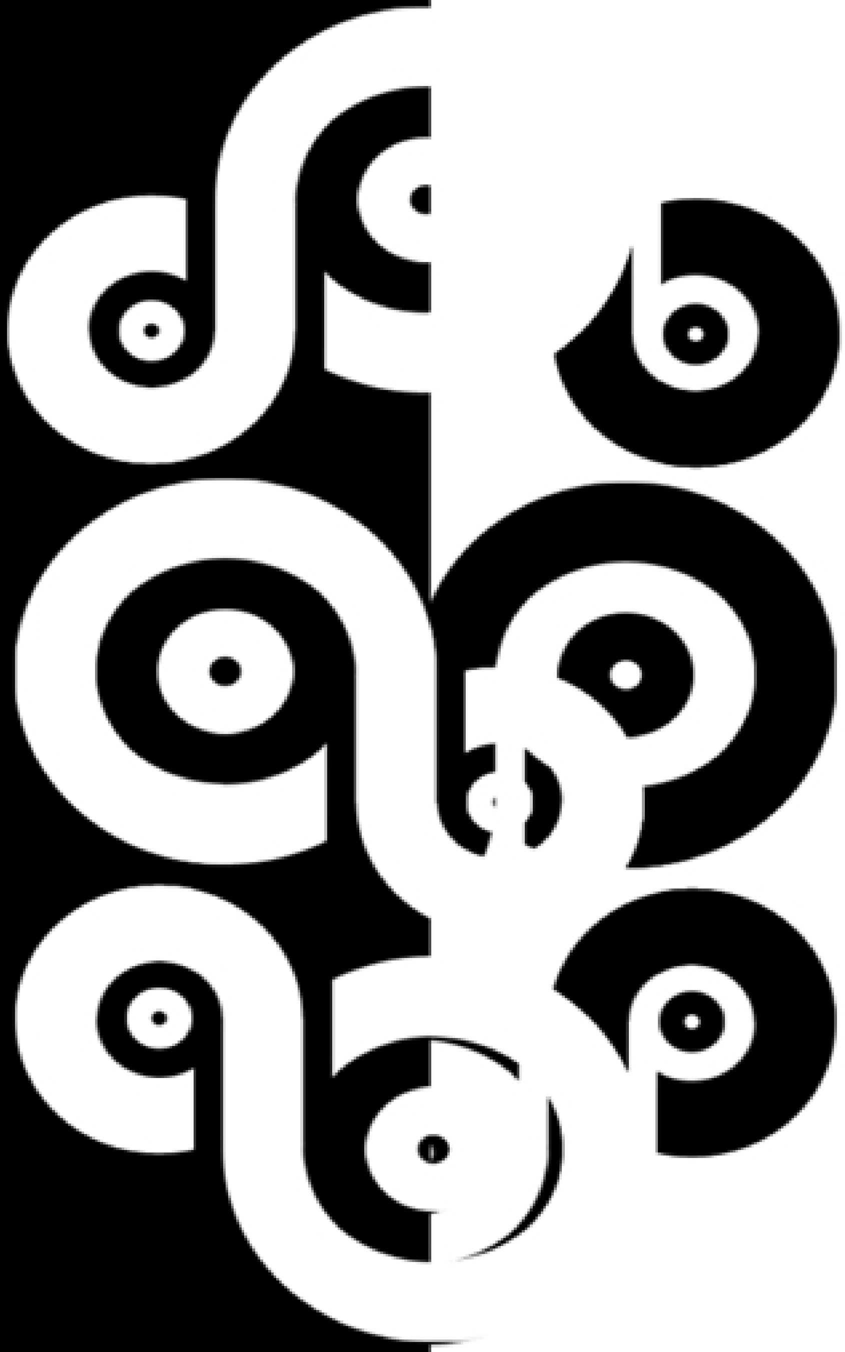
Neural Processing MATLAB Kit

User's Manual



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Introduction

What is NPMK?

NPMK is a MATLAB toolkit containing several tools that are used to open, manipulate and perform basic data analysis of Blackrock Microsystems data files (NEV and NSx).

Data Files

Blackrock Microsystems data is saved in two types of files:

- NEV: Short for Neural EVents, it contains events recorded during a experimental session. These events may include information on threshold-crossed spike waveforms, information received through the digital input and the serial input, tracking information recorded in NeuroMotive Video Tracking System, text comments, or other custom comments sent to the NSP during an experiment.

- NSx: Short for Neural Stream X, where X indicates the sampling frequency of the continuous file. This data type contains continuous streamed data to the NSP. Depending on the sampling frequency, a second of data may contain up to 30,000 samples in this file.

    - NS1: Data sampled at 500 Hz
    - NS2: Data sampled at 1 kHz
    - NS3: Data sampled at 2 kHz
    - NS4: Data sampled at 10 kHz
    - NS5: Data sampled at 30 kHz

File Specifications (Format)

The data files can be recorded in various file specifications. Currently, NPMK supports file formats 2.1, 2.2, and 2.3. Refer to the file format documentation for details on what each file format contains. Blackrock Microsystems recommends using the latest file format to record your data.

Reading Data Files

openNEV

Opens a NEV file for reading, returns all file information in a MATLAB structure. If an output argument is not specified the default structure name will be NEV. Works with file specifications 2.1 & 2.2 & 2.3.

openNEV

To open a NEV file containing the basic header information, digital input values, and spike timestamps.

openNEV(‘read’)

To open a NEV file containing the basic header information, digital input values, spike waveforms and timestamps, comments, NeuroMotive tracking information, custom events, etc.

Note that all input arguments are optional. Input arguments may be in any order. Other optional inputs are:

‘fname’: File name of the data file to be opened.

‘report’: The function will display a read report in MATLAB prompt

‘nowarning’: By default, the function will display an warning when errors occur. This argument will suppress the warning.

‘nosave’: By default, openNEV will save a copy of the NEV structure in a MATLAB file. This will accelerate subsequent readings of the same NEV file significantly.

‘nomat’: By default, openNEV will look for a MAT file version of the data file and loads it for faster file load. This argument will force openNEV to ignore the MAT file.

‘uV’: By default, all values in the spike waveforms are raw data files. The ‘uV’ argument will load the waveforms in units of uV.

‘overwrite’: Passing this argument will automatically overwrite the MAT file without prompting the user in a case a MAT file already exists.

‘8bits’: By default, openNEV reads data from the 16-bit digital port. If this argument is passed then only the lower 8-bits are read and the upper 8-bits are ignored.

‘t:XX:XX’ By default, the entire file is read. However, the user can specify only a portion of the file to be read. For example, to read the first 50 seconds the user can pass ‘t:1:50’ argument to openNEV.

```
openNEV('report','read', t:50:100’, ‘uV’, ‘nomat’, ‘nosave’);
```

In the example above, the file dialogue will prompt for a file. A report of the file contents will be shown. The spike waveforms are in units of uV. Only the data from 50-100 seconds will be read. openNEV is forced to ignore any MAT files and re-load the actual NSx file instead. The loaded data will also not be saved as a MAT file.

```
openNEV('report','read');
```

In the example above, the file dialogue will prompt for a file. A report of the file contents will be shown. The digital data will not be parsed. The data needs to be in the proper format (refer below). The spike waveforms are in raw units and not in uV.

openNSx

Opens a NSx file for reading, returns all file information in a MATLAB structure. If an output argument is not specified the structure name will be NSx, where x can be 1-5 depending on the data file read. Works with file specifications 2.1 & 2.2 & 2.3.

```
openNSx
```

To open a NSx file containing the basic header information only.

```
openNSx(‘read’)
```

To open a NSx file containing the basic header information and all the continuous data.

Note that all input arguments are optional. Input arguments may be in any order. Other optional inputs are:

‘fname’: File name of the data file to be opened.

‘report’: The function will display a read report in MATLAB prompt

‘nowarning’: By default, the function will display an warning when errors occur. This argument will suppress the warning.

‘e:XX:XX’: By default, openNSx will read all the channels. The user can specify only a few electrodes to be read. In this case, openNSx will prompt for a CMP file.

‘c:XX-XX: By default, openNSx will read all the channels. The user can specify only a few channels to be read.

‘uV’: By default, all values in the spike waveforms are raw data files. The ‘uV’ argument will load the waveforms in units of uV.

‘overwrite’: Passing this argument will automatically overwrite the MAT file without prompting the user in a case a MAT file already exists.

‘8bits’: By default, openNEV reads data from the 16-bit digital port. If this argument is passed then only the lower 8-bits are read and the upper 8-bits are ignored.

‘t:XX:XX’ By default, the entire file is read. However, the user can specify only a portion of the file to be read. For example, to read the first 50 seconds the user can pass ‘t:1:50’ argument to openNEV.

‘mode’: Mode will describe the numbers used in the ‘t:XX:XX’ argument. Mode can be ‘sample’, ‘sec’, ‘min’, or ‘hour’.

‘p:XXX’: By default, all samples are read in usigned 16-bit format. If ‘double’ is passed as an argument all samples will be read in double precision.

‘s:XX: This argument can be used to read a down-sampled version of the data for quick look. For example, if s:2 then every other sample is loaded.

Example:

```
openNSx('report','read','c:\data\sample.ns5','e:15:30','t:3:10','
min', 'p:short', 's:5');
```

In the example above, the file c:\data\sample.ns5 will be used. A report of the file contents will be shown. The data will be read from electrodes 15 through 50 in the 3-10 minute time interval. A decimated version of the datafile will be read, where only every 5th sample is read.

```
openNSx('read’, ‘c:15:30’);
```

In the example above, the file user will be prompted for the file. The file will be read using 'int16' precision as default. Data from channels 15 through 30 will be read only.

Data Manipulation

combineNSxNEV

This function loads two NSx and NEV files and it will combine them together into one file. The resulting file will be saved as new NSx and NEV files.

```
[NSx, NEV] = combineNSxNEV(filename1, filename2)
```

Note that all input arguments are optional. Input arguments may be in any order.

filename1: The name of the first NSx file. In its absense, a dialog will open and will prompt the user to select an NSx file.

filename2: The name of the second NSx file. In its absense, a dialog will open and will prompt the user to select an NSx file.

NSx: The combined NSx structure.

NEV: The combined NEV structure.

calcTimeDelay

This function calculates the time difference between the end of the first NSx file and the beginning of the second NSx file. It is useful in cases where one needs to calculate the time it took to stop one file recording and start the next one.

```
timeDelay = calcTimeDelay(NSx1, NSx2)
```

Note that all input arguments are optional. Input arguments may be in any order.

NSx1: The first NSx file passed to the function. This input is optional. In its absense, a dialog will open and will prompt the user to select an NSx file.

NSx2: The second NSx file passed to the function. This input is also optional. In its absense, a dialog will open and will prompt the user to select an NSx file.

timeDelay: The calculated time delay.