MORL

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Computer Science Senior Design
Self-Assessment

Project Description

Multi-objective reinforcement learning is a subfield of deep learning, which is currently a booming field within Computer Science. Multi-objective reinforcement learning is the process of conditioning a computer program to make decisions based on more than one goal. The applications of multi-objective reinforcement learning vary widely and include intelligent robotics, bioinformatics, and data analysis. Our project focuses on improving feature selection for multi-objective reinforcement learning. For any machine learning algorithm, data cleaning and feature selection is essential to achieving good results. We plan to use filter methods and genetic algorithms to improve feature selection for multi-objective reinforcement learning.

Classroom Experience

My experience in the classroom throughout my undergraduate career has played a role in preparing me for this project. In Intelligent Data Analysis my sophomore year, I learned the basics of data analysis with focus on clustering, decision trees, support vector machines, and association rules. In addition, I learned about the importance of feature selection and knowing my data. I learned that techniques like PCA exist to analyze features give visual representations of multivariate data. I also participated in a Deep Learning Seminar last year as part of an independent study. There I was formally and thoroughly introduced to neural networks and the concept of deep neural networks.

Work Experience

My experience in the workplace has done a lot to prepare me for this project. In my work at Cincinnati Children's Hospital Medical Center, I have applied various machine learning and data analysis techniques to real research problems in proteomics and bioinformatics. I also have experience with big data visualization and have been able to articulate my work at conferences and in peer-reviewed journal articles. I also have some experience as a Web Developer at Kinetic Vision. At Kinetic Vision, I learned a lot about best practices in software engineering and how to design and organize a project.

Motivation

I've been doing research-oriented projects since I was a senior in high school, so I was interested in a research-oriented senior design. For a long time I have been interested in artificial intelligence and machine learning. As I grew and developed in my career as a Computer Scientist, I saw pertinent applications in a variety of fields, such as bioinformatics and data analytics. I am especially driven towards machine learning applications in

bioinformatics because of my childhood dream of tackling problems related to autism, a disorder with which my brother was diagnosed at a young age. When I was discussing project ideas with my partner and advisor, I was excited to pick up a manageable piece of the puzzle in furthering deep learning as a field. I see this project as broadening horizons not only for my own interests, but for all those who have interests like mine. I want to help the deep learning community make computers learn better so that we can solve bigger problems across many fields.

Preliminary Project Design
As I've been discussing with my partner, I think our preliminary goals will include a literature search for thorough understanding of the topics we will be exploring, namely multiobjective reinforcement learning, genetic algorithms, and filter methods. Progress towards these goals has already been made and we expect to start the next phase soon. In the implementation phase, we will need to compare our changes to some baseline, so implementing a current method of feature selection and reinforcement learning would be a good first step of implementation. Our next step would be to attempt to use filter methods for feature selection, as suggested in the OpenAI request for research (https://openai.com/requests-for-research/#multiobjective-rl). Simultaneously, we can be developing genetic algorithms for the same purpose of feature selection, and explore to what extent these can be used to improve multiobjective reinforcement learning. Towards the end of this project, we need to exhaustively evaluate these across multiple datasets and show their practical applications. Finally, I think we should aim to have some user-friendly graphical tool to perform feature selection using our algorithm or a selection of algorithms given a user-provided dataset.