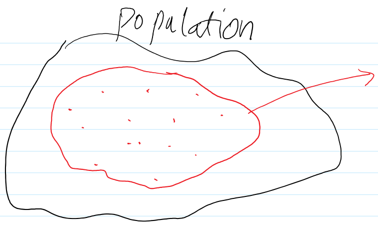
Mean and Variance

mean : $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$



Sample

$\bar{x}$: mean of the sample

σ^2 : variance of the sample

n : number of points in the sample

Variance : $\sigma^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$

$$\sigma^2 = \frac{1}{n-1}\sum\left(x_i^2 + \bar{x}^2 - 2\bar{x}x_i\right) = \frac{1}{n-1}\left\{\sum x_i^2 + \sum \bar{x}^2 - 2\sum \bar{x}x_i\right\}$$

$$= \frac{1}{n-1}\left\{\sum x_i^2 + n\bar{x}^2 - 2\bar{x}\underbrace{\sum x_i}_{\overset{\parallel}{n\bar{x}}}\right\} = \frac{1}{n-1}\left\{\sum x_i^2 + n\bar{x}^2 - 2n\bar{x}^2\right)$$

$S = \sum x_i^2$

$W = \sum x_i$

$\bar{x} = \frac{1}{n}\sum x_i \Rightarrow W = n\bar{x}$

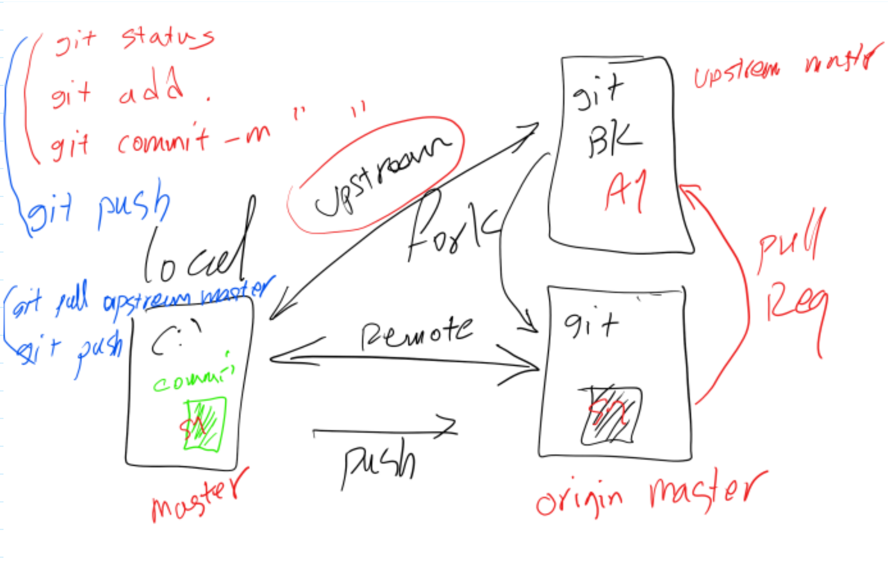
$\frac{W}{n} = \bar{x}$

$$\sigma^2 = \frac{1}{n-1}\left\{S - n \cdot \frac{W^2}{n^2}\right) \Rightarrow$$

$$\boxed{\sigma^2 = \frac{1}{n-1}\left(S - \frac{W^2}{n}\right)}$$

Git remote

Sunday, April 5, 2020 1:01 PM



git clone http:\\ ...

git status

git add .

git commit -m "test"

git remote -v

git remote add 'name' http:\\

git pull "name of the remote" master

git push 'name of the remote"

Assignment 06

Sunday, April 5, 2020 1:08 PM

- calculate :

π two methods

1: $\frac{\pi}{4} = \sum_{i=1}^{n} \frac{(-1)^n}{2n+1} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} + \dots + \frac{(-1)^n}{(2n+1)}$

$\frac{\pi^2}{6} = \sum_{i=1}^{n} \frac{1}{i^2}$

2: $e = 1 + \sum_{i=1}^{n} \frac{x^i}{i!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}$

two methods →
- use recursive functions
- fast method

3: Maximize $\left(\frac{a}{x}\right)^x$
& plot

Verify by solving by hand

$e^x = 1 + \sum_{i=1}^{n} \frac{x^i}{i!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!}$

$y_1 = x$

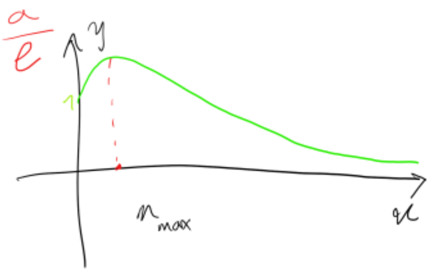
$y_2 = y_1 \times \frac{x}{2} = \frac{x^2}{2!}$

$y_3 = y_2 \times \frac{x}{3} = \frac{x^3}{3!}$

$y_4 = y_3 \times \frac{x}{4} = \frac{x^4}{4!}$

$y_i = y_{i-1} \times \frac{x}{i}$

$\max \left(\frac{a}{x}\right)^x = \frac{a}{e}$



$a = 1$

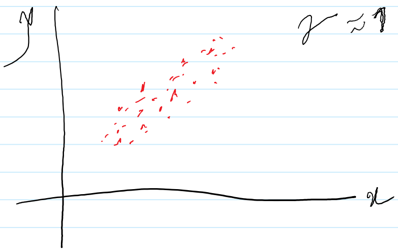
$a = 2$

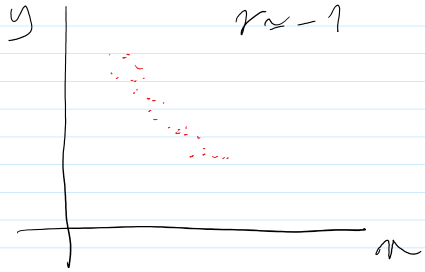
$a = 10$

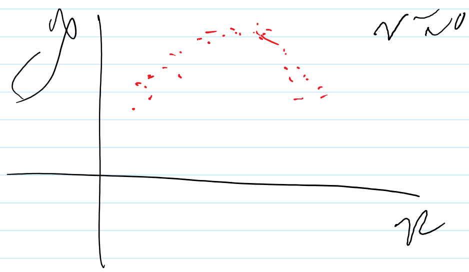
$x = \frac{a}{e}$

Correlation coefficient

Sunday, April 5, 2020 1:10 PM







$$corr = S_{xy} / S_x \cdot S_y$$

$$S_x^2 = \frac{1}{n-1} \sum (x_i - \bar{x})^2$$

$$S_{xy} = \frac{1}{n-1} \sum \left\{ (x_i - \bar{x})(y_i - \bar{y}) \right\}$$

$$S_y^2 = \frac{1}{n-1} \sum (y_i - \bar{y})^2$$

$$\bar{x} = \frac{1}{n} \sum x_i \qquad \bar{y} = \frac{1}{n} \sum y_i$$

Polynomial & PCA

Sunday, April 26, 2020 10:22 AM

	x_1	x_2	y
100	1		
	2		
	⋮		
	100		

$$a_1 x_1 + a_2 x_2 = y$$

$$y = a_1 x_1^2 + a_2 x_1 x_2 + a_3 x_2^2 + a_4 x_1 + a_5 x_2$$

x_1	x_2	x_1^2	x_2^2	$x_1 x_2$

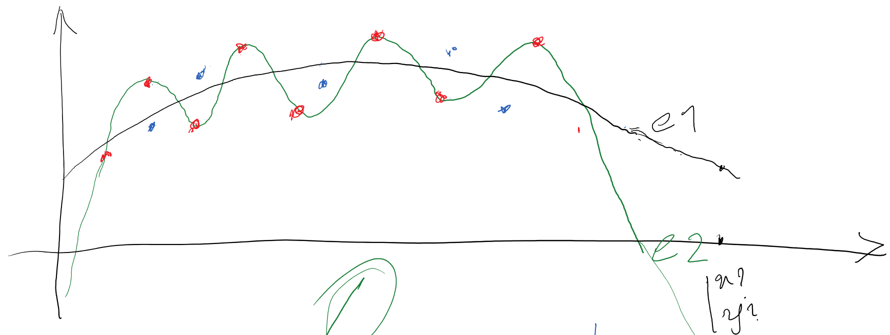
	X		$x - \mu = x'$
	x_1	$\xrightarrow{x_1 - \mu}$	5
	x_2	$\xrightarrow{5}$	⋮
	x_3	$\longrightarrow$	⋮
	⋮		⋮
100	x_{100}		

$$\bar{x'} = 0$$

$$\sigma_{x'} = 1$$

Overfit

Sunday, April 26, 2020 10:53 AM



Red $e_2 \ll e_1$

Blue $e_2 > e_1$