

Raw Signals

IMU  
(3-axis accel.)

PPG  
(3 wavelengths)

EDA  
(skin cond.)

Preprocessing

Resampling  
Low-pass filtering

Resampling  
High-pass filtering

Resampling  
Tonic/Phasic split

Temporal  
Segmentation

5-second windows • 10% overlap • 1421 labeled segments

Feature  
Extraction

**IMU (30)**

Quantiles, entropy  
Katz fractal dimension  
Sum of abs. changes  
Variance of differences

**PPG (183)**

Statistical moments  
RMSSD, SDNN, pNN50  
LF/HF power ratio  
Heart rate variability

**EDA (47)**

Tonic level (SCL)  
Slope, IQR, MAD  
Mean absolute diff.  
Skewness, kurtosis

Fusion &  
Alignment

Time alignment → Modality fusion → Label matching

Feature  
Selection

Correlation ranking → Redundancy pruning ( $r > 0.90$ ) → LOSO-consistent filtering

Model  
Training

Random Forest (n=100, depth=6) • LOSO Cross-Validation • Per-modality models

LOSO  
Results

IMU  
 $r = 0.52$

PPG  
 $r = 0.26$

EDA  
 $r = 0.02$