Optimal control and the Value of Information for a Stochastic Epidemiological SIS-Model

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We present a stochastic SIS-model of epidemic disease, where the recovery rate can be influenced by a decision maker. The problem of minimization of the expected aggregated economic losses due to infection and due to medication is considered. The resulting stochastic optimal control problem is investigated on two alternative assumptions about the information pattern. If a complete and exact measurement is always available, then the optimal control is sought in a state-feedback form for which the Hamilton-Jacobi-Bellman (HJB) equation is employed. If no state measurement is available at all, then the optimal control is sought in an open-loop form. Given at least an estimated initial probability density for the number of infected, the open loop problem can be reformulated as an optimal control problem for the associated Kolmogorov forward equation (describing the evolution of the probability density of the state). Optimality conditions are derived in both cases, which requires involvement of non-standard arguments due to the degeneracy of the involved HJB and Kolmogorov parabolic equations. The effect of the observations on the optimal performance is investigated theoretically and numerically.

References

[1] Grandits P., Kovacevic R. and Veliov,V.M.: *Optimal control and the Value of Information for a Stochastic Epidemiological SIS-Mode*, Research Report **2016-14**, ORCOS, TU Wien, 2016.