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Dear Dr. Diamond

Please find enclosed the manuscript “A comparison of computational methods for detecting bursts in neuronal spike trains and their application to human stem-cell derived neuronal networks”.

Accurate identification of patterns of bursting activity is an essential aspect of the analysis of experimental recordings of neuronal activity in a variety of contexts. Despite this, no one widely used method for identifying periods of bursting activity in neuronal spike trains has been adopted in the field. Instead, many methods have been proposed for detecting bursts, however assessment of these methods has generally only been performed by their original authors, using very specific sets of conditions. In this manuscript we present an unbiased assessment of eight previously published burst detection methods.

We develop a list of desirable properties that a method should ideally possess to accurately detect bursts in a variety of spike trains. We assess each method in regards to these properties using both simulated and experimental data, and show that a number of existing techniques perform poorly at detecting bursts in a range of contexts. Based on this, we provide recommendations for the robust analysis of bursting in neuronal spike trains using existing methods. We also employ a number of the high performing burst detection methods to analyse novel recordings of networks of human induced pluripotent stem cell-derived neurons, and describe the ontogeny of bursting activity in these networks over several months of development.

A significant number of articles that have been previously published in J. Neuroscience, including several in the last twelve months, employ burst detection techniques that were assessed in our study. Since the choice of burst detection technique used to analyse experimental recordings can have implications for the conclusions about the nature of bursting activity in the data, we consider an awareness of the limitations these techniques and the conditions under which

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they are most suitable to be important. We thus believe that our study would be of relevance to the audience of J. Neuroscience, and your journal would allow the recommendations from our analysis to be accessible to a wide range of both computational and experimental neuroscientists working in this area.

This manuscript has not been published before and all authors have approved the final manuscript.

Thank you in advance for your consideration.

Yours sincerely,

Ellese Cotterill