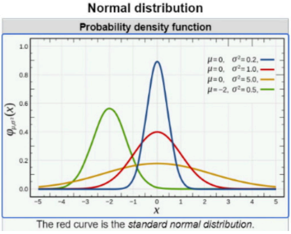
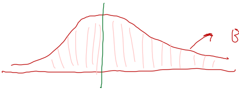
Normal / Gaussian Dsitribution

In probability theory and statistics, a normal distribution or Gaussian distribution is a type of continuous probability distribution for a real-valued random variable



The red curve is the *standard normal distribution.*

1) Continous random variable (pdf)



μ = median = mode

$X = \{ - - - - - - \}$

$\sigma^2 \uparrow\uparrow$

spread $\uparrow\uparrow$

Notation

$N(\mu, \sigma^2)$

Parameters $\mu \in \mathbb{R}$ = mean

$\sigma^2 \in \mathbb{R} > 0$

= Variance

$x \in \mathbb{R}$

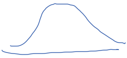
Example: Weights of student in a class

heights of students in a class

{Doctor}

{Doctor}

Iris dataset → Petal length, Sepal length



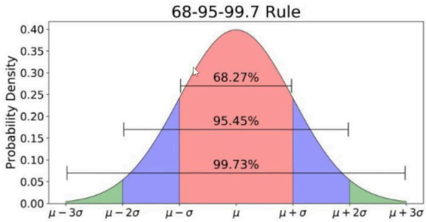
Petal width Sepal width

$$\boxed{PDF = \frac{1}{\sigma\sqrt{2\pi}} e^{-1/2\left(\frac{x_i-\mu}{\sigma}\right)^2}}$$

Mean of Normal / Gaussian

$$\mu = \sum_{i=1}^{n} \frac{x_i}{n} \qquad \sigma^2 = \sum_{i=1}^{n} \frac{(x_i-\mu)^2}{n} \qquad \sigma = \sqrt{\text{variance}}$$

Emperical Rule of Normal / Gaussian Distribution



QQ plot

$X = \{ - - - - - - - \} \Rightarrow$ Normal / Gaussian Distribution

Probability

$$Pr(\mu-\sigma \le X \le \mu+\sigma) \approx 68\%$$

$$Pr(\mu-2\sigma \le X \le \mu+2\sigma) \approx 95\%$$

$$Pr(\mu-3\sigma \le X \le \mu+3\sigma) \approx 99.7\%$$