



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Tejas Narayanan; Ashish Rao; Bidipta Sarkar	Project Number S1409
Project Title Novel Reinforcement Learning Methods in Collaborative Environments	
<p style="text-align: center;">Abstract</p> <p>Objectives Reinforcement learning (RL) is an emerging field with numerous applications in a wide variety of domains, such as robotics, supply chain and network optimization, marketing, and more. Our research focuses on developing improved RL algorithms and applying them to domains involving complex interactions between multiple intelligent systems.</p> <p>Methods We propose a novel algorithm which employs a Bayesian method of parameter space exploration to solve reinforcement learning problems. We parameterize policies as neural networks, and a Gaussian process is used to learn the expected return of a policy given the parameters. The system is trained by updating the parameters in the directions suggested by the Gaussian Process to maximize the expected return and explore important new states.</p> <p>Results Our method is applied to three challenging robotic simulations where we achieve gains of 8%, 20%, and 33% over current methods. We also observe good performance in cooperative and competitive environments that require communication between multiple intelligent systems.</p> <p>Conclusions The improved performance of our methods will enable the development of intelligent systems that tackle significantly more complex problems in robotics and other fields. Our novel method of Bayesian parameter space exploration can be theoretically shown to result in less conservative updates towards better policies.</p>	
Summary Statement We develop a novel method of Bayesian parameter space exploration inspired by Policy Gradient methods to solve Reinforcement Learning Problems.	
Help Received We designed, developed, and implemented our algorithm by ourselves, but received some help. In particular, we emailed Dr. Yi Wu (UC Berkeley) and Dr. Ryan Lowe (McGill University) to clarify some questions we had on their papers.	