Worksheet 1 (StepScan)

Topic 1: Public Foot Pressure Database (CASIA-D)

1) The shared Dropbox link for CASIA-D dataset is at
   https://www.dropbox.com/s/kbhe66qg4wim0sj/RSScanData.zip?dl=0
   There are 6 zipped files and a text file within the shared "RSScanData" zip file.
   More details about the dataset can be found in DataReadme.txt.
2) The (sub) zipped file that we would like to focus on this worksheet is
   "alignedPerFootDataBarefoot.zip",
   i.e., the feet are aligned (translation and rotation) to a specific foot template.
3) Within this zip file, the foot pressure data is in "AlignedFootDataBarefoot.npz" and the meta
   data is in "AlignedFootMetaDataBarefoot.npy".
   If you would like to read and write the NumPy's NPY format (.npy files) in MATLAB, you many
   need the npy-matlab toolbox (https://github.com/kwikteam/npy-matlab).
4) The main variables in meta data that we would like to focus on this topic are
   - "Subject ID": 4—103
   - "Foot classification": left (0) / right (1)
   - "A flag saying when the footstep is incomplete because it did not fall fully on the sensor
     space": complete (0) / incomplete (1)
   After loading the data, the pre-processing procedure required is to remove any footstep that
   is incomplete. Therefore, after pre-processing, the number of footsteps reduced from 2898
   to 2851 for the next topic.

Topic 2: Center of Pressure (COP) Features (Biomechanics Field)

1) The paper entitled "Measures of Postural Steadiness: Differences Between Healthy Young
   and Elderly Adults" [1] is the main resource on this topic.
2) The first step is to compute the COP (RD, AP, and ML) time series.
   a. As some papers used Center of Area (COA) instead of COP, both COA and COP should
      be implemented for practice.
   b. The mean COP (i.e., the local coordinate system) is normally used as a reference in
      biomechanics field [1].
   c. To create a binary image from grayscale image: if 0 => 0 (black), else 1-255 => 1 (white).
3) The second step is to compute the COP features.
   Understanding all the COP features in [1] as well as implementing them are necessary.

Topic 3: Verification/Authentication Using Matching Scores

1) First is to compute a score matrix using (I) Euclidean distance and (II) correlation coefficient
   for individual users, separate foot sides, and COP features. Two separate matrices may be
   created for each model: one for matching scores between samples enrolled into the system
   (genuine) and another for imposters (other users or individuals who are not enrolled in the
   system).
2) Second is to evaluate individual models using the key performance metrics: (I) the false
   acceptance rate (FAR), (II) the false rejection rate (FRR), (III) the accuracy graph (which
   plots the FAR and FRR as functions of the threshold), (IV) the receiver operating

characteristic (ROC) curve (which plots FAR against the FRR), (V) Zero-FAR, and (VI) the equal error rate (EER).

Checkpoint

Please show the key performance metrics for Subject #4 (as a genuine user), Left side, and MDIST features.