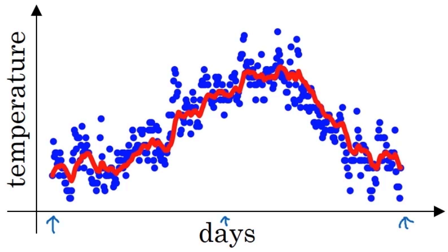
Exponentially weighted averages

Temperature in London

$\theta_1 = 40°F$ 4°C ←
$\theta_2 = 49°F$ 9°C
$\theta_3 = 45°F$ ⋮
⋮
$\theta_{180} = 60°F$ 15°C
$\theta_{181} = 56°F$ ⋮
⋮



$V_0 = 0$
$V_1 = 0.9 V_0 + 0.1 \theta_1$
$V_2 = 0.9 V_1 + 0.1 \theta_2$
$V_3 = 0.9 V_2 + 0.1 \theta_3$
⋮
$V_t = 0.9 V_{t-1} + 0.1 \theta_t$

Andrew Ng

The red line is the exponentially weighted average

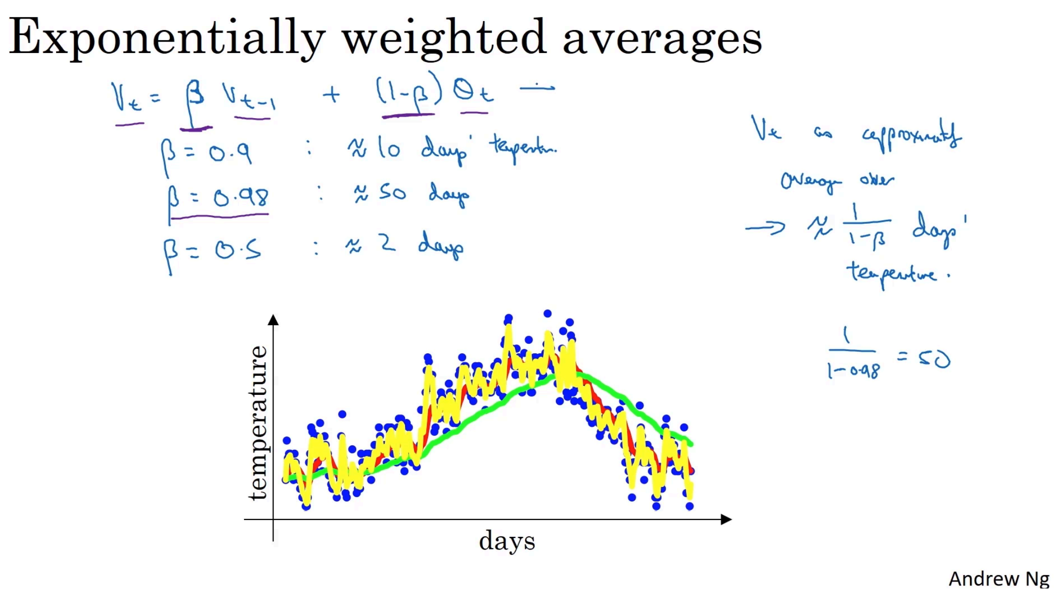
$$V_t = \beta V_{t-1} + (1-\beta)\theta_t$$

Here you can think of V_t as averaging over the past 1/(1-beta) days' temperature.

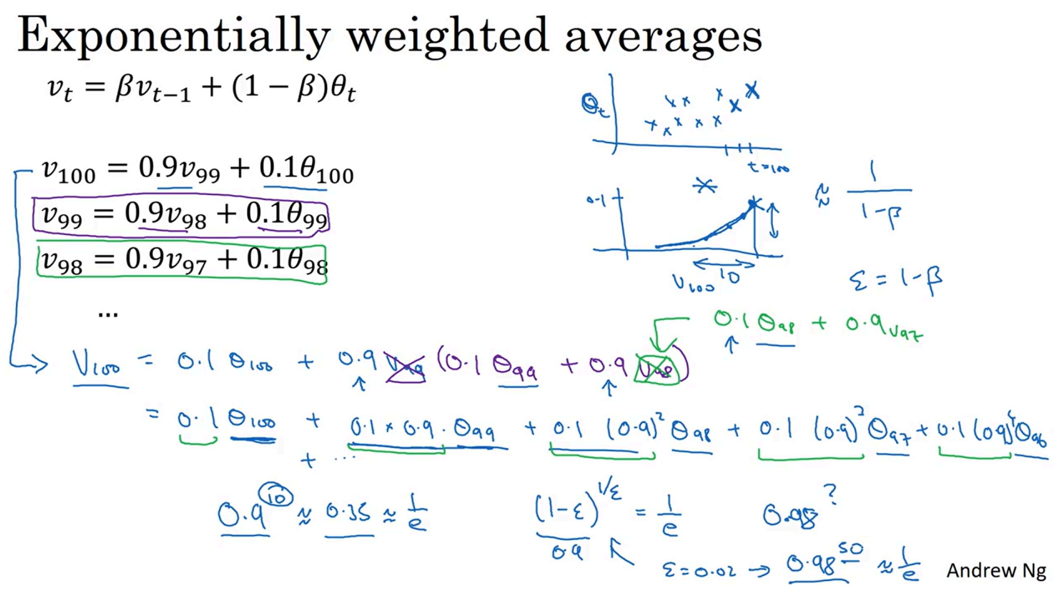
V_t as approximately
average over
$\approx \frac{1}{1-\beta}$ days'
temperature.

High beta → (eg: green line), the plot is smoother because it keeps track of a longer range of days' temperatures. Adapts slowly to newer temperatures

Very low beta → (eg: red line), very noisy yellow line since you are very susceptible to new temperatures.



Intuition for EWAs



Explanation of the graphs on the top right

Top graph: just the temperature measurements over time.

Bottom one: exponentially decaying function of weightage factor for each of the elements on top.

So v_100 = element wise product of those two graphs and sum them up