Linear Model

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Model Math

A linear model can be characterised by the following structural normal equation:

$$X^T X y = X^T y \beta \tag{1}$$

where X is the data or design matrix, y the dependent variable and $beta$ the coefficient vector.

Fitting in R

A model can be fit with the following code (using the `iris` data):

```
linear_model <- lm(Petal.Width ~., data=iris)
```

A summary can be obtained via:

```
summary( linear_model)
```

```
##
## Call:
## lm(formula = Petal.Width ~ ., data = iris)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.59239 -0.08288 -0.01349  0.08773  0.45239
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       -0.47314    0.17659  -2.679  0.00824 **
## Sepal.Length      -0.09293    0.04458  -2.084  0.03889 *
## Sepal.Width        0.24220    0.04776   5.072 1.20e-06 ***
## Petal.Length       0.24220    0.04884   4.959 1.97e-06 ***
## Speciesversicolor  0.64811    0.12314   5.263 5.04e-07 ***
## Speciesvirginica   1.04637    0.16548   6.323 3.03e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1666 on 144 degrees of freedom
## Multiple R-squared:  0.9538, Adjusted R-squared:  0.9522
## F-statistic: 594.9 on 5 and 144 DF,  p-value: < 2.2e-16
```