assignment 6

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```
#puudata.xls is used in every exercise
#clear memory
rm(list = ls())
setwd("C:/Users/oyeda/Desktop/R_COURSE/assignment6")
#load the data
data<-read.table("puudata.txt", header = T, sep = "\t")
```

Exercise 1

- Construct a linear height model for spruces (PUULAJI = 2) in the - first canopy cover layer. Use
- diameter (LPM) as an explanatory variable. Report the model's - - parameters, coefficient of
- determination, and residual error. Report also the p-value of the - explanatory variable.

```
spruceCanopy1 <- subset(data, data$PUULAJI==2 & data$LATVKERROS==1)
lm_fit = lm(formula= PITUUS~LPM, data=spruceCanopy1)
summary(lm_fit)
```

```
##
## Call:
## lm(formula = PITUUS ~ LPM, data = spruceCanopy1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -298.656  -16.420   -1.221   17.060  114.284
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 31.726999   1.414875   22.42   <2e-16 ***
## LPM          0.676181   0.006779   99.75   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 27.77 on 1709 degrees of freedom
## Multiple R-squared:  0.8534, Adjusted R-squared:  0.8533
## F-statistic:  9950 on 1 and 1709 DF,  p-value: < 2.2e-16
```

```
names(lm_fit)
```

```
##  [1] "coefficients"  "residuals"     "effects"       "rank"
##  [5] "fitted.values" "assign"        "qr"            "df.residual"
##  [9] "xlevels"       "call"          "terms"         "model"
```

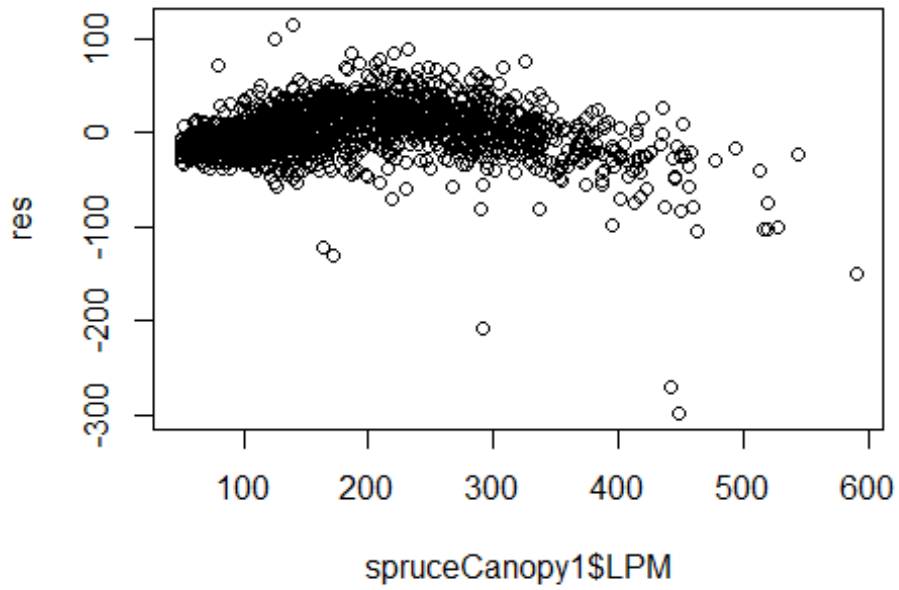
- Parameters: "LPM" and "intercept"
- coefficient of determination: 0.8534
- p-value: < 2.2e-16

Exercise 2

Exercise 1 continues.

- **Plot the model's residual error as a function of diameter.**
- **Does the variance change as diameter grows?**

```
res =residuals(lm_fit)
plot(res~ spruceCanopy1$LPM)
```



- **The variance changes slightly as the diameter grows. There are a few larger residuals as the diameter grows**

I also tried my hands on the qq-plots

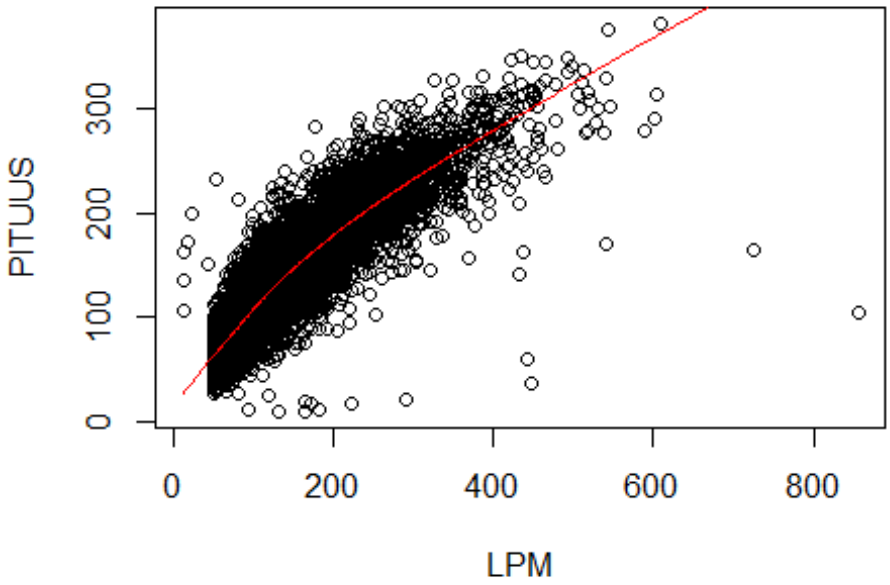
```
#{oldpar <- par(mfrow = c(2, 2))
#plot(lm_fit)
#par(oldpar)}
```

Exercise 3

Exercise 1 continues.

- **Plot the height of spruces in the first canopy layer as a function of diameter. Add a red curve to the picture that illustrates the values predicted with the model.**

```
spr1<- data[data["LATVKERROS"]==1,]
plot(PITUUS~LPM, spr1)
lines(lowess(spr1$LPM, spr1$PITUUS), col="red")
```




```
#abline(lm_fit, col="purple")
#or
#abline(coef = coef(lm_fit), col="red")
```

Exercise 4

Exercise 1 continues.

- Develop the model further. Add new explanatory variables from the puudata and examine how model's coefficient of determination and residual error #change. Can you make the model better and if so, which explanatory variables belong into the model?

```
lm_fit2= lm(formula= PITUUS~LPM+ELAVALARAJA, data=spruceCanopy1)
lm_fit3= lm(formula= PITUUS~LPM+ELAVALARAJA+LATVUSLEV, data=spruceCanopy1)
summary(lm_fit2)
```

```
##
## Call:
## lm(formula = PITUUS ~ LPM + ELAVALARAJA, data = spruceCanopy1)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -291.78  -12.94   -0.94   14.08  116.64
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 30.018163   1.278822   23.47   <2e-16 ***
## LPM          0.595353   0.007347   81.04   <2e-16 ***
## ELAVALARAJA  0.365241   0.018412   19.84   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 25.04 on 1708 degrees of freedom
```

```
## Multiple R-squared:  0.8809, Adjusted R-squared:  0.8807
## F-statistic:  6314 on 2 and 1708 DF,  p-value: < 2.2e-16
```

```
summary(lm_fit3)
```

```
##
## Call:
## lm(formula = PITUUS ~ LPM + ELAVALARAJA + LATVUSLEV, data = spruceCanopy1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -295.252  -12.822   -0.758   13.863  116.796
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 31.257848   1.303859  23.973  < 2e-16 ***
## LPM          0.620567   0.009336  66.471  < 2e-16 ***
## ELAVALARAJA  0.366603   0.018319  20.012  < 2e-16 ***
## LATVUSLEV   -0.353131   0.081355  -4.341  1.5e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 24.91 on 1707 degrees of freedom
## Multiple R-squared:  0.8822, Adjusted R-squared:  0.882
## F-statistic:  4260 on 3 and 1707 DF,  p-value: < 2.2e-16
```

```
summary(lm_fit)
```

```
##
## Call:
## lm(formula = PITUUS ~ LPM, data = spruceCanopy1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -298.656  -16.420   -1.221   17.060  114.284
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 31.726999   1.414875   22.42   <2e-16 ***
## LPM          0.676181   0.006779   99.75   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 27.77 on 1709 degrees of freedom
## Multiple R-squared:  0.8534, Adjusted R-squared:  0.8533
## F-statistic:  9950 on 1 and 1709 DF,  p-value: < 2.2e-16
```

ELAVALARAJA(lower limit of living canopy) was added the coefficient of determination increased from 0.8534 to 0.8809 and the residual standard error reduced from 27.77 to 25. 04

- **However adding LATVUSLEV(width of the canopy) didn't improve the prediction considerably. The coefficient of determination only increased from 0.8809 to 0.8822 while the residual standard error only reduced neglibigly from 25.04 to 24.91. The P value of LATVUSLEV was also higher and close to 0.05 compared to others there are much more lower. Also the standard error is much higher.**