Reading Ponemah 6.x data into Matlab

# Introduction

The information that follows may be used to query a Ponemah 6.xx Experiment database and to retrieve data from Ponemah 6.xx Waveform files.

A Ponemah 6.xx Experiment consists of a sub-directory that contains a single Experiment database (.PnmExp) and one or more Waveform file (.PnmWav) that are associated with the current Experiment. The assumption is that we are dealing with a valid Experiment, there is no error checking for an invalid Experiment structure in this example.

The Matlab .m files are provided as samples for users to incorporate into their solutions as needed. This solution is being provided outside DSI’s standard Development and Test process. Please see the Testing section for details about what tests have been executed.

# Quick Start

* Follow Installation instructions
* Call GetExperimentInfo(<*Experiment Folder*>*, 1*)
  + e.g. GetExperimentInfo(*‘C:\Ponemah\_Data\Exp\_xxxx’, 1*);
  + e.g. GetExperimentInfo(*'.\TestData\Exp\_1Subj\_ECG\_BP\_Scheduled', 1*);
* Identify the Channel Ids of interest in the output generated
* In GetAllData.m modify szExpPath and channelId
* Add signal processing in while loop

# Installation

Download the zip file from <https://datasci.box.com/s/0ht2aefrotstmdghwrzof2xok6tki1tg> and copy its contents into your Matlab folder.

## 32 bit Matlab

Copy the contents of the x32 subdirectory into its parent directory

## 64 bit Matlab

Copy the contents of the x64 subdirectory into its parent directory

## Compatibility

* TestSamples.m requires R2014b or greater: uses *datetime* which was introduced in R2014b
* R2009a or greater is needed for .NET support

# File Descriptions

The following files are available in the folder:

* Binary/Config files

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| --- | --- |
| **File** | **Description** |
| log4net.dll | Helper dll for logging status/issues |
| log4net.Ponemah.config | Config file for logger |
| Ponemah.Logger.dll | Helper dll for logging status/issues |
| Ponemah.WaveformFile.dll | Assembly that interprets the waveform file |
| Ponemah6xExtractor.dll | Assembly that interprets the contents of the Experiment Database |
| SQLite.Interop.dll | Helper dll to access the Experiment Database |
| System.Data.SQLite.dll | Helper dll to access the Experiment Database |

* Matlab Sample files  
  Update the “%% User Inputs” section as needed

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| **File** | **Description** |
| Display1000Samples.m | Displays 1000 samples from the requested channel and time |
| DisplayFirst1000Samples.m | Displays the first 1000 samples from the requested channel |
| GetAllData.m | Steps through all data for a requested channel. No actions are performed on the retrieved data |
| PrintAllTimeSegments.m | Displays all data segment start/end times in local time. Iterates through all subjects/channels |

* Matlab Functions

|  |  |
| --- | --- |
| **File** | **Description** |
| GetExperimentInfo.m | Retrieves subjects, segment times, channel IDs and labels from the Experiment database and outputs to a file or display |
| GetPnmWaveformData\_Setup.m | A precursor to GetPnmWaveformDataUtc() to prepare for retrieving data  *Example: See GetAllData.m* |
| GetPnmWaveformDataUtc.m | Requests data for a specified channel id, start time and number of points, must be preceded by GetPnmWaveformDataUtc()  *Example: See GetAllData.m* |
| GetTimeSegmentsLocal.m | Retrieves all segment times for a channel in Local (Experiment) time  *Example: see PrintAllTimeSegments.m* |
| GetTimeSegmentsUtc.m | Retrieves all segment times for a channel in UTC time  *Example: see GetTimeSegmentsLocal.m* |

* Test files

|  |  |
| --- | --- |
| **File** | **Description** |
| TestSamples.m | Reads samples from waveform files by requesting specific samples and by reading the entire waveform file and compares a short snippet with expected results |
| TestExperimentInfo.m | Compare the output from GetExperimentInfo() with expected results |
| TestData folder | Contains 3 Experiments and expected results associated with the Experiments |

# Retrieving data

### Identify Channel Ids

* Each channel in an Experiment has a unique Channel Id. The data associated with a channel is retrieved by using this Channel Id
* The Channel Ids associated with a subject can be determined by using GetExperimentInfo()
* GetExperimentInfo(*szExpPath, fileId*)
  + *szExpPath* Experiment Folder  
    *fileId* return from fopen() or 1 for output to the screen  
    e.g. GetExperimentInfo('C:\Ponemah\_Data\Exp\_1Subj\_ECG\_BP\_Scheduled', 1)
  + For each Subject in the Experiment, the following information is displayed:
    - Start Time: Local time of the first sample in the first channel
    - End Time: Local time of the last sample in the first channel
    - Num Segments: Number of contiguous sets of data in the Subject’s first channel
    - Channel Id and Channel Label for each channel in the Subject
* Record the Channel Id of interest

### Determine Sample Times

* Times stored in the waveform file are in UTC.
* The timezone in which the acquisition occurred is saved in the Experiment database.
* When accessing a user defined range of samples, GetTimeSegmentsLocal() may be used to retrieve the available time ranges for a channel. See a usage example in PrintAllTimeSegments.m
* Typically all channels in the subject share the same time ranges, this may not be the case if a channel was deleted or added between acquisitions
* Often all subjects will share the same time ranges as well, this may not be the case if a subject was added or deleted.

### Requesting Samples

Samples are retrieved by calling GetPnmWaveformData\_Setup() followed by one or more calls to GetPnmWaveformDataUtc(). The calls have been split up for speed, permitting setup information to be retrieved once and faster processing when calling GetPnmWaveformDataUtc()

#### Request All Samples

* See GetAllData.m
* Adjust numSamplesRequested based on memory availability

#### Request Specific Samples

* Determine the Local start time and the number of samples you wish to retrieve
* See Display1000Samples.m for an example

# Functions

## GetExperimentInfo()

Retrieves information about the Experiment from the Experiment database.

### Inputs

* szExpPath Experiment folder
* fileId value from fopen() to write output to file  
   use 1 to display output on the screen

## GetPnmWaveformData\_Setup()

First of a pair of functions used to retrieve data, this is followed by one or more calls to GetPnmWaveformDataUtc()

### Inputs

* szExpPath Experiment folder
* channelId Channel Id from which samples are being requested.
* numSamplesRequested Number of samples requested

### Outputs

* reader WaveformDatasetReader object
* timezone Experiment timezone
* segStartTimesUtc Channel segment start times in UTC
* segEndTimesUtc Channel segment end times in UTC
* sampleRate Channel samples rate
* sampleBuffer Buffer allocated to retrieve samples

## GetPnmWaveformDataUtc()

Retrieves sample data from an Experiment waveform file. This is the second of a pair of functions used to retrieve data, one or more of these calls is preceded by a call to GetPnmWaveformData\_Setup()

### Inputs

* reader WaveformDatasetReader object
* channelId Channel Id from which samples are being requested.
* startTimeUtc UTC time of first requested sample
* numSamplesRequested Number of samples requested
* sampleBuffer Buffer in which samples are stored
* sampleRate Channel sample rate
* segStartTimesUtc Channel UTC segment start times
* segEndTimesUtc Channel UTC segment end times

### Outputs

* actualStartTimeUtc UTC time of the first sample returned in sampleBuffer
* samplesReturned Number of samples returned in sampleBuffer

## GetTimeSegmentsLocal()

Retrieves all segment times in Local (Experiment) time

### Inputs

* szExpPath Experiment folder
* channelId Channel Id from which samples are being requested

Outputs

* segStartTimesLocal Local segment start times (acq timezone)
* segEndTimesLocal Local segment end times (acq timezone)

## GetTimeSegmentsUtc()

Retrieves all segment times in UTC time

### Inputs

* szExpPath Experiment folder
* channelId Channel Id from which samples are being requested

Outputs

* segStartTimesUtc UTC segment start times
* segEndTimesUtc UTC segment end times

# Testing

* Tested with R2015b
* The sample code has been tested with the 3 Experiments that are included in the TestData folder
* The expected results used in TestExperimentInfo.m were verified by viewing the Experiments in Ponemah 6.1.
* The expected results used in TestSamples.m were generated by using an ASCII output feature in Ponemah 6.1 (BP channels) or from Dataquest ART (ECG, EMG, EEG channels) Ponemah 6.1 was not used for these channels due to a limitation in the ASCII output for signals close to 0.