Appendix A

Muscle Names

Throughout the thesis, short names of different muscles are used to represent the EMG channels. In the short names, "L" means *left* while "R" means *right*. For every type of muscle, EMG from both the left and right ones are recorded. Every muscle is represented by 2 or 3 letters, as shown in Table A.1

Commonly Acquired EMG during supine, sitting, standing and stepping experiments	
SOL	soleus
MG	medial gastrocnemius
TA	tibialis anterior
MH	medial hamstring
VL	vastus lateralis
RF	rectus femoris
GL	gluteus maximus
GM	gluteus medius
AD	adductor
Additional Acquired EMG during voluntary control experiments	
EDL	extensor digitorum longus
EHL	extensor hallucis longus
IC	intercostals
Acquired EMG for stimulation artifact	
PS	paraspinals

Table A.1: Commonly Acquired EMG channels

Appendix B

EMG Peak Detection Software

To help the practitioners at University of Louisville at Kentucky to process the EMG signal for the spinal cord injuries research, a MATLAB program with graphic user interface (GUI) is developed. It is called *EmgPackage*, and its core functionality is to detect EMG peaks reliably and accurately by implementing the peak detection algorithm described in Chapter 3. It also allows the users to adjust the parameters to yield the best results for their specific data and applications. Since no detection algorithm is perfect and there will be missed detections or false positives sometimes, the software allows the users to manually adjust the detection results by adding or deleting peaks.

Figure B.0-1 shows the interface when EmgPackage is first opened. There are mainly five sections:

Input Control Select data for processing

Process Control Select muscles and stimulation events, and algorithm-related parameters. The default values of the parameters already give the best overall performance, but if the users particularly want a low false positive rate or a low false negative rate, then parameters can be adjusted to yield the desired performance.

Load Results After processing, the peak detection results are saved and can be loaded and further modified.

Postprocessing Control Users can manually modify the peak detection results by adding or deleting a single peak or a group of similar peaks.

EMG Signal Six consecutive stimulation intervals are shown on each page (starting at the upper left one and goes horizontally to the upper right one, which is followed by the lower left and ending at the lower right one). Users can go to the next or the previous page, or jump to any specific page. Every of the six sub-windows shows one stimulation interval, and the horizontal axis represents the latency. The red circles show the detected peaks. The numbers next to them are their cluster numbers.

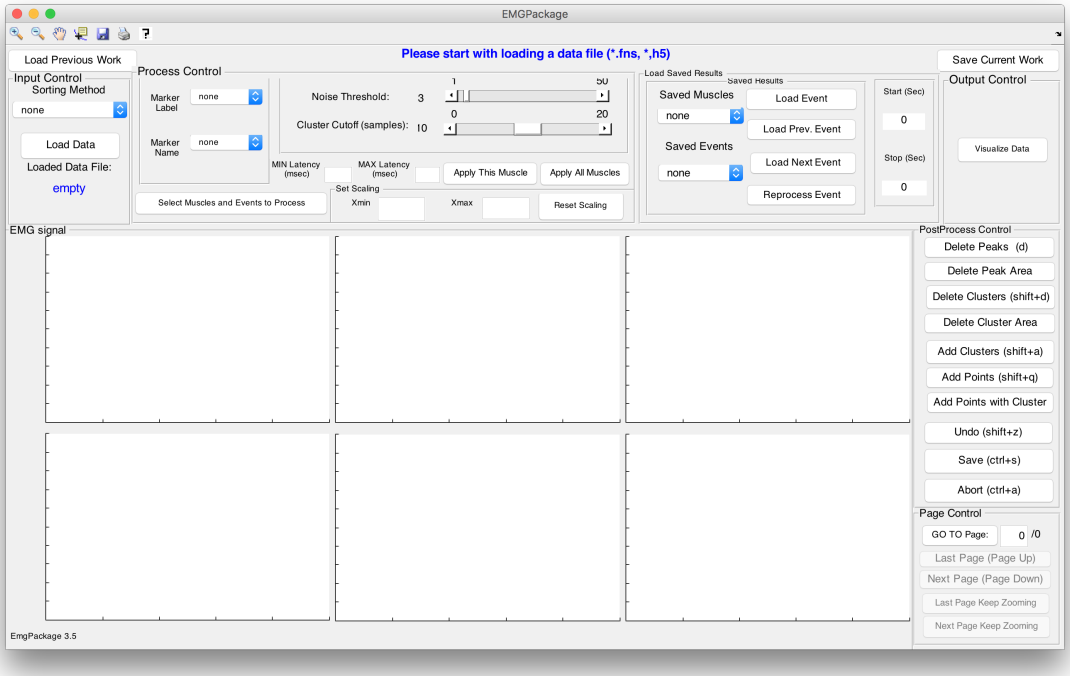

Figure B.0-1: EmgPackage's main GUI when it's first opened.

The detected peaks are clustered based on their latencies using hierarchical clustering. The idea is that many of the similar peaks across different stimulation intervals have similar latencies. By grouping similar peaks together, users can modify a group of similar peaks instead of one by one. This can greatly reduce their work load.

Figure B.0-2 shows the sub-GUI when users click the button "Select Muscles and Events to Process". Users can select arbitrary muscles and stimulation events that they are interested in for peak detection.

Figure B.0-3 shows an example of the peak detection results.

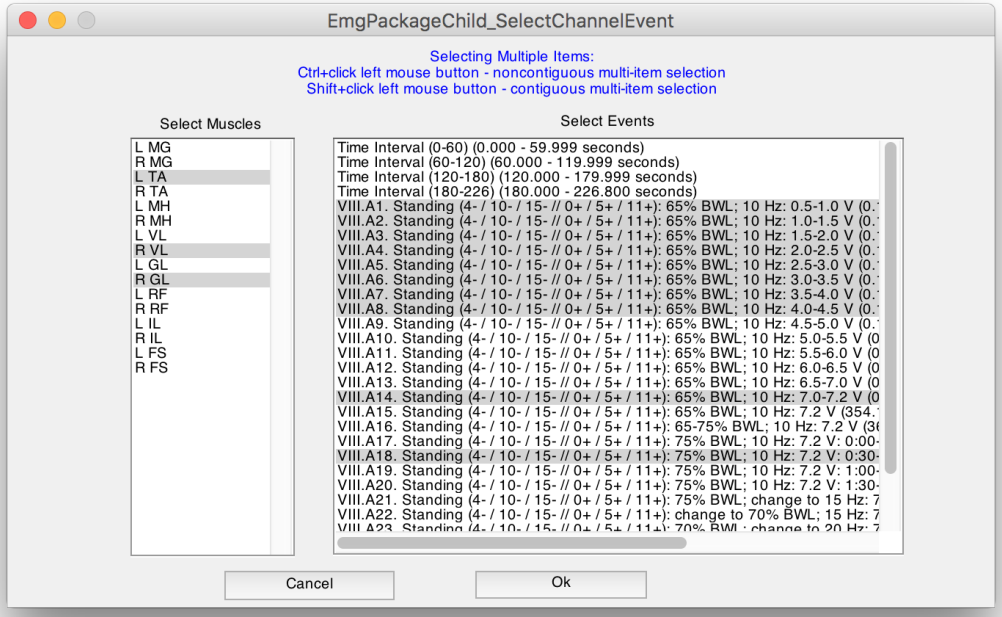

Figure B.0-2: Sub-GUI for selection of different muscles and stimulation events

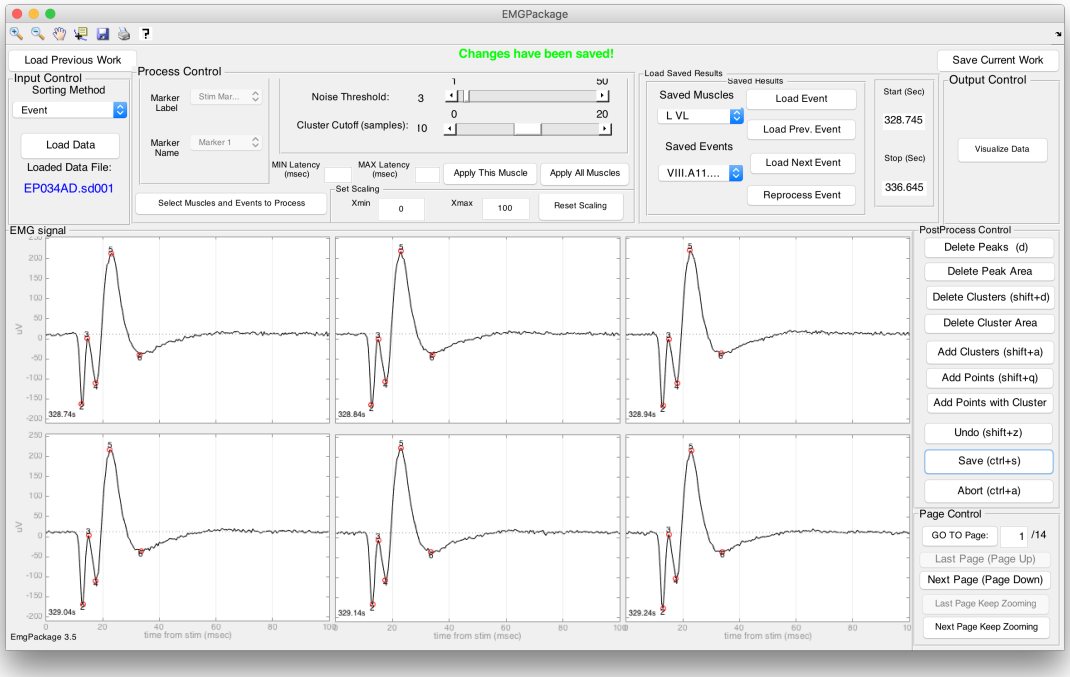

Figure B.0-3: An example of peak detection results from using EmgPackage: every one of the six sub-plots is one stimulation interval with the horizontal axis being the latency. The beginning of every sub-plot is the occurrence of one stimulus. The red circles show the detected peaks. The numbers next them indicate their cluster numbers.