Construction of a representative time-coherent global XYZ median beat

A three-step approach is used (see Figure 1 in Perez-Alday et al, Computers in Biology and Medicine, Volume 104, January 2019, Pages 127-138):

1. Beat labeling and dominant type beat selection

First, each beat on a 10-second 12-lead ECG recording must be appropriately labeled. Non-analyzable beats due to noise and artifacts, and non-dominant ectopic beats must be excluded from analysis. Kors transformation matrix is used to obtain the orthogonal X, Y, and Z leads from 12-lead ECG (see Kors transformation matrix in our GEH GitHub page)

2. Single-lead median beat construction

At the next step, all included beats on a single lead, V_x, are then aligned to construct a representative single-lead median beat, V_{MX}. The maximum absolute of the first derivative (maximum |dV/dt|) is used to construct the single-lead median beat. After alignment, the representative median beat, V_{MX}, is constructed using the *median* function of MATLAB (MathWorks, Natick, MA, USA).

3. Global XYZ multi-lead beat construction

At the third step, we construct a time-coherent global XYZ median beat. Single-lead alignment is performed only on a single lead (X). Corresponding time points on leads Y and Z are used for construction of time-coherent global XYZ median beat.

$$V_{MX\_Time} = V_{MX}\left(centered\ at\ \max_{QRS}\left|\frac{\partial V_{MX}}{\partial t}\right|\right)$$

$$V_{MY_{Time}} = V_{MY}\left(centered\ at\ \max_{QRS}\left|\frac{\partial V_{MX}}{\partial t}\right|\right)$$

$$V_{MZ\_Time} = V_{MZ}\left(centered\ at\ \max_{QRS}\left|\frac{\partial V_{MX}}{\partial t}\right|\right)$$