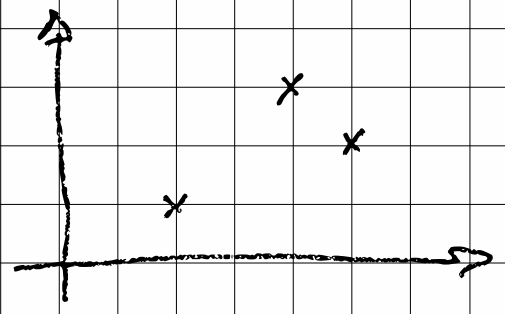
(1)



$$\frac{1}{N}\sum_{i=1}^{n}(y_i-(ax_i+b))^2 \quad \text{((Error}(a,b)$$

$$\frac{\partial \text{Error}}{\partial a} = \frac{1}{N}\sum_{i=1}^{n} 2(y_i-ax_i-b)(-x_i) = 0$$

$$\frac{\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} b x_i}{\sum_{i=1}^{n} x_i^2} = a$$

$$\frac{\partial E}{\partial b}\frac{1}{N}\sum_{i=1}^{n}(y_i-ax_i-b)^2 = \frac{1}{N}\sum_{i=1}^{n} 2(y_i-ax_i-b)(-1) = 0$$

$$\sum_{i=1}^{n}(-y_i+ax_i+b)$$

$$-\sum_{i=1}^{n} y_i + \frac{\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} b x_i}{\sum_{i=1}^{n} x_i^2}\sum_{i=1}^{n} x_i + nb = 0$$

$$\frac{\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} b x_i}{\sum_{i=1}^{n} x_i^2}\sum_{i=1}^{n} x_i + nb = \sum_{i=1}^{n} y_i$$

$$\frac{\partial}{\partial b}\left[\frac{1}{N}\sum(y_i-(ax_i+b))^2\right]=0$$

$$\frac{1}{N}\sum 2(y_i-ax_i-b)(-1)=0$$

$$\sum -\frac{2}{N}(y_i-ax_i-b)=0$$

$$\sum -\frac{2}{N}y_i+\frac{2}{N}ax_i+\frac{2}{N}b=0$$

$$a\sum x_i+\sum b=\sum y_i$$

$$\frac{\sum x_i\sum x_iy_i}{\sum x_i^2}-\frac{b(\sum x_i)^2}{\sum x_i^2}+bn=\sum y_i$$

$$\frac{1}{\sum x_i^2}\left(\sum x_i\sum x_iy_i-b(\sum x_i)^2+bn\sum x_i^2\right)=\sum y_i$$

$$\sum x_i\sum x_iy_i-b\left((\sum x_i)^2-n\sum x_i^2\right)=\sum y_i\sum x_i^2$$

$$-b\left((\sum x_i)^2-n\sum x_i^2\right)=\sum y_i\sum x_i^2-\sum x_i\sum x_iy_i$$

$$-b=\frac{\sum y_i\sum x_i^2-\sum x_i\sum x_iy_i}{(\sum x_i)^2-n\sum x_i^2}$$

$$b=\frac{\sum x_i\sum x_iy_i-\sum y_i\sum x_i^2}{(\sum x_i)^2-n\sum x_i^2}\quad(b)$$

back substitution

$$a = \frac{\sum x_i y_i}{\sum x_i^2} - \frac{(\sum x_i)^2 \sum x_i y_i - \sum x_i \sum y_i \sum x_i^2}{(\sum x_i)^2 \sum x_i^2 - n \sum x_i^2 \sum x_i^2}$$

$$a = \frac{\sum x_i y_i}{\sum x_i^2} - \frac{\sum x_i y_i}{\sum x_i^2} - \frac{(\sum x_i \sum x_i y_i - \sum y_i \sum x_i^2) \sum x_i}{((\sum x_i)^2 - n \sum x_i^2) \sum x_i^2}$$

$$\frac{\sum x_i y_i ((\sum x_i)^2 - n \sum x_i^2) - (\sum x_i \sum x_i y_i - \sum y_i \sum x_i^2) \sum x_i}{((\sum x_i)^2 - n \sum x_i^2) \sum x_i^2}$$

$$\frac{(\sum x_i)^2 \sum x_i y_i - \sum x_i y_i \sum x_i^2 \cdot n - (\sum x_i)^2 \sum x_i y_i + \sum x_i \sum y_i \sum x_i^2}{\sum x_i^2 (\sum x_i)^2 - n \sum x_i^2 \sum x_i^2}$$

$$\frac{\sum x_i^2 (\sum x_i \sum y_i - \sum x_i y_i \cdot n)}{\sum x_i^2 ((\sum x_i)^2 - n \cdot \sum x_i^2)} = \frac{\sum x_i \sum y_i - n \sum x_i y_i}{(\sum x_i)^2 - n \sum x_i^2}$$

(a)