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Dr. Alex Roxin
Centre de Recerca Matemàtica
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Dear Dr. Nagai,

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 will be useful to the CREST Cognitive mirroring project as predictive coding is based on these concepts.

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 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 the predictive coding element of the CREST Cognitive Mirroring project. In particular, the machine learning course covered Bayesian variational inference, the basis of active inference.

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. During this internship, I used machine learning in recurrent neural networks to analyse time series data. My previous professional experience also gives me the communication and collaboration skills required to work on a large project, such as CREST.

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

Sincerely,

Thomas J. Delaney