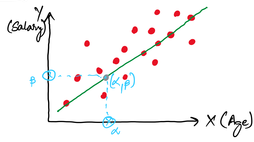
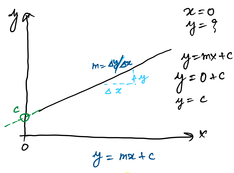
Straight line



$y = mx + c$ ← Intercept

Slope of the line

Salary = m * Age + c



$x=0$, $y=?$

$y = mx + c$

$y = 0 + c$

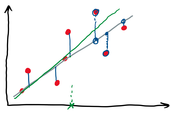
$y = c$

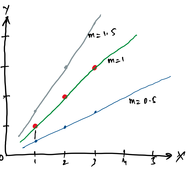
$y = mx + c$

$h(x) = c + mx$

$h(x) = \theta_0 + \theta_1 x$

Residuals





$y = mx$

Case I ($m = 0.5$)

$x=1$	$y=0.5$
$x=2$	$y=1$
$x=3$	$y=1.5$

Case II ($m = 1$)

$x=1$	$y=1$
$x=2$	$y=2$
$x=3$	$y=3$

Case III ($m = 1.5$)

$x=1$	$y=1.5$
$x=2$	$y=3$
$x=3$	$y=4.5$

$J(\text{case I}) = \frac{1}{2\times3}\left[(1-0.5)^2 + (2-1)^2 + (3-1.5)^2\right]$

$= \frac{1}{6}(0.25 + 1 + 2.25)$

$= \frac{1}{6}(3.5) = 0.58$

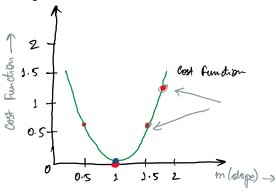
$J(\text{case II}) = \frac{1}{6}\left[(1-1)^2 + (2-2)^2 + (3-3)^2\right]$

$= 0$

$J(\text{case III}) = \frac{1}{6}\left[0.5^2 + 1^2 + 1.5^2\right]$

$= 0.58$

Plotting the cost function:



Gradient Descent

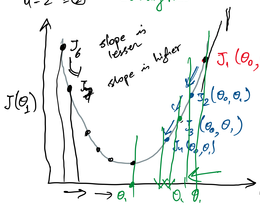
$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J_1(\theta_0, \theta_1)$

Cost function

Learning Rate

$\alpha = 1$ ← 1

$\alpha = 2$ ← 2



$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J_1(\theta_0, \theta_1)$

Cost function

Learning Rate

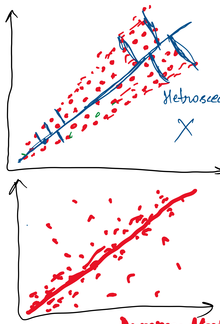
$y = x^2$

$\frac{dy}{dx} = 2x$

$\theta_0 := \theta_0 - \alpha \frac{\partial}{\partial \theta_0} \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x_i) - y_i\right)^2$

$(\theta_0 + \theta_1 x_i - y_i)^2$

$\theta_1 := \theta_1 - \alpha \frac{\partial}{\partial \theta_1} \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x_i) - y_i\right)^2$



Dummy Variables

State	NY	IN	CA	IL
New York	1	0	0	0
Indianapolis	0	1	0	0
California	0	0	1	0
Illinois	0	0	0	1

$IL = 1 - (NY + IN + CA)$

$10 = \frac{50 + 11500 + -520}{3}$

$30 - 11580 = -520 \quad (-11470)$