Assignment 1

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Exercise 4: recursive estimation and optimization of λ

Write the update equations for R_t and $\hat{\Theta}_t$!

$R_0 = 0.1 \cdot I_2 \qquad \Theta = 0 \in \mathbb{R}^2 \qquad x_1^T = (1 \quad 2018)$

$x_2^T \approx (1 \quad 2018.84) \qquad y_1 = 2930483 \qquad y_2 = 2934044$

without forgetting / (exponential) weight matrix

$\hat{\Theta}_t = (X_t^T X_t)^{-1} X_t^T y_t = R_t^{-1} h_t$

$R_t = R_{t-1} + x_t x_t^T$

$$\Rightarrow R_1 = R_0 + x_1 x_1^T = 0.1 I_2 + \begin{pmatrix} 1 \\ 2018 \end{pmatrix} (1 \quad 2018) = \begin{pmatrix} 1.1 & 2018.1 \\ 2018.1 & 4072324 \end{pmatrix}$$

$$\Rightarrow R_2 = R_1 + x_2 x_2^T = \begin{pmatrix} 1.1 & 2018.1 \\ 2018.1 & 4\,072\,324 \end{pmatrix} + \begin{pmatrix} 1 \\ 2018.84 \end{pmatrix} (1 \quad 2018.84)$$

$$\approx \begin{pmatrix} 2.1 & 4036.84 \\ 4036.84 & 8\,144\,984.3403 \end{pmatrix}$$