LIMITING DISCOUNTED-COST CONTROL OF PARTIALLY OBSERVABLE STOCHASTIC SYSTEMS

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Abstract— This paper presents two main results on partially observable (PO) stochastic systems. In the first one, we consider a general PO system

$$x_{t+1} = F(x_t, a_t, \xi_t),\ y_t = G(x_t, \eta_t) \quad (t = 0, 1, \dots) \tag{1}$$

on Borel spaces, with possibly unbounded cost-per- stage functions, and give conditions for the existence of α-discount optimal control policies ($0 < \alpha < 1$). In the second result we specialize (1) to additive-noise systems

$$x_{t+1} = F_n(x_t, a_t) + \xi_t,\ y_t = G_n(x_t) + \eta_t \quad (t = 0, 1, \dots)$$

in Euclidean spaces, with $F_n(x, a)$ and $G_n(x)$ converging pointwise to functions $F_\infty(x, a)$ and $G_\infty(x)$, respectively, and give conditions for the limiting PO model

$$x_{t+1} = F_\infty(x_t, a_t) + \xi_t,\ y_t = G_\infty(x_t) + \eta_t$$

to have an α-discount optimal policy.