K-vecinos más cercanos (kNN)

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kNN

#K-vecinos proximos

Cargar library

```
library(MASS)
```

Cargar los datos iris

```
Z<-as.data.frame(iris)
colnames(Z)
```

```
## [1] "Sepal.Length" "Sepal.Width"  "Petal.Length" "Petal.Width"  "Species"
```

Definir la matriz de datos y la variable respuesta

Con las clasificaciones

```
x<-Z[,1:4]
y<-Z[,5]
```

Se definen las variables y observaciones

```
n<-nrow(x)
p<-ncol(x)
```

Gráfico scatter plot

Creación de un vector de colores

```
y
```

```
##   [1] setosa     setosa     setosa     setosa     setosa     setosa
##   [7] setosa     setosa     setosa     setosa     setosa     setosa
##  [13] setosa     setosa     setosa     setosa     setosa     setosa
```

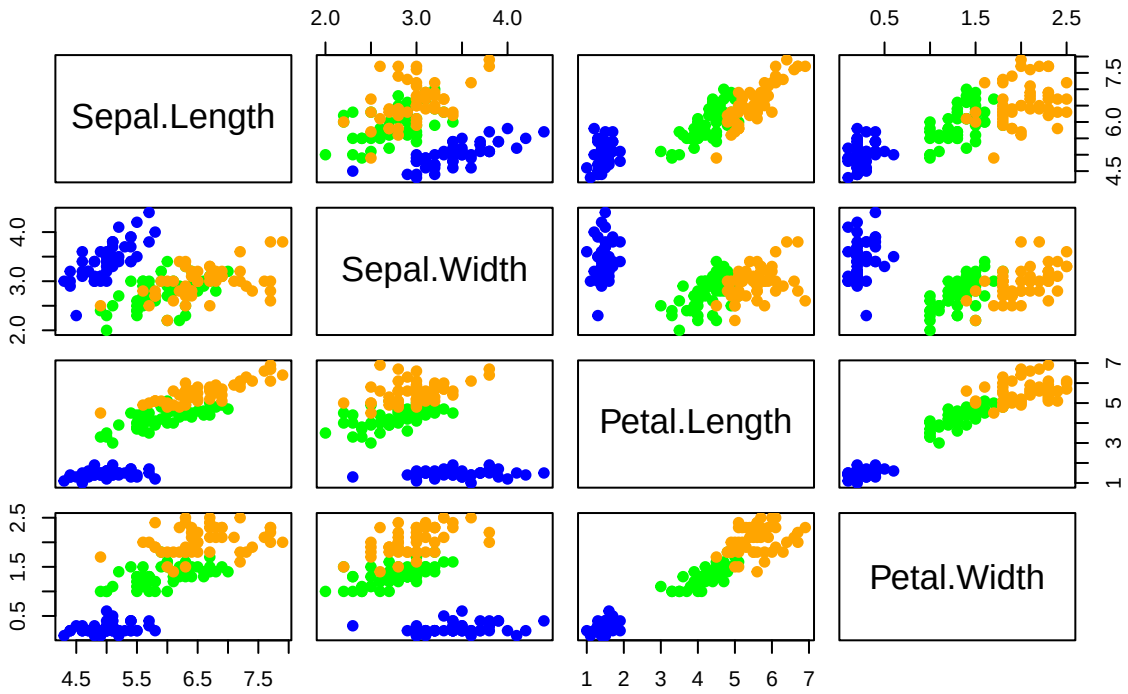
```
##  [19] setosa     setosa     setosa     setosa     setosa     setosa
##  [25] setosa     setosa     setosa     setosa     setosa     setosa
##  [31] setosa     setosa     setosa     setosa     setosa     setosa
##  [37] setosa     setosa     setosa     setosa     setosa     setosa
##  [43] setosa     setosa     setosa     setosa     setosa     setosa
##  [49] setosa     setosa     versicolor versicolor versicolor versicolor
##  [55] versicolor versicolor versicolor versicolor versicolor versicolor
##  [61] versicolor versicolor versicolor versicolor versicolor versicolor
##  [67] versicolor versicolor versicolor versicolor versicolor versicolor
##  [73] versicolor versicolor versicolor versicolor versicolor versicolor
##  [79] versicolor versicolor versicolor versicolor versicolor versicolor
##  [85] versicolor versicolor versicolor versicolor versicolor versicolor
##  [91] versicolor versicolor versicolor versicolor versicolor versicolor
##  [97] versicolor versicolor versicolor versicolor virginica  virginica
## [103] virginica  virginica  virginica  virginica  virginica  virginica
## [109] virginica  virginica  virginica  virginica  virginica  virginica
## [115] virginica  virginica  virginica  virginica  virginica  virginica
## [121] virginica  virginica  virginica  virginica  virginica  virginica
## [127] virginica  virginica  virginica  virginica  virginica  virginica
## [133] virginica  virginica  virginica  virginica  virginica  virginica
## [139] virginica  virginica  virginica  virginica  virginica  virginica
## [145] virginica  virginica  virginica  virginica  virginica  virginica
## Levels: setosa versicolor virginica
```

```
col.iris<-c("blue","green","orange")[y]
col.iris
```

```
##   [1] "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"
##   [9] "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"
##  [17] "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"
##  [25] "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"
##  [33] "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"
##  [41] "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"   "blue"
##  [49] "blue"   "blue"   "green"  "green"  "green"  "green"  "green"  "green"
##  [57] "green"  "green"  "green"  "green"  "green"  "green"  "green"  "green"
##  [65] "green"  "green"  "green"  "green"  "green"  "green"  "green"  "green"
##  [73] "green"  "green"  "green"  "green"  "green"  "green"  "green"  "green"
##  [81] "green"  "green"  "green"  "green"  "green"  "green"  "green"  "green"
##  [89] "green"  "green"  "green"  "green"  "green"  "green"  "green"  "green"
##  [97] "green"  "green"  "green"  "green"  "orange" "orange" "orange" "orange"
## [105] "orange" "orange" "orange" "orange" "orange" "orange" "orange" "orange"
## [113] "orange" "orange" "orange" "orange" "orange" "orange" "orange" "orange"
## [121] "orange" "orange" "orange" "orange" "orange" "orange" "orange" "orange"
## [129] "orange" "orange" "orange" "orange" "orange" "orange" "orange" "orange"
## [137] "orange" "orange" "orange" "orange" "orange" "orange" "orange" "orange"
## [145] "orange" "orange" "orange" "orange" "orange" "orange"
```

```
pairs(x, main="Data set Iris, Setosa (azul),Versicolor (verde), Virginica (naranja)",
      pch=19,col=col.iris)
```

Data set Iris, Setosa (azul),Versicolor (verde), Virginica (naranja)



#kNN

Cargar library

```
library(class)
```

Se fija una "semilla" para tener valores iguales

```
set.seed(1000)
```

Creación de los ciclos para k=1 hasta k=20

Selecciona el valor de k que tenga el error más bajo.

Inicialización de una lista vacia de tamaño 20

```
knn.class<-vector(mode="list",length=20)
knn.tables<-vector(mode="list", length=20)
```

Clasificaciones erroneas

```
knn.mis<-matrix(NA, nrow=20, ncol=1)
knn.mis
```

```
##       [,1]
```

```
##  [1,]   NA
##  [2,]   NA
##  [3,]   NA
##  [4,]   NA
##  [5,]   NA
##  [6,]   NA
##  [7,]   NA
##  [8,]   NA
##  [9,]   NA
## [10,]   NA
## [11,]   NA
## [12,]   NA
## [13,]   NA
## [14,]   NA
## [15,]   NA
## [16,]   NA
## [17,]   NA
## [18,]   NA
## [19,]   NA
## [20,]   NA
```

```
for(k in 1:20){
  knn.class[[k]]<-knn.cv(x,y,k=k)
  knn.tables[[k]]<-table(y,knn.class[[k]])
  # la suma de las clasificaciones menos las correctas
  knn.mis[k]<- n-sum(y==knn.class[[k]])
}

knn.mis
```

```
##       [,1]
##  [1,]    6
##  [2,]    7
##  [3,]    6
##  [4,]    6
##  [5,]    5
##  [6,]    4
##  [7,]    5
##  [8,]    5
##  [9,]    4
## [10,]    5
## [11,]    4
## [12,]    6
## [13,]    5
## [14,]    3
## [15,]    4
## [16,]    5
## [17,]    4
## [18,]    3
## [19,]    3
## [20,]    4
```

Número optimo de k-vecinos

```
which(knn.mis==min(knn.mis))
```

```
## [1] 14 18 19
```

```
knn.tables[[14]]
```

```
##
## y            setosa versicolor virginica
##   setosa         50          0         0
##   versicolor      0         48         2
##   virginica       0          1        49
```

```
knn.tables[[18]]
```

```
##
## y            setosa versicolor virginica
##   setosa         50          0         0
##   versicolor      0         48         2
##   virginica       0          1        49
```

```
knn.tables[[19]]
```

```
##
## y            setosa versicolor virginica
##   setosa         50          0         0
##   versicolor      0         48         2
##   virginica       0          1        49
```

El más eficiente es k=14 se señala el k más eficiente

```
k.opt<-14

knn.cv.opt<-knn.class[[k.opt]]
knn.cv.opt
```

```
##   [1] setosa     setosa     setosa     setosa     setosa     setosa
##   [7] setosa     setosa     setosa     setosa     setosa     setosa
##  [13] setosa     setosa     setosa     setosa     setosa     setosa
##  [19] setosa     setosa     setosa     setosa     setosa     setosa
##  [25] setosa     setosa     setosa     setosa     setosa     setosa
##  [31] setosa     setosa     setosa     setosa     setosa     setosa
##  [37] setosa     setosa     setosa     setosa     setosa     setosa
##  [43] setosa     setosa     setosa     setosa     setosa     setosa
##  [49] setosa     setosa     versicolor versicolor versicolor versicolor
##  [55] versicolor versicolor versicolor versicolor versicolor versicolor
##  [61] versicolor versicolor versicolor versicolor versicolor versicolor
##  [67] versicolor versicolor versicolor versicolor virginica  versicolor
##  [73] versicolor versicolor versicolor versicolor versicolor versicolor
##  [79] versicolor versicolor versicolor versicolor versicolor virginica
##  [85] versicolor versicolor versicolor versicolor versicolor versicolor
##  [91] versicolor versicolor versicolor versicolor versicolor versicolor
##  [97] versicolor versicolor versicolor versicolor virginica  virginica
## [103] virginica  virginica  virginica  virginica  versicolor virginica
## [109] virginica  virginica  virginica  virginica  virginica  virginica
```

```
## [115] virginica  virginica  virginica  virginica  virginica  virginica
## [121] virginica  virginica  virginica  virginica  virginica  virginica
## [127] virginica  virginica  virginica  virginica  virginica  virginica
## [133] virginica  virginica  virginica  virginica  virginica  virginica
## [139] virginica  virginica  virginica  virginica  virginica  virginica
## [145] virginica  virginica  virginica  virginica  virginica  virginica
## Levels: setosa versicolor virginica
```

Tabla de contingencia con las clasificaciones buenas y malas

```
knn.tables[[k.opt]]
```

```
##
## y            setosa versicolor virginica
##   setosa         50          0         0
##   versicolor      0         48         2
##   virginica       0          1        49
```

Cantidad de observaciones mal clasificadas

```
knn.mis[k.opt]
```

```
## [1] 3
```

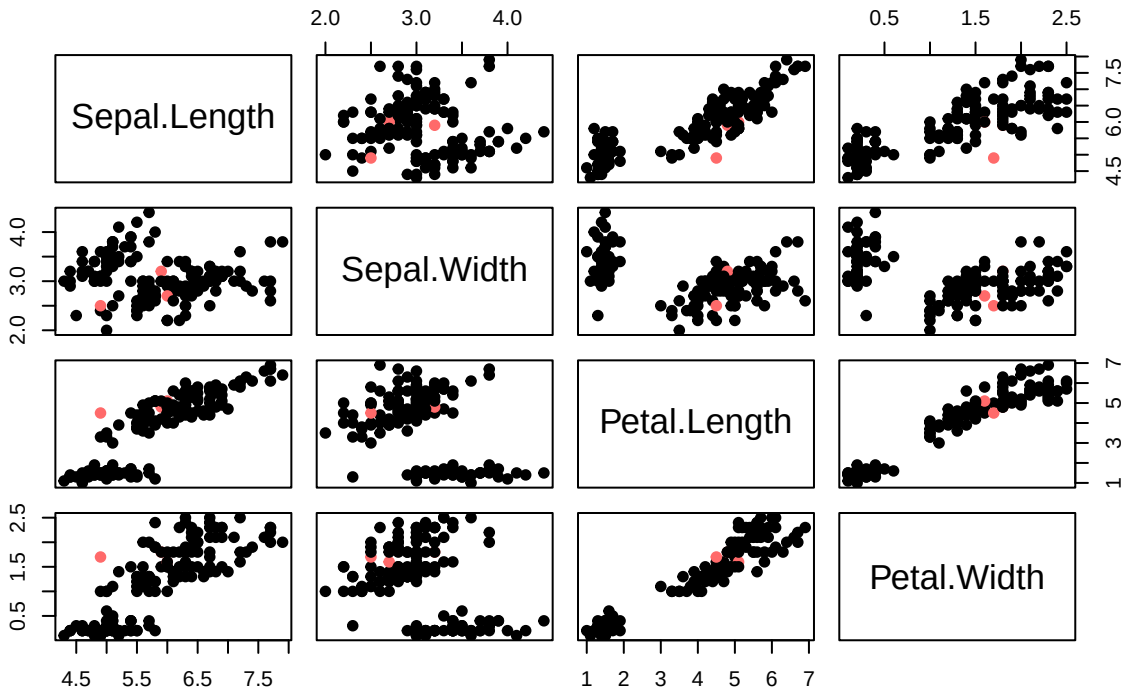
Error de clasificación (MR)

```
knn.mis[k.opt]/n
```

```
## [1] 0.02
```

Gráfico de clasificaciones correctas y erroneas

```
col.knn.iris<-c("indianred1","black")[1*(y==knn.cv.opt)+1]
pairs(x, main="Clasificación kNN de Iris",
      pch=19, col=col.knn.iris)
```


Clasificación kNN de Iris
Sepal.Length
Sepal.Width
Petal.Length
Petal.Width
2.0
3.0
4.0
0.5
1.5
2.5
4.5
6.0
7.5
1
3
5
7
4.5
5.5
6.5
7.5
1
2
3
4
5
6
7