Notes on Introduction to Statistical Learning

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September 5, 2021

1 Linear Regression

Mathematically we can write the linear relationship as:

$$Y \approx \beta_0 + \beta_1 X \tag{1}$$

Once we know the coefficients from training we can predict using:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x \tag{2}$$

1.1 Estimating the Coefficients

We need to estimate $\hat{\beta}_0$ and $\hat{\beta}_1$ in such a way that it is as close as possible to β_0 and β_1. The most common approach is using the least squares criterion.

ith residual is calculated as:

$$e_i = y_i - \hat{y}_i \tag{3}$$

We define the *residual sum of squares* (RSS) as:

$$RSS = e_1^2 + e_2^2 + \cdots + e_n^2 \tag{4}$$

The least squares approach chooses $\hat{\beta}_0$ and $\hat{\beta}_1$ to minimize the RSS. The equation is as follows:

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \tag{5}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} \tag{6}$$

1.2 Assessing the Accuracy of the Coefficients Estimates

How accurate is the sample mean $\hat{\mu}$ as an estimate of μ? We answer this question by computing *standard error* of $\hat{\mu}$. We have the well known formula:

$$Var(\hat{\mu}) = SE(\hat{\mu})^2 = \frac{\sigma^2}{n} \tag{7}$$

Standard errors associated with the predicted coefficients is given as:

2 Multiple Linear Regression

This is the second section