

Machine Learning Project

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June 08, 2018

The data was download on my Mac and then I used them

```
Train_Data <- read.csv("./data/pml-training.csv")  
dim(Train_Data)
```

```
## [1] 19622      160
```

The data seems hasa large number of columns in the dataset, Lets check if there are missing data in it

```
na <- apply(Train_Data, 2, function(x) sum(x %in% c(NA, "")))  
na
```

##	X	user_name	raw_timestamp_part_1
##	0	0	0
##	raw_timestamp_part_2	cvtd_timestamp	new_window
##	0	0	0
##	num_window	roll_belt	pitch_belt
##	0	0	0
##	yaw_belt	total_accel_belt	kurtosis_roll_belt
##	0	0	19216
##	kurtosis_picth_belt	kurtosis_yaw_belt	skewness_roll_belt
##	19216	19216	19216
##	skewness_roll_belt.1	skewness_yaw_belt	max_roll_belt
##	19216	19216	19216
##	max_picth_belt	max_yaw_belt	min_roll_belt
##	19216	19216	19216
##	min_pitch_belt	min_yaw_belt	amplitude_roll_belt
##	19216	19216	19216
##	amplitude_pitch_belt	amplitude_yaw_belt	var_total_accel_belt
##	19216	19216	19216
##	avg_roll_belt	stddev_roll_belt	var_roll_belt
##	19216	19216	19216
##	avg_pitch_belt	stddev_pitch_belt	var_pitch_belt
##	19216	19216	19216
##	avg_yaw_belt	stddev_yaw_belt	var_yaw_belt
##	19216	19216	19216
##	gyros_belt_x	gyros_belt_y	gyros_belt_z
##	0	0	0
##	accel_belt_x	accel_belt_y	accel_belt_z
##	0	0	0
##	magnet_belt_x	magnet_belt_y	magnet_belt_z
##	0	0	0
##	roll_arm	pitch_arm	yaw_arm
##	0	0	0
##	total_accel_arm	var_accel_arm	avg_roll_arm
##	0	19216	19216

##	stddev_roll_arm	var_roll_arm	avg_pitch_arm
##	19216	19216	19216
##	stddev_pitch_arm	var_pitch_arm	avg_yaw_arm
##	19216	19216	19216
##	stddev_yaw_arm	var_yaw_arm	gyros_arm_x
##	19216	19216	0
##	gyros_arm_y	gyros_arm_z	accel_arm_x
##	0	0	0
##	accel_arm_y	accel_arm_z	magnet_arm_x
##	0	0	0
##	magnet_arm_y	magnet_arm_z	kurtosis_roll_arm
##	0	0	19216
##	kurtosis_pitch_arm	kurtosis_yaw_arm	skewness_roll_arm
##	19216	19216	19216
##	skewness_pitch_arm	skewness_yaw_arm	max_roll_arm
##	19216	19216	19216
##	max_pitch_arm	max_yaw_arm	min_roll_arm
##	19216	19216	19216
##	min_pitch_arm	min_yaw_arm	amplitude_roll_arm
##	19216	19216	19216
##	amplitude_pitch_arm	amplitude_yaw_arm	roll_dumbbell
##	19216	19216	0
##	pitch_dumbbell	yaw_dumbbell	kurtosis_roll_dumbbell
##	0	0	19216
##	kurtosis_pitch_dumbbell	kurtosis_yaw_dumbbell	skewness_roll_dumbbell
##	19216	19216	19216
##	skewness_pitch_dumbbell	skewness_yaw_dumbbell	max_roll_dumbbell
##	19216	19216	19216
##	max_pitch_dumbbell	max_yaw_dumbbell	min_roll_dumbbell
##	19216	19216	19216
##	min_pitch_dumbbell	min_yaw_dumbbell	amplitude_roll_dumbbell
##	19216	19216	19216
##	amplitude_pitch_dumbbell	amplitude_yaw_dumbbell	total_accel_dumbbell
##	19216	19216	0
##	var_accel_dumbbell	avg_roll_dumbbell	stddev_roll_dumbbell
##	19216	19216	19216
##	var_roll_dumbbell	avg_pitch_dumbbell	stddev_pitch_dumbbell
##	19216	19216	19216
##	var_pitch_dumbbell	avg_yaw_dumbbell	stddev_yaw_dumbbell
##	19216	19216	19216
##	var_yaw_dumbbell	gyros_dumbbell_x	gyros_dumbbell_y
##	19216	0	0
##	gyros_dumbbell_z	accel_dumbbell_x	accel_dumbbell_y
##	0	0	0
##	accel_dumbbell_z	magnet_dumbbell_x	magnet_dumbbell_y
##	0	0	0
##	magnet_dumbbell_z	roll_forearm	pitch_forearm
##	0	0	0
##	yaw_forearm	kurtosis_roll_forearm	kurtosis_pitch_forearm
##	0	19216	19216
##	kurtosis_yaw_forearm	skewness_roll_forearm	skewness_pitch_forearm
##	19216	19216	19216
##	skewness_yaw_forearm	max_roll_forearm	max_pitch_forearm
##	19216	19216	19216

```
##          max_yaw_forearm      min_roll_forearm      min_pitch_forearm
##          19216                19216                19216
##          min_yaw_forearm  amplitude_roll_forearm  amplitude_pitch_forearm
##          19216                19216                19216
##          amplitude_yaw_forearm      total_accel_forearm      var_accel_forearm
##          19216                0                19216
##          avg_roll_forearm      stddev_roll_forearm      var_roll_forearm
##          19216                19216                19216
##          avg_pitch_forearm      stddev_pitch_forearm      var_pitch_forearm
##          19216                19216                19216
##          avg_yaw_forearm      stddev_yaw_forearm      var_yaw_forearm
##          19216                19216                19216
##          gyros_forearm_x      gyros_forearm_y      gyros_forearm_z
##          0                0                0
##          accel_forearm_x      accel_forearm_y      accel_forearm_z
##          0                0                0
##          magnet_forearm_x      magnet_forearm_y      magnet_forearm_z
##          0                0                0
##          classe
##          0
```

Seems there lots of NAs, so we skip these variables and analyze only complete ones.

```
index <- which(na == 0)
Train_Data <- Train_Data[,index]
Train_Data <- Train_Data[,8:60]
```

Lets see the Matrix Model

```
library(randomForest)
```

```
## Warning: package 'randomForest' was built under R version 3.1.1
```

```
## randomForest 4.6-10
## Type rfNews() to see new features/changes/bug fixes.
```

```
library(caret)
```

```
## Warning: package 'caret' was built under R version 3.1.1
```

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

```
model <- randomForest(classe~., data = Train_Data)
pred <- predict(model, Train_Data)
confusionMatrix(Train_Data$classe, pred)
```

```
## Confusion Matrix and Statistics
```

```
##
##          Reference
## Prediction      A      B      C      D      E
```

```
##          A 5580    0    0    0    0
##          B    0 3797    0    0    0
##          C    0    0 3422    0    0
##          D    0    0    0 3216    0
##          E    0    0    0    0 3607
##
## Overall Statistics
##
##          Accuracy : 1
##          95% CI   : (1, 1)
## No Information Rate : 0.284
## P-Value [Acc > NIR] : <2e-16
##
##          Kappa : 1
## Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##          Class: A Class: B Class: C Class: D Class: E
## Sensitivity          1.000    1.000    1.000    1.000    1.000
## Specificity          1.000    1.000    1.000    1.000    1.000
## Pos Pred Value       1.000    1.000    1.000    1.000    1.000
## Neg Pred Value       1.000    1.000    1.000    1.000    1.000
## Prevalence           0.284    0.194    0.174    0.164    0.184
## Detection Rate       0.284    0.194    0.174    0.164    0.184
## Detection Prevalence 0.284    0.194    0.174    0.164    0.184
## Balanced Accuracy    1.000    1.000    1.000    1.000    1.000
```

We should check the model on different dataset.

```
Test_Data <- read.csv("../data/pml-testing.csv")
Test_Data <- Test_Data[,index]
Test_Data <- Test_Data[,8:59]
Test_Data$classe <- factor(nrow(Test_Data))
levels(Test_Data$classe) <- levels(Train_Data$classe)
Test2 <- rbind(Train_Data[1,], Test_Data)
Test2 <- Test2[2:21,]
```

Lets see the Model

```
TestModel <- predict(model, Test2)
TestModel
```

```
##  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21
## 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
```