ECM2002 – Machine Learning Algorithms Lab L1+L2

Register Number:19BLC1186

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Lab Exercise No:1

Date:8/2/2021

Dataset: Carseats Dataset

Task: to plot accuracy

```
library(ISLR)
data(Carseats)
summary(Carseats)
```

```
##      Sales          CompPrice       Income        Advertising
##  Min.   : 0.000   Min.   : 77   Min.   : 21.00   Min.   : 0.000
##  1st Qu.: 5.390   1st Qu.:115   1st Qu.: 42.75   1st Qu.: 0.000
##  Median : 7.490   Median :125   Median : 69.00   Median : 5.000
##  Mean   : 7.496   Mean   :125   Mean   : 68.66   Mean   : 6.635
##  3rd Qu.: 9.320   3rd Qu.:135   3rd Qu.: 91.00   3rd Qu.:12.000
##  Max.   :16.270   Max.   :175   Max.   :120.00   Max.   :29.000
##    Population        Price        ShelveLoc        Age          Education
##  Min.   : 10.0   Min.   : 24.0   Bad   : 96   Min.   :25.00   Min.   :10.0
##  1st Qu.:139.0   1st Qu.:100.0   Good  : 85   1st Qu.:39.75   1st Qu.:12.0
##  Median :272.0   Median :117.0   Medium:219   Median :54.50   Median :14.0
##  Mean   :264.8   Mean   :115.8                Mean   :53.32   Mean   :13.9
##  3rd Qu.:398.5   3rd Qu.:131.0                3rd Qu.:66.00   3rd Qu.:16.0
##  Max.   :509.0   Max.   :191.0                Max.   :80.00   Max.   :18.0
##  Urban       US
##  No :118   No :142
##  Yes:282   Yes:258
##
##
##
##
```

```
names(Carseats)
```

```
##  [1] "Sales"       "CompPrice"   "Income"      "Advertising" "Population"
##  [6] "Price"       "ShelveLoc"   "Age"         "Education"   "Urban"
## [11] "US"
```

```
fix
```

```
## function (x, ...)
## {
##     subx <- substitute(x)
##     if (is.name(subx))
##         subx <- deparse(subx)
##     if (!is.character(subx) || length(subx) != 1L)
##         stop("'fix' requires a name")
##     parent <- parent.frame()
##     if (exists(subx, envir = parent, inherits = TRUE))
##         x <- edit(get(subx, envir = parent), title = subx, ...)
##     else {
##         x <- edit(function() {
##         }, title = subx, ...)
##         environment(x) <- .GlobalEnv
##     }
##     assign(subx, x, envir = .GlobalEnv)
## }
## <bytecode: 0x7fd3f1df5a98>
## <environment: namespace:utils>
```

```
data(Carseats)

str(Carseats)
```

```
## 'data.frame':    400 obs. of  11 variables:
##  $ Sales      : num  9.5 11.22 10.06 7.4 4.15 ...
##  $ CompPrice  : num  138 111 113 117 141 124 115 136 132 132 ...
##  $ Income     : num  73 48 35 100 64 113 105 81 110 113 ...
##  $ Advertising: num  11 16 10 4 3 13 0 15 0 0 ...
##  $ Population : num  276 260 269 466 340 501 45 425 108 131 ...
##  $ Price      : num  120 83 80 97 128 72 108 120 124 124 ...
##  $ ShelveLoc  : Factor w/ 3 levels "Bad","Good","Medium": 1 2 3 3 1 1 3 2 3 3 ...
##  $ Age        : num  42 65 59 55 38 78 71 67 76 76 ...
##  $ Education  : num  17 10 12 14 13 16 15 10 10 17 ...
##  $ Urban      : Factor w/ 2 levels "No","Yes": 2 2 2 2 2 1 2 2 1 1 ...
##  $ US         : Factor w/ 2 levels "No","Yes": 2 2 2 2 1 2 1 2 1 2 ...
```

```
#install.packages("e1071")
#install.packages("caTools")
#install.packages("class")

library(e1071)
library(caTools)
library(class)

data(Carseats)
head(Carseats)
```

```
##   Sales CompPrice Income Advertising Population Price ShelveLoc Age Education
## 1  9.50       138     73          11        276   120       Bad  42        17
## 2 11.22       111     48          16        260    83      Good  65        10
## 3 10.06       113     35          10        269    80    Medium  59        12
## 4  7.40       117    100           4        466    97    Medium  55        14
## 5  4.15       141     64           3        340   128       Bad  38        13
## 6 10.81       124    113          13        501    72       Bad  78        16
##   Urban  US
## 1   Yes Yes
## 2   Yes Yes
## 3   Yes Yes
## 4   Yes Yes
## 5   Yes  No
## 6    No Yes
```

```
split <- sample.split(Carseats, SplitRatio = 0.9)
train_cl <- subset(Carseats, split == "TRUE")
test_cl <- subset(Carseats, split == "FALSE")

train_scale <- scale(train_cl[, 1:4])
test_scale <- scale(test_cl[, 1:4])
train_scale
```

```
##             Sales    CompPrice       Income Advertising
## 1    0.7194402943  0.836149005  0.152158517  0.61517794
## 2    1.3225121739 -0.916498471 -0.740330641  1.36640044
## 3    0.9157892784 -0.786672732 -1.204425003  0.46493344
## 4   -0.0168683960 -0.527021254  1.116046808 -0.43653356
## 5   -1.1563937499  1.030887613 -0.169137579 -0.58677807
## 7   -0.2868482490 -0.656846993  1.294544640 -1.03751157
## 8    1.5434047810  0.706323266  0.437755048  1.21615594
## 9   -0.3184043358  0.446671788  1.473042471 -1.03751157
## 10  -0.9670572296  0.446671788  1.580141170 -1.03751157
## 12   1.5819733315 -0.527021254  0.901849410 -0.43653356
## 13  -1.2159996915 -0.202456907 -1.204425003 -0.73702257
## 14   1.2313501456 -0.656846993 -1.454321967  0.61517794
## 15   1.3049810147 -1.176149949  1.722939436  0.61517794
## 16   0.4424479775  1.550190569  0.937548977 -0.28628906
## 18   1.6976789828  1.420364830  0.187858084  0.91566694
## 19   2.2656885439 -0.981411341  1.473042471 -1.03751157
## 20   0.4494604412  0.251933179  0.259257216  1.36640044
## 21  -0.3639853499 -0.007718299  0.759051145 -0.73702257
## 23  -0.8303141871  0.187020310 -0.811729773 -0.13604456
## 24  -0.5533218703 -0.267369776 -1.347223268 -1.03751157
## 25   0.9438391332  1.290539091  1.794338568  1.36640044
## 26   2.6128054978  0.901061874 -1.311523702 -1.03751157
## 27   0.3092111669 -1.176149949  1.651540303  0.61517794
## 29  -1.5631166455 -1.435801427  0.187858084 -1.03751157
## 30   0.1268871102 -1.370888558  1.080347242  1.21615594
## 31   2.1394641970 -0.007718299  0.901849410 -1.03751157
## 32   0.2811613120  0.706323266 -0.383334977  1.36640044
## 34   0.4634853686 -0.721759863 -1.097326304  0.91566694
## 35  -1.6753160650 -0.656846993 -0.526133243 -1.03751157
## 36   1.2699186961  0.381758918  0.544853747  0.61517794
## 37   0.5055601509 -0.202456907  0.259257216 -1.03751157
## 38  -0.8758952013 -0.267369776 -0.990227605 -0.28628906
## 40  -1.4754608490  0.316846049 -0.311935845 -1.03751157
## 41  -1.8856899765 -0.397195515  1.044647676 -1.03751157
## 42   0.1794805881  2.069493525 -0.561832809 -1.03751157
## 43   1.0455198571 -3.123536034  0.009360252 -1.03751157
## 45  -1.1528875181 -2.604233078  0.366355915 -0.13604456
## 46  -1.0126382437  1.030887613 -0.204837146 -1.03751157
## 47   1.7502724607  0.122107440  0.759051145  1.06591144
## 48  -1.0757504172  0.057194571  1.044647676 -1.03751157
## 49  -1.2405433145 -0.591934124 -0.597532375 -1.03751157
## 51  -2.1135950473 -1.695452905 -1.311523702  1.66688945
## 52  -1.0617254898 -0.267369776  0.759051145 -1.03751157
## 53   0.1619494288  1.809842047 -1.025927171 -0.58677807
## 54  -0.1851675252 -1.046324210 -0.169137579  0.91566694
## 56  -0.2097111482  1.160713352  0.437755048 -0.28628906
## 57   1.5644421722  0.511584657  0.473454614 -1.03751157
## 58  -2.2924128720 -2.084930122  0.794750711 -1.03751157
## 59  -0.7111023039 -1.435801427  0.866149844  1.21615594
## 60  -0.7847331729 -0.462108385  0.080759385 -0.43653356
## 62  -0.0449182508 -1.305975688 -1.311523702 -1.03751157
## 63  -1.9733457729  0.901061874 -0.847429340 -1.03751157
## 64   0.3582984129 -0.397195515  0.687652012  0.46493344
## 65   0.1233808784 -1.630540036 -0.062038881  0.76542244
## 67   0.4915352235  0.122107440  0.830450278 -1.03751157
## 68   0.5476349332  0.057194571 -0.276236278  1.06591144
```

```
## 69   2.0833644872  1.550190569  0.009360252  1.96737845
## 70   0.1899992837  0.122107440 -0.347635411 -1.03751157
## 71   0.7054153669 -2.344581600  0.437755048  1.21615594
## 73  -0.6760399853 -0.656846993 -0.847429340 -1.03751157
## 74   1.8098784023 -0.462108385  0.759051145  0.46493344
## 75  -0.4376162190  1.615103439 -0.026339314 -0.28628906
## 76   0.3863482678 -2.409494470  1.508742038  2.41811195
## 78   0.0883185598 -0.462108385  0.080759385  0.76542244
## 79  -1.0582192579  0.576497527 -0.740330641 -0.88726707
## 80   0.5932159474  0.576497527 -0.062038881 -1.03751157
## 81   0.1970117474 -0.786672732  1.116046808  1.36640044
## 82   0.0252063863 -0.591934124  0.116458951 -1.03751157
## 84  -1.0617254898 -1.046324210 -1.168725437  0.01419994
## 85  -1.8295902667 -0.916498471 -1.561420666 -1.03751157
## 86   0.3582984129 -0.007718299  1.223145507 -1.03751157
## 87   0.4389417456  1.615103439  0.544853747  0.31468894
## 89  -0.3113918721 -0.527021254 -0.954528039  0.01419994
## 90   0.1759743563  0.187020310 -0.097738447 -0.58677807
## 91  -0.7426583906 -0.656846993 -1.668519365 -1.03751157
## 92  -0.9249824473 -1.825278644 -0.811729773  0.61517794
## 93  -1.0231569393 -0.721759863  1.580141170 -1.03751157
## 95   0.3302485580 -0.656846993  1.008948109 -0.28628906
## 96  -0.6550025942  0.576497527 -1.561420666  0.46493344
## 97   0.7124278306  1.420364830 -0.954528039  0.46493344
## 98   0.0006627633  2.329145003  0.473454614 -0.28628906
## 100 -0.9004388243 -0.267369776 -0.776030207 -0.58677807
## 101 -1.1704186774 -0.786672732  0.009360252  0.61517794
## 102 -0.4376162190  0.187020310  0.866149844 -1.03751157
## 103 -0.7531770862 -0.786672732 -1.668519365 -1.03751157
## 104 -0.8338204190 -0.137544037  0.794750711 -1.03751157
## 106 -0.6655212898 -1.370888558  1.116046808  0.16444444
## 107 -2.5553802614 -1.500714297 -1.275824136 -1.03751157
## 108  0.3863482678  0.576497527  1.365943772 -1.03751157
## 109 -1.3948175163 -1.176149949  0.366355915 -0.73702257
## 111  0.5441287014  0.187020310 -0.240536712  0.01419994
## 112 -0.2903544809  0.446671788  1.758639002  0.76542244
## 113 -0.2728233216 -0.591934124  1.080347242 -0.28628906
## 114 -0.5042346243  0.381758918 -1.418622401  0.61517794
## 115  0.6528218890 -0.202456907  0.651952446  0.31468894
## 117 -0.8303141871  0.641410396  0.223557650 -1.03751157
## 118  0.4740040642  1.290539091 -0.561832809 -1.03751157
## 119  0.0427375456 -0.851585602  0.687652012 -0.73702257
## 120 -0.0273870915  0.316846049  0.901849410  0.16444444
## 122  1.4802926076 -0.007718299  0.723351579  0.46493344
## 123 -0.1991924526 -0.397195515  1.116046808 -0.28628906
## 124  0.2601239209  0.122107440  1.223145507 -1.03751157
## 125  0.4985476872  0.381758918  1.580141170 -1.03751157
## 126  0.6633405846 -2.344581600  0.330656349 -1.03751157
## 128 -0.3254167995 -0.007718299 -0.740330641 -0.58677807
## 129 -0.8723889694  0.511584657  1.116046808 -0.58677807
## 130 -1.0441943305  1.160713352  1.830038135  0.01419994
## 131  0.3372610217 -2.020017253  0.544853747  0.91566694
## 133  0.7334652217 -0.007718299  0.651952446  0.31468894
## 134  0.0602687049  0.446671788  1.044647676 -0.73702257
## 135 -1.3246928791  0.446671788 -1.347223268 -1.03751157
## 136 -0.3534666544 -1.890191514  0.901849410  1.06591144
## 137 -0.7987581004  0.381758918  0.223557650 -1.03751157
## 139  0.9894201474 -0.007718299  1.223145507  0.76542244
```

```
## 140  1.7011852147  1.355451961 -0.240536712  0.46493344
## 141 -0.4972221606  0.511584657 -0.311935845  0.46493344
## 142 -0.3219105676  0.965974744 -0.954528039 -1.03751157
## 144 -2.4256496827 -0.202456907  0.687652012  0.01419994
## 145  0.5756847881  0.446671788 -0.026339314 -1.03751157
## 146  0.4634853686  1.225626222 -0.204837146  0.61517794
## 147 -1.2440495464 -0.721759863  0.509154181 -1.03751157
## 148  1.0735697120  0.965974744 -0.526133243  0.31468894
## 150  1.4136742023 -0.267369776  1.830038135  0.91566694
## 151  1.0665572483 -0.202456907  0.544853747  0.16444444
## 152  1.1647317403 -0.916498471 -0.383334977  1.51664494
## 153  0.0672811686  0.187020310  0.330656349 -1.03751157
## 155 -0.1956862207  0.251933179  0.009360252  0.46493344
## 156  0.0918247917 -1.760365775  0.116458951 -1.03751157
## 157  0.0146876908  1.355451961 -1.240124569 -1.03751157
## 158  0.9683827563 -0.267369776 -0.383334977  0.16444444
## 159  1.7818285474  1.095800483  0.759051145 -0.88726707
## 161 -0.9740696933 -0.916498471 -1.454321967 -1.03751157
## 162 -1.5841540366  1.160713352 -1.704218931 -0.28628906
## 163 -1.3387178066 -0.202456907  0.187858084 -1.03751157
## 164 -0.6199402756  0.316846049 -0.169137579 -1.03751157
## 166 -2.4817493924  1.420364830 -0.383334977  0.01419994
## 167 -0.2587983942 -0.397195515 -0.062038881  1.51664494
## 168 -0.2587983942 -1.241062819  0.152158517 -1.03751157
## 169 -0.0519307145  0.251933179  0.723351579 -1.03751157
## 170  1.4136742023 -1.370888558 -0.990227605  1.21615594
## 172  1.7678036200 -2.084930122  1.330244206  0.76542244
## 173  0.5546473970 -1.370888558  1.187445941  0.91566694
## 174 -0.3745040455  0.641410396  0.794750711 -0.28628906
## 175 -2.6114799712  0.901061874 -1.597120232 -1.03751157
## 177 -0.6444838986  0.836149005  1.365943772  0.31468894
## 178  1.0630510164  0.836149005  0.116458951 -1.03751157
## 179  1.1261631899 -1.370888558  0.080759385  1.06591144
## 180  0.1163684147  1.225626222 -1.561420666 -0.58677807
## 181 -0.8794014331  0.771236135  1.544441604  1.21615594
## 183 -0.9495260703  0.771236135 -0.311935845 -0.43653356
## 184 -0.7461646225 -0.462108385  0.187858084 -0.13604456
## 185  0.8772207279  0.446671788 -1.275824136  0.01419994
## 186  0.9192955102  0.316846049  1.116046808  0.61517794
## 188 -0.4972221606 -0.527021254 -1.311523702 -1.03751157
## 189  0.2180491386 -0.591934124 -1.133025870 -1.03751157
## 190  1.6345668093 -0.462108385  1.722939436  1.66688945
## 191  0.4704978324  0.316846049 -1.133025870  0.91566694
## 192 -0.2728233216  2.004580656 -0.954528039  0.91566694
## 194  2.0447959368  0.901061874  0.045059818  0.01419994
## 195 -0.0764743375 -0.851585602  1.044647676  1.66688945
## 196 -1.1423688225 -0.527021254  0.866149844 -0.43653356
## 197 -1.1739249092  0.316846049 -1.454321967 -0.13604456
## 199 -1.3422240384 -0.851585602  0.402055482 -0.28628906
## 200 -0.3604791181 -0.202456907  0.687652012 -0.28628906
## 201 -0.6620150579  1.225626222  0.830450278 -1.03751157
## 202 -0.5287782473  0.836149005  0.509154181 -1.03751157
## 203 -1.1739249092 -0.267369776  0.330656349 -0.43653356
## 205  0.4529666731  1.939667786  0.402055482 -1.03751157
## 206 -0.6199402756 -0.786672732 -1.668519365 -0.88726707
## 207 -0.8688827375  2.394057873 -0.062038881 -1.03751157
## 208  0.2601239209 -0.916498471  1.294544640 -1.03751157
## 210 -1.5525979499 -1.760365775 -1.704218931  0.61517794
```

```
## 211 -1.0827628809 -0.007718299 -0.990227605 -0.73702257
## 212  0.6808717439 -0.527021254  1.758639002  1.06591144
## 213  1.6100231863  1.290539091  0.009360252  1.81713395
## 214  0.2741488483  1.550190569  0.544853747 -0.28628906
## 216 -1.7910217163 -0.591934124  0.509154181  1.21615594
## 217 -0.6024091163  1.030887613 -1.275824136 -1.03751157
## 218 -1.0897753446 -1.241062819 -0.883128906 -1.03751157
## 219  0.7895649315  0.836149005 -0.276236278  0.76542244
## 221  1.1016195669  0.381758918  1.830038135  1.21615594
## 222 -0.3569728862 -0.072631168 -0.883128906 -1.03751157
## 223  0.0146876908  0.706323266  1.794338568 -0.13604456
## 224 -1.4018299800 -0.981411341 -0.847429340  0.31468894
## 225 -1.1739249092  0.576497527  0.473454614 -1.03751157
## 227  0.1233808784 -0.397195515 -1.275824136 -1.03751157
## 228  0.4354355138 -0.786672732 -0.169137579  0.46493344
## 229 -0.7181147676  1.550190569  0.152158517  0.91566694
## 230  1.3119934784 -1.760365775  1.258845074 -1.03751157
## 232  0.2250616023  0.446671788  0.009360252 -1.03751157
## 233  1.9957086908  0.771236135  0.402055482  0.46493344
## 234  0.4214105863 -0.137544037  0.259257216  1.66688945
## 235  0.6948966713 -0.656846993 -0.240536712  0.61517794
## 236 -0.6725337535  0.057194571 -1.311523702  0.16444444
## 238  0.7615150766  1.680016308 -1.454321967  0.16444444
## 239 -0.0308933234 -0.267369776 -1.597120232 -1.03751157
## 240 -1.2475557782 -0.137544037  1.294544640 -1.03751157
## 241  1.0034450748  2.199319264  0.402055482 -1.03751157
## 243 -0.9705634614 -0.072631168 -0.811729773 -1.03751157
## 244  0.1303933421 -0.072631168 -1.561420666  0.91566694
## 245  0.4669916005  0.316846049 -1.382922835 -1.03751157
## 246  0.8947518872 -0.721759863 -0.918828472 -1.03751157
## 247 -0.1921799889 -0.332282646 -0.454734110  1.96737845
## 249 -0.7321396951 -0.916498471 -0.597532375 -1.03751157
## 250 -0.8408328827 -0.007718299 -0.062038881 -1.03751157
## 251  0.6002284111  0.771236135  1.294544640  0.46493344
## 252 -1.3071617198  0.901061874  1.508742038 -0.28628906
## 254 -0.6339652030 -0.072631168 -1.597120232 -0.28628906
## 255  0.7474901492 -1.111237080  1.258845074  2.41811195
## 256  0.0918247917 -0.137544037  0.437755048  0.16444444
## 257 -1.1388625906  1.420364830 -1.025927171 -1.03751157
## 258  0.4284230501 -0.007718299 -0.240536712  1.06591144
## 260 -0.8162892597 -0.137544037 -1.168725437  0.46493344
## 261  0.0777998642  0.251933179  1.722939436  0.16444444
## 262 -0.6094215800 -0.267369776 -0.954528039 -0.43653356
## 263 -0.3780102774 -0.332282646  0.294956783  1.21615594
## 265 -0.1746488296  0.187020310 -1.418622401 -0.28628906
## 266 -0.7496708544  0.316846049 -1.204425003  0.46493344
## 267  0.5791910200  0.187020310  0.866149844  0.76542244
## 268 -0.5673467977  0.576497527  0.473454614  0.01419994
## 269 -0.3219105676 -0.137544037 -0.419034544 -1.03751157
## 271  1.5924920270 -0.397195515 -1.525721100 -1.03751157
## 272 -1.0161444756 -0.916498471 -0.454734110 -1.03751157
## 273  1.9396089810 -0.786672732 -1.275824136 -1.03751157
## 274  0.9087768147 -0.591934124  1.330244206  0.16444444
## 276 -0.2728233216 -1.176149949  1.794338568  0.61517794
## 277 -0.1816612933  0.641410396  0.009360252  1.06591144
## 278  0.1233808784  0.706323266 -0.740330641  0.76542244
## 279 -0.0799805694 -0.721759863  1.580141170 -0.73702257
## 280 -1.4123486756  1.030887613 -0.419034544  0.91566694
```

```
## 282  1.3119934784 -0.202456907  0.009360252  0.01419994
## 283  0.1023434872  1.615103439  0.973248543 -1.03751157
## 284 -0.7321396951  0.641410396  1.473042471 -1.03751157
## 285 -0.1676363659 -1.241062819 -0.811729773  0.61517794
## 287  0.0287126182 -0.527021254  1.758639002  0.61517794
## 288 -0.1991924526 -1.955104383 -0.883128906 -0.43653356
## 289 -0.1641301340 -0.591934124 -1.025927171 -1.03751157
## 290  0.4564729049  1.160713352  0.294956783  2.71860095
## 291  0.7159340624 -1.176149949  1.508742038  1.06591144
## 293  1.5328860855 -0.786672732 -0.097738447  1.36640044
## 294  1.3435495651 -0.137544037  0.544853747 -1.03751157
## 295  1.8274095616  1.485277700  0.259257216 -0.58677807
## 296 -1.1353563588 -0.462108385 -1.204425003  1.06591144
## 298 -1.5350667906 -0.462108385  0.509154181  0.91566694
## 299  1.2383626093  1.485277700 -0.204837146 -1.03751157
## 300  0.6843779757  0.641410396 -1.025927171  1.51664494
## 301  0.3933607315 -0.591934124  0.330656349 -0.88726707
## 302 -0.0133621641 -1.695452905  0.866149844 -1.03751157
## 304  0.8982581191  0.511584657 -0.597532375  1.36640044
## 305  1.5714546359 -0.137544037  1.044647676  0.76542244
## 306  0.2040242111 -0.656846993 -1.418622401  2.86884545
## 307 -0.9355011428  0.381758918 -1.311523702 -0.88726707
## 309  0.6282782660  0.057194571  0.402055482  1.81713395
## 310  1.3084872465  0.381758918  1.508742038  0.91566694
## 311  0.7299589899  3.237925176 -0.133438013  3.31957895
## 312 -0.4551473783  1.355451961 -0.026339314  0.76542244
## 313 -0.2272423075  0.771236135  1.722939436 -0.28628906
## 315  0.0953310235  0.511584657 -1.275824136  0.46493344
## 316 -0.3709978136  0.381758918 -1.704218931  0.16444444
## 317  2.8687604235 -0.202456907 -1.168725437 -0.28628906
## 318 -0.3639853499  1.095800483 -1.382922835 -1.03751157
## 320 -0.1676363659  0.122107440 -0.847429340  1.81713395
## 321 -0.5568281021  0.706323266  0.045059818  0.76542244
## 322  0.0252063863 -0.137544037 -1.061626738 -0.28628906
## 323  0.6002284111  0.965974744 -0.668931508  0.46493344
## 324  1.0209762341 -1.176149949  1.294544640  1.66688945
## 326  1.4908113032  1.225626222  0.009360252  0.61517794
## 327 -0.9670572296  0.511584657 -1.382922835 -1.03751157
## 328 -0.4270975234 -0.851585602 -1.097326304  1.51664494
## 329 -1.5070169358 -0.527021254 -0.097738447 -0.88726707
## 331 -0.8618702738 -0.202456907 -0.347635411 -1.03751157
## 332  0.9298142058  0.641410396 -0.204837146  1.21615594
## 333 -0.5989028844 -1.241062819 -1.275824136  1.96737845
## 334 -0.5533218703  0.706323266 -0.311935845  0.01419994
## 335  0.0637749368 -2.084930122  1.722939436  0.31468894
## 337 -0.7987581004  0.836149005 -1.204425003 -0.13604456
## 338  0.4073856589  0.316846049 -1.097326304 -1.03751157
## 339 -0.5182595517 -0.851585602 -1.597120232 -1.03751157
## 340  1.4347115934  0.576497527 -0.883128906 -0.43653356
## 342 -0.0238808597 -1.760365775  1.830038135 -1.03751157
## 343  0.1268871102  0.771236135  1.187445941  0.91566694
## 344 -0.5112470880 -0.527021254 -0.954528039  0.46493344
## 345  0.3442734855  0.836149005  0.402055482 -1.03751157
## 346 -0.9249824473 -0.267369776 -0.026339314 -1.03751157
## 348 -0.1991924526 -1.890191514 -1.061626738 -1.03751157
## 349  1.7958534748  0.446671788  1.187445941  1.96737845
## 350  0.6563281209  0.576497527 -1.490021533  1.66688945
## 351  0.4179043545 -0.916498471  1.151746375  1.51664494
```

```
## 353  2.1008956465  0.511584657  1.223145507  1.06591144
## 354  0.7019091350 -1.176149949 -0.062038881  0.76542244
## 355 -0.7531770862  0.511584657 -1.347223268 -0.88726707
## 356 -0.1501052066  0.316846049  1.116046808 -1.03751157
## 357 -1.3562489659  1.095800483  1.437342905 -1.03751157
## 359 -1.1493812862 -0.137544037  0.973248543  0.46493344
## 360 -1.5140293995  0.316846049 -0.240536712  0.61517794
## 361  0.4634853686 -0.462108385  0.616252880  0.01419994
## 362  0.4319292819  0.381758918 -1.561420666  0.46493344
## 364  0.9859139155 -0.916498471  0.223557650 -0.88726707
## 365  1.0700634801 -0.202456907 -1.704218931  1.36640044
## 366 -0.3219105676  1.874754917 -1.382922835 -1.03751157
## 367 -0.5147533198 -0.072631168 -0.454734110  0.61517794
## 368  2.4269752093 -1.955104383  1.330244206 -1.03751157
## 370  0.9859139155  0.641410396  1.116046808  2.26786745
## 371  0.0813060961  0.057194571 -0.990227605  2.26786745
## 372  0.5721785563  1.744929178  0.437755048 -1.03751157
## 373  0.1233808784 -0.267369776 -0.668931508 -1.03751157
## 375  0.6984029032  0.381758918 -0.776030207  0.01419994
## 376  0.1584431970  0.446671788 -0.811729773 -0.43653356
## 377  3.0931592624  1.030887613 -0.311935845  1.81713395
## 378 -0.2237360756  0.446671788 -0.276236278 -1.03751157
## 379 -0.4691723057  0.511584657  0.687652012 -0.58677807
## 381  0.7685275403 -1.241062819 -0.169137579  0.46493344
## 382 -1.2440495464 -0.072631168 -0.133438013  2.11762295
## 383 -0.8758952013 -0.267369776 -1.454321967  1.81713395
## 384  0.6668468164 -1.760365775  1.722939436 -1.03751157
## 386 -0.5533218703  0.381758918  0.152158517  0.91566694
## 387 -0.7461646225  1.744929178  1.687239869 -1.03751157
## 388  0.4284230501  1.095800483  0.152158517  1.06591144
## 389  0.2425927616  0.641410396  0.723351579  0.61517794
## 390  0.3477797173  0.187020310 -0.954528039  0.16444444
## 392 -0.4726785375  1.809842047 -0.204837146 -1.03751157
## 393 -1.0231569393  0.251933179 -0.954528039  0.91566694
## 394 -0.6585088260 -1.046324210 -0.633231942  0.46493344
## 395 -0.7356459269  0.316846049 -0.383334977  1.81713395
## 397 -0.4586536101  0.901061874 -1.632819799 -0.58677807
## 398 -0.0133621641  2.394057873 -1.525721100  0.76542244
## 399 -0.5287782473 -1.630540036  0.366355915  0.01419994
## 400  0.7930711633  0.576497527 -1.133025870 -1.03751157
## attr(,"scaled:center")
##       Sales   CompPrice      Income Advertising
##    7.448110  125.118902   68.737805    6.905488
## attr(,"scaled:scale")
##       Sales   CompPrice      Income Advertising
##    2.852065   15.405266   28.011545    6.655818
```

```
classifier_knn <- knn(train = train_scale,
                      test = test_scale,
                      cl = train_cl$Urban,
                      k = 1)
classifier_knn
```

```
##  [1] Yes Yes Yes Yes No  Yes Yes Yes Yes Yes Yes Yes Yes No  Yes No  Yes Yes Yes
## [20] Yes Yes Yes Yes Yes Yes Yes No  Yes No  Yes No  Yes Yes No  No  No  No  Yes
## [39] Yes Yes Yes Yes No  Yes Yes Yes No  Yes Yes Yes Yes Yes Yes No  Yes No  Yes
## [58] No  Yes Yes Yes No  Yes Yes Yes Yes Yes No  No  Yes No  Yes
## Levels: No Yes
```

```
cm <- table(test_cl$Urban, classifier_knn)
cm
```

```
##      classifier_knn
##       No Yes
##   No   7  15
##   Yes 12  38
```

```
misClassError <- mean(classifier_knn != test_cl$Urban)
print(paste('Accuracy =', 1-misClassError))
```

```
## [1] "Accuracy = 0.625"
```

```
accuracies <- vector()

for(i in 1:20){
  print(paste("For k = ",i))
  classifier_knn <- knn(train = train_scale,
                        test = test_scale,
                        cl = train_cl$Urban,
                        k = i)
  misClassError <- mean(classifier_knn != test_cl$Urban)
  print(paste('Accuracy =', 1-misClassError))
  accuracies[i] <- 1-misClassError
}
```

```
## [1] "For k =  1"
## [1] "Accuracy = 0.625"
## [1] "For k =  2"
## [1] "Accuracy = 0.597222222222222"
## [1] "For k =  3"
## [1] "Accuracy = 0.694444444444444"
## [1] "For k =  4"
## [1] "Accuracy = 0.625"
## [1] "For k =  5"
## [1] "Accuracy = 0.736111111111111"
## [1] "For k =  6"
## [1] "Accuracy = 0.694444444444444"
## [1] "For k =  7"
## [1] "Accuracy = 0.680555555555556"
## [1] "For k =  8"
## [1] "Accuracy = 0.694444444444444"
## [1] "For k =  9"
## [1] "Accuracy = 0.722222222222222"
## [1] "For k =  10"
## [1] "Accuracy = 0.680555555555556"
## [1] "For k =  11"
## [1] "Accuracy = 0.680555555555556"
## [1] "For k =  12"
## [1] "Accuracy = 0.708333333333333"
## [1] "For k =  13"
## [1] "Accuracy = 0.694444444444444"
## [1] "For k =  14"
## [1] "Accuracy = 0.722222222222222"
## [1] "For k =  15"
## [1] "Accuracy = 0.708333333333333"
## [1] "For k =  16"
## [1] "Accuracy = 0.708333333333333"
## [1] "For k =  17"
## [1] "Accuracy = 0.694444444444444"
## [1] "For k =  18"
## [1] "Accuracy = 0.694444444444444"
## [1] "For k =  19"
## [1] "Accuracy = 0.694444444444444"
## [1] "For k =  20"
## [1] "Accuracy = 0.708333333333333"
```

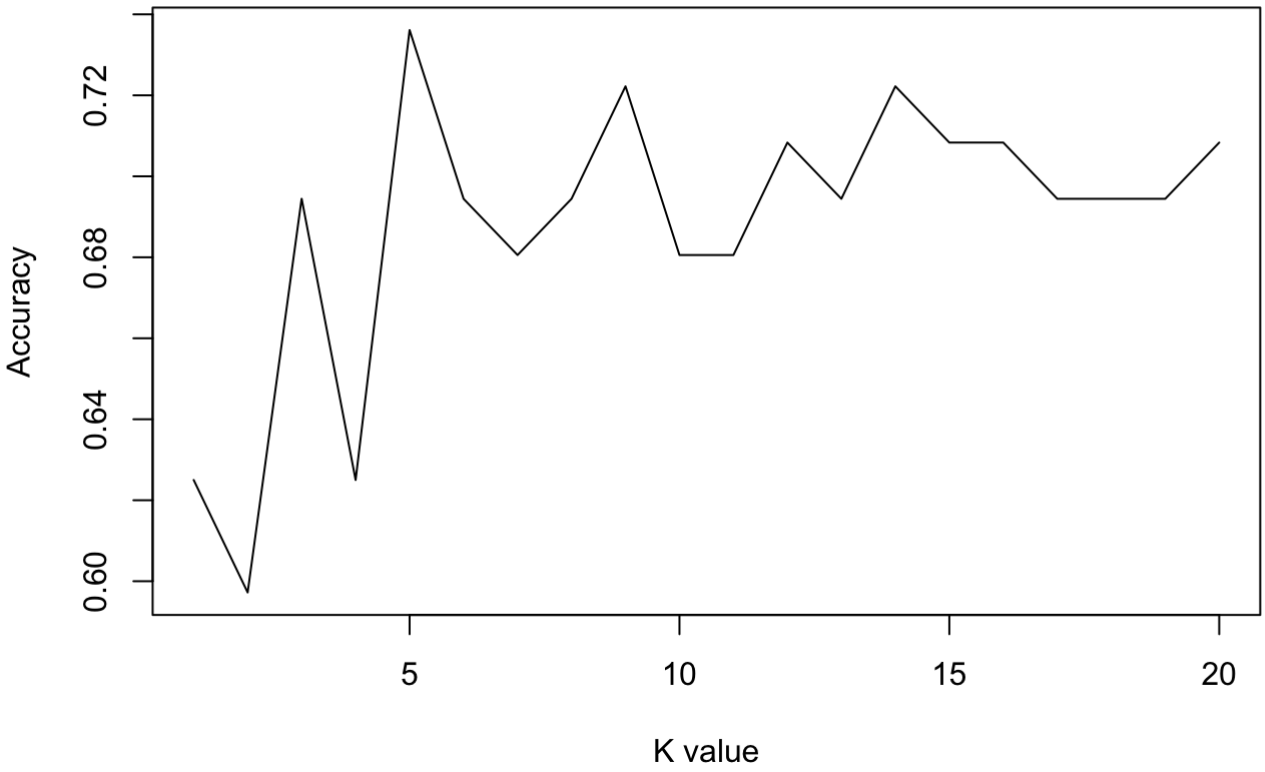
```
print(accuracies)
```

```
##  [1] 0.6250000 0.5972222 0.6944444 0.6250000 0.7361111 0.6944444 0.6805556
##  [8] 0.6944444 0.7222222 0.6805556 0.6805556 0.7083333 0.6944444 0.7222222
## [15] 0.7083333 0.7083333 0.6944444 0.6944444 0.6944444 0.7083333
```

```
print(1:20)
```

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

```
plot(1:20,accuracies,ylab="Accuracy",xlab="K value", type='l')
```


Accuracy
0.60
0.64
0.68
0.72
5
10
15
20
K value