$$E[p(y|x)] = ax$$

$$y \leftarrow x$$

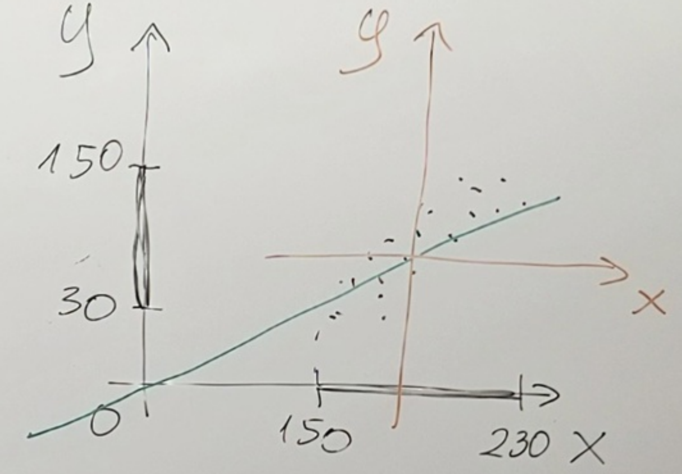
x	x_1	x_2	x_3	$\dots$	x_N
y	y_1	y_2	y_3	$\dots$	y_N

$$\bar{y} = ax$$

$$\bar{y} = \bar{y}\,\sigma_y + \mu_y$$

$$x \leftarrow \frac{x - \mu_x}{\sigma_x}$$

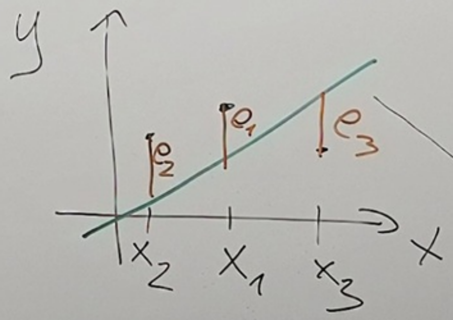
$$y \leftarrow \frac{y - \mu_y}{\sigma_y}$$

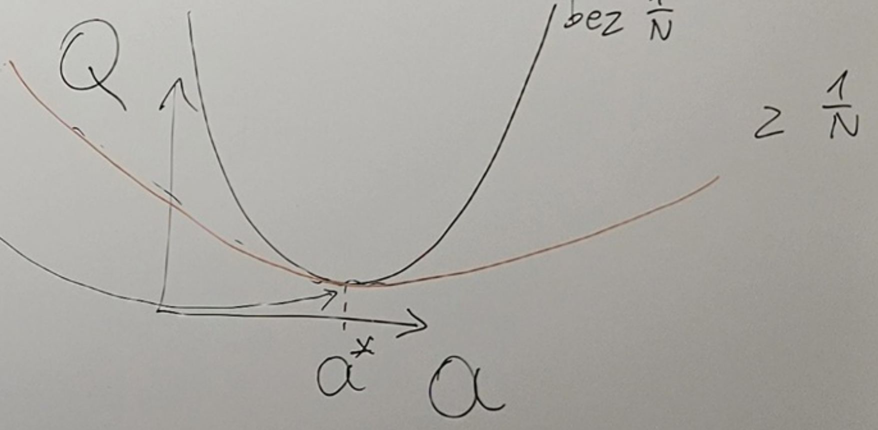


Dane: $\{(x_i, y_i)\}_{i=1}^{N}$

Szukane: a w $\bar{y} = ax$

$$e_i = y_i - \bar{y}_i$$





Kryt: $Q(a) = \frac{1}{N}\sum_{i=1}^{N} |e_i|$ → numer.

$$Q(a) = \cancel{\frac{1}{N}}\sum_{i=1}^{N} e_i^2$$ → analit. / → numer.

Metoda rozw: $\frac{dQ}{da} = 0$

x Wzrost	y Waga	Ciś. górne	Ciś. dolne	Puls	Płeć

lr = sklearn.linear_models.LinearRegression().fit(X,Y)

lr.coef_

lr.intercept_

$$Q(a) = \sum_{i=1}^{N} (y_i - ax_i)^2 = \sum_{i=1}^{N} (y_i^2 - 2ax_iy_i + a^2x_i^2)$$

$$\frac{\partial Q}{\partial a} = \sum_{i=1}^{N} (-2x_iy_i + 2ax_i^2)$$

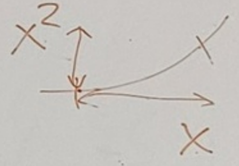
$$-2\sum_{i=1}^{N} (x_iy_i - ax_i^2) = 0$$

$$\sum_{i=1}^{N} x_iy_i - a\sum_{i=1}^{N} x_i^2 = 0$$

$$\boxed{a^* = \frac{\sum_{i=1}^{N} x_iy_i}{\sum_{i=1}^{N} x_i^2}}$$

$\bar{y} = ax + b$

$$Q(a,b) = \sum_{i=1}^{N} \left(y_i - (ax_i + b)\right)^2$$

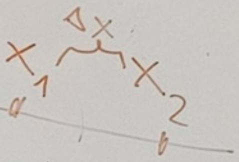


$$\frac{df}{dx}$$

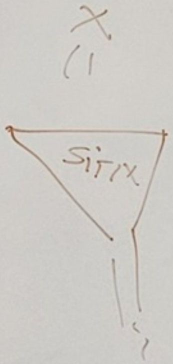
$dx \to 0$

$2x$

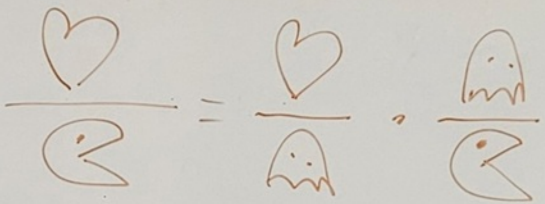
$$\frac{\Delta f}{\Delta x}$$



$\Delta x = 0.1$



$$\frac{d}{dx}(\sin x)^2 = \frac{d}{dx} = f(g(x))$$



$$\frac{df}{dx} = \frac{df}{d\sin x} \cdot \frac{d\sin x}{dx} = \frac{df}{dg} \cdot \frac{dg}{dx}$$

$$\underset{x}{x} \to \underset{g}{\sin x} \to \underset{f}{(\cdot)^2}$$

$$\frac{d\sin x}{dx} = \cos x$$

$$\frac{d(\sin x)^2}{dx} = 2\sin x\cos x$$

$$\frac{d(\sin x)^2}{d\sin x} = 2\sin x$$

$$E\left[p(y|x)\right] = ax + b$$

x	x_1	x_2	x_3	$\dots$	x_N
y	y_1	y_2	y_3	$\dots$	y_N

Dane: $\{(x_i, y_i)\}_{i=1}^{N}$

Szukane: a w $\bar{y} = ax + b$

Metoda rozw:

$$\begin{cases} \dfrac{\partial Q}{\partial a} = 0 \\[2ex] \dfrac{\partial Q}{\partial b} = 0 \end{cases} \equiv \nabla_{\begin{bmatrix} a \\ b \end{bmatrix}} Q = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$Q(a,b) = \cancel{\frac{1}{N}} \sum_{i=1}^{N} e_i^2 \longrightarrow \text{analit.}$$

$$\bar{y} = ax + b$$

$$Q(a,b) = \sum_{i=1}^{N} \left(y_i - (ax_i + b)\right)^2 = \sum_{i=1}^{N} \left(y_i - ax_i - b\right)^2$$

$$\frac{dQ(a,b)}{da} = \cancel{-}\sum_{i=1}^{N} x_i \cdot \cancel{2} \left(y_i - ax_i - b\right) = 0$$

$$\frac{dQ(a,b)}{db} = \cancel{-N} \sum_{i=1}^{N} \cancel{2}\left(y_i - ax_i - b\right) = 0$$

$$\sum_{i=1}^{N} x_i \left(y_i - ax_i - b\right) = 0$$

$$\sum_{i=1}^{N} x_i y_i - \sum_{i=1}^{N} a x_i^2 - \sum_{i=1}^{N} x_i b = 0$$

$$\sum_{i=1}^{N} \left(y_i - ax_i - b\right) = 0$$

$$\sum_{i=1}^{N} y_i - \sum_{i=1}^{N} a x_i - \sum_{i=1}^{N} b = 0$$

$$\sum_{i=1}^{N} x_i y_i - a\sum_{i=1}^{N} x_i^2 - ($$

$$\begin{cases} \sum_{i=1}^{N} x_i y_i - a\sum_{i=1}^{N} x_i^2 - b\sum_{i=1}^{N} x_i = 0 \\ \sum_{i=1}^{N} y_i - a\sum_{i=1}^{N} x_i - Nb = 0 \end{cases} \rightarrow b = \frac{\sum_{i=1}^{N} y_i - a\sum_{i=1}^{N} x_i}{N} = \overbrace{\frac{1}{N}\sum_{i=1}^{N} y_i}^{\hat{y}} - a\underbrace{\frac{1}{N}\sum_{i=1}^{N} x_i}_{\hat{x}}$$

$$\boxed{b = \hat{y} - a\hat{x}}$$

W domu dokończyć

W domu

Czy licząc a w $\bar{y} = ax$ dla ustand. danych jaka byłaby wartość b w drugiej metodzie? Czy potrafię „przewidzieć" jej wartość."