* Sample and Population

measure the central tendency of a data set
衡量数据集中趋势

随机选一些人 Randomly

generate a random sample from a population

Sample mean → 样本均值 mean → 平均数

μ = Population Mean $\bar{x}$ = Sample mean

$$\frac{x_1+x_2+\cdots+x_N}{N} = \frac{\sum_{i=1}^{N} x_i}{N} = \mu$$

$$\frac{\sum_{i=1}^{n} x_i}{n} = \frac{x_1+x_2+\cdots+x_n}{n}$$ Sum of Population

Essentially Equivalent.

* Dispersion 离中趋势

2 2 3 3 $\mu = \frac{2+2+3+3}{4} = 2.5$ ← $\sigma^2 = 0.25$

0 0 5 5 $\mu = \frac{0+0+5+5}{4} = 2.5$ ← $\sigma^2 = 6.25$

Further more disperse

Variance 总体方差 $\sigma^2 = \frac{\sum_{i=1}^{N}(x_i-\mu)^2}{N}$

Squared Absolute Number

Distance between each number and the mean

Square it → Positive Number (平方后,变正数)

2 2 3 3 (Make the number Positive)

i	x_i	μ	$x_i-\mu$	$(x_i-\mu)^2$
1	$x_1=2$	2.5	-0.5	0.25
2	$x_2=2$	2.5	-0.5	0.25
3	$x_3=3$	2.5	0.5	0.25
4	$x_4=3$	2.5	0.5	0.25 = 1

$\sum_{i=1}^{4}(x_i-\mu)^2 = 1$ $\sigma^2 = 1/4 = 0.25$

i	x_i	$x_i-\mu$	$(x_i-\mu)^2$
1	$x_1=0$	-2.5	6.25
2	$x_2=0$	-2.5	6.25
3	$x_3=5$	2.5	6.25
4	$x_4=5$	2.5	6.25

$\sigma^2 = 6.25$

总体方差

$\sigma^2 = \text{variance} = \frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}$ → N大的话，难测算

$\mu = \frac{\sum_{i=1}^{n} x_i}{n}$

↓

If Sample? $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ ⇒ Sample Variance ↓ $S_n^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

通常会低估 σ^2

Problem

μ 可能在 Sample 外

那 S_n^2 就低估了实际 σ^2

Unbiased estimate σ^2/S_n^2 ⇒ $S^2 = S_{n-1}^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$ ← Better!

很抱歉，最近一直在准备会计初级职称考试，今天下午刚考完。
剩下的我会在今晚通宵补上。和明天的作业一起交上来。绝对下不为例。