Prediction Assignment Writeup

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Overview

This document summarizes the work done for the *Prediction Assignment Writeup* project for the *Coursera Practical Machine Learning* course. It's created using the functionalities of the *knitr* package in *RStudio* using the actual analysis code. The repository for this work can be found at https://github.com/amete/PracticalMachineLearningAssignment.

Background

Using devices such as *Jawbone Up*, *Nike FuelBand*, and *Fitbit* it is now possible to collect a large amount of data about personal activity relatively inexpensively. These type of devices are part of the quantified self movement – a group of enthusiasts who take measurements about themselves regularly to improve their health, to find patterns in their behavior, or because they are tech geeks. One thing that people regularly do is quantify how much of a particular activity they do, but they rarely quantify *how well they do it*. In this project, your goal will be to use data from accelerometers on the belt, forearm, arm, and dumbell of 6 participants. They were asked to perform barbell lifts correctly and incorrectly in 5 different ways. More information is available from the website here: http://groupware.les.inf.puc-rio.br/har (see the section on the Weight Lifting Exercise Dataset).

Analysis

```
require(data.table)
require(dplyr)
require(caret)
```

```
training <- tbl_df(fread("training.csv",na.strings=c('#DIV/0!', '', 'NA')))
testing  <- tbl_df(fread("testing.csv",na.strings=c('#DIV/0!', '', 'NA')))
```

```
set.seed(1234)
trainingDS <- createDataPartition( y = training$classe,
                                                          p = 0.7,
                                                     list = FALSE)
     actual.training <- training[trainingDS,] actual.validation <-
                                            training[-trainingDS,]
```

```
nzv <- nearZeroVar(actual.training)
actual.training <- actual.training[,-nzv]
actual.validation <- actual.validation[,-nzv]


mostlyNA <- sapply(actual.training,function(x) mean(is.na(x))) > 0.95
actual.training <- actual.training[,mostlyNA==FALSE]
actual.validation <- actual.validation[,mostlyNA==FALSE]


actual.training <- actual.training[,-(1:5)]
actual.validation <- actual.validation[,-(1:5)]
```

```
set.seed(1234)
modelRF  <- train( classe ~.,
```

```
data = actual.training,
method = "rf",
trControl = trainControl(method="cv",number=3) )
```

```
set.seed(1234)
modelBM <- train( classe ~.,
```

```
data = actual.training,
method = "gbm",
trControl = trainControl(method="repeatedcv",number = 5,repeats = 1),
verbose = FALSE)
```

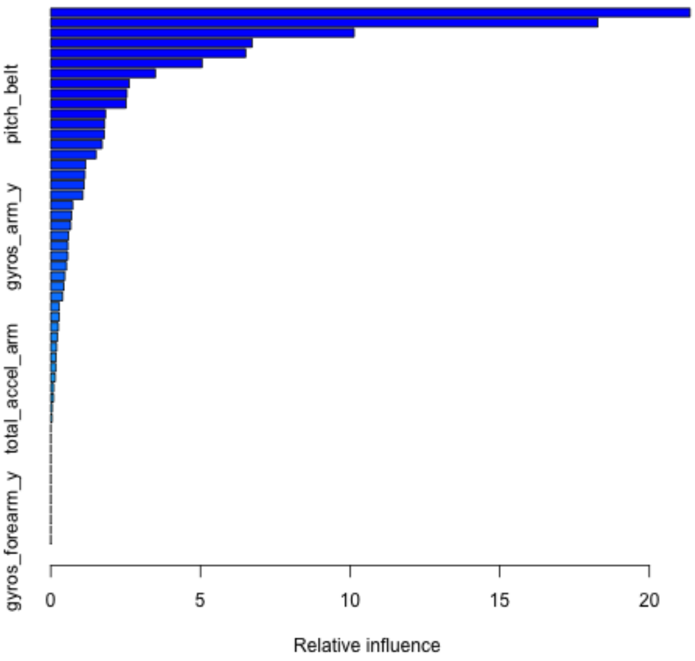
```r
prediction.validation.rf <- predict(modelRF,actual.validation)
conf.matrix.rf <- confusionMatrix(prediction.validation.rf,actual.validation$classe)
print(conf.matrix.rf)
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction    A    B    C    D    E
##          A 1674    4    0    0    0
##          B    0 1134    4    0    0
##          C    0    1 1022    1    0
##          D    0    0    0  963    2
##          E    0    0    0    0 1080
##
##
## Overall Statistics
##
##                Accuracy : 0.9
##                  95% CI : (0.9964, 0.998
##     No Information Rate : 0.28
##     P-Value [Acc > NIR] : < 2.2e-16
##
##                   Kappa : 0.9974
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: A Class: B Class: C Class: D Class: E
## Sensitivity            1.0000   0.9956   0.9961   0.9990   0.9982
## Specificity            0.9991   0.9992   0.9996   0.9996   1.0000
## Pos Pred Value         0.9976   0.9965   0.9980   0.9979   1.0000
## Neg Pred Value         1.0000   0.9989   0.9992   0.9998   0.9996
## Prevalence             0.2845   0.1935   0.1743   0.1638   0.1839
## Detection Rate         0.2845   0.1927   0.1737   0.1636   0.1835
## Detection Prevalence   0.2851   0.1934   0.1740   0.1640   0.1835
## Balanced Accuracy      0.9995   0.9974   0.9978   0.9993   0.9991
```

```r
prediction.validation.bm <- predict(modelBM,actual.validation)
conf.matrix.bm <- confusionMatrix(prediction.validation.bm,actual.validation$classe)
print(conf.matrix.bm)
```

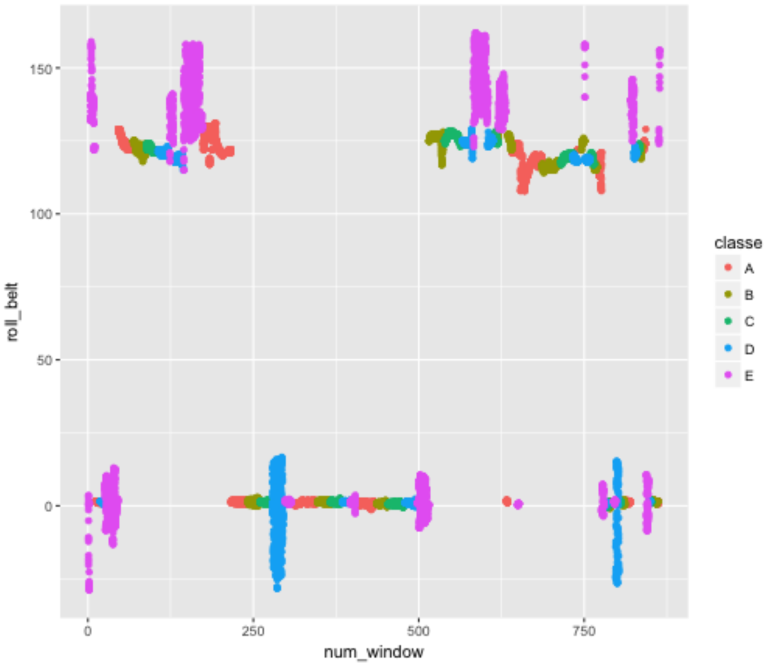
```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction    A    B    C    D    E
##          A 1673   14    0    0    0
##          B    1 1107    9    7    1
##          C    0   15 1017   11    3
##          D    0    3    0  946    9
##          E    0    0    0    0 1069
##
## Overall Statistics
##
##                Accuracy : 0.9876
##                  95% CI : (0.9844, 0.9903)
##     No Information Rate : 0.2845
##     P-Value [Acc > NIR] : < 2.2e-16
##
##                   Kappa : 0.9843
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: A Class: B Class: C Class: D Class: E
## Sensitivity            0.9994   0.9719   0.9912   0.9813   0.9880
## Specificity            0.9967   0.9962   0.9940   0.9976   1.0000
## Pos Pred Value         0.9917   0.9840   0.9723   0.9875   1.0000
## Neg Pred Value         0.9998   0.9933   0.9981   0.9963   0.9973
## Prevalence             0.2845   0.1935   0.1743   0.1638   0.1839
## Detection Rate         0.2843   0.1881   0.1728   0.1607   0.1816
## Detection Prevalence   0.2867   0.1912   0.1777   0.1628   0.1816
## Balanced Accuracy      0.9980   0.9841   0.9926   0.9894   0.9940
```

```
print(summary(modelBM))
```

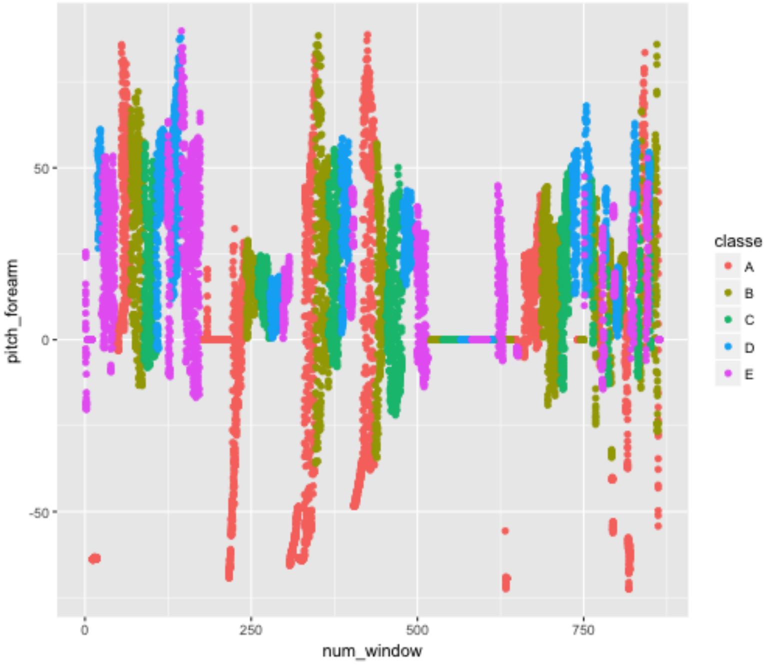


```
##                                       var     rel.inf
## num_window                     num_window 21.35545512
## roll_belt                       roll_belt 18.27724938
## pitch_forearm               pitch_forearm 10.13583112
## magnet_dumbbell_z       magnet_dumbbell_z  6.72541291
## yaw_belt                         yaw_belt  6.51200291
## magnet_dumbbell_y       magnet_dumbbell_y  5.05649194
## roll_forearm                 roll_forearm  3.49549946
## accel_forearm_x           accel_forearm_x  2.61845321
## magnet_belt_z               magnet_belt_z  2.53921239
## pitch_belt                     pitch_belt  2.51716927
## gyros_belt_z                 gyros_belt_z  1.82833065
## gyros_dumbbell_y         gyros_dumbbell_y  1.79600229
## accel_dumbbell_z         accel_dumbbell_z  1.78978003
## roll_dumbbell               roll_dumbbell  1.71291149
## accel_dumbbell_y         accel_dumbbell_y  1.51172485
## yaw_arm                           yaw_arm  1.16790745
## magnet_forearm_z         magnet_forearm_z  1.13838373
## accel_forearm_z           accel_forearm_z  1.11085165
## accel_dumbbell_x         accel_dumbbell_x  1.07112326
## magnet_belt_y               magnet_belt_y  0.73220505
## roll_arm                         roll_arm  0.69769807
## magnet_arm_z                 magnet_arm_z  0.66713578
## gyros_arm_y                   gyros_arm_y  0.59235410
## magnet_belt_x               magnet_belt_x  0.56962809
## accel_belt_z                 accel_belt_z  0.56689770
## gyros_belt_y                 gyros_belt_y  0.52256127
## magnet_arm_x                 magnet_arm_x  0.46724034
## magnet_dumbbell_x       magnet_dumbbell_x  0.43441017
## total_accel_dumbbell total_accel_dumbbell  0.39610082
## magnet_forearm_x         magnet_forearm_x  0.28197085
## total_accel_forearm   total_accel_forearm  0.27783955
## gyros_dumbbell_x         gyros_dumbbell_x  0.25152542
## magnet_arm_y                 magnet_arm_y  0.22235172
## pitch_dumbbell             pitch_dumbbell  0.19453168
## accel_arm_z                   accel_arm_z  0.17252396
## accel_forearm_y           accel_forearm_y  0.16660947
## gyros_belt_x                 gyros_belt_x  0.14726266
## total_accel_arm           total_accel_arm  0.09844732
## gyros_forearm_z          gyros_forearm_z  0.09281553
## gyros_dumbbell_z        gyros_dumbbell_z  0.04731855
## magnet_forearm_y        magnet_forearm_y  0.04077878
## total_accel_belt        total_accel_belt  0.00000000
## accel_belt_x                accel_belt_x  0.00000000
## accel_belt_y                accel_belt_y  0.00000000
## pitch_arm                      pitch_arm  0.00000000
## gyros_arm_x                  gyros_arm_x  0.00000000
## gyros_arm_z                  gyros_arm_z  0.00000000
## accel_arm_x                  accel_arm_x  0.00000000
## accel_arm_y                  accel_arm_y  0.00000000
## yaw_dumbbell                yaw_dumbbell  0.00000000
## yaw_forearm                  yaw_forearm  0.00000000
## gyros_forearm_x          gyros_forearm_x  0.00000000
## gyros_forearm_y          gyros_forearm_y  0.00000000
```

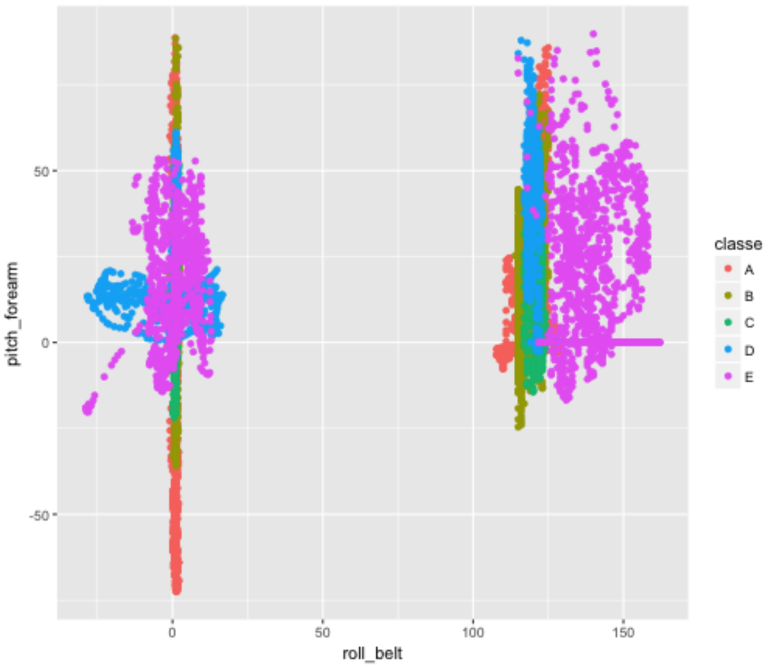
```
qplot(num_window, roll_belt , data = actual.training, col = classe)
```



```
qplot(num_window, pitch_forearm, data = actual.training, col = classe)
```



```r
qplot(roll_belt , pitch_forearm, data = actual.training, col = classe)
```



```r
prediction.testing.rf <- predict(modelRF,testing)
print(prediction.testing.rf)
```

```
##  [1] B A B A A E D B A A B C B A E E A B B B
## Levels: A B C D E
```