

Neural Network

A multi-layer perceptron (MLP) algorithm with backpropagation.

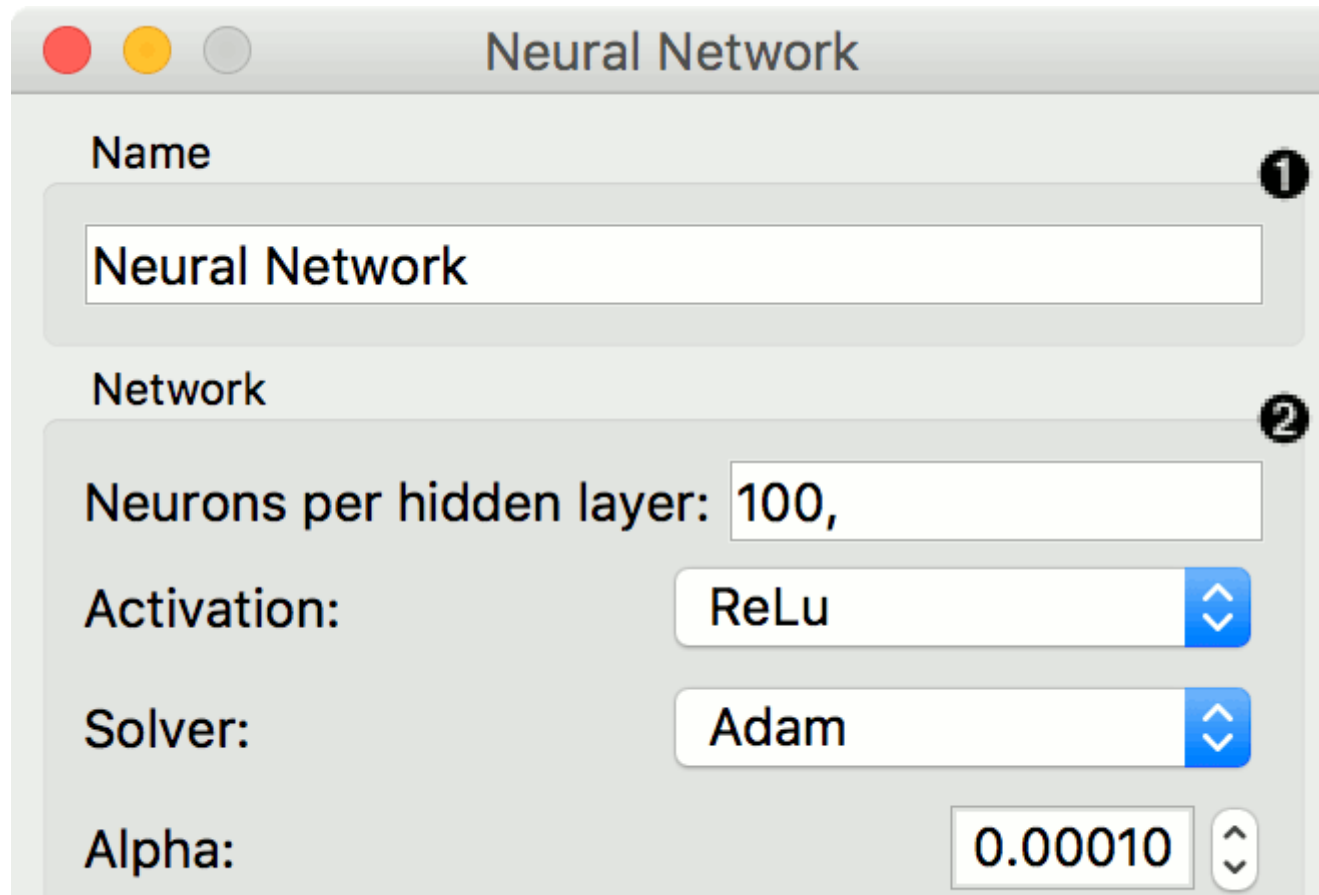
Inputs

- Data: input dataset
- Preprocessor: preprocessing method(s)

Outputs

- Learner: multi-layer perceptron learning algorithm
- Model: trained model

The **Neural Network** widget uses sklearn's **Multi-layer Perceptron algorithm** that can learn non-linear models as well as linear.



The screenshot shows the 'Neural Network' widget interface. It has a title bar with three colored buttons (red, yellow, grey) and the text 'Neural Network'. Below the title bar, there are two main sections. The first section is labeled 'Name' and contains a text input field with the value 'Neural Network'. The second section is labeled 'Network' and contains several settings: 'Neurons per hidden layer' with a text input field containing '100,', 'Activation' with a dropdown menu showing 'ReLu', 'Solver' with a dropdown menu showing 'Adam', and 'Alpha' with a text input field containing '0.00010' and a small up/down arrow button. The 'Network' section is marked with a circled '2' in the top right corner.

Max iterations: 200

Report ☒ Apply Automatically

1. A name under which it will appear in other widgets. The default name is “Neural Network”.
2. Set model parameters:
 - Neurons per hidden layer: defined as the i th element represents the number of neurons in the i th hidden layer. E.g. a neural network with 3 layers can be defined as 2, 3, 2.
 - Activation function for the hidden layer:
 - Identity: no-op activation, useful to implement linear bottleneck
 - Logistic: the logistic sigmoid function
 - tanh: the hyperbolic tan function
 - ReLu: the rectified linear unit function
 - Solver for weight optimization:
 - L-BFGS-B: an optimizer in the family of quasi-Newton methods
 - SGD: stochastic gradient descent
 - Adam: stochastic gradient-based optimizer
 - Alpha: L2 penalty (regularization term) parameter
 - Max iterations: maximum number of iterations

Other parameters are set to **sklearn's defaults**.

3. Produce a report.
4. When the box is ticked (*Apply Automatically*), the widget will communicate changes automatically. Alternatively, click *Apply*.

Examples

The first example is a classification task on *iris* dataset. We compare the results of **Neural Network** with the **Logistic Regression**.

The image shows an Orange Data Mining workflow and the settings for the Neural Network widget.

Workflow: A 'File' widget is connected to both a 'Neural Network' widget and a 'Logistic Regression' widget. Both are connected to a 'Test & Score' widget.

Neural Network Widget Settings:

- Name: Neural Network
- Network:
 - Neurons per hidden layer: 100,
 - Activation: ReLu
 - Solver: Adam
 - Alpha: 0.00010
 - Max iterations: 200
- Buttons: Report, Apply Automatically (checked)

Test & Score Widget Settings:

- Sampling:
 - ☒ Cross validation
 - Number of folds: 10
 - ☒ Stratified
 - ☐ Cross validation by feature
 - ☐ Random sampling
 - Repeat train/test: 10
 - Training set size: 66 %
 - ☒ Stratified
 - ☐ Leave one out
 - ☐ Test on train data
 - ☐ Test on test data
- Target Class: (Average over classes)
- Button: Report

Evaluation Results:

Method	AUC	CA	F1	Precision	Recall
Neural Network	0.992	0.947	0.922	0.904	0.940
Logistic Regression	0.984	0.960	0.938	0.978	0.900

The second example is a prediction task, still using the *iris* data. This workflow shows how to use the *Learner* output. We input the **Neural Network** prediction model into **Predictions** and observe the predicted values.

The image displays the Orange Data Mining Neural Network widget interface. It includes a workflow canvas, a configuration panel, and a detailed predictions table.

Workflow: A 'File' widget is connected to a 'Neural Network' widget, which is then connected to a 'Predictions' widget.

Neural Network Configuration Panel:

- Name:** Neural Network
- Network:**
 - Neurons per hidden layer: 100,
 - Activation: ReLu
 - Solver: Adam
 - Alpha: 0.00010
 - Max iterations: 200
- Buttons:** Report, Apply Automatically (checked)

Info Panel:

- Data:** 150 instances.
- Predictors:** 1
- Task:** Classification
- Buttons:** Restore Original Order

Show Panel:

- ☒ Predicted class
- ☒ Predicted probabilities for:
 - Iris-setosa
 - Iris-versicolor
 - Iris-virginica
- ☒ Draw distribution bars

Data View:

- ☒ Show full data set

Output Panel:

- ☒ Original data
- ☒ Predictions
- ☒ Probabilities
- Buttons:** Report

Predictions Table:

	Neural Network	iris	sepal length	sepal width	petal length	petal width
56	0.03 : 0.83 : 0.14 → Iris-versi...	Iris-versicolor	5.700	2.800	4.500	1.300
57	0.06 : 0.62 : 0.32 → Iris-versi...	Iris-versicolor	6.300	3.300	4.700	1.600
58	0.07 : 0.91 : 0.02 → Iris-versi...	Iris-versicolor	4.900	2.400	3.300	1.000
59	0.01 : 0.87 : 0.12 → Iris-versi...	Iris-versicolor	6.600	2.900	4.600	1.300
60	0.06 : 0.83 : 0.11 → Iris-versi...	Iris-versicolor	5.200	2.700	3.900	1.400
61	0.01 : 0.98 : 0.01 → Iris-versi...	Iris-versicolor	5.000	2.000	3.500	1.000
62	0.05 : 0.77 : 0.18 → Iris-versi...	Iris-versicolor	5.900	3.000	4.200	1.500
63	0.00 : 0.98 : 0.02 → Iris-versi...	Iris-versicolor	6.000	2.200	4.000	1.000
64	0.02 : 0.74 : 0.24 → Iris-versi...	Iris-versicolor	6.100	2.900	4.700	1.400
65	0.11 : 0.82 : 0.07 → Iris-versi...	Iris-versicolor	5.600	2.900	3.600	1.300
66	0.02 : 0.85 : 0.13 → Iris-versi...	Iris-versicolor	6.700	3.100	4.400	1.400
67	0.06 : 0.70 : 0.24 → Iris-versi...	Iris-versicolor	5.600	3.000	4.500	1.500
68	0.03 : 0.94 : 0.03 → Iris-versi...	Iris-versicolor	5.800	2.700	4.100	1.000
69	0.00 : 0.72 : 0.27 → Iris-versi...	Iris-versicolor	6.200	2.200	4.500	1.500
70	0.02 : 0.95 : 0.03 → Iris-versi...	Iris-versicolor	5.600	2.500	3.900	1.100
71	0.04 : 0.38 : 0.58 → Iris-virgi...	Iris-versicolor	5.900	3.200	4.800	1.800
72	0.02 : 0.91 : 0.07 → Iris-versi...	Iris-versicolor	6.100	2.800	4.000	1.300
73	0.00 : 0.59 : 0.41 → Iris-versi...	Iris-versicolor	6.300	2.500	4.900	1.500
74	0.01 : 0.88 : 0.11 → Iris-versi...	Iris-versicolor	6.100	2.800	4.700	1.200
75	0.02 : 0.89 : 0.09 → Iris-versi...	Iris-versicolor	6.400	2.900	4.300	1.300
76	0.02 : 0.84 : 0.14 → Iris-versi...	Iris-versicolor	6.600	3.000	4.400	1.400
77	0.00 : 0.76 : 0.23 → Iris-versi...	Iris-versicolor	6.800	2.800	4.800	1.400