A Simulation Example

Estimate the conditional mean of Y given $\boldsymbol{X}$

$$Y = f(\boldsymbol{X}) + \epsilon$$

Assume probability model:

$$Y = 1 - 2x - 3x^2 + 5x^3 + \epsilon$$

where $\epsilon \sim \mathsf{N}(0,\sigma^2)$

Alternatively:

$$Y \mid X \sim \mathsf{N}(1 - 2x - 3x^2 + 5x^3, \sigma^2) \quad \text{or}$$

$$\mu(x) = E[Y \mid \boldsymbol{X} = \boldsymbol{x}] = 1 - 2x - 3x^2 + 5x^3$$

conditional mean is a **linear combination of the feature variables**

note: the true probability model and thus also $\mu(x)$ are often not known!

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