

Summer 2020 Report

Clark Fitzgerald

This report fulfills the remainder of my summer 2020 faculty startup request agreement with Dean Joanna Mott from March 2019, which required me to submit a proposal and report of outcomes for 1 month summer salary. To see details and results from any of these activities, follow the links in this document. I submitted this report to Dr. David Zeigler, Chair, Department of Mathematics and Statistics, on 15 August 2020.

This summer, I began to develop expertise in the new [Julia programming language](#), because I plan to use it in research over the coming years. Julia builds on existing compiler technology to solve many of the challenges in statistical computing through its fundamental design, which makes it a compelling choice for researchers experimenting with data science software and numerical algorithms.

In other areas, I collaborated with faculty across campus on a statistical analysis, resulting in an accepted publication. I also advised an undergraduate student on a machine learning project, and worked on a number of other minor projects.

Paper Accepted in Behavioral Neuroscience

I [analyzed the data](#) for a project led by Jeff Calton in the Psychology Department. The journal Behavioral Neuroscience accepted our paper titled “Disruption of the Anterior Thalamic Head Direction Signal Following Reduction of the Hippocampal Theta Rhythm” on August 10th. By analyzing the time series of neuron firing data, I was able to provide evidence that no rhythmic patterns could be detected in the data, which was essential for the arguments and interpretation presented in the paper.

Julia Reading Group

I organized and facilitated a [reading group](#) for the Julia programming language, which marks the beginning of a base of Julia users on campus. A group of 5 to 10 students, faculty, and outside professionals met weekly for six weeks, from June 19th through July 24th to share and discuss solutions to the mathematical / algorithmic problems from [Project Euler](#). We grew from typing our first commands to solving challenging mathematical problems. This intimate, collegial discussion group worked well online; everybody both contributed and learned something. Sacramento State now has a small core of Julia users to provide support for our subsequent individual programming efforts.

Student Proposed Machine Learning Project

Stephen Gibson, a CSUS undergraduate computer science major, produced [SkateboardML](#), a machine learning project he proposed to distinguish videos of different skateboarding tricks.

First, he produced a labeled data set with over 200 short video clips of skateboarding tricks. This labeled video data will allow other researchers to reuse it to develop and validate new models. Second, he adapted an existing a computer vision model to this new skateboarding application. The model worked well, since it was able to classify skateboarding tricks with accuracy around 90%.

Other Outcomes

Besides the above projects, I worked on a number of smaller projects. I continued my career as an open source developer by contributing to the [improved documentation of the Julia language](#). I contributed to the technical documentation of the Debugger package by writing an [introduction catered to beginners](#). I initiated and participated in [design discussions](#) on the technical merits of choosing between symbols and strings in the Julia language. Finally, I created my [personal Sac State website](#), which I will to make my fall courses more accessible.