Linear Regression

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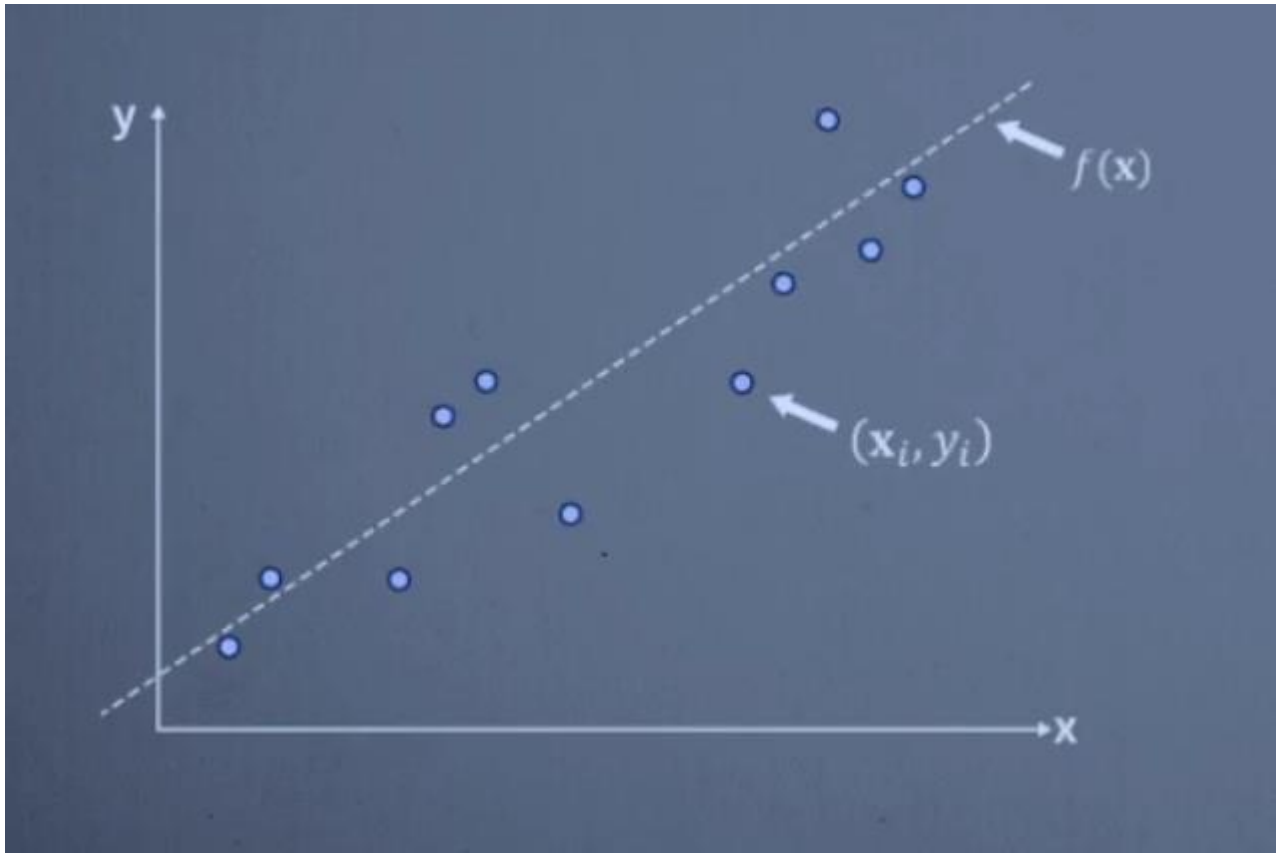
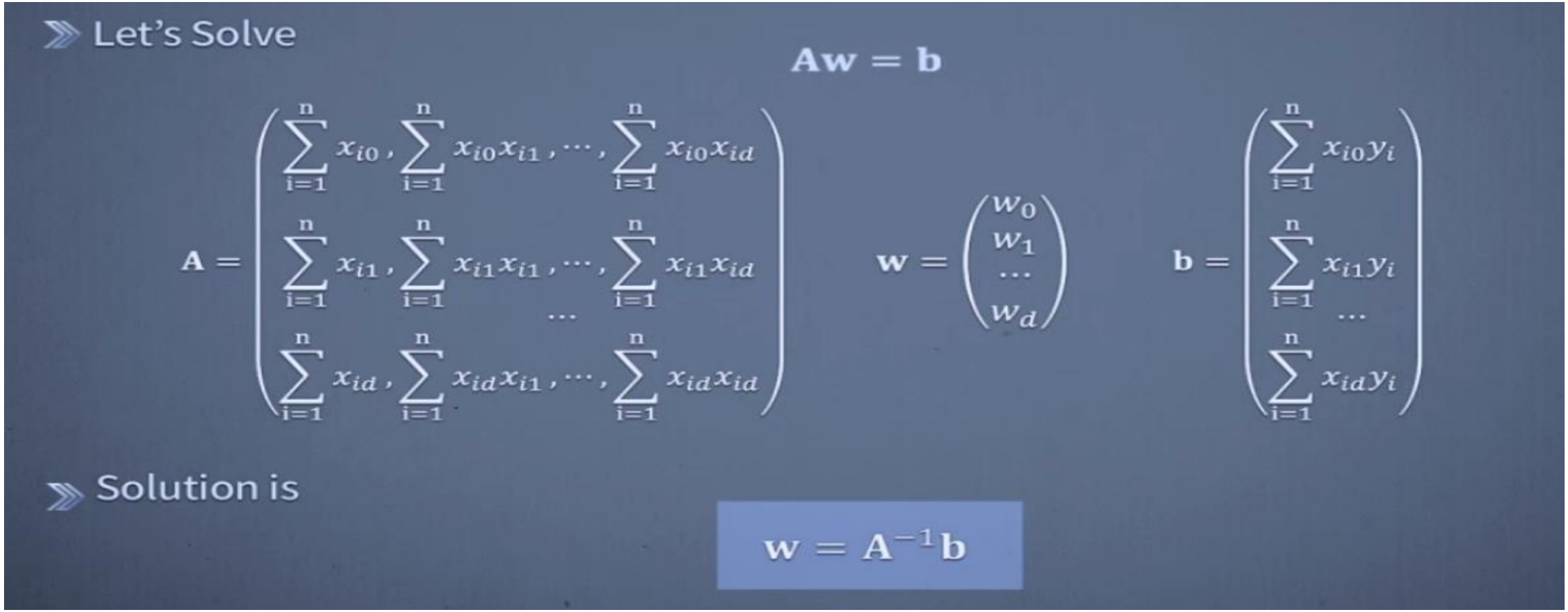
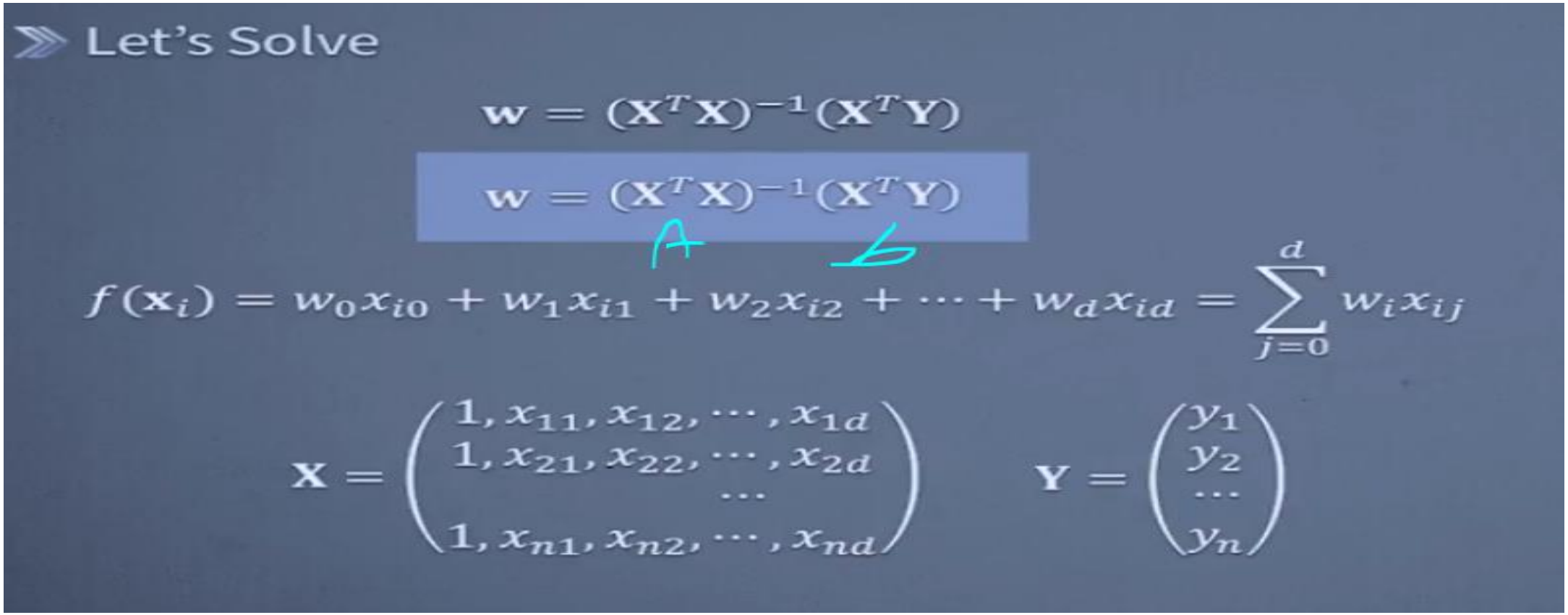


주어진 데이터와 오차가 최소화되는 직선 찾기
거리의 최소화 : 주어진 data와 직선까지의 거리 제곱의 합이 최소
=미분을 해서 0이 되는 지점
=1차 연립 방정식
Traing data의 X와 Y를 통해 A와 b를 구하고 w를 최종적으로 구한다.

일차 연립방정식의 해


Let's Solve
$\mathbf{Aw} = \mathbf{b}$
$\mathbf{A} = \begin{pmatrix} \sum_{i=1}^{n} x_{i0}, \sum_{i=1}^{n} x_{i0}x_{i1}, \cdots, \sum_{i=1}^{n} x_{i0}x_{id} \\ \sum_{i=1}^{n} x_{i1}, \sum_{i=1}^{n} x_{i1}x_{i1}, \cdots, \sum_{i=1}^{n} x_{i1}x_{id} \\ \cdots \\ \sum_{i=1}^{n} x_{id}, \sum_{i=1}^{n} x_{id}x_{i1}, \cdots, \sum_{i=1}^{n} x_{id}x_{id} \end{pmatrix}$
$\mathbf{w} = \begin{pmatrix} w_0 \\ w_1 \\ \cdots \\ w_d \end{pmatrix}$
$\mathbf{b} = \begin{pmatrix} \sum_{i=1}^{n} x_{i0}y_i \\ \sum_{i=1}^{n} x_{i1}y_i \\ \cdots \\ \sum_{i=1}^{n} x_{id}y_i \end{pmatrix}$
Solution is
$\mathbf{w} = \mathbf{A}^{-1}\mathbf{b}$

일차 연립방정식의 해


Let's Solve
$\mathbf{w} = (\mathbf{X}^T\mathbf{X})^{-1}(\mathbf{X}^T\mathbf{Y})$
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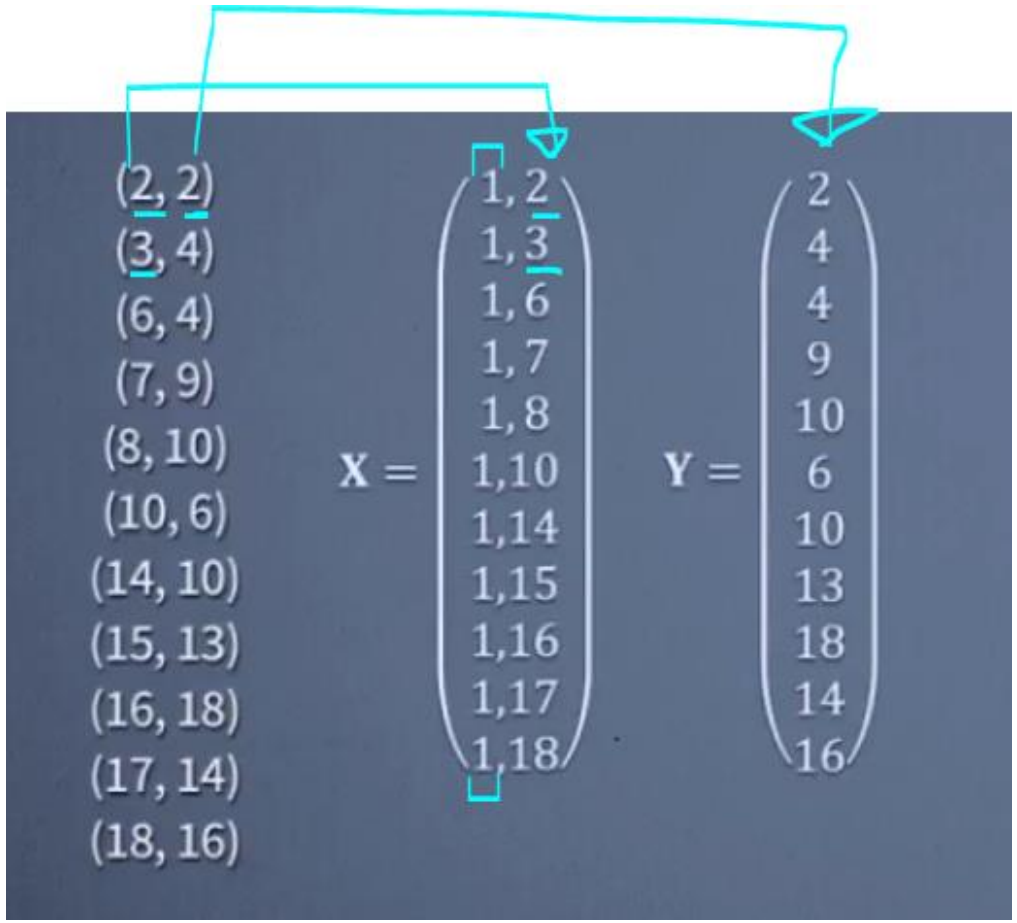
A
b
$f(\mathbf{x}_i) = w_0x_{i0} + w_1x_{i1} + w_2x_{i2} + \cdots + w_dx_{id} = \sum_{j=0}^{d} w_ix_{ij}$
$\mathbf{X} = \begin{pmatrix} 1, x_{11}, x_{12}, \cdots, x_{1d} \\ 1, x_{21}, x_{22}, \cdots, x_{2d} \\ \cdots \\ 1, x_{n1}, x_{n2}, \cdots, x_{nd} \end{pmatrix}$
$\mathbf{Y} = \begin{pmatrix} y_1 \\ y_2 \\ \cdots \\ y_n \end{pmatrix}$

일차 연립방정식의 해



$$\mathbf{A} = \mathbf{X}^T\mathbf{X} = \begin{pmatrix} 11, 116 \\ 116, 1552 \end{pmatrix}$$

$$\mathbf{b} = \mathbf{X}^T\mathbf{Y} = \begin{pmatrix} 106 \\ 1392 \end{pmatrix}$$

$$\mathbf{w} = (\mathbf{A})^{-1}\mathbf{b} = \begin{pmatrix} 0.840708 \\ 0.834071 \end{pmatrix}$$