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A Checker-Board Sky: Automating Telescope Scheduling with Reinforcement Learning

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The size, complexity, and duration of telescope surveys are growing beyond the capacity of traditional methods for scheduling observations. Scheduling algorithms must have the capacity to balance multiple (often competing) observational and scientific goals, address both short-term and long-term considerations, and adapt to rapidly changing stochastic elements (e.g., weather). Reinforcement learning (RL) methods have the potential to significantly automate the scheduling and operation of telescope campaigns and greatly reduce the amount of human effort needed to vet schedules produced via costly simulation work.
In this work, we present the application of an RL-based scheduler, which uses a Markov decision process framework to construct scheduling policies in a way that is scalable, recoverable in the case of interruptions during observation, and computationally efficient for surveys that can include over a hundred observations. We simulate surveys of objects in the Galactic equator, assuming the location and optics of Stone Edge Observatory. We present schedules generated by our RL technique. While initial results are not comparable to human-tuned schedules, we are encouraged by the technique's scalable, automated approach. We examine how well an RL agent's produced schedules compare to human-designed schedules by comparing different formulations of cumulative reward for these schedules. We also investigate the success of our model as we vary the complexity of the telescope environment and as we vary the reward function. We present this work as a motivation to explore more complex situations and surveys.

Significance

Showing the potential use of reinforcement learning as a novel technique for automating small-scale telescope surveys.

References

Experiment context, if any

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