Multivariate Linear Regression

Linear Regression

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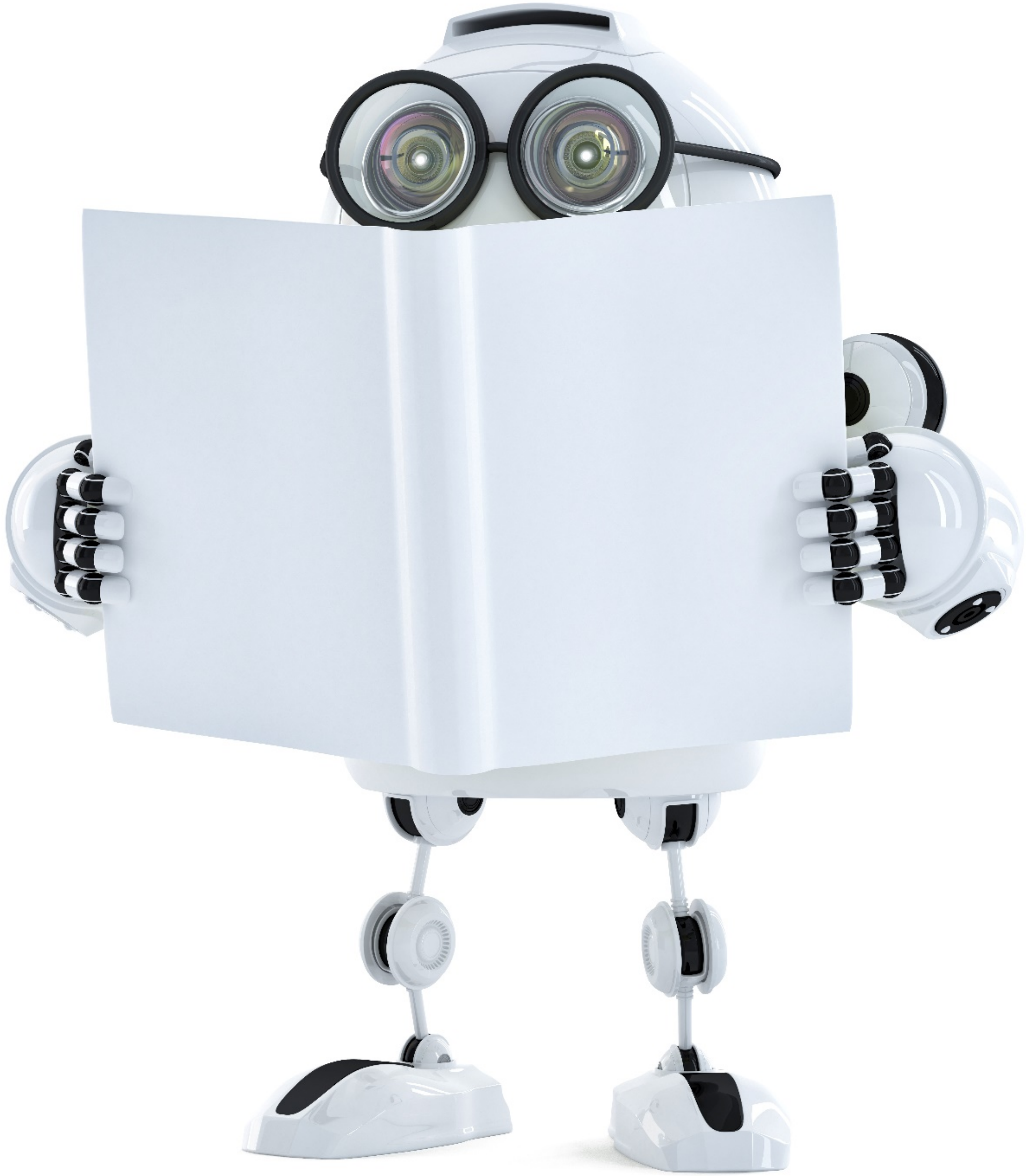

한 개이상의 Feature로 구성된 데이터를 분석할 때

식은 많아지지만 여전히 Cost 함수의 최적화

$$J(w_0, w_1) = \frac{1}{2m}\sum_{i=1}^{m}(w_1 x^{(i)} + w_0 - y^{(i)})^2$$

$$\frac{\partial J}{\partial w_0} = \frac{1}{m}\sum_{i=1}^{m}(w_1 x^{(i)} + w_0 - y^{(i)})$$

$$\frac{\partial J}{\partial w_1} = \frac{1}{m}\sum_{i=1}^{m}(w_1 x^{(i)} + w_0 - y^{(i)})x^{(i)}$$

$$J(w_0, w_1, \ldots, w_n) = \frac{1}{2m} \sum_{i=1}^{m} (w_1 x_1^{(i)} + w_2 x_2^{(i)} + \cdots + w_n x_n^{(i)} + w_0 - y^{(i)})^2$$

$$= \frac{1}{2m} \sum_{i=1}^{m} (\mathbf{w}^T \mathbf{x}^{(i)} - y^{(i)})^2$$

$$\frac{\partial J}{\partial w_0} = \frac{1}{m} \sum_{i=1}^{m} (\mathbf{w}^T \mathbf{x}^{(i)} - y^{(i)})$$

$$\frac{\partial J}{\partial w_1} = \frac{1}{m} \sum_{i=1}^{m} (\mathbf{w}^T \mathbf{x}^{(i)} - y^{(i)}) \cdot x_1$$

$$\frac{\partial J}{\partial w_n} = \frac{1}{m} \sum_{i=1}^{m} (\mathbf{w}^T \mathbf{x}^{(i)} - y^{(i)}) \cdot x_2$$

$$\frac{\partial J}{\partial w_n} = \frac{1}{m} \sum_{i=1}^{m} (\mathbf{w}^T \mathbf{x}^{(i)} - y^{(i)}) \cdot x_n$$

Simultaneously update

```python
for _ in range(iterations):
    predictions = x.dot(theta)

    for i in range(theta.size):
        partial_marginal = x[:, i]
        errors_xi = (predictions - y) * partial_marginal
        theta[i] = theta[i] - alpha * (1.0 / m) * errors_xi.sum()

    theta_history.append(theta)
    cost_history.append(compute_cost(x, y, theta))
```

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$$w_n =: w_n - \alpha\frac{\partial J}{\partial w_0}$$

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Human knowledge belongs to the world.