deeplearning.ai

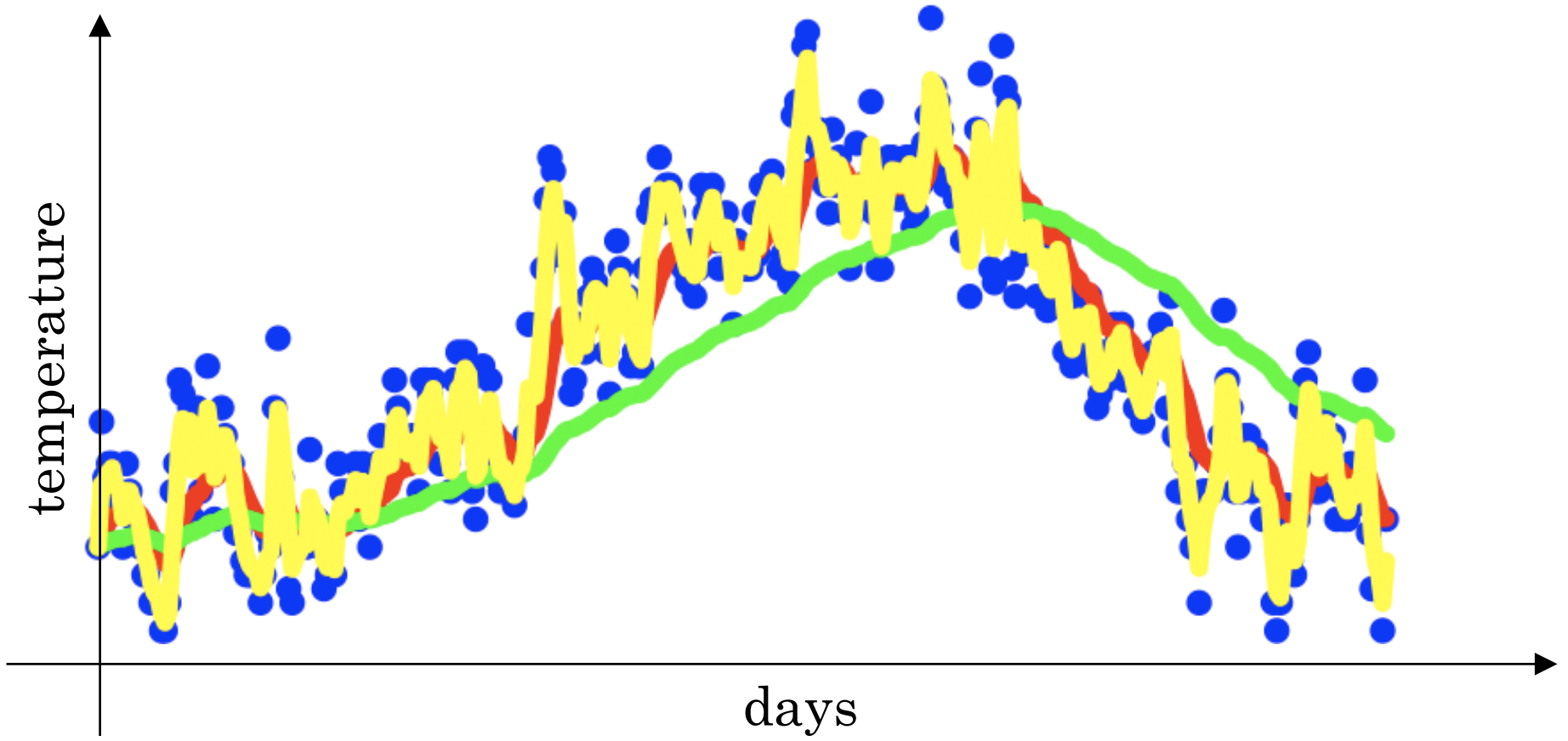
Optimization Algorithms

Understanding exponentially weighted averages

Exponentially weighted averages

$$v_t = \beta v_{t-1} + (1-\beta)\theta_t$$

$\beta = 0.9$ 0.98 0.5



Exponentially weighted averages

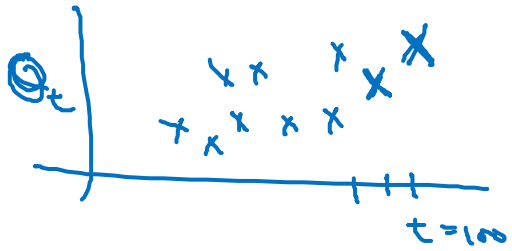
$$v_t = \beta v_{t-1} + (1-\beta)\theta_t$$

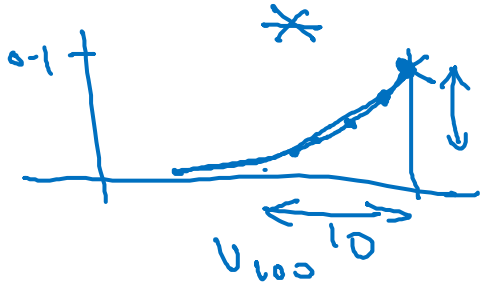
$$v_{100} = 0.9v_{99} + 0.1\theta_{100}$$

$$v_{99} = 0.9v_{98} + 0.1\theta_{99}$$

$$v_{98} = 0.9v_{97} + 0.1\theta_{98}$$

...





$\approx \frac{1}{1-\beta}$

$\varepsilon = 1-\beta$

$0.1\theta_{98} + 0.9v_{97}$

$v_{100} = 0.1\theta_{100} + 0.9v_{99}$

$= 0.1\theta_{100} + 0.9(0.1\theta_{99} + 0.9v_{98})$

$= 0.1\theta_{100} + 0.1 \times 0.9 \cdot \theta_{99} + 0.1(0.9)^2\theta_{98} + 0.1(0.9)^2\theta_{97} + 0.1(0.9)^3\theta_{96} + \ldots$

$0.9^{10} \approx 0.35 \approx \frac{1}{e}$

$(1-\varepsilon)^{1/\varepsilon} = \frac{1}{e}$

$0.98^{?}$

$\varepsilon = 0.02 \rightarrow 0.98^{50} \approx \frac{1}{e}$

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Implementing exponentially weighted averages

$$v_0 = 0$$
$$v_1 = \beta v_0 + (1-\beta)\,\theta_1$$
$$v_2 = \beta v_1 + (1-\beta)\,\theta_2$$
$$v_3 = \beta v_2 + (1-\beta)\,\theta_3$$
$$\dots$$

$V_\theta := 0$

$V_\theta := \beta v + (1-\beta)\theta_1$

$V_\theta := \beta v + (1-\beta)\theta_2$

$\vdots$

$V_\theta = 0$

Repeat {

Get next θ_t

$V_\theta := \beta V_\theta + (1-\beta)\theta_t$

}

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