ECE 5255 Biomedical System Design Fall 2013

Lab 4: Biomedical Kit

Due: Tuesday, 11/19/13

Purpose: To become familar with obtaining standard datasets, loading and processing them using NI Biomedical Workbench

Background:

Relevant Websites:

-Physionet: "PhysioNet offers free access via the web to large collections of recorded physiologic signals and related open-source software. The PhysioNet web site is a public service of the PhysioNet Resource funded by the National Institutes of Health's NIBIB and NIGMS."
http://www.physionet.org/
-NI Biomedical Workbench
https://decibel.ni.com/content/docs/DOC-12646

Procedure:

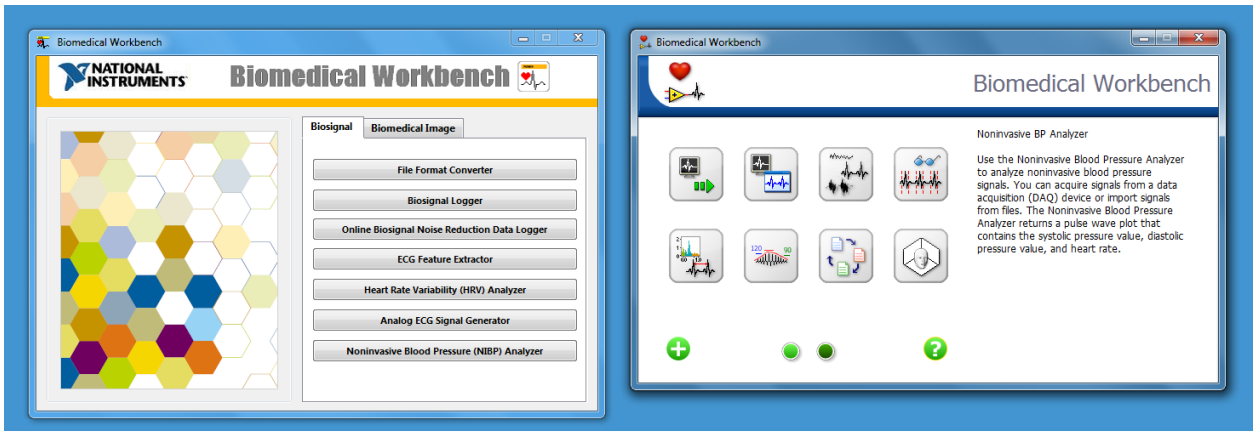
1) Install software: If you haven't already, download NI Biomedical Workbench (and LabView 8.5 engine if prompted). The procedure will differ slightly depending whether you have version 3.0 (installed in the lab) or the new version just released on the NI website. The buttons differ somewhat, but the overall procedures are the same. The main difference is that the new version has native support for PhysioNet format files, and requires a licensing fee for the full version.

Notes: Navigating the biomedical-related sections of NI's website can be challenging. Several different names are used for the LabVIEW biomedical software provided by NI, and documents are located in varying locations on the site. So far, the most effective strategies I've found for finding documents are following links within other NI documents, searching Google for terms, and subscribing/searching the NI Biomedical User Group (https://decibel.ni.com/content/groups/biomedical-user-group)

Name	Observed Usage	Notes
NI Biomedical Startup Kit 3.0	In the NI Labs forums https://decibel.ni.com/content/docs/DOC-12646	V3.0 has been superseded by the "LabVIEW Biomedical Toolkit". Primary difference: the source code is no longer free by request, but is included with the new full (paid) version.
Biomedical Workbench	Title within the executable software itself	both the new and old versions display the same name, disambiguation picture is below

LabVIEW Biomedical Toolkit	NI LabVIEW Toolkits page(purchase only) http://sine.ni.com/nips/cds/view/p/lang/en/nid/210828 LabVIEW evaluation products download page (evaluation version) https://lumen.ni.com/nicif/us/evaltlktsigproc/content.xhtml	Latest version of the biomedical software

Version Disambiguation:



"NI Biomedical Startup Kit 3.0" "NI LabVIEW Biomedical Toolkit"

2) Get standard ECG data files from PhysioNet:
MIT-BIH normal sinus rhythm database
http://www.physionet.org/physiobank/database/nsrdb/

or, goto search box on upper right of PhysioNet page, and search for MITBIH (MIT Beth Israel Hospital). Go to the Normal Sinus Rhythm database page (nsrdb) and download the top 5 files (in MIE8, right-click and Save Target As).

3) Convert files if needed (Biomedical Workbench, v.3):

If you are using Biomedical Workbench, v3.0, you will need to convert the MITBIH files to *.tdms format before you can open them. To do this
-Open Biomedical Workbench and select File Format Converter
-click in the Input Path box, and navigate to '16265.hea'
-There will be a waveform plot and a list of files in the left side. Just click OK.
-Now the fileformat converter will show Input Format: MIT, Output Format TDMS (if it doesn't, change - the output format with the dropbox)
-In the Channel Settings box, choose to convert all the data in these files by clicking 'Add ALL'.
-Click the green Run arrow to start the conversion process.

4) View file contents (Biomedical Workbench, v3.0):

in NI Biomedical Workbench, click button for ECG extractor
Choose a file to extract ECG segments, by clicking Import
Set the file path to the output folder of the converted file, that is, 16265.tdms. Select this file and hit OK.
In the Configure Biosignal Import, select ECG1 or ECG2 found under File Contents and click OK.
Back on the ECG Feature Extractor, click Run. It will extract features from the ECG signal. The Normal Sinus Rhythm contains segments labeled PQRSTU. Bumps in the signal correspond to increases in electrical activity, occurring usually when the different chambers of the heart contract.
The Statistics button shows information such as heart rate and QRS segment length.

5) To Do:

Question 1. Find research/journal papers referencing the MIT-BIH Normal Sinus Rhythm database. List the citations below using IEEE Citation format. http://www.ieee.org/documents/ieeecitationref.pdf

A) _____
B) _____
C) _____

Question 2. What fields are these papers published in? (engineering/physiology/etc)

A)_____
B) _____
C) _____

Question 3. What is each paper about, and why is it referencing the MIT-BIH database? What research question are they using the database to test? In your opinion, do their results

A) _____

B) _____

C) _____

Question 4. Does the paper use any other databases? If so, list them.

A) _____
B) _____

C) _____

Notes:

The P wave corresponds to atrial contraction. The left and right atria move blood from the veins into the ventricles of the heart. The right -atrium is supplied by deoxygenated blood returning from the body. The left atriumis supplied by freshly oxygenated blood from the lungs.

The largest electrical signal appears when the ventricles contract. This occurs during the QRS segment. Ventricle contraction pushes blood through the lungs (right ventricle) and through the rest of the body (left ventricle).

Other info:

Info on ECG traces (NI)
http://www.ni.com/white-paper/6349/en

Physionet: Matlab toolbox for reading in data
http://physionet.org/physiotools/matlab/wfdb-swig-matlab/

intro to PhysioBank
http://www.physionet.org/physiobank/physiobank-intro.shtml

python module for accessing physiobank database
http://www.pybytes.com/pywfdb/