사회과학자를 위한 데이터 과학 방법론:

보충, 오타, 또는 에러

R을 이용한 사회과학 자료분석

박종희

- 262쪽 평균과 분산에 대한 증명 (by courtesy of 박경태) 기대값은

$$
\begin{aligned}
p(x|\mu,\sigma^2) &= \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right) \\
\mathbb{E}(e^X) &= \int_{\mathbb{R}} e^x \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right) dx \\
&= \int_{\mathbb{R}} \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x^2-2\mu x+\mu^2-2\sigma^2 x)}{2\sigma^2}\right) dx \\
&= \int_{\mathbb{R}} \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{x^2-2(\mu+\sigma^2)x+(\mu+\sigma^2)^2-2\mu\sigma^2-\sigma^4}{2\sigma^2}\right) dx \\
&= \int_{\mathbb{R}} \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-(\mu+\sigma^2))^2}{2\sigma^2}\right) dx \times \exp\left(\mu+\frac{1}{2}\sigma^2\right) \\
\mathbb{E}(e^X) &= \exp\left(\mu+\frac{1}{2}\sigma^2\right)
\end{aligned}
$$

분산은

$$
\begin{aligned}
\mathbb{V}(e^X) &= \mathbb{E}((e^X)^2) - (\mathbb{E}(e^X))^2 \\
\mathbb{E}((e^X)^2) &= \int_{\mathbb{R}} e^{2x} \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right) dx = \exp(2\mu+2\sigma^2) \\
&= \exp(2\mu+2\sigma^2) - \exp(2\mu+\sigma^2) = \exp(2\mu+\sigma^2)(\exp(\sigma^2)-1)
\end{aligned}
$$

- 309쪽 수식 (9.16)에서 곱셈이 덧셈으로 잘못 표시되었습니다.

$$
\begin{aligned}
\mathcal{N}(\mu|\mathbf{y}) &\propto \mathcal{N}(\mathbf{y}|\mu,\sigma^2)\mathcal{N}(\mu|\mu_0,\sigma_0^2) \\
&\propto \exp\left(-\frac{1}{2\sigma^2}\sum_{i=1}^{n}(y_i-\mu)^2\right) \times \exp\left(-\frac{1}{2\sigma_0^2}\sum_{i=1}^{n}(\mu-\mu_0)^2\right) \\
&= \exp\left(-\frac{1}{2\sigma^2}\sum_{i=1}^{n}(y_i-\mu)^2\right) \times \exp\left(-\frac{1}{2\sigma_0^2}\sum_{i=1}^{n}(\mu-\mu_0)^2\right) \\
&= \exp\left(-\frac{1}{2\sigma^2}\sum_{i=1}^{n}(y_i-\mu)^2\right) \times \exp\left(-\frac{1}{2\sigma_0^2}\sum_{i=1}^{n}(\mu-\mu_0)^2\right) \\
&\propto \exp\left[-\frac{1}{2}\left(\frac{\mu^2}{\sigma_0^2}+\frac{\mu^2 n}{\sigma^2}\right)+\mu\left(\frac{\mu_0}{\sigma_0^2}+\frac{\sum_{i=1}^{n} y_i}{\sigma^2}\right)\right]
\end{aligned}
$$