

JustNN Help

User guide

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JustNN

Just simple neural networks

JustNN Introduction

Welcome to **JustNN**, a simple and easy to use neural network application.

Using **JustNN** you can:

- 1.Import text, csv, spreadsheet, image or binary files into the **Grid**.
- 2.Use many editing and pre-formatting functions on the grid.
- 3.Build neural networks from the grid.
- 4.Train, validate and query the neural network.

New Users should do the **Getting Started** exercises.

Neural Planner Software Ltd

Getting Started

The exercises can be started by clicking the **Getting Started** button on the **Tip of the Day** or using the menu command **Help > Getting Started...**

1.XOR

In the first exercise you will open, train and query a simple neural network that simulates XOR, (exclusive-or). XOR is a logical operator that results in the output being true if one of the inputs, but not both, is true. If both inputs are true the output is false.

2.Color Circle

In this exercise you will be guided through a series of steps to make a neural network that learns which secondary color is produced when any two of the three primary colors are mixed together. You will open a partially completed grid file. You will edit the grid and then create, train and query the neural network

3.Races

In the Races exercise you will start with an empty grid. You will then import the results of 370 horse races. Then you will create, train and validate a neural network. When it is completed the neural network will be used to predict the results of other horse races.

Main Windows

The main windows used in **JustNN**

Grid

	Runners	Distance	Handicap	Class	Stake>5k	Odds>2	W
[1]	11	7	false	5	false	true	f
[2]	5	8	false	3	false	false	t
[3]	7	5	true	2	true	true	f
[4]	4	8	false	1	true	false	t
[5]	8	14	true	4	false	true	t
[6]	10	10	true	3	true	false	f
[7]	6	8	false	4	false	false	t
[8]	4	6	false	3	false	false	f
[9]	13	8	true	3	true	true	f
[10]	9	14	true	1	true	true	f
[11]	12	7	false	3	true	true	f
[12]	5	13	false	4	false	false	t
[13]	12	5	true	4	true	true	t
[14]	4	14	false	1	true	false	t
[15]	12	7	true	2	true	true	f
[16]	18	6	true	3	true	true	t
[17]	9	8	false	1	true	true	t
[18]	22	10	true	5	false	true	f
[19]	10	9	true	5	false	true	f
[20]	5	7	false	4	false	false	t
[21]	16	6	false	5	false	true	t
[22]	12	10	false	6	false	false	f
[23]	3	6	false	2	true	false	t
[24]	12	8	true	3	true	true	f
[25]	3	18	false	3	true	false	t
[26]	18	6	true	5	false	true	f
[27]	4	12	false	6	false	false	f
[28]	6	6	true	5	false	false	t
[29]	8	7	false	7	false	false	t

The Grid view shows all the Examples arranged in rows and all the Input/Outputs arranged in columns. The first column contains the Example types and names. The first row contains the Input/Output types and names. Everything on the Grid can be edited by moving to the cell containing the value and then pressing the enter key to start the Edit Grid dialog. The cell can be selected either using the arrow keys or the mouse. A single click will select the cell and a double click will start the Edit Grid dialog. A double click on the Example name cell will select the whole row and a double click on the Input/Output name cell will select the whole column. The

row or the column can be deselected by pressing the Esc key.

Creating a New Grid.

A new Grid is created by pressing the new toolbar button or using the **File > New** menu command. The new Grid will be empty except for a horizontal line, a vertical line and an underline marker that shows the current position in the Grid. New Grid rows and columns are created at the current position.

Creating the first Example row and Input/Output column.

Press return and a prompt will appear that says "Create new Example row?". Answer Yes. Another prompt will appear that says "Create new Input/Output column?". Answer Yes again. You will now see that the Grid has one cell containing "?", a row name containing "T:0" and a column name containing "I:0". The "?" indicates that the cell has no value, the "T:0" indicates that it is a Training Example in row 0 and the "I:0" indicates that it is an Input in column 0. Press return again and an Edit Grid dialog box will appear that allows you to enter the cell value. Using the same dialog you can change the Input/Output column name, mode and type. The dialog can also be used to change the Example row name and type.

Creating more Input/Output columns.

Move the marker one cell to the right by pressing the right arrow or tab key. Now press the return key and a prompt will appear that says "Create new Input/Output column?". Answer Yes. Press return again and the Edit Grid dialog box will appear. This time the Example row will already contain a name and type. You can set the cell value, the Input/Output name and the type can be set to "I:" for input, "O:" for output, "X:" for exclude or "S:" for serial. The mode can be set to "Real", "Integer", "Bool" or "Text". Any type of Input/Output column can be inserted into the Grid using the functions on the Insert menu.

Creating more Example rows.

Move the marker one cell down by pressing the down arrow key. Now press the return key and a prompt will appear that says "Create new Example row?". Answer Yes. Press return again and the Edit Grid dialog box will appear. This time the Input/Output column will already contain a name and type. You can set the cell value, Example name and the type can be set to T: for training, V: for validating, Q: for querying or X: for exclude. Any type of Example row be inserted into the Grid using the functions on the Insert menu.

Copying Example rows and Input/Output columns.

Double click on the name to select the whole row or column. Cut will remove the selected row or column and place it on the clipboard. Copy will place a copy of the selected row or column on the clipboard. Paste will insert a copy of the clipboard before the currently selected row or column. If the clipboard contains a row then Paste will insert the row into the Grid. If the clipboard contains a column then Paste will insert a column into the Grid. The invisible Grid data, limits and defaulted values, will be regenerated after a Paste column thus any neural network that has already been generated from the Grid will be invalidated.

1

Column names

	Runners	Distance	Handicap	Class	Stake>5k	Odds>2	Win
--	---------	----------	----------	-------	----------	--------	-----

The columns can be named or numbered.

2

Row names

[\[1\]](#)[\[2\]](#)[\[3\]](#)[\[4\]](#)[\[5\]](#)[\[6\]](#)

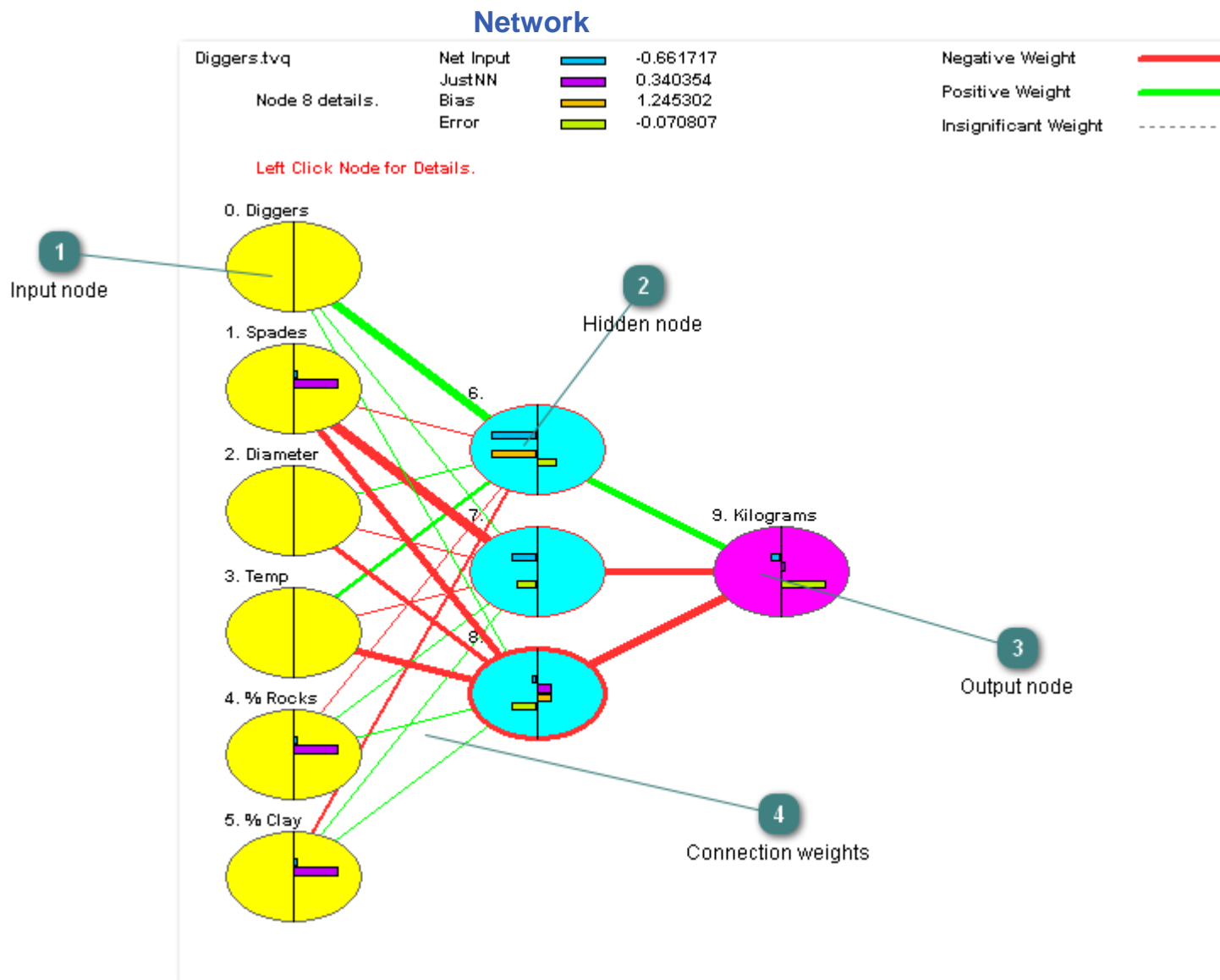
The rows can be named or numbered.

3

Cell values

11	7	false	5
5	8	false	3
7	5	true	2
4	8	false	1
8	14	true	4
10	10	true	3
6	8	false	4
4	6	false	3

The grid cell values can be integer, real, boolean or text.



The **Network** view shows how the nodes in a **JustNN** neural network are interconnected.

How to create a new neural network

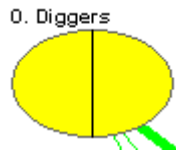
A new neural network can be created from the [Grid](#) by pressing the [New Network](#) toolbar button or selecting **Action > New Network**. This will produce the New Network dialog. This dialog allows the neural network configuration to be specified. The dialog will already contain the necessary information to generate a neural network that will be capable of learning the information in the Grid. However, the generated network may take a long time to learn and it may give poor results when tested. A better neural network can be generated by checking Grow hidden layer 1 and allowing **JustNN** to determine the optimum number of nodes and connections.

It is rarely necessary to have more than one layer of hidden nodes but **JustNN** will generate two or three hidden layers if Grow hidden layer 2 and Grow hidden layer 3 are checked.

The time that JustNN will spend looking for the optimum network can be controlled by setting the Growth rate variables. Every time that the period expires JustNN will generate a new neural network slightly different from the previous one. The best network is saved.

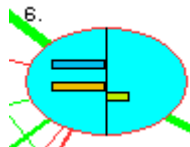
1

Input node



2

Hidden node



Hidden nodes are fully connected to input nodes, output nodes or other layers of hidden nodes.

3

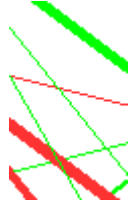
Output node



Output nodes are connected to the output columns in the grid.

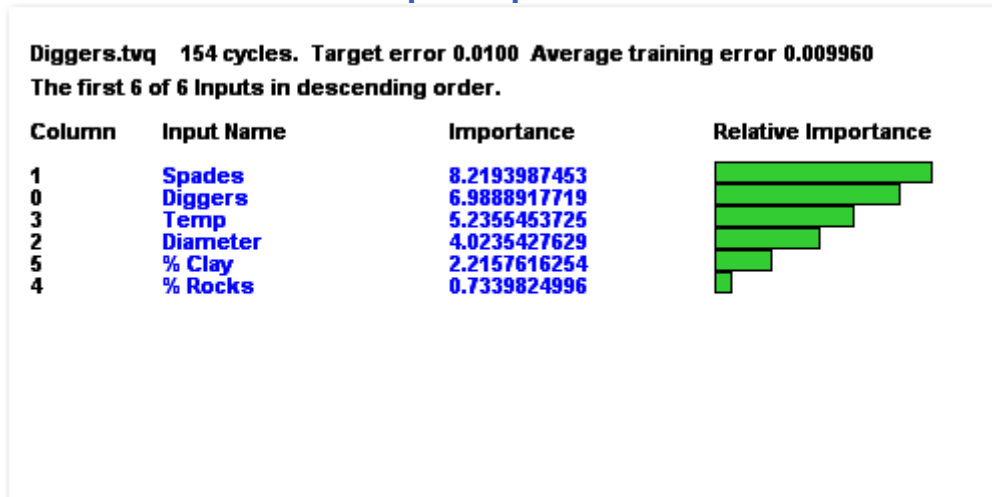
4

Connection weights



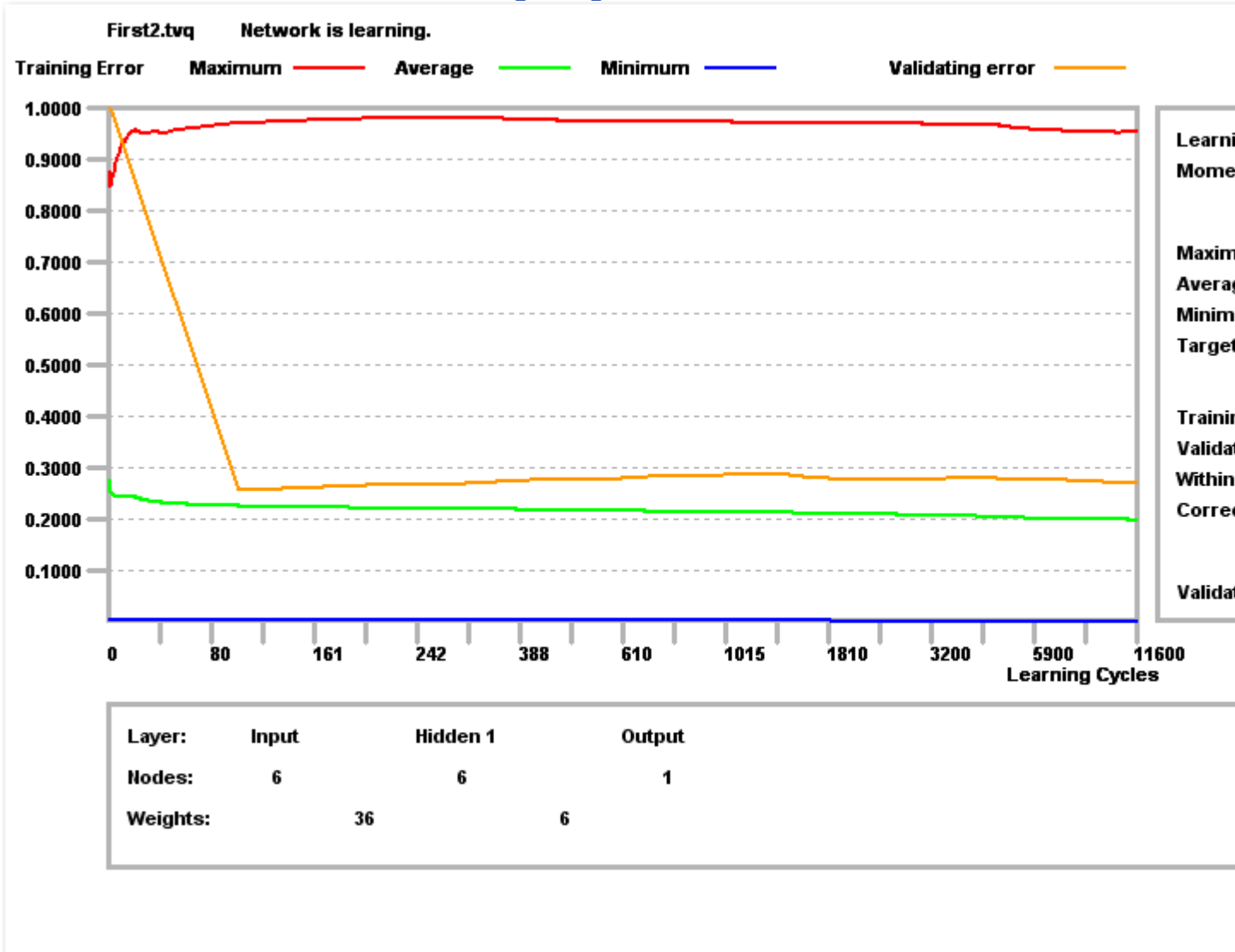
The input layer is fully connected to the first hidden layer. Each connection has a weight that is updated while the network is learning. Hidden layers are fully connected the next hidden layer or the output layer.

Input Importance



The **Input Importance** view shows the importance and the relative importance of each Input column. The Importance is the sum of the absolute weights of the connections from the input node to all the nodes in the first hidden layer. The inputs are shown in the descending order of importance from the most important input.

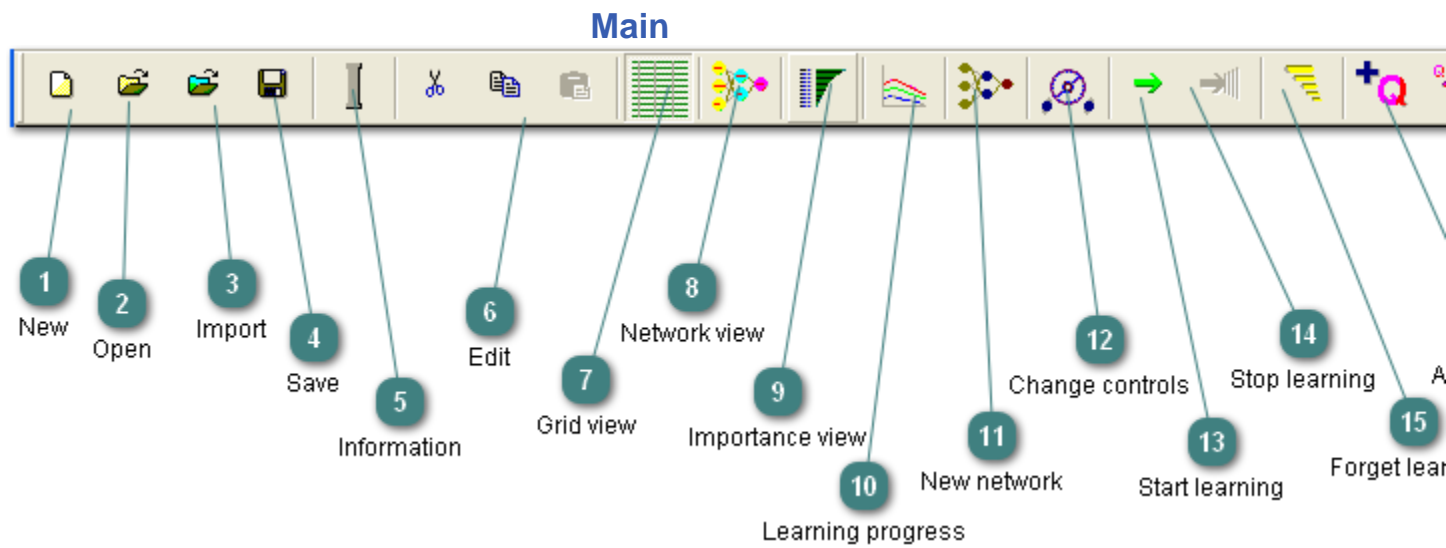
Learning Progress



The **Learning Progress** view shows how learning is progressing. Up to 5000 graph points are recorded. This is sufficient for over 200,000,000 learning cycles. The graph is produced by sampling these points. The horizontal axis is nonlinear to allow the whole learning progress to be displayed. As more cycles are executed the graph is squashed to the left. The scaled errors for all example rows are used. The red line is the maximum example error, the blue line is the minimum example error and the green line is the average example error. The orange line is the average validating error.

Toolbars

Most functions in **JustNN** have toolbar icons



1

New

Create a new document with a blank neural network grid

2

Open

Open an existing grid and neural network.

3

Import

Import a TXT, CSV, XLS, BMP or binary file into the neural network grid.

4

Save

Save the active neural network document.

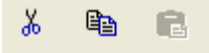
5

Information

View the details of the currently open network file.

6

Edit



Cut, copy and paste. The row or column is selected by double clicking the row or column name.

7

Grid view



View and edit the grid.

8

Network view



View the neural network.

9

Importance view



View the importance of the inputs.

10

Learning progress



View the learning progress graphs.

11

New network



Opens the New network dialog to create a neural network from the grid.

12

Change controls



Opens the controls dialog to set the learning, validating and other controls.

13

Start learning



Starts the learning process.

14

Stop learning



Stop the learning process.

15

Forget learning

Forget learning. The network weights are set to small random values. The random number sequence is normally started at the same point when the network forgets but it can be restarted from a point based on the current time.

16

Add query

Adds a querying row to the grid.

17

Change query value

Increases, decreases, maximises or minimizes the query value.

18

Zoom

Zoom in or out.

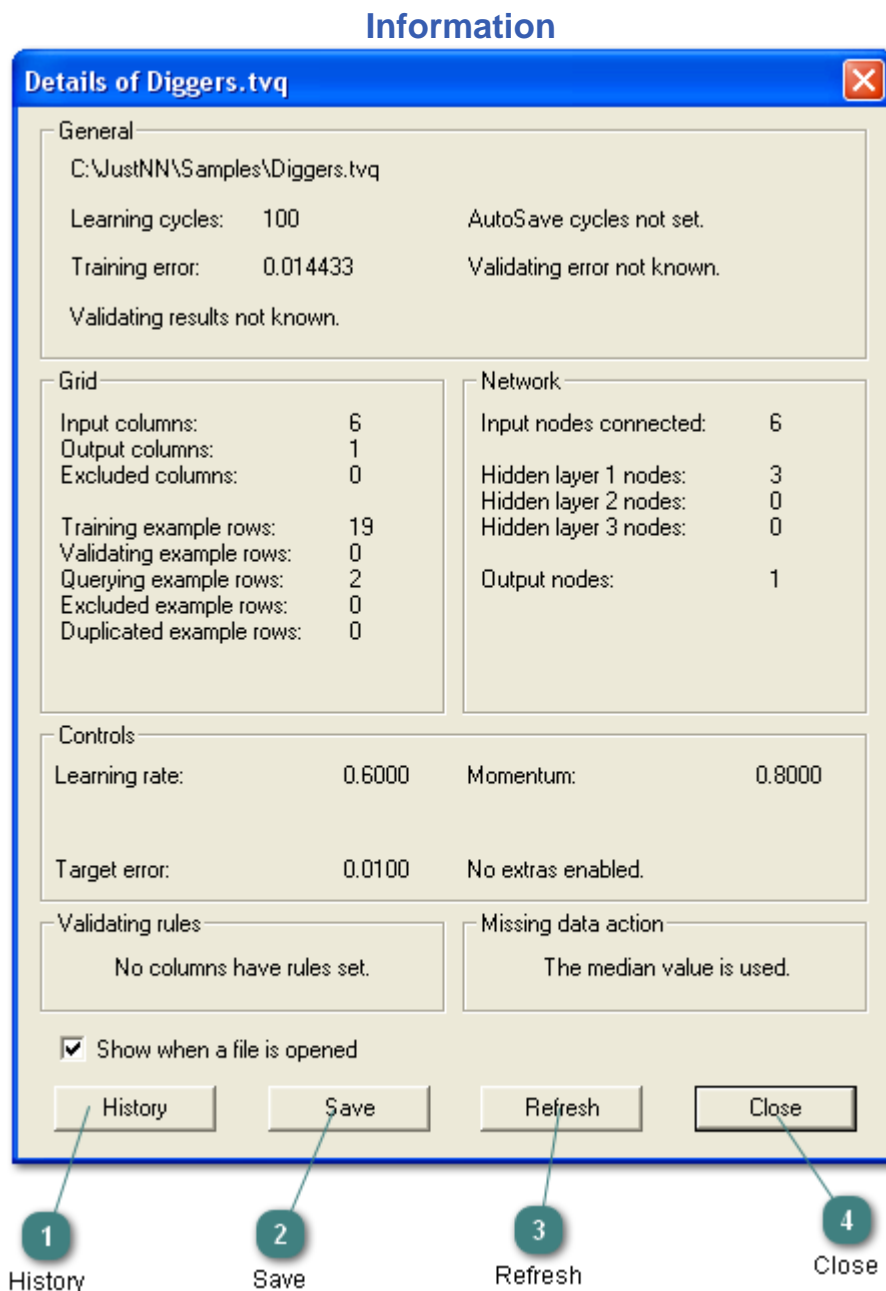
19

Support

Email support.

Main Dialogs

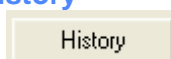
Most of the facilities in **JustNN** can be accessed or changed using dialogs.



Information. Details of the neural network file are displayed when the file is loaded or when Information is selected on the menu.

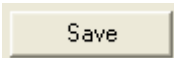
1

History



Click to show the file loading and saving history.

2

Save

Click to save all the information details to a text file.

3

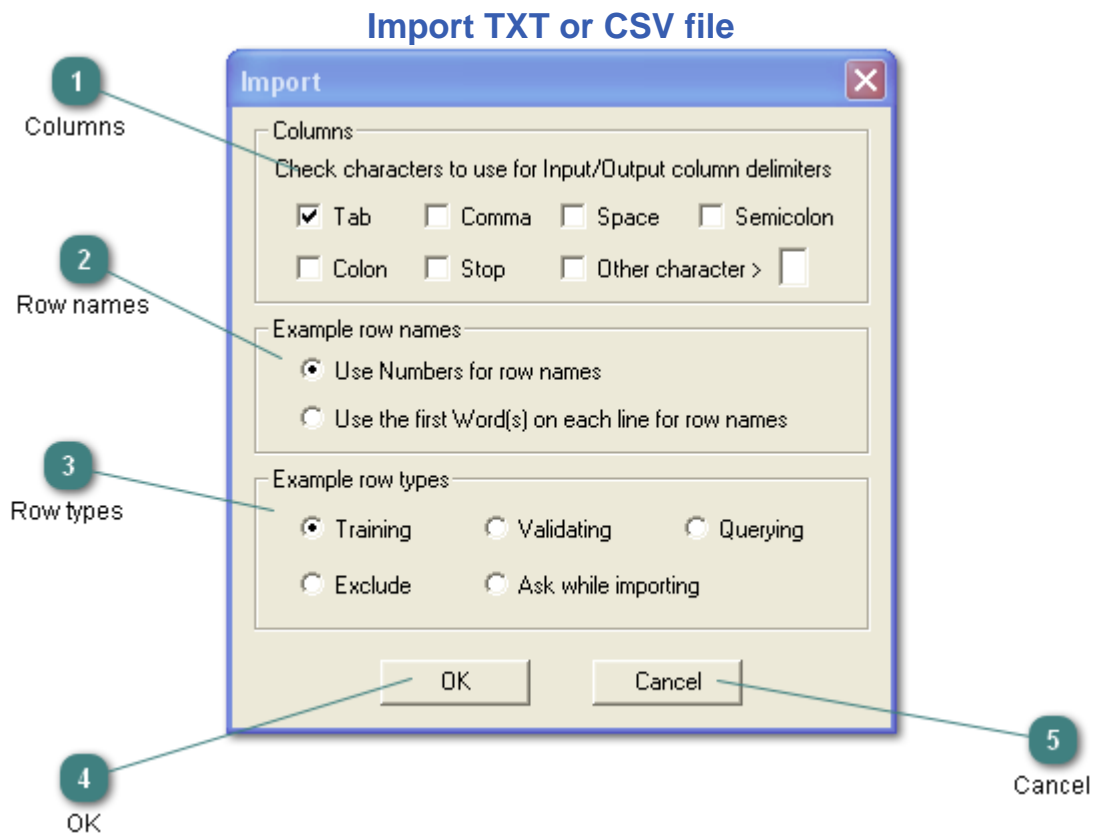
Refresh

Click to refresh the information while the neural network is learning.

4

Close

Click to close the dialog.



Import. Import a text or comma separated file.

JustNN can import a txt or a csv file to create a new Grid or to add new example rows to an existing Grid.

1. **File > New** to create a new Grid or **File > Open** to add rows to an existing Grid.

2. **File > Import...**

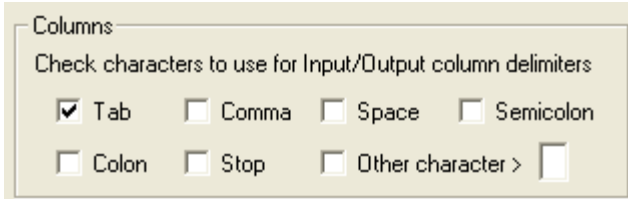
3. Open the file that is to be imported

4. In the dialog check all the characters that are to be used for column delimiters. Line ends are used for row delimiters.

5. Any words before the first delimiter on each line can be used for row names. If no row names are available then **JustNN** can generate numbers for row names.

6. Press OK.

1 **Columns**



Columns

Check characters to use for Input/Output column delimiters

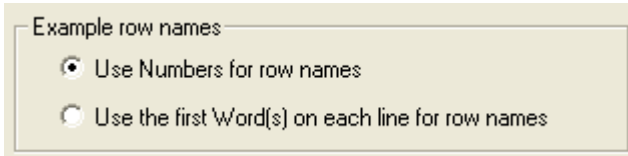
Tab Comma Space Semicolon

Colon Stop Other character >

Check the characters to use as Input/Output column delimiters.

2

Row names



Example row names

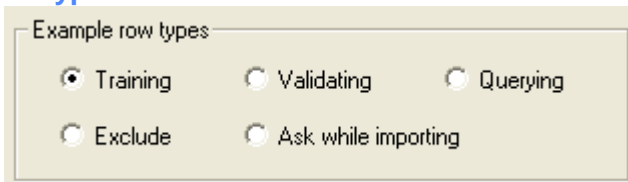
Use Numbers for row names

Use the first Word(s) on each line for row names

Set how to produce Example row names.

3

Row types



Example row types

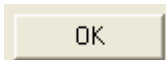
Training Validating Querying

Exclude Ask while importing

Set the example row type for all imported rows or ask for row types while importing.

4

OK

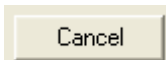


OK

Click to accept all settings and close the dialog.

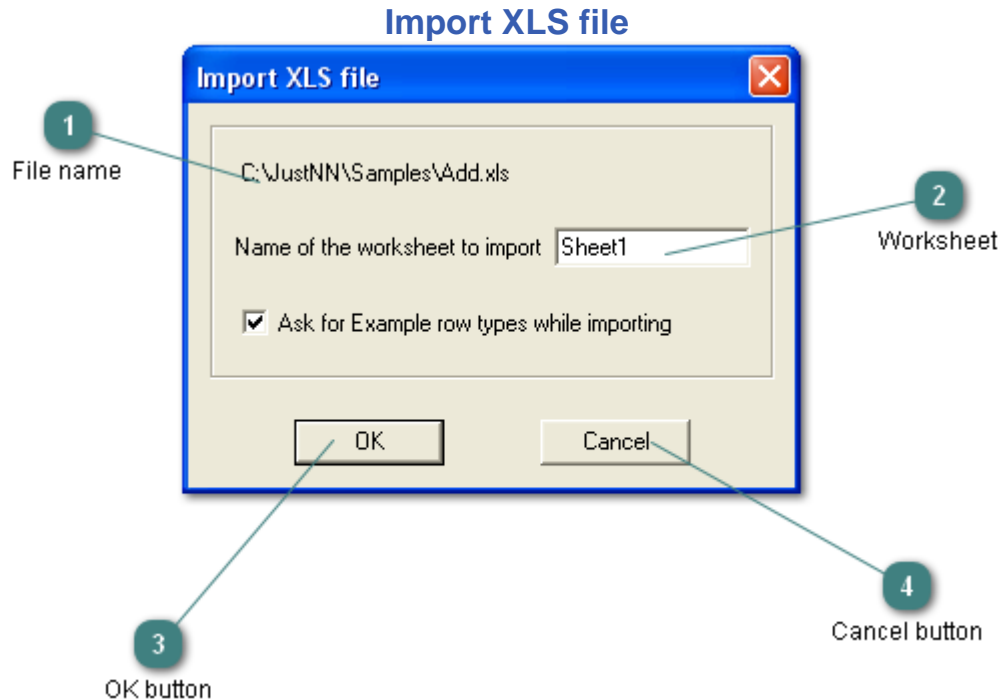
5

Cancel



Cancel

Click to reject all settings and close the dialog.



Import. Simple spreadsheet files produced by **Excel** in **xls** format can be imported directly into **EasyNN-plus** but a much greater degree of import control is available if the files are first saved as comma separated **csv** types. Files in **xls** format are limited to 256 columns and 65536 rows.

If the **xls** file is to be imported directly to produce a new Grid proceed as follows.

1. **File > New** to create a new Grid.
2. **File > Import...**
3. Open the **xls** file that is to be imported.
4. Enter the name of the sheet that is to be imported if it is different to **Sheet1**.
5. Answer the messages according to how you want to create the Grid Input/Output and Example names.
6. Step through all the columns setting the type and mode.

1

File name

C:\JustNN\Samples\Add.xls

The file to be imported.

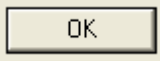
2

Worksheet

Name of the worksheet to import Sheet1

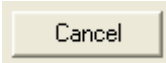
Enter the name of the worksheet to import.

3

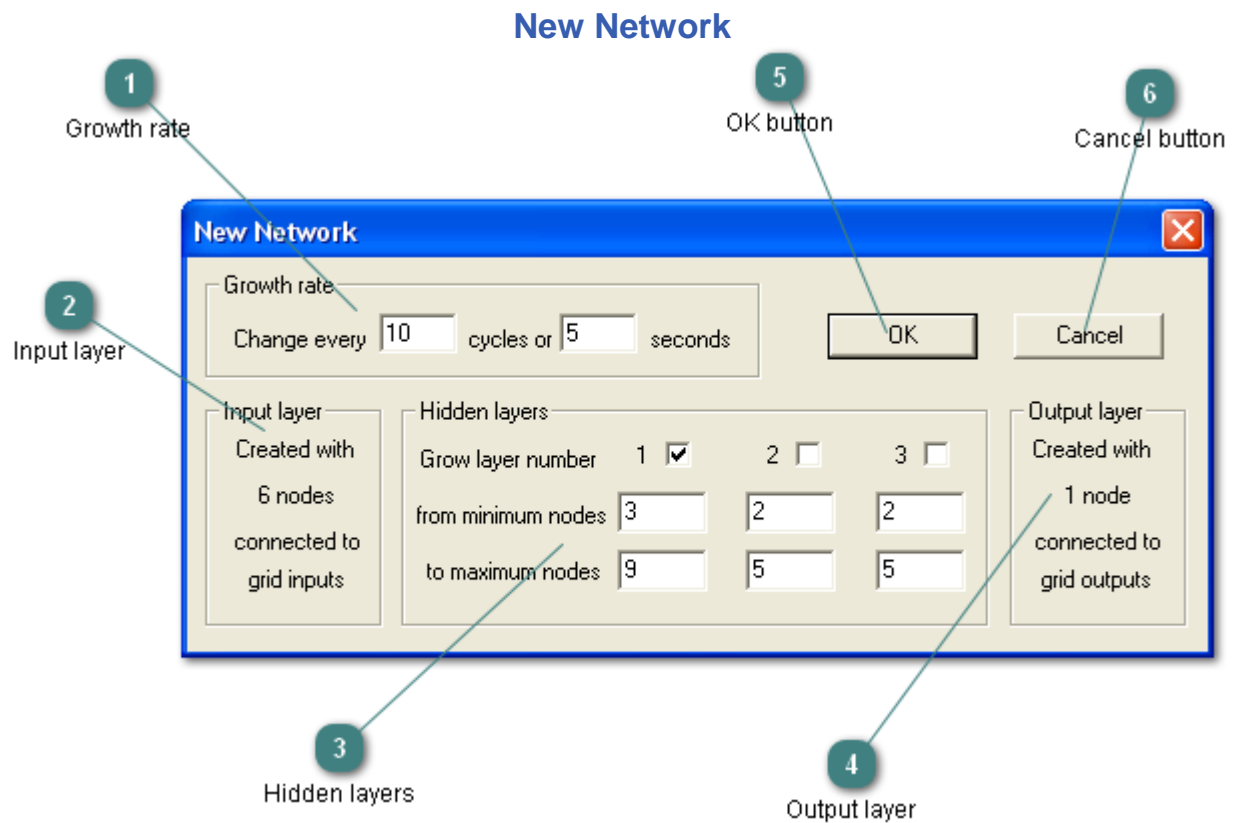
OK button

Click to accept settings and close the dialog.

4

Cancel button

Click to reject settings and close the dialog.



1 Growth rate

Growth rate
Change every cycles or seconds

A network is produced when the cycles or seconds elapses until the optimum network is found.

2 Input layer

Input layer
Created with
6 nodes
connected to
grid inputs

The number of nodes in the input layer is determined by the number of input columns in the grid.

3 Hidden layers

Hidden layers			
Grow layer number	1 <input checked="" type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
from minimum nodes	<input type="text" value="3"/>	<input type="text" value="2"/>	<input type="text" value="2"/>
to maximum nodes	<input type="text" value="9"/>	<input type="text" value="5"/>	<input type="text" value="5"/>

The hidden layers are grown from the minimum to the maximum number of nodes.

4

Output layer

Output layer
Created with
1 node
connected to
grid outputs

The number of nodes in the output layer is determined by the number of output columns in the grid.

5

OK button

OK

Press to accept all the settings and close the dialog.

6

Cancel button

Cancel

Press to reject all the settings and close the dialog.

Controls

The screenshot shows the 'Controls' dialog box with the following settings and callouts:

- 1 Learning:** Points to the Learning section.
- 2 Validating:** Points to the Validating section.
- 3 Slow learning:** Points to the Slow learning section.
- 4 Target error stops:** Points to the Target error stops section.
- 7 OK button:** Points to the OK button.
- 8 Cancel button:** Points to the Cancel button.

Learning
 Learning rate: 0.6 Decay Optimize
 Momentum: 0.8 Decay Optimize

Validating
 Cycles before first validating cycle: 100
 Cycles per validating cycle: 100
 Select 0 examples at random from the
 Training examples = 19

Slow learning
 Delay learning cycles by 0 milliseconds

Target error stops
 Stop when Average error is below 0.00999
 or stop when All errors are below

Validating stops
 Stop when 100 % of the validating examples
 are Within 10 % of desired outputs
 or Correct after rounding

Fixed period stops
 Stop after 20.0000 seconds
 Stop on 100 cycles

OK Cancel

1 Learning

Learning

Learning rate: 0.6 Decay Optimize

Momentum: 0.8 Decay Optimize

2 Validating

Validating

Cycles before first validating cycle

Cycles per validating cycle

Select examples at random from the

Training examples = 19

3

Slow learning

Slow learning

Delay learning cycles by millisecs

4

Target error stops

Target error stops

Stop when Average error is below

or stop when All errors are below

5

Validating stops

Validating stops

Stop when % of the validating examples

are Within % of desired outputs

or Correct after rounding

6

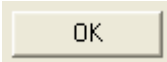
Fixed period stops

Fixed period stops

Stop after seconds

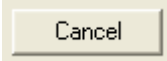
Stop on cycles

7

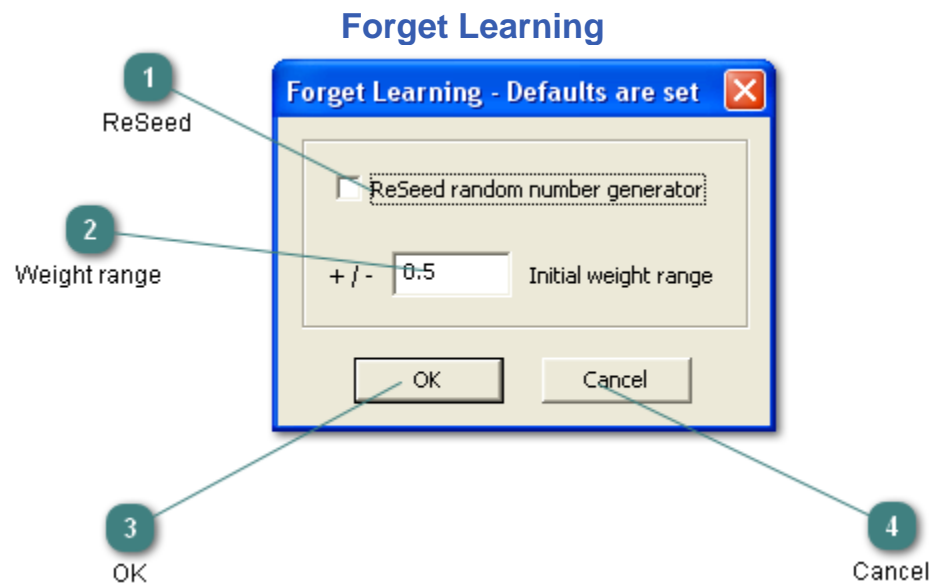
OK button

Press to accept all the settings and close the dialog.

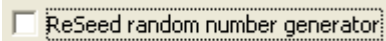
8

Cancel button

Press to reject all the settings and close the dialog.

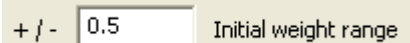


1

ReSeed

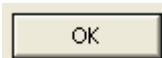
If checked, the random number generator is seeded starting at a value set by the current time.

2

Weight range

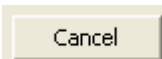
The range of values to set the weights and biases.

3

OK

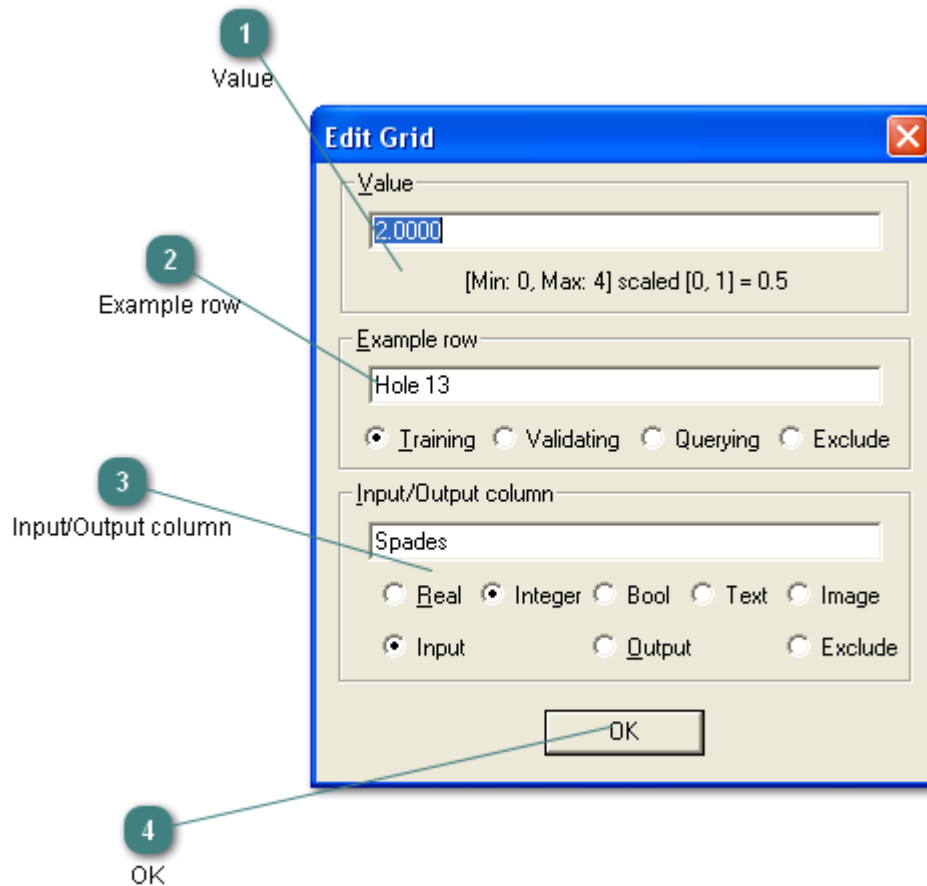
Click to accept all settings and close the dialog.

4

Cancel

Click to reject all settings and close the dialog.

Edit Grid



Enter the grid cell value. The value will be scaled to be from 0 to 1 using the column minimum and maximum.

1 Value

This is a close-up of the 'Value' section of the dialog. It shows a text input field with '2.0000' entered. Below the field, the text '[Min: 0, Max: 4] scaled [0, 1] = 0.5' is displayed.

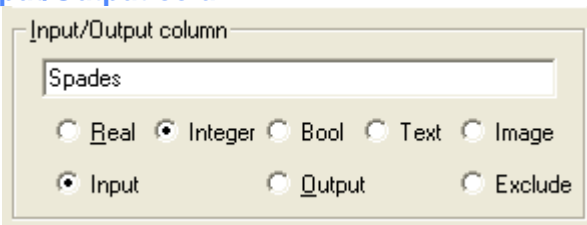
The value in the selected cell with column minimum, maximum and the scaled value.

2 Example row

This is a close-up of the 'Example row' section of the dialog. It shows a text input field with 'Hole 13' entered. Below the field are four radio buttons: 'Training' (selected), 'Validating', 'Querying', and 'Exclude'.

Enter the example row name and set the type of row.

3

Input/Output column

Input/Output column

Spades

Real Integer Bool Text Image

Input Output Exclude

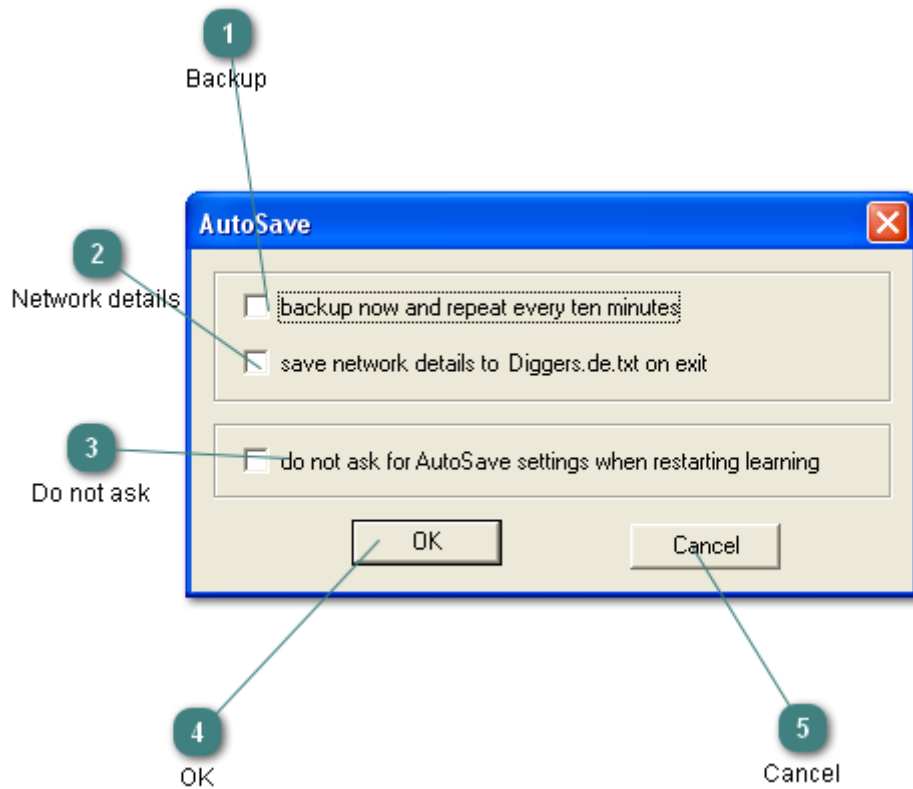
Enter the column name. Set the column type and mode.

4

OK

Click to complete the edit and close the dialog.

AutoSave



1 Backup

backup now and repeat every ten minutes

Check to backup the file every ten minutes while the network is learning.

2 Network details

save network details to

Check to save all details to the named text file on exit.

3 Do not ask

do not ask for AutoSave settings when restarting learning

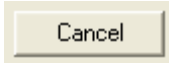
Check to stop this dialog being produced when learning is started.

4 OK

OK

Press to accept all settings and close the dialog.

5

Cancel

Press to reject all settings and close the dialog.