Tristan McGinnis

Individual Capstone Assessment

For my senior design project, I chose to develop a network of autonomous, machine-learning-driven server-side bots for the Source engine-based game *Team Fortress 2*. Codenamed SWISSBOT, I aim to create a rewards-based learning model that will gradually "teach" a proprietary computer-controlled player how to interact with the rules of the game as well as calculate and predict player movement in a three-dimensional game space to deal damage to the opposing team, obtain points, and complete objectives. The bots will learn through a series of controlled tests created in Hammer (Valve Software's proprietary level editor) to master the basic mechanics of cardinal movement, obstruction detection, jumping, and further complex scenarios commonly found in a regular match. The goal of this project is to create a realistic computer-controlled opponent compared to that of an experienced player.

Throughout my academic career, I had been at odds with what I was driven to achieve within the field. I had always had an interest in game development and theory, yet didn't dive into the field out of a then shaky perspective of the industry. Whilst attending, however, I was soon introduced to the incredible capabilities and utility of Python through the Python Programming (CS 2021) course. Of course, I was aware that a more robust language such as C++ or Java (while classes such as Operating Systems was a much more suitable candidate for game creation, but the utility, and automation capabilities of Python would be something that would stick with me on my journey to pin down my future. My co-ops were not very well-aligned with a now back-of-mind aspiration for game development, being a Database Engineering Intern at CINTAS for eight months merely taught me that my future did *not* involve SQL, however one of the many projects I was assigned had to do with automation, and I soon found myself fascinated with the concept.

It was only when I was taking AI Principles and Applications (CS 4033) did I begin to further understand and appreciate the complexity of machine learning and how these processes could be applied to automated programs. Finally, after enough time I was comfortable enough to create and tinker with my own small-scale scripts and Markov-chains, creating a basis that would soon come back to assist in this project. The motivation for my project comes from that initial passion for video games from when I had first began taking classes, now backed with all the languages and skills I would need to approach working on much grander applications. My co-ops did not give me the proper opportunity to apply my knowledge up to this point, especially into what I was most passionate about. This will be a great opportunity to not only solidify what I learned previously, but develop it further.

My expected result is a fully autonomous program that will challenge the skills of human players through machine-controlled opponents, having been taught the objectives and skill needed to succeed in a hectic and complex digital environment. To incrementally test the success and progression of the program, I will be constructing a series of simple, in-game tests of increasing difficulty that will challenge the bots and record their progress. I plan to self-evaluate my

contributions by monitoring the success of the tests and by eventually pitting my bots up against those that come pre-made with the game to emulate their expected performance against real players.