

# Kai Malcolm

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## Education

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### Vanderbilt University

Nashville, TN | August 2019 - May 2022

B.Eng. Mechanical Engineering | Minors: Electrical Engineering, Scientific Computing

3.75/4.00 GPA

Coursework: Robotics I, Signals and Systems, Statistics, Data Structures, Computational Neuroscience, Linear Control Theory

## Technical Skills

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**Design/Analysis:** CAD/Computer Aided Design (Autodesk Inventor, Onshape, PTC Creo), COMSOL Multiphysics

**Software:** MATLAB, Python, pandas, Linux, Microsoft Excel, Git, numpy; Familiar— scipy, SQL, Simulink

**Hardware/Tools:** Machining (Lathe, Bandsaw, Mill), Arduino, 3D Printing

## Work History

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### Vanderbilt University

Machine Learning at Slave Societies Digital Archives

April 2020 - Present

- Built a pipeline in Python, utilizing natural language processing (NLP) library spaCy, to train a machine learning model for named entity recognition (NER) to automatically determine entities (names, locations, dates) from 3 centuries of Atlantic World records, totaling to 700,000 digital images of saved manuscripts.
- 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.

Biomedical Engineering Research Assistant, Constantinidis Lab

January 2021 - Present

- Optimized MATLAB classifier for identifying stimulus given neuronal level data (cue rate, spike train, etc.).
- Investigated the role of MATLAB's built-in function parameters for cross validation and learning/coding schemes (SVM, knn, trees, k folds, hold out) on performance.

**Brown University** | Summer Research Assistant

June 2021 - August 2021

- Investigated the widely used Hodgkin-Huxley (HH) model to determine how the inherent structure of the HH dynamical system may determine the dynamics of various neural networks (NN) of similar architectures.
- Built a tool (Python, SciPy) for procedurally generating NN architectures and simulating their neural activity.

**Vanderbilt Robotics** | Deposition Team Lead (2020); Excavation Team (2019)

August 2019 - May 2021

- Managed a team of 5 members in order to design, CAD, and subsequently build the deposition subsystem.
- Tested sensors, chose motors and linear actuators, prototyped, and fabricated parts in the machine shop.
- Created parts, drawings, and virtual assembly of systems via collaborative CAD software, Onshape.

**DZH Dynamics** | Electronics Engineer

September 2020 - March 2021

- Worked remotely with a research effort in Madrid, Spain, to develop a novel, energy-efficient attitude control technique based on spacecraft inertial morphing capabilities, targeted towards cubesats and small satellites.
- Electromechanical design, general design review and technical documentation (electrical schematics in Eagle).
- Reviewing motor and ESC selection and designing the electrical system (batteries, microprocessor, converters) for an experiment in simulated microgravity controlling inertial bodies for attitude adjustment.

**Space Generation Advisory Council** | Research Paper Co-author

June 2020 - October 2020

- Published a research report investigating the feasibility of a Martian small satellite constellation providing global communication services, which was presented at the International Astronautical Conference, IAC 2020.
- Sized the Electrical Power System (EPS), focusing on the batteries and solar arrays to provide power to communications equipment and electric propulsion (Hall thrusters), to complete a conceptual design study.

## Projects

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**EEG For Motor Control**

April 2021 - May 2021

- Designed the circuitry, filter, and code for a homemade EEG, utilizing op amps and instrumentation amplifiers with the goal of reading alpha and beta waves from the brain via electrode pads. Change in brainwave magnitude used to control stepper motors for drawing on an Etch-a-sketch.
- Implemented fast fourier transforms, notch filters, and amplification / further filtering of microVolt brainwaves.