# Kai Malcolm

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## Education & Skills

**Vanderbilt University**                                   Nashville, TN | August 2019 - May 2022

B.E. Mechanical Engineering, Minors**:** Electrical Engineering (EE), Scientific Computing          3.80/4.00 GPA

**Coursework**: Data Structures, Digital Signal Processing, Data Privacy in Biomedicine, Computational Neuroscience

**Software Skills:** MATLAB, Simulink, Python, NumPy, TensorFlow, Git, Linux, C++, Machine Learning (ML), Artificial Intelligence (AI), Raspberry Pi, Rapid Prototyping, Sensors, Filtering, Neural Networks

## Work History

**Vanderbilt University**                                                                 **Nashville, TN**

Machine Learning at Slave Societies Digital Archives                         April 2020 - Present

- Worked with the Vanderbilt Data Science Institute in order to implement a machine learning pipeline in Python, utilizing natural language processing (NLP) library SpaCy, to train an ML model for named entity recognition (NER) to automatically determine entities (names, locations, dates).
- Built out entity linking functionality to identify relationships (filial, enslavement) between recognized entities.
- Trained and tested models varying the hyper parameters to identify optimal learning rate and dropout.
- Currently building out model validation checks to identify deficiencies and improve the ML model and wrapped logic.

**Vanderbilt Aerospace Design Laboratory**                                           **Nashville, TN**

Vice President; Payload Lead                                                        May 2021 - Present

- Leading the payload team of 5 engineers to design the payload for the NASA Student Launch Initiative.
- Payload is a modular remote sensing and embedded systems project focused on landing localization, utilizing IMUs and computer vision for identifying the landing site, to provide a more robust, extra-Terrestrial version of GPS.
- Prototyping hardware, creating testing rigs in order to simulate rocket flight conditions while in the lab.
- IMU data analysis, extensive filtering in the time and frequency domains for data cleaning.
- Interdisciplinary project, including electronics, software, structures, materials, fabrication, and assembly.

**Brown University**                                                                     **Providence, RI**

Summer Research Assistant                                                     June 2021 - August 2021

- Investigated the Hodgkin-Huxley (HH) model of electrochemical dynamics to determine how the inherent structure of HH-like systems may constrain the resulting dynamics of various neural network (NN) architectures.
- Built a tool (via Python, SciPy) for procedurally generating NN architectures and simulating their dynamics.
- Reported progress and gave multiple poster presentations to national research symposiums

**Vanderbilt University**                                                                 **Nashville, TN**

Biomedical Engineering Research Assistant, Constantinidis Lab            January 2021 - May 2021

- Neuroscience data analysis: decoded neural signals (time series spike train) to determine when a stimulus had been presented to a monkey (live animal subject from the lab) with an implanted electrode array.
- Optimized MATLAB classifier identifying stimulus given cue rate and investigated the roles of built-in function parameters such as cross validation and learning/coding schemes (SVM, knn, trees, k folds, hold out) on performance.

## Projects

**BMI: EEG For Motor Control**                                                  April 2021 - May 2021

- Created a low-budget Brain Machine Interface (BMI/BCI), allowing the user to control stepper motors for drawing on an Etch-a-sketch by measuring changes in electrophysiological- and bio-signals (brainwave frequency components).
- Designed the circuitry, filter, and software for an EEG device, utilizing op amps for real-time signal processing.
- Implemented fast fourier transforms (FFTs) and a real-time display taking advantage of serial communication.

**Computational Neuroscience Projects**                                   August 2021 - December 2021

- Designed multiple neural networks for applications including classification of MNIST digits / MNIST fashion, facial recognition, and cluster classification, experimenting with learning rates, decay, and neural network architectures.
- Employed auto-associators, Principal Component Analysis (PCA), back propagation, and convolutional neural networks in order to converge to optimal solutions.