**Honors Experiential Learning Project Proposal Form**

Complete this proposal **prior** to your project’s start date and upload it in the UHP Database (<https://webapps.uc.edu/uchonorsstudent>). Create a project (“Add a new record”) in the “Tracking Project” tab and then upload your proposal document as an attachment. The deadline for [submitting proposals](http://www.uc.edu/honors/experiences/experiencesubmission.html) is on the 5th of each month.

*While the quality of the proposal is most important, strong proposals are typically 3-4 pages in length (single-spaced). Please maintain the proposal format.*

**Basic Information**  
Full Name: Jeremiah Dale Greer

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College: College of Engineering and Applied Science

Major: Computer Science

Title of Project: Machine Learning Algorithms Applied to Determining an Unknown and Variable Set of Rules

Thematic Area (choose only one): Research

Expected Project Start Date: TBD

Expected Project End Date: TBD

**Project Information**

1. Provide a detailed abstract of your proposed honors experiential learning project.

Card games have been an area of joy and fascination for many years as people have played them and gained various skills and strategies in playing them. One card game of particular interest, Mao, is introduced to new players as a game where you cannot be told any of the rules other than it plays similarly to the game of UNO. Beyond that, the players must figure out the rules to the game for themselves as the game goes on. The rules for the game are consistent and agreed upon for everyone who knows how to play, and so there is a set of consistent rules for the game; however, one additional rule to the game is that whoever wins a round of the game can either add a rule themselves or remove a rule that had been added by another player. This way, the rules of the game are constantly being changed between rounds, forcing players to attempt to find patterns among what was played in order to determine the rules for the game.

The goal of this proposal is to create a program capable of figuring out the patterns when cards are played in order to determine the rules to the game itself. My hope is that through creating this program I will gain insight into the processes by which machine learning algorithms function. In addition, this experience will help me to grow in my ability of problem solving and my experience within my field of study, Computer Science. In terms of my learning experienced throughout the project, I will gain knowledge in programming techniques and methods used throughout all areas of Computer Science that will benefit me in the future. I will also gain knowledge about the idea of machine learning and how algorithms used in programs that make use of such a concept are created and utilized in order to achieve the effect of learning within a program, as well as achieving the effect in a rapid manner to allow for the quick and advanced learning which is theoretically only capable by a program or machine, due to the much faster rate at which machines are capable of performing tasks compared to humans.

Designing and building the program will require an extensive amount of work and time in order to bring the project to fruition, with research time, design time, and programming time possibly greatly exceeding 90+ hours of work. Not only will an extensive amount of time be spent researching the various concepts necessary in order to produce such a program, but the actual process of coding the program, as well as testing the program for functionality and bugs, will be a very large time commitment as well.

**Clearly and thoroughly address how each of the following elements will be exhibited in your work:**

1. Connection to Learning Outcomes within the Honors Thematic Area (identified above)

There are three learning outcomes I hope to achieve which are tied in within the thematic area of Research. The main learning outcomes that I plan on investigating extensively are the possession of a well-developed awareness of literature in the field of Computer Science, and in particular the area of machine learning, the ability to formulate a theory, problem, or hypotheses for my proposed research project based on my previously mentioned review of literature, and the ability to identify and apply appropriate methodologies to design research study as well as collect and analyze data.

The first outcome, increasing my awareness of literature within the field, will be accomplished in the beginning stages of my project, during which I will begin looking at the research others have done in regards to the area of Computer Science in general, in regards to the various programming techniques and methods previously mentioned, as well as the area of machine learning. Machine learning is a fairly new concept in the area of Computer Science, not in the sense that it hasn’t existed, as people have wanted to train machines to do anything for quite a while, but instead that the concept has actually come to fruition and begun showing results within the past few years. Extensive work has been done in the area of machine learning already, with IBM’s Deep Blue and Watson being prime recent examples. Deep Blue was a chess playing computer created by IBM that had gained enough ability to challenge and defeat the World Chess Champion Gary Kasparov. Watson was a computer designed by IBM to compete in the game of Jeopardy, and did exactly that against two of the top Jeopardy players to have been on the show. Using learning algorithms in order to alter the way in which it searched for answers, Watson was able to effectively teach himself how to play Jeopardy, the end result of which caused the program to actually beat the other two Jeopardy players in a game that has largely been difficult to computers due to its reliance upon wordplay within the English language, another area that computers are deficient in but could improve through machine learning.

The second outcome, creating a theory, problem, or hypothesis for the project based on the literature review, is partly achieved through my creation of this research proposal, but additionally it will be fulfilled through my thoughts on how to design the program to figure out the rules to a card game. After gaining knowledge on the idea of machine learning through the review of its literature, as well as the various aspects of machine learning’s implementation within programming and the design of programs in general, I will be able to give a reasonable idea as to how I will go about the creation of the program for my project, as well as how machine learning would factor into the design of said program. For instance, I will be able to decide how exactly the program should go about learning something, as well as what would be the best technique for learning (based on available learning techniques that are capable of being implemented into code).

The third outcome, identifying and applying methodologies to design research study, will be fulfilled through my design of the program as well as the process by which I will test the program to determine if its capabilities have reached my desired goal of their functionality. After my appropriate research of literature and my development of the design of the implementation of the concept of machine learning, I will then design the program in its entirety, accounting for the various aspects of the way the card game is played as well as how exactly the program must learn how to “learn” the card game by detecting patterns in the ways in which cards are played. For instance, when designing my program, I will learn to design it in a set format to allow others to understand the code that I wrote. In addition, I will have a specific way in which I will test the program for functionality as well as various potential bugs located within.

1. Connection to Goals and Academic Theories (include reference list, as appropriate)
2. The first reference that I will try to tie in to my developmental goals for the project is the book *Machine Learning: A Guide to Current* Research written by Tom Mitchell. Citation: Mitchell, Tom M., Jaime G. Carbonell, and Ryszard Stanisław Michalski. *Machine Learning: A Guide to Current Research*. Boston: Kluwer Academic, 1986. Print. This work is a guide toward the current research done by others within the area of machine learning. This will help contribute to my project by helping to give me a wide range of knowledge about the various works in the area of machine learning, fulfilling the first learning outcome, increasing my awareness of literature within the field. In addition, the book will give me an extensive amount of knowledge about machine learning, helping me in my overall project and future endeavors within the area of machine learning.

B. The second reference that I will try to tie in to my developmental goals for the project is the concept of Operant Conditioning, created by B. F. Skinner. The idea is that animals and people learn through a series of positive and negative reinforcements and punishments associated with an action. This is beneficial by helping me to determine the best course of action for helping the program to figure the rules to the card game through the negative reinforcement of gaining a card whenever the computer makes a mistake. In addition, it grounds this theory of learning within a realistic realm, helping to solidify the concept that the program is capable of learning in such a method (assuming the method is capable of being transferred to code).

1. Initiative, Independence, and/or Creativity

I am the sole contributor to this project, in that I will be the only one researching various aspects of machine learning necessary to the creation of the program, I will be the only one designing and coding the program itself, and I will be the only one presenting the project when it is finished. With how programming works, entire projects are often designed and completed by a single person over extended periods of time, as coding tends to require a complete understanding of what one is creating, which is difficult to transfer to multiple people unless both have a complete understanding of what needs to be done and how it needs to be done. The project is also unique and creative in that A) the code of the program is completely built through my own design without the help of others, B) to my knowledge, no program has been made to determine the rules to a card game, especially a card game where the rules are constantly changing, and C) machine learning is an area of study that still has a very large amount of potential expansions that allow for many unique opportunities of study.

1. Reflection

In my reflection, I plan to have a weekly progress report in which I write a journal about what has been learned so far in the previous week and think about how what I’ve learned will affect my future work on this particular project as well as future projects. I hope to be able to reflect on experiences that I’ve learned within the week, such as mistakes made when programming or discoveries made when researching, and I hope that this reflection will help me to remember such mistakes and discoveries and carry them over into future work when programming and studying Computer Science.

1. Dissemination

For my dissemination, I plan on creating a poster which details my research and process by which I developed the program, allowing people to view my project in a concise and interesting way. In addition, and more uniquely, I plan on presenting my program to other students in Rhodes Hall, where students will be able to view my poster, as well as play Mao against my program, being able to witness firsthand its ability to figure out the rules that the students create, as well as get a close look at machine learning in action.

1. Project Advisor(s)

Paul Talaga, Asst Professor – Educator

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1. Budget (if applicable)

Unpaid Research: Total number of hours per week: TBD

Total number of weeks engaged in research: TBD