A MDP APPROACH TO THE CONTROL OF TRAFFIC LIGHTS

René Haijema, University of Amsterdam, The Netherlands, r.haijema@uva.nl
Jan van der Wal, Eindhoven University of Technology, The Netherlands.

Optimal control of traffic lights, such that the overall average waiting time per car is minimized, appears to be quite complicated. For large (networks of) intersections, the MDP becomes intractable due to the curse of dimensionality in the state space.

We suggest a one-step policy improvement approach based on the relative values of a (near-) optimal fixed cycle. Under the fixed cycle the value of a state at an intersection is decomposed into values for each queue. Key idea of our so-called relative value based rules is to interrupt the fixed cycle, by shortening or lengthening green periods and when all signals show red to prescribe which queue to serve next.

We consider several relative value based rules and compare them to the underlying fixed cycle, and actuated control policies and for tractable cases also to the optimal (MDP) policy. The rules can be extended to deal with arrival information, and extensions to networks of intersections and appear to perform very well with waiting time reductions in the order of 20% or even more.