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Summary: This paper investigates finite-horizon optimal control problem of completely unknown discrete-time linear systems. The completely unknown here refers to that the system dynamics are unknown. Compared with infinite-horizon optimal control, the Riccati equation (RE) of finite-horizon optimal control is time-dependent and must meet certain terminal boundary constraints, which brings the greater challenges. Meanwhile, the completely unknown system dynamics have also caused additional challenges. The main innovation of this paper is the developed cyclic fixed-finite-horizon-based Q-learning algorithm to approximate the optimal control input without requiring the system dynamics. The developed algorithm main consists of two phases: the data collection phase over a fixed-finite-horizon and the parameters update phase. A least-squares method is used to correlate the two phases to obtain the optimal parameters by cyclic. Finally, simulation results are given to verify the effectiveness of the proposed cyclic fixed-finite-horizon-based Q-learning algorithm.

MSC:

58F15 Hyperbolic structures (expanding maps, Anosov systems, etc.) (MSC2000)
58F17 Geodesic and horocycle flows (MSC2000)
53C35 Differential geometry of symmetric spaces

Keywords:

finite-horizon; optimal control; discrete-time linear systems; completely unknown dynamics; Q-learning

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