

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

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

Faculty Name: Piotr Szczurek

Department: Computer and Mathematical Sciences

Research Project Title: Developing a Generalizable Node Functionality Metric for Determining Functional Roles in Networks

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

This project involves analyzing network data such as social networks or connectomes by examining their topological properties. It is based on past research that has used machine learning techniques for classifying network functional roles. The goal of this work would be to develop a generalizable metric called node functionality to identify the specific functions that are served by nodes of a network. For example, in a connectome, one could find neurons that serve sensory roles in the nervous system. In a social network, one could identify the people serving important social roles within a community. The idea to derive the method is based on prior work on identifying the functional role of neurons in the *C.elegans* worm connectome, which used algorithms from the field of information retrieval along with machine learning techniques. This project would use these ideas to develop a generalizable method of network analysis and apply it to various domains. The ultimate objective is to create a single metric that can be applied to all types of networks. It would involve extensive statistical analysis, programming in Python, applying machine learning techniques, and experimentation with different datasets. The outcome of this work could be applied to many real-world problems. For example, one could determine malicious users or networks of users in a social network that try to influence others (e.g. influencing outcomes of elections). The role of the student in this project would be mostly on experimentation and testing of potential metrics on various datasets.