Introduction to Machine Learning (CS419M)
Lecture 2: Linear Regression (Part I)
Why study about linear regression?

• Simple but powerful model
• Provides interpretations of how inputs affect the final predicted outputs
• Helps better understand non-linear models
• Can be applied to transformations of the inputs
Least squares fit when $X \in \mathbb{R}^2$

Minimize the sum of the squared errors:

$$L_{\text{MSE}} = \sum_i (y_i - w_1 x_i - w_2 x_2 - w_0)^2$$
Least squares regression: 
Closed form solutions

For 1-D data, solve \( \arg \min_{w_0, w_1} \sum_i (y_i - w_1 x_i - w_0)^2 \)

to get, \( w_0 = \bar{y} - w_1 \bar{x} \quad w_1 = \frac{\sum_i x_i y_i/n - \bar{x}\bar{y}}{\sum_i x_i^2/n - \bar{x}^2} \)

More generally, for any d-dimensional \( x_i \), solve \( \arg \min_w y_i - w^T x_i \)

to get, \( w = (X^T X)^{-1} X^T Y \)