Lecture 6.2: Continuous Distribution Part Deux

2013/10/09

Previously... Uniform Distribution

Suppose a continuous RV X can only assume values in an interval (a, b) and suppose that the pdf is constant over the interval. We say $X \sim \text{Uniform}(a, b)$

$$f(x) = \begin{cases} \frac{1}{b-a} & \text{for } a \leq x \leq b, \\ 0 & \text{for } x < a \text{ for } x > b \end{cases}$$

Previously... Gamma Distribution

A continuous random variable X is said to have the gamma distribution with

- shape parameter $k > 0$
- scale parameter $\theta > 0$

if it has pdf of the form

$$\begin{aligned} f(x) &= \frac{1}{\theta^k \Gamma(k)} x^{k-1} e^{-x/\theta} \\ &= \frac{1}{\theta^k \Gamma(k)} x^{k-1} \exp(-x/\theta) \end{aligned}$$

for $x > 0$

Previously... Exponential Distribution

Special case of Gamma Distribution: when the shape parameter $k = 1$ and with scale parameter θ:

$$f(x) = \frac{1}{\theta} \exp(-x/\theta)$$

or alternatively with rate parameter λ

$$f(x) = \lambda \exp(-\lambda x)$$

for $x > 0$.

Previously... Beta Distribution

A continuous random variable X is said to have the beta distribution with $\alpha > 0$ and $\beta > 0$

$$f(x) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1}(1-x)^{\beta-1}$$

for $0 < x < 1$.

Goals for Today

- Normal Distribution
- t-Distribution

Continuous Distributions: Normal

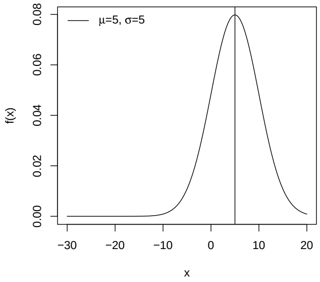
The most important and well-known example of a continuous distribution is the Normal/Gaussian distribution with parameters μ and σ where $-\infty < \mu < \infty$ and $\sigma > 0$ and

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{1}{2\sigma^2}(x-\mu)^2\right)$$

for $-\infty < x < \infty$.
Note: Don't try to integrate this! We'll be using tables in front inside jacket of the textbook. More later.

Continuous Distributions: Normal Example

μ (mean) specifies the center, σ (standard deviation) the spread



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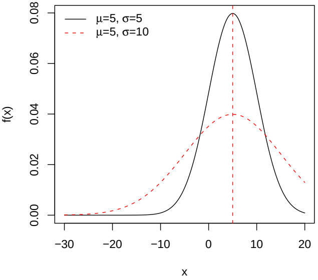

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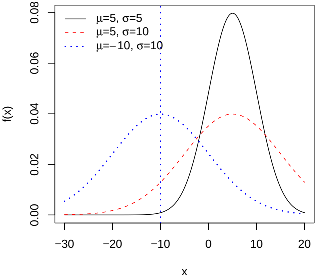

Continuous Distributions: Normal

When $\mu = 0$ and $\sigma = 1$, we have the standard/standardized normal distribution which is typically denoted by z:

$$f(z) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{z^2}{2}\right)$$

for $-\infty < z < \infty$

Next Time

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