Maximum Likelihood

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1 Gaussian Likelihood

$$
\begin{aligned}
X &\overset{iid}{\sim} N(\mu, \sigma^2) \\
L(theta|X) &= p(X|theta) \\
&= p(X|\mu, \sigma^2) \\
&= \prod p(x_i|\mu, \sigma^2)
\end{aligned}
$$

$$
\begin{aligned}
\max_{\mu,sd} L(theta|X) &= \max_{\mu,\sigma^2} \prod p(x_i|\mu, \sigma^2) \\
&= \max_{\mu,\sigma^2} ln(\prod p(x_i|\mu, \sigma^2))) \\
&= \max_{\mu,\sigma^2} \sum ln(p(x_i|\mu, \sigma^2))
\end{aligned}
$$

$$
\begin{aligned}
p(x|\mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} & \\
&= \max_{\mu,\sigma^2} \sum ln(\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x_i-\mu)^2}{2\sigma^2}})
\end{aligned}
$$