

Case Study 3 Model

```
library(randomForest)

## randomForest 4.6-14
## Type rfNews() to see new features/changes/bug fixes.

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
##

library(matrixStats)

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

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. : -0.009264 Min. :0.005057
## 1st Qu.:0.08774 1st Qu.: -0.0099182 1st Qu.: -0.003717 1st Qu.:0.008527
## Median :0.12398 Median : -0.0007629 Median : -0.003039 Median :0.010563
## Mean :0.22175 Mean : -0.0001620 Mean : -0.003025 Mean :0.012033
## 3rd Qu.:0.19150 3rd Qu.: 0.0080109 3rd Qu.: -0.002410 3rd Qu.:0.013822
## Max. :5.04379 Max. : 0.8102417 Max. : 0.004240 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

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## 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

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

## [1] 0.2216921

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

## [1] 0.7783079

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

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

## [1] 179817

nrow(test)

## [1] 12052

nrow(train)

## [1] 167765

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"

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]

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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_hr")

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 = 1000)
  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))), "\n")
  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))), "\n")
}

print_baseline(test_sample)

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

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 %

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## 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 75.73017 %
## AUROC is 0.5111058
##
## 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                      10.663827
## ECG_sd                        26.898367
## ECG_HR                       41.578533
## EDA_chest_mean                16.241486
## EDA_chest_sd                 28.469141
## EDA_chest_min                18.025517
## EDA_chest_max                17.222410
## EDA_chest_range              26.312310
## EDA_chest_slope              6.201597
## EMG_mean                    10.969525
## EMG_sd                      15.254620

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```

## EMG_range                12.679581
## Resp_Volume              20.932598
## Resp_range               22.819946
## breath_rate              15.810911
## Temp_chest_mean          20.230128
## Temp_chest_sd            11.717379
## Temp_chest_min           19.344592
## Temp_chest_max           22.277386
## Temp_chest_range         11.104953
## Temp_chest_slope         -1.833392
##
## Predictors:  all_wrist
## Accuracy is 98.07501 %
## AUROC is 0.9569094
##
## Predictors:  all_chest
## Accuracy is 100 %
## AUROC is 1
##
##                               MeanDecreaseAccuracy
## ACC_chest_mean                20.680372
## ACC_chest_sd                  33.855076
## ECG_mean                      6.499021
## ECG_sd                       24.714430
## ECG_HR                       33.534447
## EDA_chest_mean               15.641860
## EDA_chest_sd                 23.385799
## EDA_chest_min                16.472247
## EDA_chest_max                16.925156
## EDA_chest_range              24.758203
## EDA_chest_slope              5.700873
## EMG_mean                     10.430120
## EMG_sd                       11.749097
## EMG_range                    11.197799
## Resp_Volume                  17.520833
## Resp_range                   18.810872
## breath_rate                  13.923698
## Temp_chest_mean              17.850462
## Temp_chest_sd                 9.028219
## Temp_chest_min               18.358461
## Temp_chest_max               20.331645
## Temp_chest_range             8.780955
## Temp_chest_slope             -2.114407
##
## Predictors:  all_physio
## Accuracy is 100 %
## AUROC is 1
##
##                               MeanDecreaseAccuracy
## BVP_mean                      7.42503445
## BVP_sd                       12.62372306
## BVP_HR                       20.36939074
## EDA_wrist_mean               13.66836238
## EDA_wrist_sd                 16.24019801

```

```

## EDA_wrist_min          12.91665377
## EDA_wrist_max          13.34254281
## EDA_wrist_range        20.95241538
## EDA_wrist_slope        9.51970954
## Temp_wrist_mean        16.83490481
## Temp_wrist_sd          9.01612941
## Temp_wrist_min         16.18160714
## Temp_wrist_max         17.54221271
## Temp_wrist_range        8.86185270
## Temp_wrist_slope        1.07230867
## ECG_mean               5.12032984
## ECG_sd                 20.93693519
## ECG_HR                 31.99134661
## EDA_chest_mean         12.36811977
## EDA_chest_sd           18.11062713
## EDA_chest_min          13.71860641
## EDA_chest_max          12.03501713
## EDA_chest_range        16.11665076
## EDA_chest_slope        4.29999012
## EMG_mean               6.99253507
## EMG_sd                 10.74213713
## EMG_range              8.02483232
## Resp_Volume            15.09367206
## Resp_range             13.30478790
## breath_rate            11.38307872
## Temp_chest_mean        14.05293990
## Temp_chest_sd          7.76456436
## Temp_chest_min         14.11874246
## Temp_chest_max         13.56557627
## Temp_chest_range        7.28134868
## Temp_chest_slope       -0.07195193
##
## Predictors:  all_modalities
## Accuracy is 100 %
## AUROC is 1
##
##               MeanDecreaseAccuracy
## ACC_wrist_mean      11.4464990
## ACC_wrist_sd        19.4057356
## BVP_mean            5.0514767
## BVP_sd              9.5725174
## BVP_HR              17.6971951
## EDA_wrist_mean      12.8416307
## EDA_wrist_sd        15.3204519
## EDA_wrist_min       12.1262738
## EDA_wrist_max       11.6931323
## EDA_wrist_range     19.2420592
## EDA_wrist_slope     7.3362374
## Temp_wrist_mean     15.0837641
## Temp_wrist_sd       8.6553154
## Temp_wrist_min      15.7348632
## Temp_wrist_max      14.2166893
## Temp_wrist_range     7.3426915
## Temp_wrist_slope    -0.4413268

```

```
## ACC_chest_mean          15.5198821
## ACC_chest_sd            22.1386506
## ECG_mean                4.5641696
## ECG_sd                  18.2360618
## ECG_HR                  25.2545130
## EDA_chest_mean          11.3920508
## EDA_chest_sd            17.1034101
## EDA_chest_min           11.4553220
## EDA_chest_max           11.3654747
## EDA_chest_range         15.0284559
## EDA_chest_slope         3.8060102
## EMG_mean                7.2320510
## EMG_sd                  8.6037343
## EMG_range               6.9897948
## Resp_Volume             11.5225736
## Resp_range              11.0144012
## breath_rate             9.8995231
## Temp_chest_mean         12.3750368
## Temp_chest_sd           7.3833692
## Temp_chest_min          12.2572575
## Temp_chest_max          13.3255246
## Temp_chest_range        6.1090504
## Temp_chest_slope        -2.0406088
```

```
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_var
})
```

```
## 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 77.66346 %
## AUROC is 0.5
##
## 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                        10.918452
## Height                     13.881056
## Weight                     14.843418
## Gender                     5.810359
## ECG_mean                   9.020674
## ECG_sd                     26.648970
## ECG_HR                     42.374735
## EDA_chest_mean             16.388259
## EDA_chest_sd               30.516722
## EDA_chest_min              16.925201
## EDA_chest_max              15.701079
## EDA_chest_range            25.222368
## EDA_chest_slope            5.437813
## EMG_mean                   10.632245
## EMG_sd                     14.718796
## EMG_range                  13.591716
## Resp_Volume                19.347859
## Resp_range                 22.755694
## breath_rate                16.237878
## Temp_chest_mean            19.908297
## Temp_chest_sd              10.253875
## Temp_chest_min             19.482304
## Temp_chest_max             19.616914
## Temp_chest_range           8.980271
## Temp_chest_slope           -1.409673
##
## Predictors: personal + all_wrist
## Accuracy is 98.78029 %
## AUROC is 0.9726969
##
## Predictors: personal + all_chest

```

```

## Accuracy is 100 %
## AUROC is 1
##
##                               MeanDecreaseAccuracy
## Age                               9.7907915
## Height                           11.9034201
## Weight                           13.1623640
## Gender                           5.1006790
## ACC_chest_mean                   19.7912694
## ACC_chest_sd                     32.5389214
## ECG_mean                         8.3146710
## ECG_sd                           26.1594890
## ECG_HR                           31.9383697
## EDA_chest_mean                   15.9785876
## EDA_chest_sd                     26.3218570
## EDA_chest_min                    15.5434745
## EDA_chest_max                    16.5828219
## EDA_chest_range                  24.6689314
## EDA_chest_slope                   6.2702790
## EMG_mean                         9.0575266
## EMG_sd                           12.5689865
## EMG_range                        10.8456522
## Resp_Volume                      18.3619655
## Resp_range                       16.1266520
## breath_rate                      12.3991546
## Temp_chest_mean                  19.2199791
## Temp_chest_sd                     8.9481761
## Temp_chest_min                   19.2027858
## Temp_chest_max                   19.0995514
## Temp_chest_range                 10.3049502
## Temp_chest_slope                 0.4203818
##
## Predictors: personal + all_physio
## Accuracy is 100 %
## AUROC is 1
##
##                               MeanDecreaseAccuracy
## Age                               9.6419270
## Height                           9.0918478
## Weight                           10.7107147
## Gender                           4.1426961
## BVP_mean                         4.6303534
## BVP_sd                           12.5648186
## BVP_HR                           19.6013479
## EDA_wrist_mean                   12.7046289
## EDA_wrist_sd                     16.9541862
## EDA_wrist_min                    12.7614031
## EDA_wrist_max                    14.0530527
## EDA_wrist_range                  19.2320589
## EDA_wrist_slope                   8.8230026
## Temp_wrist_mean                  16.6113376
## Temp_wrist_sd                     9.3287212
## Temp_wrist_min                   14.4910093
## Temp_wrist_max                   15.2166425

```

```

## Temp_wrist_range          9.6650827
## Temp_wrist_slope         0.4783589
## ECG_mean                 5.3359224
## ECG_sd                   20.0218367
## ECG_HR                   31.6158097
## EDA_chest_mean           11.8595826
## EDA_chest_sd             16.7125437
## EDA_chest_min            13.6476034
## EDA_chest_max            11.1243671
## EDA_chest_range          15.4777760
## EDA_chest_slope          4.2898775
## EMG_mean                 6.8652532
## EMG_sd                   9.5014413
## EMG_range                8.2077013
## Resp_Volume              15.3485969
## Resp_range               13.4709682
## breath_rate              11.6515567
## Temp_chest_mean          13.9972096
## Temp_chest_sd            6.6664224
## Temp_chest_min           14.4897827
## Temp_chest_max           12.9661016
## Temp_chest_range          6.5219428
## Temp_chest_slope         1.2087509
##
## Predictors: personal + all_modalities
## Accuracy is 100 %
## AUROC is 1
##
##                               MeanDecreaseAccuracy
## Age                          7.6067296
## Height                       8.5648713
## Weight                       9.1567912
## Gender                       3.8459343
## ACC_wrist_mean              12.5504641
## ACC_wrist_sd                18.3498295
## BVP_mean                    4.1827397
## BVP_sd                      10.2568829
## BVP_HR                      16.6338136
## EDA_wrist_mean              12.5972537
## EDA_wrist_sd                15.3901548
## EDA_wrist_min               11.4991948
## EDA_wrist_max               12.9677211
## EDA_wrist_range             17.3394579
## EDA_wrist_slope             7.0520157
## Temp_wrist_mean             13.7964671
## Temp_wrist_sd               10.9212983
## Temp_wrist_min              14.2960201
## Temp_wrist_max              14.9563960
## Temp_wrist_range            8.3254850
## Temp_wrist_slope            -1.5700040
## ACC_chest_mean              14.9111263
## ACC_chest_sd                22.7952286
## ECG_mean                    4.4364815
## ECG_sd                      18.1373575

```

```
## ECG_HR                24.5581754
## EDA_chest_mean        12.5446907
## EDA_chest_sd          17.9737707
## EDA_chest_min         11.3710174
## EDA_chest_max         11.9609608
## EDA_chest_range       15.8694151
## EDA_chest_slope       3.1876081
## EMG_mean              6.7026326
## EMG_sd                 8.7676939
## EMG_range              6.8048502
## Resp_Volume           11.2278974
## Resp_range            11.4407076
## breath_rate           9.5428964
## Temp_chest_mean       12.1263075
## Temp_chest_sd         8.0285059
## Temp_chest_min        12.4811781
## Temp_chest_max        13.2268431
## Temp_chest_range       5.0776937
## Temp_chest_slope      -0.7311903
```

LDA

```
LDA <- function(train_sample, test_sample, predictors){
  model_lda <- lda(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), data = train_sample)
  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 99.89213 %
## AUROC is 0.9993056
##
## 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_v
}

```

```
## 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 99.71789 %
## AUROC is 0.993685
##
## Predictors: personal + all_wrist
## Accuracy is 94.2997 %
## AUROC is 0.8723997
##
## Predictors: personal + all_chest
## Accuracy is 97.20378 %
```

```
## AUROC is 0.9374071
##
## Predictors: personal + all_physio
## Accuracy is 100 %
## AUROC is 1
##
## Predictors: personal + all_modalities
## Accuracy is 98.19117 %
## AUROC is 0.9595097
##
```

Logistic Regression

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

```
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 99.78427 %
## AUROC is 0.9951709
##
## Predictors: all_wrist
## Accuracy is 97.73482 %
## AUROC is 0.9495588
##
## Predictors: all_chest
## Accuracy is 99.85894 %
## AUROC is 0.9968425
##
## Predictors: all_physio
## Accuracy is 100 %
## AUROC is 1
##
## Predictors: all_modalities
## Accuracy is 99.98341 %
## AUROC is 0.9998932
##
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 = predic
})

## 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 99.80086 %
## AUROC is 0.9955423
##
## Predictors: personal + all_wrist
## Accuracy is 98.18287 %
## AUROC is 0.9880366
##
## Predictors: personal + all_chest
## Accuracy is 99.60173 %
## AUROC is 0.9910847
##
## Predictors: personal + all_physio
## Accuracy is 92.29174 %
## AUROC is 0.9503739
##
## Predictors: personal + all_modalities
## Accuracy is 93.6774 %

```

```
## AUROC is 0.9592949
##
```

We choose the Random Forest & LDA

Cross-Validation

- We choose predictors that we got > 97% accuracy.
- Let us do cross validation.

RF - no personal

```
# 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_wri

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
  }
}

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	76.7999308	93.4327087	85.5218855	99.2029226

```

## chest_physio auc      chest_physio 0.6140405 0.8494141 0.6614173 0.9949281
## 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 76.3586016 95.1022147 87.2306397 98.3145135
## all_chest auc         all_chest 0.5163360 0.9045969 0.7013780 0.9892751
## all_physio acc        all_physio 79.6815507 92.0613288 94.1077441 99.5848555
## all_physio auc        all_physio 0.5227642 0.8307858 0.8622047 0.9973584
## all_modalities acc    all_modalities 81.3430253 92.7342419 96.0269360 99.4187977
## all_modalities auc    all_modalities 0.5617886 0.8495958 0.9070866 0.9963018
##                        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      98.7788558 98.3684739 33.5274542 81.7642140 76.7165636
## chest_physio auc      0.9740061 0.9738484 0.5515165 0.6420931 0.5065517
## 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         98.1933757 98.2346051 78.5940100 83.9715719 78.1483892
## all_chest auc         0.9604057 0.9762644 0.8450977 0.6525128 0.5368966
## all_physio acc        97.2231516 97.0632530 94.9334443 85.4096990 99.6827205
## all_physio auc        0.9382368 0.9646910 0.9139186 0.6677224 0.9979238
## all_modalities acc    98.1850117 96.9210174 94.8668885 85.7190635 97.6407419
## all_modalities auc    0.9614631 0.9728788 0.9140225 0.6744715 0.9572698
##                        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      85.1689301 97.0953327 89.6926009 79.3277172 100.0000000
## chest_physio auc      0.8574789 0.9813852 0.7698933 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         89.7565419 93.8927507 95.1445853 79.7076313 100.0000000
## all_chest auc         0.9112062 0.9596443 0.9112541 0.5522959 1.0000000
## all_physio acc        89.1271944 71.4581264 78.1009197 82.9534192 100.0000000
## all_physio auc        0.9298311 0.8170874 0.5105556 0.6239067 1.0000000
## all_modalities acc    89.8062272 79.9900695 78.1092054 88.4869508 100.0000000
## all_modalities auc    0.9342133 0.8717650 0.5107407 0.7459913 1.0000000
##                        15
## wrist_physio acc      92.4176921
## wrist_physio auc      0.9070765
## chest_physio acc      90.6385101
## chest_physio auc      0.8408919
## all_wrist acc         91.4033921
## all_wrist auc         0.9002815
## all_chest acc         88.7678750
## all_chest auc         0.7936019
## all_physio acc        94.0721649
## all_physio auc        0.9028428
## all_modalities acc    93.0329232
## all_modalities auc    0.9053365

```

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

```

## wrist_physio acc      wrist_physio auc      chest_physio acc      chest_physio auc
##      87.5775878          0.8031745          85.7357400          0.7840919
##      all_wrist acc      all_wrist auc      all_chest acc      all_chest auc
##      89.0467882          0.8202020          89.4278204          0.8140510

```

```
##      all_physio acc      all_physio auc all_modalities acc all_modalities auc
##      90.3639715      0.8319886      91.4854067      0.8508617
rowSds(as.matrix(cv[,c(2:16)]))

## [1] 7.1862230 0.1435777 16.6618097 0.1828512 6.0520693 0.1285396
## [7] 8.3451435 0.1763587 8.9086292 0.1698047 7.2838596 0.1559990
```

RF - with personal

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

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
  }
}
```

```
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 75.6230530 93.7308348 87.2053872 99.1863168
## chest_physio auc chest_physio 0.6163513 0.8562500 0.7007874 0.9948225
## 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 76.9643475 94.3526405 87.7861953 97.3679841
## all_chest auc all_chest 0.5304154 0.9034658 0.7143701 0.9832523
## all_physio acc all_physio 80.0536518 92.0017036 94.3434343 98.8791099
## all_physio auc all_physio 0.5315041 0.8295594 0.8677165 0.9928677
## all_modalities acc all_modalities 80.1401869 93.3390119 96.4478114 99.1032879
## all_modalities auc all_modalities 0.5335366 0.8641672 0.9169291 0.9942942
##      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 99.0799599 97.8915663 32.4376040 81.4130435 78.1809307
## chest_physio auc 0.9807903 0.9698194 0.5378520 0.6127390 0.5375862
## 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 97.7333556 97.2389558 79.0183028 83.5033445 78.3924504
## all_chest auc 0.9492733 0.9744756 0.8474288 0.6409576 0.5420690
## all_physio acc 98.6701238 97.9836011 96.3477537 85.6856187 99.7071266
## all_physio auc 0.9734502 0.9746673 0.9192943 0.6745393 0.9980835
## all_modalities acc 99.0715959 95.8584337 94.7920133 85.9030100 98.2997071
## all_modalities auc 0.9825421 0.9736478 0.9102149 0.6784541 0.9687326
## 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 88.7711163 95.9947037 90.3388847 79.3359762 100.000000
## chest_physio auc 0.9009352 0.9743318 0.7840741 0.5440962 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 90.9655515 93.3879510 95.7162980 79.5672283 100.000000
## all_chest auc 0.9252671 0.9570853 0.9275910 0.5491983 1.000000
## all_physio acc 84.7052004 51.6468057 77.6286353 82.7386852 100.000000
## all_physio auc 0.9012933 0.6901252 0.5000000 0.6191691 1.000000
## all_modalities acc 88.2411395 63.3565045 77.6286353 88.6438718 100.000000
## all_modalities auc 0.9241129 0.7651676 0.5000000 0.7494534 1.000000
## 15
## wrist_physio acc 89.7988028
## wrist_physio auc 0.8169310
## chest_physio acc 92.2514134
## chest_physio auc 0.8733692
## all_wrist acc 89.8154307
## all_wrist auc 0.8492987
## all_chest acc 90.3807782
## all_chest auc 0.8056372
## all_physio acc 94.3049551
## all_physio auc 0.9055568
## all_modalities acc 94.8869305
## all_modalities auc 0.9223856
```

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

```
## wrist_physio acc wrist_physio auc chest_physio acc chest_physio auc
## 87.5990392 0.8021108 86.0960527 0.7922536
## all_wrist acc all_wrist auc all_chest acc all_chest auc
## 89.0279334 0.8285968 89.4916922 0.8166991
## all_physio acc all_physio auc all_modalities acc all_modalities auc
## 88.9797604 0.8251884 90.3808093 0.8455759
```

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

```
## [1] 7.3655939 0.1472855 16.9286988 0.1831599 7.5628633 0.1453211
## [7] 8.0534250 0.1745380 12.8184712 0.1755008 10.1686635 0.1644042
```

LDA - no personal

```
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 acc", "chest_ecg auc", "wrist_bvp", "wrist_bvp", "wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "all_wrist acc", "all_wrist auc", "all_chest acc", "all_chest auc", "all_physio acc", "all_physio auc", "all_modalities acc", "all_modalities auc")
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp", "wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "wrist_bvp", "wrist_bvp", "wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "all_wrist", "all_wrist", "all_chest", "all_chest", "all_physio", "all_physio", "all_modalities", "all_modalities")

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$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), data = train_sample)
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$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	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	77.6479751	93.3390119	83.4595960	93.5818665
## chest_physio auc	chest_physio	0.4933871	0.8790969	0.6131890	0.9587381
## 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	76.1595708	92.3764906	87.8872054	95.1843241
## all_chest auc	all_chest	0.4845255	0.8457589	0.7167323	0.9683708
## all_physio acc	all_physio	77.5268259	90.6047700	92.3400673	91.1076054
## all_physio auc	all_physio	0.4924692	0.8254157	0.8208661	0.9434172
## all_modalities acc	all_modalities	77.4662513	91.1584327	92.9713805	97.2019263
## all_modalities auc	all_modalities	0.4920844	0.8010685	0.8380663	0.9821957
##	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   96.4285714 94.1516064 22.0133111 78.6287625 77.1640091
## chest_physio auc   0.9326044 0.8690175 0.4908630 0.5053536 0.5161537
## 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      91.8785547 95.8668005 23.0199667 78.2107023 77.0663846
## all_chest auc      0.8546513 0.9094828 0.5046574 0.5064817 0.5188518
## all_physio acc     94.5633991 97.7995315 24.5590682 78.2608696 77.7985682
## all_physio auc     0.9299910 0.9543158 0.5133637 0.4989339 0.5294828
## all_modalities acc 91.6109067 97.0883534 47.0216306 78.4364548 80.0846079
## all_modalities auc 0.8382214 0.9595939 0.6270395 0.5059540 0.5805529
##                    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    81.6743955 96.9215492 97.3320076 79.3524942 100.0000000
## chest_physio auc    0.8805602 0.9401113 0.9746430 0.5444606 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      82.2623385 85.7745780 98.9062888 82.9451602 100.0000000
## all_chest auc       0.8855280 0.8460935 0.9874191 0.6247550 1.0000000
## all_physio acc     75.6624710 62.0324396 97.9451487 75.2147341 99.8921341
## all_physio auc      0.7304154 0.7566822 0.9540741 0.6578652 0.9993056
## all_modalities acc 79.7035442 67.0556107 99.7100008 88.5860588 100.0000000
## all_modalities auc 0.8690145 0.7888736 0.9981321 0.7513983 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    91.6694380
## chest_physio auc    0.8281814
## all_wrist acc      99.0771533
## all_wrist auc       0.9831724
## all_chest acc      89.0089790
## all_chest auc       0.8140950
## all_physio acc     97.3727968
## all_physio auc      0.9453665
## all_modalities acc 98.3621550
## all_modalities auc 0.9885095

```

```
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          84.2243063          0.7617573
##      all_wrist acc      all_wrist auc      all_chest acc      all_chest auc
##      85.9579842          0.7707071          83.7698230          0.7644935

```

```
##      all_physio acc      all_physio auc all_modalities acc all_modalities auc
##      82.1786953      0.7701310      85.7638209      0.8013803
```

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

```
## [1] 9.7839591 0.1615969 10.7752029 0.1601589 18.8822983 0.2200719
## [7] 19.0505096 0.2046671 10.2403113 0.1436337 18.4867893 0.1891452
## [13] 19.4891957 0.1891802 14.5911838 0.1778716
```

LDA - with personal

```
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 acc", "chest_ecg auc", "chest_physio acc", "chest_physio auc", "all_wrist acc", "all_wrist auc", "all_chest acc", "all_chest auc", "wrist_bvp", "wrist_physio", "chest_ecg", "chest_physio")
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp", "wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "chest_physio", "chest_physio", "all_wrist", "all_wrist", "all_chest", "all_chest", "wrist_bvp", "wrist_physio", "chest_ecg", "chest_physio")
```

```
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$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(c(eval(parse(text = predictor_vars[1])), predictors))), data = train_sample))
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$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 79.7248183 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 78.5565940 93.1005111 99.8148148 98.6632348
## chest_physio auc    chest_physio 0.4990106 0.8699661 0.9988223 0.9885338
## 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 77.5527864 93.2793867 99.1835017 98.9455330
## all_chest auc      all_chest 0.4926341 0.8644901 0.9948073 0.9892023
```


## all_physio acc	all_physio	78.5219799	91.2862010	99.8316498	98.3394221
## all_physio auc	all_physio	0.4987907	0.8249843	0.9960630	0.9702622
## all_modalities acc	all_modalities	78.2796816	90.7069847	96.9360269	84.2992361
## all_modalities auc	all_modalities	0.4972515	0.7874774	0.9345091	0.6371923
##		5	6	7	8
## wrist_bvp acc		77.5677484	83.1492637	86.6971714	80.8946488
## wrist_bvp auc		0.5002004	0.6066406	0.7869539	0.5938394
## wrist_physio acc		86.8183339	90.0100402	85.3410982	78.1856187
## wrist_physio auc		0.9073051	0.7673652	0.6712687	0.5012640
## chest_ecg acc		78.2535965	81.5595716	22.2961730	78.4280936
## chest_ecg auc		0.5000000	0.5695313	0.5000000	0.5000000
## chest_physio acc		96.5205754	58.9106426	22.0965058	78.5033445
## chest_physio auc		0.9562440	0.7385541	0.4884716	0.5025871
## all_wrist acc		94.6637671	91.7503347	90.7237937	79.4648829
## all_wrist auc		0.9556281	0.8078481	0.7968999	0.5255764
## all_chest acc		94.5717631	70.5823293	23.4276206	78.7959866
## all_chest auc		0.8999105	0.8128194	0.5072805	0.5088081
## all_physio acc		94.0448310	81.4257028	24.1098170	78.2859532
## all_physio auc		0.9533399	0.8818143	0.5116702	0.4990938
## all_modalities acc		94.2539311	80.8985944	33.8519135	78.5284281
## all_modalities auc		0.9512042	0.8784604	0.5695684	0.5031685
##		10	11	12	13
## wrist_bvp acc		80.0596224	75.4799735	98.8814318	85.9431781
## wrist_bvp auc		0.5711734	0.7860695	0.9750000	0.6898688
## wrist_physio acc		81.3183173	49.9420722	93.0897340	87.7023456
## wrist_physio auc		0.5933778	0.6792003	0.8455556	0.7445256
## chest_ecg acc		99.4120570	91.2777226	99.7431436	74.4301288
## chest_ecg auc		0.9869485	0.8082071	0.9983456	0.5493503
## chest_physio acc		81.7406426	96.3174446	97.3237219	80.7978196
## chest_physio auc		0.8821612	0.9754535	0.9827623	0.5769925
## all_wrist acc		91.2305399	52.0523006	100.0000000	87.1820284
## all_wrist auc		0.8417074	0.6927238	1.0000000	0.7450262
## all_chest acc		81.5915866	83.4078120	97.8291491	84.5969607
## all_chest auc		0.8811992	0.8855546	0.9860177	0.6623576
## all_physio acc		69.2861875	54.8990401	99.9420002	74.5953089
## all_physio auc		0.5897840	0.7109673	0.9996264	0.6640372
## all_modalities acc		80.9373965	58.2092023	99.6022869	85.1585728
## all_modalities auc		0.8600277	0.7321807	0.9974384	0.7370970
##		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		87.9946791			
## chest_physio auc		0.7503458			
## all_wrist acc		98.6780845			
## all_wrist auc		0.9725104			
## all_chest acc		84.1370136			
## all_chest auc		0.6818225			
## all_physio acc		99.0189558			
## all_physio auc		0.9795989			
## all_modalities acc		96.5497173			

```
## all_modalities auc    0.9412482
```

```
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        83.1432807        0.7812048
##      all_wrist acc      all_wrist auc      all_chest acc      all_chest auc
##      86.0532914        0.7679600        82.8255412        0.7749142
##      all_physio acc      all_physio auc      all_modalities acc      all_modalities auc
##      81.4246231        0.7739447        82.5626827        0.7740592
```

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

```
## [1] 10.0592121  0.1684166 11.4115701  0.1526739 19.2408793  0.2141612
## [7] 20.4771686   0.2106329 11.8006313  0.1655395 18.8340118  0.1932074
## [13] 20.8619025  0.2084911 17.2289924  0.1739996
```

Full Dataset

LDA - no personal

```
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 acc", "chest_ecg auc", "all_wrist acc", "all_wrist auc", "all_chest acc", "all_chest auc", "all_physio acc", "all_physio auc", "all_modalities acc", "all_modalities auc", "wrist_bvp auc", "wrist_bvp acc")
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp", "wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "all_wrist", "all_wrist", "all_chest", "all_chest", "all_physio", "all_physio", "all_modalities", "all_modalities", "wrist_bvp", "wrist_bvp")
```

```
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$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(predictors, collapse = ' + '))), data = train_sample)
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$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 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	78.0460367	93.6967632	87.3316498	94.1713716
## chest_physio auc	chest_physio	0.5042195	0.8874409	0.7037402	0.9617844
## 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	76.9730010	92.8534923	88.9983165	96.2636998
## all_chest auc	all_chest	0.4982930	0.8638795	0.7427165	0.9749570
## all_physio acc	all_physio	77.4749048	91.2010221	93.0471380	90.6426436
## all_physio auc	all_physio	0.4921394	0.8507778	0.8374016	0.9404586
## all_modalities acc	all_modalities	77.4749048	93.7308348	91.6750842	96.2969113
## all_modalities auc	all_modalities	0.4921394	0.8631515	0.8091845	0.9764370
##		5	6	7	8
## wrist_bvp acc		78.2535965	84.2034806	85.3660566	79.9832776
## wrist_bvp auc		0.5000000	0.6312500	0.6800765	0.5554346
## wrist_physio acc		90.7075945	95.8668005	78.5108153	78.4782609
## wrist_physio auc		0.8078704	0.9047943	0.5180970	0.5074850
## chest_ecg acc		78.2535965	81.2667336	22.2961730	78.4280936
## chest_ecg auc		0.5000000	0.5626953	0.5000000	0.5000000
## chest_physio acc		95.9183673	97.9668675	22.2795341	78.5033445
## chest_physio auc		0.9171243	0.9532494	0.4992278	0.5017442
## all_wrist acc		86.0070258	92.7459839	88.9018303	79.7909699
## all_wrist auc		0.6842405	0.8310903	0.7541792	0.5379114
## all_chest acc		94.0531950	98.8872155	22.8951747	78.1354515
## all_chest auc		0.8782668	0.9784278	0.5038544	0.5050185
## all_physio acc		95.6925393	99.7322624	23.4525790	78.0518395
## all_physio auc		0.9501201	0.9982964	0.5074411	0.4976013
## all_modalities acc		92.5142188	98.0003347	45.8569052	78.5367893
## all_modalities auc		0.8451040	0.9872764	0.6138243	0.5044863
##		10	11	12	13
## wrist_bvp acc		79.2066910	74.6193313	99.7265722	87.4463165
## wrist_bvp auc		0.5414179	0.7721704	0.9938889	0.7411957
## wrist_physio acc		83.6535277	47.5504800	93.4957329	88.1978857
## wrist_physio auc		0.6523870	0.6638736	0.8546296	0.8035083
## chest_ecg acc		100.0000000	88.4640847	100.0000000	77.3372977
## chest_ecg auc		1.0000000	0.7375753	1.0000000	0.5000000
## chest_physio acc		81.4425306	96.7477656	97.8622918	79.3607532
## chest_physio auc		0.8789335	0.9425133	0.9859676	0.5446429
## all_wrist acc		77.4842663	52.3502152	100.0000000	87.2481004
## all_wrist auc		0.8158384	0.6946330	1.0000000	0.7628441
## all_chest acc		81.9311030	84.5829196	98.4754329	84.6382557
## all_chest auc		0.8833903	0.8449472	0.9900486	0.6621093
## all_physio acc		75.9191785	53.8894406	99.3371448	83.1764123
## all_physio auc		0.7413293	0.7044972	0.9851852	0.7170681
## all_modalities acc		79.4633985	63.2323734	100.0000000	88.5695408
## all_modalities auc		0.8674647	0.7643721	1.0000000	0.7502610
##		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       92.3262388
## chest_physio auc       0.8432577
## all_wrist acc          98.6780845
## all_wrist auc          0.9833813
## all_chest acc          89.1253741
## all_chest auc          0.8124980
## all_physio acc         99.7256402
## all_physio auc         0.9942946
## all_modalities acc     98.6282009
## all_modalities auc     0.9909698
```

```
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          84.8458239          0.7758081
##      all_wrist acc      all_wrist auc      all_chest acc      all_chest auc
##      85.7050014          0.7676852          84.3339455          0.7771359
##      all_physio acc      all_physio auc      all_modalities acc      all_modalities auc
##      82.6107263          0.7837535          85.7458291          0.8060229
```

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

```
## [1]  9.7504505  0.1731233 12.5896162  0.1665360 18.9048426  0.2218578
## [7] 19.2105585  0.2050838 11.6233762  0.1469155 18.7759008  0.1922177
## [13] 20.6982435  0.1979836 15.2523144  0.1780224
```

LDA - with personal

```
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 acc", "chest_ecg auc", "all_wrist acc", "all_wrist auc", "all_chest acc", "all_chest auc", "all_physio acc", "all_physio auc", "all_modalities acc", "all_modalities auc")
colnames(cv) <- c("predictor", c(1:15))
cv$predictor <- c("wrist_bvp", "wrist_bvp", "wrist_physio", "wrist_physio", "chest_ecg", "chest_ecg", "all_wrist", "all_wrist", "all_chest", "all_chest", "all_physio", "all_physio", "all_modalities", "all_modalities")

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$predictor[(i-1)*2+1]
    predictors = eval(parse(text = predictor))
    model_lda <- lda(as.formula(paste("label ~ ", paste(c(eval(parse(text = predictor_vars[1])), predictors))), data = data))
    predict_lda <- predict(model_lda, test_sample)[[1]]
    acc = mean(test_sample$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	78.5219799	93.6286201	98.7205387	98.8126868
##	chest_physio auc	chest_physio	0.4987907	0.8843290	0.9918630	0.9896257
##	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	77.8729664	93.0919932	97.9545455	99.0866822
##	all_chest auc	all_chest	0.4946680	0.8755455	0.9869914	0.9871402
##	all_physio acc	all_physio	78.4873659	91.5161840	99.7895623	98.4224510
##	all_physio auc	all_physio	0.4985708	0.8463142	0.9986617	0.9737508
##	all_modalities acc	all_modalities	78.5652475	93.2793867	99.4696970	82.7715045
##	all_modalities auc	all_modalities	0.4990655	0.8491379	0.9956242	0.6036479
##			5	6	7	8
##	wrist_bvp acc		77.9357645	81.2416332	86.5307820	80.3428094
##	wrist_bvp auc		0.4986635	0.5621094	0.7836216	0.5692472
##	wrist_physio acc		92.0374707	90.0602410	87.0382696	78.0852843
##	wrist_physio auc		0.9491236	0.7685371	0.7102596	0.4983765
##	chest_ecg acc		78.2535965	80.9320616	22.2961730	78.4280936
##	chest_ecg auc		0.5000000	0.5548828	0.5000000	0.5000000
##	chest_physio acc		95.9100033	59.9146586	22.3211314	78.4280936
##	chest_physio auc		0.9147101	0.7449425	0.5001606	0.5000000
##	all_wrist acc		95.9936434	90.8048862	90.1830283	78.9632107
##	all_wrist auc		0.9730128	0.7853516	0.7880989	0.5176014
##	all_chest acc		93.4342589	73.9123159	22.6123128	78.7709030
##	all_chest auc		0.8612587	0.8340077	0.5020343	0.5079457
##	all_physio acc		94.7139512	88.8721553	22.4376040	78.2859532
##	all_physio auc		0.9662249	0.9291951	0.5009101	0.4990938
##	all_modalities acc		94.7975912	85.1070950	28.8519135	78.4782609
##	all_modalities auc		0.9637042	0.9052385	0.5421842	0.5017248
##			10	11	12	13
##	wrist_bvp acc		79.9933753	76.3157895	99.6022869	86.3891642
##	wrist_bvp auc		0.5798726	0.7800674	0.9911111	0.6997085
##	wrist_physio acc		82.7923153	44.1575637	94.0508741	88.4786918
##	wrist_physio auc		0.6300098	0.6421298	0.8670370	0.7588198
##	chest_ecg acc		99.9254720	91.7907977	98.6825752	74.6696399
##	chest_ecg auc		0.9983456	0.8208253	0.9915146	0.5950839
##	chest_physio acc		80.8214641	96.6070837	94.6225868	81.7310869
##	chest_physio auc		0.8762292	0.9781210	0.9653645	0.6024780
##	all_wrist acc		91.5038092	46.6319100	100.0000000	87.2728774
##	all_wrist auc		0.8479040	0.6579868	1.0000000	0.7452271
##	all_chest acc		80.4074197	82.4064879	96.0311542	86.8186323
##	all_chest auc		0.8735571	0.8840055	0.9744370	0.7108583
##	all_physio acc		73.3686651	46.9794770	99.9337145	80.8556326
##	all_physio auc		0.6895357	0.6602143	0.9995731	0.7076030

```
## all_modalities acc 81.3845644 49.6193313 99.5691441 85.0925008 99.5519416
## all_modalities auc 0.8733441 0.6771319 0.9972249 0.7494230 0.9899703
##
## 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 88.1277020
## chest_physio auc 0.7531120
## all_wrist acc 99.0522115
## all_wrist auc 0.9845443
## all_chest acc 84.5610243
## all_chest auc 0.6828413
## all_physio acc 99.6840705
## all_physio auc 0.9934302
## all_modalities acc 98.9025607
## all_modalities auc 0.9789509
```

```
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 82.9911089 0.7803884
## all_wrist acc all_wrist auc all_chest acc all_chest auc
## 85.8412184 0.7676030 82.8286515 0.7768832
## all_physio acc all_physio auc all_modalities acc all_modalities auc
## 82.0855771 0.7863661 82.5804185 0.7851069
```

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

```
## [1] 10.2063498 0.1759732 12.9575743 0.1562389 19.1230390 0.2161076
## [7] 20.1974695 0.2056249 13.0206963 0.1694795 18.7531892 0.1907088
## [13] 21.9356139 0.2093050 19.6628768 0.1912847
```