

The Regression Equation

Sections 5.3, 5.4

Lecture 13

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Fri, Feb 5, 2016

Outline

- 1 Calculating the Regression Line
- 2 Facts about the Regression Line
- 3 Assignment

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Calculating the Regression Line

The Equation of the Regression Line

The equation of the regression line is

$$\hat{y} = a + bx,$$

where

$$b = r \left(\frac{s_y}{s_x} \right)$$

and

$$a = \bar{y} - b\bar{x}.$$

Example

Example (Calculating the Regression Line)

- Consider again the data

x	y
3	40
5	80
7	160
9	180
16	240

- Find the equation of the regression line.

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Example (Calculating the Regression Line)

- Consider again the data

x	y
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- Find the equation of the regression line.
- To do that, we need to find \bar{x} , \bar{y} , s_x , s_y , and r .

Example

Example (Calculating the Regression Line)

- Using the TI-83, we get

$$\bar{x} = 8,$$

$$\bar{y} = 140,$$

$$s_x = 5,$$

$$s_y = 80,$$

$$r = 0.9375.$$

- Then

$$b = (0.9375) \left(\frac{80}{5} \right) = 15$$

and

$$a = 140 - (15)(8) = 20.$$

Example

Example (Height vs. Weight)

Height (x)	Weight (y)
70	185
65	140
71	180
76	220
68	150
67	170
68	185
72	205
74	210
69	155

- Find the equation of the regression line and use it to predict the weight of persons of heights 68, 70, 72, and 84 inches.

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Facts about the Regression Line

- The regression line always passes through the point (\bar{x}, \bar{y}) .
- The regression line can be used to predict y given x , but it should not be used to predict x given y . Regressing x on y gives a different line altogether. (Why?)
- The square of the correlation, r^2 , measures the fraction of the variation in y that is “explained” by the variation in x .

Example

Example (Explaining Variation)

- In the free-lunch/graduation rate example, $r = -0.8544$, so $r^2 = 0.73$.
- We conclude that the variation in the free-lunch rate explains, or accounts for, 73% of the variation in the graduation rate.
- The remaining 27% is “unexplained,” or unaccounted for, by the model.

Example

Example (Explaining Variation)

- In the height/weight example, $r = 0.89375$, so $r^2 = 0.7988$.
- We conclude that the variation in height explains, or accounts for, 80% of the variation in weight.
- The remaining 20% is “unexplained,” or unaccounted for, by the model.

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Assignment

Assignment

- Read Sections 5.1, 5.2, 5.3.
- Apply Your Knowledge: 1, 2, 4, 5.
- Check Your Skills: 20, 21, 23, 24, 25, 26.
- Exercises: 30, 34, 35(a-b), 37, 38.