Can AI Detect G-Waves in Neural Data?

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Abstract

In this note we propose to detect gravitational radiation in neural data by first training a learning machine on data from simulations.

Recent research has shown the impact of realistic gravitational radiation on neural information processing [1]. The impact is seen at shorter than pico-second timescales. Figures 1 and 2 illustrate this impact by magnifying the impinging signal to very high strain values. These figures are the result of computer (MATLAB) simulation experiments based on the software developed in [2].

We ask the question: what if we gave AI the task to detect these waves in real neural data? Just as in regular machine learning, there is a training set and then the algorithm is given a task to perform, here too we can provide these simulation outputs, suitably classified, as the training set to the neural network. The network is then run on test neural data which is obtained from actual experiments involving some form of short-range contact-less coupling between axons.

The consequences of success in detecting such signals in this setting would be important. Specifically, they would validate the body of work [3] which claims that metric perturbations engender significant alterations in neural signals and hence computations. The limitation of this approach is that whereas the test data is 'real', the training data is based on simulations. However, similar scenarios - where test data is real and training is based on simulations in other contexts - can be independently studied to determine the statistical error that results from such a discrepancy and then if the present study surmounts this limitation statistically or is within reasonable bounds of it, its outcome can be treated as significant. Some of these issues are considered in detail by Winsberg in [4].

References

[1] Aman Chawla and Salvatore Domenic Morgera. Computer study of metric perturbations impinging on coupled axon tracts. *Physics Essays*, 36(2):160–167, 2023.

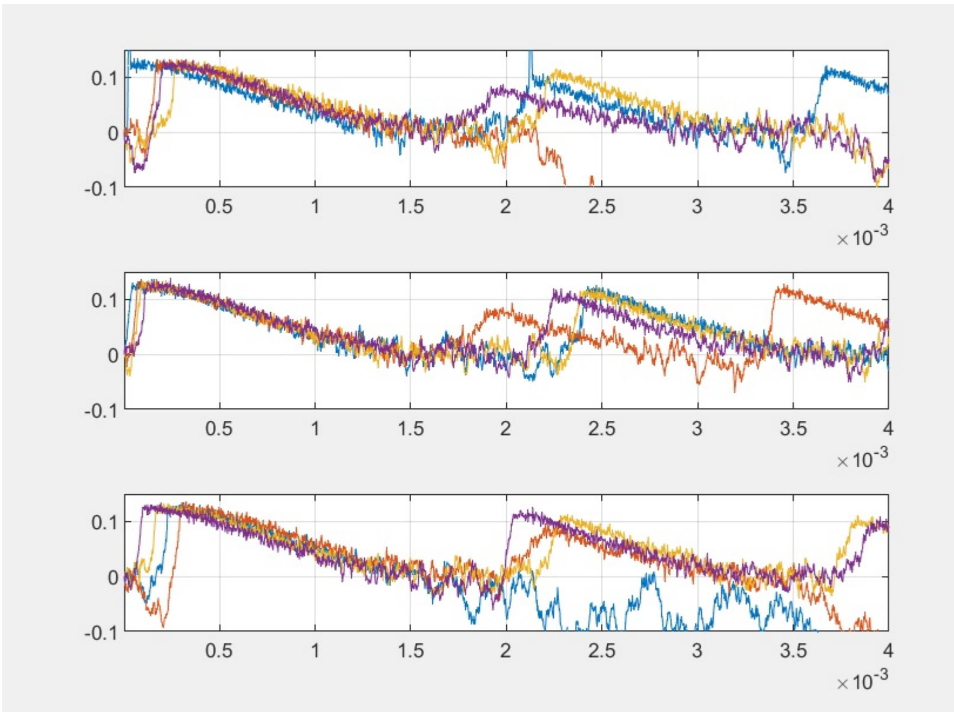

Figure 1: First exhibit: Low strain gravitational wave plus ion channel noise. The x-axis is time in seconds and the y-axis is voltage in Volts. The different colors represent different nodes of Ranvier. The top sub-figure is axon 1, the middle sub-figure is axon 2 and the lowest sub-figure is axon 3.

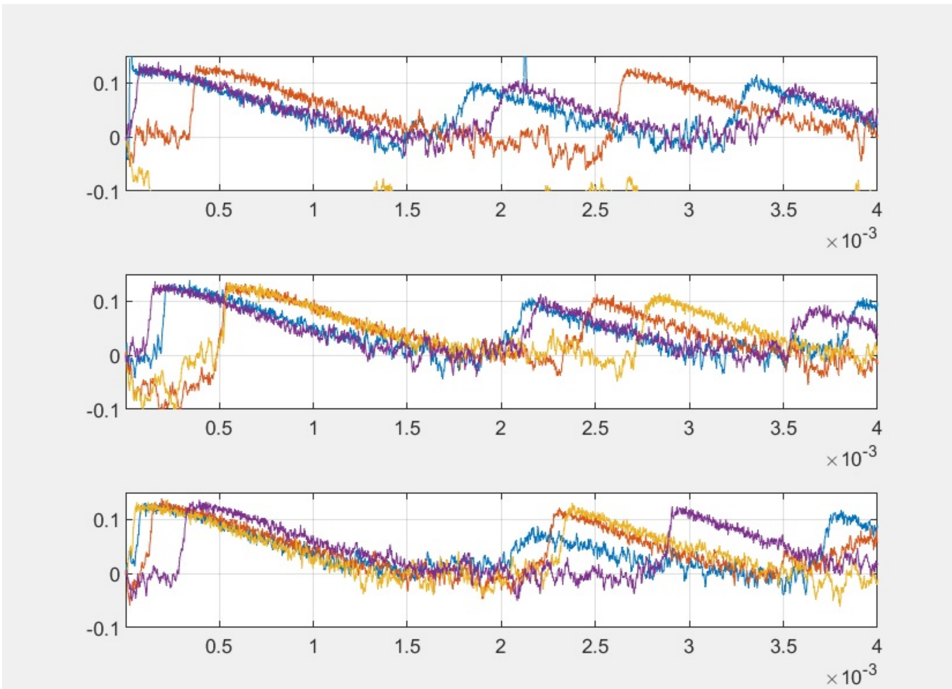

Figure 2: High strain gravitational wave plus ion channel noise. The x-axis is time in seconds and the y-axis is voltage in Volts. The different colors represent different nodes of Ranvier. There is more temporal separation between the traces. The top sub-figure is axon 1, the middle sub-figure is axon 2 and the lowest sub-figure is axon 3.

[2] Aman Chawla, Salvatore Morgera, and Arthur Snider. On axon interaction and its role in neurological networks. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, 2019.

[3] Aman Chawla and Salvatore Domenic Morgera. Mechanism of universal quantum computation in the brain. *Arxiv*, 2022.

[4] Eric Winsberg. *Science in the age of computer simulation.* University of Chicago Press, 2019.