Explaining the Space of SSP Policies via Policy-Property Dependencies: Complexity, Algorithms, and Relation to Multi-Objective Planning: Supplement

Primary Keywords: *None*

Proof of Theorem 2

A single property $|\Phi| = 1$ can directly be mapped into the SSP's optimization function. Φ is solvable iff the corresponding optimal solution satisfies the threshold. This shows the first part of the claim.

For $|\Phi| = 2$, one can adapt the proof by (Feinberg 2000) showing NP-hardness in the flat case based on a reduction from the Hamiltonian cycle problem. We can apply the same proof idea, however considering a succinct circuit representation of the graph, i.e., yielding a reduction from the succinct Hamiltonian cycle problem which is known to be NEXPTIME-complete (Galperin and Wigderson 1983). The circuit can be encoded directly into the planning task using binary variables to track the succinct representation of graph nodes, and implementing the circuit's transition test via actions. This shows that PSS is NEXPTIME-hard. Membership follows via guess and check, both can be done in exponential time.

References

Feinberg, E. A. 2000. Constrained Discounted Markov Decision Processes and Hamiltonian Cycles. *Math. Oper. Res.*, 25(1): 130–140.

Galperin, H.; and Wigderson, A. 1983. Succinct Representations of Graphs. *Inf. Control.*, 56(3): 183–198.