Exponential Smoothing

Simple Average

Simple Average

- Equal contribution of all points

Weighted Moving Average

Simple Average

- Equal contribution of all points

Weighted moving Average

- Higher weights to certain (recent) observations

Simple Exponential Smoothing

Simple Average	Weighted moving Average	Simple exponential smoothing
• Equal contribution of all points	• Higher weights to certain (recent) observations	• Exponentially Increasing weights to observations

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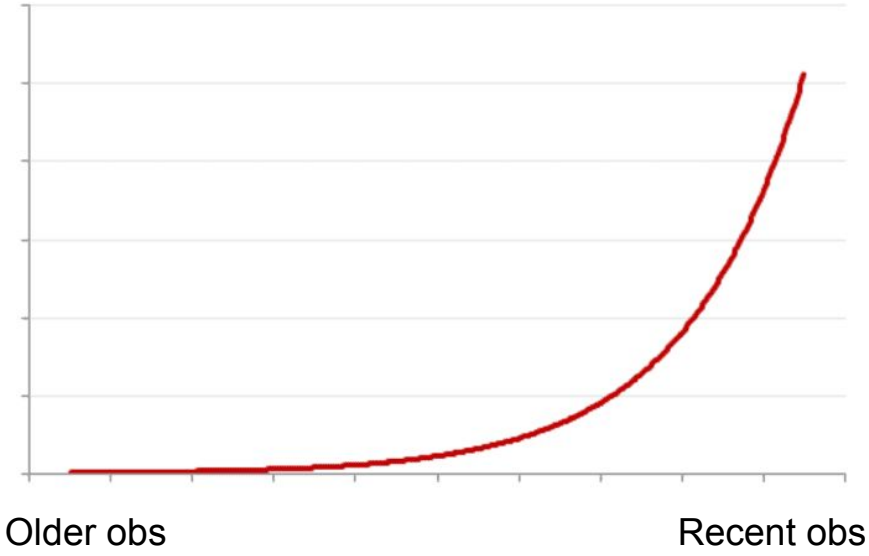
Simple Exponential Smoothing

- Weights increase exponentially as the observations become more recent
- Slow and smooth change in weights



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Simple Exponential Smoothing

- Weights increase exponentially as the observations become more recent
- Slow and smooth change in weights

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots$$

Forecast

Past observations

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Simple Exponential Smoothing

- Weights increase exponentially as the observations become more recent
- Slow and smooth change in weights

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots.$$

Smoothing Parameter

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Simple Exponential Smoothing

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots$$

	$\alpha = 0.2$	$\alpha = 0.4$	$\alpha = 0.6$	$\alpha = 0.8$
y_T	0.2000	0.4000	0.6000	0.8000
y_{T-1}	0.1600	0.2400	0.2400	0.1600
y_{T-2}	0.1280	0.1440	0.0960	0.0320
y_{T-3}	0.1024	0.0864	0.0384	0.0064
y_{T-4}	0.0819	0.0518	0.0154	0.0013
y_{T-5}	0.0655	0.0311	0.0061	0.0003

Simple Exponential Smoothing

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots.$$

$$\hat{Y}_{t+2} = \alpha Y_{t+1} + \alpha(1-\alpha)Y_t + \alpha(1-\alpha)^2 Y_{t-1} + \alpha(1-\alpha)^3 Y_{t-2} + \alpha(1-\alpha)^4 Y_{t-3} + \ldots.$$

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Simple Exponential Smoothing

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots.$$

$$\hat{Y}_{t+2} = \alpha Y_{t+1} + \alpha(1-\alpha)Y_t + \alpha(1-\alpha)^2 Y_{t-1} + \alpha(1-\alpha)^3 Y_{t-2} + \alpha(1-\alpha)^4 Y_{t-3} + \ldots.$$

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Simple Exponential Smoothing

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots.$$

$$\hat{Y}_{t+2} = \alpha Y_{t+1} + \alpha(1-\alpha)Y_t + \alpha(1-\alpha)^2 Y_{t-1} + \alpha(1-\alpha)^3 Y_{t-2} + \alpha(1-\alpha)^4 Y_{t-3} + \ldots.$$

$$\hat{Y}_{t+2} = \alpha Y_{t+1} + (1-\alpha)\left[\alpha Y_t + \alpha(1-\alpha)^1 Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots.\right]$$

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Simple Exponential Smoothing

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots.$$

$$\hat{Y}_{t+2} = \alpha Y_{t+1} + \alpha(1-\alpha)Y_t + \alpha(1-\alpha)^2 Y_{t-1} + \alpha(1-\alpha)^3 Y_{t-2} + \alpha(1-\alpha)^4 Y_{t-3} + \ldots.$$

$$\hat{Y}_{t+2} = \alpha Y_{t+1} + (1-\alpha)\left[\alpha Y_t + \alpha(1-\alpha)^1 Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3} + \ldots.\right]$$

$$\hat{Y}_{t+2} = \alpha Y_{t+1} + (1-\alpha)\left[\hat{Y}_{t+1}\right]$$

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Simple Exponential Smoothing

- Weights increase exponentially as the observations become more recent
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$$\hat{Y}_{next} = \alpha Y_{prev} + (1-\alpha)\hat{Y}_{prev}$$

Simple Exponential Smoothing

Thank You