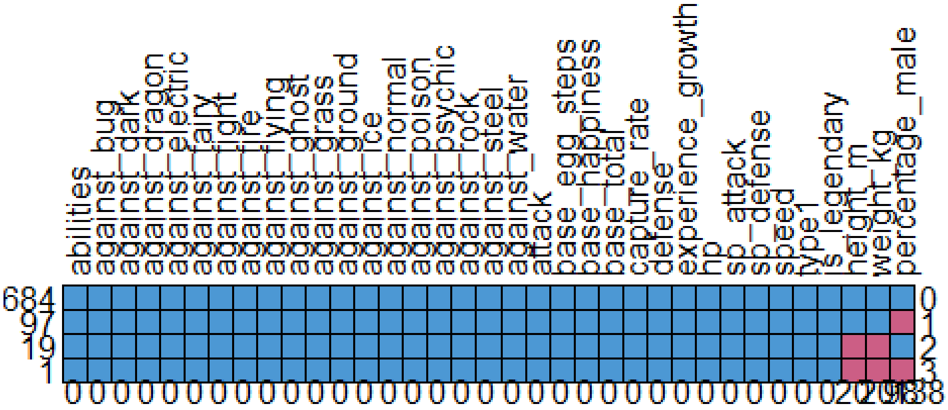
project_pokemon.R

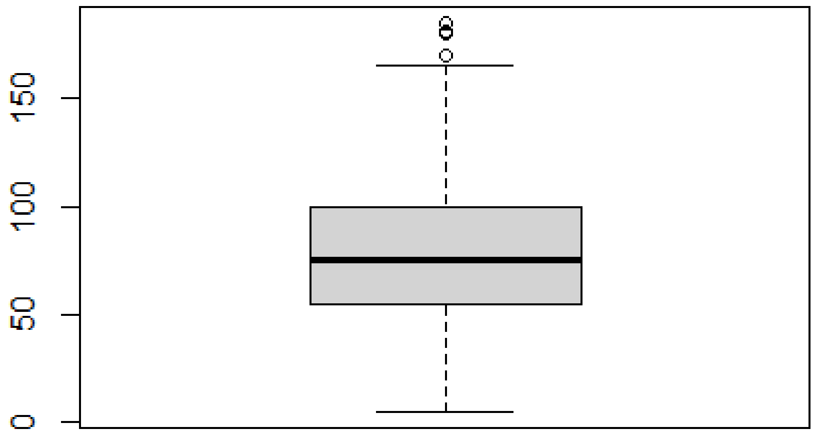
Sarvesh

```
#selecting and importing data

pok=read.csv("https://raw.githubusercontent.com/10sarvesh/Pokemon/main/pokemo
n.csv",header = TRUE)  #importing the dataset into a variable pok
df_pok=data.frame(pok)  #assigning the variable to dataframe
dim(df_pok)     #shows (no. of observations,no. of features)

## [1] 801  41

View(df_pok)


df_pok1=df_pok[-c(25,30,31,33,38,40)]   #dropping columns that are not
required
View(df_pok1)
summary(df_pok1)   #summary of new modified dataset

##   abilities          against_bug      against_dark    against_dragon
##  Length:801         Min.   :0.2500   Min.   :0.250   Min.   :0.0000
##  Class :character   1st Qu.:0.5000   1st Qu.:1.000   1st Qu.:1.0000
##  Mode  :character   Median :1.0000   Median :1.000   Median :1.0000
##                     Mean   :0.9963   Mean   :1.057   Mean   :0.9688
##                     3rd Qu.:1.0000   3rd Qu.:1.000   3rd Qu.:1.0000
##                     Max.   :4.0000   Max.   :4.000   Max.   :2.0000
##
##  against_electric against_fairy   against_fight    against_fire
##  Min.   :0.000    Min.   :0.250   Min.   :0.000   Min.   :0.250
##  1st Qu.:0.500    1st Qu.:1.000   1st Qu.:0.500   1st Qu.:0.500
##  Median :1.000    Median :1.000   Median :1.000   Median :1.000
##  Mean   :1.074    Mean   :1.069   Mean   :1.066   Mean   :1.135
##  3rd Qu.:1.000    3rd Qu.:1.000   3rd Qu.:1.000   3rd Qu.:2.000
##  Max.   :4.000    Max.   :4.000   Max.   :4.000   Max.   :4.000
##
##  against_flying  against_ghost   against_grass   against_ground
##  Min.   :0.250   Min.   :0.000   Min.   :0.250   Min.   :0.000
##  1st Qu.:1.000   1st Qu.:1.000   1st Qu.:0.500   1st Qu.:1.000
##  Median :1.000   Median :1.000   Median :1.000   Median :1.000
##  Mean   :1.193   Mean   :0.985   Mean   :1.034   Mean   :1.098
##  3rd Qu.:1.000   3rd Qu.:1.000   3rd Qu.:1.000   3rd Qu.:1.000
##  Max.   :4.000   Max.   :4.000   Max.   :4.000   Max.   :4.000
##
##   against_ice    against_normal  against_poison   against_psychic
##  Min.   :0.250   Min.   :0.000   Min.   :0.0000   Min.   :0.000
##  1st Qu.:0.500   1st Qu.:1.000   1st Qu.:0.5000   1st Qu.:1.000
##  Median :1.000   Median :1.000   Median :1.0000   Median :1.000  
##  Mean   :1.208   Mean   :0.887   Mean   :0.9753   Mean   :1.005  
##  3rd Qu.:2.000   3rd Qu.:1.000   3rd Qu.:1.0000   3rd Qu.:1.000  
##  Max.   :4.000   Max.   :1.000   Max.   :4.0000   Max.   :4.000  
##                                                                  
##   against_rock  against_steel    against_water       attack      
##  Min.   :0.25   Min.   :0.2500   Min.   :0.250   Min.   :  5.00  
##  1st Qu.:1.00   1st Qu.:0.5000   1st Qu.:0.500   1st Qu.: 55.00  
##  Median :1.00   Median :1.0000   Median :1.000   Median : 75.00  
##  Mean   :1.25   Mean   :0.9835   Mean   :1.058   Mean   : 77.86  
##  3rd Qu.:2.00   3rd Qu.:1.0000   3rd Qu.:1.000   3rd Qu.:100.00  
##  Max.   :4.00   Max.   :4.0000   Max.   :4.000   Max.   :185.00  
##                                                                  
##  base_egg_steps  base_happiness     base_total     capture_rate   
##  Min.   : 1280   Min.   :  0.00   Min.   :180.0   Min.   :  3.00  
##  1st Qu.: 5120   1st Qu.: 70.00   1st Qu.:320.0   1st Qu.: 45.00  
##  Median : 5120   Median : 70.00   Median :435.0   Median : 60.00  
##  Mean   : 7191   Mean   : 65.36   Mean   :428.4   Mean   : 98.96  
##  3rd Qu.: 6400   3rd Qu.: 70.00   3rd Qu.:505.0   3rd Qu.:170.00  
##  Max.   :30720   Max.   :140.00   Max.   :780.0   Max.   :255.00  
##                                                                   
##     defense       experience_growth    height_m            hp        
##  Min.   :  5.00   Min.   : 600000   Min.   : 0.100   Min.   :  1.00  
##  1st Qu.: 50.00   1st Qu.:1000000   1st Qu.: 0.600   1st Qu.: 50.00  
##  Median : 70.00   Median :1000000   Median : 1.000   Median : 65.00  
##  Mean   : 73.01   Mean   :1054996   Mean   : 1.164   Mean   : 68.96  
##  3rd Qu.: 90.00   3rd Qu.:1059860   3rd Qu.: 1.500   3rd Qu.: 80.00  
##  Max.   :230.00   Max.   :1640000   Max.   :14.500   Max.   :255.00  
##                                     NA's   :20                       
##  percentage_male    sp_attack        sp_defense         speed       
##  Min.   :  0.00   Min.   : 10.00   Min.   : 20.00   Min.   :  5.00  
##  1st Qu.: 50.00   1st Qu.: 45.00   1st Qu.: 50.00   1st Qu.: 45.00  
##  Median : 50.00   Median : 65.00   Median : 66.00   Median : 65.00  
##  Mean   : 55.16   Mean   : 71.31   Mean   : 70.91   Mean   : 66.33  
##  3rd Qu.: 50.00   3rd Qu.: 91.00   3rd Qu.: 90.00   3rd Qu.: 85.00  
##  Max.   :100.00   Max.   :194.00   Max.   :230.00   Max.   :180.00  
##  NA's   :98                                                         
##     type1              weight_kg       is_legendary    
##  Length:801         Min.   :  0.10   Min.   :0.00000  
##  Class :character   1st Qu.:  9.00   1st Qu.:0.00000  
##  Mode  :character   Median : 27.30   Median :0.00000  
##                     Mean   : 61.38   Mean   :0.08739  
##                     3rd Qu.: 64.80   3rd Qu.:0.00000  
##                     Max.   :999.90   Max.   :1.00000  
##                     NA's   :20
```

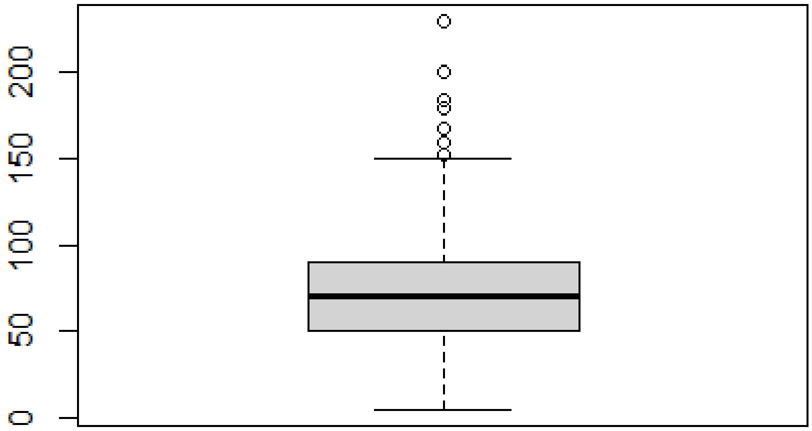
```
#data cleaning

#checking if there are any duplicated entries

which(duplicated(df_pok1))   #returns the row number or index having
duplicate

## integer(0)

#Thus we can see there are no duplicate entries

#by finding summary(dataset) we can see which features have missing values

#visualizing the missing values

library(mice)

## Warning: package 'mice' was built under R version 4.0.5

##
## Attaching package: 'mice'

## The following object is masked from 'package:stats':
##
##     filter

## The following objects are masked from 'package:base':
##
##     cbind, rbind

md.pattern(df_pok1,plot=TRUE,rotate.names = TRUE)
```



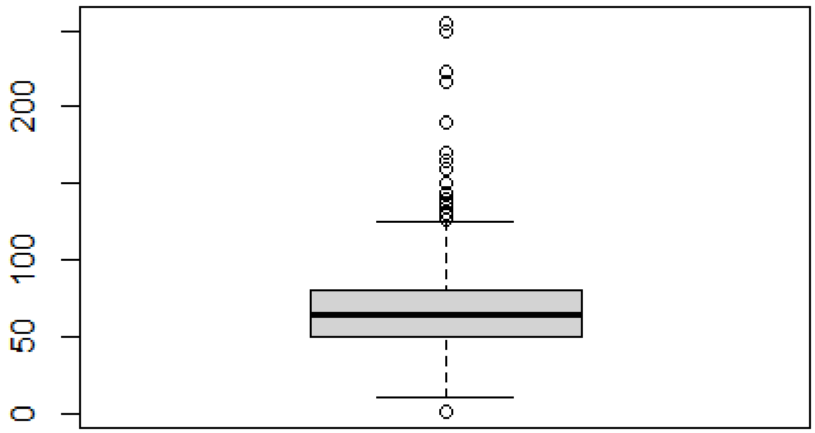
```
##     abilities against_bug against_dark against_dragon against_electric
## 684         1           1            1              1                1
## 97          1           1            1              1                1
## 19          1           1            1              1                1
## 1           1           1            1              1                1
##             0           0            0              0                0
##     against_fairy against_fight against_fire against_flying against_ghost
## 684             1             1            1              1             1
## 97              1             1            1              1             1
## 19              1             1            1              1             1
## 1               1             1            1              1             1
##                 0             0            0              0             0
##     against_grass against_ground against_ice against_normal against_poison
## 684             1              1           1              1              1
## 97              1              1           1              1              1
## 19              1              1           1              1              1
## 1               1              1           1              1              1
##                 0              0           0              0              0
##     against_psychic against_rock against_steel against_water attack
## 684               1            1             1             1      1
## 97                1            1             1             1      1
## 19                1            1             1             1      1
## 1                 1            1             1             1      1
##                   0            0             0             0      0
##     base_egg_steps base_happiness base_total capture_rate defense
## 684              1              1          1            1       1
## 97               1              1          1            1       1
## 19               1              1          1            1       1
## 1                1              1          1            1       1
##                  0              0          0            0       0
##     experience_growth hp sp_attack sp_defense speed type1 is_legendary
height_m
## 684                  1  1         1          1     1     1            1
1
## 97                   1  1         1          1     1     1            1
1
## 19                   1  1         1          1     1     1            1
0
## 1                    1  1         1          1     1     1            1
0
##                      0  0         0          0     0     0            0
20
##     weight_kg percentage_male
## 684         1               1   0
## 97          1               0   1
## 19          0               1   2
## 1           0               0   3
##            20              98 138

#this plot shows the no. of missing values in  corresponding variables

#replacing the missing values with mean values of resp. attributes

df_pok1$height_m[is.na(df_pok1$height_m)]=mean(df_pok1$height_m,na.rm = TRUE)
df_pok1$weight_kg[is.na(df_pok1$weight_kg)]=mean(df_pok1$weight_kg,na.rm =
TRUE)
df_pok1$percentage_male[is.na(df_pok1$percentage_male)]=mean(df_pok1$percenta
ge_male,na.rm = TRUE)

#boxplot to find outliers and replacing them with (0.05,0.95) quantiles

outlier_attack=boxplot(df_pok1$attack)$out                  #plotting the
diagram
```



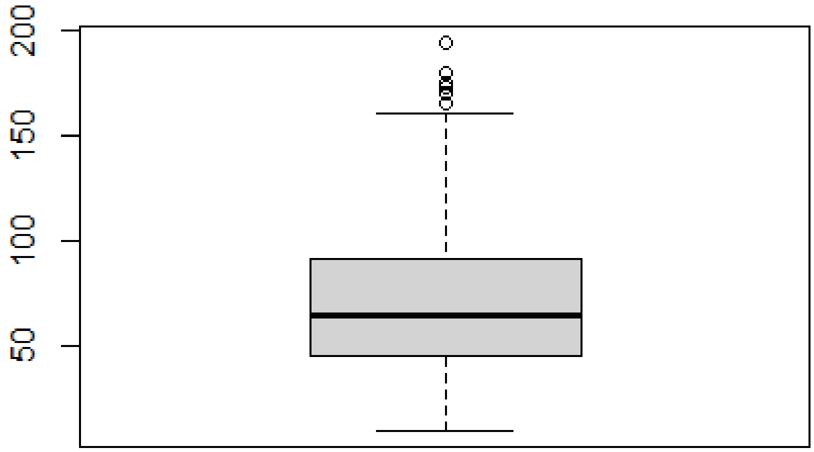
```
outlier_attack                                                #displays
outliers(values)

## [1] 185 180 180 170 181

q_attack=quantile(df_pok1$attack,c(0.05,0.95))                #creating
quantile of [0.05,0.95] C.I.
q_attack                                                      #displays the
quantile limits

##  5% 95%
##  30 135

q_attack[1]=df_pok1$attack[df_pok1$attack<q_attack[1]]        #replacing values
less than lower quantile with lower quantile

## Warning in q_attack[1] = df_pok1$attack[df_pok1$attack < q_attack[1]]:
number of
## items to replace is not a multiple of replacement length

q_attack[2]=df_pok1$attack[df_pok1$attack>q_attack[2]]        #replacing values
more than upper quantile with upper quantile

## Warning in q_attack[2] = df_pok1$attack[df_pok1$attack > q_attack[2]]:
number of
## items to replace is not a multiple of replacement length

outlier_defence=boxplot(df_pok1$defense)$out
```



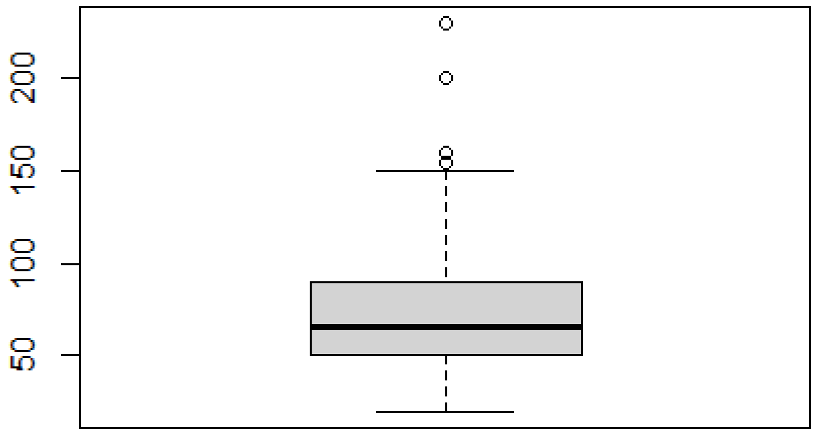
```
outlier_defence

##  [1] 180 180 160 230 230 230 200 160 168 184 152

q_defence=quantile(df_pok1$defense,c(0.05,0.95))
q_defence

##  5% 95%
##  35 130

q_defence[1]=df_pok1$defense[df_pok1$defense<q_defence[1]]

## Warning in q_defence[1] = df_pok1$defense[df_pok1$defense < q_defence[1]]:
## number of items to replace is not a multiple of replacement length

q_defence[2]=df_pok1$defense[df_pok1$defense>q_defence[2]]

## Warning in q_defence[2] = df_pok1$defense[df_pok1$defense > q_defence[2]]:
## number of items to replace is not a multiple of replacement length

outlier_hp=boxplot(df_pok1$hp)$out
```



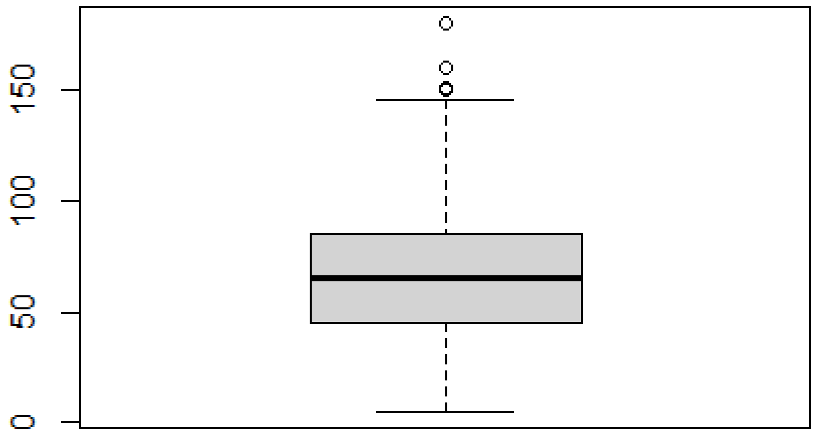
```
outlier_hp

##  [1] 140 250 130 130 160 190 255 150   1 144 130 170 150 135 150 165 126
126 216
## [20] 137 137 223

q_hp=quantile(df_pok1$hp,c(0.05,0.95))
q_hp

##  5% 95%
##  35 110

q_hp[1]=df_pok1$hp[df_pok1$hp<q_hp[1]]

## Warning in q_hp[1] = df_pok1$hp[df_pok1$hp < q_hp[1]]: number of items to
## replace is not a multiple of replacement length

q_hp[2]=df_pok1$hp[df_pok1$hp>q_hp[2]]

## Warning in q_hp[2] = df_pok1$hp[df_pok1$hp > q_hp[2]]: number of items to
## replace is not a multiple of replacement length

outlier_spat=boxplot(df_pok1$sp_attack)$out
```



```
outlier_spat

##  [1] 175 170 194 165 165 180 180 170 170 173

q_spat=quantile(df_pok1$sp_attack,c(0.05,0.95))
q_spat

##  5% 95%
##  30 131

q_spat[1]=df_pok1$sp_attack[df_pok1$sp_attack<q_spat[1]]

## Warning in q_spat[1] = df_pok1$sp_attack[df_pok1$sp_attack < q_spat[1]]:
number
## of items to replace is not a multiple of replacement length

q_spat[2]=df_pok1$sp_attack[df_pok1$sp_attack>q_spat[2]]

## Warning in q_spat[2] = df_pok1$sp_attack[df_pok1$sp_attack > q_spat[2]]:
number
## of items to replace is not a multiple of replacement length

outlier_spdf=boxplot(df_pok1$sp_defense)$out
```



```
outlier_spdf

## [1] 230 154 154 200 160 154

q_spdf=quantile(df_pok1$sp_defense,c(0.05,0.95))
q_spdf

##  5% 95%
##  31 120

q_spdf[1]=df_pok1$sp_defense[df_pok1$sp_defense<q_spdf[1]]

## Warning in q_spdf[1] = df_pok1$sp_defense[df_pok1$sp_defense < q_spdf[1]]:
## number of items to replace is not a multiple of replacement length

q_spdf[2]=df_pok1$sp_defense[df_pok1$sp_defense>q_spdf[2]]

## Warning in q_spdf[2] = df_pok1$sp_defense[df_pok1$sp_defense > q_spdf[2]]:
## number of items to replace is not a multiple of replacement length

outlier_speed=boxplot(df_pok1$speed)$out
```



```
outlier_speed

## [1] 150 150 150 160 180 151

q_speed=quantile(df_pok1$speed,c(0.05,0.95))
q_speed

##  5% 95%
##  25 115

q_speed[1]=df_pok1$speed[df_pok1$speed<q_speed[1]]

## Warning in q_speed[1] = df_pok1$speed[df_pok1$speed < q_speed[1]]: number
of
## items to replace is not a multiple of replacement length

q_speed[2]=df_pok1$speed[df_pok1$speed>q_speed[2]]

## Warning in q_speed[2] = df_pok1$speed[df_pok1$speed > q_speed[2]]: number
of
## items to replace is not a multiple of replacement length

#data transformation

#converting the column 'abilities' from categorical to numeric

df_pok1$abilities=factor(df_pok1$abilities)       #creating a vector to store
all categorical values
```

```r
df_pok1$abilities=as.numeric(df_pok1$abilities)   #converting them to numeric
type
View(df_pok1)

#rescaling the data in the range [0,4] using rescale function

library(scales)
```

```
## Warning: package 'scales' was built under R version 4.0.5
```

```r
df_pok1$abilities=rescale(df_pok1$abilities,to=c(0,4))
df_pok1$attack=rescale(df_pok1$attack,to=c(0,4))
df_pok1$base_egg_steps=rescale(df_pok1$base_egg_steps,to=c(0,4))
df_pok1$base_happiness=rescale(df_pok1$base_happiness,to=c(0,4))
df_pok1$base_total=rescale(df_pok1$base_total,to=c(0,4))
df_pok1$capture_rate=rescale(df_pok1$capture_rate,to=c(0,4))
df_pok1$defense=rescale(df_pok1$defense,to=c(0,4))
df_pok1$experience_growth=rescale(df_pok1$experience_growth,to=c(0,4))
df_pok1$height_m=rescale(df_pok1$height_m,to=c(0,4))
df_pok1$hp=rescale(df_pok1$hp,to=c(0,4))
df_pok1$percentage_male=rescale(df_pok1$percentage_male,to=c(0,4))
df_pok1$sp_attack=rescale(df_pok1$sp_attack,to=c(0,4))
df_pok1$sp_defense=rescale(df_pok1$sp_defense,to=c(0,4))
df_pok1$speed=rescale(df_pok1$speed,to=c(0,4))
df_pok1$weight_kg=rescale(df_pok1$weight_kg,to=c(0,4))

View(df_pok1)

#saving the cleaned data to csv file

write.csv(df_pok1,file="D:\\BDA\\Sem 2\\Enabling
Technologies\\Project\\archive\\pokemon_cleaned.csv",row.names = FALSE)


#############################################################################
####################################


#Here we have 2 target variables:'type1' and 'is-legendary' and all others
are feature variables

df_pok1=read.csv("D:\\BDA\\Sem 2\\Enabling
Technologies\\Project\\archive\\pokemon_cleaned.csv",header=TRUE)


str(df_pok1)                 #gives the overall of structure of data other
than statistical summary
```

```
## 'data.frame':    801 obs. of  35 variables:
##  $ abilities        : num  2.021 2.021 2.021 0.175 0.175 ...
##  $ against_bug      : num  1 1 1 0.5 0.5 0.25 1 1 1 1 ...
##  $ against_dark     : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ against_dragon   : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ against_electric : num  0.5 0.5 0.5 1 1 2 2 2 2 1 ...
##  $ against_fairy    : num  0.5 0.5 0.5 0.5 0.5 0.5 1 1 1 1 ...
##  $ against_fight    : num  0.5 0.5 0.5 1 1 0.5 1 1 1 0.5 ...
##  $ against_fire     : num  2 2 2 0.5 0.5 0.5 0.5 0.5 0.5 2 ...
##  $ against_flying   : num  2 2 2 1 1 1 1 1 1 2 ...
##  $ against_ghost    : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ against_grass    : num  0.25 0.25 0.25 0.5 0.5 0.25 2 2 2 0.5 ...
##  $ against_ground   : num  1 1 1 2 2 0 1 1 1 0.5 ...
##  $ against_ice      : num  2 2 2 0.5 0.5 1 0.5 0.5 0.5 1 ...
##  $ against_normal   : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ against_poison   : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ against_psychic  : num  2 2 2 1 1 1 1 1 1 1 ...
##  $ against_rock     : num  1 1 1 2 2 4 1 1 1 2 ...
##  $ against_steel    : num  1 1 1 0.5 0.5 0.5 0.5 0.5 0.5 1 ...
##  $ against_water    : num  0.5 0.5 0.5 2 2 2 0.5 0.5 0.5 1 ...
##  $ attack           : num  0.978 1.267 2.111 1.044 1.311 ...
##  $ base_egg_steps   : num  0.522 0.522 0.522 0.522 0.522 ...
##  $ base_happiness   : num  2 2 2 2 2 2 2 2 2 2 ...
##  $ base_total       : num  0.92 1.5 2.97 0.86 1.5 ...
##  $ capture_rate     : num  0.667 0.667 0.667 0.667 0.667 ...
##  $ defense          : num  0.782 1.031 2.098 0.676 0.942 ...
##  $ experience_growth: num  1.77 1.77 1.77 1.77 1.77 ...
##  $ height_m         : num  0.167 0.25 0.528 0.139 0.278 ...
##  $ hp               : num  0.693 0.929 1.244 0.598 0.898 ...
##  $ percentage_male  : num  3.52 3.52 3.52 3.52 3.52 ...
##  $ sp_attack        : num  1.2 1.52 2.43 1.09 1.52 ...
##  $ sp_defense       : num  0.857 1.143 1.905 0.571 0.857 ...
##  $ speed            : num  0.914 1.257 1.714 1.371 1.714 ...
##  $ type1            : chr  "grass" "grass" "grass" "fire" ...
##  $ weight_kg        : num  0.0272 0.0516 0.3997 0.0336 0.0756 ...
##  $ is_legendary     : int  0 0 0 0 0 0 0 0 0 0 ...
```

```
dim(df_pok1)
```

```
## [1] 801  35
```

```
unique(df_pok1$type1)        #returns all unique values of pokemon type
```

```
##  [1] "grass"    "fire"     "water"    "bug"      "normal"   "poison"  
##  [7] "electric" "ground"   "fairy"    "fighting" "psychic"  "rock"    
## [13] "ghost"    "ice"      "dragon"   "dark"     "steel"
```

```
#creating train and test

train=df_pok1[1:535,]        #assigning the training data: 66% of entire
dataset
```

```
test=df_pok1[536:801,]       #assigning test data: remaining 34% of dataset


#predicting 'type'of pokemon

test_ft1=test[-c(33,35)]     #assigning the feature variables to predict 
'type'
test_ft1

test_tgt1=test$type1         #assigning the target variable 'type'


#Naive Bayes Classifier

df_pok1$type1=as.factor(df_pok1$type1)     #encoding 'type1' into category
library(e1071)

## Warning: package 'e1071' was built under R version 4.0.5

library(caret)

## Warning: package 'caret' was built under R version 4.0.5

## Loading required package: lattice

## Loading required package: ggplot2

model_type=naiveBayes(train$type1~.,data = train[-c(35)])    #applying Naive 
Bayes model on the training data
model_type

## 
## Naive Bayes Classifier for Discrete Predictors
## 
## Call:
## naiveBayes.default(x = X, y = Y, laplace = laplace)
## 
## A-priori probabilities:
## Y
##        bug       dark     dragon   electric      fairy   fighting 
fire 
## 0.07850467 0.02616822 0.02429907 0.05233645 0.01495327 0.03364486 
0.06728972 
##      ghost      grass     ground        ice     normal     poison 
psychic 
## 0.02616822 0.09532710 0.04299065 0.02803738 0.15140187 0.04485981 
0.06542056 
##       rock      steel      water 
## 0.05607477 0.02616822 0.16635514 
## 
## Conditional probabilities:
##           abilities
## Y               [,1]      [,2]
##   bug      2.5332145 1.0970090
##   dark     1.6026136 0.9155540
##   dragon   2.0387014 0.8363609
##   electric 2.5583606 0.6215727
##   fairy    0.9002079 0.3743062
##   fighting 2.0628321 1.1869258
##   fire     0.9780550 0.9695406
##   ghost    1.4677755 0.8012219
##   grass    1.2191920 0.9289113
##   ground   2.0627316 0.7042922
##   ice      2.3828136 1.0544942
##   normal   1.9070352 1.0440804
##   poison   1.7539848 0.9991222
##   psychic  2.6967627 0.9993784
##   rock     2.5530146 1.0456984
##   steel    1.7683398 1.1449481
##   water    2.7540938 1.1958763
## 
##           against_bug
## Y               [,1]      [,2]
##   bug      0.7857143 0.4152997
##   dark     1.6428571 0.4972452
##   dragon   1.0000000 0.5000000
##   electric 0.9107143 0.1950105
##   fairy    0.4375000 0.1157275
##   fighting 0.5416667 0.1767767
##   fire     0.4305556 0.1135642
##   ghost    0.4464286 0.2004459
##   grass    1.8627451 0.8489902
##   ground   1.0217391 0.3528540
##   ice      1.0333333 0.4418576
##   normal   0.8641975 0.2623493
##   poison   0.5104167 0.2146682
##   psychic  1.7142857 0.6217352
##   rock     1.1000000 0.4433415
##   steel    0.6785714 0.3010969
##   water    1.0449438 0.3816862
## 
##           against_dark
## Y               [,1]      [,2]
##   bug      1.0119048 0.1741913
##   dark     0.5357143 0.1336306
##   dragon   1.1538462 0.3755338
##   electric 1.0357143 0.1889822
##   fairy    0.5000000 0.0000000
##   fighting 0.5555556 0.1616904
##   fire     0.9166667 0.1889822
##   ghost    1.9285714 0.2672612
##   grass    1.0000000 0.2449490
##   ground   1.0869565 0.2881041
##   ice      1.2000000 0.4140393
##   normal   0.9876543 0.1576251
##   poison   0.8958333 0.2074256
##   psychic  1.8285714 0.3823853
##   rock     1.0500000 0.2738613
##   steel    1.3928571 0.5608569
##   water    1.0112360 0.2497445
## 
##           against_dragon
## Y               [,1]       [,2]
##   bug      0.9761905 0.10777013
##   dark     1.0000000 0.00000000
##   dragon   2.0000000 0.00000000
##   electric 0.9464286 0.15748520
##   fairy    0.0000000 0.00000000
##   fighting 0.9722222 0.11785113
##   fire     0.9861111 0.08333333
##   ghost    1.0714286 0.26726124
##   grass    1.0000000 0.00000000
##   ground   1.0652174 0.31277162
##   ice      1.0000000 0.00000000
##   normal   0.9506173 0.21801574
##   poison   1.0000000 0.00000000
##   psychic  0.8571429 0.35503580
##   rock     0.9500000 0.15256429
##   steel    0.5000000 0.19611614
##   water    0.9943820 0.21968963
## 
##           against_electric
## Y               [,1]       [,2]
##   bug      1.2500000 0.54381220
##   dark     1.1428571 0.36313652
##   dragon   0.5384615 0.37977726
##   electric 0.5178571 0.09449112
##   fairy    1.2500000 0.46291005
##   fighting 1.0000000 0.00000000
##   fire     1.0277778 0.37691311
##   ghost    1.1071429 0.40089186
##   grass    0.5294118 0.15529857
##   ground   0.0000000 0.00000000
##   ice      1.1333333 0.74322335
##   normal   1.2592593 0.44095855
##   poison   1.0416667 0.46430562
##   psychic  1.1285714 0.37066826
##   rock     0.9333333 0.62606232
##   steel    0.9642857 0.41437097
##   water    1.8764045 0.78073719
## 
##           against_fairy
## Y               [,1]      [,2]
##   bug      0.9047619 0.2758158
##   dark     1.8571429 0.3631365
##   dragon   2.0000000 0.0000000
##   electric 0.9464286 0.1574852
##   fairy    1.0000000 0.0000000
##   fighting 1.9444444 0.2357023
##   fire     0.5763889 0.1965728
##   ghost    1.0357143 0.4584374
##   grass    0.9607843 0.3720637
##   ground   1.0652174 0.3127716
##   ice      1.0000000 0.0000000
##   normal   1.0000000 0.0000000
##   poison   0.6041667 0.2074256
##   psychic  1.0142857 0.1911926
##   rock     0.9833333 0.2450663
##   steel    0.5357143 0.1336306
##   water    1.0449438 0.2783928
## 
##           against_fight
## Y               [,1]      [,2]
##   bug      0.4047619 0.2135100
##   dark     2.0000000 1.0377490
##   dragon   0.7692308 0.2594373
##   electric 1.0535714 0.3929774
##   fairy    0.4375000 0.1157275
##   fighting 1.0000000 0.2970443
##   fire     1.0138889 0.2799518
##   ghost    0.0000000 0.0000000
##   grass    0.9215686 0.4286321
##   ground   1.0869565 0.4683669
##   ice      1.6000000 0.6324555
##   normal   1.6913580 0.4648111
##   poison   0.5208333 0.2074256
##   psychic  0.4285714 0.1145873
##   rock     2.1000000 0.8448628
##   steel    1.8571429 1.2314559
##   water    1.0224719 0.3762110
## 
##           against_fire
## Y               [,1]       [,2]
##   bug      2.1904762 0.70669603
##   dark     1.0714286 0.43221891
##   dragon   0.5000000 0.00000000
##   electric 1.1071429 0.31497039
##   fairy    1.0000000 0.00000000
##   fighting 1.0555556 0.23570226
##   fire     0.5069444 0.09422828
##   ghost    0.9642857 0.13363062
##   grass    2.0784314 0.39207842
##   ground   0.9347826 0.31277162
##   ice      1.8000000 0.41403934
##   normal   0.9938272 0.05555556
##   poison   1.0416667 0.20412415
##   psychic  1.0142857 0.19119263
##   rock     0.5833333 0.24855907
##   steel    1.7142857 0.46880723
##   water    0.5280899 0.14808533
##
##             against_flying
## Y                 [,1]      [,2]
##   bug      2.1190476 0.6699975
##   dark     1.0000000 0.0000000
##   dragon   1.0000000 0.0000000
##   electric 0.4732143 0.0787426
##   fairy    1.0000000 0.0000000
##   fighting 1.9444444 0.2357023
##   fire     1.1388889 0.4072751
##   ghost    1.0000000 0.0000000
##   grass    2.0392157 0.2800560
##   ground   0.9130435 0.1937767
##   ice      1.0000000 0.0000000
##   normal   1.0000000 0.0000000
##   poison   1.1250000 0.3378320
##   psychic  1.0571429 0.2355041
##   rock     0.5416667 0.1978694
##   steel    0.4464286 0.1064538
##   water    1.0168539 0.2436633
##
##             against_ghost
## Y                 [,1]      [,2]
##   bug      1.0238095 0.1543033
##   dark     0.5357143 0.1336306
##   dragon   1.1538462 0.3755338
##   electric 1.0357143 0.1889822
##   fairy    1.0000000 0.0000000
##   fighting 1.1111111 0.3233808
##   fire     1.0000000 0.0000000
##   ghost    1.9285714 0.2672612
##   grass    1.0098039 0.2343117
##   ground   1.0869565 0.2881041
##   ice      1.2000000 0.4140393
##   normal   0.0000000 0.0000000
##   poison   0.9375000 0.1689160
##   psychic  2.0000000 0.0000000
##   rock     1.0500000 0.2738613
##   steel    1.4285714 0.5135526
##   water    1.0280899 0.2306063
##
##             against_grass
## Y               [,1]      [,2]
##   bug      0.3869048 0.2080864
##   dark     0.8571429 0.2344036
##   dragon   0.5384615 0.2858859
##   electric 0.9285714 0.1781742
##   fairy    0.8750000 0.2314550
##   fighting 0.9722222 0.1178511
##   fire     0.5138889 0.1684429
##   ghost    0.7857143 0.2567763
##   grass    0.4313725 0.1421129
##   ground   2.0434783 0.8779242
##   ice      1.3333333 0.5875697
##   normal   0.8888889 0.2500000
##   poison   0.5000000 0.1805788
##   psychic  0.9000000 0.2029199
##   rock     2.4000000 1.2205143
##   steel    0.6071429 0.2723524
##   water    2.0449438 0.7524220
##
##            against_ground
## Y               [,1]      [,2]
##   bug      0.4702381 0.3793543
##   dark     1.0000000 0.5547002
##   dragon   0.6923077 0.4803845
##   electric 2.1428571 0.7559289
##   fairy    0.7500000 0.4629100
##   fighting 1.0555556 0.2357023
##   fire     1.9444444 0.7538262
##   ghost    1.0714286 0.6157279
##   grass    0.5784314 0.2715244
##   ground   1.0869565 0.5146087
##   ice      0.8666667 0.3518658
##   normal   0.7530864 0.4339028
##   poison   1.7083333 0.6902531
##   psychic  0.8714286 0.4084198
##   rock     2.0000000 0.8304548
##   steel    2.2857143 1.0690450
##   water    1.0168539 0.3949212
##
##            against_ice
## Y               [,1]      [,2]
##   bug      1.3452381 0.5352011
##   dark     1.0000000 0.4803845
##   dragon   3.0769231 1.0377490
##   electric 0.9821429 0.2539373
##   fairy    1.2500000 0.4629100
##   fighting 0.9722222 0.1178511
##   fire     0.5625000 0.1829813
##   ghost    1.2142857 0.4258153
##   grass    2.1568627 0.6441288
##   ground   2.3043478 0.8221249
##   ice      0.6166667 0.2968084
##   normal   1.2407407 0.4409586
##   poison   1.2083333 0.4148511
##   psychic  1.1571429 0.3979992
##   rock     1.1833333 0.5795857
##   steel    0.6071429 0.2129077
##   water    0.5842697 0.2096528
## 
##           against_normal
## Y               [,1]       [,2]
##   bug      0.9404762 0.19761940
##   dark     0.9285714 0.26726124
##   dragon   1.0000000 0.00000000
##   electric 0.9107143 0.23779743
##   fairy    1.0000000 0.00000000
##   fighting 0.9722222 0.11785113
##   fire     0.9722222 0.11615534
##   ghost    0.0000000 0.00000000
##   grass    1.0000000 0.00000000
##   ground   0.9130435 0.19377669
##   ice      0.9333333 0.25819889
##   normal   1.0000000 0.00000000
##   poison   1.0000000 0.00000000
##   psychic  1.0000000 0.00000000
##   rock     0.4750000 0.07628214
##   steel    0.4464286 0.10645383
##   water    0.9831461 0.09074935
## 
##           against_poison
## Y               [,1]       [,2]
##   bug      0.8928571 0.42102828
##   dark     0.9642857 0.13363062
##   dragon   0.8846154 0.21926450
##   electric 0.8750000 0.32274861
##   fairy    2.0000000 0.00000000
##   fighting 0.9444444 0.23570226
##   fire     0.9305556 0.21222555
##   ghost    0.4464286 0.10645383
##   grass    1.7450980 0.44014258
##   ground   0.4456522 0.12960871
##   ice      0.8666667 0.22886885
##   normal   1.0493827 0.21801574
##   poison   0.4791667 0.07058246
##   psychic  1.1714286 0.38238526
##   rock     0.4333333 0.22679678
##   steel    0.0000000 0.00000000
##   water    0.9775281 0.31900157
## 
##           against_psychic
## Y                 [,1]       [,2]
##   bug      1.1904762 0.44106828
##   dark     0.0000000 0.00000000
##   dragon   0.9230769 0.18776690
##   electric 0.9464286 0.15748520
##   fairy    1.0000000 0.00000000
##   fighting 1.8333333 0.38348249
##   fire     1.1527778 0.39314564
##   ghost    1.1428571 0.53452248
##   grass    1.1764706 0.54610923
##   ground   0.9347826 0.17217511
##   ice      0.9333333 0.17593289
##   normal   0.9938272 0.05555556
##   poison   1.9166667 0.92861124
##   psychic  0.5142857 0.08451543
##   rock     0.8833333 0.25200347
##   steel    0.3928571 0.12838815
##   water    0.9831461 0.30571673
##
##           against_rock
## Y                 [,1]       [,2]
##   bug      2.4761905 1.01784313
##   dark     1.4285714 0.51355259
##   dragon   1.1923077 0.59646394
##   electric 0.9821429 0.25393725
##   fairy    1.2500000 0.46291005
##   fighting 0.4861111 0.05892557
##   fire     1.9166667 0.76997217
##   ghost    1.1428571 0.36313652
##   grass    1.0980392 0.34669306
##   ground   0.5326087 0.15638581
##   ice      2.0666667 0.88371510
##   normal   1.2469136 0.43390276
##   poison   1.0833333 0.45841567
##   psychic  1.1571429 0.39799920
##   rock     0.9500000 0.42243139
##   steel    0.5178571 0.15393198
##   water    1.0393258 0.33898846
##
##           against_steel
## Y                 [,1]       [,2]
##   bug      0.9880952 0.20624681
##   dark     1.0714286 0.43221891
##   dragon   1.0000000 0.00000000
##   electric 0.4732143 0.07874260
##   fairy    2.0000000 0.00000000
##   fighting 0.9722222 0.11785113
##   fire     0.5069444 0.09422828
##   ghost    1.0000000 0.00000000
##   grass    1.0392157 0.19603921
##   ground   1.1086957 0.36793409
##   ice      1.8000000 0.41403934
##   normal   1.0432099 0.22635054
##   poison   1.0000000 0.00000000
##   psychic  1.1285714 0.37066826
##   rock     1.7666667 0.43018307
##   steel    0.6428571 0.23440362
##   water    0.5308989 0.14509120
##
##           against_water
## Y               [,1]       [,2]
##   bug      1.0000000 0.27050089
##   dark     1.1428571 0.36313652
##   dragon   0.6153846 0.21926450
##   electric 1.0000000 0.00000000
##   fairy    1.0000000 0.00000000
##   fighting 1.0000000 0.00000000
##   fire     2.1666667 0.56061191
##   ghost    0.9642857 0.13363062
##   grass    0.5098039 0.07001400
##   ground   2.1739130 0.77765229
##   ice      1.1000000 0.50709255
##   normal   0.9938272 0.05555556
##   poison   1.0833333 0.28232985
##   psychic  1.0142857 0.19119263
##   rock     2.2000000 0.99654576
##   steel    1.2500000 0.50952467
##   water    0.5365169 0.16664539
##
##           attack
## Y              [,1]      [,2]
##   bug      1.361376 0.8832485
##   dark     1.869841 0.6207465
##   dragon   2.362393 0.8369248
##   electric 1.376190 0.5441270
##   fairy    1.138889 0.7292092
##   fighting 2.000000 0.6923170
##   fire     1.773457 0.6277491
##   ghost    1.574603 0.7723551
##   grass    1.508061 0.5954232
##   ground   1.945894 0.7313971
##   ice      1.429630 0.6490621
##   normal   1.489986 0.6943147
##   poison   1.575000 0.4501714
##   psychic  1.327619 0.8077932
##   rock     1.854074 0.7928949
##   steel    1.941270 0.7403501
##   water    1.502871 0.6559439
##
##           base_egg_steps
## Y              [,1]       [,2]
##   bug      0.4182195 0.11561333
##   dark     0.8074534 0.93432972
##   dragon   1.8060201 1.26518693
##   electric 0.6583851 0.57846658
##   fairy    0.2608696 0.16101219
##   fighting 0.5797101 0.08436022
##   fire     0.7536232 0.74368346
##   ghost    0.9316770 0.89099257
##   grass    0.5899403 0.49689051
##   ground   0.7032136 0.72559712
##   ice      0.8579710 0.72445546
##   normal   0.5711218 0.59375106
##   poison   0.4855072 0.08851780
##   psychic  1.4211180 1.44123063
##   rock     0.8000000 0.43472263
##   steel    1.4534161 1.20027556
##   water    0.6389839 0.59485985
## 
##           base_happiness
## Y             [,1]      [,2]
##   bug      2.000000 0.0000000
##   dark     1.214286 0.5789342
##   dragon   1.472527 0.7657299
##   electric 1.989796 0.3583125
##   fairy    2.750000 1.0350983
##   fighting 2.000000 0.0000000
##   fire     1.912698 0.4296283
##   ghost    1.357143 0.6333237
##   grass    1.957983 0.2699873
##   ground   1.913043 0.4170288
##   ice      1.800000 0.4140393
##   normal   2.022928 0.6092220
##   poison   2.035714 0.1749636
##   psychic  1.983673 0.9537765
##   rock     1.866667 0.3457459
##   steel    1.418367 0.7337230
##   water    1.921348 0.3445920
## 
##           base_total
## Y             [,1]      [,2]
##   bug      1.212540 0.8311147
##   dark     1.808095 0.7636090
##   dragon   2.348718 1.1923068
##   electric 1.664524 0.7583153
##   fairy    1.274167 0.7841561
##   fighting 1.457778 0.7579436
##   fire     1.810370 0.7743564
##   ghost    1.838571 0.7789196
##   grass    1.558039 0.7140038
##   ground   1.620580 0.7873544
##   ice      1.731111 0.7839123
##   normal   1.435473 0.7826393
##   poison   1.458056 0.6300080
##   psychic  1.883048 0.9624049
##   rock     1.682222 0.6750469
##   steel    2.145238 0.9050294
##   water    1.612809 0.7743647
##
##           capture_rate
## Y                [,1]      [,2]
##   bug      1.8552532 1.2442357
##   dark     1.2902494 1.2731250
##   dragon   0.5641026 0.2503559
##   electric 1.6706349 1.2237645
##   fairy    1.7083333 1.0744163
##   fighting 1.6058201 0.9717338
##   fire     1.1238977 1.0164031
##   ghost    1.4240363 1.0606075
##   grass    1.5832555 1.2170902
##   ground   1.7073844 1.2589343
##   ice      1.3238095 1.2272741
##   normal   1.8669410 1.3806959
##   poison   2.0357143 1.1742044
##   psychic  1.3351474 1.2366865
##   rock     1.1867725 1.1709932
##   steel    0.8287982 1.2160330
##   water    1.6354557 1.2499237
##
##           defense
## Y                [,1]      [,2]
##   bug      1.1200000 0.6775609
##   dark     1.0679365 0.5137588
##   dragon   1.4837607 0.5136935
##   electric 1.0095238 0.4385814
##   fairy    1.0644444 0.3887301
##   fighting 1.0469136 0.3813342
##   fire     1.0854321 0.4301014
##   ghost    1.2139683 0.6268906
##   grass    1.1294118 0.4407362
##   ground   1.4964251 0.6110078
##   ice      1.1140741 0.4890236
##   normal   0.9481481 0.4373388
##   poison   1.1207407 0.3926707
##   psychic  1.1083175 0.5191480
##   rock     1.7777778 0.6613716
##   steel    2.2819048 0.8294553
##   water    1.1991011 0.5144049
##
##           experience_growth
## Y               [,1]      [,2]
##   bug      1.4504853 0.6928654
##   dark     1.8431758 0.3712551
##   dragon   2.3076923 0.6933752
##   electric 1.7251593 0.3355643
##   fairy    0.7692308 0.0000000
##   fighting 1.9142906 0.7669626
##   fire     1.7946474 0.3372031
##   ghost    1.6235110 1.1516764
##   grass    1.9106305 0.5001981
##   ground   1.8393478 0.4117656
##   ice      1.8537385 0.5266147
##   normal   1.5212412 0.5526057
##   poison   1.9838397 0.8231430
##   psychic  1.7691538 0.6194718
##   rock     1.2832256 0.8925902
##   steel    2.1703297 0.5716155
##   water    1.7798954 0.8161619
## 
##           height_m
## Y               [,1]       [,2]
##   bug      0.2136243 0.12154408
##   dark     0.2222222 0.09805807
##   dragon   0.5427350 0.47637274
##   electric 0.2248402 0.13782672
##   fairy    0.2013889 0.13749299
##   fighting 0.2916667 0.12756091
##   fire     0.3065416 0.18770729
##   ghost    0.3571429 0.28177827
##   grass    0.2487140 0.17535576
##   ground   0.3263220 0.20743048
##   ice      0.3018519 0.15638479
##   normal   0.2563634 0.17203433
##   poison   0.3128216 0.20589300
##   psychic  0.2555556 0.24586264
##   rock     0.3527007 0.40779097
##   steel    0.5218254 0.67876999
##   water    0.3514357 0.48983246
## 
##           hp
## Y               [,1]      [,2]
##   bug      0.8458943 0.2729697
##   dark     0.9910011 0.2933510
##   dragon   1.1617202 0.3335804
##   electric 0.9122610 0.2878035
##   fairy    1.0472441 0.3340662
##   fighting 1.0437445 0.4400111
##   fire     1.0481190 0.3171006
##   ghost    1.0056243 0.6252357
##   grass    1.0010807 0.2795221
##   ground   1.0941458 0.4262526
##   ice      1.1601050 0.3489361
##   normal   1.2011276 0.6095882
##   poison   1.0590551 0.3226467
##   psychic  1.1208099 0.5219048
##   rock     0.9874016 0.3255654
##   steel    1.0573678 0.2789777
##   water    1.0913917 0.4347168
## 
##           percentage_male
## Y              [,1]      [,2]
##   bug      1.993577 0.7385446
##   dark     2.123588 0.4067953
##   dragon   2.015864 0.8184976
##   electric 2.222209 0.4026323
##   fairy    1.936500 1.3145749
##   fighting 3.065333 0.7060398
##   fire     2.863853 0.7981240
##   ghost    2.014731 0.0551174
##   grass    2.541926 0.7330896
##   ground   2.026900 0.0710155
##   ice      1.729097 0.9749291
##   normal   1.872610 0.6907104
##   poison   2.000000 1.0215078
##   psychic  2.189552 0.6084482
##   rock     2.681023 0.7521764
##   steel    2.117846 0.1059102
##   water    2.318737 0.6523503
## 
##           sp_attack
## Y               [,1]      [,2]
##   bug      0.8840580 0.5747958
##   dark     1.5108696 0.7635048
##   dragon   1.8561873 1.0297075
##   electric 1.6537267 0.6952729
##   fairy    1.2500000 0.6257591
##   fighting 0.8212560 0.5932717
##   fire     1.7059179 0.5963813
##   ghost    1.7204969 0.7392218
##   grass    1.4803922 0.6114573
##   ground   0.8610586 0.5814682
##   ice      1.5579710 0.6075114
##   normal   1.0064412 0.5349929
##   poison   1.0824275 0.4133657
##   psychic  1.7291925 0.8050792
##   rock     1.0079710 0.5120440
##   steel    1.2158385 0.7313909
##   water    1.3563752 0.6291354
## 
##           sp_defense
## Y               [,1]      [,2]
##   bug      0.8326531 0.7087408
##   dark     0.9333333 0.5654880
##   dragon   1.1721612 0.6614131
##   electric 0.9653061 0.4343851
##   fairy    1.0357143 0.4973203
##   fighting 0.8359788 0.5108460
##   fire     0.9989418 0.4728688
##   ghost    1.1863946 0.6350616
##   grass    0.9154062 0.3920926
##   ground   0.7734990 0.3918249
##   ice      1.1238095 0.7838671
##   normal   0.8035273 0.4800237
##   poison   0.7904762 0.3252919
##   psychic  1.2658503 0.5910965
##   rock     0.9746032 0.5912296
##   steel    1.2952381 0.5409710
##   water    0.9474585 0.5604172
## 
##            speed
## Y               [,1]      [,2]
##   bug      1.2234014 0.7804192
##   dark     1.8187755 0.7681295
##   dragon   1.7336264 0.6262361
##   electric 1.8351020 0.6859360
##   fairy    0.8142857 0.4865539
##   fighting 1.2761905 0.5754881
##   fire     1.5365079 0.5985682
##   ghost    1.4938776 0.7178748
##   grass    1.2934454 0.6121649
##   ground   1.2720497 0.6200838
##   ice      1.4247619 0.5358154
##   normal   1.4670899 0.6648061
##   poison   1.3771429 0.5246654
##   psychic  1.7645714 0.8320827
##   rock     0.9752381 0.6222256
##   steel    1.1200000 0.6400628
##   water    1.3578170 0.4948323
## 
##            weight_kg
## Y                [,1]       [,2]
##   bug      0.09759095 0.10907895
##   dark     0.10559255 0.05951352
##   dragon   0.30230662 0.27164159
##   electric 0.16841627 0.19804059
##   fairy    0.07446489 0.07934172
##   fighting 0.23200196 0.23107912
##   fire     0.27943991 0.33744446
##   ghost    0.31031921 0.78798276
##   grass    0.14144618 0.21185428
##   ground   0.46616115 0.78694928
##   ice      0.33294659 0.36839854
##   normal   0.18959409 0.30806179
##   poison   0.14313800 0.10408797
##   psychic  0.13861058 0.17354966
##   rock     0.38648187 0.33757241
##   steel    0.85299917 0.83994608
##   water    0.22668803 0.30879645
```

```
pred_type=predict(model_type,newdata = test_ft1)         #predicting the
'type' on test data
pred_type
```

```
##   [1] ground   ground   fighting fighting bug      bug      bug      bug
##   [9] bug      poison   fairy    fairy    grass    grass    water    dark
##  [17] dark     ground   fire     fire     grass    ice      ice      dark
##  [25] dark     psychic  ghost    ghost    rock     rock     rock     rock
##  [33] poison   poison   dark     dark     normal   normal   psychic
psychic
##  [41] psychic  psychic  psychic  psychic  water    ice      ice      ice
##  [49] ice      grass    grass    bug      bug      bug      grass    grass
##  [57] ice      ice      water    bug      ice      steel    steel    steel
##  [65] steel    steel    electric electric electric psychic  psychic  ghost
##  [73] ghost    ghost    dragon   dragon   dragon   ice      ice      ice
##  [81] bug      bug      ground   fighting fighting dragon   ground
ground
##  [89] steel    steel    normal   normal   normal   dark     dark     fire
##  [97] bug      dragon   dragon   dragon   fire     fire     steel    rock
## [105] dragon   normal   normal   dragon   dragon   dragon   dragon   water
## [113] psychic  steel    grass    grass    grass    fire     fire
psychic
## [121] water    water    dark     normal   ground   normal   fire     fire
## [129] bug      bug      bug      fire     fire     fairy    fairy    fairy
## [137] grass    grass    fighting fighting normal   psychic  psychic  steel
## [145] steel    steel    fairy    fairy    fairy    fairy    dark     dark
## [153] rock     rock     poison   dragon   water    water    normal
normal
## [161] rock     rock     rock     rock     fairy    bug      fairy    rock
## [169] dragon   dragon   dragon   steel    grass    grass    grass    grass
## [177] ice      ice      dragon   dragon   dragon   dragon   dragon   ice
## [185] psychic  fire     grass    grass    grass    fire     fire     dark
## [193] water    water    water    normal   normal   normal   normal
normal
## [201] bug      bug      ice      fighting ice      fire     fairy    fairy
## [209] rock     rock     water    poison   water    ground   ground   bug
## [217] bug      grass    grass    fairy    fairy    fire     fire
fighting
## [225] fighting grass    grass    grass    fairy    ice      fighting bug
## [233] bug      ground   ground   water    normal   normal   rock
normal
```

```
## [241] dragon   steel    fairy    ice      dragon   grass    dragon
dragon
## [249] dragon   fairy    psychic  fairy    fairy    psychic  ghost    steel
## [257] psychic  rock     dragon   dark     electric steel    steel
dragon
## [265] psychic  steel
## 17 Levels: bug dark dragon electric fairy fighting fire ghost grass ...
water
```

```
#creating confusion matrix

cm_type=table(test_tgt1,pred_type)        #creating confusion matrix to
compare target and predicted values
confusionMatrix(cm_type)
```

```
## Confusion Matrix and Statistics
##
##           pred_type
## test_tgt1  bug dark dragon electric fairy fighting fire ghost grass ground
ice
##   bug       18    1      1        0     2        0    2     0     0      0
4
##   dark       0    8      5        0     0        0    0     0     0      0
0
##   dragon     0    0     16        0     0        0    0     0     0      0
0
##   electric   1    0      0        4     2        0    0     0     0      0
0
##   fairy      0    0      1        0     9        0    0     0     0      0
0
##   fighting   1    0      0        0     0        8    0     0     0      0
1
##   fire       0    1      1        0     0        0   13     0     0      0
0
##   ghost      0    0      0        0     1        0    0     5     5      2
0
##   grass      0    0      1        0     5        0    0     0    18      0
0
##   ground     0    2      1        0     0        0    0     0     0      6
0
##   ice        0    0      0        0     0        0    0     0     0      0
8
##   normal     0    0      1        0     0        2    0     0     2      1
1
##   poison     0    0      1        0     0        0    2     0     0      0
0
##   psychic    0    0      0        0     0        0    0     1     0      0
0
##   rock       0    0      0        0     0        0    0     0     0      0
1
```

```
##   steel      0    0      0        0     0        0    0     0     0      0
0
##   water      2    1      0        0     1        0    0     0     0      2
4
##           pred_type
## test_tgt1 normal poison psychic rock steel water
##   bug          0      1       0    0     1     0
##   dark         0      0       0    0     2     0
##   dragon       0      0       0    0     0     0
##   electric     3      0       0    0     1     0
##   fairy        0      0       0    0     0     0
##   fighting     0      0       0    0     0     0
##   fire         0      0       1    0     0     0
##   ghost        0      0       0    0     0     0
##   grass        0      0       0    0     3     0
##   ground       0      0       0    0     0     0
##   ice          0      0       0    0     0     0
##   normal      17      0       1    0     0     0
##   poison       0      4       0    0     0     1
##   psychic      0      0      16    0     1     0
##   rock         0      0       0   14     0     0
##   steel        0      0       0    0    10     0
##   water        0      0       0    2     0    13
##
## Overall Statistics
##
##                Accuracy : 0.703
##                  95% CI : (0.6442, 0.7573)
##     No Information Rate : 0.1053
##     P-Value [Acc > NIR] : < 2.2e-16
##
##                   Kappa : 0.6826
##
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: bug Class: dark Class: dragon Class: electric
## Sensitivity             0.81818     0.61538       0.57143         1.00000
## Specificity             0.95082     0.97233       1.00000         0.97328
## Pos Pred Value          0.60000     0.53333       1.00000         0.36364
## Neg Pred Value          0.98305     0.98008       0.95200         1.00000
## Prevalence              0.08271     0.04887       0.10526         0.01504
## Detection Rate          0.06767     0.03008       0.06015         0.01504
## Detection Prevalence    0.11278     0.05639       0.06015         0.04135
## Balanced Accuracy       0.88450     0.79386       0.78571         0.98664
##                      Class: fairy Class: fighting Class: fire Class: ghost
## Sensitivity               0.45000         0.80000     0.76471      0.83333
## Specificity               0.99593         0.99219     0.98795      0.96923
## Pos Pred Value            0.90000         0.80000     0.81250      0.38462
## Neg Pred Value            0.95703         0.99219     0.98400      0.99605
## Prevalence                0.07519         0.03759     0.06391      0.02256
## Detection Rate            0.03383         0.03008     0.04887      0.01880
## Detection Prevalence      0.03759         0.03759     0.06015      0.04887
## Balanced Accuracy         0.72297         0.89609     0.87633      0.90128
##                      Class: grass Class: ground Class: ice Class: normal
## Sensitivity               0.72000       0.54545    0.42105       0.85000
## Specificity               0.96266       0.98824    1.00000       0.96748
## Pos Pred Value            0.66667       0.66667    1.00000       0.68000
## Neg Pred Value            0.97071       0.98054    0.95736       0.98755
## Prevalence                0.09398       0.04135    0.07143       0.07519
## Detection Rate            0.06767       0.02256    0.03008       0.06391
## Detection Prevalence      0.10150       0.03383    0.03008       0.09398
## Balanced Accuracy         0.84133       0.76684    0.71053       0.90874
##                      Class: poison Class: psychic Class: rock Class: steel
## Sensitivity                0.80000        0.88889     0.87500      0.55556
## Specificity                0.98467        0.99194     0.99600      1.00000
## Pos Pred Value             0.50000        0.88889     0.93333      1.00000
## Neg Pred Value             0.99612        0.99194     0.99203      0.96875
## Prevalence                 0.01880        0.06767     0.06015      0.06767
## Detection Rate             0.01504        0.06015     0.05263      0.03759
## Detection Prevalence       0.03008        0.06767     0.05639      0.03759
## Balanced Accuracy          0.89234        0.94041     0.93550      0.77778
##                      Class: water
## Sensitivity               0.92857
## Specificity               0.95238
## Pos Pred Value            0.52000
## Neg Pred Value            0.99585
## Prevalence                0.05263
## Detection Rate            0.04887
## Detection Prevalence      0.09398
## Balanced Accuracy         0.94048
```

```
#shows classification report and confusion matrix

#predicting 'is legendary' or 'not'
#is_legendary:1 not_is_legendary:0

test_ft2=test[-c(35)]        #assigning the feature variables to predict
'is_legendary' or 'not'


test_tgt2=test$is_legendary  #assigning the target variable 'is_legendary'


model_leg=naiveBayes(train$is_legendary~.,data = train)   #applying Naive
Bayes model on the training data
model_leg
```

```
##
## Naive Bayes Classifier for Discrete Predictors
##
## Call:
## naiveBayes.default(x = X, y = Y, laplace = laplace)
##
## A-priori probabilities:
## Y
##          0          1
## 0.93457944 0.06542056
##
## Conditional probabilities:
##    abilities
## Y       [,1]      [,2]
##   0 2.093139 1.1714033
##   1 1.807663 0.9473362
##
##    against_bug
## Y       [,1]      [,2]
##   0 0.996000 0.5813001
##   1 1.235714 0.7950741
##
##    against_dark
## Y       [,1]      [,2]
##   0 1.040000 0.3669732
##   1 1.385714 0.5157193
##
##    against_dragon
## Y    [,1]      [,2]
##   0 0.965 0.2746377
##   1 1.100 0.3985267
##
##    against_electric
## Y       [,1]      [,2]
##   0 1.104000 0.6827271
##   1 1.071429 0.5305776
##
##    against_fairy
## Y       [,1]      [,2]
##   0 1.014000 0.3900105
##   1 1.064286 0.4825745
##
##    against_fight
## Y        [,1]      [,2]
##   0 1.0985000 0.7114669
##   1 0.9642857 0.6246848
##
##    against_fire
## Y        [,1]      [,2]
##   0 1.1060000 0.6431106
##   1 0.9785714 0.5298842
##
##    against_flying
## Y        [,1]      [,2]
##   0 1.1835000 0.5732451
##   1 0.9571429 0.3292467
##
##    against_ghost
## Y       [,1]      [,2]
##   0 0.938000 0.5326570
##   1 1.328571 0.6056457
##
##    against_grass
## Y        [,1]      [,2]
##   0 1.1040000 0.8392513
##   1 0.8642857 0.5468589
##
##    against_ground
## Y       [,1]      [,2]
##   0 1.114500 0.7495922
##   1 1.085714 0.8088273
##
##    against_ice
## Y       [,1]      [,2]
##   0 1.199500 0.7424130
##   1 1.178571 0.7365745
##
##    against_normal
## Y    [,1]      [,2]
##   0 0.908 0.2385368
##   1 0.900 0.2363945
##
##    against_poison
## Y    [,1]      [,2]
##   0 0.956 0.4835096
##   1 0.900 0.4338609
##
##    against_psychic
## Y        [,1]      [,2]
##   0 1.0415000 0.5029002
##   1 0.7357143 0.2904285
##
##    against_rock
## Y       [,1]      [,2]
##   0 1.235500 0.6861898
##   1 1.371429 0.9262738
##
##    against_steel
## Y        [,1]      [,2]
##   0 0.9610000 0.4377353
##   1 0.8785714 0.4303360
##
##    against_water
## Y       [,1]      [,2]
##   0 1.082000 0.6592763
##   1 1.035714 0.5428101
##
##    attack
## Y       [,1]      [,2]
##   0 1.536311 0.7039694
##   1 2.287619 0.6559696
##
##    base_egg_steps
## Y        [,1]      [,2]
##   0 0.5516522 0.2198203
##   1 3.3043478 1.0228133
##
##    base_happiness
## Y       [,1]      [,2]
##   0 1.946857 0.3890451
##   1 1.375510 1.3842215
##
##    base_total
## Y       [,1]      [,2]
##   0 1.516613 0.7367329
##   1 3.038095 0.4487559
##
##    capture_rate
## Y         [,1]      [,2]
##   0 1.65968254 1.2122912
##   1 0.07619048 0.2152019
##
##    defense
## Y       [,1]      [,2]
##   0 1.147200 0.5612787
##   1 1.788444 0.4602512
##
##    experience_growth
## Y       [,1]      [,2]
##   0 1.670538 0.6822159
##   1 2.437316 0.2077123
##
##    height_m
## Y        [,1]      [,2]
##   0 0.2782500 0.2795927
##   1 0.5801587 0.4738424
##
##    hp
## Y       [,1]      [,2]
##   0 1.028535 0.4197314
##    1 1.482115 0.2774508
##
##    percentage_male
## Y       [,1]      [,2]
##   0 2.248851 0.7693362
##   1 2.125518 0.6127815
##
##    sp_attack
## Y       [,1]      [,2]
##   0 1.226522 0.6371299
##   1 2.297516 0.7112965
##
##    sp_defense
## Y    [,1]      [,2]
##   0 0.892 0.5011245
##   1 1.760 0.5291190
##
##    speed
## Y       [,1]      [,2]
##   0 1.354651 0.6438213
##   1 2.147918 0.5601711
##
##    type1
## Y          bug       dark     dragon   electric      fairy   fighting
##   0 0.08400000 0.02600000 0.02000000 0.05200000 0.01600000 0.03600000
##   1 0.00000000 0.02857143 0.08571429 0.05714286 0.00000000 0.00000000
##    type1
## Y         fire      ghost      grass     ground        ice     normal
##   0 0.06400000 0.02600000 0.10000000 0.04400000 0.02600000 0.15800000
##   1 0.11428571 0.02857143 0.02857143 0.02857143 0.05714286 0.05714286
##    type1
## Y       poison    psychic       rock      steel      water
##   0 0.04800000 0.05000000 0.05800000 0.02200000 0.17000000
##   1 0.00000000 0.28571429 0.02857143 0.08571429 0.11428571
##
##    weight_kg
## Y        [,1]      [,2]
##   0 0.1942581 0.2620418
##   1 0.7587117 0.9142326
```

```
pred_leg=predict(model_leg,test_ft2)                          #predicting the
'is_legendary' or not on test data
pred_leg
```

```
##   [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0
##  [38] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0
##  [75] 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 1 1 1 1 1 1
1 1 1
```

```
## [112] 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0
## [149] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1
1 1 1
## [186] 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0
0 0 0
## [223] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 1 1 1
1 1 1
## [260] 0 1 1 0 1 1 1
## Levels: 0 1

cm_leg=table(test_tgt2,pred_leg)          #creating confusion matrix to
compare target and predicted values
confusionMatrix(cm_leg)

## Confusion Matrix and Statistics
##
##          pred_leg
## test_tgt2   0   1
##         0 223   8
##         1   5  30
##
##                Accuracy : 0.9511
##                  95% CI : (0.9179, 0.9737)
##     No Information Rate : 0.8571
##     P-Value [Acc > NIR] : 6.747e-07
##
##                   Kappa : 0.7937
##
##  Mcnemar's Test P-Value : 0.5791
##
##             Sensitivity : 0.9781
##             Specificity : 0.7895
##          Pos Pred Value : 0.9654
##          Neg Pred Value : 0.8571
##              Prevalence : 0.8571
##          Detection Rate : 0.8383
##    Detection Prevalence : 0.8684
##       Balanced Accuracy : 0.8838
##
##        'Positive' Class : 0
##

#shows classification report and confusion matrix
```