Rapport de TP sur le fitre de Kalman

Ewen LE HAY

15 octobre 2025

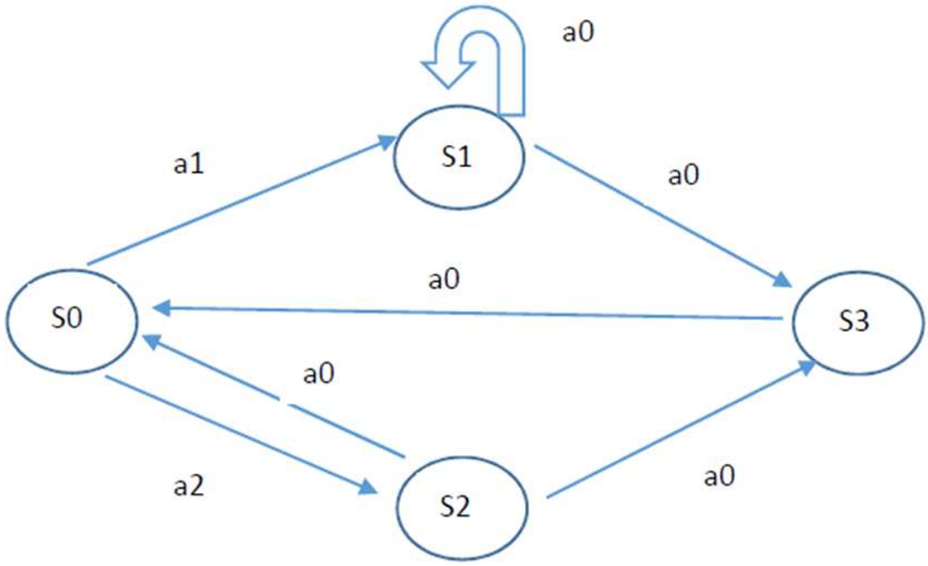
RO12 - Navigation pour les systèmes autonomes

École Nationale Supérieure de Techniques Avancées - ENSTA - Palaiseau

Table des matières

Introduction

This document present the answers to the Task 1 of the Reinforcement Learning Assignement.



1 Enumerate all the possible policies

Here are the only 2 solutions :

$$\pi_1(S0) = a_1$$
$$\pi_1(S1) = a_0$$
$$\pi_1(S2) = a_0$$
$$\pi_1(S3) = a_0$$

&

$$\pi_2(S0) = a_2$$
$$\pi_2(S1) = a_0$$
$$\pi_2(S2) = a_0$$
$$\pi_2(S3) = a_0$$

2 Write the equation for each optimal value function for each state

$$
\begin{aligned}
V^*(S_0) &= \gamma \max\Big(V^*(S_1), V^*(S_2)\Big) \\
V^*(S_1) &= \gamma\Big((1-x)V^*(S_1) + xV^*(S_3)\Big) \\
V^*(S_2) &= 1 + \gamma\Big((1-y)V^*(S_0) + yV^*(S_3)\Big) \\
V^*(S_3) &= 10 + \gamma V^*(S_0)
\end{aligned}
$$

3 Is there exist a value for x, that for all $\gamma \in [0,1)$ and $y \in [0,1]$, $\pi^*(S0) = a_2$

If we take x=0 then $V^*(S_1)$ become :

$$V^*(S_1) = \gamma V^*(S_1)$$

Since $\gamma \neq 1$, we have $V^*(S_1) = 0$

So $V^*(S_1) < V^*(S_2)$ (all starting values are positive and only sums are involved so $V^*(S_2) \geq 0$) and so $\pi^*(S0) = a_2$

4 Is there exist a value for y, that for all $\gamma \in [0,1)$ and $x \in (0,1]$, $\pi^*(S0) = a_1$

Experimentally (using the python script), we see that no y exist for gamma = 0.9 & x = 0.01