Math 5365

Data Mining 1

Homework 7

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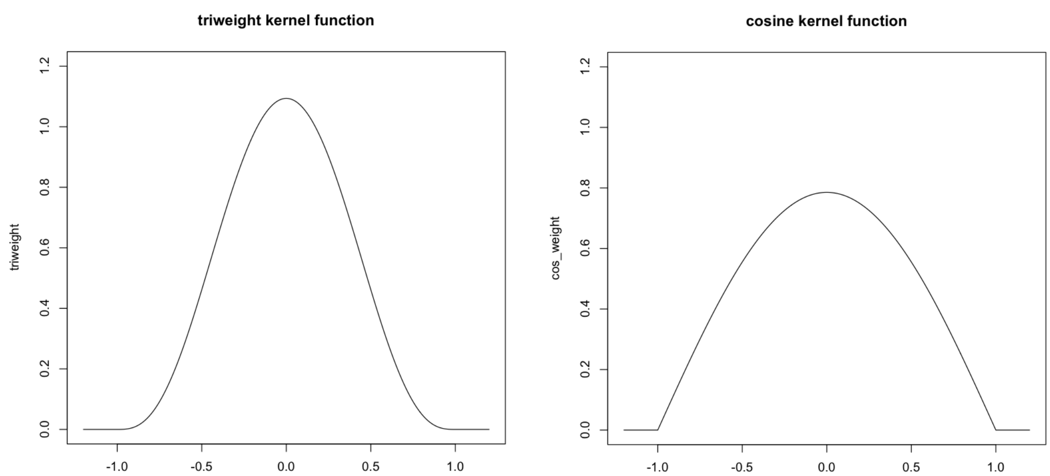
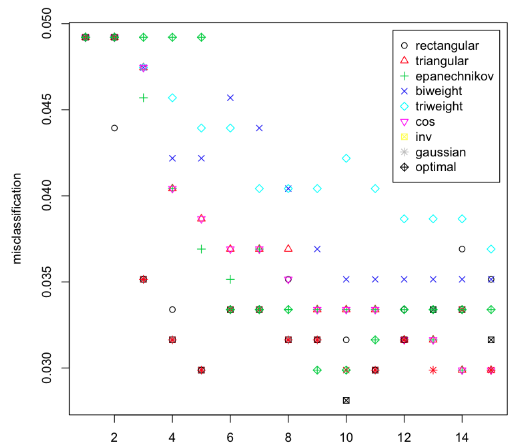
1. Use R to plot the triweight and cosine kernel functions from Hechenbichler and Schliep(2004). Use a plot window of xlim=c(-1.2,1.2) and ylim=c(0,1.2). (Hint: Boolean commands like (x $\leq$ 20) return TRUE/FALSE values, but they are treated as 1's and 0's when multiplied by numbers.)



2. Returning to the wdbc.data data set, use train.kknn to find the optimal kernel function and value of k for predicting breast cancer diagnosis using weighted k-nearest neighbors.

   The optimal kernel function type for this case is 'inv', and the optimal k is 10.



3. Divide the data into 70% training and 30% testing data, and calculate the test accuracy using the optimal kernel function and value of k. Find a 95% confidence interval for the accuracy.

   The accuracy for this case was 0.977 %. The 95% confidence interval was (0.9612476 0.9877801).

4. For the same training and test data, find the test accuracy using a rectangular kernel and the optimal value of k obtained in homework 6.

   The optimal value of k in homework 6 is 4. Using this with the regular knn which gives a rectangular gave an accuracy rate of 0.93 %.

5. Test whether the difference in test accuracies is statistically significant.

   For this run, the p-value is 0.05737. This is borderline, but still greater than 0.05. Thus it is not technically statistically significant although it is close to being so.

```
#Data Mining hw 7
library(class)
library(kknn)
library(exact2x2)
wdbc <- read.table("~/Dropbox/Tarleton/data_mining/hw05/wdbc.data",
```

```
        header = FALSE, sep = ",")

#1. Use R to plot the triweight and cosine kernel functions from
#  Hechenbichler and Schliep(2004). Use a plot window of
#  xlim=c(-1.2,1.2) and ylim=c(0,1.2).
#  (Hint: Boolean commands like (x <= 20) return TRUE/FALSE values,
#  but they are treated as 1's and 0's when multiplied by numbers.)

triweight_d = function(x){
  frac = 35/32
  d = frac * ((1 - x*x)^3) * (abs(x) <= 1)
}
x <- seq(from=-1.2,to=1.2,by=0.01)
triweight <-triweight_d(x)
plot(x, triweight,
     type='l',
     xlim=c(-1.2,1.2),
     ylim=c(0,1.2),
     main="triweight kernel function")

#2. Returning to the wdbc.data data set, use train.kknn to find the
#   optimal kernel function and value of k for predicting breast
#   cancer diagnosis using weighted k-nearest neighbors.

wdbc <-wdbc[,-1]
fit_bc <- train.kknn(V2 ~ ., data = wdbc, kmax = 15, kernel =
                     c('rectangular', 'triangular',
                       'epanechnikov', 'biweight',
                       'triweight', 'cos','inv',
                       'gaussian', 'optimal'),
                        distance = 2)
plot(fit_bc)
ktype <- (fit_bc$best.parameters)$kernel
k <- (fit_bc$best.parameters)$k

#3. Divide the data into 70% training and 30% testing data, and
#   calculate the test accuracy using the optimal kernel function
#   and value of k. Find a 95% confidence interval for the accuracy.

splitset <- splitdata(wdbc, 0.7, FALSE)
train1 <- splitset$train
pred_V2 = (kknn(V2 ~ ., train = wdbc[train1,], test = wdbc[-train1,],
           k = k, kernel = ktype, distance = 2))$fitted.values
```

```
e1 = (confmatrix(wdbc$V2[-train1], pred_V2))$error
exact_conf_int <- binom.test(nrow(wdbc) - round(e1 * nrow(wdbc), digits = 0),
                             nrow(wdbc), p = 0.05)

#4. For the same training and test data, find the test accuracy
#   using a rectangular kernel and the optimal value of k obtained
#   in homework 6.

pred_V2_2 = knn(train = wdbc[train1,-1], test = wdbc[-train1,-1],
                cl = wdbc$V2[train1], 4)

confmatrix(wdbc$V2[-train1], pred_V2_2)

#5. Test whether the difference in test accuracies is
#   statistically significant.
acc1 = (wdbc$V2[-train1] == pred_V2)
acc2 = (wdbc$V2[-train1] == pred_V2_2)

mcnemartable = table(acc1, acc2)

mcnemar.exact(mcnemartable)
```