

**Dr. James Girard Summer Undergraduate Research Program
Faculty Mentor – Project Application**

Due Date: *January 17, 2020 by 5pm*

Faculty Name: Dr. Jason Perry

Department: Computer and Mathematical Sciences

Research Project Title: *Cracking Passwords with Machine Learning*

Research Project Abstract (Please provide an overview of your project -- this will be shared with students as a project description; maximum 250 words):

We all rely on passwords—usually passwords made up out of our own heads—to protect our online lives. To break into our accounts and steal our personal data or even our identities, often all an attacker needs to do is guess our password. It is well known that many people create “weak” passwords that are easy to guess.

To crack a password database, hackers often start with large dictionaries of common passwords to try. A more advanced technique is to generate passwords according to pattern-based rules that correspond to ways that people commonly make up passwords. But there is a further possibility. Today’s advanced machine learning algorithms, such as neural nets, are very good at learning the patterns behind large amounts of data. Using real passwords as training data, could a neural net *learn* how to generate passwords that match real people’s passwords better than rule-generated passwords? This question is important to answer, not as a way to give the bad guys an advantage, but as a means to characterize the security of passwords and help people choose better ones.

In this research project, you will use machine learning software and publicly-available password datasets to train a model for generating passwords that resemble human-chosen passwords, measuring its performance and adjusting parameters in order to produce the best possible model. Then you will compare the model’s performance to that of rule-generated passwords, and draw conclusions about what characterizes secure and insecure passwords.