AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

Faculty of Science and Technology

FINAL TERM PROJECT REPORT

Assignment Title:	Credit Card Faud DetectingDataset Project Report		
Assignment No:	1	Date of Submission:	15 August 2023
Course Title:	Introduction to Data Science		
Course Code:	01153	Section:	C
Semester:	Summer 2022-23	Course Teacher:	Abdus Salam

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7			Choose an item.	
8			Choose an item.	
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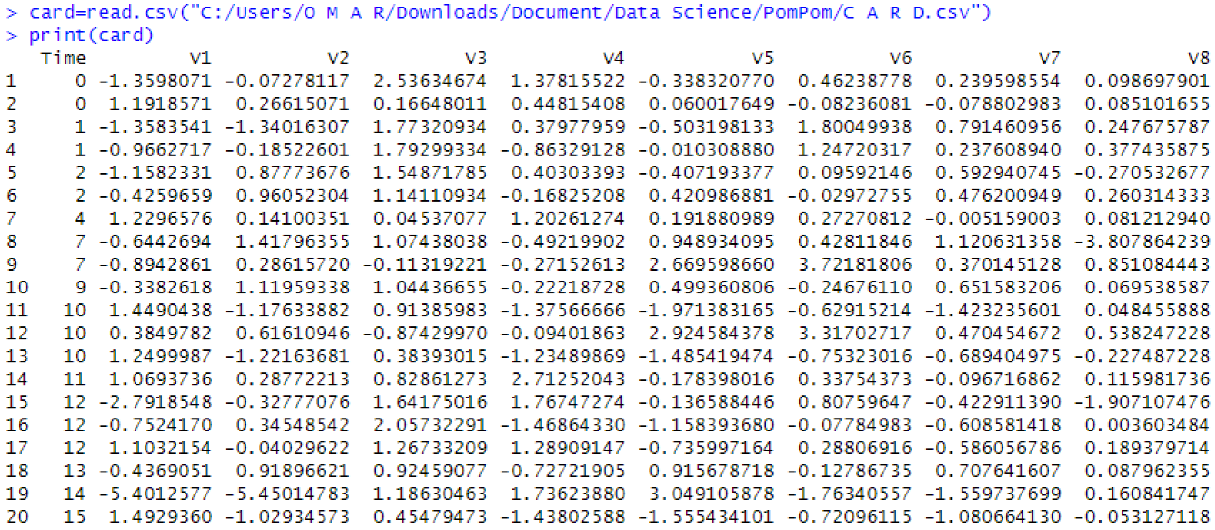
Faculty use only

FACULTYCOMMENTS	Marks Obtained	
	Total Marks	

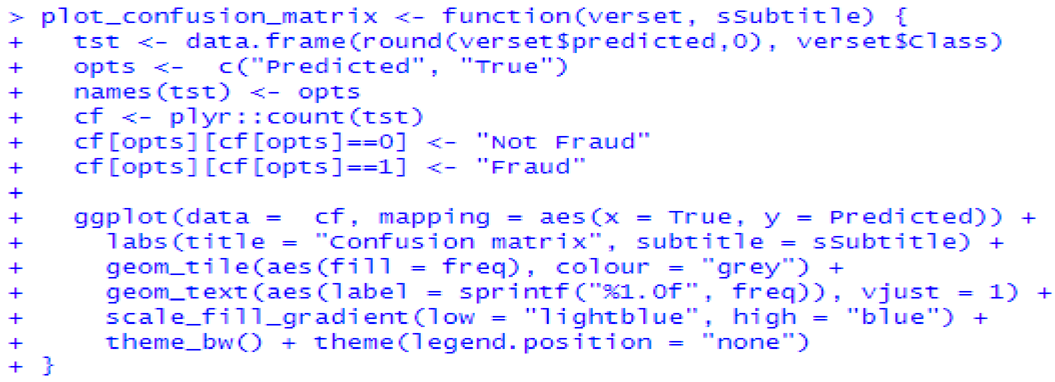
DATASET Link : https://www.kaggle.com/datasets/mlg-ulb/creditcardfraud

At first I insert the Dataset(.csv) file of Credit card fraud detection



```
> card=read.csv("C:/Users/O M A R/Downloads/Document/Data Science/PomPom/C A R D.csv")
> print(card)
   Time         V1          V2          V3          V4           V5          V6           V7           V8
1     0 -1.3598071 -0.07278117  2.53634674  1.37815522 -0.338320770  0.46238778  0.239598554  0.098697901
2     0  1.1918571  0.26615071  0.16648011  0.44815408  0.060017649 -0.08236081 -0.078802983  0.085101655
3     1 -1.3583541 -1.34016307  1.77320934  0.37977959 -0.503198133  1.80049938  0.791460956  0.247675787
4     1 -0.9662717 -0.18522601  1.79299334 -0.86329128 -0.010308880  1.24720317  0.237608940  0.377435875
5     2 -1.1582331  0.87773676  1.54871785  0.40303393 -0.407193377  0.09592146  0.592940745 -0.270532677
6     2 -0.4259659  0.96052304  1.14110934 -0.16825208  0.420986881 -0.02972755  0.476200949  0.260314333
7     4  1.2296576  0.14100351  0.04537077  1.20261274  0.191880989  0.27270812 -0.005159003  0.081212940
8     7 -0.6442694  1.41796355  1.07438038 -0.49219902  0.948934095  0.42811846  1.120631358 -3.807864239
9     7 -0.8942861  0.28615720 -0.11319221 -0.27152613  2.669598660  3.72181806  0.370145128  0.851084443
10    9 -0.3382618  1.11959338  1.04436655 -0.22218728  0.499360806 -0.24676110  0.651583206  0.069538587
11   10  1.4490438 -1.17633882  0.91385983 -1.37566666 -1.971383165 -0.62915214 -1.423235601  0.048455888
12   10  0.3849782  0.61610946 -0.87429970 -0.09401863  2.924584378  3.31702717  0.470454672  0.538247228
13   10  1.2499987 -1.22163681  0.38393015 -1.23489869 -1.485419474 -0.75323016 -0.689404975 -0.227487228
14   11  1.0693736  0.28772213  0.82861273  2.71252043 -0.178398016  0.33754373 -0.096716862  0.115981736
15   12 -2.7918548 -0.32777076  1.64175016  1.76747274 -0.136588446  0.80759647 -0.422911390 -1.907107476
16   12 -0.7524170  0.34548542  2.05732291 -1.46864330 -1.158393680 -0.07784983 -0.608581418  0.003603484
17   12  1.1032154 -0.04029622  1.26733209  1.28909147 -0.735997164  0.28806916 -0.586056786  0.189379714
18   13 -0.4369051  0.91896621  0.92459077 -0.72721905  0.915678718 -0.12786735  0.707641607  0.087962355
19   14 -5.4012577 -5.45014783  1.18630463  1.73623880  3.049105878 -1.76340557 -1.559737699  0.160841747
20   15  1.4929360 -1.02934573  0.45479473 -1.43802588 -1.555434101 -0.72096115 -1.080664130 -0.053127118
```

Confusion Matrix function



```
> plot_confusion_matrix <- function(verset, sSubtitle) {
+   tst <- data.frame(round(verset$predicted,0), verset$Class)
+   opts <-  c("Predicted", "True")
+   names(tst) <- opts
+   cf <- plyr::count(tst)
+   cf[opts][cf[opts]==0] <- "Not Fraud"
+   cf[opts][cf[opts]==1] <- "Fraud"
+
+   ggplot(data =  cf, mapping = aes(x = True, y = Predicted)) +
+     labs(title = "Confusion matrix", subtitle = sSubtitle) +
+     geom_tile(aes(fill = freq), colour = "grey") +
+     geom_text(aes(label = sprintf("%1.0f", freq)), vjust = 1) +
+     scale_fill_gradient(low = "lightblue", high = "blue") +
+     theme_bw() + theme(legend.position = "none")
+ }
```

Column & Row number

sprintf("Rows: %d Columns: %d",nrow(card), length(names(card)))

First few rows of data

head(card,10) %>%

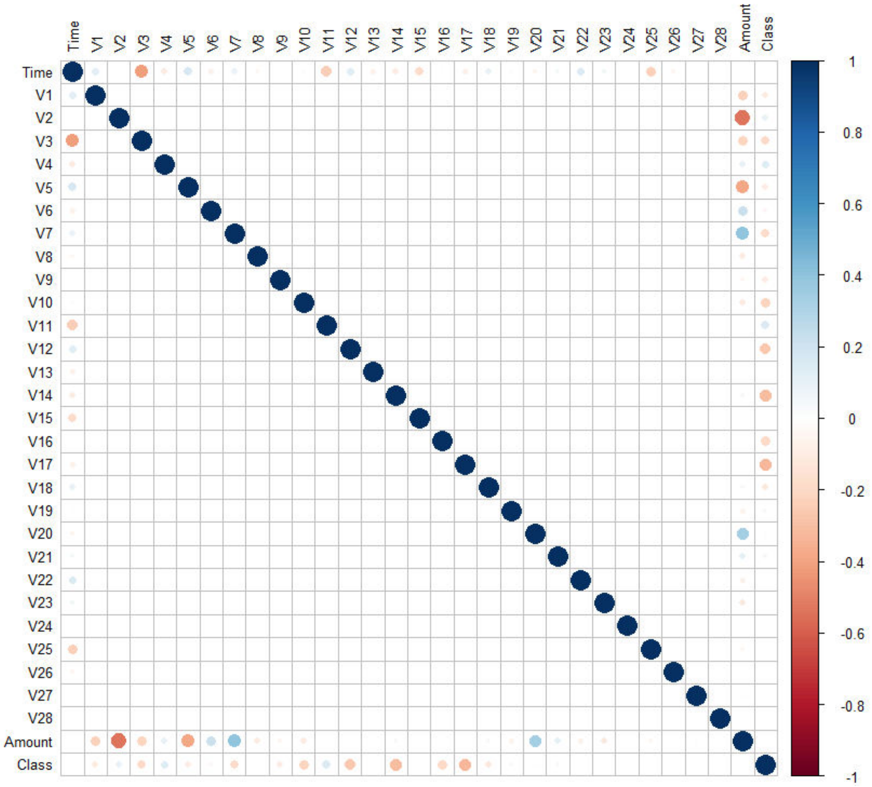
kable("html", escape=F, align="c") %>%

kable_styling(bootstrap_options = "striped", full_width = F, position = "center")

Correlations : Pearson Correlation

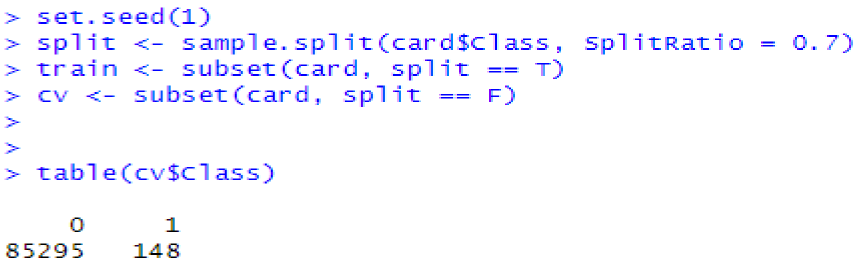
correlations <- cor(card,method="pearson")

corrplot(correlations, number.cex = .9, method = "circle", type = "full", tl.cex=0.8,tl.col = "black")



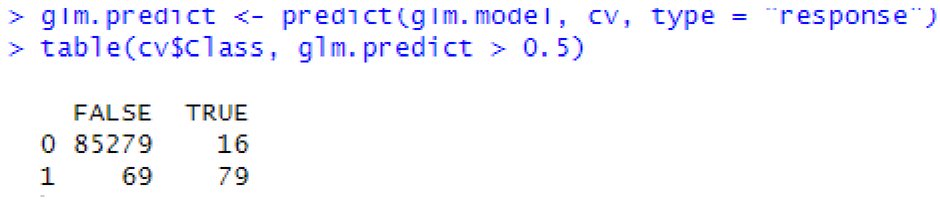
Predictive Modeling

Split data 70:30 where baseline accuracy **99.826785%**



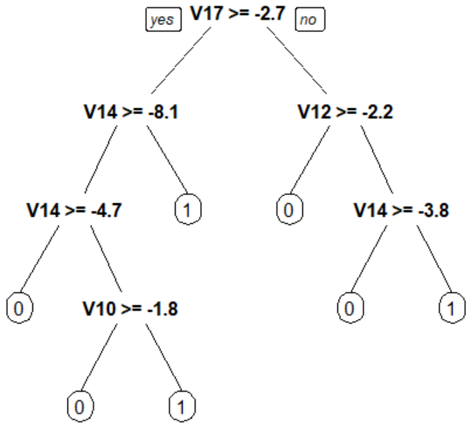
```
> set.seed(1)
> split <- sample.split(card$Class, SplitRatio = 0.7)
> train <- subset(card, split == T)
> cv <- subset(card, split == F)
>
>
> table(cv$Class)

    0     1
85295   148
```

Logistic regression (Accuracy -> 99.900518%)

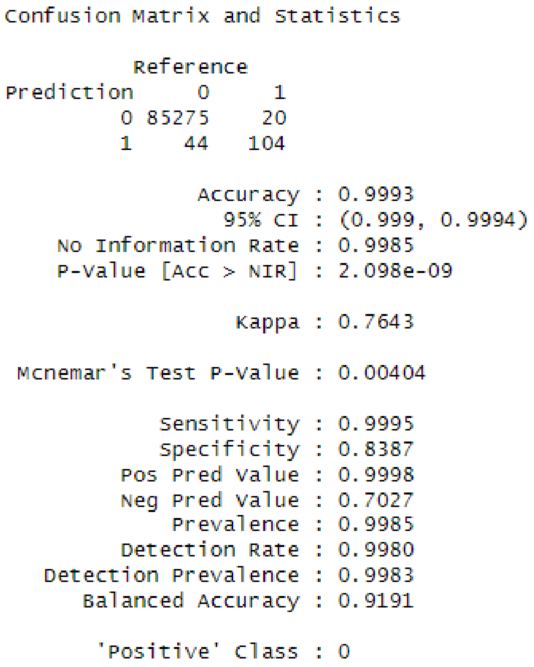


```
> glm.predict <- predict(glm.model, cv, type = "response")
> table(cv$Class, glm.predict > 0.5)

     FALSE  TRUE
  0 85279    16
  1    69    79
```

Decision Tree Model

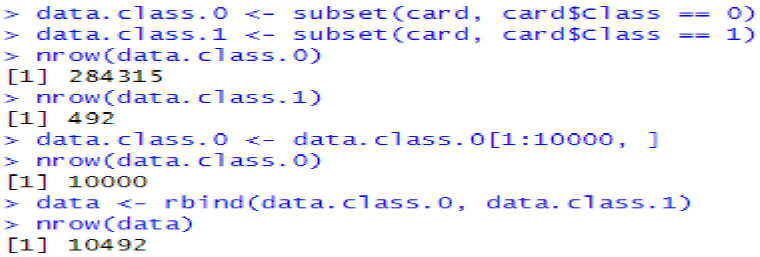


Confusion Matrix & Statistics -> 99.925096 % accuracy (best) using decision tree



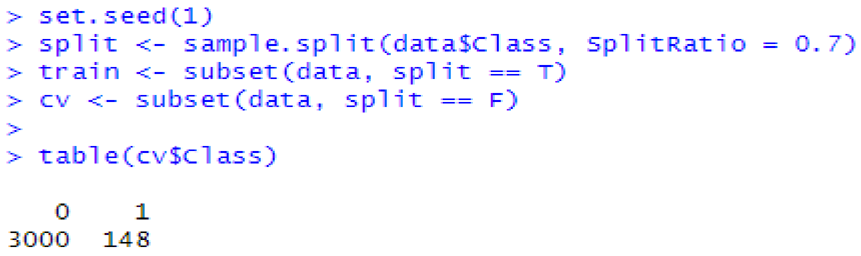
```
Confusion Matrix and Statistics

          Reference
Prediction     0     1
         0 85275    20
         1    44   104
                                          
               Accuracy : 0.9993          
                 95% CI : (0.999, 0.9994)
    No Information Rate : 0.9985          
    P-Value [Acc > NIR] : 2.098e-09       
                                          
                  Kappa : 0.7643          
                                          
 Mcnemar's Test P-Value : 0.00404         
                                          
            Sensitivity : 0.9995          
            Specificity : 0.8387          
         Pos Pred Value : 0.9998          
         Neg Pred Value : 0.7027          
             Prevalence : 0.9985          
         Detection Rate : 0.9980          
   Detection Prevalence : 0.9983          
      Balanced Accuracy : 0.9191          
                                          
       'Positive' Class : 0               
```

Now we only keep 10000 rows of data with class = 0



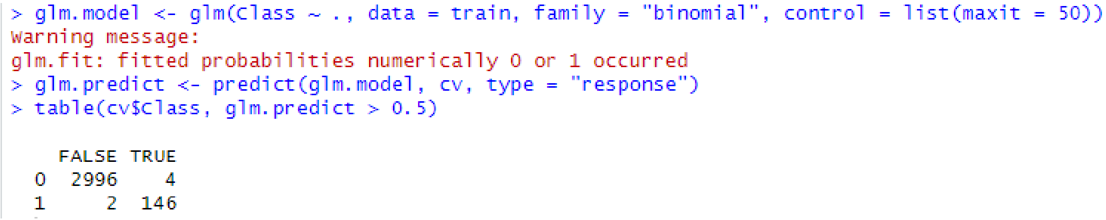
```
> data.class.0 <- subset(card, card$Class == 0)
> data.class.1 <- subset(card, card$Class == 1)
> nrow(data.class.0)
[1] 284315
> nrow(data.class.1)
[1] 492
> data.class.0 <- data.class.0[1:10000, ]
> nrow(data.class.0)
[1] 10000
> data <- rbind(data.class.0, data.class.1)
> nrow(data)
[1] 10492
```

Split Data 70:30 (Baseline accuracy -> 95.298602%)



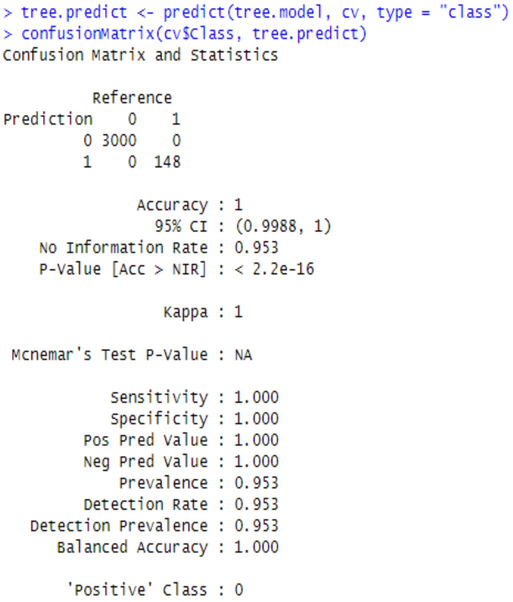
```
> set.seed(1)
> split <- sample.split(data$Class, SplitRatio = 0.7)
> train <- subset(data, split == T)
> cv <- subset(data, split == F)
>
> table(cv$Class)

   0    1 
3000  148 
```

Logistic regression (Accuracy 99.809402%)



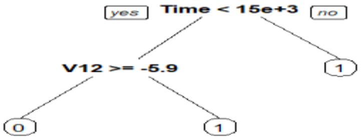
```
> glm.model <- glm(Class ~ ., data = train, family = "binomial", control = list(maxit = 50))
Warning message:
glm.fit: fitted probabilities numerically 0 or 1 occurred
> glm.predict <- predict(glm.model, cv, type = "response")
> table(cv$Class, glm.predict > 0.5)

    FALSE TRUE
  0  2996    4
  1     2  146
```

SVM Model with accuracy of 98.856416%

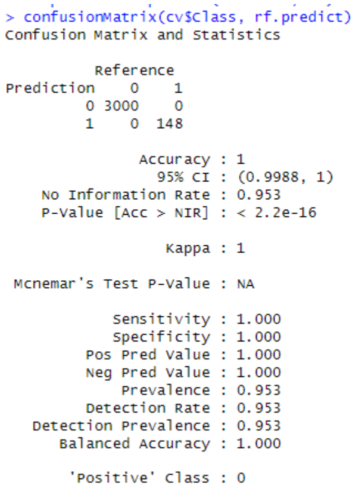


```
> tree.predict <- predict(tree.model, cv, type = "class")
> confusionMatrix(cv$Class, tree.predict)
Confusion Matrix and Statistics

          Reference
Prediction    0    1
         0 3000    0
         1    0  148
                                     
               Accuracy : 1          
                 95% CI : (0.9988, 1)
    No Information Rate : 0.953      
    P-Value [Acc > NIR] : < 2.2e-16  
                                     
                  Kappa : 1          
                                     
 Mcnemar's Test P-Value : NA         
                                     
            Sensitivity : 1.000      
            Specificity : 1.000      
         Pos Pred Value : 1.000      
         Neg Pred Value : 1.000      
             Prevalence : 0.953      
         Detection Rate : 0.953      
   Detection Prevalence : 0.953      
      Balanced Accuracy : 1.000      
                                     
       'Positive' Class : 0          
```

Decision Tree Model



Confusion Matrix and Statistics



```
> confusionMatrix(cv$Class, rf.predict)
Confusion Matrix and Statistics

          Reference
Prediction    0    1
         0 3000    0
         1    0  148
                                    
               Accuracy : 1         
                 95% CI : (0.9988, 1)
    No Information Rate : 0.953     
    P-Value [Acc > NIR] : < 2.2e-16 
                                    
                  Kappa : 1         
                                    
 Mcnemar's Test P-Value : NA        
                                    
            Sensitivity : 1.000     
            Specificity : 1.000     
         Pos Pred Value : 1.000     
         Neg Pred Value : 1.000     
             Prevalence : 0.953     
         Detection Rate : 0.953     
   Detection Prevalence : 0.953     
      Balanced Accuracy : 1.000     
                                    
       'Positive' Class : 0         
```

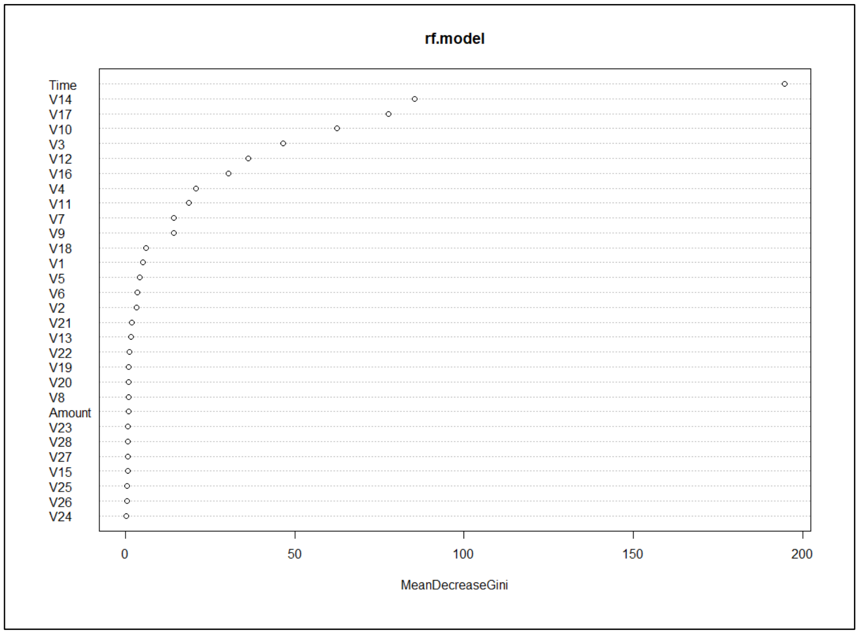
Random Forest(rf) model

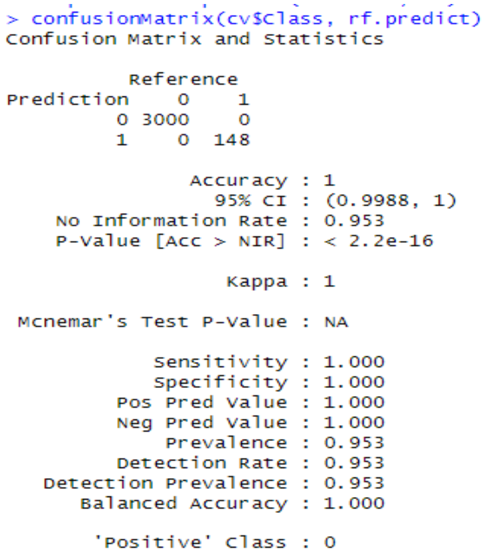
set.seed(10)

rf.model <- randomForest(Class ~ ., data = train,ntree = 2000, nodesize = 20)

rf.predict <- predict(rf.model, cv)

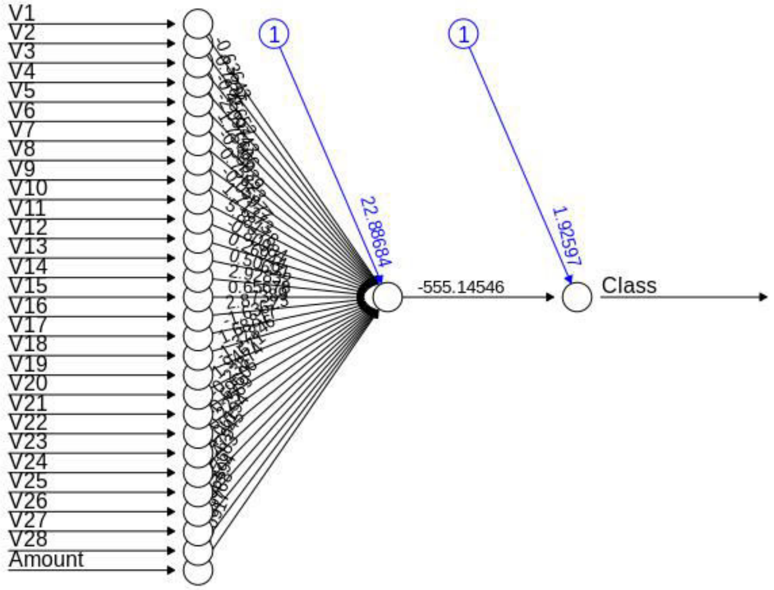
confusionMatrix(cv$Class, rf.predict)





```
> confusionMatrix(cv$Class, rf.predict)
Confusion Matrix and Statistics

          Reference
Prediction    0    1
         0 3000    0
         1    0  148
                                          
               Accuracy : 1               
                 95% CI : (0.9988, 1)     
    No Information Rate : 0.953           
    P-Value [Acc > NIR] : < 2.2e-16       
                                          
                  Kappa : 1               
                                          
 Mcnemar's Test P-Value : NA              
                                          
            Sensitivity : 1.000           
            Specificity : 1.000           
         Pos Pred Value : 1.000           
         Neg Pred Value : 1.000           
             Prevalence : 0.953           
         Detection Rate : 0.953           
   Detection Prevalence : 0.953           
      Balanced Accuracy : 1.000           
                                          
       'Positive' Class : 0               
```

ANN Model (Artificial Neural Nertwok)



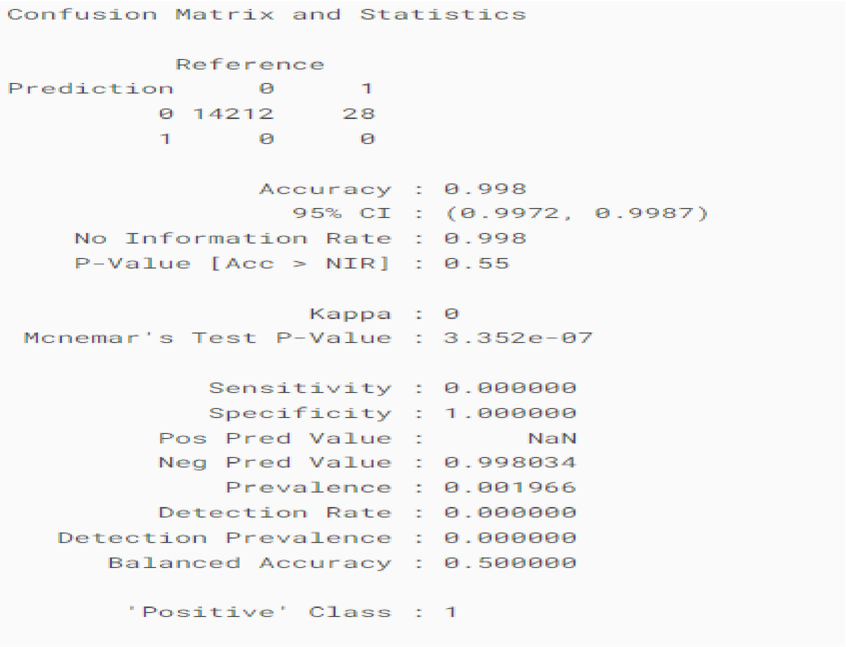
“Class” is of a class “Integer” , the factor transformationwas performed:

card$Class <- factor(card$Class)

K-Nearest Neighbours

set.seed(1998)

knn1 <- knn(train = train[,-31], test = test[,-31], cl = train$Class, k = 5) confusionMatrix(knn1, test$Class, positive = "1")

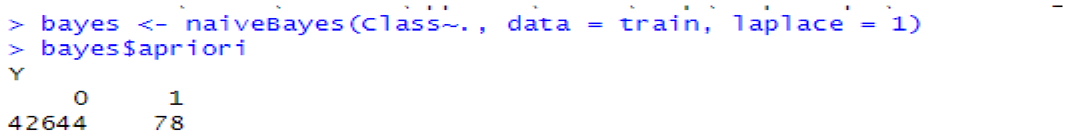


```
Confusion Matrix and Statistics

          Reference
Prediction     0     1
         0 14212    28
         1     0     0

               Accuracy : 0.998
                 95% CI : (0.9972, 0.9987)
    No Information Rate : 0.998
    P-Value [Acc > NIR] : 0.55

                  Kappa : 0
 Mcnemar's Test P-Value : 3.352e-07

            Sensitivity : 0.000000
            Specificity : 1.000000
         Pos Pred Value :      NaN
         Neg Pred Value : 0.998034
             Prevalence : 0.001966
         Detection Rate : 0.000000
   Detection Prevalence : 0.000000
      Balanced Accuracy : 0.500000

       'Positive' Class : 1
```

Naive Bayes

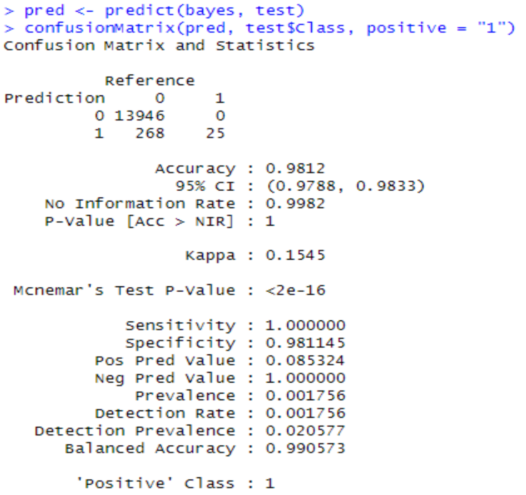
bayes <- naiveBayes(Class~., data = train, laplace = 1)

bayes$apriori



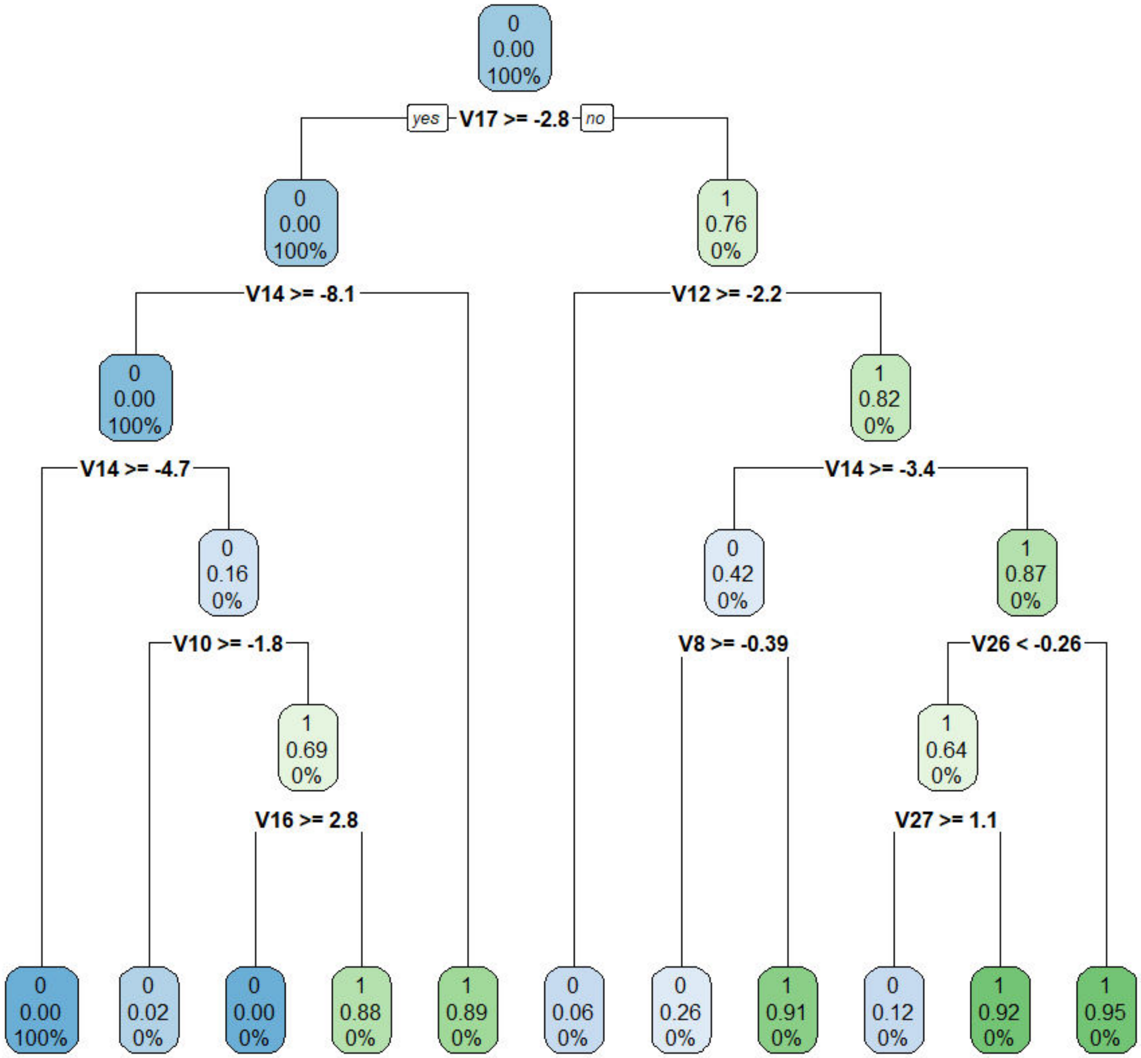
```
> bayes <- naiveBayes(Class~., data = train, laplace = 1)
> bayes$apriori
Y
    0     1 
42644    78 
```

Confusion Matrix



```
> pred <- predict(bayes, test)
> confusionMatrix(pred, test$Class, positive = "1")
Confusion Matrix and Statistics

          Reference
Prediction     0     1
         0 13946     0
         1   268    25
                                          
               Accuracy : 0.9812          
                 95% CI : (0.9788, 0.9833)
    No Information Rate : 0.9982          
    P-Value [Acc > NIR] : 1               
                                          
                  Kappa : 0.1545          
                                          
 Mcnemar's Test P-Value : <2e-16          
                                          
            Sensitivity : 1.000000        
            Specificity : 0.981145        
         Pos Pred Value : 0.085324        
         Neg Pred Value : 1.000000        
             Prevalence : 0.001756        
         Detection Rate : 0.001756        
   Detection Prevalence : 0.020577        
      Balanced Accuracy : 0.990573        
                                          
       'Positive' Class : 1               
```

Overall Decison Tree


0
0.00
100%
yes
V17 >= -2.8
no
0
0.00
100%
1
0.76
0%
V14 >= -8.1
V12 >= -2.2
0
0.00
100%
1
0.82
0%
V14 >= -4.7
V14 >= -3.4
0
0.16
0%
0
0.42
0%
1
0.87
0%
V10 >= -1.8
V8 >= -0.39
V26 < -0.26
1
0.69
0%
1
0.64
0%
V16 >= 2.8
V27 >= 1.1
0
0.00
100%
0
0.02
0%
0
0.00
0%
1
0.88
0%
1
0.89
0%
0
0.06
0%
0
0.26
0%
1
0.91
0%
0
0.12
0%
1
0.92
0%
1
0.95
0%