

- 100 Days of ML
- Day 34 - Working...
  - Day 35 - Complete...
  - Day 36 - Handling...
  - Day 37 - Handling...
  - Day 38 - Missing Indi...
  - Day 39 - KNN Impu...
  - Day 40 - Iterative I...
  - Day 41 - Outliers in...
  - Day 42 - Outlier De...
  - Day 43 - Outlier de...
  - Day 44 - Outlier De...
  - Day 45 - Feature C...
  - Day 46 - Curse of...

- Types of Gradient Descent
- Mathematical Formulation

## Mathematical Formulation

Saturday, May 22, 2021 3:38 PM

$n$ -dim dataset 3-cols

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

(lpa) (cgpa) (iq)

cgpa | iq | lpa

(2,3)

$x_1$	$x_2$	$y$
8.1	93	3.2
7.5	95	3.5

$\{m, b\}$

$\{\beta_0, \beta_1, \beta_2\}$

$L(\beta_0, \beta_1, \beta_2)$

1) Random values

$$\beta_0 = 0, \beta_1, \beta_2 = 1$$

2) epoch = 100, lr = 0.1

$$\begin{cases} \beta_0 = \beta_0 - \eta \text{slope} \\ \beta_1 = \beta_1 - \eta \text{slope} \\ \beta_2 = \beta_2 - \eta \text{slope} \end{cases}$$

$$\frac{\partial L}{\partial \beta_0} \quad \frac{\partial L}{\partial \beta_1} \quad \frac{\partial L}{\partial \beta_2}$$

$n$ -dim

$(n+1) \beta_0 - \beta_n$



## Types of Gradient Descent

## Mathematical Formulation

$$L = \frac{1}{2} \sum_{i=1}^n (y_i - \hat{y}_i)^2$$

$$= \frac{1}{2} \left[ (y_1 - \hat{y}_1)^2 + (y_2 - \hat{y}_2)^2 \right]$$

$$L = \frac{1}{2} \left[ (y_1 - \beta_0 - \beta_1 x_{11} - \beta_2 x_{12})^2 + (y_2 - \beta_0 - \beta_1 x_{21} - \beta_2 x_{22})^2 \right]$$

$$\frac{\partial L}{\partial \beta_0} = \frac{1}{2} \left[ 2(y_1 - \hat{y}_1)(-1) + 2(y_2 - \hat{y}_2)(-1) \right]$$

$$\frac{\partial L}{\partial \beta_0} = - \left( \frac{2}{2} \right) \left[ (y_1 - \hat{y}_1) + (y_2 - \hat{y}_2) \right]$$

$$\hat{y}_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2}$$

	$x_1$	$x_2$	$y$
1	8.1	9.3	3.2
2	7.5	9.5	3.5

$$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

$$\hat{y}_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12}$$

$$\hat{y}_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22}$$





100 Days of ML

- Day 34 - Working...
- Day 35 - Complete...
- Day 36 - Handling...
- Day 37 - Handling...
- Day38-Missing Indi...
- Day39 - KNN Impu...
- Day40 - Iterative I...
- Day 41 - Outliers in...
- Day 42 - Outlier De...
- Day 43 - Outlier de...
- Day44 - Outlier De...
- Day 45 - Feature C...
- Day 46 - Curse of...

Types of Gradient Descent

Mathematical Formulation

$$L = \frac{1}{2} \left[ (y_1 - \beta_0 - \beta_1 x_{11} - \beta_2 x_{12})^2 + (y_2 - \beta_0 - \beta_1 x_{21} - \beta_2 x_{22})^2 \right]$$

$$\frac{\partial L}{\partial \beta_0} = \frac{1}{2} \left[ 2(y_1 - \hat{y}_1)(-1) + 2(y_2 - \hat{y}_2)(-1) \right]$$

$$\frac{\partial L}{\partial \beta_0} = - \left[ \frac{2}{2} \right] \left[ (y_1 - \hat{y}_1) + (y_2 - \hat{y}_2) \right]$$

$$= - \frac{2}{n} \left[ (y_1 - \hat{y}_1) + (y_2 - \hat{y}_2) + (y_3 - \hat{y}_3) + \dots + (y_n - \hat{y}_n) \right]$$

$$= - \frac{2}{n} \sum_{i=1}^n (y_i - \hat{y}_i) = \frac{\partial L}{\partial \beta_0}$$

$\hat{y} = \beta_0 + \beta_1 x_1 + \beta_2 x_2$   
 $\hat{y}_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12}$   
 $\hat{y}_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22}$

$(7.5) \quad (95) \quad (3.3)$



## 100 Days of ML

Day 34 - Working...

Day 35 - Complete...

Day 36 - Handling...

Day 37 - Handling...

Day38-Missing Indi...

Day39 - KNN Impu...

Day40 - Iterative I...

Day 41 - Outliers in...

Day 42 - Outlier De...

Day 43 - Outlier de...

Day44 - Outlier De...

Day 45 - Feature C...

Day 46 - Curse of...

Types of Gradient Descent

Mathematical Formulation

$$L = \frac{1}{2} \sum_{i=1}^n (y_i - \hat{y}_i)^2$$

$$L = \frac{1}{2} [(y_1 - \hat{y}_1)^2 + (y_2 - \hat{y}_2)^2]$$

$$L = \frac{1}{2} [(y_1 - \beta_0 - \beta_1 x_{11} - \beta_2 x_{12})^2 + (y_2 - \beta_0 - \beta_1 x_{21} - \beta_2 x_{22})^2]$$

$$\frac{\partial L}{\partial \beta_1} = \frac{1}{2} [2(y_1 - \hat{y}_1)(-x_{11}) + 2(y_2 - \hat{y}_2)(-x_{21})]$$

$$\frac{\partial L}{\partial \beta_1} = \frac{-2}{n} [(y_1 - \hat{y}_1)(x_{11}) + (y_2 - \hat{y}_2)(x_{21}) + (y_3 - \hat{y}_3)(x_{31}) + \dots + (y_n - \hat{y}_n)(x_{n1})]$$

$$\frac{\partial L}{\partial \beta_1} = \frac{-2}{n} \sum_{i=1}^n (y_i - \hat{y}_i) x_{i1}$$

$x_{i1}$  → 1 col data  
 $\beta_1$  → values of 1 col.

	$\beta_1 \rightarrow x_1$	$\beta_2 \rightarrow x_2$	$y$
1	8.1	9.3	3.2
2	7.5	9.5	3.5
3			
4			

$x_{11}$   
 $x_{21}$   
 $x_{31}$   
 $x_{n1}$





100 Days of ML

Day 34 - Working...	Types of Gradient Descent
Day 35 - Complete...	Mathematical Formulation
Day 36 - Handling...	
Day 37 - Handling...	
Day38-Missing Indi...	
Day39 - KNN Impu...	
Day40 - Iterative I...	
Day 41 - Outliers in...	
Day 42 - Outlier De...	
Day 43 - Outlier de...	
Day44 - Outlier De...	
Day 45 - Feature C...	
Day 46 - Curse of...	

$$\frac{\partial L}{\partial \beta_1} = -\frac{2}{n} \sum_{i=1}^n (y_i - \hat{y}_i) x_{i1}$$

$$\frac{\partial L}{\partial \beta_2} = -\frac{2}{n} \sum_{i=1}^n (y_i - \hat{y}_i) x_{i2}$$

$$\left\{ \frac{\partial L}{\partial \beta_m} \right\} = -\frac{2}{n} \sum_{i=1}^n (y_i - \hat{y}_i) x_{im}$$

$x_{i1} \rightarrow 1^{st} \text{ col data}$   
 $\beta_1 \rightarrow \text{values of 1 col.}$

$m \text{ cols}$   
 $\beta_0 - \beta_m$

code

