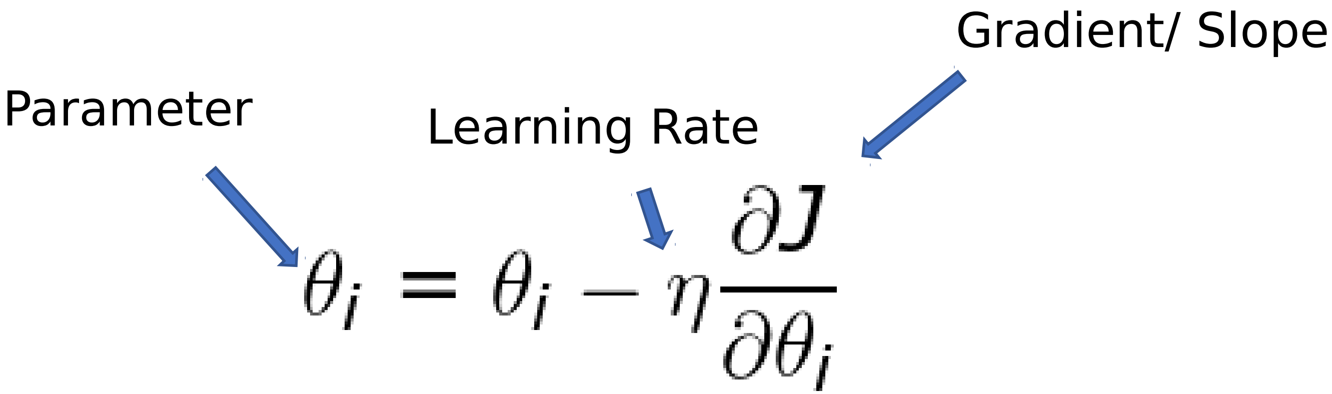
Optimizers

Gradient Descent



Parameter

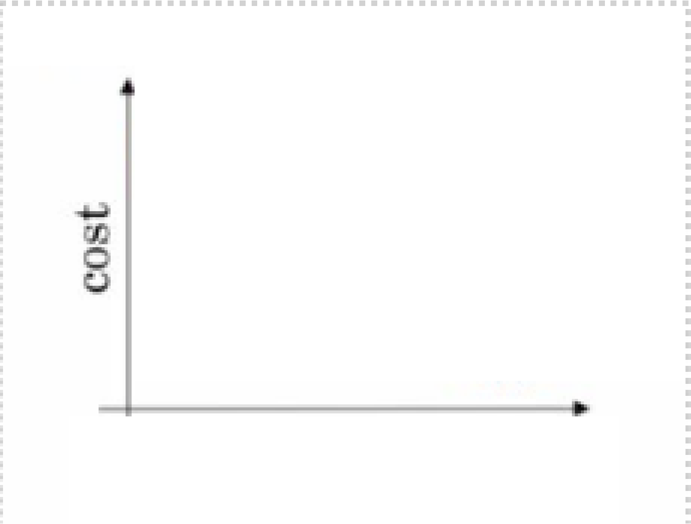
Learning Rate

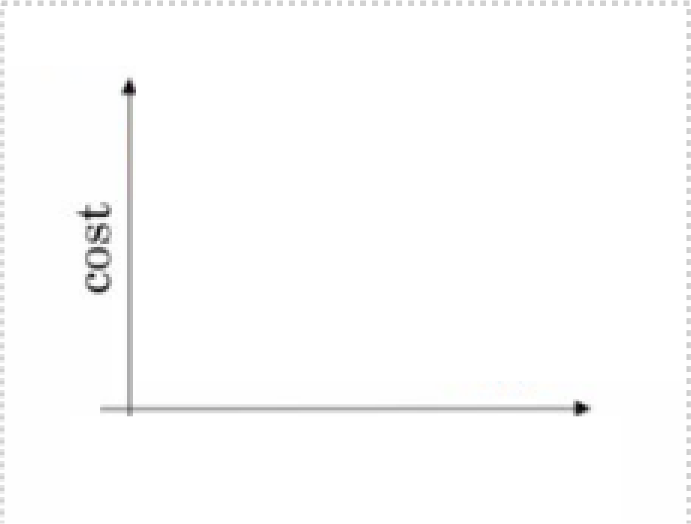
Gradient/ Slope

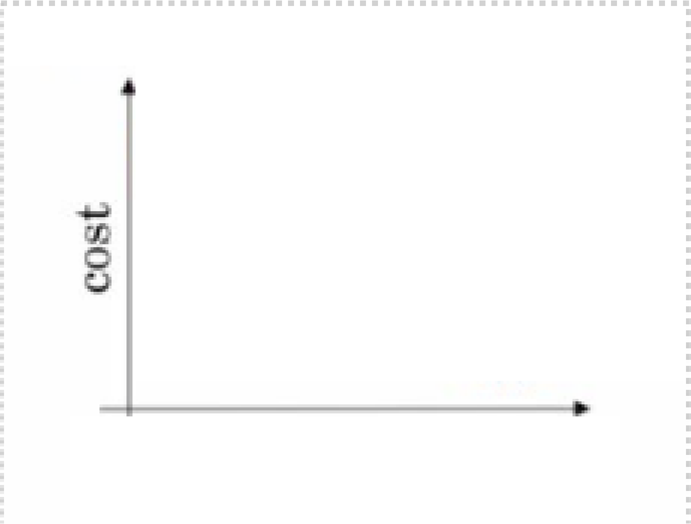
$$\theta_i = \theta_i - \eta \frac{\partial J}{\partial \theta_i}$$

Entire Training set (m)	Batch Gradient Descent
Single Observation (1)	Stochastic Gradient Descent
1 < x < m	Mini – Batch Gradient Descent

Gradient Descent

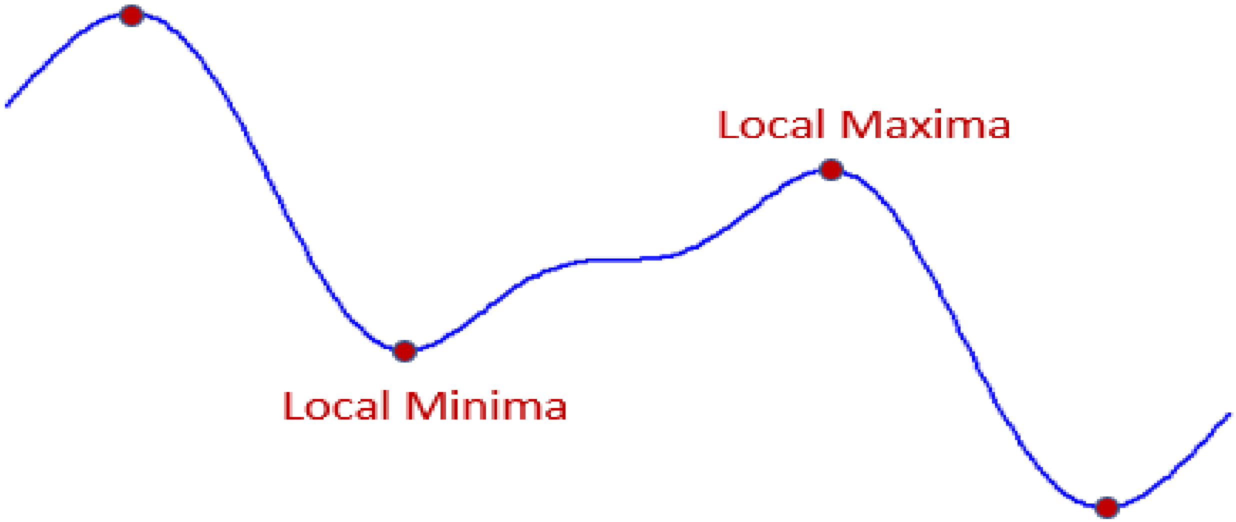






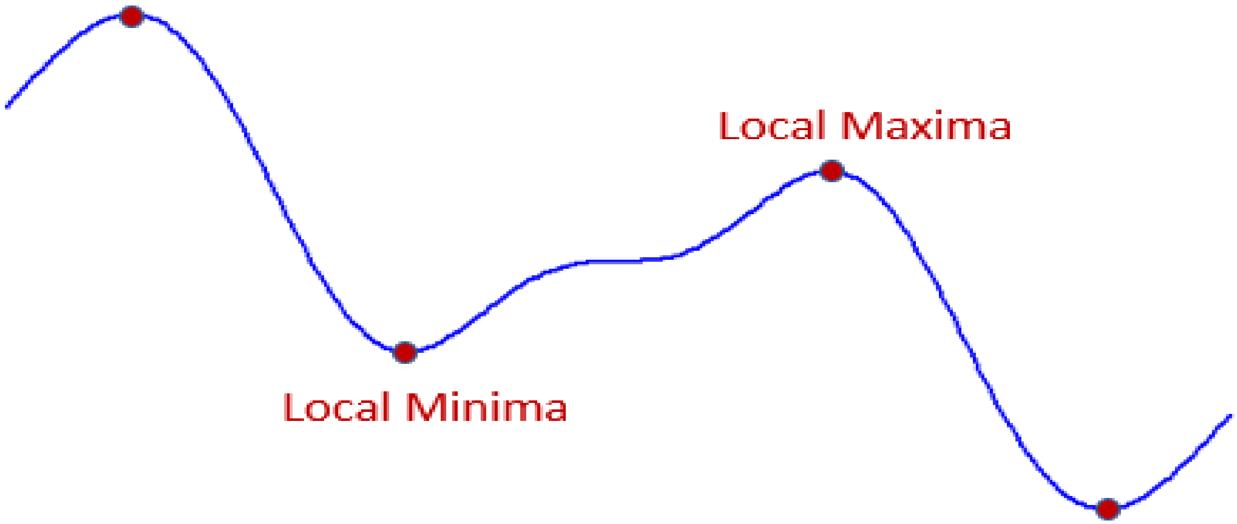
Problems of Gradient Descent

1. Getting stuck at Local Minima



$$\theta_i = \theta_i - \eta \frac{\partial J}{\partial \theta_i}$$

Problems of Gradient Descent



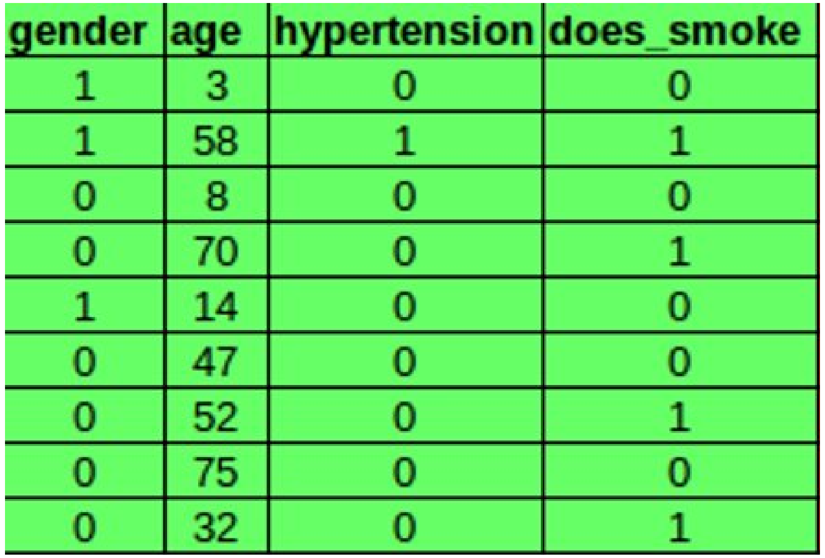
$$v_t = \beta v_{t-1} + (1-\beta)\frac{\partial J}{\partial \theta}$$

$$\theta_i = \theta_i - \eta v_t$$

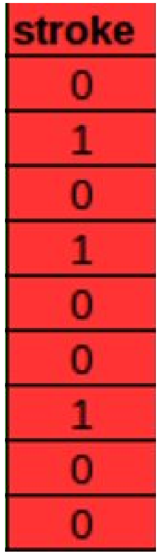
Problems of Gradient Descent

2. Same Learning Rate for all parameters

n	n	n	n



gender	age	hypertension	does_smoke
1	3	0	0
1	58	1	1
0	8	0	0
0	70	0	1
1	14	0	0
0	47	0	0
0	52	0	1
0	75	0	0
0	32	0	1

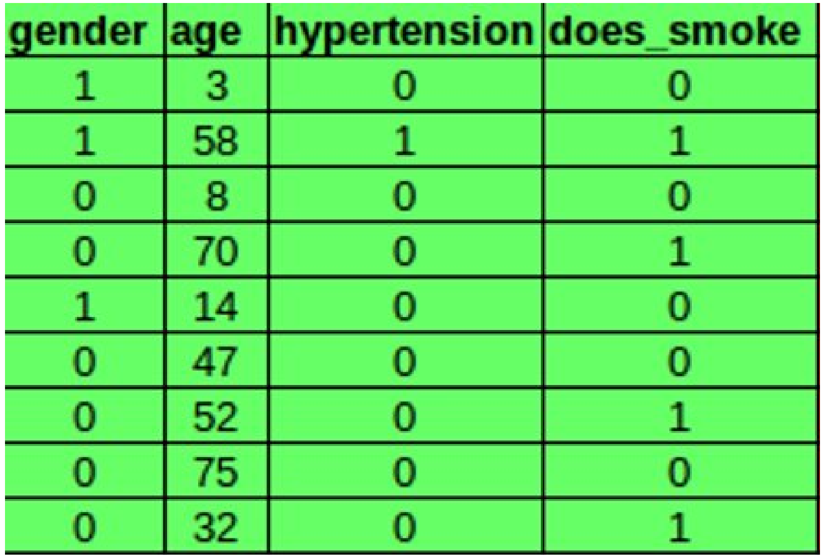


stroke
0
1
0
1
0
0
1
0
0

Problems of Gradient Descent

2. Same Learning Rate for all parameters

n1	n2	n3	n4



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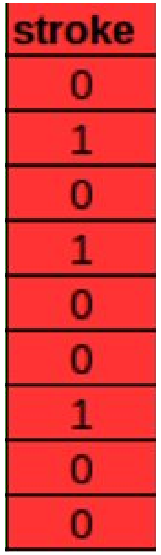
0	75	0	0
0	32	0	1



stroke
0
1
0
1
0
0
1
0
0

Problems of Gradient Descent

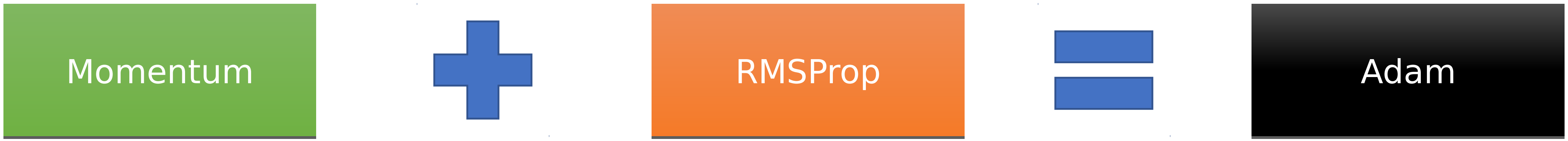
2. Same Learning Rate for all parameters

RMSProp

$$\mu_t = \beta\mu_{t-1} + (1 - \beta)(\frac{\partial J}{\partial \theta_{t,i}})^2$$

$$\theta_{t,i} = \theta_{t,i} - \frac{\eta}{\sqrt{\mu_t + \epsilon}}\frac{\partial J}{\partial \theta_{t,i}}$$

Adam



Momentum + RMSProp = Adam

Exponential Weighted
Sum of Past gradients

Exponential Weighted
Sum of Squares of
Past Gradients

Thank You