

Math 102

Krishanu Sankar

October 18, 2018

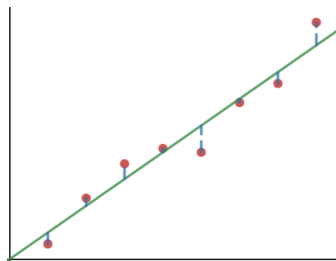
Announcements

- ▶ Review Sessions for Thursday 10/25 Midterm
 - ▶ Monday 10/22 in Buchanan A201, 3-7pm
 - ▶ Tuesday 10/23 in CHBE 101, 3-7pm
 - ▶ Bring questions if you have them!
- ▶ Midterm covers material up to and including Optimization.
- ▶ See the 'Midterm' tab on Canvas.

Goals Today

- ▶ Data fitting
 - ▶ Formula for nonzero y -intercept.
 - ▶ Spreadsheet (demo)
- ▶ The Chain Rule

Last Time - Best fit line



Points:

$(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$

Line: $y = ax$ for some a

Residuals: i -th residual is

$$r_i = ax_i - y_i$$

$$SSR(a) = r_1^2 + \dots + r_n^2$$

is minimized at $a = \frac{x_1y_1 + \dots + x_ny_n}{x_1^2 + \dots + x_n^2}$

Line with Nonzero y -intercept

Points: $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$

Line: $y = ax + b$ for some slope a , and y -intercept b

Residuals: i -th residual is

$$r_i = ax_i + b - y_i$$

$$\begin{aligned} SSR(a, b) &= r_1^2 + \dots + r_n^2 \\ &= (ax_1 + b - y_1)^2 + \dots + (ax_n + b - y_n)^2 \end{aligned}$$

Two variables: requires multivariable calculus!

General best fit

- ▶ x = Concentration of Penicillin
- ▶ y = Bacterial survivors

x	0	2	3	4	5	6
y	10000000	20000	1600	160	80	32

Question: Why would it be a bad idea to fit the data with a line?

General best fit

Points: $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$

Line: $y = f(x)$ for some function $f(x)$

Residuals: i -th residual is

$$r_i = f(x_i) - y_i$$

$$\begin{aligned} SSR &= r_1^2 + \dots + r_n^2 \\ &= (f(x_1) - y_1)^2 + \dots + (f(x_n) - y_n)^2 \end{aligned}$$

(Spreadsheet demo)

The Chain Rule

Example: Calculate the derivative.

$$h(x) = \sqrt{x^5 + 11}$$