

# Bayesian Linear Regression

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## 1 Framework

### 1.1 Notations

$$y = x \cdot \beta + \varepsilon, \varepsilon \sim \mathcal{N}(0, \sigma^2) \tag{1.1}$$

1. Individual observations  $(x, y) \in \mathbb{R}^k \times \mathbb{R}$
2. Observed data  $(X, Y) \in \mathbb{R}^{n \times k} \times \mathbb{R}^n$
3. Linear regression weights  $\beta \in \mathbb{R}^k$
4. Observation error variance  $\sigma^2$

### 1.2 Model Assumptions

1. Observations  $x$  have full rank
2. Observation errors are independent, normally distributed with mean zero and variance  $\sigma^2$
3. Relation 1.1 holds
4. Error variance  $\sigma^2$  is either known, or its prior distribution is inverse gamma distribution with parameters  $a_0, b_0$
5.  $\beta$  has a prior distribution  $\mathcal{N}(\beta_0, \sigma^2 \Sigma_0)$