SpikeTaro 1.0



The Spike Sorting Software for Records of Multi-unit Neural Spikes.

Product Introduction



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1 Summary

SpikeTaro outputs single unit spikes from the record consisting of multi-unit spikes. In general, sorting algorithms use two parameters, that is, spike height and spike duration. However, in case of a record including huge amount of spike units, interactions between the spikes from different sources lead to the sorting performance depression on such process. SpikeTaro overcomes this problem by developing novel sorting algorithms as follows:

- Extract single unit spike by evaluating confidence level (Peak detection algorithm and others)
- Sorting spikes based on correlation of spike waveforms and spike heights (Time resolution independent correlation algorithm)



SpikeTaro Screenshot

The following is the paper when this method was developed and was applied first time. SpikeTaro is now widely used, and this algorithm and software are used in international conferences and draft papers. • Perez Goodwyn P, Katsumata-Wada A, Okada K: Morphology and neurophysiology of tarsal vibration receptors in the water strider Aquarius *paludum* (*Heteroptera: Gerridae*), J. Insect Physiol. 55(2009), pp. 855-861

2 SpikeTaro Functions

2.1 Digital Filter Function

SpikeTaro comes with FIR filter (Finite Impulse Response filter). This filter is a kind of digital filter, showing liner phase property. In the "FIR Filter Setting Dialog" of SpikeTaro, user can use bandpass or highpass filters and can also set cutoff frequency(s) freely.

Below is an example of bandpass (500 - 1500 Hz) filter setting and the amplitude characteristics in SpikeTaro.



SpikeTaro Filter Setting

With these filtering parameters, the filtering process shows characteristics as follows:

- Signal amplitude depresses 1/10000 within spectrum of 0 500 Hz
- Signal amplitude is the same of a input data within 500 1500 Hz.
- Signal amplitude depresses 1/1000 to 1/10000 within 1500 Hz over.

• Amplitude gain sharply changes.

We also show below an example of filtering process in SpikeTaro. In this case, the filtering result shows that the noise of power supply frequency is removed.



2.2 Sorting Function

SpikeTaro's sorting algorithm is composed of two processes below.

- Spike extraction.
- Sorting by correlation coefficients (contribution ratio) between spike waveforms.

2.2.1 Spike Extraction

Using peak detection algorithm, SpikeTaro detects first point of the spike of rising phase, peak point and termination point of the spike, automatically. SpikeTaro can extract single unit spike from an integrated signal of several spikes. In case of low reliability, that is, the extracted spike is too short, SpikeTaro ignores the extracted spike.



Spike Extraction

2.2.2 Sorting

In sorting process, SpikeTaro calculates correlation coefficients (contribution ratios) between all combinations of extracted spikes. Subsequently, SpikeTaro sorts spikes according with contribution ratio. User can set "contribution ratio threshold" as a sorting parameter. SpikeTaro shows better sorting performance, because SpikeTaro uses whole shape information of a spike waveform.



In the calculation of correlation, SpikeTaro applies natural spline interpolation to single spike waveform in order to avoid data clipping error.



We show below an example of sorting results by SpikeTaro.

SpikeTaro Sorting Result

2.2.3 Raster Plot

SpikeTaro also outputs a raster plot. The horizontal axis of raster plot indicates time, and the vertical axis indicates cluster ID which corresponds to a sorted cluster. Raster plot can be used for time sequential analysis of the each spike unit.







SpikeTaro Raster Plot

2.3 Clustering Function

SpikeTaro also has clustering function that is independent of sorting algorithm. The clustering algorithm is Ward method indicating high classification sensitivity. Spike heights and spike durations are used as parameters of the clustering process.



SpikeTaro Clustering Parameters

Parameters of spike height and spike duration are measured against only complete spike waveforms. At the clustering process, SpikeTaro automatically extracts this complete spike waveforms, and applies Ward method. SpikeTaro outputs clear classification result, because the input spike waveforms to the clustering process do not include apparent error which is produced by many superimposed spike waveforms around the target spike.



SpikeTaro Clustering Result

3 Required Environment

SpikeTaro works under the following environment.

	Environment
OS Type	Microsoft Windows 7 (64, 32 bit), Vista (64, 32 bit), XP SP2 or later.
Memory	2 GB or more. (NOTE)
CPU	Intel(R) Core(TM)2 Duo 1 GHz or more.
Others	Internet connection is required for installation.

(NOTE) The amount of data SpikeTaro can process is dependent on the memory amount of the environment. If a lot of memories can be used, large data can be processed.

4 Contact us

Contact information about SpikeTaro is as follows:

SpikeTaro customer support TEL: +81-75-321-7300 FAX: +81-75-321-7305 E-mail: spiketaro@chino-js.com

We also announce new SpikeTaro information in SpikeTaro home pages. Pease visit our home pages.

SpikeTaro home page URL: http://www.spiketaro.com/en/ (English) http://www.spiketaro.com/ja/ (Japanese)

Evaluation Software

We provide evaluation software to researchers considering buying. Satisfy yourself before purchase for performance, accuracy and convenience of SpikeTaro.

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