Spike Sorting is completely free software that implements a signal separation and clustering algorithm, optimized for classifying action potentials recorded with a single electrode and originating from an unknown number of neurons. The spike sorting problem is a classic challenge in neurophysiology, fundamental for most experiments and analyses that aim to isolate the activity of single neurons from signals that often contain the activity of multiple cells, where the number of cells is unknown. Spike Sorting offers a solution based on wavelet analysis and a genetic algorithm, which does not depend on the number of sources to separate the signals (it assumes an unknown number of sources). The software is programmed in C#, and the .exe file can be downloaded to run it directly on your computer.

Citation Requirement 📝

Please **cite the following work** if you use the program for your research or publications:

> Alscher, Federico; Lenzi, Rocío A.; Pérez Escobar, Pamela; Villafañe, Sebastián; Andres, Daniela S. (2023) “Algorithm and validation method for spike sorting based on wavelet analysis and a genetic algorithm”, Proceedings of the 24th Congress of Bioengineering, NY: Springer.

Both the validation algorithm and the data for validation, as presented in the mentioned work, can be downloaded from the links on the Neuroengineering Laboratory webpage.

Usage and Technical Details 💻

The software is optimized for use with signals from intraoperative recordings of neuronal activity obtained with high impedance Microelectrodes (MER). For the program to function correctly, it's recommended to use signals with the lowest possible amount of noise, as noise can cause issues during detection or classification. The program was tested with a variety of signals, which can be found at the following link: http://labning.com.ar/documentos/SpikeSorting/data.zip. The results of this testing can be found in the published work mentioned above. So far, the program has been found to have computation times of less than 60 seconds with signals up to 500,000 data points, so it is recommended to use signals no larger than this. In "advanced settings” you can find various algorithm parameters that need modification. The modification of these parameters will depend on the user, based on the specific signal being analyzed. Finally, re-running the program does not guarantee the same results due to the nature of the algorithm used, which relies on the generation of random numbers.