CS 513 Final - Q4

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2023-12-18

Load data Convert categorical output to numerical for neural net

```
rm(list=ls())
library(caTools)
library(class)
library(e1071)
```

```
## Warning: package 'e1071' was built under R version 4.3.2
```

```
library(caret)
```

```
## Loading required package: ggplot2
```

```
## Loading required package: lattice
```

```
## Warning: package 'lattice' was built under R version 4.3.2
```

```
library(neuralnet)
```

```
## Warning: package 'neuralnet' was built under R version 4.3.2
```

```
library(BBmisc)
```

```
## Warning: package 'BBmisc' was built under R version 4.3.2
```

```
##
## Attaching package: 'BBmisc'
```

```
## The following object is masked from 'package:base':
##
##     isFALSE
```

```
library(plyr)
data = read.csv("Hear_attack.csv")
data = data[complete.cases(data), ]
data$Heart_attack <- sapply(data$Heart_attack, switch, "Light"=0, "Mild"=0.5, "Massive"=1)
set.seed(255)
```

Perform standard scaling (equivalent to Python's StandardScaler)

```
data$RestHR <- normalize(data$RestHR, method="standardize")
data$MaxHR <- normalize(data$MaxHR, method="standardize")
data$RecHR <- normalize(data$RecHR, method="standardize")
data$BP <- normalize(data$BP, method="standardize")
```

Perform test-train split

```
split = sample.split(data$Heart_attack, SplitRatio=0.7)
train = subset(data, split == TRUE)
test = subset(data, split == FALSE)
```

Train neural net

```
heartnet = neuralnet(Heart_attack~.,data=train,hidden=10,learningrate=0.001,algorithm="backprop",thresh
```

```
## hidden: 10    thresh: 0.005    rep: 1/1    steps:   25000    min thresh: 0.0367611013401728
##                                                    50000    min thresh: 0.0281223678157586
##                                                    75000    min thresh: 0.0225905697177387
##                                                     1e+05    min thresh: 0.0192381298766882
##                                                   125000    min thresh: 0.0171707863979606
##                                                   150000    min thresh: 0.0141853044610411
##                                                   175000    min thresh: 0.012451068266808
##                                                    2e+05    min thresh: 0.0108415994402096
##                                                   225000    min thresh: 0.00942329623633254
##                                                   250000    min thresh: 0.00819285550794291
##                                                   275000    min thresh: 0.00712883970170413
##                                                    3e+05    min thresh: 0.00621344392360406
##                                                   325000    min thresh: 0.00542337848807443
##                                                   340016    error: 0.38715  time: 1.33 mins
```

Display

```
plot(heartnet)
```

Evaluation Note 0 = Light 0.5 = Mild 1 = Massive

```
output = compute(heartnet, test[,-5])
results = data.frame(actual=test$Heart_attack, predicted=output$net.result)
results = sapply(results, round_any, accuracy=0.5, f=round)
results
```

```
##       actual predicted
##  [1,]    0.0       0.0
##  [2,]    0.0       0.0
##  [3,]    0.0       0.0
##  [4,]    0.0       0.0
##  [5,]    0.0       0.0
##  [6,]    0.0       0.0
##  [7,]    0.0       0.0
##  [8,]    0.0       0.0
##  [9,]    0.0       0.0
## [10,]    0.0       0.0
## [11,]    0.0       0.0
## [12,]    0.0       0.0
## [13,]    0.0       0.0
## [14,]    0.0       0.0
## [15,]    0.0       0.0
## [16,]    0.0       0.0
## [17,]    0.0       0.0
## [18,]    0.0       0.0
## [19,]    0.0       0.0
## [20,]    0.0       0.0
## [21,]    0.0       0.0
## [22,]    0.0       0.0
```

```
## [23,]    0.0       0.0
## [24,]    0.0       0.0
## [25,]    0.0       0.0
## [26,]    0.0       0.0
## [27,]    0.0       0.0
## [28,]    0.0       0.0
## [29,]    0.0       0.0
## [30,]    0.0       0.0
## [31,]    0.5       1.0
## [32,]    0.5       0.5
## [33,]    0.5       0.5
## [34,]    0.5       0.5
## [35,]    0.5       0.5
## [36,]    0.5       0.5
## [37,]    0.5       0.5
## [38,]    0.5       0.5
## [39,]    0.5       0.5
## [40,]    0.5       0.5
## [41,]    0.5       0.5
## [42,]    0.5       0.5
## [43,]    0.5       0.5
## [44,]    0.5       0.5
## [45,]    0.5       0.5
## [46,]    0.5       0.5
## [47,]    0.5       0.5
## [48,]    0.5       0.5
## [49,]    0.5       0.5
## [50,]    0.5       0.5
## [51,]    0.5       0.5
## [52,]    0.5       0.5
## [53,]    0.5       0.5
## [54,]    0.5       0.5
## [55,]    0.5       0.5
## [56,]    0.5       0.5
## [57,]    0.5       0.5
## [58,]    0.5       0.5
## [59,]    0.5       0.5
## [60,]    0.5       1.0
## [61,]    1.0       1.0
## [62,]    1.0       1.0
## [63,]    1.0       1.0
## [64,]    1.0       1.0
## [65,]    1.0       1.0
## [66,]    1.0       1.0
## [67,]    1.0       1.0
## [68,]    1.0       1.0
## [69,]    1.0       1.0
## [70,]    1.0       1.0
## [71,]    1.0       1.0
## [72,]    1.0       1.0
## [73,]    1.0       1.0
## [74,]    1.0       1.0
## [75,]    1.0       1.0
## [76,]    1.0       1.0
```

```
## [77,]    1.0       1.0
## [78,]    1.0       1.0
## [79,]    1.0       1.0
## [80,]    1.0       1.0
## [81,]    1.0       1.0
## [82,]    1.0       1.0
## [83,]    1.0       1.0
## [84,]    1.0       1.0
## [85,]    1.0       1.0
## [86,]    1.0       1.0
## [87,]    1.0       1.0
## [88,]    1.0       1.0
## [89,]    1.0       1.0
## [90,]    1.0       1.0
```

Performance Note 0 = Light 0.5 = Mild 1 = Massive

```
conf = table(test$Heart_attack, round_any(output$net.result, accuracy=0.5, f=round))
confusionMatrix(conf)
```

```
## Confusion Matrix and Statistics
##
##
##        0 0.5  1
##   0   30   0  0
##   0.5  0  28  2
##   1    0   0 30
##
## Overall Statistics
##
##                Accuracy : 0.9778
##                  95% CI : (0.922, 0.9973)
##     No Information Rate : 0.3556
##     P-Value [Acc > NIR] : < 2.2e-16
##
##                   Kappa : 0.9667
##
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: 0 Class: 0.5 Class: 1
## Sensitivity            1.0000     1.0000   0.9375
## Specificity            1.0000     0.9677   1.0000
## Pos Pred Value         1.0000     0.9333   1.0000
## Neg Pred Value         1.0000     1.0000   0.9667
## Prevalence             0.3333     0.3111   0.3556
## Detection Rate         0.3333     0.3111   0.3333
## Detection Prevalence   0.3333     0.3333   0.3333
## Balanced Accuracy      1.0000     0.9839   0.9688
```

Accuracy is 97.78% on the test set.