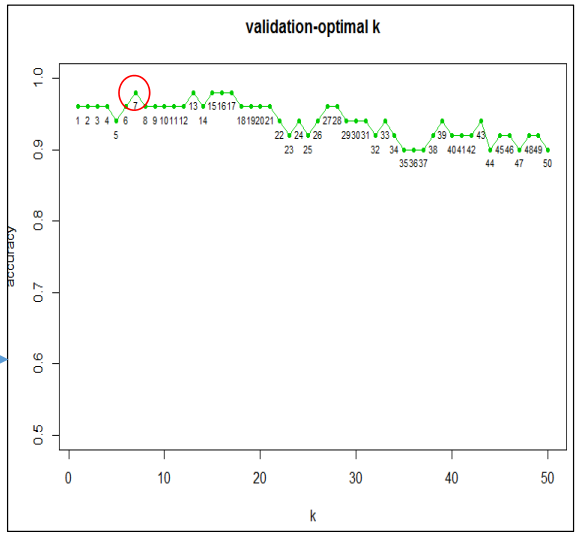
Wk10-2 : k-인접기법(k-Nearest Neighbor) II

- 최적 k 탐색과 비중 k-인접기법 -

6. kNN에서 최적 k 탐색

- 최적 k의 탐색 : 1 to nrow(train_data)/2 (여기서는 1 to 50 까지)

```
# optimal k selection (1 to n/2)
accuracy_k <- NULL
# try k=1 to nrow(train)/2, may use nrow(train)/3(or 4,5) depending the size o
nnum<-nrow(iris.train)/2
for(kk in c(1:nnum))
{
  set.seed(1234)
  knn_k<-knn(train=iris.train,test=iris.test,cl=trainLabels,k=kk)
  accuracy_k<-c(accuracy_k,sum(knn_k==testLabels)/length(testLabels))
}

# plot for k=(1 to n/2) and accuracy
test_k<-data.frame(k=c(1:nnum), accuracy=accuracy_k[c(1:nnum)])
plot(formula=accuracy~k, data=test_k,type="o",ylim=c(0.5,1), pch=20, col=3, ma
with(test_k,text(accuracy~k,labels = k,pos=1,cex=0.7))
```




```
# minimum k for the highest accuracy
min(test_k[test_k$accuracy %in% max(accuracy_k),"k"])
```

k=7에서 정확도(.98)가 가장 높음

6. kNN에서 최적 k 탐색

- 최종 kNN모형 (k=7)

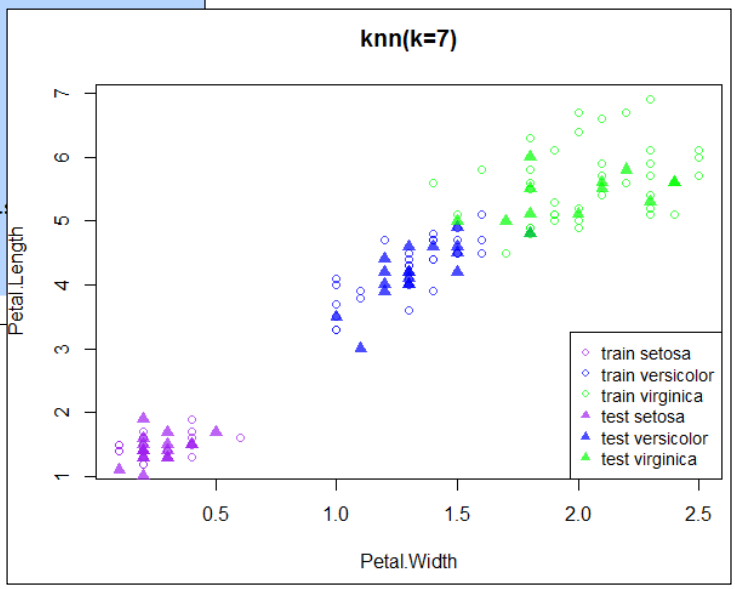
```
#k=7 knn
md1<-knn(train=iris.train,test=iris.test,cl=trainLabels,k=7)
CrossTable(x=testLabels,y=md1, prop.chisq=FALSE)
```

```
Total Observations in Table:  50

             | md1
  testLabels |     setosa | versicolor |  virginica | Row Total |
-------------|------------|------------|------------|-----------|
      setosa |         19 |          0 |          0 |        19 |
             |      1.000 |      0.000 |      0.000 |     0.380 |
             |      1.000 |      0.000 |      0.000 |           |
             |      0.380 |      0.000 |      0.000 |           |
-------------|------------|------------|------------|-----------|
  versicolor |          0 |         18 |          1 |        19 |
             |      0.000 |      0.947 |      0.053 |     0.380 |
             |      0.000 |      1.000 |      0.077 |           |
             |      0.000 |      0.360 |      0.020 |           |
-------------|------------|------------|------------|-----------|
   virginica |          0 |          0 |         12 |        12 |
             |      0.000 |      0.000 |      1.000 |     0.240 |
             |      0.000 |      0.000 |      0.923 |           |
             |      0.000 |      0.000 |      0.240 |           |
-------------|------------|------------|------------|-----------|
Column Total |         19 |         18 |         13 |        50 |
             |      0.380 |      0.360 |      0.260 |           |
-------------|------------|------------|------------|-----------|
```

- 정확도 : 49/50 -> 98%
- versicolor를 virginica로 오분류(1개)
- 오분류율 : 1/50-> 2%

6. kNN(k=7)의 결과-그래픽

```
# with two variables, how classify?
plot(formula=Petal.Length ~ Petal.Width,
     data=iris.train,col=alpha(c("purple","blue","green"),0.7)[trainLabels],
     main="knn(k=7)")
points(formula = Petal.Length~Petal.Width,
       data=iris.test,
       pch = 17,
       cex= 1.2,
       col=alpha(c("purple","blue","green"),0.7)[md1]
)

legend("bottomright",
       c(paste("train",levels(trainLabels)),paste("test",levels
       pch=c(rep(1,3),rep(17,3)),
       col=c(rep(alpha(c("purple","blue","green"),0.7),2)),
       cex=0.9
)
```



- Petal.width와 Petal.length에 산점도를 그려보면 setosa는 잘 분류됨.
- virginica와 versicolor는 분류가 잘 되지 않음.

7. Weighted kNN

• 거리에 따라 가중치를 부여하는 두 가지 알고리즘이 존재 (패키지 : kknn)

```
################################################
# weighted KNN
install.packages("kknn")#weighted value kn
library(kknn)
help("kknn")
```

kknn {kknn} R Documentation

Weighted k-Nearest Neighbor Classifier

Description

Performs k-nearest neighbor classification of a test set using a training set. For each row of the test set, the k nearest training set vectors (according to Minkowski distance) are found, and the classification is done via the maximum of summed kernel densities. In addition even ordinal and continuous variables can be predicted.

Usage

```
kknn(formula = formula(train), train, test, na.action = na.omit(),
        k = 7, distance = 2, kernel = "optimal", ykernel = NULL, scale=TRUE,
        contrasts = c('unordered' = "contr.dummy", ordered = "contr.ordinal"))
kknn.dist(learn, valid, k = 10, distance = 2)
```

Arguments

formula	A formula object.
train	Matrix or data frame of training set cases.
test	Matrix or data frame of test set cases.
learn	Matrix or data frame of training set cases.
distance	Parameter of Minkowski distance.
kernel	Kernel to use. Possible choices are "rectangular" (which is standard unweighted knn), "triangular", "epanechnikov" (or beta(2,2)), "biweight" (or beta(3,3)), "triweight" (or beta(4,4)), "cos", "inv", "gaussian", "rank" and "optimal".

7. Weighted kNN 결과

• k=5, distance=1

```
#knn(weighted value)
md2<-kknn(Species~., train=train,test=test,k=5,distance=1,kernel="triangular")
md2
```

- weighted kNN의 결과를 md2로 저장
- weighted kNN의 결과를 보기 위해서 fitted함수를 이용 (fitted(md2))

```
#knn(weighted value)
md2<-kknn(Species~., train=train,test=test,k=5,distance=1,kernel="triangular")
md2
md2_fit<-fitted(md2)
md2_fit
```

```
> md2_fit<-fitted(md2)
> md2_fit
 [1] setosa     setosa     setosa     setosa     setosa     setosa     setosa
 [8] setosa     setosa     setosa     setosa     setosa     setosa     setosa
[15] setosa     setosa     setosa     setosa     setosa     versicolor versicolor
[22] versicolor versicolor versicolor virginica  versicolor virginica  versicolor
[29] versicolor versicolor versicolor versicolor versicolor versicolor versicolor
[36] versicolor versicolor versicolor virginica  virginica  virginica  virginica
[43] versicolor virginica  virginica  virginica  virginica  virginica  virginica
[50] virginica
Levels: setosa versicolor virginica
```

7. Weighted kNN 결과

```
# accuracy of weighted knn
CrossTable(x=testLabels,y=md2_fit,prop.chisq=FALSE,prop.c=FALSE)
```

```
> CrossTable(x=testLabels,y=md2_fit,prop.chisq=FALSE,prop.c=FALSE)

   Cell Contents
|-------------------------|
|                       N |
|           N / Row Total |
|         N / Table Total |
|-------------------------|

Total Observations in Table:  50

             | md2_fit
  testLabels |     setosa | versicolor |  virginica | Row Total |
-------------|------------|------------|------------|-----------|
      setosa |         19 |          0 |          0 |        19 |
             |      1.000 |      0.000 |      0.000 |     0.380 |
             |      0.380 |      0.000 |      0.000 |           |
-------------|------------|------------|------------|-----------|
  versicolor |          0 |         17 |          2 |        19 |
             |      0.000 |      0.895 |      0.105 |     0.380 |
             |      0.000 |      0.340 |      0.040 |           |
-------------|------------|------------|------------|-----------|
   virginica |          0 |          1 |         11 |        12 |
             |      0.000 |      0.083 |      0.917 |     0.240 |
             |      0.000 |      0.020 |      0.220 |           |
-------------|------------|------------|------------|-----------|
Column Total |         19 |         18 |         13 |        50 |
-------------|------------|------------|------------|-----------|
```

- 정확도 : 47/50 -> 94%
- versicolor를 virginica로 오분류(2개)
- virginica를 versicolor로 오분류(1개)

7. Weighted kNN 결과

- k=7, distance=2로 옵션 변경한 결과

```
# weighted knn (k=7, distance=2)
md3<-kknn(Species~., train=train,test=test,k=7,distance=2,kernel="triangular")
md3
# to see results for weighted knn
md3_fit<-fitted(md2)
md3_fit
# accuracy of weighted knn
CrossTable(x=testLabels,y=md3_fit,prop.chisq=FAL
```

```
Total Observations in Table:  50

             | md3_fit
  testLabels |     setosa | versicolor |  virginica | Row Total |
-------------|------------|------------|------------|-----------|
      setosa |         19 |          0 |          0 |        19 |
             |      1.000 |      0.000 |      0.000 |     0.380 |
             |      0.380 |      0.000 |      0.000 |           |
-------------|------------|------------|------------|-----------|
  versicolor |          0 |         19 |          0 |        19 |
             |      0.000 |      1.000 |      0.000 |     0.380 |
             |      0.000 |      0.380 |      0.000 |           |
-------------|------------|------------|------------|-----------|
   virginica |          0 |          1 |         11 |        12 |
             |      0.000 |      0.083 |      0.917 |     0.240 |
             |      0.000 |      0.020 |      0.220 |           |
-------------|------------|------------|------------|-----------|
Column Total |         19 |         20 |         11 |        50 |
-------------|------------|------------|------------|-----------|
```

- 정확도 : 49/50 -> 98%
- virginica를 versicolor로 오분류(1개)