



deeplearning.ai

# Optimization Algorithms

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## Adam optimization algorithm

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$$V_{dw} = 0, S_{dw} = 0, V_{db} = 0, S_{db} = 0$$

On iteration  $t$ :

Compute  $dw, db$  using current mini-batch

$$V_{dw} = \beta_1 V_{dw} + (1 - \beta_1) dw, \quad V_{db} = \beta_1 V_{db} + (1 - \beta_1) db \quad \leftarrow \text{"momentum"} \beta_1$$

$$S_{dw} = \beta_2 S_{dw} + (1 - \beta_2) dw^2, \quad S_{db} = \beta_2 S_{db} + (1 - \beta_2) db^2 \quad \leftarrow \text{"RMSprop"} \beta_2$$

yhat = np.array([.9, 0.2, 0.1, .4, .9])

$$V_{dw}^{\text{corrected}} = V_{dw} / (1 - \beta_1^t), \quad V_{db}^{\text{corrected}} = V_{db} / (1 - \beta_1^t)$$

$$S_{dw}^{\text{corrected}} = S_{dw} / (1 - \beta_2^t), \quad S_{db}^{\text{corrected}} = S_{db} / (1 - \beta_2^t)$$

$$W := W - \alpha \frac{V_{dw}^{\text{corrected}}}{\sqrt{S_{dw}^{\text{corrected}} + \epsilon}}$$

$$b := b - \alpha \frac{V_{db}^{\text{corrected}}}{\sqrt{S_{db}^{\text{corrected}} + \epsilon}}$$

# Hyperparameters choice:

→  $\alpha$  : needs to be tune

→  $\beta_1$  : 0.9 → ( $dw$ )

→  $\beta_2$  : 0.999 → ( $dw^2$ )

→  $\epsilon$  :  $10^{-8}$

Adam : Adaptive moment estimation



Adam Coates