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List of Abbreviations

2D: Two-dimensional

3D: Three-dimensional

ANS: Autonomic Nervous System

ASM: Angular Second Moment

AUC: Area Under the Curve

AV: Audio-visual

BVP: Blood Volume Pulse

CASE: Continuously Annotated Signals of Emotion

CDA: Continuous Decomposition Analysis

CNN: Convolutional Neural Networks

CNS: Central Nervous System

CWD: Choi–Williams Distribution

cvxEDA: Convex Optimization based on EDA

CWT: Continuous Wavelet Transform

DDA: Discrete Decomposition Analysis

DCM: Dynamic Causal Modeling

DR: Dynamic Range

ECG: Electrocardiogram

EDA: Electrodermal Activity

EEG: Electroencephalogram

EMG: Electromyogram

ER: Emotion Recognition

FDTA: Fractal Dimension Texture Analysis

FOS: First-Order Statistics

GADF: Gramian Angular Difference Field

GAF: Gramian Angular Field

GASF: Gramian Angular Summation Field

GLCM: Gray Level Co-occurrence Matrix

GLRLM: Gray Level Run-Length Matrix

GLU: Gray-Level Uniformity

HM: Hu's Moments

HR: Heart Rate

HRV: Heart Rate Variability

HVHA: High Valence/High Arousal

HVLA: High Valence/Low Arousal

KNN: K-Nearest Neighbors

KW: Kruskal-Wallis

LR: Logistic Regression

LRE: Long Run Emphasis

LTI: Linear Time-Invariant

LVHA: Low Valence/High Arousal

LVLA: Low Valence/Low Arousal

MAP: Maximum Peak

MASM: Mean of Angular Second Moment

MCN: Mean of Contrast

MCR: Mean of Correlation

MDE: Mean of Difference Entropy

MDN: Median

MDV: Mean of Difference Variance

ME: Mean of Entropy

MFD: Mean of First Derivative

MFCC: Mel-Frequency Cepstral Coefficients

MFC: Mel-Frequency Cepstrum

MIDM: Mean of Inverse Difference Moment

MIMC1: Mean of Information Measures of Correlation-1

MIMC2: Mean of Information Measures of Correlation-2

MIP: Minimum Peak

ML: Machine Learning

MN: Mean

MMCC: Mean of Maximal Correlation Coefficient

MSA: Mean of Sum Average

MSD: Mean of Second Derivative

MSE: Mean of Sum Entropy

MSV: Mean of Sum Variance

MSSV: Mean of Sum of Squares Variance

MTF: Markov Transition Field

PNS: Peripheral Nervous System

RASM: Range of Angular Second Moment

RCN: Range of Contrast

RCR: Range of Correlation

RDE: Range of Difference Entropy

RDV: Range of Difference Variance

RE: Range of Entropy

RIDM: Range of Inverse Difference Moment

RIMC1: Range of Information Measures of Correlation-1

RIMC2: Range of Information Measures of Correlation-2

RLU: Run Length Uniformity

RMCC: Range of Maximal Correlation Coefficient

RPC: Run Percentage

RP: Recurrence Plot

RSA: Range of Sum Average

RSE: Range of Sum Entropy

RSP: Respiration

RSV: Range of Sum Variance

RSSV: Range of Sum of Squares Variance

SAM: Self-Assessment Manikin

SFD: Standard Deviation of First Derivative

SKT: Skin Temperature

SparsEDA: Nonnegative Sparse Deconvolution

SRE: Short Run Emphasis

SSD: Standard Deviation of Second Derivative

SS: Sum of Squares

STD: Standard Deviation

STFT: Short Time Fourier Transform

SVM: Support Vector Machine

TFR: Time-Frequency Representation

VA: Valence-Arousal

WVD: Wigner–Ville Distribution

XGB: XGBoost

ZM: Zernike's Moments

List of Symbols

A : State transition matrix

B : Tall matrix containing cubic B-spline basis functions as columns

C : Observation matrix

C_P : Coefficient matrix for the phasic component

C_T : Coefficient matrix for the tonic component

$T(t)$: Diffusion/reabsorption

D_{ij} : Euclidean distance between any two points in the phase space

f : Frequency

f : Linear frequency

f_m : Mel-frequency

H : Matrix representation in the Laplace transform of $h(t)$

$H_m(f_k)$: Value of the m-th triangular filter at frequency f_k

$h(t)$: Impulse response shaped as a bi-exponential Bateman function

I : Current

j : Imaginary unit

l : Vector of spline coefficients

M : Tridiagonal matrix with moving average coefficients

M_{ij} : Element of the MTF matrix representing the transition probability based on the time order of the original time series

$P(t)$: Phasic component

p : Sudo Motor Nerve Activity (SMNA)

q : Auxiliary variable

q : Vector in optimization problems

$q(x_i)$: Bin to which the value x_i belongs

R : Recurrence matrix

R : Skin resistance

r : Phasic activity

ri : Radius in polar coordinates

$S(t)$: Sweat secretion via pore opening

$S(f_k, t)$: Spectrogram magnitude at frequency f_k and time t

$SC(t)$: Skin conductance at time t

$SC_P(t)$: Phasic component of skin conductance at time t

$SC_T(t)$: Tonic component of skin conductance at time t

t : Tonic component

τ : Delay coefficient in phase space reconstruction

τ : Variable representing time in STFT

τ_1 : Slow time constant of the phasic curve shape

τ_2 : Fast time constant of the phasic curve shape

$u(t)$: Unitary step function

u_k : Input at discrete time step k

U : Heaviside step function

V : Voltage

W : Markov transition matrix

$w(t-\tau)$: Window function in STFT

w_{ij} : Probability of transitioning from bin i to bin j

X : Original time series data

X : Time series data

$X(t)$: Time series data

$\hat{X}$: Normalized time series

$x(t)$: Time-domain signal

x_k : State variable at discrete time step k

ϵ : Additive independent and identically distributed zero-average Gaussian noise term

ϵ : Threshold distance in phase space reconstruction

μS : MicroSiemens

ϕ : Angle

ϕ_i : Polar angle corresponding to the i-th element of the time series

$\nu(t)$: Observation noise at time t

ν_k : Observation noise at discrete time step k