2_ksvm___support_vector_machines.R

win10

2021-05-14

```
# ##############################################################################
rm(list = ls())
options(digits = 5)
# if (!is.null(dev.list())){dev.off()}
# ##############################################################################

library(kernlab) # Kernel-based machine learning methods
library(ggplot2)
```

```
##
## Attaching package: 'ggplot2'
```

```
## The following object is masked from 'package:kernlab':
##
##     alpha
```

```
library(reshape2)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
# read file. Use credit_card_data.txt
my_data <- read.table(file.choose(), header=FALSE, sep = "", dec=".")

#split data into train-test

# create function for scaling
scale_func = function(a_var) {
  (a_var - min(a_var)) / (max(a_var) - min(a_var))
}

# use lapply to apply function to data
# cast the output of lapply to a data frame
my_data_scaled = as.data.frame(lapply(my_data[, 1:11], scale_func))

# to ensure repeatable results despite random selection
```

```r
set.seed(123)

# determine test:train split ratio.
split_ratio = 0.7 # e.g. train:test = 0.7 : (1-0.7)

#split data into test and train
random_sampling = sample(
  1:nrow(my_data_scaled),
  size = nrow(my_data_scaled) * split_ratio,
  replace = FALSE
) #randomly select data.

# capture training and testing, predictors/factors/features
train_data = my_data_scaled[random_sampling, ]
test_data = my_data_scaled[-random_sampling, ]

# capture training and testing, responses
train_results = train_data[, 11]
test_results = test_data[, 11]
# capturing "known" responses is essential for SVM; this is the "supervised" part
# because SVM is a classifier OR supervised type of machine learning

# predictors/features/variables
x_train <- as.matrix(train_data)
x_test <- as.matrix(test_data)

# target/response
y_train <- as.factor(train_results)
y_test <- as.factor(test_results)

#results=list()
results <- vector(mode = "list", length = 1)
C_set_values <- vector(mode = "list", length = 1)
Accuracy_set_values <- vector(mode = "list", length = 1)
Kernel_set_values <- vector(mode = "list", length = 1)

i_index <- 1

df_of_values <-NA # initialize results df

# runs svm, returns result
func_C_val_test <-function(kernel_name, C_value,x,y,data_set_type)
{
  model <- ksvm(y~x,scaled=TRUE, type="C-svc", kernel= kernel_name, C=C_value, kpar="automatic")
  a <- colSums(model@xmatrix[[1]] * model@coef[[1]])
  a0 <- model@b * (-1)
  predict_y <- predict(model,x)
  qty_predict_is_actual <- sum(predict_y == y)
  total_observations <- nrow(my_data)
  match_predict <-  qty_predict_is_actual / total_observations
  C_set_values[i_index] <- C_value
  Accuracy_set_values[i_index] <- match_predict
  Kernel_set_values[i_index] <- kernel_name
```

```
  i_index <- i_index + 1

  df_of_values <- rbind(df_of_values,
                        data.frame("kernel_name"= kernel_name,
                                   c("C_value"=C_set_values[1],
                                     "match_predict" = Accuracy_set_values[1],
                                     "dataset"= data_set_type
                                   )
                        )
  )
  return(df_of_values)
}


test_range <-  c(0.000001, 0.00001, 0.0001, 0.001, 0.1, 1, 10, 100, 1000, 10000)
#class(test_range)
kernel_list <- c("rbfdot","polydot","vanilladot","tanhdot","laplacedot","besseldot","anovadot",
                 "splinedot")
#kernel_list <- c("rbfdot","polydot","vanilladot","tanhdot")

# run svm for each C and each kernel
for (kernel_name in kernel_list)
{
  for (C_value in test_range)
  {
    df_of_values <-func_C_val_test(kernel_name, C_value, x_train, y_train,"training")
  }
}
```

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```
df_of_values <- rbind(df_of_values,NA)

#results=list()
results <- vector(mode = "list", length = 1)
C_set_values <- vector(mode = "list", length = 1)
Accuracy_set_values <- vector(mode = "list", length = 1)
Kernel_set_values <- vector(mode = "list", length = 1)

i_index <- 1

# run svm for each C and each kernel
for (kernel_name in kernel_list)
{
  for (C_value in test_range)
  {
    df_of_values <-func_C_val_test(kernel_name, C_value, x_test, y_test,"Test")
  }
}
```

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```
df_of_values
```

```
##     kernel_name C_value match_predict  dataset
## 1          <NA>      NA            NA     <NA>
## 2        rbfdot   1e-06       0.37920 training
## 3        rbfdot   1e-05       0.37920 training
## 4        rbfdot   1e-04       0.37920 training
## 5        rbfdot   1e-03       0.37920 training
## 6        rbfdot   1e-01       0.68960 training
## 7        rbfdot   1e+00       0.69878 training
## 8        rbfdot   1e+01       0.69878 training
## 9        rbfdot   1e+02       0.69878 training
## 10       rbfdot   1e+03       0.69878 training
## 11       rbfdot   1e+04       0.69878 training
## 12      polydot   1e-06       0.37920 training
## 13      polydot   1e-05       0.37920 training
## 14      polydot   1e-04       0.37920 training
## 15      polydot   1e-03       0.67584 training
## 16      polydot   1e-01       0.69878 training
## 17      polydot   1e+00       0.69878 training
## 18      polydot   1e+01       0.69878 training
## 19      polydot   1e+02       0.69878 training
## 20      polydot   1e+03       0.69878 training
## 21      polydot   1e+04       0.69878 training
## 22   vanilladot   1e-06       0.37920 training
## 23   vanilladot   1e-05       0.37920 training
## 24   vanilladot   1e-04       0.37920 training
## 25   vanilladot   1e-03       0.67584 training
## 26   vanilladot   1e-01       0.69878 training
## 27   vanilladot   1e+00       0.69878 training
## 28   vanilladot   1e+01       0.69878 training
## 29   vanilladot   1e+02       0.69878 training
## 30   vanilladot   1e+03       0.69878 training
## 31   vanilladot   1e+04       0.69878 training
## 32      tanhdot   1e-06       0.37920 training
## 33      tanhdot   1e-05       0.37920 training
## 34      tanhdot   1e-04       0.37920 training
## 35      tanhdot   1e-03       0.37920 training
## 36      tanhdot   1e-01       0.64526 training
## 37      tanhdot   1e+00       0.65443 training
## 38      tanhdot   1e+01       0.64985 training
## 39      tanhdot   1e+02       0.63761 training
## 40      tanhdot   1e+03       0.64679 training
## 41      tanhdot   1e+04       0.64679 training
## 42   laplacedot   1e-06       0.37920 training
## 43   laplacedot   1e-05       0.37920 training
## 44   laplacedot   1e-04       0.37920 training
## 45   laplacedot   1e-03       0.37920 training
```

```
## 46   laplacedot   1e-01       0.68807 training
## 47   laplacedot   1e+00       0.69878 training
## 48   laplacedot   1e+01       0.69878 training
## 49   laplacedot   1e+02       0.69878 training
## 50   laplacedot   1e+03       0.69878 training
## 51   laplacedot   1e+04       0.69878 training
## 52    besseldot   1e-06       0.37920 training
## 53    besseldot   1e-05       0.37920 training
## 54    besseldot   1e-04       0.37920 training
## 55    besseldot   1e-03       0.37920 training
## 56    besseldot   1e-01       0.68349 training
## 57    besseldot   1e+00       0.69419 training
## 58    besseldot   1e+01       0.69878 training
## 59    besseldot   1e+02       0.69878 training
## 60    besseldot   1e+03       0.69878 training
## 61    besseldot   1e+04       0.69878 training
## 62     anovadot   1e-06       0.37920 training
## 63     anovadot   1e-05       0.37920 training
## 64     anovadot   1e-04       0.37920 training
## 65     anovadot   1e-03       0.50153 training
## 66     anovadot   1e-01       0.69878 training
## 67     anovadot   1e+00       0.69878 training
## 68     anovadot   1e+01       0.69878 training
## 69     anovadot   1e+02       0.69878 training
## 70     anovadot   1e+03       0.69878 training
## 71     anovadot   1e+04       0.69878 training
## 72    splinedot   1e-06       0.38685 training
## 73    splinedot   1e-05       0.40367 training
## 74    splinedot   1e-04       0.44648 training
## 75    splinedot   1e-03       0.69878 training
## 76    splinedot   1e-01       0.69878 training
## 77    splinedot   1e+00       0.69878 training
## 78    splinedot   1e+01       0.69878 training
## 79    splinedot   1e+02       0.69878 training
## 80    splinedot   1e+03       0.69878 training
## 81    splinedot   1e+04       0.69878 training
## 82         <NA>      NA            NA     <NA>
## 83       rbfdot   1e-06       0.16820     Test
## 84       rbfdot   1e-05       0.16820     Test
## 85       rbfdot   1e-04       0.16820     Test
## 86       rbfdot   1e-03       0.16820     Test
## 87       rbfdot   1e-01       0.29511     Test
## 88       rbfdot   1e+00       0.30122     Test
## 89       rbfdot   1e+01       0.30122     Test
## 90       rbfdot   1e+02       0.30122     Test
## 91       rbfdot   1e+03       0.30122     Test
## 92       rbfdot   1e+04       0.30122     Test
## 93      polydot   1e-06       0.16820     Test
## 94      polydot   1e-05       0.16820     Test
## 95      polydot   1e-04       0.16820     Test
## 96      polydot   1e-03       0.20183     Test
## 97      polydot   1e-01       0.30122     Test
## 98      polydot   1e+00       0.30122     Test
## 99      polydot   1e+01       0.30122     Test
```

```
## 100     polydot   1e+02       0.30122     Test
## 101     polydot   1e+03       0.30122     Test
## 102     polydot   1e+04       0.30122     Test
## 103  vanilladot   1e-06       0.16820     Test
## 104  vanilladot   1e-05       0.16820     Test
## 105  vanilladot   1e-04       0.16820     Test
## 106  vanilladot   1e-03       0.20183     Test
## 107  vanilladot   1e-01       0.30122     Test
## 108  vanilladot   1e+00       0.30122     Test
## 109  vanilladot   1e+01       0.30122     Test
## 110  vanilladot   1e+02       0.30122     Test
## 111  vanilladot   1e+03       0.30122     Test
## 112  vanilladot   1e+04       0.30122     Test
## 113     tanhdot   1e-06       0.16820     Test
## 114     tanhdot   1e-05       0.16820     Test
## 115     tanhdot   1e-04       0.16820     Test
## 116     tanhdot   1e-03       0.16820     Test
## 117     tanhdot   1e-01       0.27829     Test
## 118     tanhdot   1e+00       0.26147     Test
## 119     tanhdot   1e+01       0.27217     Test
## 120     tanhdot   1e+02       0.27064     Test
## 121     tanhdot   1e+03       0.26758     Test
## 122     tanhdot   1e+04       0.26758     Test
## 123  laplacedot   1e-06       0.16820     Test
## 124  laplacedot   1e-05       0.16820     Test
## 125  laplacedot   1e-04       0.16820     Test
## 126  laplacedot   1e-03       0.16820     Test
## 127  laplacedot   1e-01       0.29205     Test
## 128  laplacedot   1e+00       0.30122     Test
## 129  laplacedot   1e+01       0.30122     Test
## 130  laplacedot   1e+02       0.30122     Test
## 131  laplacedot   1e+03       0.30122     Test
## 132  laplacedot   1e+04       0.30122     Test
## 133   besseldot   1e-06       0.16820     Test
## 134   besseldot   1e-05       0.16820     Test
## 135   besseldot   1e-04       0.16820     Test
## 136   besseldot   1e-03       0.16820     Test
## 137   besseldot   1e-01       0.29205     Test
## 138   besseldot   1e+00       0.29969     Test
## 139   besseldot   1e+01       0.30122     Test
## 140   besseldot   1e+02       0.30122     Test
## 141   besseldot   1e+03       0.30122     Test
## 142   besseldot   1e+04       0.30122     Test
## 143    anovadot   1e-06       0.16820     Test
## 144    anovadot   1e-05       0.16820     Test
## 145    anovadot   1e-04       0.16820     Test
## 146    anovadot   1e-03       0.16820     Test
## 147    anovadot   1e-01       0.30122     Test
## 148    anovadot   1e+00       0.30122     Test
## 149    anovadot   1e+01       0.30122     Test
## 150    anovadot   1e+02       0.30122     Test
## 151    anovadot   1e+03       0.30122     Test
## 152    anovadot   1e+04       0.30122     Test
## 153   splinedot   1e-06       0.17737     Test
```

```
## 154   splinedot   1e-05       0.17737     Test
## 155   splinedot   1e-04       0.19878     Test
## 156   splinedot   1e-03       0.29664     Test
## 157   splinedot   1e-01       0.30122     Test
## 158   splinedot   1e+00       0.30122     Test
## 159   splinedot   1e+01       0.30122     Test
## 160   splinedot   1e+02       0.30122     Test
## 161   splinedot   1e+03       0.30122     Test
## 162   splinedot   1e+04       0.30122     Test
```