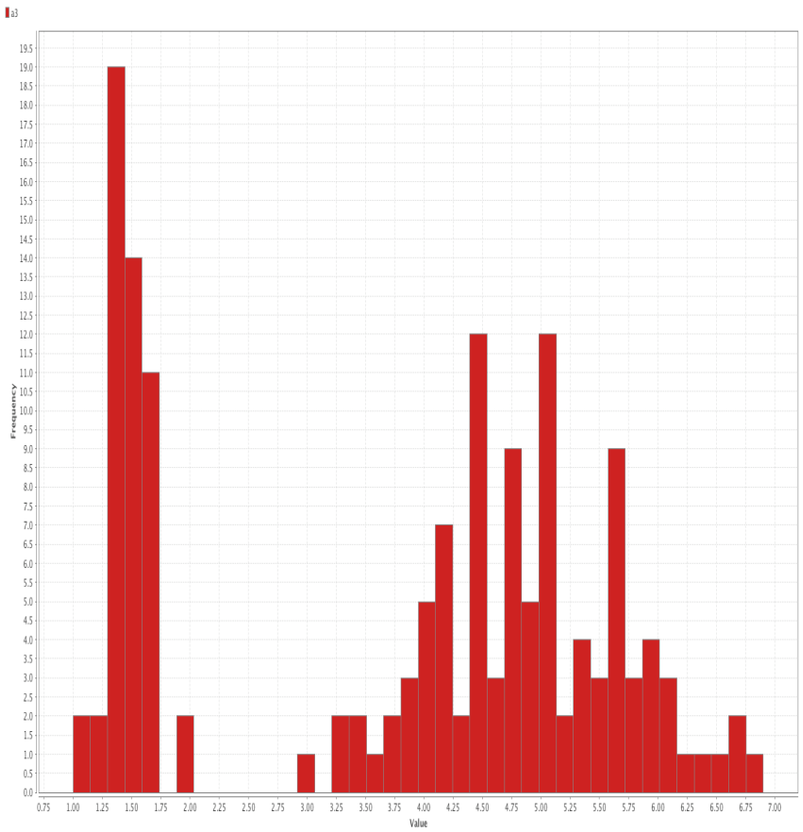
- Discretize by
  - frequency
  - binning
- Enter the number of bins

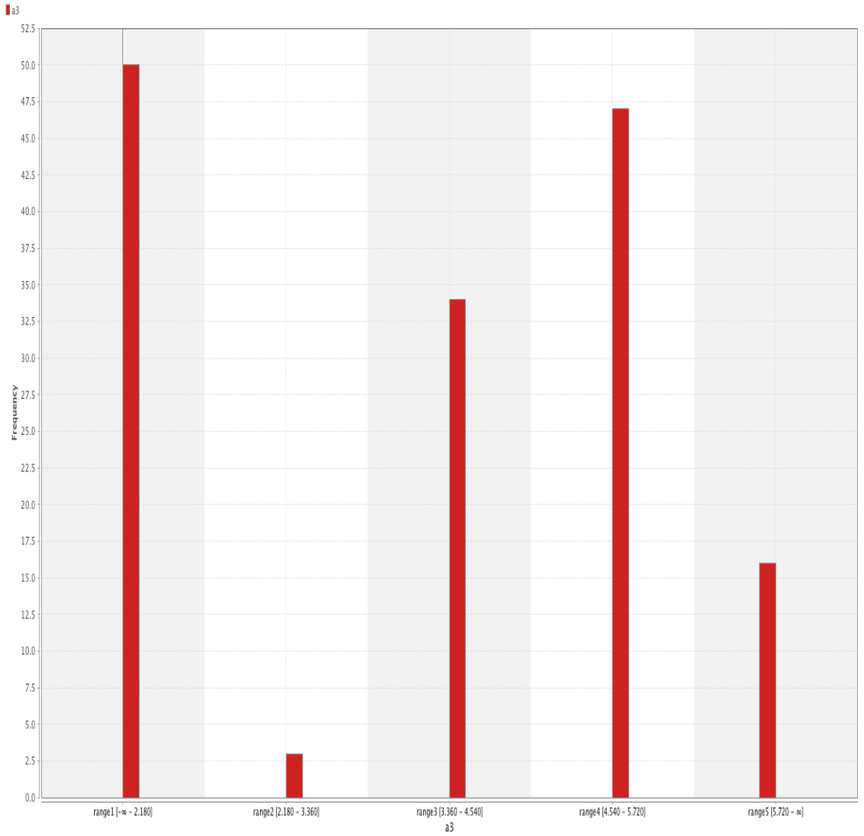


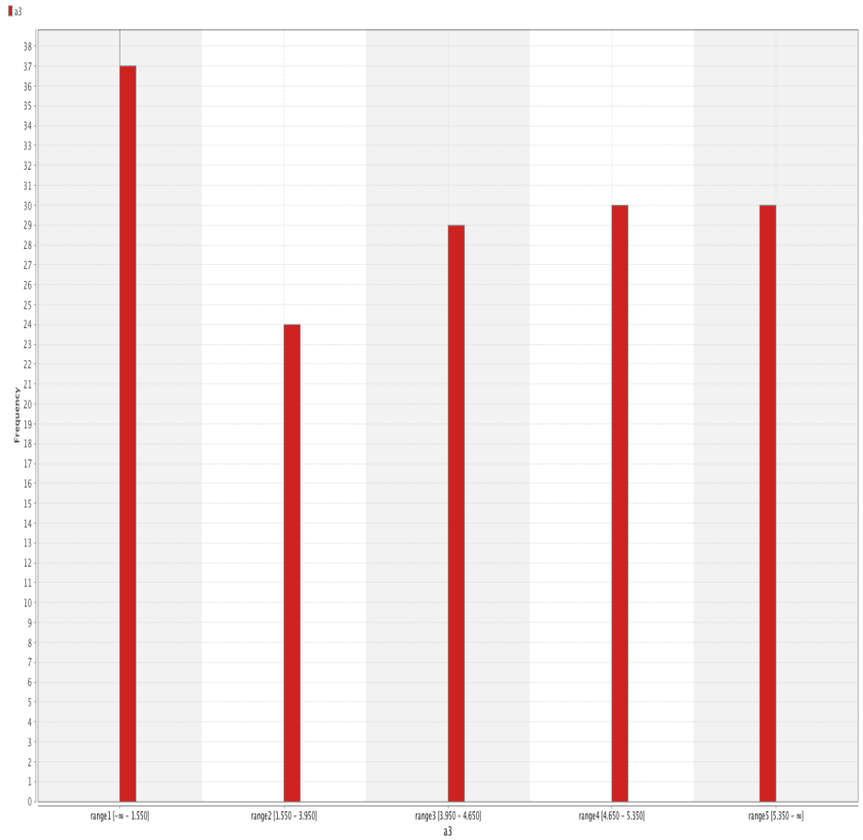


Visualization of the Results

- Original
- Binning
- Frequency







- Note that in the case of the Discretization by frequency the intervals are of different lengths.

Other Transformations

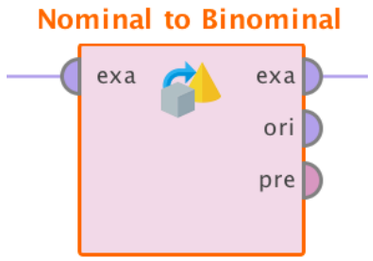
- Try other transformations (operators):
  - Nominal to Binominal
  - Nominal to Numeric
  - Numerical to Binominal
  - …

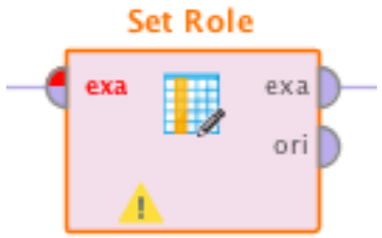
Selection of Attributes

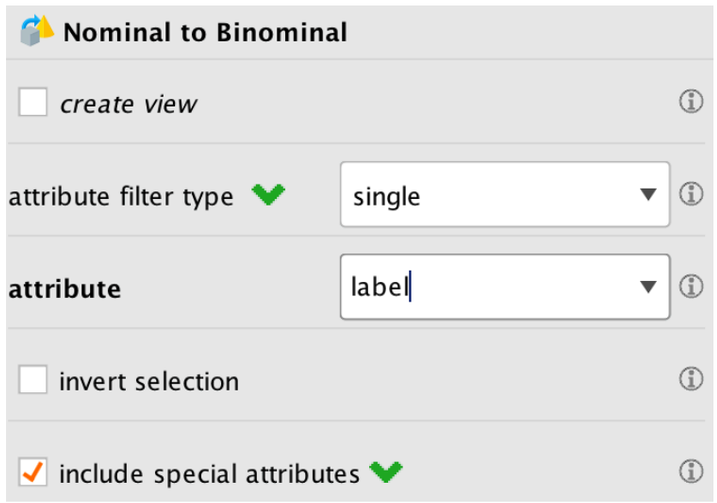
- Manually
- Balancing of attributes
- Automatic selection of attributes

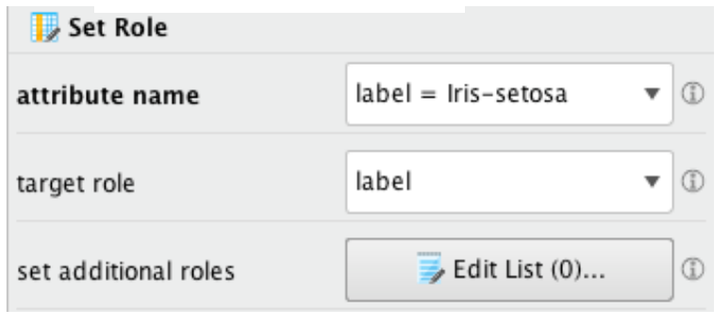
Manual Selection

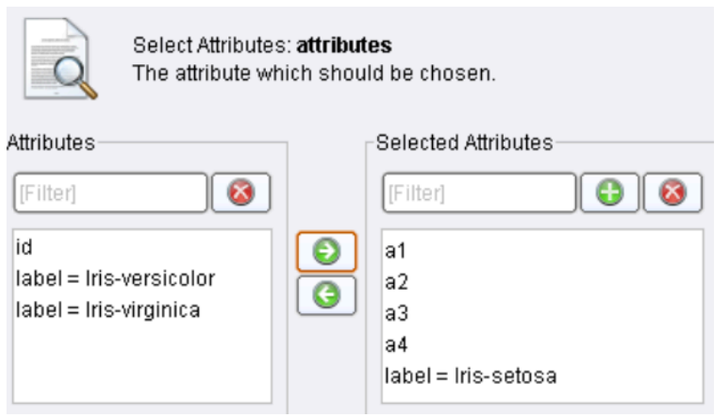
- Transfer Iris data to Nominal
- Indetify the Setosa class
  - Set Role operator
- Work on Subset operator

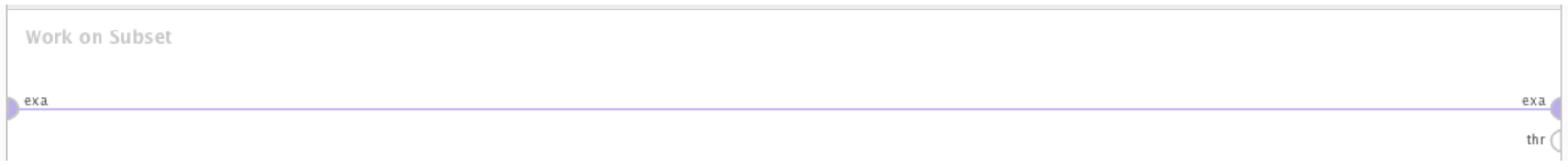


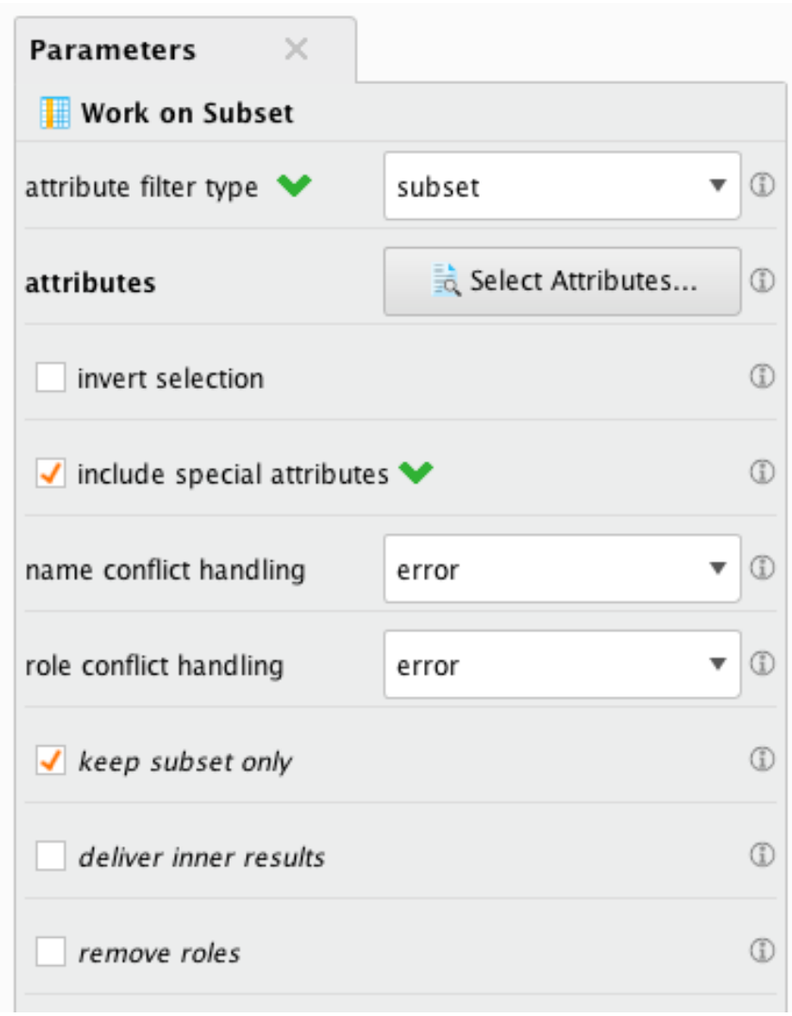






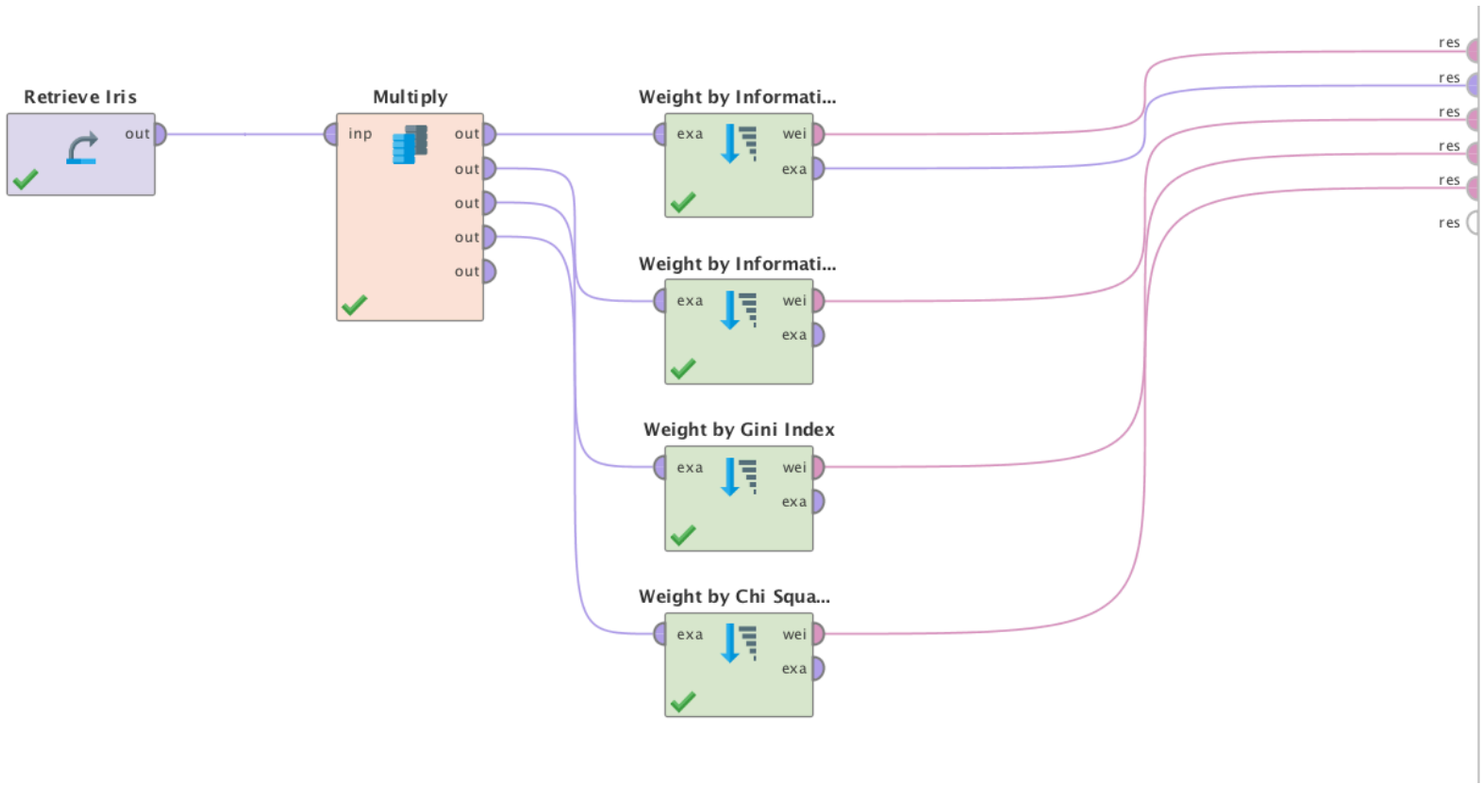






Evaluation of the Contribution of Attributes

- Find the contribution of each attribute on the Iris data using various methods of evaluation
- Use different methods from the group of Attribute weighting operators, e.g.
  - Information Gain
  - Information Gain Ratio
  - Gini Index
  - Chi Squared Statistic



- Compare methods among themselves.

AttributeWeights (Weight by Chi Squared Statistic)

Table View | Plot View | Annotations

attribute	weight
a2	0
a1	0.286
a3	0.897
a4	1

AttributeWeights (Weight by Information Gain)

Table View | Plot View | Annotations

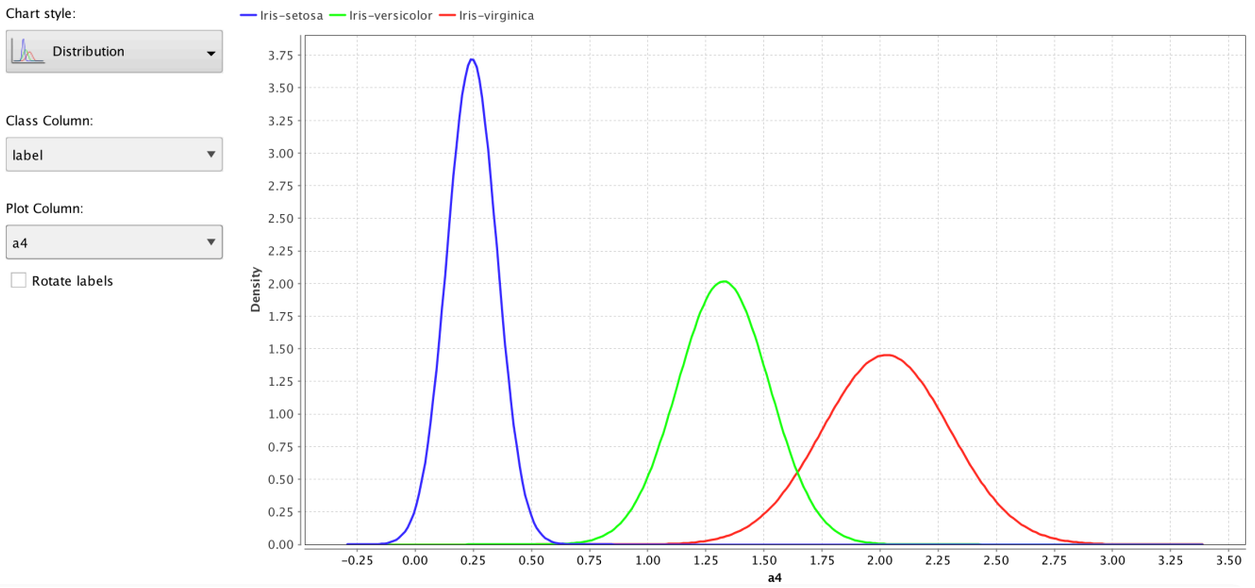
attribute	weight
a2	0
a1	0.498
a3	1
a4	1

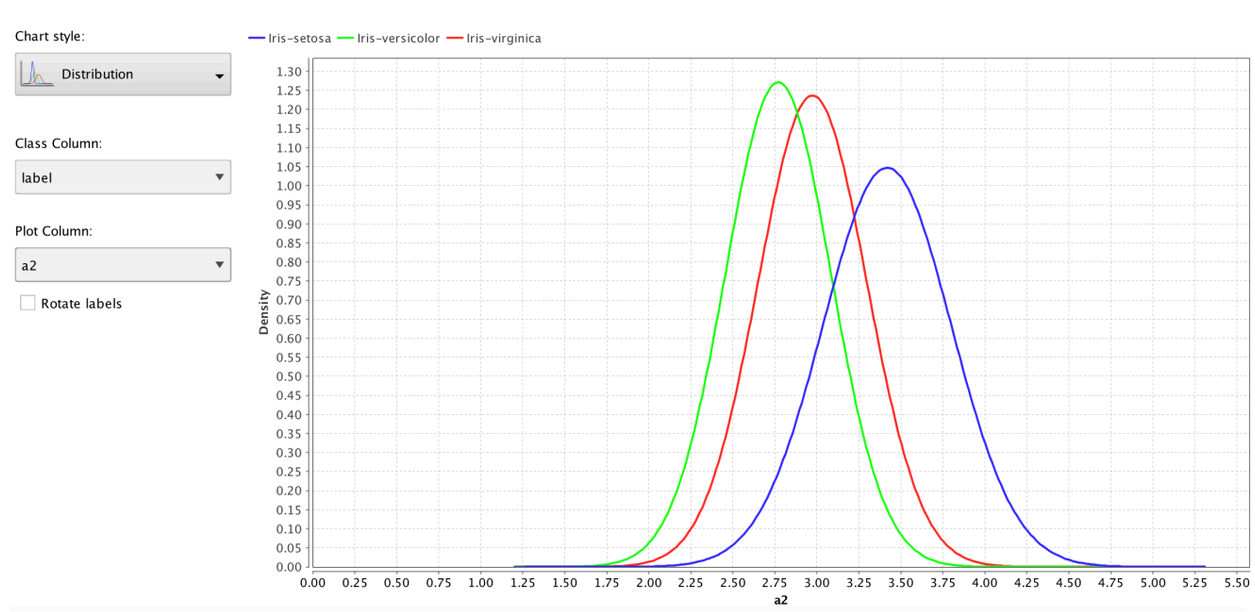
AttributeWeights (Weight by Gini Index)

Table View | Plot View | Annotations

attribute	weight
a2	0
a1	0.557
a3	1
a4	1

- Let’s see the original Iris data, e.g. by using the Distribution plot.



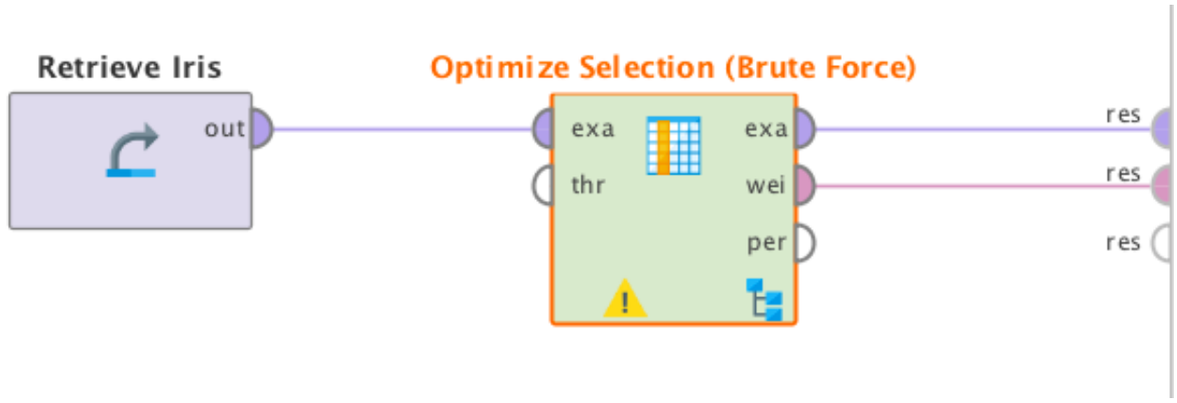


- We see that the attribute a4 separated the classes well.

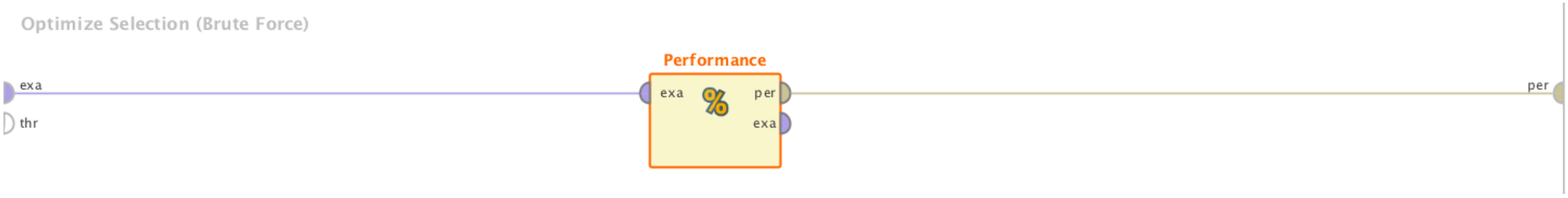
- On the contrary, attribute a2 does not help us with the classification.

Selection of the Attributes

- Let's try some methods of choosing the best subset of attributes.
- Load the Iris dataset.
- Add Optimize Selection operator for searching the feature space.



- Add a method for evaluating a set of attributes. For example Performance (CFS) operator.



- Inspect the selected attributes.

attribute	weight
a1	0
a2	0
a3	1
a4	1

Wrapper Methods

- The Wrapper methods require a model.
- This rating of a set of attributes uses the misclassification error of any classifier calculated by cross-validation (more details in lecture 5).