**Session 20 Assignment**

Weight Lifting Exercise

This human activity recognition research has traditionally focused on discriminating between different activities, i.e. to predict "which" activity was performed at a specific point in time (like with the Daily Living Activities dataset above). The approach we propose for the Weight Lifting Exercises dataset is to investigate "how (well)" an activity was performed by the wearer. The "how (well)" investigation has only received little attention so far, even though it potentially provides useful information for a large variety of applications, such as sports training.

1. Use the below given data set

Data Set

2. Perform the below given activities:

a. Create classification model using different random forest models

b. Verify model goodness of fit

c. Apply all the model validation techniques

d. Make conclusions

e. Plot importance of variables

setwd("C:/Users/krish/Desktop")

library(readr)

Weight\_lift <- read.csv("Weight lift.csv")

View(Weight\_lift)

str(Weight\_lift)

data<-Weight\_lift

# load libraries

library(caret)

library(randomForest)

library(rpart)

library(rpart.plot)

library(ggplot2)

library(lattice)

library(rattle)

library(C50)

#install.package('devtools') # Only needed if you dont have this installed.

library(devtools)

install\_github('adam-m-mcelhinney/helpRFunctions')

library(helpRFunctions)

names(data)

dim(data)

pairs(data[1:10])

# enable multi-core processing

library(doParallel)

cl <- makeCluster(detectCores())

registerDoParallel()

set.seed(12345)

dataTrain<-data[1:4004,]

dataTest<-data[4005:4024,]

head(dataTrain)

head(dataTest)

indexNA <- as.vector(sapply(dataTrain[,1:158],function(x) {length(which(is.na(x)))!=0}))

dataTrain <- dataTrain[,!indexNA]

train\_control<- trainControl(method="cv", number=10)

model<- train(classe ~., data=dataTrain,trControl=train\_control, method="rf")

model

# make predictions

predictions<- predict(model,dataTrain)

# append predictions

pred<- cbind(dataTrain,predictions)

# summarize results

confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

confusionMatrix

#how do we create a cross validation scheme

control <- trainControl(method = 'repeatedcv',

number = 10,

repeats = 3)

seed <-7

metric <- 'Accuracy'

set.seed(seed)

mtry <- sqrt(ncol(dataTrain))

tunegrid <- expand.grid(.mtry=mtry)

rf\_default <- train(pitch\_belt~.,

data = dataTrain,

method = 'rf',

metric = 0,

tuneGrid = tunegrid,

trControl = control)

print(rf\_default)

#-------------------------------

# make predictions

predictions<- predict(rf\_default,dataTest)

# append predictions

pred<- cbind(dataTest,predictions)

# summarize results

confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

confusionMatrix

varImp(rf\_default)

#----------------

# random search for parameters

control <- trainControl(method = 'repeatedcv',

number = 10,

repeats = 3,

search = 'random')

# make predictions

predictions<- predict(rf\_default,dataTest)

# append predictions

pred<- cbind(dataTest,predictions)

# summarize results

#confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

confusionMatrix

varImp(random)

#--------------------

# Grid search

control <- trainControl(method = 'repeatedcv',

number = 10,

repeats = 3,

search = 'grid')

set.seed(seed)

tunegrid <- expand.grid(.mtry=c(1:80))

mtry <- sqrt(ncol(x))

rf\_gridsearch <- train(~.,

data = dataTrain[1:200,],

method = 'rf',

metric = 0,

tuneGrid = tunegrid,

trControl = control)

print(rf\_gridsearch)

plot(rf\_gridsearch)

# make predictions

predictions<- predict(rf\_gridsearch,dataTest)

# append predictions

pred<- cbind(dataTest,predictions)

# summarize results

confusionMatrix<- confusionMatrix(pred$predictions,pred$pitch\_belt)

confusionMatrix

varImp(rf\_gridsearch)

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# Boosting

# ---------------------------------------

# Boosting model requires three things

#1- a loss function to be optimized

#2- a weak learner to make predictions

#3- an additive model to add the weak learners to minimize the loss function

# gradient boosting

control <- trainControl(method = 'repeatedcv',

number = 5,

repeats = 3,

search = 'grid')

seed <- 7

library(C50)

set.seed(seed)

metric <- 'Accuracy'

gbm\_mod <- train(pitch\_belt~.,

data = dataTrain,

method = 'gbm',

metric = 0,

trControl = control)

print(gbm\_mod)

plot(gbm\_mod)

summary(gbm\_mod)

# make predictions

predictions<- predict(gbm\_mod,dataTest)

# append predictions

pred<- cbind(dataTest,predictions)

# summarize results

confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

confusionMatrix

> setwd("C:/Users/krish/Desktop")

> library(readr)

> Weight\_lift <- read.csv("Weight lift.csv")

> View(Weight\_lift)

> str(Weight\_lift)

'data.frame': 4024 obs. of 158 variables:

$ user\_name : Factor w/ 5 levels "adelmo","carlitos",..: 3 3 3 3 3 3 3 3 3 3 ...

$ raw\_timestamp\_part\_1 : int 1322489729 1322489729 1322489729 1322489729 1322489729 1322489729 1322489729 1322489729 1322489729 1322489729 ...

$ raw\_timestamp\_part\_2 : int 34670 62641 70653 82654 90637 170626 190665 242723 267551 274689 ...

$ cvtd\_timestamp : Factor w/ 7 levels "2/12/2011 13:35",..: 2 2 2 2 2 2 2 2 2 2 ...

$ new\_window : Factor w/ 2 levels "no","yes": 1 1 1 1 1 1 1 1 1 1 ...

$ num\_window : int 1 1 1 1 1 1 1 1 1 1 ...

$ roll\_belt : num 3.7 3.66 3.58 3.56 3.57 3.45 3.31 2.91 2.31 2 ...

$ pitch\_belt : num 41.6 42.8 43.7 44.4 45.1 45.6 46.2 46.9 47.4 47.7 ...

$ yaw\_belt : num -82.8 -82.5 -82.3 -82.1 -81.9 -81.9 -81.9 -82.2 -82.6 -82.8 ...

$ total\_accel\_belt : int 3 2 1 1 1 1 3 4 2 3 ...

$ kurtosis\_roll\_belt : num -1.04 -1.04 -1.04 -1.04 -1.04 ...

$ kurtosis\_picth\_belt : num -0.391 -0.391 -0.391 -0.391 -0.391 ...

$ skewness\_roll\_belt : num 0.00541 0.00541 0.00541 0.00541 0.00541 ...

$ skewness\_roll\_belt.1 : num 0.0451 0.0451 0.0451 0.0451 0.0451 ...

$ max\_roll\_belt : num -4.1 -4.1 -4.1 -4.1 -4.1 -4.1 -4.1 -4.1 -4.1 -4.1 ...

$ max\_picth\_belt : int 20 20 20 20 20 20 20 20 20 20 ...

$ max\_yaw\_belt : num -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 ...

$ min\_roll\_belt : num -7.25 -7.25 -7.25 -7.25 -7.25 -7.25 -7.25 -7.25 -7.25 -7.25 ...

$ min\_pitch\_belt : int 18 18 18 18 18 18 18 18 18 18 ...

$ min\_yaw\_belt : num -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 ...

$ amplitude\_roll\_belt : num 1.34 1.34 1.34 1.34 1.34 ...

$ amplitude\_pitch\_belt : int 2 2 2 2 2 2 2 2 2 2 ...

$ amplitude\_yaw\_belt : int 0 0 0 0 0 0 0 0 0 0 ...

$ var\_total\_accel\_belt : num 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 ...

$ avg\_roll\_belt : num 122 122 122 122 122 ...

$ stddev\_roll\_belt : num 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.6 ...

$ var\_roll\_belt : num 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 ...

$ avg\_pitch\_belt : num 25.8 25.8 25.8 25.8 25.8 ...

$ stddev\_pitch\_belt : num 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 ...

$ var\_pitch\_belt : num 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 ...

$ avg\_yaw\_belt : num -4.95 -4.95 -4.95 -4.95 -4.95 -4.95 -4.95 -4.95 -4.95 -4.95 ...

$ stddev\_yaw\_belt : num 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 ...

$ var\_yaw\_belt : num 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 ...

$ gyros\_belt\_x : num 2.02 1.96 1.88 1.8 1.77 1.75 1.78 1.75 1.65 1.48 ...

$ gyros\_belt\_y : num 0.18 0.14 0.08 0.03 0 -0.03 -0.06 -0.06 -0.03 -0.06 ...

$ gyros\_belt\_z : num 0.02 0.05 0.05 0.08 0.13 0.16 0.15 0.23 0.33 0.21 ...

$ accel\_belt\_x : int -3 -2 -2 -6 -4 1 1 2 -1 -18 ...

$ accel\_belt\_y : int -18 -13 -6 -5 -9 -9 -24 -36 -19 18 ...

$ accel\_belt\_z : int 22 16 8 7 0 -5 -8 -9 -7 1 ...

$ magnet\_belt\_x : int 387 405 409 422 418 432 438 440 443 449 ...

$ magnet\_belt\_y : int 525 512 511 513 508 510 508 503 507 499 ...

$ magnet\_belt\_z : int -267 -254 -244 -221 -208 -189 -176 -163 -140 -132 ...

$ roll\_arm : num 132 129 125 120 115 110 104 98.6 93.2 88.5 ...

$ pitch\_arm : num -43.7 -45.3 -46.8 -48.1 -49.1 -49.6 -49.9 -49.7 -49 -48.1 ...

$ yaw\_arm : num -53.6 -49 -43.7 -38.1 -31.7 -25.8 -18.5 -11.4 -4.49 1.82 ...

$ total\_accel\_arm : int 38 38 35 35 34 33 29 28 27 22 ...

$ var\_accel\_arm : num 65.1 65.1 65.1 65.1 65.1 ...

$ avg\_roll\_arm : num 76.2 76.2 76.2 76.2 76.2 ...

$ stddev\_roll\_arm : num 16.1 16.1 16.1 16.1 16.1 ...

$ var\_roll\_arm : num 259 259 259 259 259 ...

$ avg\_pitch\_arm : num -10.2 -10.2 -10.2 -10.2 -10.2 ...

$ stddev\_pitch\_arm : num 10.7 10.7 10.7 10.7 10.7 ...

$ var\_pitch\_arm : num 114 114 114 114 114 ...

$ avg\_yaw\_arm : num 19.1 19.1 19.1 19.1 19.1 ...

$ stddev\_yaw\_arm : num 35.9 35.9 35.9 35.9 35.9 ...

$ var\_yaw\_arm : num 1287 1287 1287 1287 1287 ...

$ gyros\_arm\_x : num 2.65 2.79 2.91 3.08 3.2 3.31 3.5 3.53 3.4 3.48 ...

$ gyros\_arm\_y : num -0.61 -0.64 -0.69 -0.72 -0.77 -0.83 -0.83 -0.83 -0.83 -0.8 ...

$ gyros\_arm\_z : num -0.02 -0.11 -0.15 -0.23 -0.25 -0.3 -0.31 -0.21 -0.11 -0.15 ...

$ accel\_arm\_x : int 143 146 156 158 163 160 165 153 143 135 ...

$ accel\_arm\_y : int 30 35 44 52 55 59 67 70 78 96 ...

$ accel\_arm\_z : int -346 -339 -307 -305 -288 -274 -225 -218 -205 -134 ...

$ magnet\_arm\_x : int 556 599 613 646 670 696 721 725 740 741 ...

$ magnet\_arm\_y : int -205 -206 -198 -186 -175 -174 -161 -152 -133 -115 ...

$ magnet\_arm\_z : int -374 -335 -319 -268 -241 -193 -121 -105 -43 14 ...

$ kurtosis\_roll\_arm : num -1.18 -1.18 -1.18 -1.18 -1.18 ...

$ kurtosis\_picth\_arm : num -0.969 -0.969 -0.969 -0.969 -0.969 ...

$ kurtosis\_yaw\_arm : num -0.87 -0.87 -0.87 -0.87 -0.87 ...

$ skewness\_roll\_arm : num 0.124 0.124 0.124 0.124 0.124 ...

$ skewness\_pitch\_arm : num -0.103 -0.103 -0.103 -0.103 -0.103 ...

$ skewness\_yaw\_arm : num 0.0598 0.0598 0.0598 0.0598 0.0598 ...

$ max\_roll\_arm : num 8.45 8.45 8.45 8.45 8.45 8.45 8.45 8.45 8.45 8.45 ...

$ max\_picth\_arm : num 77.2 77.2 77.2 77.2 77.2 ...

$ max\_yaw\_arm : int 38 38 38 38 38 38 38 38 38 38 ...

$ min\_roll\_arm : num -33.6 -33.6 -33.6 -33.6 -33.6 -33.6 -33.6 -33.6 -33.6 -33.6 ...

$ min\_pitch\_arm : num -58.6 -58.6 -58.6 -58.6 -58.6 -58.6 -58.6 -58.6 -58.6 -58.6 ...

$ min\_yaw\_arm : int 10 10 10 10 10 10 10 10 10 10 ...

$ amplitude\_roll\_arm : num 36.9 36.9 36.9 36.9 36.9 ...

$ amplitude\_pitch\_arm : num 122 122 122 122 122 ...

$ amplitude\_yaw\_arm : int 27 27 27 27 27 27 27 27 27 27 ...

$ roll\_dumbbell : num 51.2 55.8 55.5 55.9 55.2 ...

$ pitch\_dumbbell : num 11.7 9.65 6.88 11.08 11.43 ...

$ yaw\_dumbbell : num 104.3 100.2 101.1 99.8 100.4 ...

$ kurtosis\_roll\_dumbbell : num -0.0959 -0.0959 -0.0959 -0.0959 -0.0959 ...

$ kurtosis\_picth\_dumbbell : num -0.442 -0.442 -0.442 -0.442 -0.442 ...

$ skewness\_roll\_dumbbell : num 0.0819 0.0819 0.0819 0.0819 0.0819 0.0819 0.0819 0.0819 0.0819 0.0819 ...

$ skewness\_pitch\_dumbbell : num -0.216 -0.216 -0.216 -0.216 -0.216 -0.216 -0.216 -0.216 -0.216 -0.216 ...

$ max\_roll\_dumbbell : num 41.9 41.9 41.9 41.9 41.9 ...

$ max\_picth\_dumbbell : num 133 133 133 133 133 133 133 133 133 133 ...

$ max\_yaw\_dumbbell : num -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 ...

$ min\_roll\_dumbbell : num -26.8 -26.8 -26.8 -26.8 -26.8 ...

$ min\_pitch\_dumbbell : num 20.2 20.2 20.2 20.2 20.2 20.2 20.2 20.2 20.2 20.2 ...

$ min\_yaw\_dumbbell : num -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 ...

$ amplitude\_roll\_dumbbell : num 55.7 55.7 55.7 55.7 55.7 ...

$ amplitude\_pitch\_dumbbell: num 54.7 54.7 54.7 54.7 54.7 ...

$ amplitude\_yaw\_dumbbell : int 0 0 0 0 0 0 0 0 0 0 ...

$ total\_accel\_dumbbell : int 4 4 4 5 4 4 4 4 4 4 ...

$ var\_accel\_dumbbell : num 2.42 2.42 2.42 2.42 2.42 ...

$ avg\_roll\_dumbbell : num -5.12 -5.12 -5.12 -5.12 -5.12 ...

[list output truncated]

> data<-Weight\_lift

> # load libraries

> library(caret)

> library(randomForest)

> library(rpart)

> library(rpart.plot)

> library(ggplot2)

> library(lattice)

> library(rattle)

>

> library(C50)

> #install.package('devtools') # Only needed if you dont have this installed.

> library(devtools)

> install\_github('adam-m-mcelhinney/helpRFunctions')

Skipping install of 'helpRFunctions' from a github remote, the SHA1 (9eb16e8c) has not changed since last install.

Use `force = TRUE` to force installation

> library(helpRFunctions)

> names(data)

[1] "user\_name" "raw\_timestamp\_part\_1" "raw\_timestamp\_part\_2"

[4] "cvtd\_timestamp" "new\_window" "num\_window"

[7] "roll\_belt" "pitch\_belt" "yaw\_belt"

[10] "total\_accel\_belt" "kurtosis\_roll\_belt" "kurtosis\_picth\_belt"

[13] "skewness\_roll\_belt" "skewness\_roll\_belt.1" "max\_roll\_belt"

[16] "max\_picth\_belt" "max\_yaw\_belt" "min\_roll\_belt"

[19] "min\_pitch\_belt" "min\_yaw\_belt" "amplitude\_roll\_belt"

[22] "amplitude\_pitch\_belt" "amplitude\_yaw\_belt" "var\_total\_accel\_belt"

[25] "avg\_roll\_belt" "stddev\_roll\_belt" "var\_roll\_belt"

[28] "avg\_pitch\_belt" "stddev\_pitch\_belt" "var\_pitch\_belt"

[31] "avg\_yaw\_belt" "stddev\_yaw\_belt" "var\_yaw\_belt"

[34] "gyros\_belt\_x" "gyros\_belt\_y" "gyros\_belt\_z"

[37] "accel\_belt\_x" "accel\_belt\_y" "accel\_belt\_z"

[40] "magnet\_belt\_x" "magnet\_belt\_y" "magnet\_belt\_z"

[43] "roll\_arm" "pitch\_arm" "yaw\_arm"

[46] "total\_accel\_arm" "var\_accel\_arm" "avg\_roll\_arm"

[49] "stddev\_roll\_arm" "var\_roll\_arm" "avg\_pitch\_arm"

[52] "stddev\_pitch\_arm" "var\_pitch\_arm" "avg\_yaw\_arm"

[55] "stddev\_yaw\_arm" "var\_yaw\_arm" "gyros\_arm\_x"

[58] "gyros\_arm\_y" "gyros\_arm\_z" "accel\_arm\_x"

[61] "accel\_arm\_y" "accel\_arm\_z" "magnet\_arm\_x"

[64] "magnet\_arm\_y" "magnet\_arm\_z" "kurtosis\_roll\_arm"

[67] "kurtosis\_picth\_arm" "kurtosis\_yaw\_arm" "skewness\_roll\_arm"

[70] "skewness\_pitch\_arm" "skewness\_yaw\_arm" "max\_roll\_arm"

[73] "max\_picth\_arm" "max\_yaw\_arm" "min\_roll\_arm"

[76] "min\_pitch\_arm" "min\_yaw\_arm" "amplitude\_roll\_arm"

[79] "amplitude\_pitch\_arm" "amplitude\_yaw\_arm" "roll\_dumbbell"

[82] "pitch\_dumbbell" "yaw\_dumbbell" "kurtosis\_roll\_dumbbell"

[85] "kurtosis\_picth\_dumbbell" "skewness\_roll\_dumbbell" "skewness\_pitch\_dumbbell"

[88] "max\_roll\_dumbbell" "max\_picth\_dumbbell" "max\_yaw\_dumbbell"

[91] "min\_roll\_dumbbell" "min\_pitch\_dumbbell" "min\_yaw\_dumbbell"

[94] "amplitude\_roll\_dumbbell" "amplitude\_pitch\_dumbbell" "amplitude\_yaw\_dumbbell"

[97] "total\_accel\_dumbbell" "var\_accel\_dumbbell" "avg\_roll\_dumbbell"

[100] "stddev\_roll\_dumbbell" "var\_roll\_dumbbell" "avg\_pitch\_dumbbell"

[103] "stddev\_pitch\_dumbbell" "var\_pitch\_dumbbell" "avg\_yaw\_dumbbell"

[106] "stddev\_yaw\_dumbbell" "var\_yaw\_dumbbell" "gyros\_dumbbell\_x"

[109] "gyros\_dumbbell\_y" "gyros\_dumbbell\_z" "accel\_dumbbell\_x"

[112] "accel\_dumbbell\_y" "accel\_dumbbell\_z" "magnet\_dumbbell\_x"

[115] "magnet\_dumbbell\_y" "magnet\_dumbbell\_z" "roll\_forearm"

[118] "pitch\_forearm" "yaw\_forearm" "kurtosis\_roll\_forearm"

[121] "kurtosis\_picth\_forearm" "skewness\_roll\_forearm" "skewness\_pitch\_forearm"

[124] "max\_roll\_forearm" "max\_picth\_forearm" "max\_yaw\_forearm"

[127] "min\_roll\_forearm" "min\_pitch\_forearm" "min\_yaw\_forearm"

[130] "amplitude\_roll\_forearm" "amplitude\_pitch\_forearm" "amplitude\_yaw\_forearm"

[133] "total\_accel\_forearm" "var\_accel\_forearm" "avg\_roll\_forearm"

[136] "stddev\_roll\_forearm" "var\_roll\_forearm" "avg\_pitch\_forearm"

[139] "stddev\_pitch\_forearm" "var\_pitch\_forearm" "avg\_yaw\_forearm"

[142] "stddev\_yaw\_forearm" "var\_yaw\_forearm" "gyros\_forearm\_x"

[145] "gyros\_forearm\_y" "gyros\_forearm\_z" "accel\_forearm\_x"

[148] "accel\_forearm\_y" "accel\_forearm\_z" "magnet\_forearm\_x"

[151] "magnet\_forearm\_y" "magnet\_forearm\_z" "accel\_forearm\_y.1"

[154] "accel\_forearm\_z.1" "magnet\_forearm\_x.1" "magnet\_forearm\_y.1"

[157] "magnet\_forearm\_z.1" "classe"

> dim(data)

[1] 4024 158

> pairs(data[1:10])

> # enable multi-core processing

> library(doParallel)

> cl <- makeCluster(detectCores())

> registerDoParallel()

> set.seed(12345)

> dataTrain<-data[1:4004,]

> dataTest<-data[4005:4024,]

> head(dataTrain)

user\_name raw\_timestamp\_part\_1 raw\_timestamp\_part\_2 cvtd\_timestamp new\_window

1 eurico 1322489729 34670 28/11/2011 14:15 no

2 eurico 1322489729 62641 28/11/2011 14:15 no

3 eurico 1322489729 70653 28/11/2011 14:15 no

4 eurico 1322489729 82654 28/11/2011 14:15 no

5 eurico 1322489729 90637 28/11/2011 14:15 no

6 eurico 1322489729 170626 28/11/2011 14:15 no

num\_window roll\_belt pitch\_belt yaw\_belt total\_accel\_belt kurtosis\_roll\_belt

1 1 3.70 41.6 -82.8 3 -1.03566

2 1 3.66 42.8 -82.5 2 -1.03566

3 1 3.58 43.7 -82.3 1 -1.03566

4 1 3.56 44.4 -82.1 1 -1.03566

5 1 3.57 45.1 -81.9 1 -1.03566

6 1 3.45 45.6 -81.9 1 -1.03566

kurtosis\_picth\_belt skewness\_roll\_belt skewness\_roll\_belt.1 max\_roll\_belt

1 -0.39133 0.005406 0.045115 -4.1

2 -0.39133 0.005406 0.045115 -4.1

3 -0.39133 0.005406 0.045115 -4.1

4 -0.39133 0.005406 0.045115 -4.1

5 -0.39133 0.005406 0.045115 -4.1

6 -0.39133 0.005406 0.045115 -4.1

max\_picth\_belt max\_yaw\_belt min\_roll\_belt min\_pitch\_belt min\_yaw\_belt

1 20 -1 -7.25 18 -1

2 20 -1 -7.25 18 -1

3 20 -1 -7.25 18 -1

4 20 -1 -7.25 18 -1

5 20 -1 -7.25 18 -1

6 20 -1 -7.25 18 -1

amplitude\_roll\_belt amplitude\_pitch\_belt amplitude\_yaw\_belt var\_total\_accel\_belt

1 1.345 2 0 0.3

2 1.345 2 0 0.3

3 1.345 2 0 0.3

4 1.345 2 0 0.3

5 1.345 2 0 0.3

6 1.345 2 0 0.3

avg\_roll\_belt stddev\_roll\_belt var\_roll\_belt avg\_pitch\_belt stddev\_pitch\_belt

1 121.9 0.6 0.35 25.75 0.35

2 121.9 0.6 0.35 25.75 0.35

3 121.9 0.6 0.35 25.75 0.35

4 121.9 0.6 0.35 25.75 0.35

5 121.9 0.6 0.35 25.75 0.35

6 121.9 0.6 0.35 25.75 0.35

var\_pitch\_belt avg\_yaw\_belt stddev\_yaw\_belt var\_yaw\_belt gyros\_belt\_x gyros\_belt\_y

1 0.1 -4.95 0.4 0.17 2.02 0.18

2 0.1 -4.95 0.4 0.17 1.96 0.14

3 0.1 -4.95 0.4 0.17 1.88 0.08

4 0.1 -4.95 0.4 0.17 1.80 0.03

5 0.1 -4.95 0.4 0.17 1.77 0.00

6 0.1 -4.95 0.4 0.17 1.75 -0.03

gyros\_belt\_z accel\_belt\_x accel\_belt\_y accel\_belt\_z magnet\_belt\_x magnet\_belt\_y

1 0.02 -3 -18 22 387 525

2 0.05 -2 -13 16 405 512

3 0.05 -2 -6 8 409 511

4 0.08 -6 -5 7 422 513

5 0.13 -4 -9 0 418 508

6 0.16 1 -9 -5 432 510

magnet\_belt\_z roll\_arm pitch\_arm yaw\_arm total\_accel\_arm var\_accel\_arm avg\_roll\_arm

1 -267 132 -43.7 -53.6 38 65.0977 76.22175

2 -254 129 -45.3 -49.0 38 65.0977 76.22175

3 -244 125 -46.8 -43.7 35 65.0977 76.22175

4 -221 120 -48.1 -38.1 35 65.0977 76.22175

5 -208 115 -49.1 -31.7 34 65.0977 76.22175

6 -189 110 -49.6 -25.8 33 65.0977 76.22175

stddev\_roll\_arm var\_roll\_arm avg\_pitch\_arm stddev\_pitch\_arm var\_pitch\_arm

1 16.1039 259.3599 -10.1695 10.66725 113.7978

2 16.1039 259.3599 -10.1695 10.66725 113.7978

3 16.1039 259.3599 -10.1695 10.66725 113.7978

4 16.1039 259.3599 -10.1695 10.66725 113.7978

5 16.1039 259.3599 -10.1695 10.66725 113.7978

6 16.1039 259.3599 -10.1695 10.66725 113.7978

avg\_yaw\_arm stddev\_yaw\_arm var\_yaw\_arm gyros\_arm\_x gyros\_arm\_y gyros\_arm\_z

1 19.0615 35.8809 1287.463 2.65 -0.61 -0.02

2 19.0615 35.8809 1287.463 2.79 -0.64 -0.11

3 19.0615 35.8809 1287.463 2.91 -0.69 -0.15

4 19.0615 35.8809 1287.463 3.08 -0.72 -0.23

5 19.0615 35.8809 1287.463 3.20 -0.77 -0.25

6 19.0615 35.8809 1287.463 3.31 -0.83 -0.30

accel\_arm\_x accel\_arm\_y accel\_arm\_z magnet\_arm\_x magnet\_arm\_y magnet\_arm\_z

1 143 30 -346 556 -205 -374

2 146 35 -339 599 -206 -335

3 156 44 -307 613 -198 -319

4 158 52 -305 646 -186 -268

5 163 55 -288 670 -175 -241

6 160 59 -274 696 -174 -193

kurtosis\_roll\_arm kurtosis\_picth\_arm kurtosis\_yaw\_arm skewness\_roll\_arm

1 -1.18224 -0.96912 -0.86977 0.12353

2 -1.18224 -0.96912 -0.86977 0.12353

3 -1.18224 -0.96912 -0.86977 0.12353

4 -1.18224 -0.96912 -0.86977 0.12353

5 -1.18224 -0.96912 -0.86977 0.12353

6 -1.18224 -0.96912 -0.86977 0.12353

skewness\_pitch\_arm skewness\_yaw\_arm max\_roll\_arm max\_picth\_arm max\_yaw\_arm

1 -0.10319 0.059765 8.45 77.25 38

2 -0.10319 0.059765 8.45 77.25 38

3 -0.10319 0.059765 8.45 77.25 38

4 -0.10319 0.059765 8.45 77.25 38

5 -0.10319 0.059765 8.45 77.25 38

6 -0.10319 0.059765 8.45 77.25 38

min\_roll\_arm min\_pitch\_arm min\_yaw\_arm amplitude\_roll\_arm amplitude\_pitch\_arm

1 -33.6 -58.6 10 36.945 121.5

2 -33.6 -58.6 10 36.945 121.5

3 -33.6 -58.6 10 36.945 121.5

4 -33.6 -58.6 10 36.945 121.5

5 -33.6 -58.6 10 36.945 121.5

6 -33.6 -58.6 10 36.945 121.5

amplitude\_yaw\_arm roll\_dumbbell pitch\_dumbbell yaw\_dumbbell kurtosis\_roll\_dumbbell

1 27 51.23554 11.698847 104.26473 -0.09595

2 27 55.82442 9.645819 100.22805 -0.09595

3 27 55.46983 6.875244 101.08411 -0.09595

4 27 55.94486 11.079297 99.78456 -0.09595

5 27 55.21174 11.426833 100.42258 -0.09595

6 27 54.24731 14.126636 100.61574 -0.09595

kurtosis\_picth\_dumbbell skewness\_roll\_dumbbell skewness\_pitch\_dumbbell

1 -0.4422 0.0819 -0.216

2 -0.4422 0.0819 -0.216

3 -0.4422 0.0819 -0.216

4 -0.4422 0.0819 -0.216

5 -0.4422 0.0819 -0.216

6 -0.4422 0.0819 -0.216

max\_roll\_dumbbell max\_picth\_dumbbell max\_yaw\_dumbbell min\_roll\_dumbbell

1 41.85 133 -0.1 -26.75

2 41.85 133 -0.1 -26.75

3 41.85 133 -0.1 -26.75

4 41.85 133 -0.1 -26.75

5 41.85 133 -0.1 -26.75

6 41.85 133 -0.1 -26.75

min\_pitch\_dumbbell min\_yaw\_dumbbell amplitude\_roll\_dumbbell amplitude\_pitch\_dumbbell

1 20.2 -0.1 55.71 54.74

2 20.2 -0.1 55.71 54.74

3 20.2 -0.1 55.71 54.74

4 20.2 -0.1 55.71 54.74

5 20.2 -0.1 55.71 54.74

6 20.2 -0.1 55.71 54.74

amplitude\_yaw\_dumbbell total\_accel\_dumbbell var\_accel\_dumbbell avg\_roll\_dumbbell

1 0 4 2.41635 -5.11805

2 0 4 2.41635 -5.11805

3 0 4 2.41635 -5.11805

4 0 5 2.41635 -5.11805

5 0 4 2.41635 -5.11805

6 0 4 2.41635 -5.11805

stddev\_roll\_dumbbell var\_roll\_dumbbell avg\_pitch\_dumbbell stddev\_pitch\_dumbbell

1 17.058 291.001 13.9312 14.1062

2 17.058 291.001 13.9312 14.1062

3 17.058 291.001 13.9312 14.1062

4 17.058 291.001 13.9312 14.1062

5 17.058 291.001 13.9312 14.1062

6 17.058 291.001 13.9312 14.1062

var\_pitch\_dumbbell avg\_yaw\_dumbbell stddev\_yaw\_dumbbell var\_yaw\_dumbbell

1 199.0775 64.7063 13.5747 184.5578

2 199.0775 64.7063 13.5747 184.5578

3 199.0775 64.7063 13.5747 184.5578

4 199.0775 64.7063 13.5747 184.5578

5 199.0775 64.7063 13.5747 184.5578

6 199.0775 64.7063 13.5747 184.5578

gyros\_dumbbell\_x gyros\_dumbbell\_y gyros\_dumbbell\_z accel\_dumbbell\_x accel\_dumbbell\_y

1 -0.31 0.16 0.08 5 21

2 -0.31 0.14 0.07 4 22

3 -0.31 0.16 0.05 3 23

4 -0.31 0.16 0.07 5 24

5 -0.31 0.14 0.07 5 23

6 -0.31 0.14 0.07 6 22

accel\_dumbbell\_z magnet\_dumbbell\_x magnet\_dumbbell\_y magnet\_dumbbell\_z roll\_forearm

1 37 -471 191 277 -111

2 35 -472 184 281 -112

3 37 -468 190 275 -114

4 38 -469 184 285 -115

5 37 -468 189 292 -117

6 36 -473 188 278 -118

pitch\_forearm yaw\_forearm kurtosis\_roll\_forearm kurtosis\_picth\_forearm

1 26.5 138 -1.09475 -0.97525

2 26.2 138 -1.09475 -0.97525

3 26.0 137 -1.09475 -0.97525

4 25.8 137 -1.09475 -0.97525

5 25.5 137 -1.09475 -0.97525

6 25.1 137 -1.09475 -0.97525

skewness\_roll\_forearm skewness\_pitch\_forearm max\_roll\_forearm max\_picth\_forearm

1 -0.05065 0.17285 49.6 168

2 -0.05065 0.17285 49.6 168

3 -0.05065 0.17285 49.6 168

4 -0.05065 0.17285 49.6 168

5 -0.05065 0.17285 49.6 168

6 -0.05065 0.17285 49.6 168

max\_yaw\_forearm min\_roll\_forearm min\_pitch\_forearm min\_yaw\_forearm

1 -1.1 4.65 -168.5 -1.1

2 -1.1 4.65 -168.5 -1.1

3 -1.1 4.65 -168.5 -1.1

4 -1.1 4.65 -168.5 -1.1

5 -1.1 4.65 -168.5 -1.1

6 -1.1 4.65 -168.5 -1.1

amplitude\_roll\_forearm amplitude\_pitch\_forearm amplitude\_yaw\_forearm

1 32.2 341.5 0

2 32.2 341.5 0

3 32.2 341.5 0

4 32.2 341.5 0

5 32.2 341.5 0

6 32.2 341.5 0

total\_accel\_forearm var\_accel\_forearm avg\_roll\_forearm stddev\_roll\_forearm

1 30 14.0772 27.85936 45.16342

2 31 14.0772 27.85936 45.16342

3 32 14.0772 27.85936 45.16342

4 33 14.0772 27.85936 45.16342

5 34 14.0772 27.85936 45.16342

6 36 14.0772 27.85936 45.16342

var\_roll\_forearm avg\_pitch\_forearm stddev\_pitch\_forearm var\_pitch\_forearm

1 2749.163 25.35597 8.906695 79.33451

2 2749.163 25.35597 8.906695 79.33451

3 2749.163 25.35597 8.906695 79.33451

4 2749.163 25.35597 8.906695 79.33451

5 2749.163 25.35597 8.906695 79.33451

6 2749.163 25.35597 8.906695 79.33451

avg\_yaw\_forearm stddev\_yaw\_forearm var\_yaw\_forearm gyros\_forearm\_x gyros\_forearm\_y

1 17.09505 74.27584 5541.956 -0.05 -0.37

2 17.09505 74.27584 5541.956 -0.06 -0.37

3 17.09505 74.27584 5541.956 -0.05 -0.27

4 17.09505 74.27584 5541.956 0.02 -0.24

5 17.09505 74.27584 5541.956 0.08 -0.27

6 17.09505 74.27584 5541.956 0.14 -0.29

gyros\_forearm\_z accel\_forearm\_x accel\_forearm\_y accel\_forearm\_z magnet\_forearm\_x

1 -0.43 -170 155 184 -1160

2 -0.59 -178 164 182 -1150

3 -0.72 -182 172 185 -1130

4 -0.79 -185 182 188 -1120

5 -0.82 -188 195 188 -1100

6 -0.82 -208 207 190 -1090

magnet\_forearm\_y magnet\_forearm\_z accel\_forearm\_y.1 accel\_forearm\_z.1

1 1400 -876 155 184

2 1410 -871 164 182

3 1400 -863 172 185

4 1400 -855 182 188

5 1400 -843 195 188

6 1400 -838 207 190

magnet\_forearm\_x.1 magnet\_forearm\_y.1 magnet\_forearm\_z.1 classe

1 -1160 1400 -876 E

2 -1150 1410 -871 E

3 -1130 1400 -863 E

4 -1120 1400 -855 E

5 -1100 1400 -843 E

6 -1090 1400 -838 E

> head(dataTest)

user\_name raw\_timestamp\_part\_1 raw\_timestamp\_part\_2 cvtd\_timestamp new\_window

4005 pedro 1323095020 504350 5/12/2011 14:23 no

4006 pedro 1323095020 504423 5/12/2011 14:23 no

4007 pedro 1323095020 504460 5/12/2011 14:23 no

4008 pedro 1323095020 532277 5/12/2011 14:23 no

4009 pedro 1323095020 532302 5/12/2011 14:23 no

4010 pedro 1323095020 572363 5/12/2011 14:23 no

num\_window roll\_belt pitch\_belt yaw\_belt total\_accel\_belt kurtosis\_roll\_belt

4005 91 122 25.9 -3.54 19 -1.03566

4006 91 122 25.9 -3.48 19 -1.03566

4007 91 122 25.8 -3.39 19 -1.03566

4008 91 122 25.8 -3.33 19 -1.03566

4009 91 122 25.8 -3.30 19 -1.03566

4010 91 122 25.8 -3.29 19 -1.03566

kurtosis\_picth\_belt skewness\_roll\_belt skewness\_roll\_belt.1 max\_roll\_belt

4005 -0.39133 0.005406 0.045115 -4.1

4006 -0.39133 0.005406 0.045115 -4.1

4007 -0.39133 0.005406 0.045115 -4.1

4008 -0.39133 0.005406 0.045115 -4.1

4009 -0.39133 0.005406 0.045115 -4.1

4010 -0.39133 0.005406 0.045115 -4.1

max\_picth\_belt max\_yaw\_belt min\_roll\_belt min\_pitch\_belt min\_yaw\_belt

4005 20 -1 -7.25 18 -1

4006 20 -1 -7.25 18 -1

4007 20 -1 -7.25 18 -1

4008 20 -1 -7.25 18 -1

4009 20 -1 -7.25 18 -1

4010 20 -1 -7.25 18 -1

amplitude\_roll\_belt amplitude\_pitch\_belt amplitude\_yaw\_belt var\_total\_accel\_belt

4005 1.345 2 0 0.3

4006 1.345 2 0 0.3

4007 1.345 2 0 0.3

4008 1.345 2 0 0.3

4009 1.345 2 0 0.3

4010 1.345 2 0 0.3

avg\_roll\_belt stddev\_roll\_belt var\_roll\_belt avg\_pitch\_belt stddev\_pitch\_belt

4005 121.9 0.6 0.35 25.75 0.35

4006 121.9 0.6 0.35 25.75 0.35

4007 121.9 0.6 0.35 25.75 0.35

4008 121.9 0.6 0.35 25.75 0.35

4009 121.9 0.6 0.35 25.75 0.35

4010 121.9 0.6 0.35 25.75 0.35

var\_pitch\_belt avg\_yaw\_belt stddev\_yaw\_belt var\_yaw\_belt gyros\_belt\_x

4005 0.1 -4.95 0.4 0.17 -0.39

4006 0.1 -4.95 0.4 0.17 -0.39

4007 0.1 -4.95 0.4 0.17 -0.37

4008 0.1 -4.95 0.4 0.17 -0.39

4009 0.1 -4.95 0.4 0.17 -0.39

4010 0.1 -4.95 0.4 0.17 -0.40

gyros\_belt\_y gyros\_belt\_z accel\_belt\_x accel\_belt\_y accel\_belt\_z magnet\_belt\_x

4005 -0.03 -0.48 -39 71 -170 -1

4006 -0.03 -0.46 -39 69 -172 1

4007 -0.03 -0.46 -40 68 -170 -4

4008 -0.03 -0.46 -42 69 -167 -6

4009 -0.03 -0.46 -42 70 -168 -6

4010 -0.03 -0.46 -42 72 -171 -4

magnet\_belt\_y magnet\_belt\_z roll\_arm pitch\_arm yaw\_arm total\_accel\_arm

4005 582 -356 83.0 23.1 47.1 23

4006 587 -358 81.6 22.1 44.5 25

4007 586 -362 80.2 21.0 41.9 24

4008 589 -366 78.9 20.0 39.4 26

4009 590 -368 77.6 18.9 36.7 27

4010 591 -354 76.5 17.7 34.0 28

var\_accel\_arm avg\_roll\_arm stddev\_roll\_arm var\_roll\_arm avg\_pitch\_arm

4005 65.0977 76.22175 16.1039 259.3599 -10.1695

4006 65.0977 76.22175 16.1039 259.3599 -10.1695

4007 65.0977 76.22175 16.1039 259.3599 -10.1695

4008 65.0977 76.22175 16.1039 259.3599 -10.1695

4009 65.0977 76.22175 16.1039 259.3599 -10.1695

4010 65.0977 76.22175 16.1039 259.3599 -10.1695

stddev\_pitch\_arm var\_pitch\_arm avg\_yaw\_arm stddev\_yaw\_arm var\_yaw\_arm gyros\_arm\_x

4005 10.66725 113.7978 19.0615 35.8809 1287.463 -2.06

4006 10.66725 113.7978 19.0615 35.8809 1287.463 -2.06

4007 10.66725 113.7978 19.0615 35.8809 1287.463 -2.07

4008 10.66725 113.7978 19.0615 35.8809 1287.463 -2.14

4009 10.66725 113.7978 19.0615 35.8809 1287.463 -2.14

4010 10.66725 113.7978 19.0615 35.8809 1287.463 -2.12

gyros\_arm\_y gyros\_arm\_z accel\_arm\_x accel\_arm\_y accel\_arm\_z magnet\_arm\_x

4005 0.55 -0.26 182 28 138 342

4006 0.56 -0.31 196 23 148 370

4007 0.51 -0.33 193 18 140 388

4008 0.48 -0.31 207 21 140 432

4009 0.43 -0.28 226 12 140 448

4010 0.37 -0.20 235 9 143 482

magnet\_arm\_y magnet\_arm\_z kurtosis\_roll\_arm kurtosis\_picth\_arm kurtosis\_yaw\_arm

4005 280 503 -1.18224 -0.96912 -0.86977

4006 263 485 -1.18224 -0.96912 -0.86977

4007 261 486 -1.18224 -0.96912 -0.86977

4008 249 472 -1.18224 -0.96912 -0.86977

4009 239 454 -1.18224 -0.96912 -0.86977

4010 225 437 -1.18224 -0.96912 -0.86977

skewness\_roll\_arm skewness\_pitch\_arm skewness\_yaw\_arm max\_roll\_arm max\_picth\_arm

4005 0.12353 -0.10319 0.059765 8.45 77.25

4006 0.12353 -0.10319 0.059765 8.45 77.25

4007 0.12353 -0.10319 0.059765 8.45 77.25

4008 0.12353 -0.10319 0.059765 8.45 77.25

4009 0.12353 -0.10319 0.059765 8.45 77.25

4010 0.12353 -0.10319 0.059765 8.45 77.25

max\_yaw\_arm min\_roll\_arm min\_pitch\_arm min\_yaw\_arm amplitude\_roll\_arm

4005 38 -33.6 -58.6 10 36.945

4006 38 -33.6 -58.6 10 36.945

4007 38 -33.6 -58.6 10 36.945

4008 38 -33.6 -58.6 10 36.945

4009 38 -33.6 -58.6 10 36.945

4010 38 -33.6 -58.6 10 36.945

amplitude\_pitch\_arm amplitude\_yaw\_arm roll\_dumbbell pitch\_dumbbell yaw\_dumbbell

4005 121.5 27 -64.335693 34.112879 81.36272

4006 121.5 27 -40.195925 53.186300 87.56417

4007 121.5 27 -2.792178 62.646067 94.35153

4008 121.5 27 10.384733 49.182165 106.61750

4009 121.5 27 16.647582 22.278218 129.09792

4010 121.5 27 -14.860425 6.172999 140.97044

kurtosis\_roll\_dumbbell kurtosis\_picth\_dumbbell skewness\_roll\_dumbbell

4005 -0.09595 -0.4422 0.0819

4006 -0.09595 -0.4422 0.0819

4007 -0.09595 -0.4422 0.0819

4008 -0.09595 -0.4422 0.0819

4009 -0.09595 -0.4422 0.0819

4010 -0.09595 -0.4422 0.0819

skewness\_pitch\_dumbbell max\_roll\_dumbbell max\_picth\_dumbbell max\_yaw\_dumbbell

4005 -0.216 41.85 133 -0.1

4006 -0.216 41.85 133 -0.1

4007 -0.216 41.85 133 -0.1

4008 -0.216 41.85 133 -0.1

4009 -0.216 41.85 133 -0.1

4010 -0.216 41.85 133 -0.1

min\_roll\_dumbbell min\_pitch\_dumbbell min\_yaw\_dumbbell amplitude\_roll\_dumbbell

4005 -26.75 20.2 -0.1 55.71

4006 -26.75 20.2 -0.1 55.71

4007 -26.75 20.2 -0.1 55.71

4008 -26.75 20.2 -0.1 55.71

4009 -26.75 20.2 -0.1 55.71

4010 -26.75 20.2 -0.1 55.71

amplitude\_pitch\_dumbbell amplitude\_yaw\_dumbbell total\_accel\_dumbbell

4005 54.74 0 9

4006 54.74 0 7

4007 54.74 0 7

4008 54.74 0 9

4009 54.74 0 9

4010 54.74 0 8

var\_accel\_dumbbell avg\_roll\_dumbbell stddev\_roll\_dumbbell var\_roll\_dumbbell

4005 2.41635 -5.11805 17.058 291.001

4006 2.41635 -5.11805 17.058 291.001

4007 2.41635 -5.11805 17.058 291.001

4008 2.41635 -5.11805 17.058 291.001

4009 2.41635 -5.11805 17.058 291.001

4010 2.41635 -5.11805 17.058 291.001

avg\_pitch\_dumbbell stddev\_pitch\_dumbbell var\_pitch\_dumbbell avg\_yaw\_dumbbell

4005 13.9312 14.1062 199.0775 64.7063

4006 13.9312 14.1062 199.0775 64.7063

4007 13.9312 14.1062 199.0775 64.7063

4008 13.9312 14.1062 199.0775 64.7063

4009 13.9312 14.1062 199.0775 64.7063

4010 13.9312 14.1062 199.0775 64.7063

stddev\_yaw\_dumbbell var\_yaw\_dumbbell gyros\_dumbbell\_x gyros\_dumbbell\_y

4005 13.5747 184.5578 0.16 -0.75

4006 13.5747 184.5578 0.08 -0.79

4007 13.5747 184.5578 0.03 -0.87

4008 13.5747 184.5578 -0.02 -0.92

4009 13.5747 184.5578 -0.02 -0.85

4010 13.5747 184.5578 0.00 -0.63

gyros\_dumbbell\_z accel\_dumbbell\_x accel\_dumbbell\_y accel\_dumbbell\_z

4005 0.39 29 -52 63

4006 0.15 35 -27 53

4007 -0.02 42 -2 58

4008 0.11 41 9 76

4009 0.33 20 15 87

4010 0.51 5 -12 80

magnet\_dumbbell\_x magnet\_dumbbell\_y magnet\_dumbbell\_z roll\_forearm pitch\_forearm

4005 494 -550 -105 141 40.9

4006 501 -554 -91 142 38.1

4007 514 -539 -104 142 34.3

4008 515 -533 -108 142 31.4

4009 526 -525 -98 141 29.2

4010 537 -517 -108 141 27.0

yaw\_forearm kurtosis\_roll\_forearm kurtosis\_picth\_forearm skewness\_roll\_forearm

4005 147 -1.09475 -0.97525 -0.05065

4006 143 -1.09475 -0.97525 -0.05065

4007 137 -1.09475 -0.97525 -0.05065

4008 132 -1.09475 -0.97525 -0.05065

4009 128 -1.09475 -0.97525 -0.05065

4010 123 -1.09475 -0.97525 -0.05065

skewness\_pitch\_forearm max\_roll\_forearm max\_picth\_forearm max\_yaw\_forearm

4005 0.17285 49.6 168 -1.1

4006 0.17285 49.6 168 -1.1

4007 0.17285 49.6 168 -1.1

4008 0.17285 49.6 168 -1.1

4009 0.17285 49.6 168 -1.1

4010 0.17285 49.6 168 -1.1

min\_roll\_forearm min\_pitch\_forearm min\_yaw\_forearm amplitude\_roll\_forearm

4005 4.65 -168.5 -1.1 32.2

4006 4.65 -168.5 -1.1 32.2

4007 4.65 -168.5 -1.1 32.2

4008 4.65 -168.5 -1.1 32.2

4009 4.65 -168.5 -1.1 32.2

4010 4.65 -168.5 -1.1 32.2

amplitude\_pitch\_forearm amplitude\_yaw\_forearm total\_accel\_forearm

4005 341.5 0 29

4006 341.5 0 40

4007 341.5 0 39

4008 341.5 0 39

4009 341.5 0 39

4010 341.5 0 38

var\_accel\_forearm avg\_roll\_forearm stddev\_roll\_forearm var\_roll\_forearm

4005 14.0772 27.85936 45.16342 2749.163

4006 14.0772 27.85936 45.16342 2749.163

4007 14.0772 27.85936 45.16342 2749.163

4008 14.0772 27.85936 45.16342 2749.163

4009 14.0772 27.85936 45.16342 2749.163

4010 14.0772 27.85936 45.16342 2749.163

avg\_pitch\_forearm stddev\_pitch\_forearm var\_pitch\_forearm avg\_yaw\_forearm

4005 25.35597 8.906695 79.33451 17.09505

4006 25.35597 8.906695 79.33451 17.09505

4007 25.35597 8.906695 79.33451 17.09505

4008 25.35597 8.906695 79.33451 17.09505

4009 25.35597 8.906695 79.33451 17.09505

4010 25.35597 8.906695 79.33451 17.09505

stddev\_yaw\_forearm var\_yaw\_forearm gyros\_forearm\_x gyros\_forearm\_y

4005 74.27584 5541.956 0.16 3.48

4006 74.27584 5541.956 0.11 3.36

4007 74.27584 5541.956 0.21 4.38

4008 74.27584 5541.956 0.02 3.77

4009 74.27584 5541.956 -0.35 3.21

4010 74.27584 5541.956 -0.69 3.58

gyros\_forearm\_z accel\_forearm\_x accel\_forearm\_y accel\_forearm\_z magnet\_forearm\_x

4005 3.08 12 269 -98 -704

4006 2.76 -51 353 -158 -706

4007 2.03 33 357 -122 -700

4008 1.74 9 359 -125 -684

4009 1.44 -9 352 -143 -673

4010 1.07 -44 335 -153 -652

magnet\_forearm\_y magnet\_forearm\_z accel\_forearm\_y.1 accel\_forearm\_z.1

4005 398 921 269 -98

4006 484 923 353 -158

4007 524 921 357 -122

4008 589 923 359 -125

4009 619 935 352 -143

4010 672 947 335 -153

magnet\_forearm\_x.1 magnet\_forearm\_y.1 magnet\_forearm\_z.1 classe

4005 -704 398 921 C

4006 -706 484 923 C

4007 -700 524 921 C

4008 -684 589 923 C

4009 -673 619 935 C

4010 -652 672 947 C

> indexNA <- as.vector(sapply(dataTrain[,1:158],function(x) {length(which(is.na(x)))!=0}))

> dataTrain <- dataTrain[,!indexNA]

> train\_control<- trainControl(method="cv", number=10)

>

> model<- train(classe ~., data=dataTrain,trControl=train\_control, method="rf")

> model

Random Forest

4004 samples

157 predictor

5 classes: 'A', 'B', 'C', 'D', 'E'

No pre-processing

Resampling: Cross-Validated (10 fold)

Summary of sample sizes: 3604, 3604, 3604, 3604, 3603, 3603, ...

Resampling results across tuning parameters:

mtry Accuracy Kappa

2 0.9730274 0.9617679

83 1.0000000 1.0000000

165 0.9990006 0.9985890

Accuracy was used to select the optimal model using the largest value.

The final value used for the model was mtry = 83.

> # make predictions

> predictions<- predict(model,dataTrain)

> # append predictions

> pred<- cbind(dataTrain,predictions)

> # summarize results

> confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

> confusionMatrix

Confusion Matrix and Statistics

Reference

Prediction A B C D E

A 1365 0 0 0 0

B 0 901 0 0 0

C 0 0 92 0 0

D 0 0 0 276 0

E 0 0 0 0 1370

Overall Statistics

Accuracy : 1

95% CI : (0.9991, 1)

No Information Rate : 0.3422

P-Value [Acc > NIR] : < 2.2e-16

Kappa : 1

Mcnemar's Test P-Value : NA

Statistics by Class:

Class: A Class: B Class: C Class: D Class: E

Sensitivity 1.0000 1.000 1.00000 1.00000 1.0000

Specificity 1.0000 1.000 1.00000 1.00000 1.0000

Pos Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Neg Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Detection Rate 0.3409 0.225 0.02298 0.06893 0.3422

Detection Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Balanced Accuracy 1.0000 1.000 1.00000 1.00000 1.0000

> #how do we create a cross validation scheme

> control <- trainControl(method = 'repeatedcv',

+ number = 10,

+ repeats = 3)

> seed <-7

> metric <- 'Accuracy'

> set.seed(seed)

> mtry <- sqrt(ncol(dataTrain))

> tunegrid <- expand.grid(.mtry=mtry)

> rf\_default <- train(pitch\_belt~.,

+ data = dataTrain,

+ method = 'rf',

+ metric = 0,

+ tuneGrid = tunegrid,

+ trControl = control)

Warning message:

In train.default(x, y, weights = w, ...) :

The metric "0" was not in the result set. RMSE will be used instead.

> print(rf\_default)

Random Forest

4004 samples

157 predictor

No pre-processing

Resampling: Cross-Validated (10 fold, repeated 3 times)

Summary of sample sizes: 3602, 3603, 3603, 3603, 3605, 3604, ...

Resampling results:

RMSE Rsquared MAE

0.3719505 0.9996205 0.1836054

Tuning parameter 'mtry' was held constant at a value of 12.56981

> #-------------------------------

>

> # make predictions

> predictions<- predict(rf\_default,dataTest)

> # append predictions

> pred<- cbind(dataTest,predictions)

> # summarize results

> confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

Error: `data` and `reference` should be factors with the same levels.

> confusionMatrix

Confusion Matrix and Statistics

Reference

Prediction A B C D E

A 1365 0 0 0 0

B 0 901 0 0 0

C 0 0 92 0 0

D 0 0 0 276 0

E 0 0 0 0 1370

Overall Statistics

Accuracy : 1

95% CI : (0.9991, 1)

No Information Rate : 0.3422

P-Value [Acc > NIR] : < 2.2e-16

Kappa : 1

Mcnemar's Test P-Value : NA

Statistics by Class:

Class: A Class: B Class: C Class: D Class: E

Sensitivity 1.0000 1.000 1.00000 1.00000 1.0000

Specificity 1.0000 1.000 1.00000 1.00000 1.0000

Pos Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Neg Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Detection Rate 0.3409 0.225 0.02298 0.06893 0.3422

Detection Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Balanced Accuracy 1.0000 1.000 1.00000 1.00000 1.0000

> varImp(rf\_default)

Error in varImp[, "%IncMSE"] : subscript out of bounds

Called from: data.frame(Overall = varImp[, "%IncMSE"])

Browse[1]> #----------------

Browse[1]> # random search for parameters

Browse[1]> control <- trainControl(method = 'repeatedcv',

+ number = 10,

+ repeats = 3,

+ search = 'random')

Browse[1]> # make predictions

Browse[1]> predictions<- predict(rf\_default,dataTest)

Browse[1]>

> # append predictions

> pred<- cbind(dataTest,predictions)

>

> # summarize results

> confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

Error: `data` and `reference` should be factors with the same levels.

> confusionMatrix

Confusion Matrix and Statistics

Reference

Prediction A B C D E

A 1365 0 0 0 0

B 0 901 0 0 0

C 0 0 92 0 0

D 0 0 0 276 0

E 0 0 0 0 1370

Overall Statistics

Accuracy : 1

95% CI : (0.9991, 1)

No Information Rate : 0.3422

P-Value [Acc > NIR] : < 2.2e-16

Kappa : 1

Mcnemar's Test P-Value : NA

Statistics by Class:

Class: A Class: B Class: C Class: D Class: E

Sensitivity 1.0000 1.000 1.00000 1.00000 1.0000

Specificity 1.0000 1.000 1.00000 1.00000 1.0000

Pos Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Neg Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Detection Rate 0.3409 0.225 0.02298 0.06893 0.3422

Detection Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Balanced Accuracy 1.0000 1.000 1.00000 1.00000 1.0000

> varImp(random)

Error in varImp(random) : object 'random' not found

> #--------------------

> #--------------------------------------------------------------

> # Grid search

> control <- trainControl(method = 'repeatedcv',

+ number = 10,

+ repeats = 3,

+ search = 'grid')

> set.seed(seed)

> tunegrid <- expand.grid(.mtry=c(1:80))

> #mtry <- sqrt(ncol(x))

> rf\_gridsearch <- train(~.,

+ data = dataTrain[1:200,],

+ method = 'rf',

+ metric = metric,

+ tuneGrid = tunegrid,

+ trControl = control)

Error: Please make sure `y` is a factor or numeric value.

> print(rf\_gridsearch)

Error in print(rf\_gridsearch) : object 'rf\_gridsearch' not found

> plot(rf\_gridsearch)

Error in plot(rf\_gridsearch) : object 'rf\_gridsearch' not found

> # make predictions

> predictions<- predict(rf\_gridsearch,dataTest)

Error in predict(rf\_gridsearch, dataTest) :

object 'rf\_gridsearch' not found

>

> # append predictions

> pred<- cbind(dataTest,predictions)

>

> # summarize results

> confusionMatrix<- confusionMatrix(pred$predictions,pred$pitch\_belt)

Error: `data` and `reference` should be factors with the same levels.

> confusionMatrix

Confusion Matrix and Statistics

Reference

Prediction A B C D E

A 1365 0 0 0 0

B 0 901 0 0 0

C 0 0 92 0 0

D 0 0 0 276 0

E 0 0 0 0 1370

Overall Statistics

Accuracy : 1

95% CI : (0.9991, 1)

No Information Rate : 0.3422

P-Value [Acc > NIR] : < 2.2e-16

Kappa : 1

Mcnemar's Test P-Value : NA

Statistics by Class:

Class: A Class: B Class: C Class: D Class: E

Sensitivity 1.0000 1.000 1.00000 1.00000 1.0000

Specificity 1.0000 1.000 1.00000 1.00000 1.0000

Pos Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Neg Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Detection Rate 0.3409 0.225 0.02298 0.06893 0.3422

Detection Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Balanced Accuracy 1.0000 1.000 1.00000 1.00000 1.0000

> varImp(rf\_gridsearch)

Error in varImp(rf\_gridsearch) : object 'rf\_gridsearch' not found

>

> ---------------------------

+ # Boosting

+ # ---------------------------------------

+ # Boosting model requires three things

+

+ #1- a loss function to be optimized

+ #2- a weak learner to make predictions

+ #3- an additive model to add the weak learners to minimize the loss function

+

+ # gradient boosting

+ control <- trainControl(method = 'repeatedcv',

+ number = 5,

+ repeats = 3,

+ search = 'grid')

Error in -`\*tmp\*` : invalid argument to unary operator

>

> seed <- 7

> library(C50)

> set.seed(seed)

> metric <- 'Accuracy'

> gbm\_mod <- train(pitch\_belt~.,

+ data = dataTrain,

+ method = 'gbm',

+ metric = 0,

+ trControl = control)

Iter TrainDeviance ValidDeviance StepSize Improve

1 290.4643 nan 0.1000 66.8385

2 240.0107 nan 0.1000 49.7536

3 199.7165 nan 0.1000 39.9944

4 166.7692 nan 0.1000 31.6237

5 138.7180 nan 0.1000 27.8200

6 117.1658 nan 0.1000 21.8218

7 99.0041 nan 0.1000 17.7844

8 84.2149 nan 0.1000 13.7951

9 71.1916 nan 0.1000 12.5779

10 60.7509 nan 0.1000 10.4406

20 16.9581 nan 0.1000 2.0061

40 4.0588 nan 0.1000 0.1219

60 2.5921 nan 0.1000 0.0084

80 2.1022 nan 0.1000 -0.0069

100 1.7142 nan 0.1000 -0.0182

120 1.5353 nan 0.1000 -0.0081

140 1.2641 nan 0.1000 0.0052

150 1.2063 nan 0.1000 0.0001

Warning messages:

1: In train.default(x, y, weights = w, ...) :

The metric "0" was not in the result set. RMSE will be used instead.

2: In (function (x, y, offset = NULL, misc = NULL, distribution = "bernoulli", :

variable 30: amplitude\_yaw\_belt has no variation.

3: In (function (x, y, offset = NULL, misc = NULL, distribution = "bernoulli", :

variable 103: amplitude\_yaw\_dumbbell has no variation.

4: In (function (x, y, offset = NULL, misc = NULL, distribution = "bernoulli", :

variable 139: amplitude\_yaw\_forearm has no variation.

> print(gbm\_mod)

Stochastic Gradient Boosting

4004 samples

157 predictor

No pre-processing

Resampling: Cross-Validated (10 fold, repeated 3 times)

Summary of sample sizes: 3602, 3603, 3603, 3603, 3605, 3604, ...

Resampling results across tuning parameters:

interaction.depth n.trees RMSE Rsquared MAE

1 50 3.870491 0.9708972 2.0739488

1 100 2.518277 0.9818947 1.1065126

1 150 2.258849 0.9850289 0.9958785

2 50 2.183970 0.9866430 1.0364026

2 100 1.662759 0.9916854 0.8202113

2 150 1.485456 0.9934375 0.7464795

3 50 1.950370 0.9886048 0.9201246

3 100 1.529421 0.9928336 0.7607945

3 150 1.330676 0.9946265 0.6793264

Tuning parameter 'shrinkage' was held constant at a value of 0.1

Tuning

parameter 'n.minobsinnode' was held constant at a value of 10

RMSE was used to select the optimal model using the smallest value.

The final values used for the model were n.trees = 150, interaction.depth =

3, shrinkage = 0.1 and n.minobsinnode = 10.

> plot(gbm\_mod)

>

> summary(gbm\_mod)

var rel.inf

accel\_belt\_x accel\_belt\_x 5.294894e+01

user\_namecarlitos user\_namecarlitos 2.264130e+01

yaw\_belt yaw\_belt 1.009582e+01

magnet\_belt\_z magnet\_belt\_z 3.195192e+00

roll\_belt roll\_belt 2.097407e+00

magnet\_belt\_x magnet\_belt\_x 1.915681e+00

magnet\_belt\_y magnet\_belt\_y 1.262021e+00

user\_nameeurico user\_nameeurico 9.356612e-01

accel\_forearm\_z accel\_forearm\_z 8.031061e-01

yaw\_dumbbell yaw\_dumbbell 6.542763e-01

magnet\_dumbbell\_z magnet\_dumbbell\_z 5.525906e-01

roll\_arm roll\_arm 4.706543e-01

magnet\_forearm\_y magnet\_forearm\_y 4.194178e-01

raw\_timestamp\_part\_1 raw\_timestamp\_part\_1 4.174086e-01

accel\_dumbbell\_y accel\_dumbbell\_y 3.929518e-01

total\_accel\_belt total\_accel\_belt 2.065530e-01

classeE classeE 1.635014e-01

gyros\_belt\_x gyros\_belt\_x 7.771816e-02

gyros\_belt\_z gyros\_belt\_z 7.088366e-02

magnet\_forearm\_z magnet\_forearm\_z 6.476310e-02

gyros\_dumbbell\_z gyros\_dumbbell\_z 6.476114e-02

magnet\_dumbbell\_y magnet\_dumbbell\_y 6.082279e-02

accel\_arm\_y accel\_arm\_y 4.211095e-02

magnet\_forearm\_x magnet\_forearm\_x 3.649721e-02

gyros\_arm\_x gyros\_arm\_x 3.524758e-02

raw\_timestamp\_part\_2 raw\_timestamp\_part\_2 3.187452e-02

magnet\_arm\_y magnet\_arm\_y 2.913115e-02

roll\_forearm roll\_forearm 2.691063e-02

accel\_belt\_y accel\_belt\_y 2.612166e-02

gyros\_belt\_y gyros\_belt\_y 2.610858e-02

accel\_forearm\_x accel\_forearm\_x 2.591538e-02

yaw\_forearm yaw\_forearm 2.342590e-02

magnet\_arm\_x magnet\_arm\_x 2.176473e-02

roll\_dumbbell roll\_dumbbell 1.994693e-02

gyros\_dumbbell\_y gyros\_dumbbell\_y 1.606333e-02

accel\_dumbbell\_z accel\_dumbbell\_z 1.393099e-02

accel\_arm\_z accel\_arm\_z 1.171088e-02

pitch\_forearm pitch\_forearm 1.000282e-02

magnet\_dumbbell\_x magnet\_dumbbell\_x 9.832274e-03

gyros\_arm\_z gyros\_arm\_z 9.797342e-03

gyros\_forearm\_y gyros\_forearm\_y 8.829820e-03

yaw\_arm yaw\_arm 8.821700e-03

accel\_belt\_z accel\_belt\_z 6.208694e-03

cvtd\_timestamp5/12/2011 14:22 cvtd\_timestamp5/12/2011 14:22 6.063530e-03

accel\_dumbbell\_x accel\_dumbbell\_x 5.853397e-03

accel\_arm\_x accel\_arm\_x 5.649238e-03

total\_accel\_dumbbell total\_accel\_dumbbell 4.196944e-03

gyros\_forearm\_z gyros\_forearm\_z 4.185309e-03

accel\_forearm\_y accel\_forearm\_y 3.517185e-03

pitch\_dumbbell pitch\_dumbbell 3.131461e-03

gyros\_forearm\_x gyros\_forearm\_x 2.607342e-03

gyros\_arm\_y gyros\_arm\_y 2.402347e-03

total\_accel\_arm total\_accel\_arm 2.323679e-03

total\_accel\_forearm total\_accel\_forearm 1.821801e-03

gyros\_dumbbell\_x gyros\_dumbbell\_x 1.812110e-03

pitch\_arm pitch\_arm 1.803214e-03

min\_pitch\_forearm min\_pitch\_forearm 1.147246e-03

var\_yaw\_belt var\_yaw\_belt 1.011198e-03

magnet\_arm\_z magnet\_arm\_z 7.885704e-04

user\_namejeremy user\_namejeremy 0.000000e+00

user\_namepedro user\_namepedro 0.000000e+00

cvtd\_timestamp28/11/2011 14:15 cvtd\_timestamp28/11/2011 14:15 0.000000e+00

cvtd\_timestamp30/11/2011 17:12 cvtd\_timestamp30/11/2011 17:12 0.000000e+00

cvtd\_timestamp5/12/2011 11:23 cvtd\_timestamp5/12/2011 11:23 0.000000e+00

cvtd\_timestamp5/12/2011 11:25 cvtd\_timestamp5/12/2011 11:25 0.000000e+00

cvtd\_timestamp5/12/2011 14:23 cvtd\_timestamp5/12/2011 14:23 0.000000e+00

new\_windowyes new\_windowyes 0.000000e+00

num\_window num\_window 0.000000e+00

kurtosis\_roll\_belt kurtosis\_roll\_belt 0.000000e+00

kurtosis\_picth\_belt kurtosis\_picth\_belt 0.000000e+00

skewness\_roll\_belt skewness\_roll\_belt 0.000000e+00

skewness\_roll\_belt.1 skewness\_roll\_belt.1 0.000000e+00

max\_roll\_belt max\_roll\_belt 0.000000e+00

max\_picth\_belt max\_picth\_belt 0.000000e+00

max\_yaw\_belt max\_yaw\_belt 0.000000e+00

min\_roll\_belt min\_roll\_belt 0.000000e+00

min\_pitch\_belt min\_pitch\_belt 0.000000e+00

min\_yaw\_belt min\_yaw\_belt 0.000000e+00

amplitude\_roll\_belt amplitude\_roll\_belt 0.000000e+00

amplitude\_pitch\_belt amplitude\_pitch\_belt 0.000000e+00

amplitude\_yaw\_belt amplitude\_yaw\_belt 0.000000e+00

var\_total\_accel\_belt var\_total\_accel\_belt 0.000000e+00

avg\_roll\_belt avg\_roll\_belt 0.000000e+00

stddev\_roll\_belt stddev\_roll\_belt 0.000000e+00

var\_roll\_belt var\_roll\_belt 0.000000e+00

avg\_pitch\_belt avg\_pitch\_belt 0.000000e+00

stddev\_pitch\_belt stddev\_pitch\_belt 0.000000e+00

var\_pitch\_belt var\_pitch\_belt 0.000000e+00

avg\_yaw\_belt avg\_yaw\_belt 0.000000e+00

stddev\_yaw\_belt stddev\_yaw\_belt 0.000000e+00

var\_accel\_arm var\_accel\_arm 0.000000e+00

avg\_roll\_arm avg\_roll\_arm 0.000000e+00

stddev\_roll\_arm stddev\_roll\_arm 0.000000e+00

var\_roll\_arm var\_roll\_arm 0.000000e+00

avg\_pitch\_arm avg\_pitch\_arm 0.000000e+00

stddev\_pitch\_arm stddev\_pitch\_arm 0.000000e+00

var\_pitch\_arm var\_pitch\_arm 0.000000e+00

avg\_yaw\_arm avg\_yaw\_arm 0.000000e+00

stddev\_yaw\_arm stddev\_yaw\_arm 0.000000e+00

var\_yaw\_arm var\_yaw\_arm 0.000000e+00

kurtosis\_roll\_arm kurtosis\_roll\_arm 0.000000e+00

kurtosis\_picth\_arm kurtosis\_picth\_arm 0.000000e+00

kurtosis\_yaw\_arm kurtosis\_yaw\_arm 0.000000e+00

skewness\_roll\_arm skewness\_roll\_arm 0.000000e+00

skewness\_pitch\_arm skewness\_pitch\_arm 0.000000e+00

skewness\_yaw\_arm skewness\_yaw\_arm 0.000000e+00

max\_roll\_arm max\_roll\_arm 0.000000e+00

max\_picth\_arm max\_picth\_arm 0.000000e+00

max\_yaw\_arm max\_yaw\_arm 0.000000e+00

min\_roll\_arm min\_roll\_arm 0.000000e+00

min\_pitch\_arm min\_pitch\_arm 0.000000e+00

min\_yaw\_arm min\_yaw\_arm 0.000000e+00

amplitude\_roll\_arm amplitude\_roll\_arm 0.000000e+00

amplitude\_pitch\_arm amplitude\_pitch\_arm 0.000000e+00

amplitude\_yaw\_arm amplitude\_yaw\_arm 0.000000e+00

kurtosis\_roll\_dumbbell kurtosis\_roll\_dumbbell 0.000000e+00

kurtosis\_picth\_dumbbell kurtosis\_picth\_dumbbell 0.000000e+00

skewness\_roll\_dumbbell skewness\_roll\_dumbbell 0.000000e+00

skewness\_pitch\_dumbbell skewness\_pitch\_dumbbell 0.000000e+00

max\_roll\_dumbbell max\_roll\_dumbbell 0.000000e+00

max\_picth\_dumbbell max\_picth\_dumbbell 0.000000e+00

max\_yaw\_dumbbell max\_yaw\_dumbbell 0.000000e+00

min\_roll\_dumbbell min\_roll\_dumbbell 0.000000e+00

min\_pitch\_dumbbell min\_pitch\_dumbbell 0.000000e+00

min\_yaw\_dumbbell min\_yaw\_dumbbell 0.000000e+00

amplitude\_roll\_dumbbell amplitude\_roll\_dumbbell 0.000000e+00

amplitude\_pitch\_dumbbell amplitude\_pitch\_dumbbell 0.000000e+00

amplitude\_yaw\_dumbbell amplitude\_yaw\_dumbbell 0.000000e+00

var\_accel\_dumbbell var\_accel\_dumbbell 0.000000e+00

avg\_roll\_dumbbell avg\_roll\_dumbbell 0.000000e+00

stddev\_roll\_dumbbell stddev\_roll\_dumbbell 0.000000e+00

var\_roll\_dumbbell var\_roll\_dumbbell 0.000000e+00

avg\_pitch\_dumbbell avg\_pitch\_dumbbell 0.000000e+00

stddev\_pitch\_dumbbell stddev\_pitch\_dumbbell 0.000000e+00

var\_pitch\_dumbbell var\_pitch\_dumbbell 0.000000e+00

avg\_yaw\_dumbbell avg\_yaw\_dumbbell 0.000000e+00

stddev\_yaw\_dumbbell stddev\_yaw\_dumbbell 0.000000e+00

var\_yaw\_dumbbell var\_yaw\_dumbbell 0.000000e+00

kurtosis\_roll\_forearm kurtosis\_roll\_forearm 0.000000e+00

kurtosis\_picth\_forearm kurtosis\_picth\_forearm 0.000000e+00

skewness\_roll\_forearm skewness\_roll\_forearm 0.000000e+00

skewness\_pitch\_forearm skewness\_pitch\_forearm 0.000000e+00

max\_roll\_forearm max\_roll\_forearm 0.000000e+00

max\_picth\_forearm max\_picth\_forearm 0.000000e+00

max\_yaw\_forearm max\_yaw\_forearm 0.000000e+00

min\_roll\_forearm min\_roll\_forearm 0.000000e+00

min\_yaw\_forearm min\_yaw\_forearm 0.000000e+00

amplitude\_roll\_forearm amplitude\_roll\_forearm 0.000000e+00

amplitude\_pitch\_forearm amplitude\_pitch\_forearm 0.000000e+00

amplitude\_yaw\_forearm amplitude\_yaw\_forearm 0.000000e+00

var\_accel\_forearm var\_accel\_forearm 0.000000e+00

avg\_roll\_forearm avg\_roll\_forearm 0.000000e+00

stddev\_roll\_forearm stddev\_roll\_forearm 0.000000e+00

var\_roll\_forearm var\_roll\_forearm 0.000000e+00

avg\_pitch\_forearm avg\_pitch\_forearm 0.000000e+00

stddev\_pitch\_forearm stddev\_pitch\_forearm 0.000000e+00

var\_pitch\_forearm var\_pitch\_forearm 0.000000e+00

avg\_yaw\_forearm avg\_yaw\_forearm 0.000000e+00

stddev\_yaw\_forearm stddev\_yaw\_forearm 0.000000e+00

var\_yaw\_forearm var\_yaw\_forearm 0.000000e+00

accel\_forearm\_y.1 accel\_forearm\_y.1 0.000000e+00

accel\_forearm\_z.1 accel\_forearm\_z.1 0.000000e+00

magnet\_forearm\_x.1 magnet\_forearm\_x.1 0.000000e+00

magnet\_forearm\_y.1 magnet\_forearm\_y.1 0.000000e+00

magnet\_forearm\_z.1 magnet\_forearm\_z.1 0.000000e+00

classeB classeB 0.000000e+00

classeC classeC 0.000000e+00

classeD classeD 0.000000e+00

> # make predictions

> predictions<- predict(gbm\_mod,dataTest)

>

> # append predictions

> pred<- cbind(dataTest,predictions)

>

> # summarize results

> confusionMatrix<- confusionMatrix(pred$predictions,pred$classe)

Error: `data` and `reference` should be factors with the same levels.

> confusionMatrix

Confusion Matrix and Statistics

Reference

Prediction A B C D E

A 1365 0 0 0 0

B 0 901 0 0 0

C 0 0 92 0 0

D 0 0 0 276 0

E 0 0 0 0 1370

Overall Statistics

Accuracy : 1

95% CI : (0.9991, 1)

No Information Rate : 0.3422

P-Value [Acc > NIR] : < 2.2e-16

Kappa : 1

Mcnemar's Test P-Value : NA

Statistics by Class:

Class: A Class: B Class: C Class: D Class: E

Sensitivity 1.0000 1.000 1.00000 1.00000 1.0000

Specificity 1.0000 1.000 1.00000 1.00000 1.0000

Pos Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Neg Pred Value 1.0000 1.000 1.00000 1.00000 1.0000

Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Detection Rate 0.3409 0.225 0.02298 0.06893 0.3422

Detection Prevalence 0.3409 0.225 0.02298 0.06893 0.3422

Balanced Accuracy 1.0000 1.000 1.00000 1.00000 1.0000