Untitled

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R Markdown

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When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
library(neuralnet)
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::compute() masks neuralnet::compute()
## x dplyr::filter()  masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
iris<-iris %>%mutate_if(is.character, as.factor)
summary(iris)
```

```
##   Sepal.Length    Sepal.Width     Petal.Length    Petal.Width
##  Min.   :4.300   Min.   :2.000   Min.   :1.000   Min.   :0.100
##  1st Qu.:5.100   1st Qu.:2.800   1st Qu.:1.600   1st Qu.:0.300
##  Median :5.800   Median :3.000   Median :4.350   Median :1.300
##  Mean   :5.843   Mean   :3.057   Mean   :3.758   Mean   :1.199
##  3rd Qu.:6.400   3rd Qu.:3.300   3rd Qu.:5.100   3rd Qu.:1.800
##  Max.   :7.900   Max.   :4.400   Max.   :6.900   Max.   :2.500
##        Species
##  setosa    :50
##  versicolor:50
##  virginica :50
##
##
##
```

```
# Train and test split
set.seed(254)
data_rows<-floor(0.80 * nrow(iris))
data_rows
```

```
## [1] 120
```

```r
train_indices<-sample(c(1:nrow(iris)), data_rows)
train_indices
```

```
##   [1]  55  37 146  70  45 124  20  76 144   3  88  10 136 126 102 125  64 111
##  [19] 122  32 147 123  95 101 149 143  94 150  11  83  54  57  61  48  29  69
##  [37] 130 115 145  17  50  96  35  93  49  12  14  60  18  97 109 134  62 113
##  [55]  75 119  41  27  25  89 100  91  19 137  46 103  85   6  44  86  71  36
##  [73] 104  42 139 118 106   9  43  84  66  39   7  72 117 108   4  38 138  65
##  [91]   5   2  87  82  40  77 128  67  92 131  74  56  59 120  23  13  33 107
## [109] 127  24 116  34  68  58  73  80   8  99 121 133
```

```r
train_data<-iris[train_indices, ]
train_data
```

```
##     Sepal.Length Sepal.Width Petal.Length Petal.Width    Species
## 55           6.5         2.8          4.6         1.5 versicolor
## 37           5.5         3.5          1.3         0.2     setosa
## 146          6.7         3.0          5.2         2.3  virginica
## 70           5.6         2.5          3.9         1.1 versicolor
## 45           5.1         3.8          1.9         0.4     setosa
## 124          6.3         2.7          4.9         1.8  virginica
## 20           5.1         3.8          1.5         0.3     setosa
## 76           6.6         3.0          4.4         1.4 versicolor
## 144          6.8         3.2          5.9         2.3  virginica
## 3            4.7         3.2          1.3         0.2     setosa
## 88           6.3         2.3          4.4         1.3 versicolor
## 10           4.9         3.1          1.5         0.1     setosa
## 136          7.7         3.0          6.1         2.3  virginica
## 126          7.2         3.2          6.0         1.8  virginica
## 102          5.8         2.7          5.1         1.9  virginica
## 125          6.7         3.3          5.7         2.1  virginica
## 64           6.1         2.9          4.7         1.4 versicolor
## 111          6.5         3.2          5.1         2.0  virginica
## 122          5.6         2.8          4.9         2.0  virginica
## 32           5.4         3.4          1.5         0.4     setosa
## 147          6.3         2.5          5.0         1.9  virginica
## 123          7.7         2.8          6.7         2.0  virginica
## 95           5.6         2.7          4.2         1.3 versicolor
## 101          6.3         3.3          6.0         2.5  virginica
## 149          6.2         3.4          5.4         2.3  virginica
## 143          5.8         2.7          5.1         1.9  virginica
## 94           5.0         2.3          3.3         1.0 versicolor
## 150          5.9         3.0          5.1         1.8  virginica
## 11           5.4         3.7          1.5         0.2     setosa
## 83           5.8         2.7          3.9         1.2 versicolor
## 54           5.5         2.3          4.0         1.3 versicolor
## 57           6.3         3.3          4.7         1.6 versicolor
## 61           5.0         2.0          3.5         1.0 versicolor
## 48           4.6         3.2          1.4         0.2     setosa
## 29           5.2         3.4          1.4         0.2     setosa
## 69           6.2         2.2          4.5         1.5 versicolor
## 130          7.2         3.0          5.8         1.6  virginica
## 115          5.8         2.8          5.1         2.4  virginica
## 145          6.7         3.3          5.7         2.5  virginica
```

```
## 17          5.4         3.9          1.3         0.4     setosa
## 50          5.0         3.3          1.4         0.2     setosa
## 96          5.7         3.0          4.2         1.2 versicolor
## 35          4.9         3.1          1.5         0.2     setosa
## 93          5.8         2.6          4.0         1.2 versicolor
## 49          5.3         3.7          1.5         0.2     setosa
## 12          4.8         3.4          1.6         0.2     setosa
## 14          4.3         3.0          1.1         0.1     setosa
## 60          5.2         2.7          3.9         1.4 versicolor
## 18          5.1         3.5          1.4         0.3     setosa
## 97          5.7         2.9          4.2         1.3 versicolor
## 109         6.7         2.5          5.8         1.8  virginica
## 134         6.3         2.8          5.1         1.5  virginica
## 62          5.9         3.0          4.2         1.5 versicolor
## 113         6.8         3.0          5.5         2.1  virginica
## 75          6.4         2.9          4.3         1.3 versicolor
## 119         7.7         2.6          6.9         2.3  virginica
## 41          5.0         3.5          1.3         0.3     setosa
## 27          5.0         3.4          1.6         0.4     setosa
## 25          4.8         3.4          1.9         0.2     setosa
## 89          5.6         3.0          4.1         1.3 versicolor
## 100         5.7         2.8          4.1         1.3 versicolor
## 91          5.5         2.6          4.4         1.2 versicolor
## 19          5.7         3.8          1.7         0.3     setosa
## 137         6.3         3.4          5.6         2.4  virginica
## 46          4.8         3.0          1.4         0.3     setosa
## 103         7.1         3.0          5.9         2.1  virginica
## 85          5.4         3.0          4.5         1.5 versicolor
## 6           5.4         3.9          1.7         0.4     setosa
## 44          5.0         3.5          1.6         0.6     setosa
## 86          6.0         3.4          4.5         1.6 versicolor
## 71          5.9         3.2          4.8         1.8 versicolor
## 36          5.0         3.2          1.2         0.2     setosa
## 104         6.3         2.9          5.6         1.8  virginica
## 42          4.5         2.3          1.3         0.3     setosa
## 139         6.0         3.0          4.8         1.8  virginica
## 118         7.7         3.8          6.7         2.2  virginica
## 106         7.6         3.0          6.6         2.1  virginica
## 9           4.4         2.9          1.4         0.2     setosa
## 43          4.4         3.2          1.3         0.2     setosa
## 84          6.0         2.7          5.1         1.6 versicolor
## 66          6.7         3.1          4.4         1.4 versicolor
## 39          4.4         3.0          1.3         0.2     setosa
## 7           4.6         3.4          1.4         0.3     setosa
## 72          6.1         2.8          4.0         1.3 versicolor
## 117         6.5         3.0          5.5         1.8  virginica
## 108         7.3         2.9          6.3         1.8  virginica
## 4           4.6         3.1          1.5         0.2     setosa
## 38          4.9         3.6          1.4         0.1     setosa
## 138         6.4         3.1          5.5         1.8  virginica
## 65          5.6         2.9          3.6         1.3 versicolor
## 5           5.0         3.6          1.4         0.2     setosa
## 2           4.9         3.0          1.4         0.2     setosa
## 87          6.7         3.1          4.7         1.5 versicolor
```

```
## 82           5.5         2.4          3.7         1.0 versicolor
## 40           5.1         3.4          1.5         0.2     setosa
## 77           6.8         2.8          4.8         1.4 versicolor
## 128          6.1         3.0          4.9         1.8  virginica
## 67           5.6         3.0          4.5         1.5 versicolor
## 92           6.1         3.0          4.6         1.4 versicolor
## 131          7.4         2.8          6.1         1.9  virginica
## 74           6.1         2.8          4.7         1.2 versicolor
## 56           5.7         2.8          4.5         1.3 versicolor
## 59           6.6         2.9          4.6         1.3 versicolor
## 120          6.0         2.2          5.0         1.5  virginica
## 23           4.6         3.6          1.0         0.2     setosa
## 13           4.8         3.0          1.4         0.1     setosa
## 33           5.2         4.1          1.5         0.1     setosa
## 107          4.9         2.5          4.5         1.7  virginica
## 127          6.2         2.8          4.8         1.8  virginica
## 24           5.1         3.3          1.7         0.5     setosa
## 116          6.4         3.2          5.3         2.3  virginica
## 34           5.5         4.2          1.4         0.2     setosa
## 68           5.8         2.7          4.1         1.0 versicolor
## 58           4.9         2.4          3.3         1.0 versicolor
## 73           6.3         2.5          4.9         1.5 versicolor
## 80           5.7         2.6          3.5         1.0 versicolor
## 8            5.0         3.4          1.5         0.2     setosa
## 99           5.1         2.5          3.0         1.1 versicolor
## 121          6.9         3.2          5.7         2.3  virginica
## 133          6.4         2.8          5.6         2.2  virginica
```

```
test_data<-iris[-train_indices,]
test_data
```

```
##     Sepal.Length Sepal.Width Petal.Length Petal.Width    Species
## 1            5.1         3.5          1.4         0.2     setosa
## 15           5.8         4.0          1.2         0.2     setosa
## 16           5.7         4.4          1.5         0.4     setosa
## 21           5.4         3.4          1.7         0.2     setosa
## 22           5.1         3.7          1.5         0.4     setosa
## 26           5.0         3.0          1.6         0.2     setosa
## 28           5.2         3.5          1.5         0.2     setosa
## 30           4.7         3.2          1.6         0.2     setosa
## 31           4.8         3.1          1.6         0.2     setosa
## 47           5.1         3.8          1.6         0.2     setosa
## 51           7.0         3.2          4.7         1.4 versicolor
## 52           6.4         3.2          4.5         1.5 versicolor
## 53           6.9         3.1          4.9         1.5 versicolor
## 63           6.0         2.2          4.0         1.0 versicolor
## 78           6.7         3.0          5.0         1.7 versicolor
## 79           6.0         2.9          4.5         1.5 versicolor
## 81           5.5         2.4          3.8         1.1 versicolor
## 90           5.5         2.5          4.0         1.3 versicolor
## 98           6.2         2.9          4.3         1.3 versicolor
## 105          6.5         3.0          5.8         2.2  virginica
## 110          7.2         3.6          6.1         2.5  virginica
## 112          6.4         2.7          5.3         1.9  virginica
## 114          5.7         2.5          5.0         2.0  virginica
```

```
## 129          6.4         2.8          5.6         2.1  virginica
## 132          7.9         3.8          6.4         2.0  virginica
## 135          6.1         2.6          5.6         1.4  virginica
## 140          6.9         3.1          5.4         2.1  virginica
## 141          6.7         3.1          5.6         2.4  virginica
## 142          6.9         3.1          5.1         2.3  virginica
## 148          6.5         3.0          5.2         2.0  virginica
```

```
model<-neuralnet( Species ~ Sepal.Length +Sepal.Width+Petal.Length +Petal.Width, data = train_data, hid
model
```

```
## $call
## neuralnet(formula = Species ~ Sepal.Length + Sepal.Width + Petal.Length +
##     Petal.Width, data = train_data, hidden = c(4, 2), linear.output = FALSE)
##
## $response
##     versicolor setosa virginica
## 1        FALSE   TRUE     FALSE
## 2         TRUE  FALSE     FALSE
## 3        FALSE  FALSE      TRUE
## 4        FALSE   TRUE     FALSE
## 5         TRUE  FALSE     FALSE
## 6        FALSE  FALSE      TRUE
## 7         TRUE  FALSE     FALSE
## 8        FALSE   TRUE     FALSE
## 9        FALSE  FALSE      TRUE
## 10        TRUE  FALSE     FALSE
## 11       FALSE   TRUE     FALSE
## 12        TRUE  FALSE     FALSE
## 13       FALSE  FALSE      TRUE
## 14       FALSE  FALSE      TRUE
## 15       FALSE  FALSE      TRUE
## 16       FALSE  FALSE      TRUE
## 17       FALSE   TRUE     FALSE
## 18       FALSE  FALSE      TRUE
## 19       FALSE  FALSE      TRUE
## 20        TRUE  FALSE     FALSE
## 21       FALSE  FALSE      TRUE
## 22       FALSE  FALSE      TRUE
## 23       FALSE   TRUE     FALSE
## 24       FALSE  FALSE      TRUE
## 25       FALSE  FALSE      TRUE
## 26       FALSE  FALSE      TRUE
## 27       FALSE   TRUE     FALSE
## 28       FALSE  FALSE      TRUE
## 29        TRUE  FALSE     FALSE
## 30       FALSE   TRUE     FALSE
## 31       FALSE   TRUE     FALSE
## 32       FALSE   TRUE     FALSE
## 33       FALSE   TRUE     FALSE
## 34        TRUE  FALSE     FALSE
## 35        TRUE  FALSE     FALSE
## 36       FALSE   TRUE     FALSE
## 37       FALSE  FALSE      TRUE
## 38       FALSE  FALSE      TRUE
```

```
## 39       FALSE  FALSE      TRUE
## 40        TRUE  FALSE     FALSE
## 41        TRUE  FALSE     FALSE
## 42       FALSE   TRUE     FALSE
## 43        TRUE  FALSE     FALSE
## 44       FALSE   TRUE     FALSE
## 45        TRUE  FALSE     FALSE
## 46        TRUE  FALSE     FALSE
## 47        TRUE  FALSE     FALSE
## 48       FALSE   TRUE     FALSE
## 49        TRUE  FALSE     FALSE
## 50       FALSE   TRUE     FALSE
## 51       FALSE  FALSE      TRUE
## 52       FALSE  FALSE      TRUE
## 53       FALSE   TRUE     FALSE
## 54       FALSE  FALSE      TRUE
## 55       FALSE   TRUE     FALSE
## 56       FALSE  FALSE      TRUE
## 57        TRUE  FALSE     FALSE
## 58        TRUE  FALSE     FALSE
## 59        TRUE  FALSE     FALSE
## 60       FALSE   TRUE     FALSE
## 61       FALSE   TRUE     FALSE
## 62       FALSE   TRUE     FALSE
## 63        TRUE  FALSE     FALSE
## 64       FALSE  FALSE      TRUE
## 65        TRUE  FALSE     FALSE
## 66       FALSE  FALSE      TRUE
## 67       FALSE   TRUE     FALSE
## 68        TRUE  FALSE     FALSE
## 69        TRUE  FALSE     FALSE
## 70       FALSE   TRUE     FALSE
## 71       FALSE   TRUE     FALSE
## 72        TRUE  FALSE     FALSE
## 73       FALSE  FALSE      TRUE
## 74        TRUE  FALSE     FALSE
## 75       FALSE  FALSE      TRUE
## 76       FALSE  FALSE      TRUE
## 77       FALSE  FALSE      TRUE
## 78        TRUE  FALSE     FALSE
## 79        TRUE  FALSE     FALSE
## 80       FALSE   TRUE     FALSE
## 81       FALSE   TRUE     FALSE
## 82        TRUE  FALSE     FALSE
## 83        TRUE  FALSE     FALSE
## 84       FALSE   TRUE     FALSE
## 85       FALSE  FALSE      TRUE
## 86       FALSE  FALSE      TRUE
## 87        TRUE  FALSE     FALSE
## 88        TRUE  FALSE     FALSE
## 89       FALSE  FALSE      TRUE
## 90       FALSE   TRUE     FALSE
## 91        TRUE  FALSE     FALSE
## 92        TRUE  FALSE     FALSE
```

```
## 93       FALSE   TRUE     FALSE
## 94       FALSE   TRUE     FALSE
## 95        TRUE  FALSE     FALSE
## 96       FALSE   TRUE     FALSE
## 97       FALSE  FALSE      TRUE
## 98       FALSE   TRUE     FALSE
## 99       FALSE   TRUE     FALSE
## 100      FALSE  FALSE      TRUE
## 101      FALSE   TRUE     FALSE
## 102      FALSE   TRUE     FALSE
## 103      FALSE   TRUE     FALSE
## 104      FALSE  FALSE      TRUE
## 105       TRUE  FALSE     FALSE
## 106       TRUE  FALSE     FALSE
## 107       TRUE  FALSE     FALSE
## 108      FALSE  FALSE      TRUE
## 109      FALSE  FALSE      TRUE
## 110       TRUE  FALSE     FALSE
## 111      FALSE  FALSE      TRUE
## 112       TRUE  FALSE     FALSE
## 113      FALSE   TRUE     FALSE
## 114      FALSE   TRUE     FALSE
## 115      FALSE   TRUE     FALSE
## 116      FALSE   TRUE     FALSE
## 117       TRUE  FALSE     FALSE
## 118      FALSE   TRUE     FALSE
## 119      FALSE  FALSE      TRUE
## 120      FALSE  FALSE      TRUE
##
## $covariate
##     Sepal.Length Sepal.Width Petal.Length Petal.Width
## 55           6.5         2.8          4.6         1.5
## 37           5.5         3.5          1.3         0.2
## 146          6.7         3.0          5.2         2.3
## 70           5.6         2.5          3.9         1.1
## 45           5.1         3.8          1.9         0.4
## 124          6.3         2.7          4.9         1.8
## 20           5.1         3.8          1.5         0.3
## 76           6.6         3.0          4.4         1.4
## 144          6.8         3.2          5.9         2.3
## 3            4.7         3.2          1.3         0.2
## 88           6.3         2.3          4.4         1.3
## 10           4.9         3.1          1.5         0.1
## 136          7.7         3.0          6.1         2.3
## 126          7.2         3.2          6.0         1.8
## 102          5.8         2.7          5.1         1.9
## 125          6.7         3.3          5.7         2.1
## 64           6.1         2.9          4.7         1.4
## 111          6.5         3.2          5.1         2.0
## 122          5.6         2.8          4.9         2.0
## 32           5.4         3.4          1.5         0.4
## 147          6.3         2.5          5.0         1.9
## 123          7.7         2.8          6.7         2.0
## 95           5.6         2.7          4.2         1.3
```

```
## 101          6.3         3.3          6.0         2.5
## 149          6.2         3.4          5.4         2.3
## 143          5.8         2.7          5.1         1.9
## 94           5.0         2.3          3.3         1.0
## 150          5.9         3.0          5.1         1.8
## 11           5.4         3.7          1.5         0.2
## 83           5.8         2.7          3.9         1.2
## 54           5.5         2.3          4.0         1.3
## 57           6.3         3.3          4.7         1.6
## 61           5.0         2.0          3.5         1.0
## 48           4.6         3.2          1.4         0.2
## 29           5.2         3.4          1.4         0.2
## 69           6.2         2.2          4.5         1.5
## 130          7.2         3.0          5.8         1.6
## 115          5.8         2.8          5.1         2.4
## 145          6.7         3.3          5.7         2.5
## 17           5.4         3.9          1.3         0.4
## 50           5.0         3.3          1.4         0.2
## 96           5.7         3.0          4.2         1.2
## 35           4.9         3.1          1.5         0.2
## 93           5.8         2.6          4.0         1.2
## 49           5.3         3.7          1.5         0.2
## 12           4.8         3.4          1.6         0.2
## 14           4.3         3.0          1.1         0.1
## 60           5.2         2.7          3.9         1.4
## 18           5.1         3.5          1.4         0.3
## 97           5.7         2.9          4.2         1.3
## 109          6.7         2.5          5.8         1.8
## 134          6.3         2.8          5.1         1.5
## 62           5.9         3.0          4.2         1.5
## 113          6.8         3.0          5.5         2.1
## 75           6.4         2.9          4.3         1.3
## 119          7.7         2.6          6.9         2.3
## 41           5.0         3.5          1.3         0.3
## 27           5.0         3.4          1.6         0.4
## 25           4.8         3.4          1.9         0.2
## 89           5.6         3.0          4.1         1.3
## 100          5.7         2.8          4.1         1.3
## 91           5.5         2.6          4.4         1.2
## 19           5.7         3.8          1.7         0.3
## 137          6.3         3.4          5.6         2.4
## 46           4.8         3.0          1.4         0.3
## 103          7.1         3.0          5.9         2.1
## 85           5.4         3.0          4.5         1.5
## 6            5.4         3.9          1.7         0.4
## 44           5.0         3.5          1.6         0.6
## 86           6.0         3.4          4.5         1.6
## 71           5.9         3.2          4.8         1.8
## 36           5.0         3.2          1.2         0.2
## 104          6.3         2.9          5.6         1.8
## 42           4.5         2.3          1.3         0.3
## 139          6.0         3.0          4.8         1.8
## 118          7.7         3.8          6.7         2.2
## 106          7.6         3.0          6.6         2.1
```

```
## 9           4.4         2.9          1.4         0.2
## 43          4.4         3.2          1.3         0.2
## 84          6.0         2.7          5.1         1.6
## 66          6.7         3.1          4.4         1.4
## 39          4.4         3.0          1.3         0.2
## 7           4.6         3.4          1.4         0.3
## 72          6.1         2.8          4.0         1.3
## 117         6.5         3.0          5.5         1.8
## 108         7.3         2.9          6.3         1.8
## 4           4.6         3.1          1.5         0.2
## 38          4.9         3.6          1.4         0.1
## 138         6.4         3.1          5.5         1.8
## 65          5.6         2.9          3.6         1.3
## 5           5.0         3.6          1.4         0.2
## 2           4.9         3.0          1.4         0.2
## 87          6.7         3.1          4.7         1.5
## 82          5.5         2.4          3.7         1.0
## 40          5.1         3.4          1.5         0.2
## 77          6.8         2.8          4.8         1.4
## 128         6.1         3.0          4.9         1.8
## 67          5.6         3.0          4.5         1.5
## 92          6.1         3.0          4.6         1.4
## 131         7.4         2.8          6.1         1.9
## 74          6.1         2.8          4.7         1.2
## 56          5.7         2.8          4.5         1.3
## 59          6.6         2.9          4.6         1.3
## 120         6.0         2.2          5.0         1.5
## 23          4.6         3.6          1.0         0.2
## 13          4.8         3.0          1.4         0.1
## 33          5.2         4.1          1.5         0.1
## 107         4.9         2.5          4.5         1.7
## 127         6.2         2.8          4.8         1.8
## 24          5.1         3.3          1.7         0.5
## 116         6.4         3.2          5.3         2.3
## 34          5.5         4.2          1.4         0.2
## 68          5.8         2.7          4.1         1.0
## 58          4.9         2.4          3.3         1.0
## 73          6.3         2.5          4.9         1.5
## 80          5.7         2.6          3.5         1.0
## 8           5.0         3.4          1.5         0.2
## 99          5.1         2.5          3.0         1.1
## 121         6.9         3.2          5.7         2.3
## 133         6.4         2.8          5.6         2.2
##
## $model.list
## $model.list$response
## [1] "versicolor" "setosa"     "virginica"
##
## $model.list$variables
## [1] "Sepal.Length" "Sepal.Width"  "Petal.Length" "Petal.Width"
##
##
## $err.fct
## function (x, y)
```

```
## {
##     1/2 * (y - x)^2
## }
## <bytecode: 0x62ff122a4288>
## <environment: 0x62ff122a6a30>
## attr(,"type")
## [1] "sse"
##
## $act.fct
## function (x)
## {
##     1/(1 + exp(-x))
## }
## <bytecode: 0x62ff1229db88>
## <environment: 0x62ff122a10c0>
## attr(,"type")
## [1] "logistic"
##
## $linear.output
## [1] FALSE
##
## $data
##     Sepal.Length Sepal.Width Petal.Length Petal.Width    Species
## 55           6.5         2.8          4.6         1.5 versicolor
## 37           5.5         3.5          1.3         0.2     setosa
## 146          6.7         3.0          5.2         2.3  virginica
## 70           5.6         2.5          3.9         1.1 versicolor
## 45           5.1         3.8          1.9         0.4     setosa
## 124          6.3         2.7          4.9         1.8  virginica
## 20           5.1         3.8          1.5         0.3     setosa
## 76           6.6         3.0          4.4         1.4 versicolor
## 144          6.8         3.2          5.9         2.3  virginica
## 3            4.7         3.2          1.3         0.2     setosa
## 88           6.3         2.3          4.4         1.3 versicolor
## 10           4.9         3.1          1.5         0.1     setosa
## 136          7.7         3.0          6.1         2.3  virginica
## 126          7.2         3.2          6.0         1.8  virginica
## 102          5.8         2.7          5.1         1.9  virginica
## 125          6.7         3.3          5.7         2.1  virginica
## 64           6.1         2.9          4.7         1.4 versicolor
## 111          6.5         3.2          5.1         2.0  virginica
## 122          5.6         2.8          4.9         2.0  virginica
## 32           5.4         3.4          1.5         0.4     setosa
## 147          6.3         2.5          5.0         1.9  virginica
## 123          7.7         2.8          6.7         2.0  virginica
## 95           5.6         2.7          4.2         1.3 versicolor
## 101          6.3         3.3          6.0         2.5  virginica
## 149          6.2         3.4          5.4         2.3  virginica
## 143          5.8         2.7          5.1         1.9  virginica
## 94           5.0         2.3          3.3         1.0 versicolor
## 150          5.9         3.0          5.1         1.8  virginica
## 11           5.4         3.7          1.5         0.2     setosa
## 83           5.8         2.7          3.9         1.2 versicolor
## 54           5.5         2.3          4.0         1.3 versicolor
```

```
## 57          6.3         3.3          4.7         1.6 versicolor
## 61          5.0         2.0          3.5         1.0 versicolor
## 48          4.6         3.2          1.4         0.2     setosa
## 29          5.2         3.4          1.4         0.2     setosa
## 69          6.2         2.2          4.5         1.5 versicolor
## 130         7.2         3.0          5.8         1.6  virginica
## 115         5.8         2.8          5.1         2.4  virginica
## 145         6.7         3.3          5.7         2.5  virginica
## 17          5.4         3.9          1.3         0.4     setosa
## 50          5.0         3.3          1.4         0.2     setosa
## 96          5.7         3.0          4.2         1.2 versicolor
## 35          4.9         3.1          1.5         0.2     setosa
## 93          5.8         2.6          4.0         1.2 versicolor
## 49          5.3         3.7          1.5         0.2     setosa
## 12          4.8         3.4          1.6         0.2     setosa
## 14          4.3         3.0          1.1         0.1     setosa
## 60          5.2         2.7          3.9         1.4 versicolor
## 18          5.1         3.5          1.4         0.3     setosa
## 97          5.7         2.9          4.2         1.3 versicolor
## 109         6.7         2.5          5.8         1.8  virginica
## 134         6.3         2.8          5.1         1.5  virginica
## 62          5.9         3.0          4.2         1.5 versicolor
## 113         6.8         3.0          5.5         2.1  virginica
## 75          6.4         2.9          4.3         1.3 versicolor
## 119         7.7         2.6          6.9         2.3  virginica
## 41          5.0         3.5          1.3         0.3     setosa
## 27          5.0         3.4          1.6         0.4     setosa
## 25          4.8         3.4          1.9         0.2     setosa
## 89          5.6         3.0          4.1         1.3 versicolor
## 100         5.7         2.8          4.1         1.3 versicolor
## 91          5.5         2.6          4.4         1.2 versicolor
## 19          5.7         3.8          1.7         0.3     setosa
## 137         6.3         3.4          5.6         2.4  virginica
## 46          4.8         3.0          1.4         0.3     setosa
## 103         7.1         3.0          5.9         2.1  virginica
## 85          5.4         3.0          4.5         1.5 versicolor
## 6           5.4         3.9          1.7         0.4     setosa
## 44          5.0         3.5          1.6         0.6     setosa
## 86          6.0         3.4          4.5         1.6 versicolor
## 71          5.9         3.2          4.8         1.8 versicolor
## 36          5.0         3.2          1.2         0.2     setosa
## 104         6.3         2.9          5.6         1.8  virginica
## 42          4.5         2.3          1.3         0.3     setosa
## 139         6.0         3.0          4.8         1.8  virginica
## 118         7.7         3.8          6.7         2.2  virginica
## 106         7.6         3.0          6.6         2.1  virginica
## 9           4.4         2.9          1.4         0.2     setosa
## 43          4.4         3.2          1.3         0.2     setosa
## 84          6.0         2.7          5.1         1.6 versicolor
## 66          6.7         3.1          4.4         1.4 versicolor
## 39          4.4         3.0          1.3         0.2     setosa
## 7           4.6         3.4          1.4         0.3     setosa
## 72          6.1         2.8          4.0         1.3 versicolor
## 117         6.5         3.0          5.5         1.8  virginica
```

```
## 108          7.3         2.9          6.3         1.8  virginica
## 4            4.6         3.1          1.5         0.2     setosa
## 38           4.9         3.6          1.4         0.1     setosa
## 138          6.4         3.1          5.5         1.8  virginica
## 65           5.6         2.9          3.6         1.3 versicolor
## 5            5.0         3.6          1.4         0.2     setosa
## 2            4.9         3.0          1.4         0.2     setosa
## 87           6.7         3.1          4.7         1.5 versicolor
## 82           5.5         2.4          3.7         1.0 versicolor
## 40           5.1         3.4          1.5         0.2     setosa
## 77           6.8         2.8          4.8         1.4 versicolor
## 128          6.1         3.0          4.9         1.8  virginica
## 67           5.6         3.0          4.5         1.5 versicolor
## 92           6.1         3.0          4.6         1.4 versicolor
## 131          7.4         2.8          6.1         1.9  virginica
## 74           6.1         2.8          4.7         1.2 versicolor
## 56           5.7         2.8          4.5         1.3 versicolor
## 59           6.6         2.9          4.6         1.3 versicolor
## 120          6.0         2.2          5.0         1.5  virginica
## 23           4.6         3.6          1.0         0.2     setosa
## 13           4.8         3.0          1.4         0.1     setosa
## 33           5.2         4.1          1.5         0.1     setosa
## 107          4.9         2.5          4.5         1.7  virginica
## 127          6.2         2.8          4.8         1.8  virginica
## 24           5.1         3.3          1.7         0.5     setosa
## 116          6.4         3.2          5.3         2.3  virginica
## 34           5.5         4.2          1.4         0.2     setosa
## 68           5.8         2.7          4.1         1.0 versicolor
## 58           4.9         2.4          3.3         1.0 versicolor
## 73           6.3         2.5          4.9         1.5 versicolor
## 80           5.7         2.6          3.5         1.0 versicolor
## 8            5.0         3.4          1.5         0.2     setosa
## 99           5.1         2.5          3.0         1.1 versicolor
## 121          6.9         3.2          5.7         2.3  virginica
## 133          6.4         2.8          5.6         2.2  virginica
##
## $exclude
## NULL
##
## $net.result
## $net.result[[1]]
##              [,1]         [,2]         [,3]
## 55  1.601170e-38 1.000000e+00 1.298708e-30
## 37  1.000000e+00 1.987582e-03 1.606099e-61
## 146 1.518550e-51 2.454243e-15 1.000000e+00
## 70  7.105483e-38 1.000000e+00 1.328137e-33
## 45  1.000000e+00 1.987582e-03 1.606099e-61
## 124 3.610940e-48 8.137557e-08 1.000000e+00
## 20  1.000000e+00 1.987582e-03 1.606099e-61
## 76  6.475931e-38 1.000000e+00 2.038987e-33
## 144 5.450583e-52 2.504358e-16 1.000000e+00
## 3   1.000000e+00 1.987582e-03 1.606099e-61
## 88  2.757899e-38 1.000000e+00 1.052913e-31
## 10  1.000000e+00 1.987582e-03 1.606099e-61
```

```
## 136 6.227984e-52 3.370393e-16 1.000000e+00
## 126 1.717897e-51 3.230297e-15 1.000000e+00
## 102 1.484091e-51 2.331914e-15 1.000000e+00
## 125 8.394893e-52 6.554200e-16 1.000000e+00
## 64  7.593145e-39 1.000000e+00 4.080085e-29
## 111 2.492582e-49 2.110541e-10 1.000000e+00
## 122 2.436396e-51 7.035128e-15 1.000000e+00
## 32  1.000000e+00 1.987582e-03 1.606099e-61
## 147 8.029602e-51 1.002337e-13 1.000000e+00
## 123 5.212206e-52 2.266912e-16 1.000000e+00
## 95  5.797446e-38 1.000000e+00 3.400220e-33
## 101 4.907908e-52 1.982622e-16 1.000000e+00
## 149 7.904729e-52 5.732160e-16 1.000000e+00
## 143 1.484091e-51 2.331914e-15 1.000000e+00
## 94  7.211933e-38 1.000000e+00 1.239945e-33
## 150 2.054311e-50 8.124288e-13 1.000000e+00
## 11  1.000000e+00 1.987582e-03 1.606099e-61
## 83  7.150465e-38 1.000000e+00 1.289968e-33
## 54  5.172284e-38 1.000000e+00 5.760756e-33
## 57  1.911504e-38 1.000000e+00 5.728107e-31
## 61  7.149501e-38 1.000000e+00 1.290772e-33
## 48  1.000000e+00 1.987582e-03 1.606099e-61
## 29  1.000000e+00 1.987582e-03 1.606099e-61
## 69  8.811969e-41 1.000000e+00 3.574382e-20
## 130 6.898532e-50 1.206894e-11 1.000000e+00
## 115 5.910974e-52 3.000139e-16 1.000000e+00
## 145 5.454428e-52 2.508295e-16 1.000000e+00
## 17  1.000000e+00 1.987582e-03 1.606099e-61
## 50  1.000000e+00 1.987582e-03 1.606099e-61
## 96  7.055361e-38 1.000000e+00 1.372297e-33
## 35  1.000000e+00 1.987582e-03 1.606099e-61
## 93  6.998568e-38 1.000000e+00 1.424514e-33
## 49  1.000000e+00 1.987582e-03 1.606099e-61
## 12  1.000000e+00 1.987582e-03 1.606099e-61
## 14  1.000000e+00 1.987582e-03 1.606099e-61
## 60  6.671977e-38 1.000000e+00 1.776505e-33
## 18  1.000000e+00 1.987582e-03 1.606099e-61
## 97  6.695672e-38 1.000000e+00 1.747641e-33
## 109 7.228449e-52 4.696742e-16 1.000000e+00
## 134 1.315433e-45 3.968430e-02 9.985972e-01
## 62  6.300075e-38 1.000000e+00 2.315585e-33
## 113 1.190078e-51 1.426019e-15 1.000000e+00
## 75  6.805633e-38 1.000000e+00 1.620929e-33
## 119 4.812030e-52 1.897380e-16 1.000000e+00
## 41  1.000000e+00 1.987582e-03 1.606099e-61
## 27  1.000000e+00 1.987582e-03 1.606099e-61
## 25  1.000000e+00 1.987582e-03 1.606099e-61
## 89  7.049685e-38 1.000000e+00 1.377410e-33
## 100 6.820959e-38 1.000000e+00 1.604170e-33
## 91  3.173896e-38 1.000000e+00 5.501326e-32
## 19  1.000000e+00 1.987582e-03 1.606099e-61
## 137 5.763454e-52 2.835904e-16 1.000000e+00
## 46  1.000000e+00 1.987582e-03 1.606099e-61
## 103 6.792748e-52 4.089350e-16 1.000000e+00
```

```
## 85  4.937381e-39 1.000000e+00 2.981131e-28
## 6   1.000000e+00 1.987582e-03 1.606099e-61
## 44  1.000000e+00 1.987582e-03 1.606099e-61
## 86  5.122704e-38 1.000000e+00 6.022936e-33
## 71  3.289076e-44 9.817322e-01 2.469511e-04
## 36  1.000000e+00 1.987582e-03 1.606099e-61
## 104 1.002050e-51 9.722097e-16 1.000000e+00
## 42  1.000000e+00 1.987582e-03 1.606099e-61
## 139 8.203586e-46 1.422956e-02 9.998415e-01
## 118 5.371473e-52 2.424111e-16 1.000000e+00
## 106 5.190939e-52 2.246360e-16 1.000000e+00
## 9   1.000000e+00 1.987582e-03 1.606099e-61
## 43  1.000000e+00 1.987582e-03 1.606099e-61
## 84  1.355170e-49 5.430808e-11 1.000000e+00
## 66  6.766925e-38 1.000000e+00 1.664218e-33
## 39  1.000000e+00 1.987582e-03 1.606099e-61
## 7   1.000000e+00 1.987582e-03 1.606099e-61
## 72  7.097521e-38 1.000000e+00 1.335034e-33
## 117 3.021557e-51 1.136340e-14 1.000000e+00
## 108 6.830430e-52 4.140053e-16 1.000000e+00
## 4   1.000000e+00 1.987582e-03 1.606099e-61
## 38  1.000000e+00 1.987582e-03 1.606099e-61
## 138 3.031977e-51 1.145088e-14 1.000000e+00
## 65  7.210105e-38 1.000000e+00 1.241398e-33
## 5   1.000000e+00 1.987582e-03 1.606099e-61
## 2   1.000000e+00 1.987582e-03 1.606099e-61
## 87  3.410430e-38 1.000000e+00 3.946641e-32
## 82  7.191884e-38 1.000000e+00 1.255997e-33
## 40  1.000000e+00 1.987582e-03 1.606099e-61
## 77  1.605979e-38 1.000000e+00 1.280838e-30
## 128 4.266711e-47 1.992757e-05 1.000000e+00
## 67  1.030713e-38 1.000000e+00 9.941174e-30
## 92  3.057856e-38 1.000000e+00 6.534452e-32
## 131 8.145444e-52 6.128273e-16 1.000000e+00
## 74  2.857764e-38 1.000000e+00 8.933320e-32
## 56  2.640611e-38 1.000000e+00 1.287069e-31
## 59  5.419751e-38 1.000000e+00 4.641889e-33
## 120 1.163945e-49 3.870000e-11 1.000000e+00
## 23  1.000000e+00 1.987582e-03 1.606099e-61
## 13  1.000000e+00 1.987582e-03 1.606099e-61
## 33  1.000000e+00 1.987582e-03 1.606099e-61
## 107 4.063692e-49 6.269529e-10 1.000000e+00
## 127 2.179633e-46 7.531395e-04 9.999997e-01
## 24  1.000000e+00 1.987582e-03 1.606099e-61
## 116 9.301786e-52 8.236807e-16 1.000000e+00
## 34  1.000000e+00 1.987582e-03 1.606099e-61
## 68  7.142415e-38 1.000000e+00 1.296699e-33
## 58  7.212898e-38 1.000000e+00 1.239178e-33
## 73  2.329842e-44 9.614361e-01 1.213721e-03
## 80  7.212812e-38 1.000000e+00 1.239247e-33
## 8   1.000000e+00 1.987582e-03 1.606099e-61
## 99  7.213998e-38 1.000000e+00 1.238305e-33
## 121 6.551611e-52 3.773008e-16 1.000000e+00
## 133 5.623574e-52 2.684868e-16 1.000000e+00
```

```
##
##
## $weights
## $weights[[1]]
## $weights[[1]][[1]]
##            [,1]       [,2]       [,3]          [,4]
## [1,]  1.4234560 -1.1944464  1.2101605  0.9113375579
## [2,] -0.2904539 -0.9993736  0.1096572  0.0008651006
## [3,]  0.9484971 -0.1330028  0.2551982  0.8731832666
## [4,] -0.9615934  1.2684301 -0.4092203 -0.9767699707
## [5,] -0.2011001  1.0345903 -1.0699969 -0.9020607328
##
## $weights[[1]][[2]]
##            [,1]         [,2]
## [1,] -0.4327106   91.2076704
## [2,] 23.6738296 -141.5999554
## [3,] -8.7599363  145.2574275
## [4,] 13.0953007    0.4824887
## [5,]  9.7989790 -109.5602592
##
## $weights[[1]][[3]]
##             [,1]      [,2]       [,3]
## [1,]    4.065277 -78.99574   10.97916
## [2,]   32.671524  72.77689 -150.96304
## [3,] -122.259002  42.72709   64.21228
##
##
##
## $generalized.weights
## $generalized.weights[[1]]
##              [,1]         [,2]          [,3]          [,4]          [,5]
## 55   2.570045e+00 4.449909e+00 -8.383053e+00 -8.496462e+00  5.724859e+00
## 37  -3.827141e-55 2.092267e-54 -2.261010e-54 -1.011602e-54  1.337510e-55
## 146  2.094269e+00 1.995211e+00 -4.821397e+00 -4.598664e+00  4.665052e+00
## 70   1.829449e-02 7.402118e-02 -1.131720e-01 -1.045990e-01  4.075158e-02
## 45  -1.039886e-50 1.000389e-49 -1.154937e-49 -5.878932e-50  3.634195e-51
## 124  1.340702e+01 1.475084e+01 -3.322092e+01 -3.330245e+01  2.986457e+01
## 20  -3.487610e-56 2.630487e-55 -2.967091e-55 -1.444183e-55  1.218850e-56
## 76   1.380522e-01 4.237958e-01 -6.822552e-01 -6.676449e-01  3.075159e-01
## 144  2.035659e-01 1.836956e-01 -4.540396e-01 -4.645912e-01  4.534497e-01
## 3   -1.754236e-53 1.291711e-52 -1.451139e-52 -7.085894e-53  6.130705e-54
## 88   1.624133e+00 2.673452e+00 -5.102217e+00 -5.470123e+00  3.617810e+00
## 10  -8.473241e-50 5.492175e-49 -6.077036e-49 -2.876448e-49  2.961229e-50
## 136  5.421045e-01 2.724234e-01 -9.326524e-01 -9.717239e-01  1.207555e+00
## 126  2.528982e+00 1.783007e+00 -4.977940e+00 -5.431110e+00  5.633391e+00
## 102  1.719681e+00 2.210018e+00 -4.673348e+00 -4.661159e+00  3.830645e+00
## 125  9.228636e-01 9.291387e-01 -2.180171e+00 -2.198775e+00  2.055709e+00
## 64   4.051848e+00 7.052544e+00 -1.328852e+01 -1.311314e+01  9.025624e+00
## 111  9.724523e+00 1.231041e+01 -2.622486e+01 -2.495814e+01  2.166169e+01
## 122  2.201719e+00 3.710243e+00 -7.131353e+00 -6.658974e+00  4.904401e+00
## 32  -1.275675e-50 7.976436e-50 -8.753260e-50 -4.185352e-50  4.458231e-51
## 147  5.249164e+00 4.753187e+00 -1.171256e+01 -1.195117e+01  1.169269e+01
## 123  1.716294e-01 7.955928e-02 -2.853011e-01 -3.253931e-01  3.823102e-01
## 95   3.569958e-01 9.556343e-01 -1.596742e+00 -1.476532e+00  7.952199e-01
```

```
## 101  3.346389e-02 5.397628e-02 -1.051899e-01 -1.048873e-01  7.454192e-02
## 149  6.182052e-01 1.045944e+00 -2.011993e+00 -1.832803e+00  1.377072e+00
## 143  1.719681e+00 2.210018e+00 -4.673348e+00 -4.661159e+00  3.830645e+00
## 94   1.901273e-04 1.919935e-03 -2.638832e-03 -2.200412e-03  4.235148e-04
## 150  5.589057e+00 8.211676e+00 -1.649878e+01 -1.605247e+01  1.244981e+01
## 11  -3.483668e-55 2.077581e-54 -2.276197e-54 -1.042859e-54  1.217473e-55
## 83   9.170934e-03 4.562285e-02 -6.754402e-02 -6.101483e-02  2.042856e-02
## 54   5.512548e-01 1.318854e+00 -2.264699e+00 -2.157437e+00  1.227938e+00
## 57   2.259959e+00 4.934036e+00 -8.706790e+00 -8.062695e+00  5.034133e+00
## 61   1.070219e-02 4.619764e-02 -6.996898e-02 -6.346230e-02  2.383948e-02
## 48  -2.136170e-52 1.754311e-51 -1.995127e-51 -9.920704e-52  7.465490e-53
## 29  -1.521801e-53 9.243837e-53 -1.013856e-52 -4.713217e-53  5.318391e-54
## 69   1.088913e+01 1.304295e+01 -2.818504e+01 -2.981068e+01  2.425589e+01
## 130  9.487971e+00 6.725585e+00 -1.868282e+01 -2.079396e+01  2.113477e+01
## 115  2.485156e-01 3.979500e-01 -7.808608e-01 -7.155382e-01  5.535767e-01
## 145  1.896218e-01 2.069754e-01 -4.705987e-01 -4.502224e-01  4.223887e-01
## 17  -4.609645e-58 3.006831e-57 -3.326813e-57 -1.582558e-57  1.610979e-58
## 50  -8.264910e-53 5.395649e-52 -5.973447e-52 -2.837816e-52  2.888422e-53
## 96   3.010537e-02 1.159674e-01 -1.793794e-01 -1.598711e-01  6.706070e-02
## 35  -4.197433e-49 2.863029e-48 -3.183843e-48 -1.538768e-48  1.466919e-49
## 93   3.821312e-02 1.406222e-01 -2.187471e-01 -2.042928e-01  8.512097e-02
## 49  -2.292363e-55 1.425368e-54 -1.570864e-54 -7.280948e-55  8.011354e-56
## 12  -8.981889e-52 7.240046e-51 -8.225274e-51 -4.056998e-51  3.138992e-52
## 14  -6.233351e-55 5.071463e-54 -5.766432e-54 -2.850213e-54  2.178432e-55
## 60   1.137853e-01 4.138518e-01 -6.504578e-01 -5.563614e-01  2.534605e-01
## 18  -2.804299e-54 1.902871e-53 -2.115796e-53 -1.017669e-53  9.800467e-55
## 97   1.106987e-01 3.598072e-01 -5.757247e-01 -5.191662e-01  2.465850e-01
## 109  7.759290e-01 4.962862e-01 -1.462423e+00 -1.640036e+00  1.728407e+00
## 134  1.720948e+01 1.923284e+01 -4.284598e+01 -4.488344e+01  3.833469e+01
## 62   1.983088e-01 6.372544e-01 -1.024036e+00 -9.098890e-01  4.417394e-01
## 113  1.697583e+00 1.411904e+00 -3.631978e+00 -3.682994e+00  3.781422e+00
## 75   7.195983e-02 2.421277e-01 -3.822714e-01 -3.711013e-01  1.602929e-01
## 119  3.219124e-02 1.459828e-02 -5.311446e-02 -6.104411e-02  7.170705e-02
## 41  -1.451087e-55 1.015797e-54 -1.133892e-54 -5.488761e-55  5.071262e-56
## 27  -4.954460e-50 3.950473e-49 -4.467125e-49 -2.242598e-49  1.731485e-50
## 25  -2.877408e-47 2.687367e-46 -3.098117e-46 -1.561230e-46  1.005597e-47
## 89   3.065437e-02 1.251632e-01 -1.920530e-01 -1.667415e-01  6.828360e-02
## 100  7.927736e-02 2.707278e-01 -4.286959e-01 -3.874006e-01  1.765929e-01
## 91   1.492787e+00 3.098780e+00 -5.530944e+00 -5.339181e+00  3.325231e+00
## 19  -8.051320e-53 4.706625e-52 -5.134533e-52 -2.358220e-52  2.813776e-53
## 137  2.161865e-01 3.451631e-01 -6.769339e-01 -6.297083e-01  4.815625e-01
## 46  -9.875936e-49 7.164772e-48 -8.012143e-48 -3.965524e-48  3.451443e-49
## 103  6.577671e-01 4.393164e-01 -1.267788e+00 -1.342001e+00  1.465198e+00
## 85   4.149705e+00 1.040751e+01 -1.775469e+01 -1.586162e+01  9.243604e+00
## 6   -5.747882e-54 4.119227e-53 -4.612336e-53 -2.240662e-53  2.008771e-54
## 44  -6.759697e-50 6.542118e-49 -7.519924e-49 -3.932676e-49  2.362380e-50
## 86   5.355918e-01 1.616508e+00 -2.638488e+00 -2.291283e+00  1.193048e+00
## 71   1.405819e+01 2.730675e+01 -5.008734e+01 -4.536365e+01  3.131507e+01
## 36  -4.079819e-54 2.510147e-53 -2.755600e-53 -1.292217e-53  1.425816e-54
## 104  1.222666e+00 1.198344e+00 -2.835814e+00 -3.032005e+00  2.723528e+00
## 42  -2.147186e-14 1.381963e-13 -1.535647e-13 -1.019779e-13 -4.782928e-14
## 139  1.501229e+01 2.391654e+01 -4.673081e+01 -4.384251e+01  3.344037e+01
## 118  2.010692e-01 1.391463e-01 -3.931320e-01 -4.253780e-01  4.478882e-01
## 106  1.589132e-01 8.184782e-02 -2.747274e-01 -3.082347e-01  3.539843e-01
```

```
## 9   -6.409029e-49 5.663239e-48 -6.479521e-48 -3.282908e-48  2.239828e-49
## 43  -5.402324e-54 5.152326e-53 -5.946720e-53 -3.015123e-53  1.888005e-54
## 84   9.150238e+00 1.038343e+01 -2.302350e+01 -2.386096e+01  2.038246e+01
## 66   7.394816e-02 2.621785e-01 -4.095765e-01 -3.976378e-01  1.647220e-01
## 39  -1.102955e-51 9.638438e-51 -1.102118e-50 -5.558786e-51  3.854609e-52
## 7   -4.678772e-54 4.557316e-53 -5.265713e-53 -2.687756e-53  1.635138e-54
## 72   1.671869e-02 7.872004e-02 -1.174138e-01 -1.080245e-01  3.724143e-02
## 117  3.313108e+00 3.171872e+00 -7.594982e+00 -7.941798e+00  7.380057e+00
## 108  6.902254e-01 3.913021e-01 -1.236450e+00 -1.405624e+00  1.537500e+00
## 4   -9.774385e-50 8.105560e-49 -9.222537e-49 -4.607968e-49  3.415953e-50
## 38  -1.388975e-56 9.690747e-56 -1.085748e-55 -5.130059e-56  4.854191e-57
## 138  3.162511e+00 3.378254e+00 -7.697995e+00 -7.952934e+00  7.044598e+00
## 65   3.379703e-04 3.595993e-03 -4.931027e-03 -4.048424e-03  7.528400e-04
## 5   -5.804001e-56 4.036262e-55 -4.512200e-55 -2.152846e-55  2.028383e-56
## 2   -3.116314e-49 2.037304e-48 -2.252088e-48 -1.081085e-48  1.089090e-49
## 87   1.219762e+00 2.468209e+00 -4.426637e+00 -4.417623e+00  2.717059e+00
## 82   2.835671e-03 1.638566e-02 -2.372721e-02 -2.148075e-02  6.316549e-03
## 40  -1.666219e-52 1.080503e-51 -1.195675e-51 -5.656863e-52  5.823105e-53
## 77   2.564025e+00 3.927796e+00 -7.685984e+00 -8.254044e+00  5.711450e+00
## 128  1.412084e+01 2.046661e+01 -4.133599e+01 -3.951527e+01  3.145463e+01
## 67   3.216372e+00 7.562317e+00 -1.310438e+01 -1.186713e+01  7.164573e+00
## 92   1.506230e+00 3.152271e+00 -5.614233e+00 -5.390239e+00  3.355177e+00
## 131  1.094688e+00 5.839001e-01 -1.918320e+00 -2.119460e+00  2.438452e+00
## 74   1.712504e+00 3.038624e+00 -5.670426e+00 -5.771927e+00  3.814660e+00
## 56   1.802638e+00 3.770726e+00 -6.720606e+00 -6.423616e+00  4.015436e+00
## 59   4.368890e-01 9.710707e-01 -1.689264e+00 -1.737510e+00  9.731847e-01
## 120  9.745583e+00 8.600688e+00 -2.135694e+01 -2.325413e+01  2.170861e+01
## 23  -4.969647e-60 4.168170e-59 -4.758991e-59 -2.347616e-59  1.736793e-60
## 13  -3.815002e-50 2.486795e-49 -2.752579e-49 -1.307628e-49  1.333267e-50
## 33  -2.564587e-59 1.750143e-58 -1.960417e-58 -9.075671e-59  8.962722e-60
## 107  7.308482e+00 1.668174e+01 -2.923941e+01 -2.682359e+01  1.627988e+01
## 127  1.573494e+01 2.026867e+01 -4.279003e+01 -4.171558e+01  3.505010e+01
## 24  -5.376863e-46 4.338336e-45 -4.901412e-45 -2.495123e-45  1.879107e-46
## 116  1.007000e+00 1.271946e+00 -2.720999e+00 -2.537462e+00  2.243125e+00
## 34  -4.875961e-60 2.988646e-59 -3.295551e-59 -1.496794e-59  1.704051e-60
## 68   1.170801e-02 4.850286e-02 -7.368556e-02 -6.904210e-02  2.607997e-02
## 58   1.027023e-04 1.105685e-03 -1.514163e-03 -1.236662e-03  2.287728e-04
## 73   1.753897e+01 1.840523e+01 -4.212838e+01 -4.474554e+01  3.906863e+01
## 80   5.539334e-05 1.086600e-03 -1.431006e-03 -1.222716e-03  1.233905e-04
## 8   -1.056220e-52 7.208240e-52 -8.030109e-52 -3.842564e-52  3.691280e-53
## 99   3.988322e-07 6.799142e-05 -8.675219e-05 -6.779080e-05  8.884110e-07
## 121  5.359341e-01 4.610270e-01 -1.168098e+00 -1.163126e+00  1.193811e+00
## 133  2.495215e-01 2.304947e-01 -5.630688e-01 -5.813453e-01  5.558173e-01
##              [,6]          [,7]          [,8]          [,9]         [,10]
## 55   9.912319e+00 -1.867352e+01 -1.892615e+01 -1.187523e+01 -2.056139e+01
## 37  -7.312057e-55  7.901782e-55  3.535349e-55  2.010072e-55 -1.098890e-54
## 146  4.444398e+00 -1.073982e+01 -1.024367e+01           NaN           NaN
## 70   1.648846e-01 -2.520943e-01 -2.329978e-01 -8.453209e-02 -3.420245e-01
## 45  -3.496160e-50  4.036275e-50  2.054570e-50  5.461639e-51 -5.254193e-50
## 124  3.285798e+01 -7.400069e+01 -7.418230e+01 -6.194887e+01 -6.815817e+01
## 20  -9.193031e-56  1.036939e-55  5.047131e-56  1.831745e-56 -1.381572e-55
## 76   9.440191e-01 -1.519746e+00 -1.487201e+00 -6.378884e-01 -1.958204e+00
## 144  4.091879e-01 -1.011388e+00 -1.034892e+00           NaN           NaN
## 3   -4.514272e-53  5.071442e-53  2.476379e-53  9.213511e-54 -6.784260e-53
```

```
## 88   5.955201e+00 -1.136536e+01 -1.218488e+01 -7.504520e+00 -1.235303e+01
## 10  -1.919406e-49  2.123803e-49  1.005261e-49  4.450274e-50 -2.884573e-49
## 136  6.068320e-01 -2.077514e+00 -2.164547e+00           NaN           NaN
## 126  3.971706e+00 -1.108852e+01 -1.209798e+01           NaN           NaN
## 102  4.922887e+00 -1.041004e+01 -1.038288e+01           NaN           NaN
## 125  2.069687e+00 -4.856403e+00 -4.897843e+00           NaN           NaN
## 64   1.570977e+01 -2.960061e+01 -2.920995e+01 -1.872209e+01 -3.258720e+01
## 111  2.742184e+01 -5.841675e+01 -5.559507e+01           NaN           NaN
## 122  8.264689e+00 -1.588532e+01 -1.483308e+01           NaN           NaN
## 32  -2.787606e-50  3.059091e-50  1.462697e-50  6.700038e-51 -4.189345e-50
## 147  1.058788e+01 -2.609011e+01 -2.662163e+01           NaN           NaN
## 123  1.772209e-01 -6.355174e-01 -7.248238e-01           NaN           NaN
## 95   2.128707e+00 -3.556795e+00 -3.289024e+00 -1.649546e+00 -4.415633e+00
## 101  1.202339e-01 -2.343139e-01 -2.336399e-01           NaN           NaN
## 149  2.329874e+00 -4.481780e+00 -4.082630e+00           NaN           NaN
## 143  4.922887e+00 -1.041004e+01 -1.038288e+01           NaN           NaN
## 94   4.276719e-03 -5.878084e-03 -4.901489e-03 -8.785081e-04 -8.871313e-03
## 150  1.829178e+01 -3.675158e+01 -3.575740e+01           NaN           NaN
## 11  -7.260732e-55  7.954856e-55  3.644583e-55  1.829675e-55 -1.091177e-54
## 83   1.016264e-01 -1.504565e-01 -1.359125e-01 -4.237550e-02 -2.108064e-01
## 54   2.937790e+00 -5.044691e+00 -4.805762e+00 -2.547145e+00 -6.093936e+00
## 57   1.099073e+01 -1.939466e+01 -1.795992e+01 -1.044244e+01 -2.279836e+01
## 61   1.029068e-01 -1.558582e-01 -1.413643e-01 -4.945087e-02 -2.134622e-01
## 48  -6.130969e-52  6.972573e-52  3.467089e-52  1.121949e-52 -9.213907e-52
## 29  -3.230537e-53  3.543224e-53  1.647176e-53  7.992728e-54 -4.855003e-53
## 69   2.905360e+01 -6.278309e+01 -6.640426e+01 -5.031463e+01 -6.026667e+01
## 130  1.498146e+01 -4.161659e+01 -4.631923e+01           NaN           NaN
## 115  8.864468e-01 -1.739393e+00 -1.593885e+00           NaN           NaN
## 145  4.610446e-01 -1.048274e+00 -1.002885e+00           NaN           NaN
## 17  -1.050827e-57  1.162655e-57  5.530725e-58  2.421055e-58 -1.579233e-57
## 50  -1.885672e-52  2.087601e-52  9.917604e-53  4.340856e-53 -2.833877e-52
## 96   2.583211e-01 -3.995734e-01 -3.561180e-01 -1.391058e-01 -5.358424e-01
## 35  -1.000572e-48  1.112690e-48  5.377689e-49  2.204555e-49 -1.503706e-48
## 93   3.132406e-01 -4.872663e-01 -4.550688e-01 -1.765687e-01 -6.497633e-01
## 49  -4.981379e-55  5.489857e-55  2.544547e-55  1.203984e-55 -7.486250e-55
## 12  -2.530252e-51  2.874570e-51  1.417840e-51  4.717424e-52 -3.802582e-51
## 14  -1.772376e-54  2.015253e-54  9.960929e-55  3.273850e-55 -2.663609e-54
## 60   9.218684e-01 -1.448916e+00 -1.239313e+00 -5.257599e-01 -1.912256e+00
## 18  -6.650154e-54  7.394287e-54  3.556550e-54  1.472860e-54 -9.994164e-54
## 97   8.014824e-01 -1.282446e+00 -1.156460e+00 -5.114979e-01 -1.662536e+00
## 109  1.105494e+00 -3.257595e+00 -3.653234e+00           NaN           NaN
## 134  4.284178e+01 -9.544082e+01 -9.997933e+01 -7.951867e+01 -8.886784e+01
## 62   1.419505e+00 -2.281073e+00 -2.026807e+00 -9.163118e-01 -2.944517e+00
## 113  3.145063e+00 -8.090350e+00 -8.203990e+00           NaN           NaN
## 75   5.393475e-01 -8.515220e-01 -8.266404e-01 -3.324998e-01 -1.118783e+00
## 119  3.251814e-02 -1.183142e-01 -1.359778e-01           NaN           NaN
## 41  -3.550009e-55  3.962728e-55  1.918213e-55  7.621330e-56 -5.335121e-55
## 27  -1.380612e-49  1.561171e-49  7.837435e-50  2.602157e-50 -2.074848e-49
## 25  -9.391814e-47  1.082730e-46  5.456190e-47  1.511258e-47 -1.411446e-46
## 89   2.788051e-01 -4.278044e-01 -3.714223e-01 -1.416425e-01 -5.783328e-01
## 100  6.030550e-01 -9.549343e-01 -8.629475e-01 -3.663114e-01 -1.250933e+00
## 91   6.902634e+00 -1.232036e+01 -1.189320e+01 -6.897616e+00 -1.431832e+01
## 19  -1.644872e-52  1.794417e-52  8.241509e-53  4.228675e-53 -2.471991e-52
## 137  7.688622e-01 -1.507893e+00 -1.402696e+00           NaN           NaN
```

```
## 46  -2.503945e-48  2.800085e-48  1.385872e-48  5.186991e-49 -3.763047e-48
## 103  9.785916e-01 -2.824040e+00 -2.989351e+00           NaN           NaN
## 85   2.318307e+01 -3.954916e+01 -3.533229e+01 -1.917425e+01 -4.808926e+01
## 6   -1.439588e-53  1.611920e-53  7.830670e-54  3.018875e-54 -2.163480e-53
## 44  -2.286340e-49  2.628064e-49  1.374392e-49  3.550295e-50 -3.436019e-49
## 86   3.600824e+00 -5.877318e+00 -5.103909e+00 -2.474772e+00 -7.469285e+00
## 71   6.082669e+01 -1.115712e+02 -1.010490e+02 -6.495768e+01 -1.261744e+02
## 36  -8.772466e-54  9.630273e-54  4.516042e-54  2.142783e-54 -1.318367e-53
## 104  2.669351e+00 -6.316869e+00 -6.753892e+00           NaN           NaN
## 42   3.078369e-13 -3.420703e-13 -2.271592e-13  9.921356e-14 -6.385543e-13
## 139  5.327488e+01 -1.040944e+02 -9.766063e+01 -6.936625e+01 -1.105095e+02
## 118  3.099529e-01 -8.757143e-01 -9.475435e-01           NaN           NaN
## 106  1.823187e-01 -6.119644e-01 -6.866030e-01           NaN           NaN
## 9   -1.979189e-48  2.264464e-48  1.147311e-48  3.366119e-49 -2.974419e-48
## 43  -1.800636e-53  2.078260e-53  1.053726e-53  2.837382e-54 -2.706080e-53
## 84   2.312944e+01 -5.128560e+01 -5.315107e+01           NaN           NaN
## 66   5.840113e-01 -9.123451e-01 -8.857512e-01 -3.416871e-01 -1.211430e+00
## 39  -3.368442e-51  3.851684e-51  1.942685e-51  5.792888e-52 -5.062253e-51
## 7   -1.592691e-53  1.840262e-53  9.393173e-54  2.457362e-54 -2.393571e-53
## 72   1.753515e-01 -2.615431e-01 -2.406281e-01 -7.725089e-02 -3.637362e-01
## 117  7.065448e+00 -1.691807e+01 -1.769062e+01           NaN           NaN
## 108  8.716382e-01 -2.754233e+00 -3.131073e+00           NaN           NaN
## 4   -2.832732e-49  3.223093e-49  1.610393e-49  5.133655e-50 -4.257163e-49
## 38  -3.386723e-56  3.794472e-56  1.792854e-56  7.295106e-57 -5.089727e-56
## 138  7.525173e+00 -1.714754e+01 -1.771542e+01           NaN           NaN
## 65   8.010193e-03 -1.098403e-02 -9.017998e-03 -1.561636e-03 -1.661576e-02
## 5   -1.410593e-55  1.576924e-55  7.523769e-56  3.048349e-56 -2.119906e-55
## 2   -7.119972e-49  7.870600e-49  3.778179e-49  1.636735e-49 -1.070023e-48
## 87   5.498016e+00 -9.860479e+00 -9.840399e+00 -5.636068e+00 -1.140468e+01
## 82   3.649960e-02 -5.285314e-02 -4.784908e-02 -1.310259e-02 -7.571209e-02
## 40  -3.776144e-52  4.178646e-52  1.976961e-52  8.751235e-53 -5.674966e-52
## 77   8.749294e+00 -1.712078e+01 -1.838615e+01 -1.184741e+01 -1.814889e+01
## 128  4.559005e+01 -9.207728e+01 -8.802155e+01 -6.524717e+01 -9.456865e+01
## 67   1.684531e+01 -2.919044e+01 -2.643443e+01 -1.486167e+01 -3.494267e+01
## 92   7.021788e+00 -1.250589e+01 -1.200693e+01 -6.959733e+00 -1.456548e+01
## 131  1.300657e+00 -4.273120e+00 -4.721167e+00           NaN           NaN
## 74   6.768635e+00 -1.263106e+01 -1.285716e+01 -7.912850e+00 -1.404036e+01
## 56   8.399417e+00 -1.497037e+01 -1.430881e+01 -8.329326e+00 -1.742313e+01
## 59   2.163092e+00 -3.762892e+00 -3.870360e+00 -2.018703e+00 -4.486959e+00
## 120  1.915832e+01 -4.757329e+01 -5.179933e+01           NaN           NaN
## 23  -1.456693e-59  1.663173e-59  8.204453e-60  2.610134e-60 -2.189186e-59
## 13  -8.690854e-50  9.619715e-50  4.569899e-50  2.003697e-50 -1.306102e-49
## 33  -6.116402e-59  6.851269e-59  3.171767e-59  1.346960e-59 -9.192015e-59
## 107  3.715913e+01 -6.513173e+01 -5.975043e+01           NaN           NaN
## 127  4.514912e+01 -9.531619e+01 -9.292282e+01 -7.270536e+01 -9.365401e+01
## 24  -1.516162e-45  1.712946e-45  8.719960e-46  2.824010e-46 -2.278560e-45
## 116  2.833302e+00 -6.061115e+00 -5.652280e+00           NaN           NaN
## 34  -1.044472e-59  1.151729e-59  5.230998e-60  2.560928e-60 -1.569682e-59
## 68   1.080417e-01 -1.641370e-01 -1.537935e-01 -5.409839e-02 -2.241138e-01
## 58   2.462950e-03 -3.372848e-03 -2.754705e-03 -4.745496e-04 -5.108964e-03
## 73   4.099825e+01 -9.384234e+01 -9.967217e+01 -8.104111e+01 -8.504377e+01
## 80   2.420437e-03 -3.187614e-03 -2.723640e-03 -2.559522e-04 -5.020776e-03
## 8   -2.519136e-52  2.806363e-52  1.342900e-52  5.547428e-53 -3.785876e-52
## 99   1.514531e-04 -1.932433e-04 -1.510062e-04 -1.842855e-06 -3.141632e-04
```

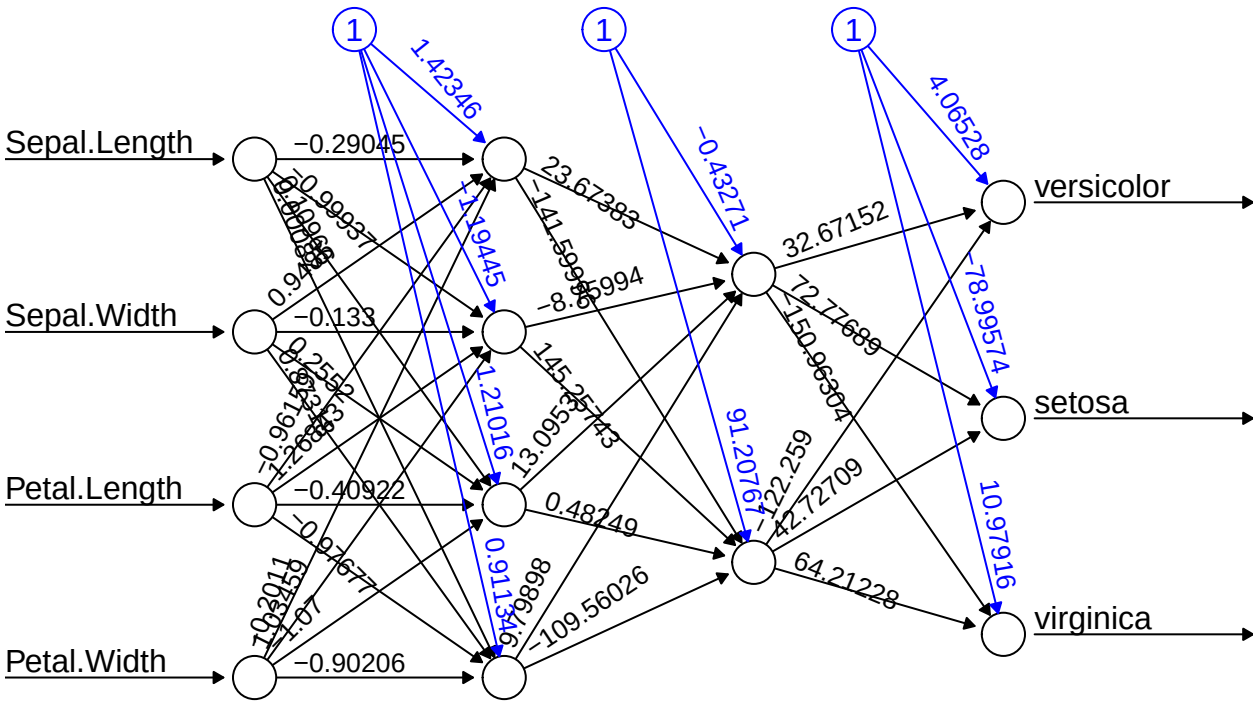
```
## 121  1.026953e+00 -2.601977e+00 -2.590900e+00           NaN           NaN
## 133  5.134344e-01 -1.254254e+00 -1.294966e+00           NaN           NaN
##            [,11]        [,12]
## 55  3.873499e+01 3.925901e+01
## 37  1.187517e-54 5.313089e-55
## 146          NaN          NaN
## 70  5.229259e-01 4.833135e-01
## 45  6.065904e-50 3.087704e-50
## 124 1.535016e+02 1.538783e+02
## 20  1.558361e-55 7.585066e-56
## 76  3.152449e+00 3.084940e+00
## 144          NaN          NaN
## 3   7.621601e-53 3.721619e-53
## 88  2.357546e+01 2.527542e+01
## 10  3.191751e-49 1.510754e-49
## 136          NaN          NaN
## 126          NaN          NaN
## 102          NaN          NaN
## 125          NaN          NaN
## 64  6.140134e+01 6.059098e+01
## 111          NaN          NaN
## 122          NaN          NaN
## 32  4.597345e-50 2.198210e-50
## 147          NaN          NaN
## 123          NaN          NaN
## 95  7.377955e+00 6.822510e+00
## 101          NaN          NaN
## 149          NaN          NaN
## 143          NaN          NaN
## 94  1.219307e-02 1.016729e-02
## 150          NaN          NaN
## 11  1.195493e-54 5.477251e-55
## 83  3.120960e-01 2.819270e-01
## 54  1.046434e+01 9.968720e+00
## 57  4.023086e+01 3.725474e+01
## 61  3.233008e-01 2.932358e-01
## 48  1.047871e-51 5.210504e-52
## 29  5.324923e-53 2.475453e-53
## 69  1.302326e+02 1.377441e+02
## 130          NaN          NaN
## 115          NaN          NaN
## 145          NaN          NaN
## 17  1.747292e-57 8.311832e-58
## 50  3.137345e-52 1.490464e-52
## 96  8.288458e-01 7.387051e-01
## 35  1.672203e-48 8.081843e-49
## 93  1.010749e+00 9.439614e-01
## 49  8.250415e-55 3.824064e-55
## 12  4.320038e-51 2.130797e-51
## 14  3.028617e-54 1.496975e-54
## 60  3.005525e+00 2.570741e+00
## 18  1.111248e-53 5.344951e-54
## 97  2.660211e+00 2.398875e+00
## 109          NaN          NaN
```

```
## 134 1.979754e+02 2.073898e+02
## 62  4.731690e+00 4.204261e+00
## 113          NaN          NaN
## 75  1.766335e+00 1.714722e+00
## 119          NaN          NaN
## 41  5.955374e-55 2.882780e-55
## 27  2.346201e-49 1.177847e-49
## 25  1.627178e-46 8.199818e-47
## 89  8.874060e-01 7.704511e-01
## 100 1.980846e+00 1.790035e+00
## 91  2.555645e+01 2.467038e+01
## 19  2.696735e-52 1.238573e-52
## 137          NaN          NaN
## 46  4.208098e-48 2.082753e-48
## 103          NaN          NaN
## 85  8.203787e+01 7.329071e+01
## 6   2.422469e-53 1.176830e-53
## 44  3.949578e-49 2.065501e-49
## 86  1.219148e+01 1.058717e+01
## 71  2.314351e+02 2.096087e+02
## 36  1.447283e-53 6.786920e-54
## 104          NaN          NaN
## 42  7.095656e-13 4.712024e-13
## 139 2.159258e+02 2.025800e+02
## 118          NaN          NaN
## 106          NaN          NaN
## 9   3.403143e-48 1.724233e-48
## 43  3.123307e-53 1.583588e-53
## 84           NaN          NaN
## 66  1.892502e+00 1.837337e+00
## 39  5.788491e-51 2.919558e-51
## 7   2.765632e-53 1.411650e-53
## 72  5.425258e-01 4.991413e-01
## 117          NaN          NaN
## 108          NaN          NaN
## 4   4.843816e-49 2.420174e-49
## 38  5.702511e-56 2.694385e-56
## 138          NaN          NaN
## 65  2.278446e-02 1.870627e-02
## 5   2.369876e-55 1.130707e-55
## 2   1.182831e-48 5.678024e-49
## 87  2.045385e+01 2.041220e+01
## 82  1.096347e-01 9.925461e-02
## 40  6.279866e-52 2.971070e-52
## 77  3.551409e+01 3.813889e+01
## 128 1.909984e+02 1.825855e+02
## 67  6.055050e+01 5.483365e+01
## 92  2.594130e+01 2.490630e+01
## 131          NaN          NaN
## 74  2.620094e+01 2.666994e+01
## 56  3.105344e+01 2.968115e+01
## 59  7.805466e+00 8.028391e+00
## 120          NaN          NaN
## 23  2.499494e-59 1.233004e-59
```

```
## 13  1.445696e-49 6.867859e-50
## 33  1.029641e-58 4.766680e-59
## 107          NaN          NaN
## 127 1.977169e+02 1.927523e+02
## 24  2.574296e-45 1.310477e-45
## 116          NaN          NaN
## 34  1.730873e-59 7.861390e-60
## 68  3.404738e-01 3.190180e-01
## 58  6.996388e-03 5.714159e-03
## 73  1.946597e+02 2.067526e+02
## 80  6.612152e-03 5.649718e-03
## 8   4.217535e-52 2.018173e-52
## 99  4.008498e-04 3.132362e-04
## 121          NaN          NaN
## 133          NaN          NaN
##
##
## $startweights
## $startweights[[1]]
## $startweights[[1]][[1]]
##            [,1]        [,2]        [,3]        [,4]
## [1,]  0.1784364  0.03180517  1.02430425  0.86798143
## [2,] -1.5608613 -1.07548182 -0.07104261  0.04399257
## [3,] -0.7420118 -0.25677290 -0.69559296  1.28046684
## [4,] -1.5417923  1.18186111 -0.55477281 -0.67644125
## [5,]  0.6627263  0.89462278 -0.48677958 -0.19119685
##
## $startweights[[1]][[2]]
##             [,1]       [,2]
## [1,]  1.38259854  0.5498319
## [2,]  0.74860902  0.3447832
## [3,]  2.34618058  1.5688060
## [4,]  0.21910371  1.1177046
## [5,] -0.02222762 -2.2190741
##
## $startweights[[1]][[3]]
##            [,1]       [,2]       [,3]
## [1,] -0.6102503 -0.3899154 -0.2255378
## [2,] -0.2183231 -0.1562910 -0.2408516
## [3,] -1.0091955 -0.5116348  1.4387121
##
##
##
## $result.matrix
##                                    [,1]
## error                      1.001880e+00
## reached.threshold          9.913458e-03
## steps                      6.171000e+03
## Intercept.to.1layhid1      1.423456e+00
## Sepal.Length.to.1layhid1 -2.904539e-01
## Sepal.Width.to.1layhid1    9.484971e-01
## Petal.Length.to.1layhid1 -9.615934e-01
## Petal.Width.to.1layhid1  -2.011001e-01
## Intercept.to.1layhid2    -1.194446e+00
```

```
## Sepal.Length.to.1layhid2 -9.993736e-01
## Sepal.Width.to.1layhid2  -1.330028e-01
## Petal.Length.to.1layhid2  1.268430e+00
## Petal.Width.to.1layhid2   1.034590e+00
## Intercept.to.1layhid3     1.210161e+00
## Sepal.Length.to.1layhid3  1.096572e-01
## Sepal.Width.to.1layhid3   2.551982e-01
## Petal.Length.to.1layhid3 -4.092203e-01
## Petal.Width.to.1layhid3  -1.069997e+00
## Intercept.to.1layhid4     9.113376e-01
## Sepal.Length.to.1layhid4  8.651006e-04
## Sepal.Width.to.1layhid4   8.731833e-01
## Petal.Length.to.1layhid4 -9.767700e-01
## Petal.Width.to.1layhid4  -9.020607e-01
## Intercept.to.2layhid1    -4.327106e-01
## 1layhid1.to.2layhid1      2.367383e+01
## 1layhid2.to.2layhid1     -8.759936e+00
## 1layhid3.to.2layhid1      1.309530e+01
## 1layhid4.to.2layhid1      9.798979e+00
## Intercept.to.2layhid2     9.120767e+01
## 1layhid1.to.2layhid2     -1.416000e+02
## 1layhid2.to.2layhid2      1.452574e+02
## 1layhid3.to.2layhid2      4.824887e-01
## 1layhid4.to.2layhid2     -1.095603e+02
## Intercept.to.versicolor   4.065277e+00
## 2layhid1.to.versicolor    3.267152e+01
## 2layhid2.to.versicolor   -1.222590e+02
## Intercept.to.setosa      -7.899574e+01
## 2layhid1.to.setosa        7.277689e+01
## 2layhid2.to.setosa        4.272709e+01
## Intercept.to.virginica    1.097916e+01
## 2layhid1.to.virginica    -1.509630e+02
## 2layhid2.to.virginica     6.421228e+01
##
## attr(,"class")
## [1] "nn"
```

```
plot(model, rep = 'best')
```



Error: 1.00188 Steps: 6171

```
# Model evaluation
#predict categories - test dataset
#list of category names
#dataframe
# table - actual and predicated
test_data
```

```
##     Sepal.Length Sepal.Width Petal.Length Petal.Width    Species
## 1            5.1         3.5          1.4         0.2     setosa
## 15           5.8         4.0          1.2         0.2     setosa
## 16           5.7         4.4          1.5         0.4     setosa
## 21           5.4         3.4          1.7         0.2     setosa
## 22           5.1         3.7          1.5         0.4     setosa
## 26           5.0         3.0          1.6         0.2     setosa
## 28           5.2         3.5          1.5         0.2     setosa
## 30           4.7         3.2          1.6         0.2     setosa
## 31           4.8         3.1          1.6         0.2     setosa
## 47           5.1         3.8          1.6         0.2     setosa
## 51           7.0         3.2          4.7         1.4 versicolor
## 52           6.4         3.2          4.5         1.5 versicolor
## 53           6.9         3.1          4.9         1.5 versicolor
## 63           6.0         2.2          4.0         1.0 versicolor
## 78           6.7         3.0          5.0         1.7 versicolor
## 79           6.0         2.9          4.5         1.5 versicolor
## 81           5.5         2.4          3.8         1.1 versicolor
## 90           5.5         2.5          4.0         1.3 versicolor
## 98           6.2         2.9          4.3         1.3 versicolor
## 105          6.5         3.0          5.8         2.2  virginica
## 110          7.2         3.6          6.1         2.5  virginica
```

```
## 112          6.4         2.7          5.3         1.9  virginica
## 114          5.7         2.5          5.0         2.0  virginica
## 129          6.4         2.8          5.6         2.1  virginica
## 132          7.9         3.8          6.4         2.0  virginica
## 135          6.1         2.6          5.6         1.4  virginica
## 140          6.9         3.1          5.4         2.1  virginica
## 141          6.7         3.1          5.6         2.4  virginica
## 142          6.9         3.1          5.1         2.3  virginica
## 148          6.5         3.0          5.2         2.0  virginica
```

```
pred<-predict(model, test_data)
pred
```

```
##             [,1]         [,2]         [,3]
## 1   1.000000e+00 1.987582e-03 1.606099e-61
## 15  1.000000e+00 1.987582e-03 1.606099e-61
## 16  1.000000e+00 1.987582e-03 1.606099e-61
## 21  1.000000e+00 1.987582e-03 1.606099e-61
## 22  1.000000e+00 1.987582e-03 1.606099e-61
## 26  1.000000e+00 1.987582e-03 1.606099e-61
## 28  1.000000e+00 1.987582e-03 1.606099e-61
## 30  1.000000e+00 1.987582e-03 1.606099e-61
## 31  1.000000e+00 1.987582e-03 1.606099e-61
## 47  1.000000e+00 1.987582e-03 1.606099e-61
## 51  5.976903e-38 1.000000e+00 2.953469e-33
## 52  5.723452e-38 1.000000e+00 3.608146e-33
## 53  1.384220e-38 1.000000e+00 2.544987e-30
## 63  6.966252e-38 1.000000e+00 1.455306e-33
## 78  5.834333e-43 9.999693e-01 4.187287e-10
## 79  1.736209e-38 1.000000e+00 8.933657e-31
## 81  7.119429e-38 1.000000e+00 1.316157e-33
## 90  6.249596e-38 1.000000e+00 2.403280e-33
## 98  6.688873e-38 1.000000e+00 1.755865e-33
## 105 5.423696e-52 2.476923e-16 1.000000e+00
## 110 5.316714e-52 2.369408e-16 1.000000e+00
## 112 1.893062e-51 4.010254e-15 1.000000e+00
## 114 9.329015e-52 8.290613e-16 1.000000e+00
## 129 6.037474e-52 3.145041e-16 1.000000e+00
## 132 1.404842e-51 2.063591e-15 1.000000e+00
## 135 2.891381e-51 1.030162e-14 1.000000e+00
## 140 3.342740e-51 1.423096e-14 1.000000e+00
## 141 5.820653e-52 2.898980e-16 1.000000e+00
## 142 1.001202e-50 1.638601e-13 1.000000e+00
## 148 7.647401e-51 8.991549e-14 1.000000e+00
```

```
labels<-c("setosa", "versicolor","virginca")
labels
```

```
## [1] "setosa"     "versicolor" "virginca"
```

```
prediction_label <- data.frame(max.col(pred)) %>%
  mutate(pred=labels[max.col.pred.]) %>%
  select(2) %>%
  unlist()
summary(test_data)
```

```
##   Sepal.Length    Sepal.Width     Petal.Length    Petal.Width
##  Min.   :4.700   Min.   :2.200   Min.   :1.200   Min.   :0.200
##  1st Qu.:5.425   1st Qu.:2.900   1st Qu.:1.600   1st Qu.:0.250
##  Median :6.050   Median :3.100   Median :4.500   Median :1.400
##  Mean   :6.043   Mean   :3.143   Mean   :3.867   Mean   :1.253
##  3rd Qu.:6.650   3rd Qu.:3.475   3rd Qu.:5.275   3rd Qu.:2.000
##  Max.   :7.900   Max.   :4.400   Max.   :6.400   Max.   :2.500
##        Species
##  setosa    :10
##  versicolor: 9
##  virginica :11
##
##
##
```

```
check= as.numeric(test_data$Species) == max.col(pred)
check
```

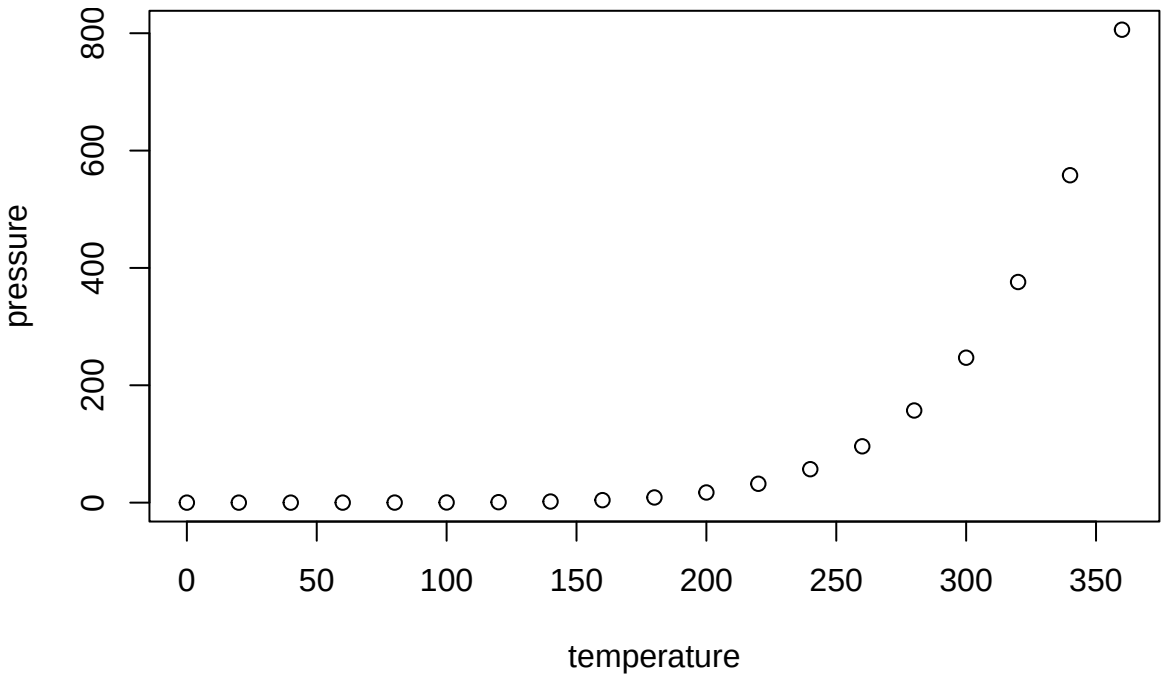
```
##  [1] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [16] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
```

```
accuracy<-(sum(check)/nrow(test_data))*100
print(accuracy)
```

```
## [1] 100
```

Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.