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Significance Test for Linear Regression

Assume that the error term ϵ in the **linear regression model** is independent of x , and is **normally distributed**, with zero **mean** and constant **variance**. We can decide whether there is any **significant relationship** between x and y by testing the null hypothesis that $\beta = 0$.

Problem

Decide whether there is a significant relationship between the variables in the linear regression model of the data set **faithful** at .05 significance level.

Solution

We apply the `lm` function to a formula that describes the variable eruptions by the variable waiting, and save the linear regression model in a new variable `eruption.lm`.

```
> eruption.lm = lm(eruptions ~ waiting, data=faithful)
```

Then we print out the F-statistics of the significance test with the `summary` function.

```
> summary(eruption.lm)
```

Call:

```
lm(formula = eruptions ~ waiting, data = faithful)
```

Residuals:

Min	1Q	Median	3Q	Max
-1.2992	-0.3769	0.0351	0.3491	1.1933

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-1.87402	0.16014	-11.7	<2e-16 ***
waiting	0.07563	0.00222	34.1	<2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.497 on 270 degrees of freedom

Multiple R-squared: 0.811, Adjusted R-squared: 0.811

F-statistic: 1.16e+03 on 1 and 270 DF, p-value: <2e-16

Answer

As the p-value is much less than 0.05, we reject the null hypothesis that $\beta = 0$. Hence there is a significant relationship between the variables in the linear regression model of the data set **faithful**.

Note

Further detail of the `summary` function for linear regression model can be found in the R documentation.

```
> help(summary.lm)
```

< Coefficient of Determination

up

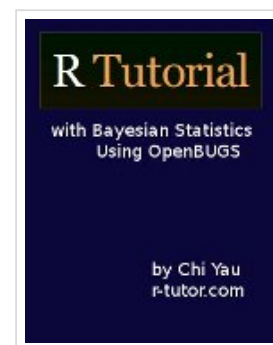
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