Chapter 11.3 A Simple Linear Regression Model

Jim Albert and Monika Hu

Chapter 11 Simple Linear Regression

The linear regression model framework

- Assume the response variable, the price of a house sale
  - a continuous variable
  - distributed as a normal random variable
- Specifically, the price Y_i for house i, is normally distributed with mean μ_i and standard deviation σ.

$$Y_i \mid \mu_i, \sigma \overset{ind}{\sim} \text{Normal}(\mu_i, \sigma) \tag{1}$$

  - $i = 1, \cdots, n$, where $n = 24$ is the number of homes in the dataset

The linear regression model framework cont'd

$$Y_i \mid \mu_i, \sigma \overset{ind}{\sim} \text{Normal}(\mu_i, \sigma) \tag{2}$$

- The *ind* over $\sim$ indicates that each response Y_i independentlyfollows its own normal density
- A common standard deviation σ is shared among all responses Y_i's

The linear regression model framework cont'd

- Since we believe the size of the house is helpful in understanding a house's price, we represent the mean price μ_i as a linear functionof the house size x_i depending on two parameters β_0 and β_1

$$\mu_i = \beta_0 + \beta_1 x_i \tag{3}$$

The intercept and slope parameters

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- The intercept β_0 gives the expected price μ_i for a house i that has zero square feet ($x_i = 0$)
  - not a meaningful parameter since no house (not even a tiny house) has zero square feet
- The slope parameter β_1 gives the change in the expected price μ_i, when the size x_i of house i increases by 1 unit, i.e., increases by 1000 square feet