**Tony Kung, Summer 2017, Development of a Clinically Usable Assessment Tool for Walking Balance**

**3 Objectives:**

(CoM = Centre of Mass)

1. Obtain the optimal CoM parameters to use in assessing standing balance
   * Assess most statistically relevant indicator of differences between the four conditions
2. Obtain the optimal location for the placement of a single IMU to approximate body CoM
3. Develop a cost-effective assessment tool to assess walking balance
   * (Combined with standing balance, in this case, using Wii Board, Shimmer IMU and Matlab)

**Folders:**

**USRP\_Deliverables**

* Elevator Pitch, Abstract and Final poster for USRP

**Data\_Sets**

* Walking data for 14 subjects from the university of Tokyo
* Nat(Natural Walking), Met(Metronome), Arm(Arms restricted), Str(Stroop Test)
* Output Legend: explains the terms in the data files (from Angela)
* Centre of Mass (COM) data from ‘CoMx’, ‘CoMy’, ‘CoMz’ (filtered by Angela, cutoff freq of 6 hz)
* Markers data from ‘mdata’
* Motion capture sampling rate = 200 Hz

**Paramater\_Work (Objective 1)**

* RMSarray.m
  + ~ Creates the array of RMS values for displacement, velocity and acceleration under 4 conditions
  + ~ NOTE: no COM data for the metronome of subjects 2 and 8, so values were taken out
* Anova\_Compare.m
* Compares the Arrays made from the above function
* Compares and computes the p values among the four conditions for each parameter
  + A p value gives the probability that the data are from the same set (lower p value than 0.05 mean they are statistically different)
* Multcompare used to compare between two conditions after anova test.
* Parameters.xlsx
* All the rms values of the parameters, as well as p value summary
* Differentiate.m
  + Differentiate function by kei

**IMU\_Location (Objective 2)**

* multregress.m
  + ZMeanNat is the array of Mean Z values of COMz, Shoulderz, ASISz for each subject
  + Used to find the coefficients for multiple regress of COMz in relation to Shoulder and ASIS height
  + Array b gives (Constant + coeff of variable 1 + coeff of variable 2 + coeff of variable 1 \* variable 2)
* mean3D.m
  + Used to calculate and make the array of projected 3D CoM values
  + Uses ASIS (Anterior Superior Iliac Spine) marker as reference point (zero)
  + Projects the 3D CoM onto the Shoulder - ASIS line down the torso
* IMULocatioinCalculations.xlsx
  + Calculations used to compute different methods to find Virtual CoM
    - (Refer to poster for picture)
  + Method One, calculated using the multiple regress from multregress.m
    - The coefficients were used to estimate the CoMz shown in sheet 1
    - Column 'Estimate' shows the estimated height from multiple regression
  + Method Two, in sheet 1. CoMz were compared to height of Shoulder and Asis markers
    - rms of CoMz was averaged between the participants and compared to the two markers
    - Gives a rough estimate of 20 mm above ASIS
  + Method Three (Sheet 2)
    - Using the 3D Centre ASIS as a reference point and projecting the 3D CoM onto the ASIS-Shoulder Line
    - Uses the values from the array calculated in mean3D.m
    - shown in the third table on the right
    - The ratio as a of the projected 3D CoM over the trunk was used as the virtual marker point
    - The root mean square error was calculated
  + Etc.
    - Second table column on sheet 2 calculated the 3D CoM without the projection onto the ASIS-Shoulder Line
    - First table column on sheet 2 calculated the 3D CoM without ASIS as a reference point (Just to look at it)
* June26th.pptx
* Summary of the virtual marker location (estimate using ASIS and Shoulder)

Balance\_Assessment (Objective 3)

* See RayFang folder