notebook

January 13, 2019

1 Homework 1

```
In [38]: library(kernlab)
         library(kknn)
```

1.1 Read Data

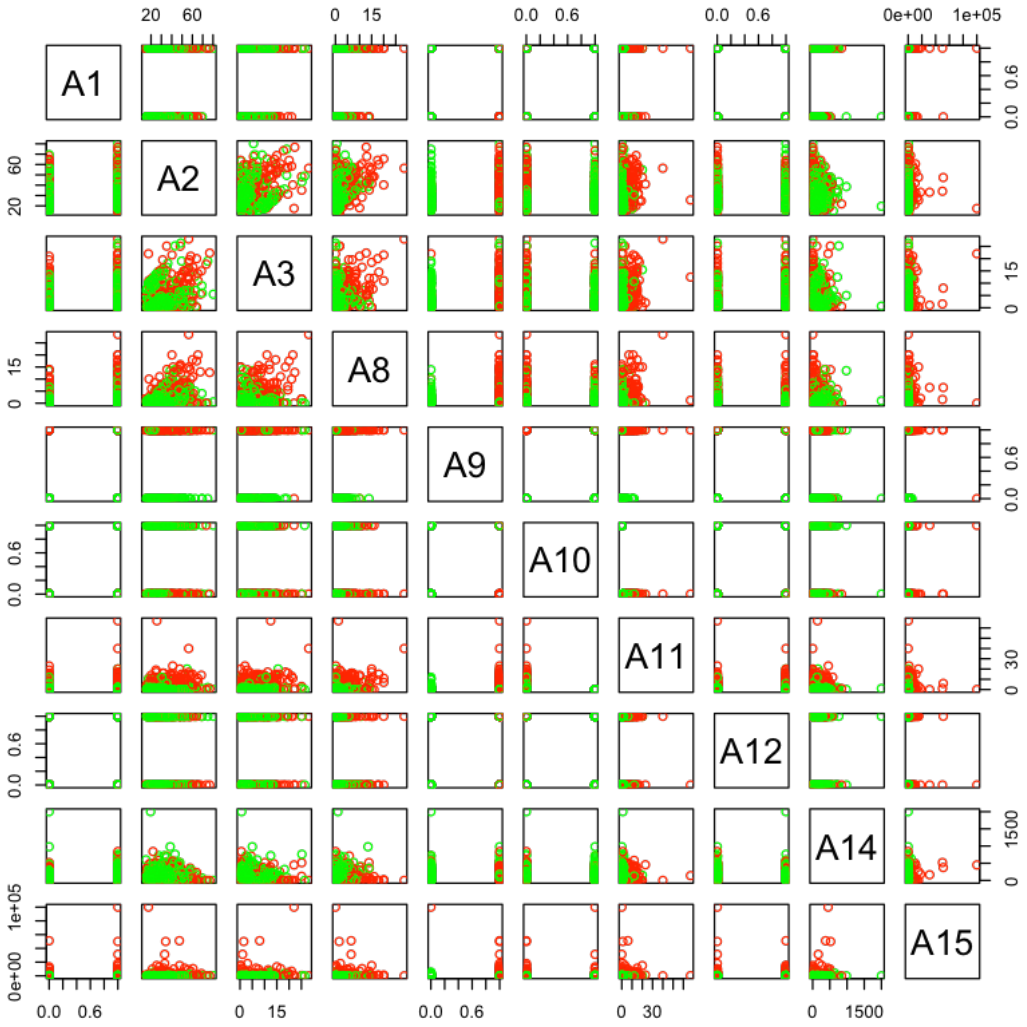
```
In [1]: data <- read.delim("credit_card_data-headers.txt", header = TRUE, sep = "\t", dec = "."
```

1.2 Explore dataset

```
In [89]: head(data)
```

A1	A2	A3	A8	A9	A10	A11	A12	A14	A15	R1
1	30.83	0.000	1.25	1	0	1	1	202	0	1
0	58.67	4.460	3.04	1	0	6	1	43	560	1
0	24.50	0.500	1.50	1	1	0	1	280	824	1
1	27.83	1.540	3.75	1	0	5	0	100	3	1
1	20.17	5.625	1.71	1	1	0	1	120	0	1
1	32.08	4.000	2.50	1	1	0	0	360	0	1

```
In [81]: plot(data[,1:10], col=ifelse(data[,11]==1,'red','green'))
```



2 SVM

```
In [39]: svm <- function(C, kernel){
             model <- ksvm(R1~A1+A2+A3+A8+A9+A10+A11+A12+A14+A15,
                           data=data,
                           type="C-svc",
                           kernel=kernel,
                           C=C,
                           scaled=TRUE)
             pred <- predict(model, data[,1:10])
             performance <- sum(pred == data[,11]) / nrow(data)
```

```
        return(performance)
    }
```

```
In [40]: svm(C=100, kernel="vanilladot")
```

```
 Setting default kernel parameters
```

0.863914373088685

2.1 Try differnt values for c

```
In [108]: cValues <- 10^(-10:10)
          performance <- c()

          for (i in seq_along(cValues)) {
              performance[i] <- svm(C=cValues[i], kernel="vanilladot")
          }
```

```
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 Setting default kernel parameters
```
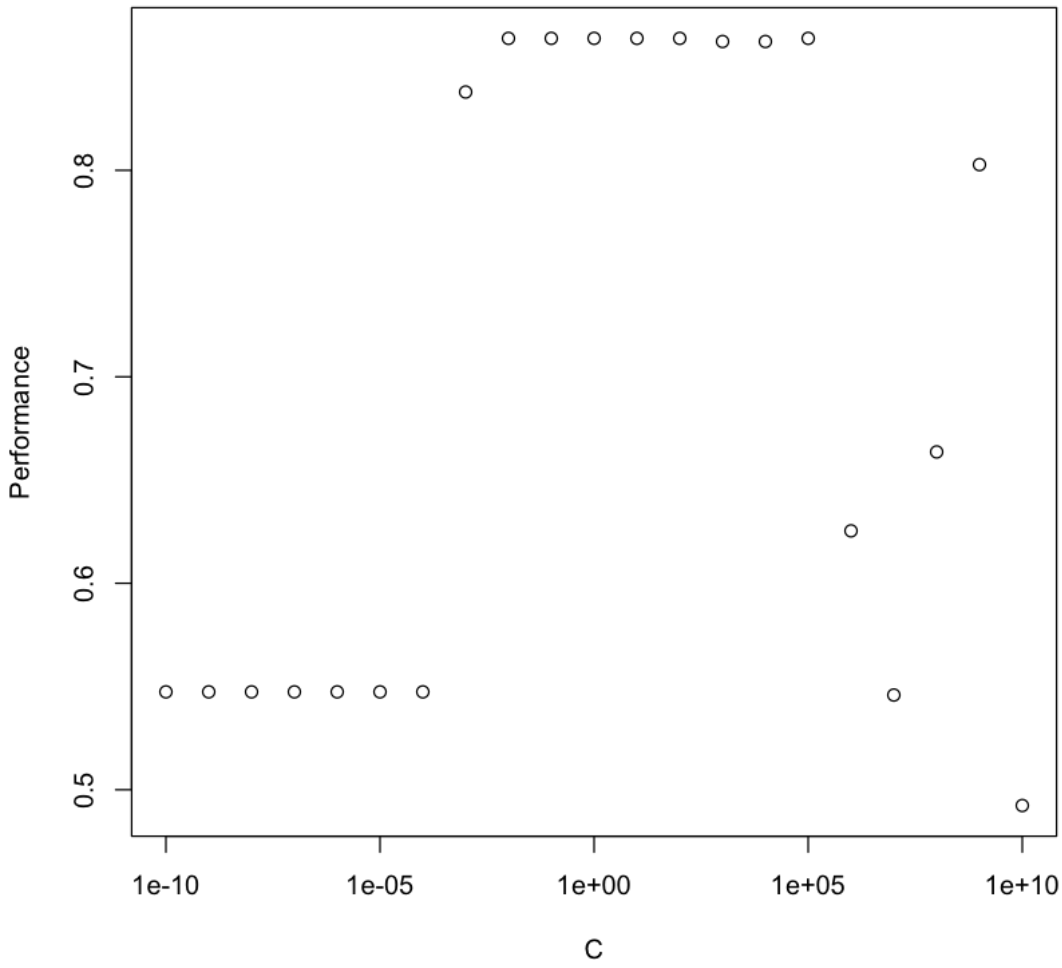

```
In [88]: plot(data.frame("C" = cValues, "Performance" = performance), log='x')
```



2.1.1 Get coefficients

```
In [122]: max(performance)
```

0.863914373088685

```
In [112]: cValues[which(performance==max(performance))]
```

1. 0.01 2. 0.1 3. 1 4. 10 5. 100 6. 1e+05

```
In [121]: model <- ksvm(R1~A1+A2+A3+A8+A9+A10+A11+A12+A14+A15,
                        data=data,
                        type="C-svc",
                        kernel="vanilladot",
```

```
                    C=1,
                    scaled=TRUE)

        a <- colSums(model@xmatrix[[1]] * model@coef[[1]])
        a0 <- -model@b

        print(a)
        print(a0)
```

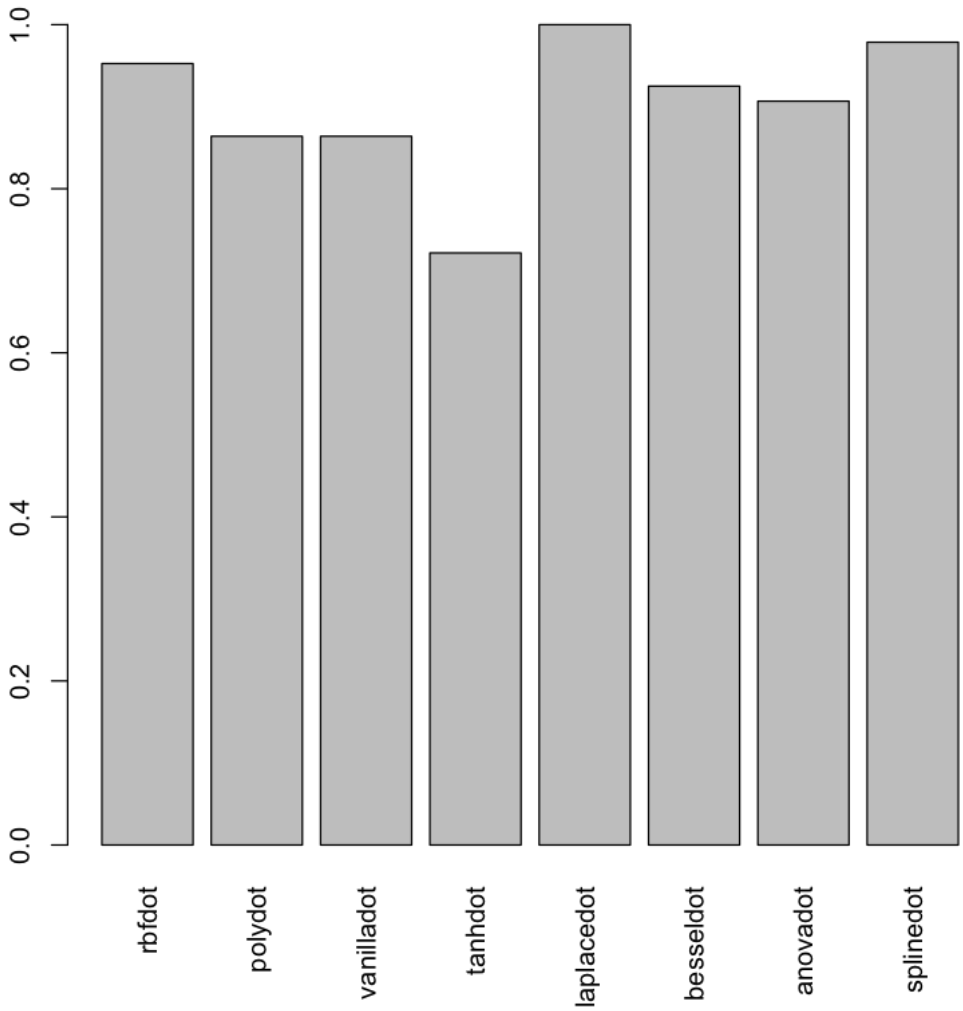
```
 Setting default kernel parameters
          A1           A2           A3           A8           A9
-0.0011026642 -0.0008980539 -0.0016074557  0.0029041700  1.0047363456
         A10          A11          A12          A14          A15
-0.0029852110 -0.0002035179 -0.0005504803 -0.0012519187  0.1064404601
[1] 0.08148382
```

2.1.2 Try other kernels

```
In [90]: kernels <- c("rbfdot", "polydot", "vanilladot", "tanhdot","laplacedot", "besseldot",
         performance <- c()

         for (i in seq_along(kernels)) {
             performance[i] <- svm(C=100, kernel=kernels[i])
         }
```

```
 Setting default kernel parameters
 Setting default kernel parameters
 Setting default kernel parameters
 Setting default kernel parameters
 Setting default kernel parameters
 Setting default kernel parameters
```

```
In [98]: barplot(performance, names.arg=kernels, las=3)
```



2.2 KNN

```
In [68]: knn <- function(k){
             pred <- c()
             for (i in 1:nrow(data)){
                 model <- kknn(R1~A1+A2+A3+A8+A9+A10+A11+A12+A14+A15,
                               train=data[-i,],
                               test=data[i,],
                               k=k,
                               distance=2,
                               kernel="optimal",
                               scale=TRUE)
```

```
            pred[i] <- fitted.values(model)
        }
        performance <- sum(round(pred) == data[,11]) / nrow(data)
        return(performance)
    }
```

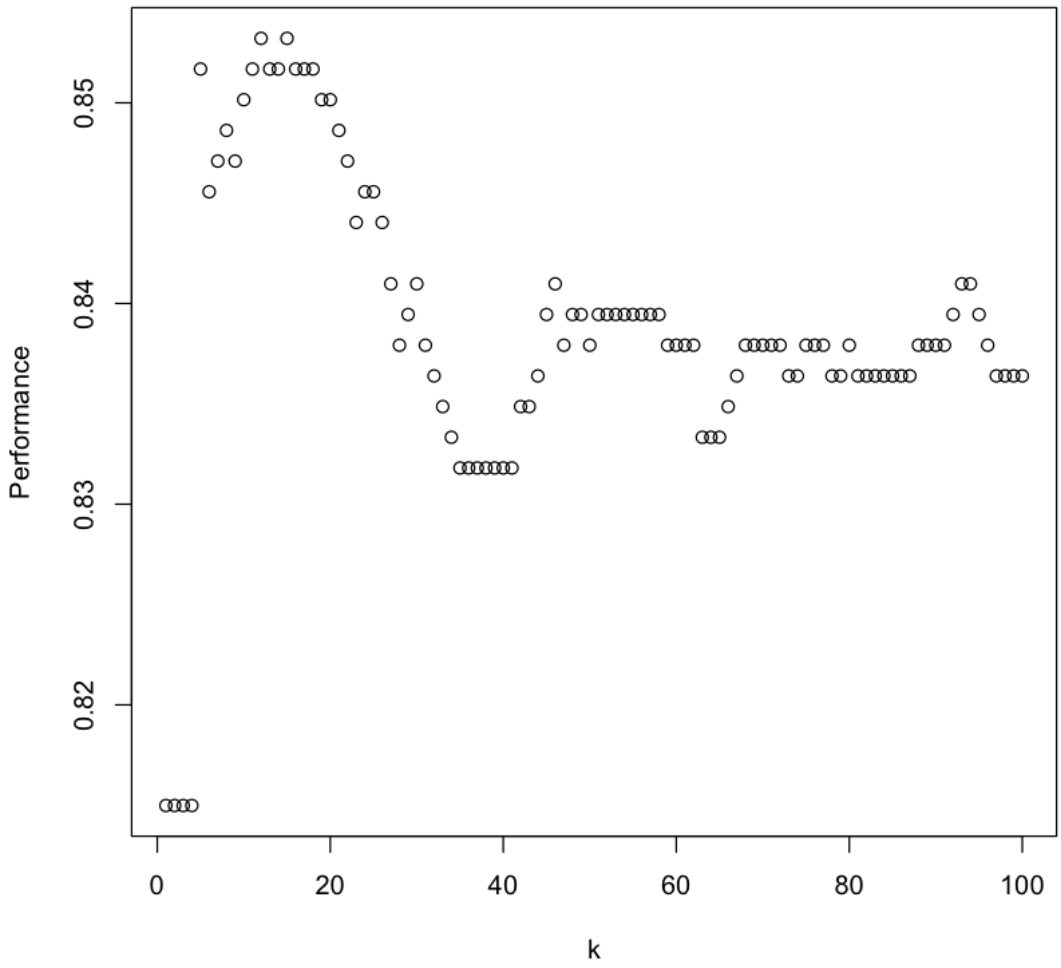
```
In [65]: knn(k=10)
```

0.850152905198777

2.2.1 Try different values for k

```
In [123]: kValues <- 1:100
          performance <- c()

          for (i in seq_along(kValues)) {
              performance[i] <- knn(k=kValues[i])
          }
```

```
In [124]: plot(data.frame("k" = kValues, "Performance" = performance))
```




```
In [125]: max(performance)
```

0.853211009174312

```
In [126]: kValues[which(performance==max(performance))]
```

1. 12 2. 15