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Dr. Alex Roxin
Centre de Recerca Matemàtica
Campus de Bellaterra, Edifici C
E-08193 Bellaterra
Barcelona, Spain

Dear Dr. Roxin,

I am writing to you to apply for the postdoctoral researcher position in your lab, as seen on the 'comp-neuro' mailing list. I am a Compututational Neuroscience PhD student in the University of Bristol, England, under the supervision of Dr. Cian O'Donnell. I am due to submit my thesis in June/July of this year. I am particularly interested in the applications of statistical modelling, information theory, and machine learning to neuroscience. Each of these areas fits well with the research performed in the CRM's Computational Neuroscience research group.

My academic background is in mathematics, computer science, and neuroscience. I completed a 4-year BA in Mathematics in Trinity College Dublin, Ireland in 2011. I also completed an MSc in Informatics in The University of Edinburgh, Scotland in 2015. During the intervening years, I was a financial software consultant. I began my PhD in the University of Bristol in September 2016. My first project during my PhD was a biophysical model of intra-cell calcium dynamics and the consequent fluorescence trace of fluorescent calcium indicators used to detect activity in neurons.

My current research uses network science to cluster neurons based on their activity, and compares these clusterings to the neurons' anatomical distribution. I use a cutting-edge cluster detection algorithm that uses hypothesis testing and spectral methods to detect clusters in a network. I also perform these analyses while modelling the neuronal activity as a function of the behaviour of the mouse.

I have presented posters on both of these projects at several conferences, and both works will be submitted for publication this year.

During the remainder of my PhD, I plan to develop a simple statistical model for the number of spiking neurons in a neuronal population, and extend this into a hierarchical model across multiple brain regions. This model will be based on the Conway-Maxwell-Binomial distribution, which is similar to a binomial distribution, but allows for over- or under-dispersion relative to a binomial distribution.

My teaching experience during my PhD has broadened my horizons by allowing me to learn and teach about machine learning, algorithms, and the practical side of statistics. All of which will be helpful when working on modelling the dynamics of hippocampal or cortical microcircuits. In particular, the machine learning course covered the basics of neural networks, and the Applied Statistics course was very helpful for assessing model suitability.

The industrial internship that I did during my PhD also fits with your planned research. During

this internship I researched cutting-edge recurrent neural networks, and their applications in industry. I also assessed their suitability for equity price modelling.

As a researcher with knowledge of neuroscience, mathematics, statistics, and machine learning, I am ideal for this role. Furthermore, I have practical experience with this knowledge not just in my research and teaching, but also in the three month research internship I undertook during my PhD. My previous professional experience also gives me the communication skills required to work in a collaborative environment like the CRM. If I am chosen for this project, I would hope to become an expert in models of the hippocampus, particularly network models. I would also hope to make a contribution with a useful model of my own.

I would be grateful for an opportunity to further discuss my application during an interview.

Sincerely,

Thomas J. Delaney