Stat765Lab03

GuoXiaodoong

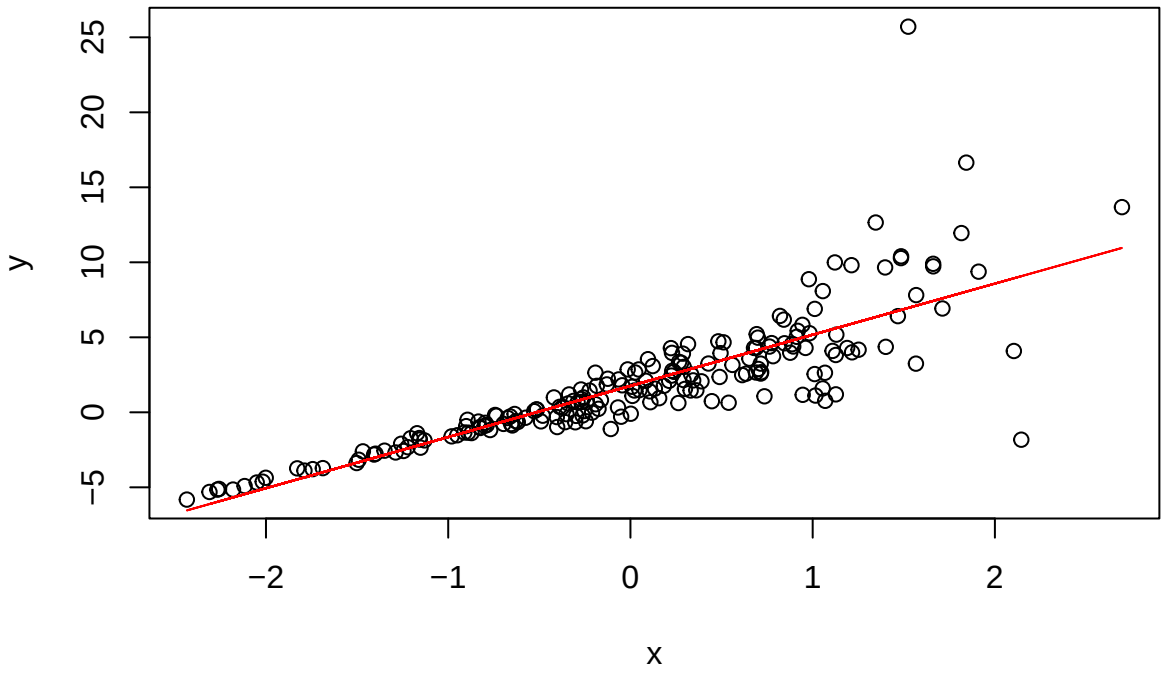
2024-03-13

Task1:

```
library(sandwich)
# Task 1
set.seed(3047) # replace "765" with your student ID.
n <- 200
x <- rnorm(n)

residual_std <- exp(x) # error standard deviation is exponential w.r.t. x values

y <- 1.5+3*x + residual_std*rnorm(n)

plot(x, y)

#Task2
fit <- lm(y~x)
summary(fit)
```

```
##
## Call:
## lm(formula = y ~ x)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -10.9011  -0.7279   0.0260   0.6039  18.7503
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.7607     0.1596   11.03   <2e-16 ***
## x             3.4102     0.1604   21.26   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.257 on 198 degrees of freedom
## Multiple R-squared:  0.6954, Adjusted R-squared:  0.6939
## F-statistic: 452.1 on 1 and 198 DF,  p-value: < 2.2e-16
```

```
lines(x, (1.7607+3.4102*x), col = 'red')
```




```
#Confident interval of the predictions
confint(fit)
```

```
##                2.5 %   97.5 %
## (Intercept) 1.445894 2.075464
## x           3.093955 3.726540
```

```
sandwich_se = sqrt(diag(vcovHC(fit)))
sandwich_se
```

```
## (Intercept)           x
##   0.1565362   0.2448696
```

```
coef(fit)-1.96*sandwich_se
```

```
## (Intercept)           x
##    1.453868    2.930303
```

```
coef(fit)+1.96*sandwich_se
```

```
## (Intercept)           x
##    2.067490    3.890192
```

```
z_stat <- coef(fit)/sandwich_se
z_stat
```

```
## (Intercept)           x
##    11.24774    13.92679
```

```
p_value <- exp(-0.717*z_stat - 0.416*z_stat^2)

p_value
```

```
##  (Intercept)            x
## 4.376794e-27 4.188860e-40
```

describe Task1:

according the plot, with the increasing of x, the y value will spared more from y=1.5+3*x

Task2:

The standard error of X is 0.1604.

The confident interval is 3.093955 3.726540

The P-Value= <2e-16 *** tells us the significant of the coefficient . the smaller P Value,the more confident we have in the predictions we make with the line.

##Task3:

The Standard Error se($\hat{i}$) in SandWich estimator is 0.2448696

the 95% confidence interval for coefficient of X is 2.930303 3.890192

The P-Value is 4.188860e-40

##Task4:

The confident interval is expended compared to original.

The P-Value is smaller.That means we are more confident with our model.