

Calcium Signal Analyser Vamp plugin documentation

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1 Copyright

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The Calcium Signal Analyser Vamp plugin has been developed within a Queen Mary University of London Bridging the Gap project between the School of Biological and Chemical Sciences (Dr Rachel Ashworth) and the School of Electronic Engineering and Computer Science (Dr Katy Noland, Dr William Marsh, Dr Mathieu Barthet). It is based on previous works made at QMUL's Centre for Digital Music by Christian Landone, Chris Duxbury and Juan Pablo Bello.

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2 Description

The Calcium Signal Analyser is a Vamp plugin [Cannam, 2010c] for automatic peak detection which extracts a Smoothed Detection Function, the Peak Times, the Peaks Onsets, the Peak Frequency, and the Mean Inter Peak Interval.

2.1 Pre-requisites

Several host applications (i.e. applications from which the plugin can be launched) exist for Vamp plugins such as Sonic Visualiser [Cannam, 2010b], or Audacity [Audacity, 2010]. One of them should be installed before installing the plugin.

The batch tool Sonic Annotator [Cannam, 2010a] can also run Vamp plugin¹.

In the following, Sonic Visualiser will be used as a host application to describe the plugin's functioning.

2.2 Installation

To install the plugin on a Win32 system (Windows XP, Vista), copy the files:

vamp-calcium-signal-analyser.dll
vamp-calcium-signal-analyser.cat (optional)
vamp-calcium-signal-analyser.n3 (optional)

into the folder "C:\Program Files\Vamp Plugins\" (if the directory does not already exists, then create it).

To install the plugin on a Apple OS/X operating system, compatible with both PPC and Intel hardware, copy the files:

vamp-calcium-signal-analyser.dylib
vamp-calcium-signal-analyser.cat (optional)
vamp-calcium-signal-analyser.n3 (optional)

to either:

/Library/Audio/Plug-Ins/Vamp/ (for the plugin to be available to all users), or
\$HOME/Library/Audio/Plug-Ins/Vamp/ (for the plugin to be available to you only).

2.3 Parameters

The Calcium Signal Analyser plugin has two input parameters:

- the peak-picking Sensitivity S which can vary in the range 0-100 % by steps of 1%;
- the peak-picking offset threshold (δ) which can vary in the range 0-1 by steps of 0.05.

2.4 Outputs

The Calcium Signal Analyser plugin has five output parameters:

- the Smoothed Detection Function (SDF), i.e. the detection function after signal

¹However, the current version of Sonic Annotator is not adapted to process files sampled at very low sample rate such as 3 Hz. Indeed, the data is processed with blocks of 16384 samples by default (whereas a typical calcium signal only contain 1000 samples).

conditioning and adaptive thresholding / Type: two-dimensional vector (the first dimension corresponds to the time labels and the second dimension to the data values);

- the Peak Times (*PT*), i.e. the time positions in seconds of the peaks / Type: one-dimensional vector;

- the Peak Onsets (*PO*), i.e. the start times in seconds of the peaks / Type: one-dimensional vector;

- the Peak Frequency (*PF*), i.e. the frequency of the peaks in Hz / Type: one-dimensional value;

- the Mean Inter Peak Interval (*MIPIT*), i.e. the mean time interval in seconds between peaks / Type: one-dimensional value.

2.5 Use of the plugin with Sonic Visualiser

2.5.1 Load a file

In order to load an audio file in Sonic Visualiser, go to the File menu, and then click on Import Audio File. Then, select the WAV file to analyse.

2.5.2 Feature extraction using a transform

In order to process the loaded file, go to the Transform menu, then choose e.g., Analysis by Plugin Name, select the Calcium Signal Analyser plugin, select one of the five outputs (Smoothed Detection Function, Peak Times, Peak Onsets, Peak Frequency, Mean Inter Peak Interval). In order to obtain several outputs, the same process has to be repeated.

2.5.3 Optional manual corrections

The editing tools of Sonic Visualiser allows us to modify the outputs (layers) manually: e.g., remove or add a new Peak Time. In order to see the values associated to a given layer, go to the Layer menu, and then Edit Layer Data. Peaks which are manually added appear with the label 'New Point' in the Peak Times Layer Data. Note that the manual modifications performed on the Peak Times do not induce a recalculation of the Peak Frequency and Mean Inter Peak Interval parameters. If manual corrections are performed, these parameters would need to be recomputed in a post-processing stage.

2.5.4 Exportation of the results

Once the peak detection is performed, the results can be exported (e.g., in a CSV text file) for further analyses. For this purpose, go to the File menu, and then Export Annotation Layer.

References

- [Audacity, 2010] Audacity (2010). Audacity home page. <http://audacity.sourceforge.net/>.
- [Cannam, 2010a] Cannam, C. (2010a). Sonic annotator. <http://omras2.org/SonicAnnotator>.
- [Cannam, 2010b] Cannam, C. (2010b). Sonic Visualiser, Queen Mary University of London. <http://www.sonicvisualiser.org/>.
- [Cannam, 2010c] Cannam, C. (2010c). Vamp audio analysis plugin system, Queen Mary University of London. <http://www.vamp-plugins.org/>.