Maximum Likelihood Method
Example: Normal distribution

$x_1, \ldots, x_n$ iid, $x_i \sim N(\mu, \sigma^2)$

$$f_{x_i}(x_i) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-(x_i - \mu)^2 / 2\sigma^2\right),$$

$$i = 1, \ldots, n$$

Joint density:

$$f_x(x) = f_{x_1, \ldots, x_n}(x_1, \ldots, x_n) = \frac{1}{(2\pi\sigma^2)^{n/2}} \exp\left(-\sum_{i=1}^{n} \frac{(x_i - \mu)^2}{2\sigma^2}\right)$$

$$\longrightarrow max$$

Same as maximization of $\log(f_x(x))$
(log is mon. increasing function)

So to maximize

$$\log(f_x(x)) = -\frac{n}{2}\log(2\pi\sigma^2) - \sum_{i=1}^{n} \frac{(x_i - \mu)^2}{2\sigma^2}$$

Same as to minimize

$$-\log(f_x(x)).$$