Optional Quiz

jbellier

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Presentation of the project

The data come from the file company_data.csv, which gathers company data on 4 variables : x1, x2, x3 and y. The goal of this project is to study the relationship between an outcome y and a predictor x1, to see the influence of this single varaible on the prediction of y.

Data load

```
CompanyDF <- read.csv("company_data.csv",header=TRUE)
dim(CompanyDF)
```

```
## [1] 500   4
```

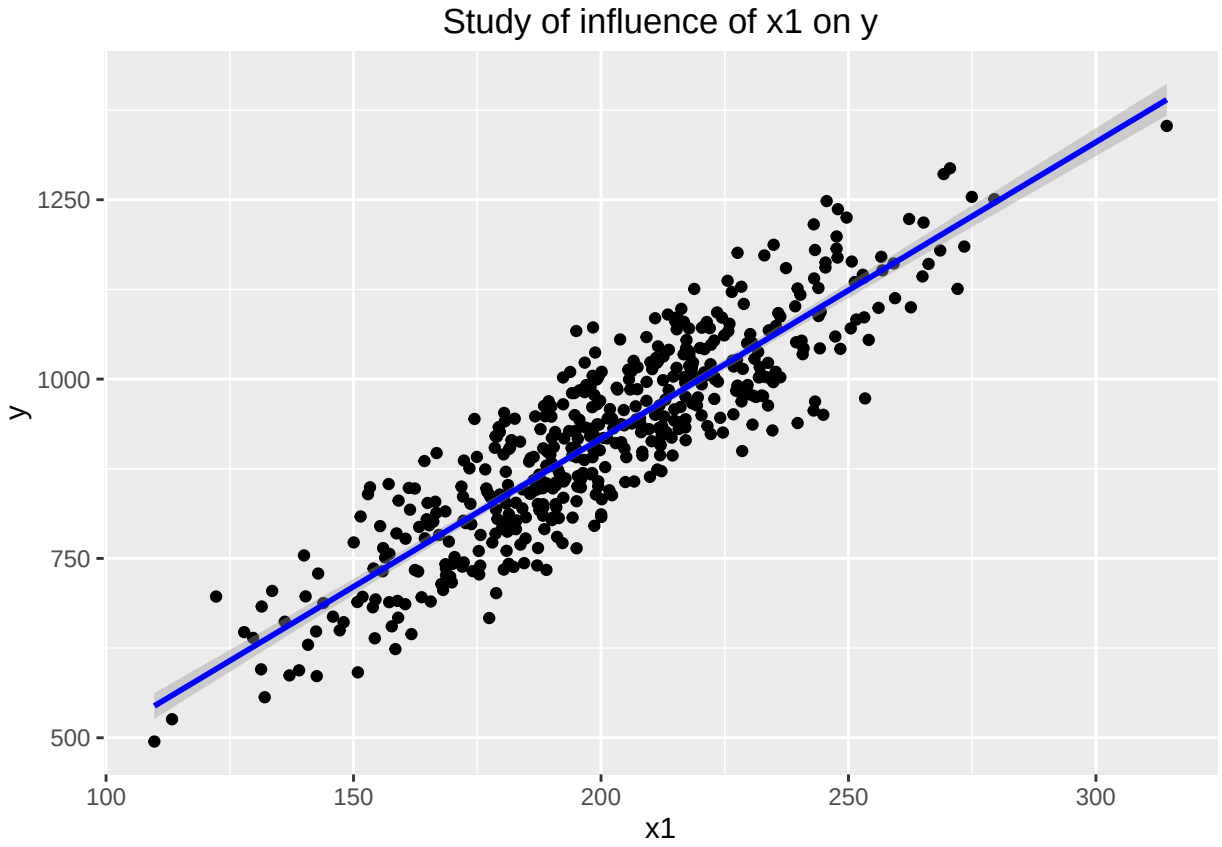
```
names(CompanyDF)
```

```
## [1] "y"  "x1" "x2" "x3"
```

Study of relationships between variables

In this section, we will plot the data and check the availability of the linear model.

```
library(ggplot2)
g <- ggplot(CompanyDF, aes(x=x1,y=y)) + geom_point() + ggtitle("Study of influence of x1 on y")
g <- g + geom_smooth(method = "lm", colour = "blue")
g
```



Here we define a linear model between y and x1.

```
fit <- lm(y~x1,CompanyDF)
summary(fit)
```

```
##
## Call:
## lm(formula = y ~ x1, data = CompanyDF)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -164.572  -48.630   -1.861   49.181  170.498
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 90.77375   19.33019   4.696 3.44e-06 ***
## x1           4.13185    0.09524  43.383  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 64.59 on 498 degrees of freedom
## Multiple R-squared:  0.7908, Adjusted R-squared:  0.7903
## F-statistic:  1882 on 1 and 498 DF,  p-value: < 2.2e-16
```

We can see that the values of the outcomes y are mainly grouped along the regression line $y = \beta_0 + \beta_1 * x_1$. Furthermore, the value of R^2 is nearly 80%. This value is the ratio of the total variation explaned by the

model. This model shows that x_1 can explain most of the values of y. So we can say to the president of the company that there is a meaningful relationship between x_1 and y.

Value of the estimated coefficient between x_1 and y

We just need to take the value of the column ***Estimate*** on the line defining x_1 :

```
coefs <- summary(fit)$coefficients
coefs[2,1]
```

```
## [1] 4.131854
```

95% Confidence interval for slope β_1

By definition, the 95% confidence interval is built on the value of the estimate and the standard error of the slope.

```
IC_beta1 <- coefs[2,1]+qt(0.975,fit$df-2)*c(-1,1)*coefs[2,2]
IC_beta1
```

```
## [1] 3.944726 4.318983
```

```
coefs[2,4]
```

```
## [1] 2.781114e-171
```

p-Value for β_1

The p-Value is given by the fourth column of the coefs table :

```
coefs[2,4]
```

```
## [1] 2.781114e-171
```