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Day 5: Normal Distribution I ☆

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Normal Distribution

The probability density of normal distribution is:

$$\mathcal{N}(\mu,\sigma^2) = rac{1}{\sigma\sqrt{2\pi}}e^{-rac{(x-\mu)^2}{2\sigma^2}}$$

Here,

- ullet μ is the mean (or expectation) of the distribution. It is also equal to median and mode of the distribution.
- σ^2 is the variance.
- σ is the standard deviation.

Standard Normal Distribution

If $\mu=0$ and $\sigma=1$, then the normal distribution is known as standard normal distribution:

$$\phi(x)=rac{e^{-rac{x^2}{2}}}{\sqrt{2\pi}}$$



Every normal distribution can be represented as standard normal distribution:

$$\mathcal{N}(\mu,\sigma^2) = rac{1}{\sigma}\phi(rac{x-\mu}{\sigma})$$

Cumulative Probability

Consider a real-valued random variable, X. The cumulative distribution function of X (or just the distribution function of X) evaluated at x is the probability that X will take a value less than or equal to x:

$$F_X(x) = P(X \le x)$$

Also,

$$P(a \le X \le b) = P(a < X < b) = F_X(b) - F_X(a)$$

The cumulative distribution function for a function with normal distribution is:

$$\Phi(x) = rac{1}{2}igg(1+ ext{erf}\left(rac{x-\mu}{\sigma\sqrt{2}}
ight)igg)$$

Where **erf** is the error function:

$$\mathtt{erf}(z) = rac{2}{\sqrt{\pi}} \int_0^z e^{-x^2} dx$$