Ganesh Vasu

688 Bancroft Street
Santa Clara, CA 95051

3/2/2023

Dear Sir/Madam,

Sub: Application for the position of R & D Neural Engineering Intern

My name is Ganesh Vasu and I graduated from UC Santa Cruz last June with a degree in BioEngineering (BioElectronics). My Final Year project was to develop a robotic hand that would harvest tomatoes in a vertical farming environment. At this point in time, I am enrolled in the Masters Program in BioMedical Engineering at San Jose State University.

I am tremendously impressed by the work Presidio Medical is engaged in and would like to contribute to the effort.

I have worked in a bio-medical lab, both in University of Texas and Prof. Rolandi's lab at the University of California, Santa Cruz. I have learned Python and had some exposure to Pandas. I have used Matlab and Gnuplot to generate graphical representations of data. My academic course foundations have been in Biology and Chemistry with advanced courses in Electronics (micro controllers, signals and systems, Applied Electronics) and Programming.

I have used mathematical software like Matlab and 3D software like AutoCAD and SolidWorks to design and print 3D components (the palm of the robotic hand). On the software side, R, Python and of course Excel have been handy in analyzing and depicting data in a usable, graphic fashion. I have used Word and Powerpoint for writing reports as well as presenting project progress to faculty committees.

My interest in the brain and Neuroscience is reflected in the thesis proposal that I presented to the Faculty Group at UC Santa Cruz. The Faculty team suggested that the proposal was more suitable for a Master's program than an undergraduate requirement.

I learn quickly and am able to apply the learning immediately.

I would appreciate it greatly if you could consider my application favorably and give me an opportunity to meet with you.

Sincerely,

Ganesh
Cell: 512 783 7645

BioEngineering (BioElectronics) Undergraduate Thesis Proposal:
"Decoding Temporal Delay of Neuronal Impulses"

Thesis Advisor: Prof. Donald Wiberg, ECE Dept. UC Santa Cruz
Submitted By: Ganesh Vasu , Aug 2021

Design Goal:
Design and Implementation of the decoding estimation algorithm (in MATLAB) for the temporal delay of neuronal impulses. The algorithm will obtain the information content of inter spike intervals. It is a combined decoding (for examining the information content) and estimation (to deal with the noise) algorithm.

Context:
Inter-spike duration is a means of neural transmission of sensed data to the brain of a vertebrate. This is analogous to frequency modulated signals. A Kalman filter estimating frequency can provide the basis for evaluating the information content embedded in the inter-spike duration. Our mathematical algorithm can determine the information content of a spike train. We use available spike train data for specific responses (odor, touch/texture). We run the data through our algorithm. The response from our algorithm should match the response that the data specifies.

Importance:
This research is important because it provides an effective model for analyzing information content of spike trains, which in turn can help determine how specific spike trains affect anatomical signals.

Research Methodology:
The project is:

- to perform a literature search of the current state of research in neuronal spike trains,
- design the decoding estimation algorithm,
- obtain relevant data from figshare.com,
- program the algorithm in MATLAB and
- validate it with the data sets from figshare.com

Expected Results:
The decoding estimation algorithm implemented in MATLAB is the expected result of the project. It is the culmination of the coursework, the literature survey, the data, and the theory about neuronal impulses.

We will compare the information content as determined by our algorithm with the information content as stated in the papers that describe actual experiments.

Candidate Datasets:

- Synthetic spike data generated by a network of 1,000 Hodgkin-Huxley type neurons (figshare.com). This will be used while developing the algorithm for testing and fine tuning. Has data for 1000 neurons and about 19,000 firings for each.
- Dynamical response properties of neocortical neurons to conductance-driven time-varying inputs (figshare.com). This will be used to test the algorithm with real data from rats for varying frequencies. This has data for 336 neuronal spike trains.
- Neuronal data of vibrissal somatosensory cortex in a texture-discrimination task (figshare.com). This will be used to test the algorithm to see if the information content from the algorithm matches the actual information (texture discrimination). (Data is from rats again). We have not looked at the content of this data set deeply. It is set up as Matlab datasets.
- Temporal Features of Spike Trains in the Moth Antennal Lobe Revealed by a Comparative Time-Frequency Analysis (figshare.com). This will be used to test for both frequency based (inter spike interval changes) and actual information for moth data. We have not looked at the content of this data set deeply. It is set up as Matlab datasets.