

## model\_evaluation\_and\_assessment\_excercise.R

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```
setwd("C:/Users/Seshan/Desktop/sv R related/acadgild/assignments/session19 Assignment")
WLE<- read.csv("WLE.csv",header=T, na.strings=c("", "NA"))
data<-WLE
View(data)
training<-data[1:4010,]
testing<-data[4011:4024,]
names(training)
```

## [1]	"user_name"	"raw_timestamp_part_1"
## [3]	"raw_timestamp_part_2"	"cvtd_timestamp"
## [5]	"new_window"	"num_window"
## [7]	"roll_belt"	"pitch_belt"
## [9]	"yaw_belt"	"total_accel_belt"
## [11]	"kurtosis_roll_belt"	"kurtosis_pitch_belt"
## [13]	"skewness_roll_belt"	"skewness_roll_belt.1"
## [15]	"max_roll_belt"	"max_pitch_belt"
## [17]	"max_yaw_belt"	"min_roll_belt"
## [19]	"min_pitch_belt"	"min_yaw_belt"
## [21]	"amplitude_roll_belt"	"amplitude_pitch_belt"
## [23]	"amplitude_yaw_belt"	"var_total_accel_belt"
## [25]	"avg_roll_belt"	"stddev_roll_belt"
## [27]	"var_roll_belt"	"avg_pitch_belt"
## [29]	"stddev_pitch_belt"	"var_pitch_belt"
## [31]	"avg_yaw_belt"	"stddev_yaw_belt"
## [33]	"var_yaw_belt"	"gyros_belt_x"
## [35]	"gyros_belt_y"	"gyros_belt_z"
## [37]	"accel_belt_x"	"accel_belt_y"
## [39]	"accel_belt_z"	"magnet_belt_x"
## [41]	"magnet_belt_y"	"magnet_belt_z"
## [43]	"roll_arm"	"pitch_arm"
## [45]	"yaw_arm"	"total_accel_arm"
## [47]	"var_accel_arm"	"avg_roll_arm"
## [49]	"stddev_roll_arm"	"var_roll_arm"
## [51]	"avg_pitch_arm"	"stddev_pitch_arm"
## [53]	"var_pitch_arm"	"avg_yaw_arm"
## [55]	"stddev_yaw_arm"	"var_yaw_arm"
## [57]	"gyros_arm_x"	"gyros_arm_y"
## [59]	"gyros_arm_z"	"accel_arm_x"
## [61]	"accel_arm_y"	"accel_arm_z"
## [63]	"magnet_arm_x"	"magnet_arm_y"
## [65]	"magnet_arm_z"	"kurtosis_roll_arm"

```

## [67] "kurtosis_picth_arm"      "kurtosis_yaw_arm"
## [69] "skewness_roll_arm"      "skewness_pitch_arm"
## [71] "skewness_yaw_arm"       "max_roll_arm"
## [73] "max_picth_arm"          "max_yaw_arm"
## [75] "min_roll_arm"           "min_pitch_arm"
## [77] "min_yaw_arm"            "amplitude_roll_arm"
## [79] "amplitude_pitch_arm"    "amplitude_yaw_arm"
## [81] "roll_dumbbell"          "pitch_dumbbell"
## [83] "yaw_dumbbell"           "kurtosis_roll_dumbbell"
## [85] "kurtosis_picth_dumbbell" "skewness_roll_dumbbell"
## [87] "skewness_pitch_dumbbell" "max_roll_dumbbell"
## [89] "max_picth_dumbbell"     "max_yaw_dumbbell"
## [91] "min_roll_dumbbell"      "min_pitch_dumbbell"
## [93] "min_yaw_dumbbell"       "amplitude_roll_dumbbell"
## [95] "amplitude_pitch_dumbbell" "amplitude_yaw_dumbbell"
## [97] "total_accel_dumbbell"   "var_accel_dumbbell"
## [99] "avg_roll_dumbbell"      "stddev_roll_dumbbell"
## [101] "var_roll_dumbbell"      "avg_pitch_dumbbell"
## [103] "stddev_pitch_dumbbell"  "var_pitch_dumbbell"
## [105] "avg_yaw_dumbbell"       "stddev_yaw_dumbbell"
## [107] "var_yaw_dumbbell"       "gyros_dumbbell_x"
## [109] "gyros_dumbbell_y"       "gyros_dumbbell_z"
## [111] "accel_dumbbell_x"       "accel_dumbbell_y"
## [113] "accel_dumbbell_z"       "magnet_dumbbell_x"
## [115] "magnet_dumbbell_y"      "magnet_dumbbell_z"
## [117] "roll_forearm"           "pitch_forearm"
## [119] "yaw_forearm"            "kurtosis_roll_forearm"
## [121] "kurtosis_picth_forearm" "skewness_roll_forearm"
## [123] "skewness_pitch_forearm" "max_roll_forearm"
## [125] "max_picth_forearm"      "max_yaw_forearm"
## [127] "min_roll_forearm"       "min_pitch_forearm"
## [129] "min_yaw_forearm"        "amplitude_roll_forearm"
## [131] "amplitude_pitch_forearm" "amplitude_yaw_forearm"
## [133] "total_accel_forearm"    "var_accel_forearm"
## [135] "avg_roll_forearm"       "stddev_roll_forearm"
## [137] "var_roll_forearm"       "avg_pitch_forearm"
## [139] "stddev_pitch_forearm"   "var_pitch_forearm"
## [141] "avg_yaw_forearm"        "stddev_yaw_forearm"
## [143] "var_yaw_forearm"        "gyros_forearm_x"
## [145] "gyros_forearm_y"        "gyros_forearm_z"
## [147] "accel_forearm_x"        "accel_forearm_y"
## [149] "accel_forearm_z"        "magnet_forearm_x"
## [151] "magnet_forearm_y"       "magnet_forearm_z"
## [153] "accel_forearm_y.1"      "accel_forearm_z.1"
## [155] "magnet_forearm_x.1"     "magnet_forearm_y.1"
## [157] "magnet_forearm_z.1"     "classe"

```

*# Logistic regression model:*

```
fit <- glm(classe~.,data = training,family = binomial)
```

```
## Warning: glm.fit: algorithm did not converge
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```
summary(fit)
```

```
##
```

```
## Call:
```

```
## glm(formula = classe ~ ., family = binomial, data = training)
```

```
##
```

```
## Deviance Residuals:
```

```
##      Min       1Q   Median       3Q      Max  
## -1.477e-04 -2.100e-08  2.100e-08  2.100e-08  9.859e-05
```

```
##
```

```
## Coefficients: (18 not defined because of singularities)
```

```
##              Estimate Std. Error z value Pr(>|z|)  
## (Intercept)      3.202e+10  1.709e+13  0.002    0.999  
## user_namecarlitos      6.085e+06  3.247e+09  0.002    0.999  
## user_nameeurico     -8.308e+06  4.435e+09 -0.002    0.999  
## user_namejeremy     -3.867e+06  2.065e+09 -0.002    0.999  
## user_namepedro       6.342e+06  3.385e+09  0.002    0.999  
## raw_timestamp_part_1  -2.421e+01  1.292e+04 -0.002    0.999  
## raw_timestamp_part_2   1.411e-05  2.360e-02  0.001    1.000  
## cvtd_timestamp28/11/2011 14:15      NA         NA      NA      NA  
## cvtd_timestamp30/11/2011 17:12      NA         NA      NA      NA  
## cvtd_timestamp5/12/2011 11:23 -2.151e+03  1.117e+06 -0.002    0.998  
## cvtd_timestamp5/12/2011 11:25      NA         NA      NA      NA  
## cvtd_timestamp5/12/2011 14:22 -1.842e+01  8.271e+04  0.000    1.000  
## cvtd_timestamp5/12/2011 14:23      NA         NA      NA      NA  
## new_windowyes      -1.196e+04  9.115e+08  0.000    1.000  
## num_window         3.216e+01  1.436e+04  0.002    0.998  
## roll_belt          3.836e+00  8.842e+03  0.000    1.000  
## pitch_belt         3.331e+00  1.228e+04  0.000    1.000  
## yaw_belt          -1.298e-01  5.861e+02  0.000    1.000  
## total_accel_belt    -2.160e+00  1.120e+04  0.000    1.000  
## kurtosis_roll_belt  -2.413e+02  1.132e+07  0.000    1.000  
## kurtosis_picth_belt  2.133e+00  6.052e+04  0.000    1.000  
## skewness_roll_belt   1.471e+01  4.592e+05  0.000    1.000  
## skewness_roll_belt.1 -1.419e+01  1.658e+05  0.000    1.000  
## max_roll_belt       1.833e+02  2.214e+07  0.000    1.000  
## max_picth_belt      2.699e+01  2.798e+05  0.000    1.000  
## max_yaw_belt        2.329e+02  1.125e+07  0.000    1.000  
## min_roll_belt      -2.742e+02  2.014e+07  0.000    1.000  
## min_pitch_belt     -2.265e+01  1.450e+06  0.000    1.000  
## min_yaw_belt        NA         NA      NA      NA  
## amplitude_roll_belt -2.385e+02  2.213e+07  0.000    1.000  
## amplitude_pitch_belt      NA         NA      NA      NA  
## amplitude_yaw_belt      NA         NA      NA      NA  
## var_total_accel_belt -1.510e+01  4.775e+05  0.000    1.000  
## avg_roll_belt       2.785e+00  1.051e+05  0.000    1.000
```

## stddev_roll_belt	1.753e+01	1.265e+06	0.000	1.000
## var_roll_belt	-3.117e+00	1.134e+05	0.000	1.000
## avg_pitch_belt	-6.328e+00	1.748e+05	0.000	1.000
## stddev_pitch_belt	-8.170e+01	1.457e+06	0.000	1.000
## var_pitch_belt	1.734e+01	3.934e+05	0.000	1.000
## avg_yaw_belt	8.784e+01	2.140e+06	0.000	1.000
## stddev_yaw_belt	1.326e+00	4.623e+06	0.000	1.000
## var_yaw_belt	1.552e-02	1.262e+04	0.000	1.000
## gyros_belt_x	1.681e+01	1.064e+05	0.000	1.000
## gyros_belt_y	1.424e+01	3.427e+05	0.000	1.000
## gyros_belt_z	-6.446e+00	1.389e+05	0.000	1.000
## accel_belt_x	-1.552e-01	1.451e+03	0.000	1.000
## accel_belt_y	4.502e-02	1.660e+03	0.000	1.000
## accel_belt_z	3.158e-01	1.794e+03	0.000	1.000
## magnet_belt_x	2.267e-01	8.493e+02	0.000	1.000
## magnet_belt_y	1.765e-01	8.810e+02	0.000	1.000
## magnet_belt_z	1.660e-01	5.184e+02	0.000	1.000
## roll_arm	-5.731e-02	1.442e+02	0.000	1.000
## pitch_arm	-5.222e-01	6.479e+02	-0.001	0.999
## yaw_arm	-1.016e-01	1.354e+02	-0.001	0.999
## total_accel_arm	-5.238e-01	2.292e+03	0.000	1.000
## var_accel_arm	-4.505e-01	2.112e+04	0.000	1.000
## avg_roll_arm	-1.565e-01	1.405e+04	0.000	1.000
## stddev_roll_arm	3.474e+00	1.064e+05	0.000	1.000
## var_roll_arm	-2.031e-02	3.502e+02	0.000	1.000
## avg_pitch_arm	1.466e+00	1.531e+05	0.000	1.000
## stddev_pitch_arm	1.567e+01	1.588e+05	0.000	1.000
## var_pitch_arm	1.251e-02	3.281e+03	0.000	1.000
## avg_yaw_arm	1.020e+00	1.778e+04	0.000	1.000
## stddev_yaw_arm	-6.699e+00	5.032e+04	0.000	1.000
## var_yaw_arm	2.898e-02	4.722e+02	0.000	1.000
## gyros_arm_x	1.337e+00	1.778e+04	0.000	1.000
## gyros_arm_y	6.535e+00	4.083e+04	0.000	1.000
## gyros_arm_z	4.908e+00	2.287e+04	0.000	1.000
## accel_arm_x	-1.632e-02	5.067e+02	0.000	1.000
## accel_arm_y	-3.202e-02	5.528e+02	0.000	1.000
## accel_arm_z	-1.523e-02	3.129e+02	0.000	1.000
## magnet_arm_x	7.353e-03	1.451e+02	0.000	1.000
## magnet_arm_y	1.141e-01	3.629e+02	0.000	1.000
## magnet_arm_z	-5.990e-02	2.168e+02	0.000	1.000
## kurtosis_roll_arm	-1.279e+00	1.372e+05	0.000	1.000
## kurtosis_pitch_arm	2.095e+00	2.848e+05	0.000	1.000
## kurtosis_yaw_arm	-8.336e+00	1.133e+05	0.000	1.000
## skewness_roll_arm	2.048e+01	1.972e+06	0.000	1.000
## skewness_pitch_arm	3.350e+01	1.123e+06	0.000	1.000
## skewness_yaw_arm	-6.954e+00	2.958e+05	0.000	1.000
## max_roll_arm	-3.085e+01	1.179e+07	0.000	1.000
## max_pitch_arm	-1.668e+03	2.989e+07	0.000	1.000
## max_yaw_arm	3.360e+00	2.645e+05	0.000	1.000
## min_roll_arm	3.030e+01	1.186e+07	0.000	1.000

## min_pitch_arm	1.668e+03	2.988e+07	0.000	1.000
## min_yaw_arm	-5.460e+00	2.966e+05	0.000	1.000
## amplitude_roll_arm	2.402e+01	1.174e+07	0.000	1.000
## amplitude_pitch_arm	1.669e+03	2.985e+07	0.000	1.000
## amplitude_yaw_arm	NA	NA	NA	NA
## roll_dumbbell	1.295e-01	6.889e+02	0.000	1.000
## pitch_dumbbell	-3.122e-01	1.172e+03	0.000	1.000
## yaw_dumbbell	1.662e-01	6.861e+02	0.000	1.000
## kurtosis_roll_dumbbell	3.774e+02	1.605e+07	0.000	1.000
## kurtosis_pitch_dumbbell	-4.045e+00	4.009e+05	0.000	1.000
## skewness_roll_dumbbell	4.256e+01	3.945e+05	0.000	1.000
## skewness_pitch_dumbbell	2.731e+01	4.182e+05	0.000	1.000
## max_roll_dumbbell	2.581e+02	1.216e+07	0.000	1.000
## max_pitch_dumbbell	2.558e+02	1.105e+07	0.000	1.000
## max_yaw_dumbbell	-3.795e+02	1.572e+07	0.000	1.000
## min_roll_dumbbell	-2.594e+02	1.209e+07	0.000	1.000
## min_pitch_dumbbell	-2.567e+02	1.104e+07	0.000	1.000
## min_yaw_dumbbell	NA	NA	NA	NA
## amplitude_roll_dumbbell	-2.599e+02	1.217e+07	0.000	1.000
## amplitude_pitch_dumbbell	-2.565e+02	1.105e+07	0.000	1.000
## amplitude_yaw_dumbbell	NA	NA	NA	NA
## total_accel_dumbbell	1.707e+00	5.707e+03	0.000	1.000
## var_accel_dumbbell	7.186e-01	4.159e+04	0.000	1.000
## avg_roll_dumbbell	-4.136e-01	1.115e+04	0.000	1.000
## stddev_roll_dumbbell	6.602e-02	9.903e+04	0.000	1.000
## var_roll_dumbbell	1.127e-02	8.361e+02	0.000	1.000
## avg_pitch_dumbbell	2.273e+00	6.363e+04	0.000	1.000
## stddev_pitch_dumbbell	-9.758e-01	5.308e+05	0.000	1.000
## var_pitch_dumbbell	1.958e-02	4.552e+03	0.000	1.000
## avg_yaw_dumbbell	9.768e-01	3.070e+04	0.000	1.000
## stddev_yaw_dumbbell	3.835e+00	1.491e+05	0.000	1.000
## var_yaw_dumbbell	-2.194e-02	1.529e+03	0.000	1.000
## gyros_dumbbell_x	1.089e+01	4.168e+04	0.000	1.000
## gyros_dumbbell_y	-5.854e-01	3.294e+04	0.000	1.000
## gyros_dumbbell_z	5.848e+00	3.567e+04	0.000	1.000
## accel_dumbbell_x	4.649e-01	1.511e+03	0.000	1.000
## accel_dumbbell_y	-1.996e-01	8.743e+02	0.000	1.000
## accel_dumbbell_z	-2.526e-01	1.095e+03	0.000	1.000
## magnet_dumbbell_x	-1.429e-01	4.937e+02	0.000	1.000
## magnet_dumbbell_y	8.417e-02	6.860e+02	0.000	1.000
## magnet_dumbbell_z	5.264e-02	3.787e+02	0.000	1.000
## roll_forearm	9.560e-03	1.646e+02	0.000	1.000
## pitch_forearm	1.215e-01	1.499e+03	0.000	1.000
## yaw_forearm	-5.853e-03	1.043e+02	0.000	1.000
## kurtosis_roll_forearm	2.956e+01	9.889e+06	0.000	1.000
## kurtosis_pitch_forearm	2.758e+00	1.556e+05	0.000	1.000
## skewness_roll_forearm	-2.087e+00	4.561e+05	0.000	1.000
## skewness_pitch_forearm	2.092e+01	8.209e+05	0.000	1.000
## max_roll_forearm	-5.134e+02	8.853e+06	0.000	1.000
## max_pitch_forearm	-1.242e+00	2.123e+04	0.000	1.000

## max_yaw_forearm	-3.206e+01	9.579e+06	0.000	1.000
## min_roll_forearm	5.123e+02	8.855e+06	0.000	1.000
## min_pitch_forearm	3.160e-02	2.930e+04	0.000	1.000
## min_yaw_forearm	NA	NA	NA	NA
## amplitude_roll_forearm	5.167e+02	8.817e+06	0.000	1.000
## amplitude_pitch_forearm	NA	NA	NA	NA
## amplitude_yaw_forearm	NA	NA	NA	NA
## total_accel_forearm	3.209e-01	2.326e+03	0.000	1.000
## var_accel_forearm	-8.244e-01	1.426e+04	0.000	1.000
## avg_roll_forearm	-3.349e-01	1.792e+04	0.000	1.000
## stddev_roll_forearm	3.649e-01	1.261e+05	0.000	1.000
## var_roll_forearm	1.848e-03	7.983e+02	0.000	1.000
## avg_pitch_forearm	-5.398e-01	1.044e+05	0.000	1.000
## stddev_pitch_forearm	-1.688e+01	6.420e+05	0.000	1.000
## var_pitch_forearm	2.086e-01	9.747e+03	0.000	1.000
## avg_yaw_forearm	1.224e+00	3.374e+04	0.000	1.000
## stddev_yaw_forearm	3.636e+00	1.006e+05	0.000	1.000
## var_yaw_forearm	-1.549e-02	8.103e+02	0.000	1.000
## gyros_forearm_x	1.341e+01	2.526e+04	0.001	1.000
## gyros_forearm_y	2.150e-03	1.120e+04	0.000	1.000
## gyros_forearm_z	-1.424e+00	2.607e+04	0.000	1.000
## accel_forearm_x	-8.488e-02	2.285e+02	0.000	1.000
## accel_forearm_y	-7.488e-02	2.917e+02	0.000	1.000
## accel_forearm_z	-1.275e-01	4.796e+02	0.000	1.000
## magnet_forearm_x	4.579e-02	1.750e+02	0.000	1.000
## magnet_forearm_y	-1.938e-02	1.765e+02	0.000	1.000
## magnet_forearm_z	1.386e-01	2.646e+02	0.001	1.000
## accel_forearm_y.1	NA	NA	NA	NA
## accel_forearm_z.1	NA	NA	NA	NA
## magnet_forearm_x.1	NA	NA	NA	NA
## magnet_forearm_y.1	NA	NA	NA	NA
## magnet_forearm_z.1	NA	NA	NA	NA

```
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 5.1432e+03  on 4009  degrees of freedom
## Residual deviance: 1.3222e-07  on 3862  degrees of freedom
## AIC: 296
##
## Number of Fisher Scoring iterations: 25
```

```
library(ResourceSelection)
```

```
## ResourceSelection 0.3-2    2017-02-28
```

```
hoslem.test(training$classe, fitted(fit))
```

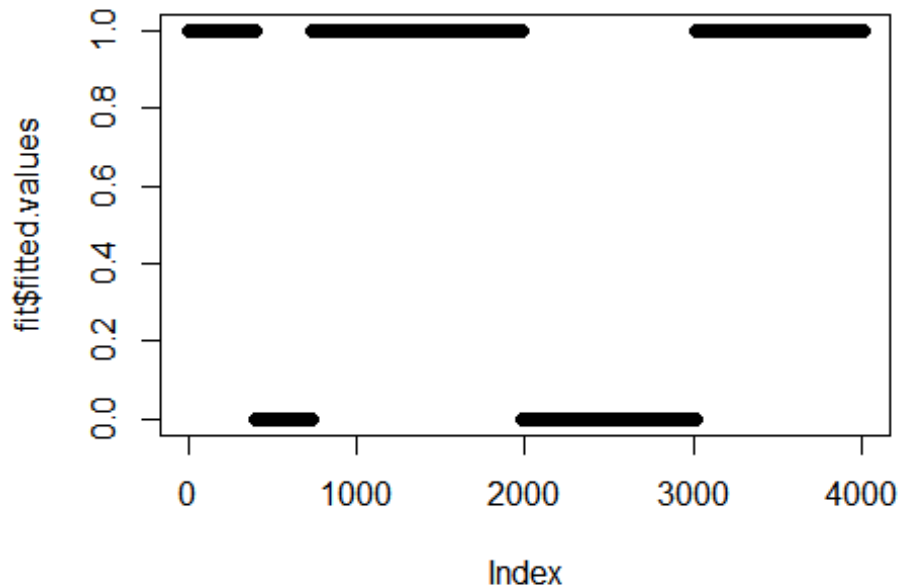
```
## Warning in Ops.factor(1, y): '-' not meaningful for factors
```

```
##
```

```
## Hosmer and Lemeshow goodness of fit (GOF) test
```

```
##
## data: training$classe, fitted(fit)
## X-squared = 4010, df = 8, p-value < 2.2e-16

#plot the fitted model
plot(fit$fitted.values)
```



```
pred <- predict(fit,newdata = testing,type = 'response')

## Warning in predict.lm(object, newdata, se.fit, scale = 1, type =
## ifelse(type == : prediction from a rank-deficient fit may be misleading

library(caret)

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

#with default prob cut 0.50
testing$pred_classe <- ifelse(pred<0.7,'yes','no')

table(testing$pred_classe,testing$classe)

##
##      A  B  C  D  E
## no  0  0 14  0  0
```

```

#training split of churn classes
round(table(training$classe)/nrow(training),2)*100

##
##  A  B  C  D  E
## 34 22  2  7 34

# test split of churn classes
round(table(testing$classe)/nrow(testing),2)*100

##
##  A  B  C  D  E
##  0  0 100  0  0

#predicted split of churn classes
round(table(testing$pred_classe)/nrow(testing),2)*100

##
##  no
## 100

#create confusion matrix
confusionMatrix(testing$classe,testing$classe)

## Confusion Matrix and Statistics
##
##              Reference
## Prediction  A  B  C  D  E
##           A  0  0  0  0  0
##           B  0  0  0  0  0
##           C  0  0 14  0  0
##           D  0  0  0  0  0
##           E  0  0  0  0  0
##
## Overall Statistics
##
##              Accuracy : 1
##              95% CI : (0.7684, 1)
##      No Information Rate : 1
##      P-Value [Acc > NIR] : 1
##
##              Kappa : NaN
##  McNemar's Test P-Value : NA
##
## Statistics by Class:
##
##              Class: A Class: B Class: C Class: D Class: E
## Sensitivity           NA           NA           1           NA           NA
## Specificity           1           1           NA           1           1
## Pos Pred Value        NA           NA           NA           NA           NA
## Neg Pred Value        NA           NA           NA           NA           NA

```



```
## Prevalence          0          0          1          0          0
## Detection Rate      0          0          1          0          0
## Detection Prevalence 0          0          1          0          0
## Balanced Accuracy   NA         NA         NA         NA         NA

# Load Libraries
library(caret)
library(rpart)

# define training control
#train_control<- trainControl(method="cv", number=10)

# train the model
#model<- train(classe~.,data=training, trControl=train_control, method="glm")

# append predictions
pred<- cbind(testing,predictions)

# summarize results
confusion Matrix<- confusion Matrix(pred$predictions,pred$pred_classe)
```

#### Confusion Matrix and Statistics

	Reference	
Prediction	yes	no
yes	54	48
no	170	1395

Accuracy : 0.8692  
 95% CI : (0.8521, 0.8851)  
 No Information Rate : 0.8656  
 P-Value [Acc > NIR] : 0.3492  
  
 Kappa : 0.2699  
 McNemar's Test P-Value : 2.503e-16  
  
 Sensitivity : 0.24107  
 Specificity : 0.96674  
 Pos Pred Value : 0.52941  
 Neg Pred Value : 0.89137  
 Prevalence : 0.13437  
 Detection Rate : 0.03239  
 Detection Prevalence : 0.06119  
 Balanced Accuracy : 0.60390  
  
 'Positive' Class : yes