OneNote for Windows 10

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Shapes Ink to Shape Ink to Text

100 Days of ML

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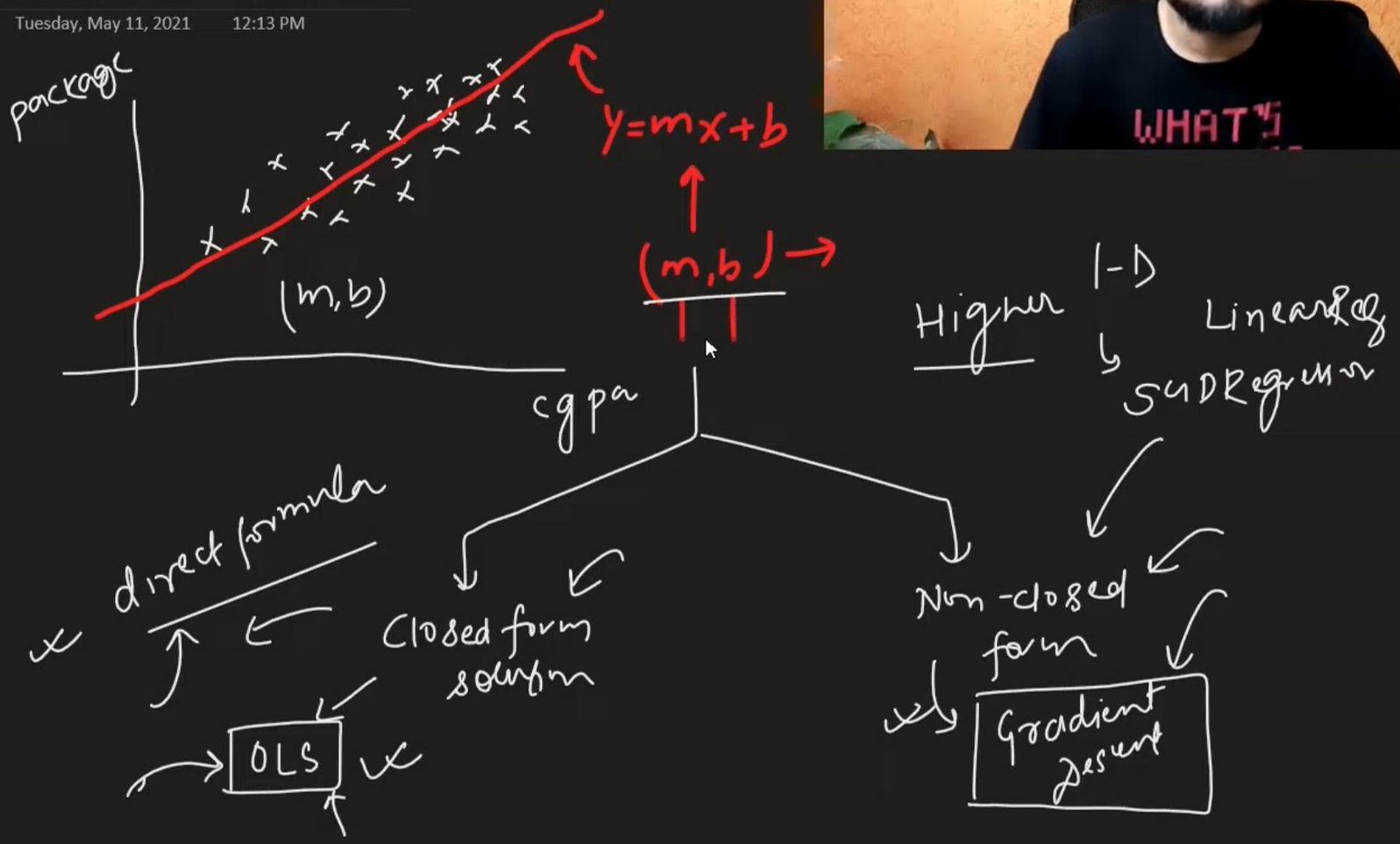
How to find m and b?

Tuesday, May 11, 2021 12:13 PM



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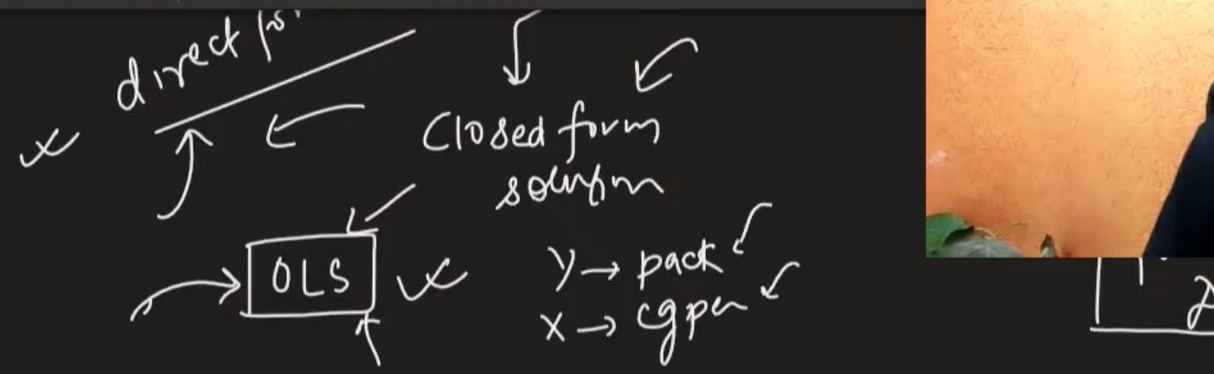

$$b = \bar{y} - m\bar{x} \qquad m = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sum_{i=1}^{n}(x_i-\bar{x})^2}$$

$\bar{x}$, $\bar{y}$ → mean

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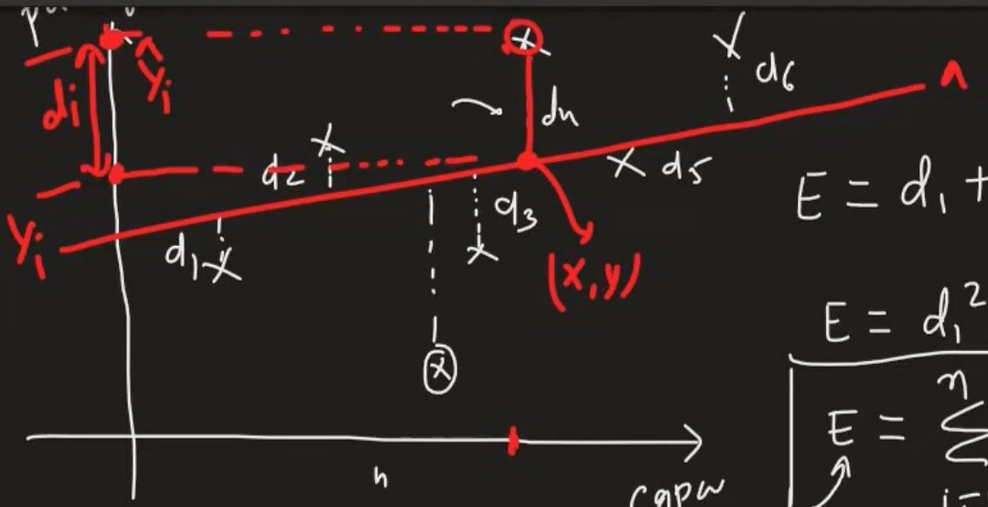


$E = d_1 + \dots$

$E = d_1^2 + d_2^2 + d_3^2 + \dots + d_n^2$

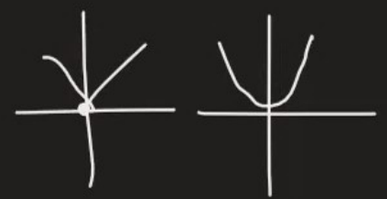
$E = \sum_{i=1}^{n} d_i^2$ ← Error function (J)

(m, b)

$E = |d_1| + |d_2| + |d_3| + \dots$

R1

R2 →



$d_i = (y_i - \hat{y}_i)$

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R1

R2 →

(m, b)

$$E = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

$d_i = (y_i - \hat{y}_i$

$\hat{y}_i$ $m x_i + b$

$\hat{y}_i = m x_i + b$

(m, b)

(m, b)

$$E(m, b) = \sum_{i=1}^{n} (y_i - m x_i - b)^2$$

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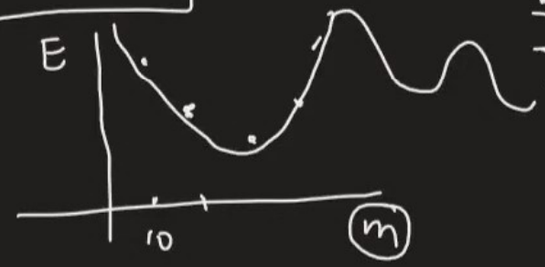
$$E(m,b) = \sum_{i=1}^{n} (y_i - mx_i - b)^2$$

$Y = f(x)$ (m, b)

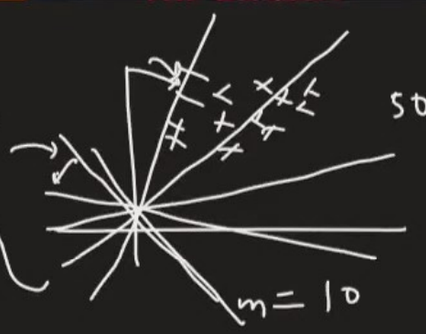
$b = 0$

$$E(m) = \sum_{i=1}^{n} (y_i - mx_i)^2$$

minimum



$m = 1$



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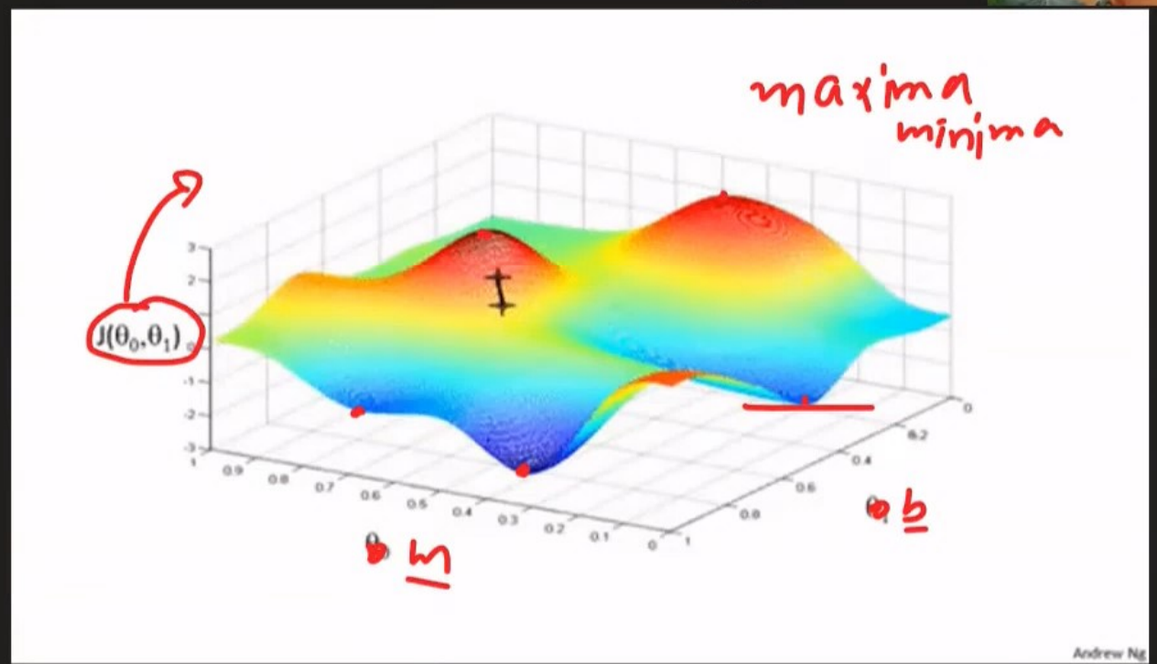

$\rightsquigarrow E(x)$

$\frac{dE}{dx} = 0$

$f(x,y)$

$\frac{\partial E}{\partial m} = 0, \frac{\partial E}{\partial b} = 0$

(m, b)

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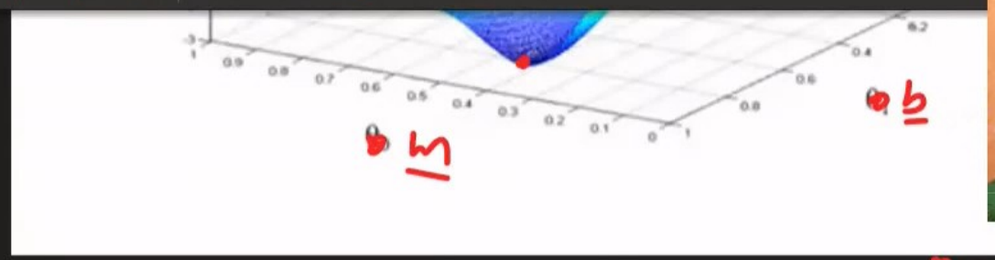

$$\frac{\partial E}{\partial b} = \frac{\partial}{\partial b}\sum_{i=1}^{n}(y_i - mx_i - b)^2 = 0$$

$$= \sum \frac{\partial}{\partial b}(y_i - mx_i - b)^2 = 0$$

$$\Rightarrow \sum -2(y_i - mx_i - b) = 0$$

$$\Rightarrow \sum (y_i - mx_i - b) = 0$$

$$\frac{b + b + b + b + \ldots + b}{n \text{ times}} = nb$$

$$\frac{\sum y_i}{n} - \frac{\sum mx_i}{n} - \frac{\sum b}{n} = \frac{0}{n}$$

$$\bar{y} - m\bar{x} - \frac{nb}{n} = 0$$

$$\bar{y} - m\bar{x} = b$$

$$b = \bar{y} - m\bar{x}$$

(m, b) n

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$$\Rightarrow \sum -2(y_i - mx_i - b) = 0$$

$$\Rightarrow \sum (y_i - mx_i - b) = 0$$

$$\bar{y} - m\bar{x}$$

$$b = \bar{y} - m\bar{x}$$

$$\frac{b + b + b + b + \ldots + b}{n \text{ times}} = nb$$

$$E = \sum (y_i - mx_i - \bar{y} + m\bar{x})^2$$

$$\frac{\partial E}{\partial m} = \sum \frac{\partial}{\partial m} (y_i - mx_i - \bar{y} + m\bar{x})^2 = 0$$

$$\Rightarrow \sum 2(y_i - mx_i - \bar{y} + m\bar{x})(-x_i + \bar{x}) = 0$$

$$= \sum -2(y_i - mx_i - \bar{y} + m\bar{x})(x_i - \bar{x}) = 0$$

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$$\Rightarrow \sum 2\left(y_i - mx_i - \bar{y} + m\bar{x}\right)\left(-x_i + \bar{x}\right) = 0$$

$$= \sum -2\left(y_i - mx_i - \bar{y} + m\bar{x}\right)\left(x_i - \bar{x}\right) = 0$$

$$= \sum \left(y_i - mx_i - \bar{y} + m\bar{x}\right)\left(x_i - \bar{x}\right) = 0$$

$$= \sum \left[\left(y_i - \bar{y}\right) - m\left(x_i - \bar{x}\right)\right]\left(x_i - \bar{x}\right) = 0$$

$$= \sum \left[\left(y_i - \bar{y}\right)\left(x_i - \bar{x}\right) - m\left(x_i - \bar{x}\right)^2\right] = 0$$

$$= \sum \left(y_i - \bar{y}\right)\left(x_i - \bar{x}\right) = m \sum \left(x_i - \bar{x}\right)^2$$

$$m = \sum_{i=1}$$

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$$= \sum \left[(y_i - \bar{y})(x_i - \bar{x}) - m(x_i - \bar{x})^2 \right]$$

$$= \sum (y_i - \bar{y})(x_i - \bar{x}) = m \sum (x_i - \bar{x})^2$$

$$m = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n} (x_i - \bar{x})^2}$$