Sharat_Sripada_HW8.R

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#
#      Course: IST-687
#      Name: Sharat Sripada
#      Homework #8
#      Due Date: 3/8/2020
#      Date Submitted: 3/7/2020
#      Topic: Making predictions

library("gdata")

## gdata: read.xls support for 'XLS' (Excel 97-2004) files ENABLED.

##

## gdata: read.xls support for 'XLSX' (Excel 2007+) files ENABLED.

##
## Attaching package: 'gdata'

## The following object is masked from 'package:stats':
##
##     nobs

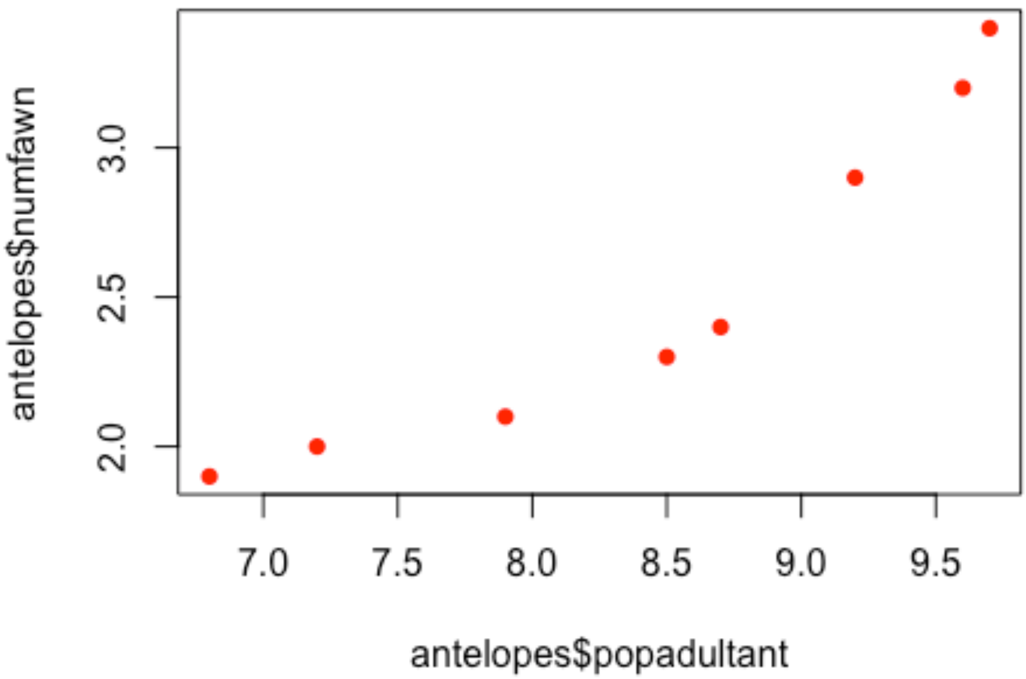
## The following object is masked from 'package:utils':
##
##     object.size

## The following object is masked from 'package:base':
##
##     startsWith

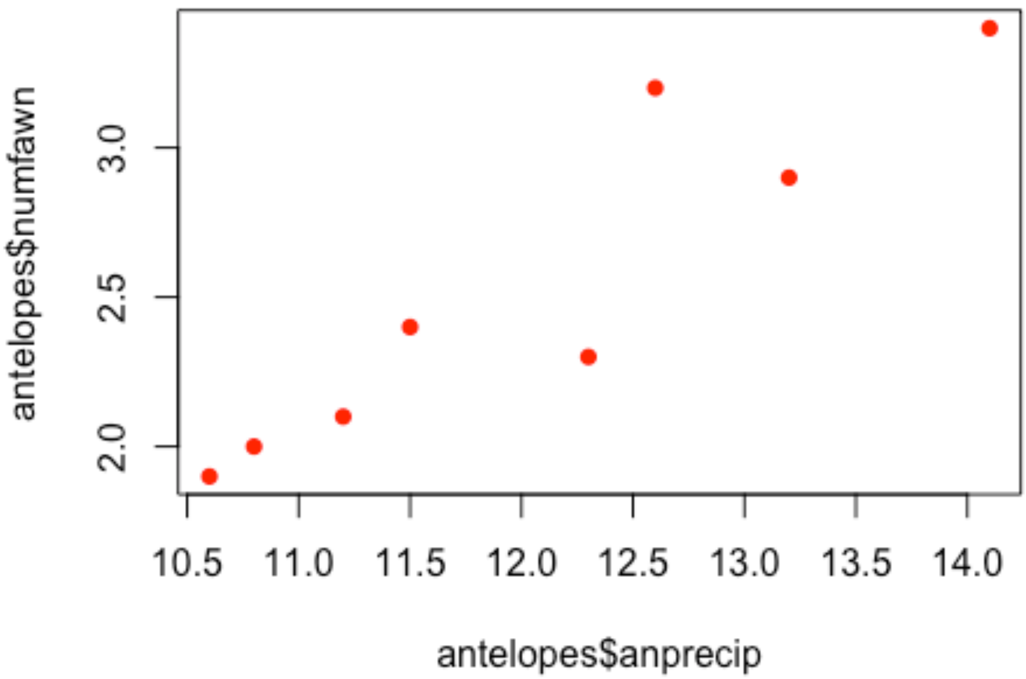
# Step-1: Read the xls
antelopes <- read.xls("/Users/ssharat/Downloads/mlr01_2_2_2_2_2_2.xlsx")
summary(antelopes)

##        X1              X2              X3              X4       
##  Min.   :1.900   Min.   :6.800   Min.   :10.60   Min.   :1.000  
##  1st Qu.:2.075   1st Qu.:7.725   1st Qu.:11.10   1st Qu.:2.000  
##  Median :2.350   Median :8.600   Median :11.90   Median :3.000  
##  Mean   :2.525   Mean   :8.450   Mean   :12.04   Mean   :2.875  
##  3rd Qu.:2.975   3rd Qu.:9.300   3rd Qu.:12.75   3rd Qu.:3.250  
##  Max.   :3.400   Max.   :9.700   Max.   :14.10   Max.   :5.000
```

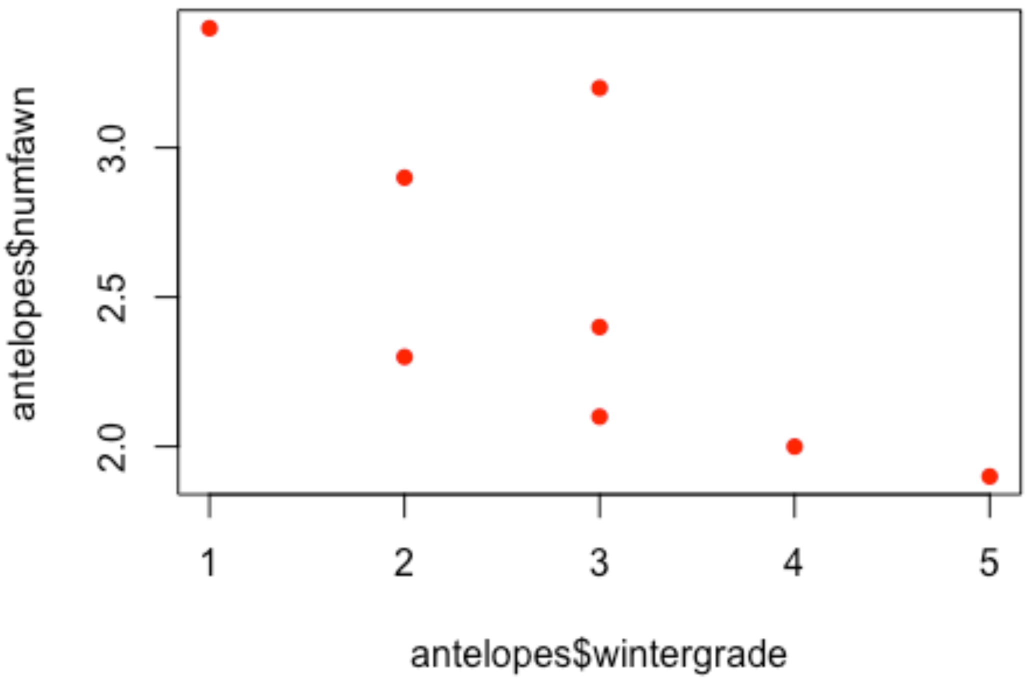
```r
View(antelopes)

# Step-2: Rename the columns:
# X1 -> numfawn
# X2 -> popadultant
# X3 -> anprecip
# X4 -> wintergrade
colnames(antelopes) <- c('numfawn', 'popadultant', 'anprecip', 'wintergrade')
colnames(antelopes)

## [1] "numfawn"     "popadultant" "anprecip"    "wintergrade"

# Step-3: str()
str(antelopes)

## 'data.frame':    8 obs. of  4 variables:
##  $ numfawn    : num  2.9 2.4 2 2.3 3.2 ...
##  $ popadultant: num  9.2 8.7 7.2 8.5 9.6 ...
##  $ anprecip   : num  13.2 11.5 10.8 12.3 12.6 ...
##  $ wintergrade: int  2 3 4 2 3 5 1 3

# Step-4: Create bivariate plots
# baby fawns vs adult antelope population
# pch: point character - 15: square, 16: circle etc
# col: color
plot(antelopes$popadultant, antelopes$numfawn, pch=16, col='red')
```




```
# baby fawns versus precipitation
plot(antelopes$anprecip, antelopes$numfawn, pch=16, col='red')
```




```r
# baby fawns versus severity of winter
plot(antelopes$wintergrade, antelopes$numfawn, pch=16, col='red')
```




```
# Step-5: Create 3 regression models
# Model-1: predict the number of fawns from the severity of the winter
model1 <- lm(formula=numfawn ~ wintergrade, data=antelopes)
summary(model1)

##
## Call:
## lm(formula = numfawn ~ wintergrade, data = antelopes)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.52069 -0.20431 -0.00172  0.13017  0.71724
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.4966     0.3904   8.957 0.000108 ***
## wintergrade  -0.3379     0.1258  -2.686 0.036263 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.415 on 6 degrees of freedom
## Multiple R-squared:  0.5459, Adjusted R-squared:  0.4702
## F-statistic: 7.213 on 1 and 6 DF,  p-value: 0.03626
```

```r
summary(model1)$r.squared

## [1] 0.5458886

# Summary for model1:
# Co-efficients:
# wintergrade P-val: 0.0362 < 0.05
# R-square: 0.5459 (which shows not very strong correlation)
# numfawn(Y) = -0.3379 * wintergrade(X) + 3.4966
test <- data.frame(wintergrade=2)
predict(model1, test, type="response")

##       1
## 2.82069

# Prediction: 2.82 (actual-data: 2.9, 2.3)

# Model-2: predict the number of fawns from the severity of the winter and
precipitation
model2 <- lm(formula=numfawn ~ wintergrade + anprecip, data=antelopes)
summary(model2)

##
## Call:
## lm(formula = numfawn ~ wintergrade + anprecip, data = antelopes)
##
## Residuals:
##         1         2         3         4         5         6         7
8
## -0.165458  0.188313  0.006417 -0.193358  0.289080 -0.193312 -0.010695
0.079013
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -5.7791     2.2139  -2.610  0.04765 *
## wintergrade   0.2269     0.1490   1.522  0.18842
## anprecip      0.6357     0.1511   4.207  0.00843 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2133 on 5 degrees of freedom
## Multiple R-squared:    0.9,  Adjusted R-squared:   0.86
## F-statistic: 22.49 on 2 and 5 DF,  p-value: 0.003164

summary(model2)$r.squared

## [1] 0.8999734

# Summary for model2:
# Co-efficients:
# wintergrade P-val: 0.18843 > 0.1
# anprecip P-val: 0.00843 < 0.01
```

```r
# R-square: 0.9 (which shows strong correlation)
test <- data.frame(wintergrade=2, anprecip=13.2)
predict(model2, test, type="response")

##        1
## 3.065458

# Prediction: 3.06 (actual-data: 2.9)

# Model-3: predict the number of fawns from the severity of the winter,
precipitation, adult population
model3 <- lm(formula=numfawn ~ wintergrade + anprecip + popadultant,
data=antelopes)
summary(model3)

##
## Call:
## lm(formula = numfawn ~ wintergrade + anprecip + popadultant,
##     data = antelopes)
##
## Residuals:
##        1        2        3        4        5        6        7        8
## -0.11533 -0.02661  0.09882 -0.11723  0.02734 -0.04854  0.11715  0.06441
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.92201    1.25562  -4.716   0.0092 **
## wintergrade  0.26295    0.08514   3.089   0.0366 *
## anprecip     0.40150    0.10990   3.653   0.0217 *
## popadultant  0.33822    0.09947   3.400   0.0273 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1209 on 4 degrees of freedom
## Multiple R-squared:  0.9743, Adjusted R-squared:  0.955
## F-statistic: 50.52 on 3 and 4 DF,  p-value: 0.001229

summary(model3)$r.squared

## [1] 0.9742884

# Summary for model3:
# Co-efficients:
# wintergrade P-val: 0.0466 < 0.05
# anprecip P-val: 0.0217 < 0.05
# popadultant P-val: 0.0273 < 0.05
# R-square: 0.973 (which shows very strong correlation)
test <- data.frame(wintergrade=2, anprecip=13.2, popadultant=9.2)
predict(model1, test, type="response")
```

```
##       1
## 2.82069

# Prediction: 2.82 (actual-data: 2.9)

# So, the best model here model-3 - theoretical & prediction is very close.

# Step-5: Parsimonious model using the step() function
model <- lm(formula=numfawn ~ ., data=antelopes)
step(model, data=antelopes, direction="backward")

## Start:  AIC=-31.35
## numfawn ~ popadultant + anprecip + wintergrade
##
##                 Df Sum of Sq      RSS     AIC
## <none>                       0.058494 -31.346
## - wintergrade  1   0.13950 0.197989 -23.592
## - popadultant  1   0.16907 0.227561 -22.478
## - anprecip     1   0.19518 0.253673 -21.609

##
## Call:
## lm(formula = numfawn ~ popadultant + anprecip + wintergrade,
##     data = antelopes)
##
## Coefficients:
## (Intercept)  popadultant     anprecip  wintergrade
##     -5.9220       0.3382       0.4015       0.2629

# The step() function showed a single iteration
# with all three variables - wintergrade, popadultant, anprecip.
```