LINEAR REGRESSION

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- Type of linear regression :
  - Simple linear regression : $\hat{y} = xw + b$
    where $\hat{y}, x, w, b$ is a scalar variable.
  - Multivariate linear regression : $\hat{y} = xw + b = \bar{x}w$
    where w, x are vectors, $\hat{y}, b$ is a scalar number.

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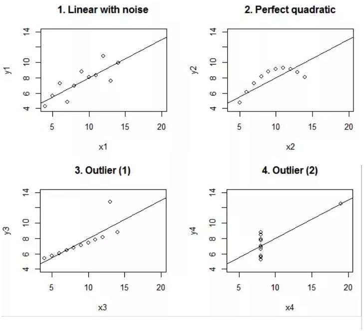
  - Hard to scale with complicated, unlinear data



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Model of Linear regression

Mathematics model :

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- Training data set : Y and X

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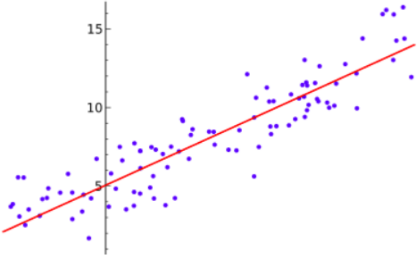
- Need to find a matrix W where $\hat{y} = Wx$ such that $\hat{y}$ most fit to y in Y



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Model of Linear regression

- Lost function :

$$\mathbb{L} = \frac{1}{2}\sum_{i=1}^{N}(y_i - \hat{y})^2 = \frac{1}{2}\sum_{i=1}^{N}(y_i - \hat{x}_i w)^2 = \frac{1}{2}\left\|y - \bar{X}w\right\|_2^2$$

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- Derivative :

$$\frac{\partial \mathbb{L}(w)}{\partial w} = \bar{X}^T\left(\bar{X}w - y\right)$$

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- Minimum at :

$$w = \left(\bar{X}^T\bar{X}\right)^{-1}\bar{X}^T y$$