**Manual for Kinematic Feature Extraction protocol**

**V. 01**

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The kinematic feature extraction (KFE) protocol utilizes a set of Matlab scripts, written and tested in version R2015a. The protocol can be used by specifying some information in the file labeled ‘KFE\_wrapper’. The protocol is capable of handling the data in several ways (as specified below), and outputs a series of kinematic features. These are summary statistics of the window that is analyzed, although the relevant kinematic data is also stored as a .mat file, and velocity profiles for each hand are also saved, allowing closer inspection of individual windows of analysis. The script has currently been tested and functions on data produced with a modified version of the SDK skeleton tracking program, as well as output from Neurobehavioural Systems’ Presentation. Note that for the latter, the files may need to be convered to ASCII format using a separate program, such as Mokka.

*Input*

In order to use the protocol on your own dataset, you must fill in some user specific information in the script titled ‘KFE\_wrapper’.

*Path* should be the full path to where the kinematic data is stored (as a .txt file). If using the re-ordering function, the .txt file specifying the acquired trial order, per subject, should also be found in the same directory. For the kinematic data file, the protocol expects the file to be named in the format *sbj\_x.txt*, where *x* corresponds to the participant numbers given later in the wrapper script. Note here that for participant numbers <10, a 0 should be added (eg. 01, 02, 03). If used, the trial-order file is expected to be named as *sbj\_x\_order.txt*.

*Datatrials.set* informs the protocol how the data file should be split up. *0* indicates that the entire file should be analyzed as a whole (ie. summary statistics of all movement produced over the course of the file), while all other numbers indicate that the file should be split into separate trials, or moments of interest; *1* specifies that the trial boundaries are in the same txt file as the kinematic data (eg. lines of coordinate data with some marker printed into the file on button presses), *2* specifies that the trial boundaries are given in separate file.

In the case of *1*, additional parameters for *datatrials.Sbound* and *datatrials.Ebound* should also be given to specify what text is embedded in the file as trial boundaries.

In the case of *2,* the .txt file should contain two columns, and one row for each trial or moment of interest. The first column should specify onsets, while the second column indicates offsets. These should be given in the same metric as the timestamps given in the kinematic data trial (for Presentation, this is in seconds).

*Datatrials.fixed* specifies whether the protocol should look for a trial-order file that allows the dataset to be re-ordered. This can be used, for example, if one has an experimental paradigm that elicits specific movements in a randomized order. Using a 1-D array with the numeric order of trial presentation allows the protocol to re-arrange the trials into a standardized ordering, allowing easier comparison of the outputs. For this input, *0* indicates that the trials should be left in the order they are encountered in the datafile, while *1* indicates they should be re-ordered.

*Datatrials.onoffpath* allows you to specify a separate path where the onsets/offsets file for individual participants is found. The protocol expects the name of this file to be in the format *sbj\_x\_onsets.txt*.

*Datatrials.header* asks whether the data uses headers, or begins immediately with kinematic data. *0* indicates no headers, and analysis commences with the first line in the datafile. *1* specifies there are headers that should be skipped. As of version 01 of the protocol, the headers are assumed to be generated by Presentation. If a different number of lines should be skipped, this must be changed in the KFE\_import file.

*FPS* allows the user to specify a different number of frames per second. This should be left at 30 for the Kinect, but may be changed if another tracking modality is used.

*Sbj* allows input of individual participant numbers. These correspond to how the data-files and meta-data files are named, and are used to find these files and name output files.

*Output*

The wrapper script passes all of the user specified information on to the other scripts, which in turn are responsible for importing, preparing, and analyzing the data. The result is a new folder, one for each data file, under the user-defined Path, with the following files:

* *CM\_sbj\_x*
  + .mat file containing the re-formatted, processed 3D data from your datafile (COR variable), along with a variable containing all trial durations, if specified (DUR variable), and a variable that indicates whether any user-defined trials were missing from the supplied data-file (ms variable)
* *Beh\_sbj\_x’*
  + .mat file containing the calculated kinematic features. If multiple trials are analyzed, these are displayed on separate rows. Spatial variables (eg. Rmax, Distance) are given in meters, while temporal variables (eg. Speed, holdtime) are given in seconds.
* *Sbj\_x\_Submoves\_trial\_y\_R/L*
  + For each trial (y) a plot is saved for each hand (R/L) that depicts the velocity profile for that hand, as well as submovements and holds. The x-axis is given in frames, while the y-axis is given in meters per second. Red x’s along the velocity profile indicate the peak of an individual submovement, while the vertical lines with numbers between them indicate the individual holds.