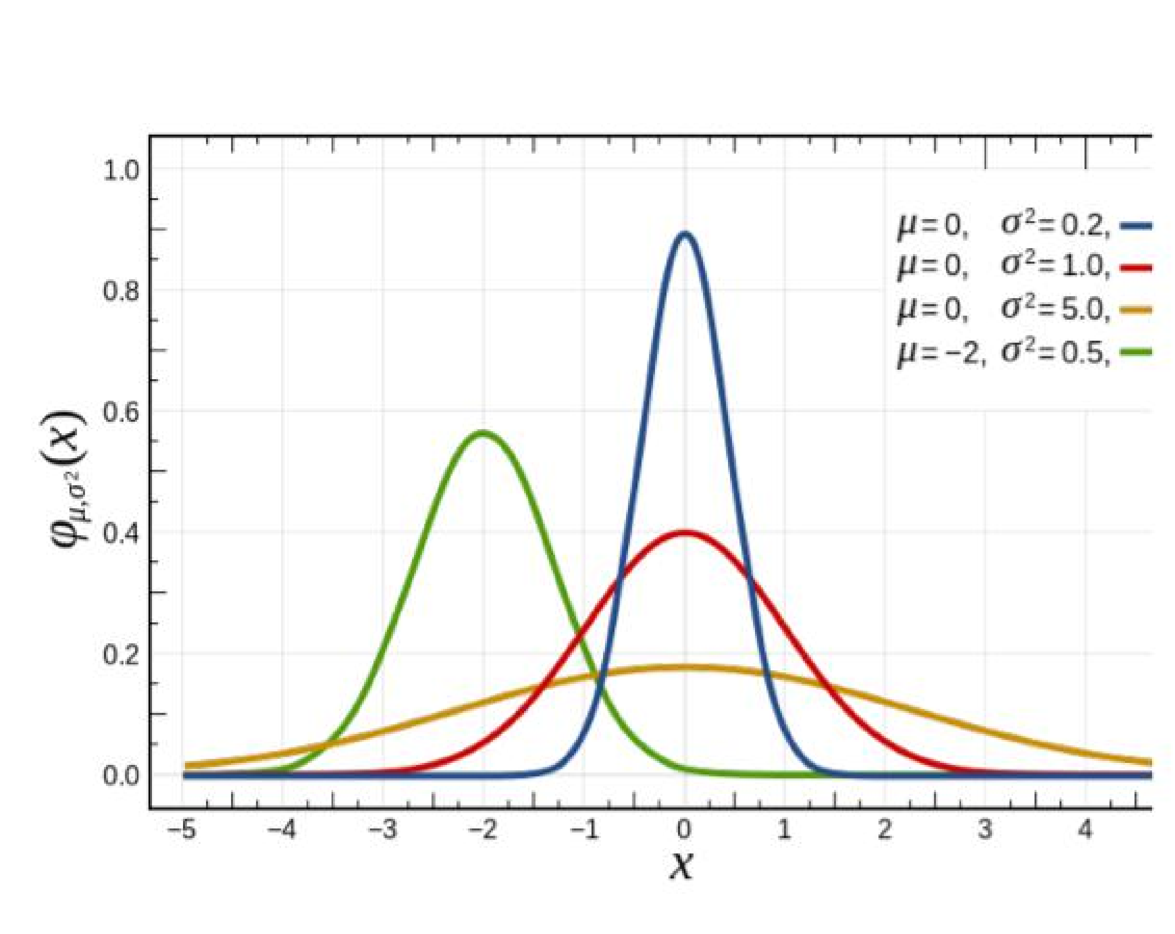
Error

Zihao Mu

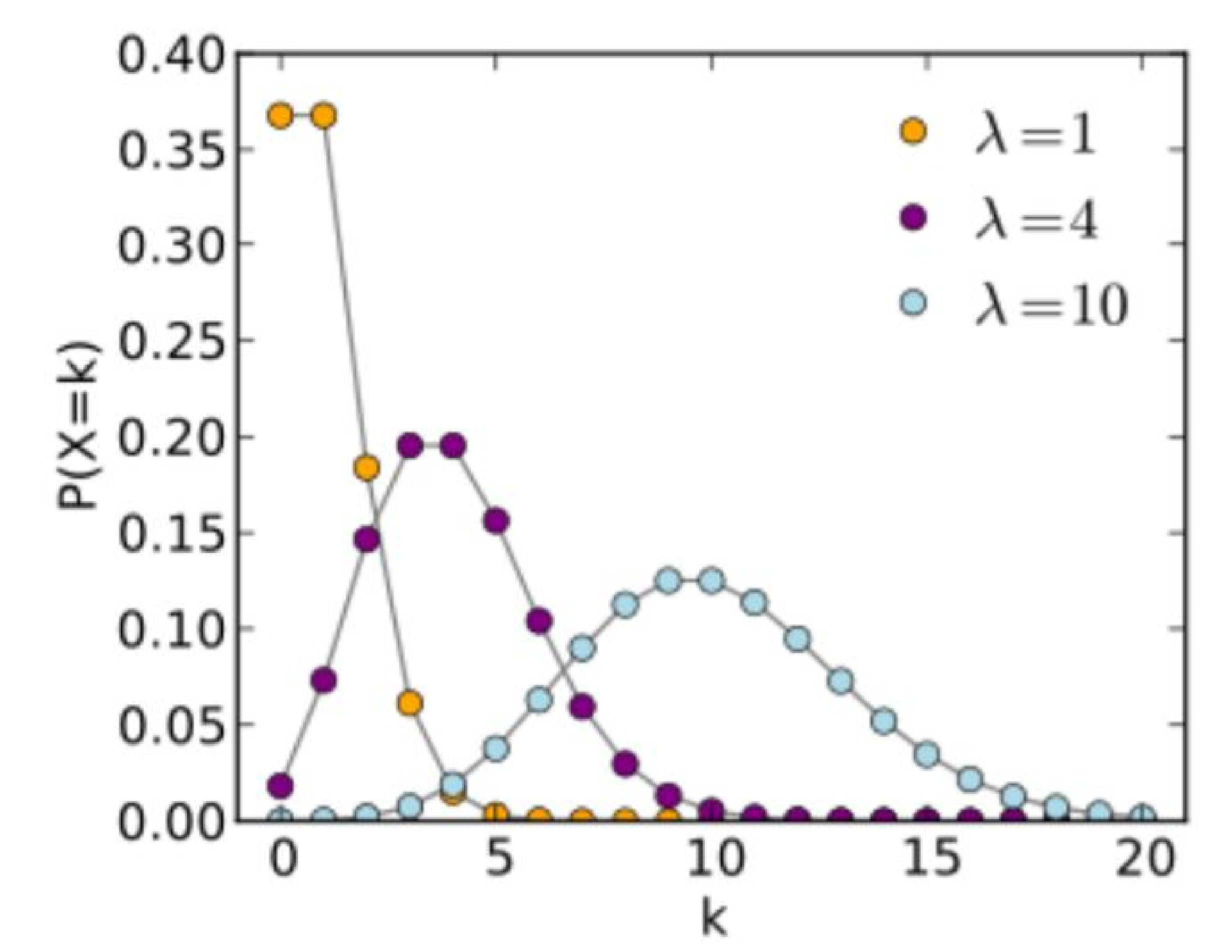
Gaussian distribution

- $y = y_0 + \varepsilon$
- $\epsilon \sim N(0, \sigma^2)$
- $precision$
- $accuracy$



Possion distribution

- $\varepsilon \sim Possion(\lambda)$
- $\lambda \leq 20$
- $\lambda \geq 20$ $Possion \rightarrow Normal$
- CCD-



Propagation of error

$$f = aA, \quad \sigma_f^2 = a^2\sigma_A^2$$

$$f = aA \pm bB, \quad \sigma_f^2 = a^2\sigma_A^2 + b^2\sigma_B^2 \pm 2ab\rho_{AB}$$

$$f = AB, \quad \sigma_f^2 \approx f^2\left[\left(\frac{\sigma_A}{A}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2 + 2\frac{\sigma_{AB}}{AB}\right]$$

$$f = \frac{A}{B}, \quad \sigma_f^2 \approx f^2\left[\left(\frac{\sigma_A}{A}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2 - 2\frac{\sigma_{AB}}{AB}\right]$$

$$f = aA^b, \quad \sigma_f^2 \approx \left(\frac{fb\sigma_A}{A}\right)^2$$

$$f = a\ln(bA), \quad \sigma_f^2 \approx \left(a\frac{\sigma_A}{A}\right)^2$$

$$f = a\log_{10}(A), \quad \sigma_f^2 \approx \left(a\frac{\sigma_A}{A\ln 10}\right)^2$$

$$f = ae^{bA}, \quad \sigma_f^2 \approx f^2(b\sigma_A)^2$$

$$f = a^{bA}, \quad \sigma_f^2 \approx f^2(b\ln(a)\sigma_A)^2$$

$$f = a\sin(bA), \quad \sigma_f^2 \approx (ab\cos(bA)\sigma_A)^2$$

$$f = a\cos(bA), \quad \sigma_f^2 \approx (ab\sin(bA)\sigma_A)^2$$

$$f = A^B, \quad \sigma_f^2 \approx f^2\left[\left(\frac{B}{A}\sigma_A\right)^2 + (\ln(A)\sigma_B)^2 + 2\frac{B\ln(A)}{A}\sigma_{AB}\right]$$

Jackknife resampling

- **Definition:** When do jacknife resampling, it takes one data from a sample of n data each time, and calculates statistics for the remaining data.

- **Estimate:** variance, bias

- **Example**:

  Mean:

$$\bar{x}_i = \frac{1}{n-1}\sum_{j\neq i}^{n} x_j$$

$$D_{(\text{jacknife})} = \frac{n-1}{n}\sum_{i=1}^{n}(\bar{x}_i - \bar{x}_.)^2$$

Bootstrapping

- **Definition:** It is a measurement technique based on random repeatable sampling.
- **Estimate:** bias, variance, confidence interval, prediction error
- **Advantage**: very simple. Strong generality, few assumptions(no Gaussian)