TAMS ARTIFICIAL INTELLIGENCE SOCIETY

2021 - 2022

Linear Regression

9/15/2021

Lesson Plan

- Linear Regression with One Feature
- Cost Function
- Gradient Descent
- Linear Regression with Multiple Features

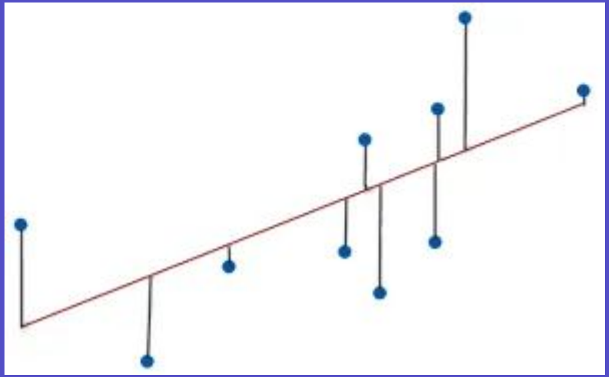
Linear Regression with One Feature

Fuel Consumption	CO2 Emissions
6.7	196
7.7	221
5.8	136
9.1	255
8.7	244

- Hypothesis: $h_\theta(x) = \theta_0 + \theta_1 x$
- How should one choose θ_0 and θ_1?

Cost Function

- Ordinary Least Squares Regression
  - Uses the mean squared error cost function

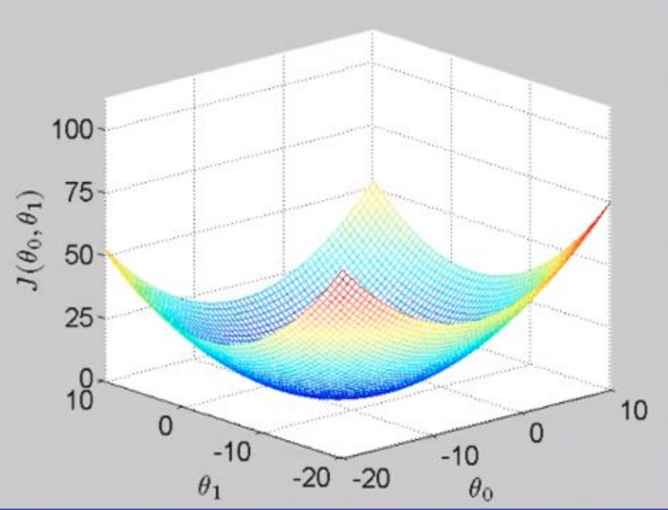


$$J(\theta_0, \theta_1) = \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)} \right)^2$$

- Goal: minimize the cost function

Image: https://statisticsbyjim.com/glossary/ordinary-least-squares/

Gradient Descent



$$\theta_j = \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta)$$

- ***α***: learning rate
- Low ***α*** → slow convergence
- High ***α*** → may cause divergence

Linear Regression with Multiple Features

Engine Size	Cylinders	City Fuel Consumption	Highway Fuel Consumption	CO2 Emissions
2	4	9.9	6.7	196
2.4	4	11.2	7.7	221
1.5	4	6	5.8	136
3.5	6	12.7	9.1	255
3.5	6	12.1	8.7	244

- Hypothesis: $h_\theta(x) = \theta_0 + \theta_1 x_1 + \cdots + \theta_n x_n$
- Same cost function & gradient descent as single feature linear regression