Economic Constraints

MORL has financial limitations that are often inherent to any openly publishable research. Given our lack of funding and our desire to produce results which are replicable by anyone, we are reliant on freely available tools such as Tensorflow, OpenAI Gym, and Python. While using free tools limits some of our performance capabilities, the vast support and availability of these tools improves its accessibility to others, and we feel this benefit outweighs the loss of limiting ourselves to freely available tools. This also enables us to be unrestricted by any potential bias of funding from other sources, as we will be receiving no monetary contributions. In addition, this frees us from any restrictions in regards to use of physical resources such as computers at UC. So long as a computer can install tensorflow and use Python and OpenAI Gym, our work should be entirely usable from this computer, thus improving universal accessibility and replicability. Thinking beyond constraints and more towards contributions, this tool could be used to support economic development, particularly in any economic area which involves multi-objective problems, and given the complexity of many economic issues, many of these issues could be modeled as multi-objective problems and therefore be used as input into the MORL system to find their solutions.

Professional Constraints

Multi-Objective Reinforcement Learning is a growing subset of Deep Learning which seeks to use Reinforcement Learning to solve complex problems in which one wishes to solve for multiple objectives. Because of this, our contribution to this area will provide us with an improved understanding into this area and providing us with hands-on experience in the areas of Deep Learning and Machine Learning. The members of this group have all worked on Machine Learning topics to some degree, from Clustering, SVMs, and Decision Trees, to Neural Networks, a Deep Learning Seminar, Genetic Algorithms, etc. By working with Reinforcement Learning, we seek to extend our knowledge to include a greater domain of Machine Learning topics and how we can use the tools within it to solve problems. This project will require us to apply all of our previous Machine Learning knowledge, improve it, and widen it. As such, this also means that the project will be inherently constrained by our own understanding of this area, so it is crucial that we ensure it is as clear as possible. This in turn will improve our knowledge and expertise as Computer Scientists and Data Analysts, supporting us in our future work and careers. In our effort to publish our work to the Machine Learning community, we will also improve our standing as researches in the field.

Social Constraints

Our project can be used by nonprofit and for profit organizations alike to analyze data and train computers to solve problems and make decisions. This can be especially useful to society by

propelling forward fields that are rich in data, but have high-complexity, multi-objective problems. For instance, the upcoming field of personalized medicine often wants to provide good information to patients without incurring excessive medical expenses. Medical professionals and researchers could use our tool to advance the current state of personalized medicine. It could also be used by bioinformaticians outside of the scope of personalized medicine, and we hope to present an example of such use in our testing. Additionally, there has been huge interest in deep learning from the automotive and robotics industries. Our optimizations of feature selection for multi-objective reinforcement learning could aid in the development of self-driving cars, autonomous robotic assistants, and other innovative technologies. While our tool will primarily improve the quality of research, the research that uses our tool could have a major impact on quality of life for everyone.

Diversity and Cultural Constraints

With the wide-reaching impact that our tool could have, it is important to consider that people from diverse cultures and lifestyles may want to use our tool and incorporate that into its design. However, as two white males from Appalachia, it can certainly be a challenge to incorporate diversity into our tool. Initially, we will only have one locale, American English for our UI and CLI tool; however, with our collective knowledge of Spanish and Mandarin Chinese, we may later seek to expand this and incorporate other locales. With the amount of artificial intelligence research currently being done in China by Baidu and other companies (Daugherty, Paul, 2017, https://www.weforum.org/agenda/2017/06/how-china-became-ai-leader/), there could be a huge benefit to the global research community to translating our tool into a Mandarin Chinese distribution. Designing our tool to be intuitive and easy to translate into other locales will be an important step in our initial design.