Project\_2

#load the mlbench package which has the BreastCancer data set  
require(mlbench)

## Loading required package: mlbench

# if you don't have any required package, use the install.packages() command  
# load the data set  
data(BreastCancer)  
# some algorithms don't like missing values, so remove rows with missing values  
BreastCancer <- na.omit(BreastCancer)   
# remove the unique identifier, which is useless and would confuse the machine learning algorithms  
BreastCancer$Id <- NULL   
# partition the data set for 80% training and 20% evaluation (adapted from ?randomForest)  
set.seed(2)  
  
ind <- sample(2, nrow(BreastCancer), replace = TRUE, prob=c(0.8, 0.2))  
  
# create model using recursive partitioning on the training data set  
require(rpart)

## Loading required package: rpart

x.rp <- rpart(Class ~ ., data=BreastCancer[ind == 1,])  
# predict classes for the evaluation data set  
x.rp.pred <- predict(x.rp, type="class", newdata=BreastCancer[ind == 2,])  
# score the evaluation data set (extract the probabilities)  
x.rp.prob <- predict(x.rp, type="prob", newdata=BreastCancer[ind == 2,])  
  
# To view the decision tree, uncomment this line.  
plot(x.rp, main="Decision tree created using rpart")  
  
# create model using conditional inference trees  
require(party)

## Loading required package: party

## Warning: package 'party' was built under R version 4.2.3

## Loading required package: grid

## Loading required package: mvtnorm

## Loading required package: modeltools

## Loading required package: stats4

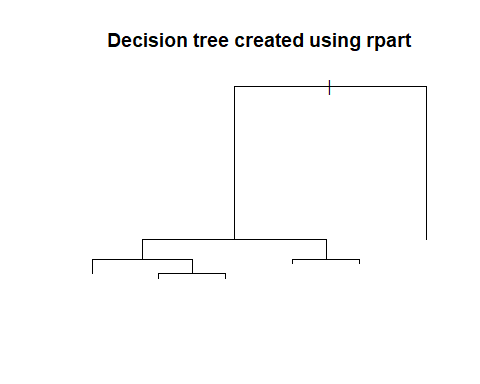
## Loading required package: strucchange

## Loading required package: zoo

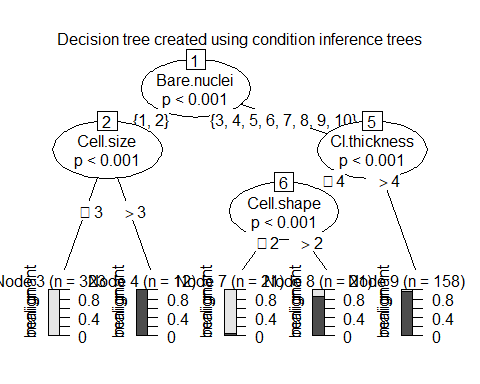
##   
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':  
##   
## as.Date, as.Date.numeric

## Loading required package: sandwich



x.ct <- ctree(Class ~ ., data=BreastCancer[ind == 1,])  
x.ct.pred <- predict(x.ct, newdata=BreastCancer[ind == 2,])  
x.ct.prob <- 1- unlist(treeresponse(x.ct, BreastCancer[ind == 2,]), use.names=F)[seq(1,nrow(BreastCancer[ind == 2,])\*2,2)]  
  
# To view the decision tree, uncomment this line.  
plot(x.ct, main="Decision tree created using condition inference trees")



# create model using random forest and bagging ensemble using conditional inference trees  
x.cf <- cforest(Class ~ ., data=BreastCancer[ind == 1,], control = cforest\_unbiased(mtry = ncol(BreastCancer)-2))  
x.cf.pred <- predict(x.cf, newdata=BreastCancer[ind == 2,])  
x.cf.prob <- 1- unlist(treeresponse(x.cf, BreastCancer[ind == 2,]), use.names=F)[seq(1,nrow(BreastCancer[ind == 2,])\*2,2)]  
  
# create model using bagging (bootstrap aggregating)  
require(ipred)

## Loading required package: ipred

x.ip <- bagging(Class ~ ., data=BreastCancer[ind == 1,])  
x.ip.prob <- predict(x.ip, type="prob", newdata=BreastCancer[ind == 2,])  
  
# create model using svm (support vector machine)  
require(e1071)

## Loading required package: e1071

# svm requires tuning  
x.svm.tune <- tune(svm, Class~., data = BreastCancer[ind == 1,],  
 ranges = list(gamma = 2^(-8:1), cost = 2^(0:4)),  
 tunecontrol = tune.control(sampling = "fix"))  
# display the tuning results (in text format)  
x.svm.tune

##   
## Parameter tuning of 'svm':  
##   
## - sampling method: fixed training/validation set   
##   
## - best parameters:  
## gamma cost  
## 0.0625 1  
##   
## - best performance: 0.02234637

# If the tuning results are on the margin of the parameters (e.g., gamma = 2^-8),   
# then widen the parameters.  
# I manually copied the cost and gamma from console messages above to parameters below.  
x.svm <- svm(Class~., data = BreastCancer[ind == 1,], cost=4, gamma=0.0625, probability = TRUE)  
x.svm.prob <- predict(x.svm, type="prob", newdata=BreastCancer[ind == 2,], probability = TRUE)  
  
m1 = c(1,0,1, 0, 1,1)  
m2 = c(1,1,1, 0, 1,0)  
m3 = c(0,1,1, 1, 1,0)  
##  
## plot ROC curves to compare the performance of the individual classifiers  
##  
  
# Output the plot to a PNG file for display on web. To draw to the screen,   
# comment this line out.  
png(filename="roc\_curve\_5\_models.png", width=700, height=700)  
  
# load the ROCR package which draws the ROC curves  
require(ROCR)

## Loading required package: ROCR

# create an ROCR prediction object from rpart() probabilities  
x.rp.prob.rocr <- prediction(x.rp.prob[,2], BreastCancer[ind == 2,'Class'])  
# prepare an ROCR performance object for ROC curve (tpr=true positive rate, fpr=false positive rate)  
x.rp.perf <- performance(x.rp.prob.rocr, "tpr","fpr")  
# plot it  
plot(x.rp.perf, col=2, main="ROC curves comparing classification performance of five machine learning models")  
  
# Draw a legend.  
#plot(legend(0.6, 0.6, c('rpart', 'ctree', 'cforest','bagging','svm'), 2:6))  
plot.new()  
# ctree  
x.ct.prob.rocr <- prediction(x.ct.prob, BreastCancer[ind == 2,'Class'])  
x.ct.perf <- performance(x.ct.prob.rocr, "tpr","fpr")  
# add=TRUE draws on the existing chart   
#plot(x.ct.perf, col=3, add=TRUE)  
  
  
# cforest  
x.cf.prob.rocr <- prediction(x.cf.prob, BreastCancer[ind == 2,'Class'])  
x.cf.perf <- performance(x.cf.prob.rocr, "tpr","fpr")  
#plot(x.cf.perf, col=4, add=TRUE)  
  
# bagging  
x.ip.prob.rocr <- prediction(x.ip.prob[,2], BreastCancer[ind == 2,'Class'])  
x.ip.perf <- performance(x.ip.prob.rocr, "tpr","fpr")  
plot.new()  
#plot(x.ip.perf, col=5, add=TRUE)  
# svm  
x.svm.prob.rocr <- prediction(attr(x.svm.prob, "probabilities")[,2], BreastCancer[ind == 2,'Class'])  
x.svm.perf <- performance(x.svm.prob.rocr, "tpr","fpr")  
  
#plot(x.svm.perf, col=6, add=TRUE)

classifier1 <- x.rp.prob[,2]   
classifier2 <- x.ct.prob  
classifier3 <- x.cf.prob  
classifier4 <- x.ip.prob[,2]  
classifier5 <- as.numeric(x.svm.prob)  
combine.df <- data.frame(classifier1, classifier2, classifier3, classifier4, classifier5 )  
combine.df

## classifier1 classifier2 classifier3 classifier4 classifier5  
## 5 0.0000000 0.00000000 2.084554e-03 0.00 1  
## 6 0.9500000 0.96202532 9.514821e-01 1.00 2  
## 8 0.0000000 0.00000000 7.256672e-04 0.00 1  
## 16 0.9500000 1.00000000 7.531241e-01 0.92 2  
## 17 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 23 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 30 0.0000000 0.00000000 2.692525e-03 0.00 1  
## 34 0.0000000 0.00000000 4.863509e-04 0.00 1  
## 35 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 38 0.0000000 0.00000000 5.394112e-02 0.00 1  
## 43 0.9500000 0.96202532 9.482237e-01 0.96 2  
## 47 0.9500000 0.85714286 7.356881e-01 0.96 2  
## 49 0.0000000 0.00000000 2.084554e-03 0.00 1  
## 52 0.8571429 0.96202532 7.369155e-01 0.76 2  
## 56 0.9500000 0.96202532 9.663243e-01 0.96 2  
## 58 0.0000000 0.00000000 2.222350e-01 0.48 2  
## 60 0.9500000 1.00000000 6.362855e-01 0.96 2  
## 64 0.0000000 0.00000000 2.674344e-01 0.20 1  
## 67 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 80 0.0000000 0.00000000 5.489697e-03 0.00 1  
## 88 0.9500000 0.85714286 7.465986e-01 0.96 2  
## 89 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 93 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 105 0.9500000 1.00000000 8.074784e-01 1.00 2  
## 106 0.8571429 0.96202532 6.716674e-01 0.44 2  
## 109 0.0000000 0.00000000 1.344835e-01 0.00 1  
## 117 0.0000000 0.00000000 4.697781e-02 0.44 1  
## 118 0.9500000 0.85714286 9.029263e-01 1.00 2  
## 119 0.0000000 0.04761905 1.124878e-01 0.00 1  
## 121 0.0000000 0.00000000 9.478894e-04 0.00 1  
## 125 0.9500000 0.96202532 8.994619e-01 0.88 2  
## 126 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 134 0.0000000 0.00000000 1.590266e-03 0.00 1  
## 136 0.0000000 0.00000000 1.441707e-01 0.00 1  
## 141 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 157 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 162 0.0000000 0.00000000 2.036213e-03 0.00 1  
## 167 0.9500000 0.96202532 9.364687e-01 1.00 2  
## 168 0.9500000 1.00000000 6.237445e-01 1.00 2  
## 174 0.9500000 0.96202532 9.977803e-01 1.00 2  
## 177 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 180 1.0000000 0.96202532 8.499656e-01 0.84 2  
## 187 0.9500000 0.85714286 7.233798e-01 0.96 2  
## 189 0.9500000 0.96202532 8.982400e-01 0.96 2  
## 192 0.9500000 0.96202532 9.996667e-01 1.00 2  
## 199 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 207 0.9500000 0.96202532 9.642700e-01 0.96 2  
## 210 0.0000000 0.00000000 3.500297e-04 0.00 1  
## 212 0.9500000 0.96202532 9.044873e-01 1.00 2  
## 217 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 219 0.9500000 0.96202532 9.305187e-01 1.00 2  
## 221 0.0000000 0.00000000 4.863509e-04 0.00 1  
## 228 0.9500000 0.96202532 9.349967e-01 0.92 2  
## 232 0.9500000 0.96202532 8.925423e-01 0.96 2  
## 233 0.9500000 1.00000000 7.431630e-01 0.88 2  
## 237 0.9500000 0.96202532 9.842427e-01 1.00 2  
## 240 0.9500000 0.96202532 9.920828e-01 1.00 2  
## 242 0.0000000 0.00000000 2.052808e-03 0.00 1  
## 248 0.9500000 0.96202532 9.542867e-01 1.00 2  
## 253 1.0000000 0.96202532 8.930572e-01 0.84 2  
## 254 0.9500000 0.96202532 9.482237e-01 0.96 2  
## 273 1.0000000 0.85714286 7.003036e-01 1.00 2  
## 278 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 280 0.9500000 0.96202532 9.176072e-01 0.84 2  
## 281 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 282 0.0000000 0.00000000 4.863509e-04 0.00 1  
## 286 0.9500000 0.96202532 9.517615e-01 1.00 2  
## 291 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 297 1.0000000 0.96202532 8.326706e-01 0.80 2  
## 313 0.9500000 1.00000000 7.940401e-01 1.00 2  
## 317 0.9500000 0.96202532 9.351493e-01 0.96 2  
## 323 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 346 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 347 0.0000000 0.00000000 1.447461e-01 0.00 1  
## 353 0.9500000 0.85714286 7.041780e-01 0.96 2  
## 354 0.9500000 0.85714286 7.335362e-01 1.00 2  
## 355 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 356 0.0000000 0.00000000 6.962316e-03 0.00 1  
## 362 0.9500000 0.85714286 7.130903e-01 0.96 2  
## 368 0.9500000 0.96202532 9.956778e-01 1.00 2  
## 370 0.0000000 0.00000000 2.627273e-03 0.00 1  
## 385 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 392 0.9500000 0.96202532 9.970804e-01 1.00 2  
## 403 0.0000000 0.00000000 3.608234e-02 0.04 1  
## 406 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 413 0.9500000 0.96202532 9.587241e-01 1.00 2  
## 420 0.0000000 0.00000000 5.541139e-02 0.08 1  
## 421 0.0000000 0.04761905 2.219940e-01 0.04 1  
## 425 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 436 0.9500000 0.96202532 9.919740e-01 1.00 2  
## 440 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 447 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 448 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 451 0.0000000 0.00000000 1.598203e-03 0.00 1  
## 453 0.0000000 0.00000000 1.628972e-03 0.00 1  
## 454 0.9500000 0.85714286 8.833552e-01 0.96 2  
## 462 0.2500000 0.04761905 2.051478e-01 0.00 1  
## 470 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 471 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 473 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 474 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 476 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 495 1.0000000 0.96202532 7.058368e-01 0.60 1  
## 498 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 500 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 505 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 509 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 513 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 524 0.9500000 0.96202532 9.962339e-01 1.00 2  
## 532 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 535 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 536 0.0000000 0.00000000 3.575162e-03 0.00 1  
## 545 0.0000000 0.00000000 2.627273e-03 0.00 1  
## 547 0.9500000 0.96202532 9.993725e-01 1.00 2  
## 548 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 555 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 557 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 559 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 566 0.9500000 0.96202532 9.945856e-01 1.00 2  
## 570 0.9500000 0.96202532 9.860097e-01 0.96 2  
## 575 0.9500000 1.00000000 7.359814e-01 1.00 2  
## 576 0.0000000 0.00000000 8.433142e-04 0.00 1  
## 580 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 584 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 586 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 588 0.0000000 0.00000000 1.590266e-03 0.00 1  
## 589 0.9500000 0.96202532 9.056452e-01 0.96 2  
## 591 0.9500000 1.00000000 6.519471e-01 0.92 2  
## 592 0.9500000 0.85714286 7.399306e-01 1.00 2  
## 604 0.9500000 1.00000000 8.360269e-01 0.96 2  
## 621 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 631 0.0000000 0.00000000 2.692525e-03 0.00 1  
## 633 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 636 0.0000000 0.00000000 1.294859e-02 0.00 1  
## 644 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 649 0.9500000 1.00000000 8.535444e-01 1.00 2  
## 658 0.9500000 1.00000000 6.478503e-01 0.96 2  
## 659 0.9500000 0.96202532 9.200020e-01 0.68 2  
## 661 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 669 0.9500000 1.00000000 8.404574e-01 1.00 2  
## 671 0.9500000 0.85714286 7.344259e-01 0.92 2  
## 673 0.0000000 0.00000000 2.641287e-04 0.00 1  
## 677 0.0000000 0.00000000 1.110223e-16 0.00 1  
## 680 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 685 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 692 0.9500000 0.96202532 8.897162e-01 0.84 2  
## 693 0.0000000 0.00000000 6.525199e-05 0.00 1  
## 694 0.0000000 0.00000000 1.027619e-02 0.00 1

str(combine.df)

## 'data.frame': 148 obs. of 5 variables:  
## $ classifier1: num 0 0.95 0 0.95 0 0 0 0 0 0 ...  
## $ classifier2: num 0 0.962 0 1 0 ...  
## $ classifier3: num 2.08e-03 9.51e-01 7.26e-04 7.53e-01 1.11e-16 ...  
## $ classifier4: num 0 1 0 0.92 0 0 0 0 0 0 ...  
## $ classifier5: num 1 2 1 2 1 1 1 1 1 1 ...

combine.df$vote<-rowSums(combine.df)  
combine.df

## classifier1 classifier2 classifier3 classifier4 classifier5 vote  
## 5 0.0000000 0.00000000 2.084554e-03 0.00 1 1.002085  
## 6 0.9500000 0.96202532 9.514821e-01 1.00 2 5.863507  
## 8 0.0000000 0.00000000 7.256672e-04 0.00 1 1.000726  
## 16 0.9500000 1.00000000 7.531241e-01 0.92 2 5.623124  
## 17 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 23 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 30 0.0000000 0.00000000 2.692525e-03 0.00 1 1.002693  
## 34 0.0000000 0.00000000 4.863509e-04 0.00 1 1.000486  
## 35 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 38 0.0000000 0.00000000 5.394112e-02 0.00 1 1.053941  
## 43 0.9500000 0.96202532 9.482237e-01 0.96 2 5.820249  
## 47 0.9500000 0.85714286 7.356881e-01 0.96 2 5.502831  
## 49 0.0000000 0.00000000 2.084554e-03 0.00 1 1.002085  
## 52 0.8571429 0.96202532 7.369155e-01 0.76 2 5.316084  
## 56 0.9500000 0.96202532 9.663243e-01 0.96 2 5.838350  
## 58 0.0000000 0.00000000 2.222350e-01 0.48 2 2.702235  
## 60 0.9500000 1.00000000 6.362855e-01 0.96 2 5.546285  
## 64 0.0000000 0.00000000 2.674344e-01 0.20 1 1.467434  
## 67 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 80 0.0000000 0.00000000 5.489697e-03 0.00 1 1.005490  
## 88 0.9500000 0.85714286 7.465986e-01 0.96 2 5.513741  
## 89 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 93 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 105 0.9500000 1.00000000 8.074784e-01 1.00 2 5.757478  
## 106 0.8571429 0.96202532 6.716674e-01 0.44 2 4.930836  
## 109 0.0000000 0.00000000 1.344835e-01 0.00 1 1.134484  
## 117 0.0000000 0.00000000 4.697781e-02 0.44 1 1.486978  
## 118 0.9500000 0.85714286 9.029263e-01 1.00 2 5.710069  
## 119 0.0000000 0.04761905 1.124878e-01 0.00 1 1.160107  
## 121 0.0000000 0.00000000 9.478894e-04 0.00 1 1.000948  
## 125 0.9500000 0.96202532 8.994619e-01 0.88 2 5.691487  
## 126 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 134 0.0000000 0.00000000 1.590266e-03 0.00 1 1.001590  
## 136 0.0000000 0.00000000 1.441707e-01 0.00 1 1.144171  
## 141 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 157 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 162 0.0000000 0.00000000 2.036213e-03 0.00 1 1.002036  
## 167 0.9500000 0.96202532 9.364687e-01 1.00 2 5.848494  
## 168 0.9500000 1.00000000 6.237445e-01 1.00 2 5.573744  
## 174 0.9500000 0.96202532 9.977803e-01 1.00 2 5.909806  
## 177 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 180 1.0000000 0.96202532 8.499656e-01 0.84 2 5.651991  
## 187 0.9500000 0.85714286 7.233798e-01 0.96 2 5.490523  
## 189 0.9500000 0.96202532 8.982400e-01 0.96 2 5.770265  
## 192 0.9500000 0.96202532 9.996667e-01 1.00 2 5.911692  
## 199 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 207 0.9500000 0.96202532 9.642700e-01 0.96 2 5.836295  
## 210 0.0000000 0.00000000 3.500297e-04 0.00 1 1.000350  
## 212 0.9500000 0.96202532 9.044873e-01 1.00 2 5.816513  
## 217 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 219 0.9500000 0.96202532 9.305187e-01 1.00 2 5.842544  
## 221 0.0000000 0.00000000 4.863509e-04 0.00 1 1.000486  
## 228 0.9500000 0.96202532 9.349967e-01 0.92 2 5.767022  
## 232 0.9500000 0.96202532 8.925423e-01 0.96 2 5.764568  
## 233 0.9500000 1.00000000 7.431630e-01 0.88 2 5.573163  
## 237 0.9500000 0.96202532 9.842427e-01 1.00 2 5.896268  
## 240 0.9500000 0.96202532 9.920828e-01 1.00 2 5.904108  
## 242 0.0000000 0.00000000 2.052808e-03 0.00 1 1.002053  
## 248 0.9500000 0.96202532 9.542867e-01 1.00 2 5.866312  
## 253 1.0000000 0.96202532 8.930572e-01 0.84 2 5.695083  
## 254 0.9500000 0.96202532 9.482237e-01 0.96 2 5.820249  
## 273 1.0000000 0.85714286 7.003036e-01 1.00 2 5.557446  
## 278 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 280 0.9500000 0.96202532 9.176072e-01 0.84 2 5.669633  
## 281 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 282 0.0000000 0.00000000 4.863509e-04 0.00 1 1.000486  
## 286 0.9500000 0.96202532 9.517615e-01 1.00 2 5.863787  
## 291 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 297 1.0000000 0.96202532 8.326706e-01 0.80 2 5.594696  
## 313 0.9500000 1.00000000 7.940401e-01 1.00 2 5.744040  
## 317 0.9500000 0.96202532 9.351493e-01 0.96 2 5.807175  
## 323 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 346 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 347 0.0000000 0.00000000 1.447461e-01 0.00 1 1.144746  
## 353 0.9500000 0.85714286 7.041780e-01 0.96 2 5.471321  
## 354 0.9500000 0.85714286 7.335362e-01 1.00 2 5.540679  
## 355 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 356 0.0000000 0.00000000 6.962316e-03 0.00 1 1.006962  
## 362 0.9500000 0.85714286 7.130903e-01 0.96 2 5.480233  
## 368 0.9500000 0.96202532 9.956778e-01 1.00 2 5.907703  
## 370 0.0000000 0.00000000 2.627273e-03 0.00 1 1.002627  
## 385 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 392 0.9500000 0.96202532 9.970804e-01 1.00 2 5.909106  
## 403 0.0000000 0.00000000 3.608234e-02 0.04 1 1.076082  
## 406 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 413 0.9500000 0.96202532 9.587241e-01 1.00 2 5.870749  
## 420 0.0000000 0.00000000 5.541139e-02 0.08 1 1.135411  
## 421 0.0000000 0.04761905 2.219940e-01 0.04 1 1.309613  
## 425 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 436 0.9500000 0.96202532 9.919740e-01 1.00 2 5.903999  
## 440 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 447 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 448 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 451 0.0000000 0.00000000 1.598203e-03 0.00 1 1.001598  
## 453 0.0000000 0.00000000 1.628972e-03 0.00 1 1.001629  
## 454 0.9500000 0.85714286 8.833552e-01 0.96 2 5.650498  
## 462 0.2500000 0.04761905 2.051478e-01 0.00 1 1.502767  
## 470 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 471 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 473 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 474 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 476 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 495 1.0000000 0.96202532 7.058368e-01 0.60 1 4.267862  
## 498 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 500 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 505 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 509 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 513 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 524 0.9500000 0.96202532 9.962339e-01 1.00 2 5.908259  
## 532 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 535 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 536 0.0000000 0.00000000 3.575162e-03 0.00 1 1.003575  
## 545 0.0000000 0.00000000 2.627273e-03 0.00 1 1.002627  
## 547 0.9500000 0.96202532 9.993725e-01 1.00 2 5.911398  
## 548 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 555 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 557 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 559 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 566 0.9500000 0.96202532 9.945856e-01 1.00 2 5.906611  
## 570 0.9500000 0.96202532 9.860097e-01 0.96 2 5.858035  
## 575 0.9500000 1.00000000 7.359814e-01 1.00 2 5.685981  
## 576 0.0000000 0.00000000 8.433142e-04 0.00 1 1.000843  
## 580 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 584 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 586 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 588 0.0000000 0.00000000 1.590266e-03 0.00 1 1.001590  
## 589 0.9500000 0.96202532 9.056452e-01 0.96 2 5.777671  
## 591 0.9500000 1.00000000 6.519471e-01 0.92 2 5.521947  
## 592 0.9500000 0.85714286 7.399306e-01 1.00 2 5.547073  
## 604 0.9500000 1.00000000 8.360269e-01 0.96 2 5.746027  
## 621 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 631 0.0000000 0.00000000 2.692525e-03 0.00 1 1.002693  
## 633 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 636 0.0000000 0.00000000 1.294859e-02 0.00 1 1.012949  
## 644 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 649 0.9500000 1.00000000 8.535444e-01 1.00 2 5.803544  
## 658 0.9500000 1.00000000 6.478503e-01 0.96 2 5.557850  
## 659 0.9500000 0.96202532 9.200020e-01 0.68 2 5.512027  
## 661 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 669 0.9500000 1.00000000 8.404574e-01 1.00 2 5.790457  
## 671 0.9500000 0.85714286 7.344259e-01 0.92 2 5.461569  
## 673 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264  
## 677 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000  
## 680 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 685 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 692 0.9500000 0.96202532 8.897162e-01 0.84 2 5.641742  
## 693 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065  
## 694 0.0000000 0.00000000 1.027619e-02 0.00 1 1.010276

combine.df$class<-ifelse(combine.df$vote > 2, 1, 0)  
combine.df

## classifier1 classifier2 classifier3 classifier4 classifier5 vote class  
## 5 0.0000000 0.00000000 2.084554e-03 0.00 1 1.002085 0  
## 6 0.9500000 0.96202532 9.514821e-01 1.00 2 5.863507 1  
## 8 0.0000000 0.00000000 7.256672e-04 0.00 1 1.000726 0  
## 16 0.9500000 1.00000000 7.531241e-01 0.92 2 5.623124 1  
## 17 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 23 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 30 0.0000000 0.00000000 2.692525e-03 0.00 1 1.002693 0  
## 34 0.0000000 0.00000000 4.863509e-04 0.00 1 1.000486 0  
## 35 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 38 0.0000000 0.00000000 5.394112e-02 0.00 1 1.053941 0  
## 43 0.9500000 0.96202532 9.482237e-01 0.96 2 5.820249 1  
## 47 0.9500000 0.85714286 7.356881e-01 0.96 2 5.502831 1  
## 49 0.0000000 0.00000000 2.084554e-03 0.00 1 1.002085 0  
## 52 0.8571429 0.96202532 7.369155e-01 0.76 2 5.316084 1  
## 56 0.9500000 0.96202532 9.663243e-01 0.96 2 5.838350 1  
## 58 0.0000000 0.00000000 2.222350e-01 0.48 2 2.702235 1  
## 60 0.9500000 1.00000000 6.362855e-01 0.96 2 5.546285 1  
## 64 0.0000000 0.00000000 2.674344e-01 0.20 1 1.467434 0  
## 67 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264 0  
## 80 0.0000000 0.00000000 5.489697e-03 0.00 1 1.005490 0  
## 88 0.9500000 0.85714286 7.465986e-01 0.96 2 5.513741 1  
## 89 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264 0  
## 93 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264 0  
## 105 0.9500000 1.00000000 8.074784e-01 1.00 2 5.757478 1  
## 106 0.8571429 0.96202532 6.716674e-01 0.44 2 4.930836 1  
## 109 0.0000000 0.00000000 1.344835e-01 0.00 1 1.134484 0  
## 117 0.0000000 0.00000000 4.697781e-02 0.44 1 1.486978 0  
## 118 0.9500000 0.85714286 9.029263e-01 1.00 2 5.710069 1  
## 119 0.0000000 0.04761905 1.124878e-01 0.00 1 1.160107 0  
## 121 0.0000000 0.00000000 9.478894e-04 0.00 1 1.000948 0  
## 125 0.9500000 0.96202532 8.994619e-01 0.88 2 5.691487 1  
## 126 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 134 0.0000000 0.00000000 1.590266e-03 0.00 1 1.001590 0  
## 136 0.0000000 0.00000000 1.441707e-01 0.00 1 1.144171 0  
## 141 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 157 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 162 0.0000000 0.00000000 2.036213e-03 0.00 1 1.002036 0  
## 167 0.9500000 0.96202532 9.364687e-01 1.00 2 5.848494 1  
## 168 0.9500000 1.00000000 6.237445e-01 1.00 2 5.573744 1  
## 174 0.9500000 0.96202532 9.977803e-01 1.00 2 5.909806 1  
## 177 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264 0  
## 180 1.0000000 0.96202532 8.499656e-01 0.84 2 5.651991 1  
## 187 0.9500000 0.85714286 7.233798e-01 0.96 2 5.490523 1  
## 189 0.9500000 0.96202532 8.982400e-01 0.96 2 5.770265 1  
## 192 0.9500000 0.96202532 9.996667e-01 1.00 2 5.911692 1  
## 199 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 207 0.9500000 0.96202532 9.642700e-01 0.96 2 5.836295 1  
## 210 0.0000000 0.00000000 3.500297e-04 0.00 1 1.000350 0  
## 212 0.9500000 0.96202532 9.044873e-01 1.00 2 5.816513 1  
## 217 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 219 0.9500000 0.96202532 9.305187e-01 1.00 2 5.842544 1  
## 221 0.0000000 0.00000000 4.863509e-04 0.00 1 1.000486 0  
## 228 0.9500000 0.96202532 9.349967e-01 0.92 2 5.767022 1  
## 232 0.9500000 0.96202532 8.925423e-01 0.96 2 5.764568 1  
## 233 0.9500000 1.00000000 7.431630e-01 0.88 2 5.573163 1  
## 237 0.9500000 0.96202532 9.842427e-01 1.00 2 5.896268 1  
## 240 0.9500000 0.96202532 9.920828e-01 1.00 2 5.904108 1  
## 242 0.0000000 0.00000000 2.052808e-03 0.00 1 1.002053 0  
## 248 0.9500000 0.96202532 9.542867e-01 1.00 2 5.866312 1  
## 253 1.0000000 0.96202532 8.930572e-01 0.84 2 5.695083 1  
## 254 0.9500000 0.96202532 9.482237e-01 0.96 2 5.820249 1  
## 273 1.0000000 0.85714286 7.003036e-01 1.00 2 5.557446 1  
## 278 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 280 0.9500000 0.96202532 9.176072e-01 0.84 2 5.669633 1  
## 281 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264 0  
## 282 0.0000000 0.00000000 4.863509e-04 0.00 1 1.000486 0  
## 286 0.9500000 0.96202532 9.517615e-01 1.00 2 5.863787 1  
## 291 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 297 1.0000000 0.96202532 8.326706e-01 0.80 2 5.594696 1  
## 313 0.9500000 1.00000000 7.940401e-01 1.00 2 5.744040 1  
## 317 0.9500000 0.96202532 9.351493e-01 0.96 2 5.807175 1  
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## 346 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 347 0.0000000 0.00000000 1.447461e-01 0.00 1 1.144746 0  
## 353 0.9500000 0.85714286 7.041780e-01 0.96 2 5.471321 1  
## 354 0.9500000 0.85714286 7.335362e-01 1.00 2 5.540679 1  
## 355 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 356 0.0000000 0.00000000 6.962316e-03 0.00 1 1.006962 0  
## 362 0.9500000 0.85714286 7.130903e-01 0.96 2 5.480233 1  
## 368 0.9500000 0.96202532 9.956778e-01 1.00 2 5.907703 1  
## 370 0.0000000 0.00000000 2.627273e-03 0.00 1 1.002627 0  
## 385 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 392 0.9500000 0.96202532 9.970804e-01 1.00 2 5.909106 1  
## 403 0.0000000 0.00000000 3.608234e-02 0.04 1 1.076082 0  
## 406 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 413 0.9500000 0.96202532 9.587241e-01 1.00 2 5.870749 1  
## 420 0.0000000 0.00000000 5.541139e-02 0.08 1 1.135411 0  
## 421 0.0000000 0.04761905 2.219940e-01 0.04 1 1.309613 0  
## 425 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 436 0.9500000 0.96202532 9.919740e-01 1.00 2 5.903999 1  
## 440 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 447 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 448 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 451 0.0000000 0.00000000 1.598203e-03 0.00 1 1.001598 0  
## 453 0.0000000 0.00000000 1.628972e-03 0.00 1 1.001629 0  
## 454 0.9500000 0.85714286 8.833552e-01 0.96 2 5.650498 1  
## 462 0.2500000 0.04761905 2.051478e-01 0.00 1 1.502767 0  
## 470 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 471 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 473 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 474 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 476 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 495 1.0000000 0.96202532 7.058368e-01 0.60 1 4.267862 1  
## 498 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 500 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 505 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 509 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 513 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 524 0.9500000 0.96202532 9.962339e-01 1.00 2 5.908259 1  
## 532 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 535 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 536 0.0000000 0.00000000 3.575162e-03 0.00 1 1.003575 0  
## 545 0.0000000 0.00000000 2.627273e-03 0.00 1 1.002627 0  
## 547 0.9500000 0.96202532 9.993725e-01 1.00 2 5.911398 1  
## 548 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 555 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 557 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 559 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 566 0.9500000 0.96202532 9.945856e-01 1.00 2 5.906611 1  
## 570 0.9500000 0.96202532 9.860097e-01 0.96 2 5.858035 1  
## 575 0.9500000 1.00000000 7.359814e-01 1.00 2 5.685981 1  
## 576 0.0000000 0.00000000 8.433142e-04 0.00 1 1.000843 0  
## 580 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264 0  
## 584 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 586 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 588 0.0000000 0.00000000 1.590266e-03 0.00 1 1.001590 0  
## 589 0.9500000 0.96202532 9.056452e-01 0.96 2 5.777671 1  
## 591 0.9500000 1.00000000 6.519471e-01 0.92 2 5.521947 1  
## 592 0.9500000 0.85714286 7.399306e-01 1.00 2 5.547073 1  
## 604 0.9500000 1.00000000 8.360269e-01 0.96 2 5.746027 1  
## 621 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 631 0.0000000 0.00000000 2.692525e-03 0.00 1 1.002693 0  
## 633 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 636 0.0000000 0.00000000 1.294859e-02 0.00 1 1.012949 0  
## 644 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 649 0.9500000 1.00000000 8.535444e-01 1.00 2 5.803544 1  
## 658 0.9500000 1.00000000 6.478503e-01 0.96 2 5.557850 1  
## 659 0.9500000 0.96202532 9.200020e-01 0.68 2 5.512027 1  
## 661 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 669 0.9500000 1.00000000 8.404574e-01 1.00 2 5.790457 1  
## 671 0.9500000 0.85714286 7.344259e-01 0.92 2 5.461569 1  
## 673 0.0000000 0.00000000 2.641287e-04 0.00 1 1.000264 0  
## 677 0.0000000 0.00000000 1.110223e-16 0.00 1 1.000000 0  
## 680 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 685 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 692 0.9500000 0.96202532 8.897162e-01 0.84 2 5.641742 1  
## 693 0.0000000 0.00000000 6.525199e-05 0.00 1 1.000065 0  
## 694 0.0000000 0.00000000 1.027619e-02 0.00 1 1.010276 0

Note that the echo = FALSE parameter was added to the code chunk to prevent printing of the R code that generated the plot.