CPSC 448: Directed Study Proposal

As a branch of artificial intelligence, machine learning allows systems to learn from data, identify patterns and make predictions with less human intervention. Machine learning has become an extremely popular topic as it allows us to quickly and automatically produce models that can analyze bigger, more complicated data and come up with faster, more accurate predictions on a larger scale. One of the machine learning methods that I am interested in is reinforcement learning. With reinforcement learning, an agent interacts with the environment observing a state, taking an action and then observing a reward and a new state. The algorithm discovers through trial and error which actions yield the greatest rewards or lowest cost. As a student specializing in mathematics and computer science, I am curious about how probability theory and game theory can be related to machine learning, and I am motivated by its wide range of real-life applications. Therefore, I hope to enroll in the directed study about reinforcement learning together with my peers under the supervision of professor Michiel van de Panne.

Through this directed study, we hope to have a broader and deeper understanding of the theory and applications of reinforcement learning. I will start by reading related publications and research papers to enhance my knowledge. One of the texts recommended by professor Panne is Reinforcement Learning: An Introduction Second edition by Richard S. Sutton and Andrew G. Barto. In this book, the author explains several different methods and approaches as well as examples and exercises. These examples help to compare the efficiency of different approaches under different scenarios and help us to have a clearer understanding of the advantages and disadvantages of each method and to which kind of environment they are best suitable for. Some of the exercises evolve writing short programs, which is a great way to test our understanding, make connections between theory and applications and improve our problem-solving skill.

The planned schedule of this directed study is to start with reading more related text and research papers. During January and February, we will try to do recommended exercises from the text and write computer simulations to gain a deeper understanding. We plan to meet weekly to discuss our progress. Meanwhile, we will extend our knowledge on machine learning by searching for more resources and attend related lectures. In March, we hope to find a more specific problem with suitable difficulty to work on, such as extending the boundary of an example provided in the text by considering different cases, or to simulate a method we learned on a new environment such as a game. By the end of the semester, we will either conclude with a summary report about what we have accomplished, or a final project such as computer simulations. We sincerely hope you consider our proposal and register us to the directed study course.

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