Case Study 3 Model

```r
library(randomForest)
```

```
## randomForest 4.6-14
```

```
## Type rfNews() to see new features/changes/bug fixes.
```

```r
library(MASS)
library(cvAUC)
```

```
## Loading required package: ROCR
```

```
## Warning: package 'ROCR' was built under R version 3.6.2
```

```
## Loading required package: data.table
```

```
##
```

```
## cvAUC version: 1.1.0
```

```
## Notice to cvAUC users: Major speed improvements in version 1.1.0
```

```
##
```

```r
library(matrixStats)
```

```r
load("final_data.rda")
data <- data.frame(new_data)
```

```r
summary(data)
```

```
##        id              label             Age             Height
##  Min.   : 1.000   Min.   :0.0000   Min.   :24.00   Min.   :165.0
##  1st Qu.: 4.000   1st Qu.:0.0000   1st Qu.:26.00   1st Qu.:172.0
##  Median : 8.000   Median :0.0000   Median :27.00   Median :178.0
##  Mean   : 8.041   Mean   :0.2217   Mean   :27.47   Mean   :177.6
##  3rd Qu.:12.000   3rd Qu.:0.0000   3rd Qu.:28.00   3rd Qu.:184.0
##  Max.   :15.000   Max.   :1.0000   Max.   :35.00   Max.   :189.0
##      Weight          Gender        ACC_wrist_mean   ACC_wrist_sd
##  Min.   :54.00   Min.   :0.000   Min.   :62.18   Min.   : 0.01898
##  1st Qu.:66.00   1st Qu.:1.000   1st Qu.:62.93   1st Qu.: 0.42623
##  Median :75.00   Median :1.000   Median :63.23   Median : 1.18674
##  Mean   :73.12   Mean   :0.866   Mean   :63.64   Mean   : 2.06887
##  3rd Qu.:80.00   3rd Qu.:1.000   3rd Qu.:64.44   3rd Qu.: 2.68943
##  Max.   :90.00   Max.   :1.000   Max.   :67.96   Max.   :17.68095
##     BVP_mean            BVP_sd            BVP_HR        EDA_wrist_mean
##  Min.   :-10.794000   Min.   :  2.383   Min.   : 47.0   Min.   : 0.09245
##  1st Qu.: -0.335750   1st Qu.: 17.895   1st Qu.: 69.0   1st Qu.: 0.31399
##  Median :  0.005333   Median : 33.912   Median : 75.0   Median : 0.77401
##  Mean   :  0.008307   Mean   : 43.700   Mean   : 75.6   Mean   : 1.81387
##  3rd Qu.:  0.351833   3rd Qu.: 55.378   3rd Qu.: 81.0   3rd Qu.: 2.50610
##  Max.   : 11.532292   Max.   :311.408   Max.   :138.0   Max.   :15.63060
##   EDA_wrist_sd      EDA_wrist_min      EDA_wrist_max     EDA_wrist_range
```

```
##  Min.   :0.000889   Min.   : 0.05527   Min.   : 0.1015   Min.   :0.005125
##  1st Qu.:0.004387   1st Qu.: 0.30089   1st Qu.: 0.3239   1st Qu.:0.023029
##  Median :0.014692   Median : 0.71665   Median : 0.8319   Median :0.071646
##  Mean   :0.051516   Mean   : 1.70082   Mean   : 1.9368   Mean   :0.236023
##  3rd Qu.:0.055648   3rd Qu.: 2.36744   3rd Qu.: 2.6814   3rd Qu.:0.250763
##  Max.   :1.353600   Max.   :14.67037   Max.   :15.9215   Max.   :4.653134
##  EDA_wrist_slope     Temp_wrist_mean Temp_wrist_sd      Temp_wrist_min
##  Min.   :-1.825027   Min.   :29.01   Min.   :0.008575   Min.   :28.97
##  1st Qu.:-0.003838   1st Qu.:31.70   1st Qu.:0.016053   1st Qu.:31.65
##  Median :-0.001279   Median :32.95   Median :0.022193   Median :32.91
##  Mean   :-0.000508   Mean   :32.75   Mean   :0.032356   Mean   :32.68
##  3rd Qu.: 0.001280   3rd Qu.:33.85   3rd Qu.:0.035804   3rd Qu.:33.75
##  Max.   : 2.261773   Max.   :35.93   Max.   :0.302920   Max.   :35.91
##  Temp_wrist_max  Temp_wrist_range Temp_wrist_slope   ACC_chest_mean
##  Min.   :29.05   Min.   :0.0200   Min.   :-1.00e-01   Min.   :0.9019
##  1st Qu.:31.75   1st Qu.:0.0700   1st Qu.:-2.00e-02   1st Qu.:0.9200
##  Median :32.99   Median :0.1000   Median : 0.00e+00   Median :0.9285
##  Mean   :32.81   Mean   :0.1234   Mean   :-9.06e-06   Mean   :0.9333
##  3rd Qu.:33.95   3rd Qu.:0.1400   3rd Qu.: 2.00e-02   3rd Qu.:0.9434
##  Max.   :35.97   Max.   :0.9600   Max.   : 8.00e-02   Max.   :0.9833
##   ACC_chest_sd       ECG_mean          ECG_sd            ECG_HR
##  Min.   :0.002264   Min.   :-0.060135   Min.   :0.07933   Min.   : 47.00
##  1st Qu.:0.004257   1st Qu.:-0.008511   1st Qu.:0.21325   1st Qu.: 66.00
##  Median :0.006064   Median : 0.002120   Median :0.26234   Median : 75.00
##  Mean   :0.008955   Mean   : 0.002572   Mean   :0.25821   Mean   : 80.82
##  3rd Qu.:0.010841   3rd Qu.: 0.012479   3rd Qu.:0.30286   3rd Qu.: 88.00
##  Max.   :0.093678   Max.   : 0.079029   Max.   :0.51159   Max.   :149.00
##  EDA_chest_mean    EDA_chest_sd      EDA_chest_min     EDA_chest_max
##  Min.   : 0.4691   Min.   :0.00595   Min.   : 0.285   Min.   : 0.5604
##  1st Qu.: 2.0327   1st Qu.:0.01359   1st Qu.: 1.954   1st Qu.: 2.1214
##  Median : 3.6993   Median :0.01903   Median : 3.592   Median : 3.7609
##  Mean   : 4.6070   Mean   :0.04767   Mean   : 4.517   Mean   : 4.7390
##  3rd Qu.: 6.4996   3rd Qu.:0.04072   3rd Qu.: 6.422   3rd Qu.: 6.5853
##  Max.   :20.2740   Max.   :1.80241   Max.   :19.970   Max.   :21.1349
##  EDA_chest_range   EDA_chest_slope     EMG_mean            EMG_sd
##  Min.   :0.03471   Min.   :-0.6877899   Min.   :-0.8151398   Min.   :0.005057
##  1st Qu.:0.08774   1st Qu.:-0.0099182   1st Qu.:-0.0093842   1st Qu.:0.008527
##  Median :0.12398   Median :-0.0007629   Median :-0.0000458   Median :0.010563
##  Mean   :0.22175   Mean   :-0.0001620   Mean   :-0.0000412   Mean   :0.012033
##  3rd Qu.:0.19150   3rd Qu.: 0.0080109   3rd Qu.: 0.0093384   3rd Qu.:0.013822
##  Max.   :5.04379   Max.   : 0.8102417   Max.   : 1.0171051   Max.   :0.108135
##    EMG_range         Resp_Volume        Resp_range         breath_rate
##  Min.   :0.02820   Min.   : 48.01   Min.   : 1.376   Min.   : 6.00
##  1st Qu.:0.05777   1st Qu.: 444.60   1st Qu.:10.791   1st Qu.:13.00
##  Median :0.07425   Median : 584.53   Median :16.168   Median :15.00
##  Mean   :0.09356   Mean   : 635.47   Mean   :18.768   Mean   :14.73
##  3rd Qu.:0.10936   3rd Qu.: 758.93   3rd Qu.:24.377   3rd Qu.:17.00
##  Max.   :1.83792   Max.   :2681.30   Max.   :72.710   Max.   :28.00
##  Temp_chest_mean Temp_chest_sd      Temp_chest_min  Temp_chest_max
##  Min.   :28.20   Min.   :0.009757   Min.   :28.13   Min.   :28.34
##  1st Qu.:33.60   1st Qu.:0.027085   1st Qu.:33.50   1st Qu.:33.70
##  Median :34.18   Median :0.031548   Median :34.08   Median :34.28
##  Mean   :33.88   Mean   :0.042550   Mean   :33.77   Mean   :33.99
##  3rd Qu.:34.59   3rd Qu.:0.039311   3rd Qu.:34.49   3rd Qu.:34.70
```

```
## Max.   :35.63   Max.   :1.844897   Max.   :35.52   Max.    :35.74
## Temp_chest_range  Temp_chest_slope
## Min.   :0.06625   Min.   :-0.3031310
## 1st Qu.:0.16806   1st Qu.:-0.0155620
## Median :0.19464   Median : 0.0000000
## Mean   :0.22308   Mean   : 0.0003405
## 3rd Qu.:0.22629   3rd Qu.: 0.0168150
## Max.   :5.47601   Max.   : 0.3354500
```

```r
nrow(subset(data, label == 1))/nrow(data)
```

```
## [1] 0.2216921
```

```r
nrow(subset(data, label == 0))/nrow(data)
```

```
## [1] 0.7783079
```

```r
data$label = as.factor(data$label)
```

```r
test = subset(data, id == 14)
train = subset(data, id != 14)
nrow(data)
```

```
## [1] 179817
```

```r
nrow(test)
```

```
## [1] 12052
```

```r
nrow(train)
```

```
## [1] 167765
```

```r
colnames(train)
```

```
##  [1] "id"               "label"            "Age"              "Height"
##  [5] "Weight"           "Gender"           "ACC_wrist_mean"   "ACC_wrist_sd"
##  [9] "BVP_mean"         "BVP_sd"           "BVP_HR"           "EDA_wrist_mean"
## [13] "EDA_wrist_sd"     "EDA_wrist_min"    "EDA_wrist_max"    "EDA_wrist_range"
## [17] "EDA_wrist_slope"  "Temp_wrist_mean"  "Temp_wrist_sd"    "Temp_wrist_min"
## [21] "Temp_wrist_max"   "Temp_wrist_range" "Temp_wrist_slope" "ACC_chest_mean"
## [25] "ACC_chest_sd"     "ECG_mean"         "ECG_sd"           "ECG_HR"
## [29] "EDA_chest_mean"   "EDA_chest_sd"     "EDA_chest_min"    "EDA_chest_max"
## [33] "EDA_chest_range"  "EDA_chest_slope"  "EMG_mean"         "EMG_sd"
## [37] "EMG_range"        "Resp_Volume"      "Resp_range"       "breath_rate"
## [41] "Temp_chest_mean"  "Temp_chest_sd"    "Temp_chest_min"   "Temp_chest_max"
## [45] "Temp_chest_range" "Temp_chest_slope"
```

```r
personal = colnames(train)[3:6]
wrist_acc = colnames(train)[7:8]
chest_acc = colnames(train)[24:25]
wrist_bvp = colnames(train)[9:11]
wrist_eda = colnames(train)[12:17]
wrist_temp = colnames(train)[18:23]
wrist_physio = colnames(train)[9:23]
chest_ecg = colnames(train)[26:28]
chest_eda = colnames(train)[29:34]
chest_emg = colnames(train)[35:37]
chest_resp = colnames(train)[38:40]
chest_temp = colnames(train)[41:46]
```

```r
chest_physio = colnames(train)[26:46]
all_wrist = colnames(train)[7:23]
all_chest = colnames(train)[24:46]
all_physio = colnames(train)[c(9:23,26:46)]
all_modalities = colnames(train)[c(7:46)]

predictor_vars <- c("personal", "wrist_acc", "chest_acc", "wrist_bvp", "wrist_eda", "wrist_temp", "wrist

test_sample = test

set.seed(1)
train_indices = sample(nrow(train), 1000)
train_sample = train[train_indices,]
# Run this instead to train on the full train set
# train_sample = train

rf <- function(train_sample, test_sample, predictors){
  set.seed(1)
  model_rf <- randomForest(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), ntree = 5
  predict_rf <- predict(model_rf, test_sample)
  cat("Accuracy is", mean(test_sample$label == predict_rf)*100, "% \n")
  cat("AUROC is", AUC(as.numeric(as.character(predict_rf)), as.numeric(as.character(test_sample$label))
  if (mean(test_sample$label == predict_rf) == 1){
    df <- data.frame(importance(model_rf, type = 1))
    print(df)
    cat('\n')
  }
}

print_baseline <- function(test_sample){
  predict_rf <- rep(0,nrow(test_sample))
  cat("Accuracy is", mean(test_sample$label == predict_rf)*100, "% \n")
  cat("AUROC is", AUC(as.numeric(as.character(predict_rf)), as.numeric(as.character(test_sample$label))
}

print_baseline(test_sample)
```

```
## Accuracy is 77.66346 %
## AUROC is 0.5
##
```

```r
for (i in 1:length(predictor_vars)){
  cat("Predictors: ", predictor_vars[i], "\n")
  rf(train_sample, test_sample, eval(parse(text = predictor_vars[i])))
}
```

```
## Predictors:  personal
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors:  wrist_acc
## Accuracy is 72.01294 %
## AUROC is 0.514696
##
## Predictors:  chest_acc
## Accuracy is 91.32094 %
```

```
## AUROC is 0.8467388
##
## Predictors:  wrist_bvp
## Accuracy is 89.39595 %
## AUROC is 0.7755971
##
## Predictors:  wrist_eda
## Accuracy is 85.84467 %
## AUROC is 0.6831352
##
## Predictors:  wrist_temp
## Accuracy is 76.00398 %
## AUROC is 0.4893162
##
## Predictors:  wrist_physio
## Accuracy is 98.48988 %
## AUROC is 0.9661961
##
## Predictors:  chest_ecg
## Accuracy is 82.04447 %
## AUROC is 0.8844017
##
## Predictors:  chest_eda
## Accuracy is 87.58712 %
## AUROC is 0.7823438
##
## Predictors:  chest_emg
## Accuracy is 75.307 %
## AUROC is 0.5258472
##
## Predictors:  chest_resp
## Accuracy is 86.89844 %
## AUROC is 0.7839966
##
## Predictors:  chest_temp
## Accuracy is 72.4693 %
## AUROC is 0.4893183
##
## Predictors:  chest_physio
## Accuracy is 100 %
## AUROC is 1
##
##                     MeanDecreaseAccuracy
## ECG_mean                      9.1944086
## ECG_sd                       25.0320995
## ECG_HR                       38.7903753
## EDA_chest_mean               17.8834158
## EDA_chest_sd                 28.2825712
## EDA_chest_min                16.4386864
## EDA_chest_max                17.5592515
## EDA_chest_range              26.9618053
## EDA_chest_slope               5.8585576
## EMG_mean                      3.8458007
## EMG_sd                       16.1981758
```

```
## EMG_range                      13.2845247
## Resp_Volume                    21.2544550
## Resp_range                     23.2212202
## breath_rate                    18.2416750
## Temp_chest_mean                20.4689125
## Temp_chest_sd                  11.5026323
## Temp_chest_min                 19.7646250
## Temp_chest_max                 23.5620817
## Temp_chest_range                9.8265898
## Temp_chest_slope                0.7674039
##
## Predictors:  all_wrist
## Accuracy is 98.07501 %
## AUROC is 0.9569094
##
## Predictors:  all_chest
## Accuracy is 100 %
## AUROC is 1
##
##                       MeanDecreaseAccuracy
## ACC_chest_mean                  18.505801
## ACC_chest_sd                    35.536270
## ECG_mean                         7.156738
## ECG_sd                          23.654543
## ECG_HR                          33.345066
## EDA_chest_mean                  16.370751
## EDA_chest_sd                    24.659602
## EDA_chest_min                   16.738178
## EDA_chest_max                   16.022553
## EDA_chest_range                 25.706254
## EDA_chest_slope                  4.080738
## EMG_mean                         2.278767
## EMG_sd                          13.921465
## EMG_range                       10.607432
## Resp_Volume                     16.883980
## Resp_range                      16.961546
## breath_rate                     12.709862
## Temp_chest_mean                 18.018281
## Temp_chest_sd                    9.543670
## Temp_chest_min                  18.337576
## Temp_chest_max                  17.299264
## Temp_chest_range                 9.176240
## Temp_chest_slope                 1.655409
##
## Predictors:  all_physio
## Accuracy is 100 %
## AUROC is 1
##
##                       MeanDecreaseAccuracy
## BVP_mean                         5.1902428
## BVP_sd                          12.9703019
## BVP_HR                          21.6696975
## EDA_wrist_mean                  13.3486438
## EDA_wrist_sd                    16.6281973
```

```
## EDA_wrist_min                  12.5954115
## EDA_wrist_max                  12.5525290
## EDA_wrist_range                21.9972161
## EDA_wrist_slope                 9.6959078
## Temp_wrist_mean               16.5087362
## Temp_wrist_sd                 10.2185320
## Temp_wrist_min                15.7221794
## Temp_wrist_max                15.8384320
## Temp_wrist_range               8.8685467
## Temp_wrist_slope               0.3267863
## ECG_mean                       5.2190745
## ECG_sd                        19.2078886
## ECG_HR                        32.0590820
## EDA_chest_mean                11.9365614
## EDA_chest_sd                  17.1995642
## EDA_chest_min                 13.3069963
## EDA_chest_max                 12.7629753
## EDA_chest_range               15.2868472
## EDA_chest_slope                2.3578981
## EMG_mean                       2.0624674
## EMG_sd                        11.1473068
## EMG_range                      8.4404319
## Resp_Volume                   15.4262581
## Resp_range                    13.3920321
## breath_rate                   11.5785588
## Temp_chest_mean               14.7093078
## Temp_chest_sd                  7.0202151
## Temp_chest_min                13.0545724
## Temp_chest_max                15.0042640
## Temp_chest_range               7.6417845
## Temp_chest_slope               0.2047934
##
## Predictors:  all_modalities
## Accuracy is 100 %
## AUROC is 1
##
##                  MeanDecreaseAccuracy
## ACC_wrist_mean                11.5297374
## ACC_wrist_sd                  18.6395392
## BVP_mean                       4.8201706
## BVP_sd                        10.9503515
## BVP_HR                        18.1121031
## EDA_wrist_mean                12.8646034
## EDA_wrist_sd                  15.2604242
## EDA_wrist_min                 12.9207128
## EDA_wrist_max                 12.6665262
## EDA_wrist_range               17.5800369
## EDA_wrist_slope                8.8611327
## Temp_wrist_mean               15.0648210
## Temp_wrist_sd                 10.3008997
## Temp_wrist_min                15.0049072
## Temp_wrist_max                15.5572699
## Temp_wrist_range               8.7126559
## Temp_wrist_slope              -0.9031157
```

```
## ACC_chest_mean          14.6436046
## ACC_chest_sd            22.2688727
## ECG_mean                 5.2207103
## ECG_sd                  17.5521278
## ECG_HR                  25.6752359
## EDA_chest_mean          12.6535387
## EDA_chest_sd            17.6136293
## EDA_chest_min           13.0799608
## EDA_chest_max           12.4364134
## EDA_chest_range         15.6900874
## EDA_chest_slope          4.5227018
## EMG_mean                 0.8656493
## EMG_sd                   8.3112467
## EMG_range                6.4201386
## Resp_Volume             12.1790078
## Resp_range              10.5988051
## breath_rate             10.7947002
## Temp_chest_mean         13.0184214
## Temp_chest_sd            7.7159645
## Temp_chest_min          13.3668074
## Temp_chest_max          13.6918899
## Temp_chest_range         6.9245280
## Temp_chest_slope        -0.3812264
```

```r
for (i in 2:length(predictor_vars)){
  cat("Predictors: personal +", predictor_vars[i], "\n")
  rf(train_sample, test_sample, c(eval(parse(text = predictor_vars[1])), eval(parse(text = predictor_va
}
```

```
## Predictors: personal + wrist_acc
## Accuracy is 78.36044 %
## AUROC is 0.5158664
##
## Predictors: personal + chest_acc
## Accuracy is 81.76236 %
## AUROC is 0.5953259
##
## Predictors: personal + wrist_bvp
## Accuracy is 95.9011 %
## AUROC is 0.9736111
##
## Predictors: personal + wrist_eda
## Accuracy is 87.6452 %
## AUROC is 0.7234398
##
## Predictors: personal + wrist_temp
## Accuracy is 77.64686 %
## AUROC is 0.4998932
##
## Predictors: personal + wrist_physio
## Accuracy is 99.07899 %
## AUROC is 0.9793834
##
## Predictors: personal + chest_ecg
## Accuracy is 80.01991 %
```

```
## AUROC is 0.8713675
##
## Predictors: personal + chest_eda
## Accuracy is 93.27912 %
## AUROC is 0.8498189
##
## Predictors: personal + chest_emg
## Accuracy is 77.58048 %
## AUROC is 0.5011859
##
## Predictors: personal + chest_resp
## Accuracy is 93.81016 %
## AUROC is 0.9119863
##
## Predictors: personal + chest_temp
## Accuracy is 77.35646 %
## AUROC is 0.5092704
##
## Predictors: personal + chest_physio
## Accuracy is 100 %
## AUROC is 1
##
##                      MeanDecreaseAccuracy
## Age                            10.1842887
## Height                         13.4742560
## Weight                         16.2952322
## Gender                          5.9430760
## ECG_mean                        9.9096055
## ECG_sd                         26.3261286
## ECG_HR                         41.1159521
## EDA_chest_mean                 16.3722350
## EDA_chest_sd                   28.8708497
## EDA_chest_min                  16.1055584
## EDA_chest_max                  15.5656027
## EDA_chest_range                27.4060284
## EDA_chest_slope                 5.7664941
## EMG_mean                        3.2901841
## EMG_sd                         14.8999984
## EMG_range                      12.5665622
## Resp_Volume                    19.4347022
## Resp_range                     21.5662945
## breath_rate                    16.6137066
## Temp_chest_mean                21.4057921
## Temp_chest_sd                  11.3477263
## Temp_chest_min                 19.2522584
## Temp_chest_max                 22.1404247
## Temp_chest_range                9.5071240
## Temp_chest_slope                0.4247978
##
## Predictors: personal + all_wrist
## Accuracy is 98.78029 %
## AUROC is 0.9726969
##
## Predictors: personal + all_chest
```

```
## Accuracy is 100 %
## AUROC is 1
##
##                  MeanDecreaseAccuracy
## Age                         10.0655628
## Height                      12.5650463
## Weight                      12.9337844
## Gender                       5.4902022
## ACC_chest_mean              19.9669458
## ACC_chest_sd                32.6726314
## ECG_mean                     7.0881633
## ECG_sd                      24.7299534
## ECG_HR                      31.8263929
## EDA_chest_mean              16.6494455
## EDA_chest_sd                27.0082500
## EDA_chest_min               16.1246031
## EDA_chest_max               15.7406402
## EDA_chest_range             25.5083904
## EDA_chest_slope              6.8338910
## EMG_mean                    -1.1948827
## EMG_sd                      12.1666646
## EMG_range                   11.5572864
## Resp_Volume                 16.9370236
## Resp_range                  16.6410147
## breath_rate                 13.1641246
## Temp_chest_mean             20.1403430
## Temp_chest_sd                8.2085096
## Temp_chest_min              17.1108865
## Temp_chest_max              18.7743842
## Temp_chest_range             8.7151822
## Temp_chest_slope             0.9414631
##
## Predictors: personal + all_physio
## Accuracy is 100 %
## AUROC is 1
##
##                  MeanDecreaseAccuracy
## Age                          8.4779440
## Height                       9.0921047
## Weight                       9.9320793
## Gender                       4.6431506
## BVP_mean                     6.4744976
## BVP_sd                      12.6151169
## BVP_HR                      18.8952805
## EDA_wrist_mean              12.6208762
## EDA_wrist_sd                14.9356950
## EDA_wrist_min               12.3449662
## EDA_wrist_max               12.9172447
## EDA_wrist_range             20.4316439
## EDA_wrist_slope              8.0766320
## Temp_wrist_mean             15.9757508
## Temp_wrist_sd               10.2613390
## Temp_wrist_min              15.7765025
## Temp_wrist_max              15.4282995
```

```
## Temp_wrist_range            8.0115150
## Temp_wrist_slope            0.6057994
## ECG_mean                    4.2731884
## ECG_sd                     20.8140657
## ECG_HR                     32.8912375
## EDA_chest_mean             12.2021209
## EDA_chest_sd               17.3834783
## EDA_chest_min              12.3317824
## EDA_chest_max              12.1374888
## EDA_chest_range            15.9742233
## EDA_chest_slope             5.0479395
## EMG_mean                    2.1504473
## EMG_sd                      9.9017597
## EMG_range                   6.5314745
## Resp_Volume                14.9979715
## Resp_range                 12.9124687
## breath_rate                12.1769804
## Temp_chest_mean            13.4629781
## Temp_chest_sd               7.8009873
## Temp_chest_min             12.5381746
## Temp_chest_max             13.7517824
## Temp_chest_range            7.4150509
## Temp_chest_slope           -1.3612837
##
## Predictors: personal + all_modalities
## Accuracy is 100 %
## AUROC is 1
##
##                  MeanDecreaseAccuracy
## Age                         9.7521556
## Height                      8.2137147
## Weight                     10.0052626
## Gender                      3.5823850
## ACC_wrist_mean             11.0690527
## ACC_wrist_sd               16.9938969
## BVP_mean                    4.8204221
## BVP_sd                     11.2240390
## BVP_HR                     16.9881589
## EDA_wrist_mean             11.7056152
## EDA_wrist_sd               14.8945730
## EDA_wrist_min              13.7271223
## EDA_wrist_max              12.6292392
## EDA_wrist_range            16.5418665
## EDA_wrist_slope             8.9030749
## Temp_wrist_mean            14.3668687
## Temp_wrist_sd               9.1321051
## Temp_wrist_min             14.2649729
## Temp_wrist_max             16.0602563
## Temp_wrist_range            7.1668184
## Temp_wrist_slope            1.2855250
## ACC_chest_mean             13.6029956
## ACC_chest_sd               23.3657412
## ECG_mean                    2.9865623
## ECG_sd                     17.7184739
```

```
## ECG_HR                     26.1565724
## EDA_chest_mean             12.1934769
## EDA_chest_sd               16.3688510
## EDA_chest_min              11.5781451
## EDA_chest_max              11.3053344
## EDA_chest_range            16.6042314
## EDA_chest_slope             3.8386206
## EMG_mean                    4.7092855
## EMG_sd                      7.8627211
## EMG_range                   7.1031113
## Resp_Volume                12.3879513
## Resp_range                 11.2621574
## breath_rate                 8.9101815
## Temp_chest_mean            13.7259716
## Temp_chest_sd               8.1659235
## Temp_chest_min             12.6297490
## Temp_chest_max             11.5809801
## Temp_chest_range            6.1703317
## Temp_chest_slope           -0.8928669
```

LDA

```
LDA <- function(train_sample, test_sample, predictors){
  model_lda <- lda(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), data = train_samp
  predict_lda <- predict(model_lda, test_sample)[[1]]
  cat("Accuracy is", mean(test_sample$label == predict_lda)*100, "% \n")
  cat("AUROC is", AUC(as.numeric(as.character(predict_lda)), as.numeric(as.character(test_sample$label)
}
```

```
for (i in 1:length(predictor_vars)){
  cat("Predictors: ", predictor_vars[i], "\n")
  LDA(train_sample, test_sample, eval(parse(text = predictor_vars[i])))
}
```

```
## Predictors:  personal
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors:  wrist_acc
## Accuracy is 77.41454 %
## AUROC is 0.509909
##
## Predictors:  chest_acc
## Accuracy is 84.20179 %
## AUROC is 0.6463596
##
## Predictors:  wrist_bvp
## Accuracy is 95.60239 %
## AUROC is 0.9015602
##
## Predictors:  wrist_eda
## Accuracy is 77.66346 %
## AUROC is 0.5
```

```
## 
## Predictors:  wrist_temp
## Accuracy is 77.57219 %
## AUROC is 0.4994124
## 
## Predictors:  wrist_physio
## Accuracy is 98.44839 %
## AUROC is 0.9880259
## 
## Predictors:  chest_ecg
## Accuracy is 100 %
## AUROC is 1
## 
## Predictors:  chest_eda
## Accuracy is 79.76269 %
## AUROC is 0.5469911
## 
## Predictors:  chest_emg
## Accuracy is 77.66346 %
## AUROC is 0.5
## 
## Predictors:  chest_resp
## Accuracy is 84.87388 %
## AUROC is 0.6628596
## 
## Predictors:  chest_temp
## Accuracy is 77.66346 %
## AUROC is 0.5
## 
## Predictors:  chest_physio
## Accuracy is 100 %
## AUROC is 1
## 
## Predictors:  all_wrist
## Accuracy is 97.44441 %
## AUROC is 0.9430581
## 
## Predictors:  all_chest
## Accuracy is 100 %
## AUROC is 1
## 
## Predictors:  all_physio
## Accuracy is 99.77597 %
## AUROC is 0.9985577
## 
## Predictors:  all_modalities
## Accuracy is 100 %
## AUROC is 1
## 
for (i in 2:length(predictor_vars)){
  cat("Predictors: personal +", predictor_vars[i], "\n")
  LDA(train_sample, test_sample, c(eval(parse(text = predictor_vars[1])), eval(parse(text = predictor_va
}
```

```
## Predictors: personal + wrist_acc
## Accuracy is 78.36874 %
## AUROC is 0.5160522
##
## Predictors: personal + chest_acc
## Accuracy is 79.02423 %
## AUROC is 0.5304606
##
## Predictors: personal + wrist_bvp
## Accuracy is 97.40292 %
## AUROC is 0.9667403
##
## Predictors: personal + wrist_eda
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors: personal + wrist_temp
## Accuracy is 77.50581 %
## AUROC is 0.498985
##
## Predictors: personal + wrist_physio
## Accuracy is 98.38201 %
## AUROC is 0.9698681
##
## Predictors: personal + chest_ecg
## Accuracy is 100 %
## AUROC is 1
##
## Predictors: personal + chest_eda
## Accuracy is 87.21374 %
## AUROC is 0.7137816
##
## Predictors: personal + chest_emg
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors: personal + chest_resp
## Accuracy is 95.5692 %
## AUROC is 0.9114026
##
## Predictors: personal + chest_temp
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors: personal + chest_physio
## Accuracy is 99.76767 %
## AUROC is 0.9947994
##
## Predictors: personal + all_wrist
## Accuracy is 94.2997 %
## AUROC is 0.8723997
##
## Predictors: personal + all_chest
## Accuracy is 97.26187 %
```

```
## AUROC is 0.9387073
##
## Predictors: personal + all_physio
## Accuracy is 100 %
## AUROC is 1
##
## Predictors: personal + all_modalities
## Accuracy is 98.84666 %
## AUROC is 0.9741828
##
```

Logistic Regression

```r
logistic <- function(train_sample, test_sample, predictors){
  model_logistic <- glm(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), family=binom
  predict_logistic <- predict(model_logistic, test_sample)
  predict_logistic <- ifelse(predict_logistic > 0.5,1,0)
  cat("Accuracy is", mean(test_sample$label == predict_logistic)*100, "% \n")
  cat("AUROC is", AUC(as.numeric(as.character(predict_logistic)), as.numeric(as.character(test_sample$la
}
```

```r
for (i in 1:length(predictor_vars)){
  cat("Predictors: ", predictor_vars[i], "\n")
  logistic(train_sample, test_sample, eval(parse(text = predictor_vars[i])))
}
```

```
## Predictors:  personal
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors:  wrist_acc
## Accuracy is 78.36044 %
## AUROC is 0.5156018
##
## Predictors:  chest_acc
## Accuracy is 81.82874 %
## AUROC is 0.5932392
##
## Predictors:  wrist_bvp
## Accuracy is 93.21274 %
## AUROC is 0.8480684
##
## Predictors:  wrist_eda
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors:  wrist_temp
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors:  wrist_physio
## Accuracy is 98.19947 %
## AUROC is 0.9767642
```

```
##
## Predictors:  chest_ecg
## Accuracy is 100 %
## AUROC is 1
##
## Predictors:  chest_eda
## Accuracy is 79.4391 %
## AUROC is 0.5397474
##
## Predictors:  chest_emg
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors:  chest_resp
## Accuracy is 82.49253 %
## AUROC is 0.6080981
##
## Predictors:  chest_temp
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors:  chest_physio
## Accuracy is 99.85065 %
## AUROC is 0.9966568
##
## Predictors:  all_wrist
## Accuracy is 97.73482 %
## AUROC is 0.9495588
##
## Predictors:  all_chest
## Accuracy is 99.96681 %
## AUROC is 0.9992571
##
## Predictors:  all_physio
## Accuracy is 99.95022 %
## AUROC is 0.9996795
##
## Predictors:  all_modalities
## Accuracy is 99.95851 %
## AUROC is 0.9997329
##
```

```r
for (i in 2:length(predictor_vars)){
  cat("Predictors: personal +", predictor_vars[i], "\n")
  logistic(train_sample, test_sample, c(eval(parse(text = predictor_vars[1])), eval(parse(text = predict
}
```

```
## Predictors: personal + wrist_acc
## Accuracy is 78.35214 %
## AUROC is 0.515416
##
## Predictors: personal + chest_acc
## Accuracy is 77.98706 %
## AUROC is 0.5072437
##
```

```
## Predictors: personal + wrist_bvp
## Accuracy is 97.85928 %
## AUROC is 0.9821161
##
## Predictors: personal + wrist_eda
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors: personal + wrist_temp
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors: personal + wrist_physio
## Accuracy is 94.57351 %
## AUROC is 0.9650641
##
## Predictors: personal + chest_ecg
## Accuracy is 100 %
## AUROC is 1
##
## Predictors: personal + chest_eda
## Accuracy is 96.60637 %
## AUROC is 0.9454695
##
## Predictors: personal + chest_emg
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors: personal + chest_resp
## Accuracy is 92.30833 %
## AUROC is 0.829411
##
## Predictors: personal + chest_temp
## Accuracy is 77.66346 %
## AUROC is 0.5
##
## Predictors: personal + chest_physio
## Accuracy is 99.94192 %
## AUROC is 0.9986999
##
## Predictors: personal + all_wrist
## Accuracy is 98.18287 %
## AUROC is 0.9880366
##
## Predictors: personal + all_chest
## Accuracy is 99.75108 %
## AUROC is 0.9944279
##
## Predictors: personal + all_physio
## Accuracy is 89.85231 %
## AUROC is 0.9346688
##
## Predictors: personal + all_modalities
## Accuracy is 91.51178 %
```

```
## AUROC is 0.9453526
##
```

We choose the Random Forest

Cross-Validation

- We got 100 percent accuracy for predictors wrist_physio, chest_ecg, chest_physio, all_wrist, all_chest, all_physio, all_modalities

- Let us do cross validation.

RF - no personal

```r
# cv <- data.frame(matrix(ncol = 16, nrow = 14))
# rownames(cv) <- c("wrist_physio acc", "wrist_physio auc", "chest_ecg acc", "chest_ecg auc", "chest_ph
# colnames(cv) <- c("predictor", c(1:15))
# cv$predictor <- c("wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "chest_physio", "chest_ph

cv <- data.frame(matrix(ncol = 16, nrow = 12))
rownames(cv) <- c("wrist_physio acc", "wrist_physio auc", "chest_physio acc", "chest_physio auc", "all_w
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_physio", "wrist_physio", "chest_physio", "chest_physio", "all_wrist", "all_wris
```

```r
for(i in 1:6){
  for (j in 1:15){
    set.seed(1)
    test = subset(data, id == j)
    train = subset(data, id != j)
    test_sample = test

    # Run this instead to train on the full train set
    # test_sample = train
    train_indices = sample(nrow(train), 1000)
    train_sample = train[train_indices,]

    predictor = cv$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_rf <- randomForest(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), ntree 
    predict_rf <- predict(model_rf, test_sample)
    acc = mean(test_sample$label == predict_rf)*100
    auc = AUC(as.numeric(as.character(predict_rf)), as.numeric(as.character(test_sample$label)))

    cv[(i-1)*2+1,j+1] <- acc
    cv[(i-1)*2+2,j+1] <- auc
  }
}
```

```r
cv
```

```
##                      predictor         1         2         3         4
## wrist_physio acc  wrist_physio 83.3592939 82.9386712 97.1127946 93.9554965
## wrist_physio auc  wrist_physio  0.6104809  0.7544241  0.9324803  0.9609746
```

```
## chest_physio acc    chest_physio 76.5143648 93.3219761 85.8164983 99.1614082
## chest_physio auc    chest_physio  0.6034778  0.8468750  0.6683071  0.9946640
## all_wrist acc           all_wrist 83.8352371 87.8960818 95.5303030 91.9212886
## all_wrist auc           all_wrist  0.6203252  0.8349971  0.8954724  0.8968599
## all_chest acc           all_chest 76.5230183 94.2844974 89.8653199 97.4925274
## all_chest auc           all_chest  0.5164908  0.8765510  0.7629921  0.9840448
## all_physio acc         all_physio 80.3911388 91.8313458 92.8114478 99.5848555
## all_physio auc         all_physio  0.5394309  0.8255123  0.8318898  0.9973584
## all_modalities acc all_modalities 80.7892004 93.3645656 96.1700337 99.3855862
## all_modalities auc all_modalities  0.5487805  0.8641897  0.9104331  0.9960904
##                               5          6          7          8          9
## wrist_physio acc     75.6189361 93.9424364 82.1048253 87.2993311 80.4181582
## wrist_physio auc      0.7770064  0.9348884  0.5986940  0.7056202  0.8655426
## chest_physio acc     98.5530278 98.3768407 33.1364393 81.5719064 77.0663846
## chest_physio auc      0.9688138  0.9729071  0.5434130  0.6369333  0.5143230
## all_wrist acc        77.7768484 96.3855422 90.6405990 86.7391304 89.2694435
## all_wrist auc         0.7748248  0.9535592  0.7943690  0.6927762  0.9297807
## all_chest acc        97.7751756 97.3644578 78.0782030 84.1555184 78.2053368
## all_chest auc         0.9500959  0.9712960  0.8421778  0.6560739  0.5381034
## all_physio acc       98.7370358 97.1552878 96.3227953 85.3762542 99.6257729
## all_physio auc        0.9755441  0.9659870  0.9240560  0.6673687  0.9975511
## all_modalities acc   98.5362998 97.1636546 95.0415973 85.6187291 99.2596811
## all_modalities auc    0.9705121  0.9819527  0.9135503  0.6718649  0.9912226
##                              10         11         12         13          14
## wrist_physio acc     84.4981782 92.6679907 77.6286353 91.4106376  98.2907401
## wrist_physio auc      0.8424588  0.8679592  0.5000000  0.8282728   0.9617385
## chest_physio acc     83.6618085 96.8801721 91.2254536 79.3277172 100.0000000
## chest_physio auc      0.8463183  0.9800064  0.8052071  0.5439140   1.0000000
## all_wrist acc        84.8459755 94.2154916 77.6286353 90.6755864  96.9382675
## all_wrist auc         0.8553947  0.9108701  0.5000000  0.8120556   0.9314636
## all_chest acc        87.9099039 93.6444886 96.6028668 79.6663363 100.0000000
## all_chest auc         0.9028091  0.9585942  0.9408149  0.5513848   1.0000000
## all_physio acc       87.2391520 58.1098974 78.7057751 82.4661381 100.0000000
## all_physio auc        0.9176464  0.7315443  0.5240741  0.6131560   1.0000000
## all_modalities acc   89.6488904 63.1247931 77.7197779 88.6273538 100.0000000
## all_modalities auc    0.9331979  0.7636826  0.5020370  0.7490889   1.0000000
##                              15
## wrist_physio acc     92.4176921
## wrist_physio auc      0.9070765
## chest_physio acc     91.0043232
## chest_physio auc      0.8532255
## all_wrist acc        91.4033921
## all_wrist auc         0.9002815
## all_chest acc        90.3142667
## all_chest auc         0.8090987
## all_physio acc       94.1137346
## all_physio auc        0.9013440
## all_modalities acc   93.3072830
## all_modalities auc    0.9050156
```

```r
rowMeans(cv[,c(2:16)])
```

```
##   wrist_physio acc   wrist_physio auc   chest_physio acc   chest_physio auc
##         87.5775878          0.8031745         85.7078881          0.7852257
##      all_wrist acc      all_wrist auc      all_chest acc      all_chest auc
```

```
##       89.0467882            0.8202020        89.4587945            0.8173685
##    all_physio acc    all_physio auc all_modalities acc all_modalities auc
##       89.4980421            0.8274975        90.5171631            0.8467746
```

```r
rowSds(as.matrix(cv[,c(2:16)]))
```

```
## [1]  7.1862230  0.1435777 16.7694802  0.1828744  6.0520693  0.1285396
## [7]  8.2374164  0.1726583 11.3359947  0.1705853 10.2080964  0.1635724
```

RF - with personal

```r
cv <- data.frame(matrix(ncol = 16, nrow = 12))
rownames(cv) <- c("wrist_physio acc", "wrist_physio auc", "chest_physio acc", "chest_physio auc", "all_w
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_physio", "wrist_physio", "chest_physio", "chest_physio", "all_wrist", "all_wris
```

```r
for(i in 1:6){
  for (j in 1:15){
    set.seed(1)
    test = subset(data, id == j)
    train = subset(data, id != j)
    test_sample = test

    # Run this instead to train on the full train set
    # test_sample = train
    train_indices = sample(nrow(train), 1000)
    train_sample = train[train_indices,]

    predictor = cv$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_rf <- randomForest(as.formula(paste("label ~ ", paste(c(eval(parse(text = predictor_vars[1]))
    predict_rf <- predict(model_rf, test_sample)
    acc = mean(test_sample$label == predict_rf)*100
    auc = AUC(as.numeric(as.character(predict_rf)), as.numeric(as.character(test_sample$label)))

    cv[(i-1)*2+1,j+1] <- acc
    cv[(i-1)*2+2,j+1] <- auc
  }
}
```

```r
cv
```

```
##                          predictor          1          2           3          4
## wrist_physio acc      wrist_physio 83.7573555 81.5843271 100.0000000 93.6482896
## wrist_physio auc      wrist_physio  0.6236858  0.7661867   1.0000000  0.9584560
## chest_physio acc      chest_physio 78.6431291 93.2879046  87.5757576 99.1946197
## chest_physio auc      chest_physio  0.6023202  0.8460937   0.7094488  0.9948753
## all_wrist acc            all_wrist 84.2159917 80.4088586 100.0000000 92.1454666
## all_wrist auc            all_wrist  0.6292683  0.8133187   1.0000000  0.9112553
## all_chest acc            all_chest 77.0076151 95.1703578  92.6599327 97.6336765
## all_chest auc            all_chest  0.5253521  0.9063002   0.8283465  0.9849429
## all_physio acc          all_physio 79.6036691 92.0102215  94.0572391 99.2361342
## all_physio auc          all_physio  0.5209350  0.8296139   0.8610236  0.9951395
## all_modalities acc all_modalities 81.3430253 93.5264055  96.6077441 99.3523746
## all_modalities auc all_modalities  0.5617886  0.8671964   0.9206693  0.9958791
```

```
##                                  5          6          7          8          9
## wrist_physio acc       76.8568083 95.1639893 80.9983361 87.6505017 81.6221933
## wrist_physio auc        0.7711681  0.9469232  0.5738806  0.7143217  0.8679396
## chest_physio acc       99.0883239 97.9752343 46.0149750 82.7591973 77.3917995
## chest_physio auc        0.9813992  0.9704938  0.6233557  0.6359325  0.5208621
## all_wrist acc          75.2258280 95.9337349 89.8003328 86.1287625 91.2870159
## all_wrist auc           0.7236697  0.9518210  0.7720669  0.6814387  0.9429834
## all_chest acc          98.3857477 96.9628514 78.4775374 83.0602007 78.2866905
## all_chest auc           0.9644121  0.9656150  0.8439492  0.6302648  0.5398276
## all_physio acc         99.3726999 98.5107095 91.9301165 84.3561873 99.6583144
## all_physio auc          0.9886320  0.9747534  0.8190299  0.6433038  0.9977641
## all_modalities acc     98.3522917 95.7914993 94.5008319 86.3545151 99.3003580
## all_modalities auc      0.9660036  0.9732219  0.9091394  0.6893407  0.9894628
##                                 10         11         12         13          14
## wrist_physio acc       83.4051010 92.3535253 77.6286353 91.6501487  97.867574
## wrist_physio auc        0.8327969  0.8714880  0.5000000  0.8356181   0.952266
## chest_physio acc       89.1189135 95.4981794 88.9800315 79.3111992 100.000000
## chest_physio auc        0.9022671  0.9711498  0.7537037  0.5435496   1.000000
## all_wrist acc          85.0281550 96.5243297 77.6286353 91.7162207  99.560239
## all_wrist auc           0.8595692  0.9694775  0.5000000  0.8346283   0.990156
## all_chest acc          93.3918516 93.2224429 96.8100091 79.5507103 100.000000
## all_chest auc           0.9457496  0.9565655  0.9388537  0.5488338   1.000000
## all_physio acc         86.7174561 53.2108573 78.2417765 82.6560951 100.000000
## all_physio auc          0.9142796  0.7001485  0.5137037  0.6173469   1.000000
## all_modalities acc     88.7048692 54.4521682 77.6286353 88.5365048 100.000000
## all_modalities auc      0.9271056  0.7081035  0.5000000  0.7470845   1.000000
##                                 15
## wrist_physio acc       89.7988028
## wrist_physio auc        0.8169310
## chest_physio acc       91.6694380
## chest_physio auc        0.8618577
## all_wrist acc          89.8154307
## all_wrist auc           0.8492987
## all_chest acc          90.2976388
## all_chest auc           0.8059171
## all_physio acc         93.9142002
## all_physio auc          0.8971946
## all_modalities acc     93.7312936
## all_modalities auc      0.9130059
```

```r
rowMeans(cv[,c(2:16)])
```

```
##    wrist_physio acc    wrist_physio auc    chest_physio acc    chest_physio auc
##          87.5990392           0.8021108          87.1005802           0.7944873
##       all_wrist acc       all_wrist auc       all_chest acc       all_chest auc
##          89.0279334           0.8285968          90.0611508           0.8256620
##      all_physio acc      all_physio auc  all_modalities acc  all_modalities auc
##          88.8983784           0.8181912          89.8788344           0.8445334
```

```r
rowSds(as.matrix(cv[,c(2:16)]))
```

```
##  [1]  7.3655939  0.1472855 13.7463547  0.1765589  7.5628633  0.1453211
##  [7]  8.3465123  0.1758463 12.4112709  0.1759760 11.8805796  0.1630575
```

LDA - no personal

```r
cv <- data.frame(matrix(ncol = 16, nrow = 16))
rownames(cv) <- c("wrist_bvp acc", "wrist_bvp auc", "wrist_physio acc", "wrist_physio auc", "chest_ecg a
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp","wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "ch
```

```r
for(i in 1:8){
  for (j in 1:15){
    set.seed(1)
    test = subset(data, id == j)
    train = subset(data, id != j)

    test_sample = test
    # Run this instead to train on the full train set
    # test_sample = train
    train_indices = sample(nrow(train), 1000)
    train_sample = train[train_indices,]

    predictor = cv$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), data = train_sa
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$label == predict_lda)*100
    auc = AUC(as.numeric(as.character(predict_lda)), as.numeric(as.character(test_sample$label)))

    cv[(i-1)*2+1,j+1] <- acc
    cv[(i-1)*2+2,j+1] <- auc
  }
}
```

```r
cv
```

```
##                     predictor          1          2          3          4
## wrist_bvp acc        wrist_bvp 75.9865005 81.7206133 87.2979798 90.0448356
## wrist_bvp auc        wrist_bvp  0.5141207  0.5808594  0.7029528  0.9366547
## wrist_physio acc  wrist_physio 76.8345448 85.0085179 94.6212121 91.6555961
## wrist_physio auc  wrist_physio  0.4934099  0.7211801  0.8742126  0.9469041
## chest_ecg acc        chest_ecg 78.7123572 81.8824532 78.6195286 78.5868482
## chest_ecg auc        chest_ecg  0.5000000  0.5845703  0.5000000  0.5001938
## chest_physio acc  chest_physio 77.6825891 93.3304940 84.4191919 93.7313185
## chest_physio auc  chest_physio  0.4937552  0.8796058  0.6356299  0.9598301
## all_wrist acc        all_wrist 77.3537556 87.6320273 87.7020202 83.0039854
## all_wrist auc        all_wrist  0.5087189  0.7771110  0.7124016  0.6409327
## all_chest acc        all_chest 76.0816892 92.4275980 88.2912458 95.6824975
## all_chest auc        all_chest  0.4834376  0.8520012  0.7261811  0.9718226
## all_physio acc      all_physio 77.5354794 90.6643952 92.9966330 93.0338758
## all_physio auc      all_physio  0.4925242  0.8270646  0.8362205  0.9556741
## all_modalities acc all_modalities 77.4316372 91.6865417 94.4276094 97.3679841
## all_modalities auc all_modalities  0.4918646  0.8155722  0.8712615  0.9831114
##                              5          6          7          8          9
## wrist_bvp acc        78.2535965 86.8473896 86.0149750 80.5936455 62.5772860
## wrist_bvp auc         0.5000000  0.6929688  0.6866467  0.5701439  0.7441464
## wrist_physio acc     90.3061224 94.8042169 78.6688852 78.3277592 86.2512203
## wrist_physio auc      0.8118319  0.8807000  0.5216418  0.5048396  0.8765411
```

```
## chest_ecg acc      78.2535965 81.6683400 22.2961730 78.4280936 77.3836642
## chest_ecg auc       0.5000000  0.5720703  0.5000000  0.5000000  0.5206897
## chest_physio acc   95.0485112 99.1633199 22.0133111 78.5869565 77.1721445
## chest_physio auc    0.8951801  0.9946763  0.4908630  0.5045251  0.5162069
## all_wrist acc       86.9688859 93.3149264 88.9267887 79.6739130 87.5366092
## all_wrist auc        0.7313517  0.8460764  0.7539407  0.5318263  0.8445515
## all_chest acc       91.2763466 99.6736948 22.9118136 78.1856187 77.1233322
## all_chest auc        0.8228914  0.9979238  0.5039615  0.5063218  0.5189861
## all_physio acc      94.4212111 99.1800535 23.8186356 78.2023411 77.7822974
## all_physio auc       0.9156124  0.9947828  0.5070029  0.4985608  0.5291379
## all_modalities acc  90.3395785 97.2891566 45.6073211 78.3444816 79.9381712
## all_modalities auc   0.8053801  0.9827513  0.6219298  0.5042437  0.5764961
##                             10         11         12         13         14
## wrist_bvp acc       79.2232527 71.9381000  99.1465739 86.9177403  95.6023896
## wrist_bvp auc        0.5394387  0.7745944   0.9809259  0.7305644   0.9015602
## wrist_physio acc    84.0758529 54.9735187  91.8220234 85.4971919  98.4483903
## wrist_physio auc     0.6528961  0.7114446   0.8172222  0.8017638   0.9880259
## chest_ecg acc      100.0000000 87.7192982 100.0000000 77.3372977 100.0000000
## chest_ecg auc        1.0000000  0.7206325   1.0000000  0.5000000   1.0000000
## chest_physio acc    81.6495528 97.0787819  97.4148645 79.3855302 100.0000000
## chest_physio auc     0.8805303  0.9428768   0.9755721  0.5453183   1.0000000
## all_wrist acc       75.5631004 60.2035750 100.0000000 84.9686158  97.4444076
## all_wrist auc        0.8012234  0.7449618   1.0000000  0.7412793   0.9430581
## all_chest acc       82.2209341 85.5097650  98.9311459 82.7799802 100.0000000
## all_chest auc        0.8852608  0.8423682   0.9882383  0.6225278   1.0000000
## all_physio acc      75.4885724 62.0655412  97.8291491 75.7680872  99.7759708
## all_physio auc       0.7270767  0.7568944   0.9514815  0.6541000   0.9985577
## all_modalities acc  79.6372971 66.9480305  99.7348579 88.2061447 100.0000000
## all_modalities auc   0.8685870  0.7881841   0.9981604  0.7488133   1.0000000
##                             15
## wrist_bvp acc       96.9155304
## wrist_bvp auc        0.9358575
## wrist_physio acc    94.4379781
## wrist_physio auc     0.8843361
## chest_ecg acc      100.0000000
## chest_ecg auc        1.0000000
## chest_physio acc    91.8772863
## chest_physio auc     0.8330945
## all_wrist acc       99.0771533
## all_wrist auc        0.9831724
## all_chest acc       88.1360160
## all_chest auc        0.7936964
## all_physio acc      97.1150648
## all_physio auc       0.9400069
## all_modalities acc  98.1709345
## all_modalities auc   0.9852420
```

```r
rowMeans(cv[,c(2:16)])
```

```
##      wrist_bvp acc       wrist_bvp auc    wrist_physio acc    wrist_physio auc
##         83.9386939          0.7194290          85.7155354          0.7657967
##      chest_ecg acc       chest_ecg auc    chest_physio acc    chest_physio auc
##         81.3925100          0.6598771          84.5702568          0.7698443
##      all_wrist acc       all_wrist auc        all_chest acc        all_chest auc
##         85.9579842          0.7707071          83.9487785          0.7677079
```

```
##      all_physio acc     all_physio auc all_modalities acc all_modalities auc
##          82.3784872          0.7723132         85.6753164          0.8027732
```

```r
rowSds(as.matrix(cv[,c(2:16)]))
```

```
##  [1]  9.7839591  0.1615969 10.7752029  0.1601589 18.8822983  0.2200719
##  [7] 19.2411631  0.2092667 10.2403113  0.1436337 18.7140721  0.1947220
## [13] 19.7771165  0.1929367 14.9253686  0.1807307
```

LDA - with personal

```r
cv <- data.frame(matrix(ncol = 16, nrow = 16))
rownames(cv) <- c("wrist_bvp acc", "wrist_bvp auc", "wrist_physio acc", "wrist_physio auc", "chest_ecg a
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp","wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "ch
```

```r
for(i in 1:8){
  for (j in 1:15){
    set.seed(1)
    test = subset(data, id == j)
    train = subset(data, id != j)

    test_sample = test
    # Run this instead to train on the full train set
    # test_sample = train
    train_indices = sample(nrow(train), 1000)
    train_sample = train[train_indices,]

    predictor = cv$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(c(eval(parse(text = predictor_vars[1])), predict
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$label == predict_lda)*100
    auc = AUC(as.numeric(as.character(predict_lda)), as.numeric(as.character(test_sample$label)))

    cv[(i-1)*2+1,j+1] <- acc
    cv[(i-1)*2+2,j+1] <- auc
  }
}
```

```r
cv
```

```
##                       predictor          1          2          3          4
## wrist_bvp acc         wrist_bvp 79.7248183 82.1976150 80.1936027 96.1059449
## wrist_bvp auc         wrist_bvp  0.6283199  0.5978533  0.5368110  0.9544998
## wrist_physio acc   wrist_physio 77.1720318 86.0732538 84.9494949 82.6884756
## wrist_physio auc   wrist_physio  0.5154236  0.7491153  0.6480315  0.5959302
## chest_ecg acc         chest_ecg 78.7123572 80.6473595 93.9225589 85.8020591
## chest_ecg auc         chest_ecg  0.5000000  0.5562500  0.8578740  0.6686047
## chest_physio acc   chest_physio 78.5912080 92.5724020 99.7979798 98.8708070
## chest_physio auc   chest_physio  0.4992304  0.8619413  0.9982853  0.9902775
## all_wrist acc         all_wrist 77.7518172 89.8722317 83.6531987 78.5785453
## all_wrist auc         all_wrist  0.5137683  0.8407318  0.6177165  0.5000000
## all_chest acc         all_chest 77.6998962 92.3168654 98.6195286 98.6632348
## all_chest auc         all_chest  0.4935686  0.8567862  0.9909339  0.9881109
```

```
## all_physio acc        all_physio 78.5392870 91.1413969 99.7138047 98.1899701
## all_physio auc         all_physio  0.4989006  0.8236358  0.9933071  0.9666328
## all_modalities acc all_modalities 78.3835237 90.8943782 97.0959596 81.3766191
## all_modalities auc all_modalities  0.4979112  0.7931828  0.9368161  0.5691162
##                                 5          6          7          8          9
## wrist_bvp acc          77.5677484 83.1492637 86.6971714 80.8946488 61.5278230
## wrist_bvp auc           0.5002004  0.6066406  0.7869539  0.5938394  0.7379940
## wrist_physio acc       86.8183339 90.0100402 85.3410982 78.1856187 81.2642369
## wrist_physio auc        0.9073051  0.7673652  0.6712687  0.5012640  0.8596383
## chest_ecg acc          78.2535965 81.5595716 22.2961730 78.4280936 77.3023104
## chest_ecg auc           0.5000000  0.5695313  0.5000000  0.5000000  0.5189655
## chest_physio acc       94.3793911 49.0294511 21.8136439 78.4615385 77.1721445
## chest_physio auc        0.8760461  0.6756814  0.4867845  0.5021801  0.5162069
## all_wrist acc          94.6637671 91.7503347 90.7237937 79.4648829 80.8981451
## all_wrist auc           0.9556281  0.8078481  0.7968999  0.5255764  0.8368634
## all_chest acc          91.0170626 54.9196787 22.6622296 78.7541806 77.2372275
## all_chest auc           0.8073481  0.7131601  0.5023555  0.5084011  0.5184204
## all_physio acc         93.7939110 78.8319946 22.7787022 78.2525084 77.8148389
## all_physio auc          0.9459042  0.8653109  0.5031049  0.4988806  0.5298276
## all_modalities acc     94.5299431 75.6358768 27.6455907 78.4698997 82.1021803
## all_modalities auc      0.9354707  0.8449744  0.5337567  0.5019524  0.6248609
##                                10         11          12         13          14
## wrist_bvp acc          80.0596224 75.4799735  98.8814318 85.9431781  97.4029207
## wrist_bvp auc           0.5711734  0.7860695   0.9750000  0.6898688   0.9667403
## wrist_physio acc       81.3183173 49.9420722  93.0897340 87.7023456  98.3820113
## wrist_physio auc        0.5933778  0.6792003   0.8455556  0.7445256   0.9698681
## chest_ecg acc          99.4120570 91.2777226  99.7431436 74.4301288 100.0000000
## chest_ecg auc           0.9869485  0.8082071   0.9983456  0.5493503   1.0000000
## chest_physio acc       81.7406426 97.5008275  97.4811501 80.1205814  99.7676734
## chest_physio auc        0.8815093  0.9806034   0.9837763  0.5677189   0.9947994
## all_wrist acc          91.2305399 52.0523006 100.0000000 87.1820284  94.2997013
## all_wrist auc           0.8417074  0.6927238   1.0000000  0.7450262   0.8723997
## all_chest acc          81.5336204 83.1761006  98.4920043 84.1674926  97.2618653
## all_chest auc           0.8808251  0.8758213   0.9902871  0.6571334   0.9387073
## all_physio acc         69.3689964 54.3363125  99.9917143 75.3055831 100.0000000
## all_physio auc          0.5927957  0.7073611   0.9998148  0.6588390   1.0000000
## all_modalities acc     80.8877112 57.1333995  99.6602867 84.4895937  98.8466645
## all_modalities auc      0.8591855  0.7252864   0.9978119  0.7295514   0.9741828
##                                15
## wrist_bvp acc          97.3312271
## wrist_bvp auc           0.9445021
## wrist_physio acc       98.5700033
## wrist_physio auc        0.9703810
## chest_ecg acc         100.0000000
## chest_ecg auc           1.0000000
## chest_physio acc       87.4127037
## chest_physio auc        0.7382434
## all_wrist acc          98.6780845
## all_wrist auc           0.9725104
## all_chest acc          83.4885268
## all_chest auc           0.6621926
## all_physio acc         97.7635517
## all_physio auc          0.9534924
## all_modalities acc     96.1007649
```

```
## all_modalities auc    0.9300215
```

```r
rowMeans(cv[,c(2:16)])
```

```
##      wrist_bvp acc      wrist_bvp auc    wrist_physio acc    wrist_physio auc
##         84.2104660         0.7250978          84.1004712           0.7345500
##      chest_ecg acc      chest_ecg auc    chest_physio acc    chest_physio auc
##         82.7858088         0.7009385          82.3141430           0.7702189
##      all_wrist acc      all_wrist auc      all_chest acc        all_chest auc
##         86.0532914         0.7679600          81.3339676           0.7589368
##     all_physio acc     all_physio auc all_modalities acc all_modalities auc
##         81.0548381         0.7691872          81.5501594           0.7636054
```

```r
rowSds(as.matrix(cv[,c(2:16)]))
```

```
##  [1] 10.0592121  0.1684166 11.4115701  0.1526739 19.2408793  0.2141612
##  [7] 21.4648699  0.2093946 11.8006313  0.1655395 19.9184292  0.1911077
## [13] 21.0640488  0.2060524 18.7123260  0.1802084
```

Full Dataset

LDA - no personal

```r
cv <- data.frame(matrix(ncol = 16, nrow = 16))
rownames(cv) <- c("wrist_bvp acc", "wrist_bvp auc", "wrist_physio acc", "wrist_physio auc", "chest_ecg a
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp","wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "ch
```

```r
for(i in 1:8){
  for (j in 1:15){
    set.seed(1)
    test = subset(data, id == j)
    train = subset(data, id != j)

    test_sample = test
    train_sample = train

    predictor = cv$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), data = train_sa
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$label == predict_lda)*100
    auc = AUC(as.numeric(as.character(predict_lda)), as.numeric(as.character(test_sample$label)))

    cv[(i-1)*2+1,j+1] <- acc
    cv[(i-1)*2+2,j+1] <- auc
  }
}
```

```r
cv
```

```
##                       predictor         1         2         3         4
## wrist_bvp acc         wrist_bvp 76.4105227 81.2010221 83.5185185 90.7339754
## wrist_bvp auc         wrist_bvp  0.5279354  0.5689453  0.6145669  0.9410397
```

```
## wrist_physio acc      wrist_physio 76.6009000 84.7103918 93.6700337 91.8050482
## wrist_physio auc      wrist_physio  0.4904429  0.7106822  0.8519685  0.9478550
## chest_ecg acc            chest_ecg 78.7123572 80.4770017 78.6195286 78.5785453
## chest_ecg auc            chest_ecg  0.5000000  0.5523438  0.5000000  0.5000000
## chest_physio acc      chest_physio 78.0806507 93.6712095 87.9461279 94.6446363
## chest_physio auc      chest_physio  0.5044394  0.8867141  0.7181102  0.9647958
## all_wrist acc            all_wrist 77.4749048 87.2402044 86.6582492 84.7392893
## all_wrist auc            all_wrist  0.5074125  0.7693942  0.6879921  0.6708640
## all_chest acc            all_chest 76.9903081 92.8875639 89.6632997 96.7784789
## all_chest auc            all_chest  0.4973650  0.8629706  0.7582677  0.9782326
## all_physio acc          all_physio 77.4922118 91.0562181 93.2828283 92.1454666
## all_physio auc          all_physio  0.4922493  0.8478801  0.8429134  0.9500211
## all_modalities acc all_modalities 77.5354794 93.5349233 92.5841751 96.5044836
## all_modalities auc all_modalities  0.4925242  0.8583776  0.8307310  0.9777578
##                                 5          6          7          8          9
## wrist_bvp acc          78.2535965 84.2034806 85.3660566 79.9832776 62.9596486
## wrist_bvp auc           0.5000000  0.6312500  0.6800765  0.5554346  0.7465294
## wrist_physio acc       90.7075945 95.8668005 78.5108153 78.4782609 85.9502115
## wrist_physio auc        0.8078704  0.9047943  0.5180970  0.5074850  0.8743330
## chest_ecg acc          78.2535965 81.2667336 22.2961730 78.4280936 77.2046860
## chest_ecg auc           0.5000000  0.5626953  0.5000000  0.5000000  0.5168966
## chest_physio acc       95.3579793 99.5147256 22.2795341 78.5117057 77.0501139
## chest_physio auc        0.9014623  0.9969123  0.4992278  0.5019380  0.5136207
## all_wrist acc          86.0070258 92.7459839 88.9018303 79.7909699 87.6830459
## all_wrist auc           0.6842405  0.8310903  0.7541792  0.5379114  0.8471782
## all_chest acc          92.7985948 99.5230924 22.7371048 78.1688963 77.1802799
## all_chest auc           0.8481708  0.9969655  0.5028373  0.5049507  0.5182861
## all_physio acc         95.7009033 99.3306560 22.9450915 78.0518395 78.4005857
## all_physio auc          0.9333708  0.9957411  0.5041756  0.4976013  0.5422414
## all_modalities acc 91.6527267 97.4062918 44.8752080 78.4531773 81.6791409
## all_modalities auc  0.8187696  0.9834966  0.6087047  0.5024078  0.6125584
##                                10          11          12          13          14
## wrist_bvp acc           79.2066910 74.6193313  99.7265722 87.4463165  97.0295387
## wrist_bvp auc            0.5414179  0.7721704   0.9938889  0.7411957   0.9463414
## wrist_physio acc        83.6535277 47.5504800  93.4957329 88.1978857  98.5396615
## wrist_physio auc         0.6523870  0.6638736   0.8546296  0.8035083   0.9904660
## chest_ecg acc          100.0000000 88.4640847 100.0000000 77.3372977 100.0000000
## chest_ecg auc            1.0000000  0.7375753   1.0000000  0.5000000   1.0000000
## chest_physio acc        81.5750248 96.5988083  97.7545778 79.3607532 100.0000000
## chest_physio auc         0.8793974  0.9385839   0.9852738  0.5446429   1.0000000
## all_wrist acc           77.4842663 52.3502152 100.0000000 87.2481004  98.5728510
## all_wrist auc            0.8158384  0.6946330   1.0000000  0.7628441   0.9683181
## all_chest acc           81.9559457 84.2767296  98.9062888 84.4565576 100.0000000
## all_chest auc            0.8835507  0.8409567   0.9928237  0.6581005   1.0000000
## all_physio acc          75.4968533 53.3018868  99.6271439 82.5239511  99.1536674
## all_physio auc           0.7313023  0.7007319   0.9916667  0.7123345   0.9945513
## all_modalities acc   79.6869824 62.7358491 100.0000000 88.3382887 100.0000000
## all_modalities auc    0.8689077  0.7611901   1.0000000  0.7478642   1.0000000
##                                15
## wrist_bvp acc           97.6554706
## wrist_bvp auc            0.9512448
## wrist_physio acc        96.2254739
## wrist_physio auc         0.9235164
## chest_ecg acc          100.0000000
```

```
## chest_ecg auc        1.0000000
## chest_physio acc     91.8606585
## chest_physio auc      0.8335759
## all_wrist acc        98.6780845
## all_wrist auc         0.9833813
## all_chest acc        86.6228799
## all_chest auc         0.7628211
## all_physio acc       99.6508148
## all_physio auc        0.9927386
## all_modalities acc   98.6032591
## all_modalities auc    0.9904511
```

```r
rowMeans(cv[,c(2:16)])
```

```
##       wrist_bvp acc      wrist_bvp auc   wrist_physio acc   wrist_physio auc
##          83.8876013         0.7141358         85.5975212          0.7667939
##       chest_ecg acc       chest_ecg auc   chest_physio acc   chest_physio auc
##          81.3092065         0.6579674         84.9471004          0.7779130
##       all_wrist acc       all_wrist auc       all_chest acc       all_chest auc
##          85.7050014         0.7676852         84.1964014          0.7737533
##      all_physio acc      all_physio auc  all_modalities acc all_modalities auc
##          82.5440079         0.7819680         85.5726657          0.8035827
```

```r
rowSds(as.matrix(cv[,c(2:16)]))
```

```
##  [1]  9.7504505  0.1731233 12.5896162  0.1665360 18.9048426  0.2218578
##  [7] 19.2625771  0.2066707 11.6233762  0.1469155 18.8309831  0.1930809
## [13] 20.8992209  0.1985601 15.4589175  0.1792556
```

LDA - with personal

```r
cv <- data.frame(matrix(ncol = 16, nrow = 16))
rownames(cv) <- c("wrist_bvp acc", "wrist_bvp auc", "wrist_physio acc", "wrist_physio auc", "chest_ecg a
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp","wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "ch
```

```r
for(i in 1:8){
  for (j in 1:15){
    set.seed(1)
    test = subset(data, id == j)
    train = subset(data, id != j)

    test_sample = test
    train_sample = train

    predictor = cv$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(c(eval(parse(text = predictor_vars[1])), predict
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$label == predict_lda)*100
    auc = AUC(as.numeric(as.character(predict_lda)), as.numeric(as.character(test_sample$label)))

    cv[(i-1)*2+1,j+1] <- acc
    cv[(i-1)*2+2,j+1] <- auc
```

```
  }
}
```

```
cv
```

```
##                              predictor          1          2          3          4
## wrist_bvp acc               wrist_bvp 79.7507788 82.0017036 79.4276094 95.9149784
## wrist_bvp auc               wrist_bvp  0.6311539  0.5956146  0.5188976  0.9553992
## wrist_physio acc         wrist_physio 77.2152994 86.1328790 84.9579125 84.1165726
## wrist_physio auc         wrist_physio  0.5100637  0.7535812  0.6482283  0.6292636
## chest_ecg acc               chest_ecg 78.7123572 80.1277683 91.4478114 80.2059117
## chest_ecg auc               chest_ecg  0.5000000  0.5443359  0.8000000  0.5379845
## chest_physio acc         chest_physio 78.5392870 93.1601363 98.6111111 99.2112255
## chest_physio auc         chest_physio  0.4989006  0.8747136  0.9911670  0.9924436
## all_wrist acc               all_wrist 77.9421945 89.8381601 84.5959596 78.5785453
## all_wrist auc               all_wrist  0.5127534  0.8389646  0.6397638  0.5000000
## all_chest acc               all_chest 78.0373832 92.1805792 97.8787879 98.9870475
## all_chest auc               all_chest  0.4957124  0.8607035  0.9865096  0.9845327
## all_physio acc             all_physio 78.5739010 91.4650767 99.8232323 98.4058452
## all_physio auc             all_physio  0.4991205  0.8444381  0.9988758  0.9723764
## all_modalities acc     all_modalities 78.6690897 92.8960818 99.4191919 81.0195948
## all_modalities auc     all_modalities  0.4997252  0.8403488  0.9944431  0.5620515
##                                      5          6          7          8          9
## wrist_bvp acc               77.9357645 81.2416332 86.5307820 80.3428094 61.4139278
## wrist_bvp auc                0.4986635  0.5621094  0.7836216  0.5692472  0.7368911
## wrist_physio acc            92.0374707 90.0602410 87.0382696 78.0852843 81.4676212
## wrist_physio auc             0.9491236  0.7685371  0.7102596  0.4983765  0.8633527
## chest_ecg acc               78.2535965 80.9320616 22.2961730 78.4280936 77.1396030
## chest_ecg auc                0.5000000  0.5548828  0.5000000  0.5000000  0.5155172
## chest_physio acc            93.5931750 50.7948461 22.2961730 78.4280936 76.8711357
## chest_physio auc             0.8569972  0.6869144  0.5000000  0.5000000  0.5098276
## all_wrist acc               95.9936434 90.8048862 90.1830283 78.9632107 81.4188090
## all_wrist auc                0.9730128  0.7853516  0.7880989  0.5176014  0.8383637
## all_chest acc               90.9501506 62.4832664 22.3044925 78.7290970 77.1965506
## all_chest auc                0.8035878  0.7612862  0.5000535  0.5069767  0.5167241
## all_physio acc              94.6888592 85.7597055 22.2961730 78.2859532 77.8067035
## all_physio auc               0.9656480  0.9093910  0.5000000  0.4990938  0.5296552
## all_modalities acc          94.5299431 82.2038153 25.3910150 78.4782609 83.3468923
## all_modalities auc           0.9535233  0.8867653  0.5199143  0.5017248  0.6517169
##                                     10         11          12         13          14
## wrist_bvp acc               79.9933753 76.3157895  99.6022869 86.3891642  97.4444076
## wrist_bvp auc                0.5798726  0.7800674   0.9911111  0.6997085   0.9647580
## wrist_physio acc            82.7923153 44.1575637  94.0508741 88.4786918  98.8466645
## wrist_physio auc             0.6300098  0.6421298   0.8670370  0.7588198   0.9741828
## chest_ecg acc               99.9254720 91.7907977  98.6825752 74.6696399 100.0000000
## chest_ecg auc                0.9983456  0.8208253   0.9915146  0.5950839   1.0000000
## chest_physio acc            81.0864525 97.1780867  96.3211534 81.0125537  99.9087288
## chest_physio auc             0.8779393  0.9779942   0.9763048  0.5818589   0.9979569
## all_wrist acc               91.5038092 46.6319100 100.0000000 87.2728774  94.8390309
## all_wrist auc                0.8479040  0.6579868   1.0000000  0.7452271   0.8844725
## all_chest acc               80.5813183 80.8589871  96.6774381 87.0251074  97.7431132
## all_chest auc                0.8746794  0.8615128   0.9785996  0.7191495   0.9494799
## all_physio acc              72.6399470 46.8718967 100.0000000 80.1040634 100.0000000
## all_physio auc               0.6719251  0.6595248   1.0000000  0.7018423   1.0000000
```

```
## all_modalities acc 81.2106658 48.9159219  99.9668572 83.9940535  99.7344839
## all_modalities auc  0.8663546  0.6726241   0.9997865  0.7394873   0.9940565
##                              15
## wrist_bvp acc        97.9464583
## wrist_bvp auc         0.9572960
## wrist_physio acc     98.8776189
## wrist_physio auc      0.9774869
## chest_ecg acc       100.0000000
## chest_ecg auc         1.0000000
## chest_physio acc     87.5290988
## chest_physio auc      0.7406639
## all_wrist acc        99.0522115
## all_wrist auc         0.9845443
## all_chest acc        83.2640505
## all_chest auc         0.6549250
## all_physio acc       99.6092451
## all_physio auc        0.9918741
## all_modalities acc   98.6531427
## all_modalities auc    0.9736460
```

```r
rowMeans(cv[,c(2:16)])
```

```
##       wrist_bvp acc        wrist_bvp auc    wrist_physio acc    wrist_physio auc
##          84.1500979           0.7216275          84.5543519           0.7453635
##       chest_ecg acc        chest_ecg auc    chest_physio acc    chest_physio auc
##          82.1741241           0.6905660          82.3027505           0.7709121
##       all_wrist acc        all_wrist auc        all_chest acc        all_chest auc
##          85.8412184           0.7676030          81.6598246           0.7636289
##      all_physio acc       all_physio auc all_modalities acc all_modalities auc
##          81.7553735           0.7829177          81.8952673           0.7770779
```

```r
rowSds(as.matrix(cv[,c(2:16)]))
```

```
##  [1] 10.2063498  0.1759732 12.9575743  0.1562389 19.1230390  0.2161076
##  [7] 21.0571544  0.2064151 13.0206963  0.1694795 19.2911470  0.1878535
## [13] 21.9440673  0.2092529 20.3955212  0.1947261
```