XOR Neural Net Demo

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This is an example of how to create a simple neural network that will learn to comput XOR useing the neuralnet package.

First, lets get the library.

```
library(neuralnet)
```

```
## Loading required package: grid
```

```
## Loading required package: MASS
```

Next, lets create all the pattern for XOR.

```
input_a <- c(0, 1, 0, 1)
input_b <- c(0, 0, 1, 1)
XORoutput  <- c(0, 1, 1, 0)
XORdata <- data.frame(input_a, input_b, XORoutput)

XORdata
```

```
##   input_a input_b XORoutput
## 1       0       0         0
## 2       1       0         1
## 3       0       1         1
## 4       1       1         0
```

We then must then get the names of the input and output values from the datafram

```
n <- names(XORdata)
n
```

```
## [1] "input_a"   "input_b"   "XORoutput"
```

Create, and train the neural network. Uses backpropagation. Arguments: - hidden = a vector of integers, each element gives the number of nodes in a hidden layer. - linear.output = If TRUE, regression. If FALSE, classification. - act.fct = Transfer function. - stepmax = Max number of epochs to train.

```
nn <- neuralnet(XORoutput~input_a+input_b, data=XORdata, hidden=c(3), linear.output=FALSE, act.fct="tanh
```

The neuralnet package lets us make a plot of the network. It shows the topoloy, bias and even weights!

```
plot(nn)
```

Lets check each XOR pattern's output!

```
compute(nn,XORdata[1:2])
```

```
## $neurons
## $neurons[[1]]
##      1 input_a input_b
## [1,] 1       0       0
## [2,] 1       1       0
## [3,] 1       0       1
## [4,] 1       1       1
##
## $neurons[[2]]
##      [,1]         [,2]          [,3]          [,4]
## [1,]    1 0.1163759430  0.5375942386 -0.4555091348
## [2,]    1 0.9999991743  0.9994267541  0.5192690506
## [3,]    1 0.9999985746 -0.9329177733 -0.9643909540
## [4,]    1 1.0000000000  0.9465287029 -0.7343944032
##
##
## $net.result
##                 [,1]
## [1,] -0.001072231431
## [2,]  0.957216173607
## [3,]  0.945155692417
## [4,]  0.003859315460
```