Algorithm portfolio · Medical applications

Vital sign monitoring

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Parameter / feature	Description	Sensor input[1,2]	Fingertip[3]	Head[3]	Thorax[3]	Watch[3]
Abnormal rhythm detector[4]	Detection of episodes of abnormal rhythm (arrhythmias)	ECG, PPG	8	8	8	8
Arrhythmia classification	Classification of various cardiac arrhythmias (e.g., atrial fibrillation, atrial flutter, or ventricular premature beats) (in Python)	ECG, PPG	7	7	7	7
Atrial fibrillation detection[4]	Detection of episodes of atrial fibrillation (AFib or AF)	ECG, PPG	8	8	8	9
Breathing rate	Number of breaths per minute	ECG, PPG	8	8	9	9
Cardiac beat detection[4,5]	Detection of heartbeats (ECG) or pulses (PPG)	ECG[4], PPG	9	9	9	9
Cardiac coherence	Rhythmic component that balances the nervous system (stress) and emotional state	ECG, PPG	8	7	8	8
Fiducial point detection	Detection of P-wave onsets, P-wave peaks, Q-wave onsets, S-wave onsets, J-points, J-point slopes, T-wave onsets, and T-wave offsets (in Python)	ECG	-	-	6	5
Heart rate / pulse rate	Number of heart beats or pulses per minute	ECG, PPG	8	8	9	9
Heart rate variability	Variation in the time intervals between heartbeats	ECG, PPG	8	8	9	9
Optical blood pressure[4]	Trends of systolic, mean, and diastolic blood pressure (occlusion-free)	PPG, absolute values require initial 1-point calibration	9	8	7	9
Perfusion/pulsatility index	Ratio of pulsatile blood flow to non-pulsatile blood in peripheral tissues and thus an estimate of peripheral blood flow	PPG	7	7	8	9
Pulmonary artery pressure	Non-invasive estimation of pulmonary artery pressure	combined chest-EIT/ECG	N/A	N/A	5	N/A
Pulmonary edema	Non-invasive detection of pulmonary edema	chest-EIT	N/A	N/A	3	N/A
RR-interval	Time interval between two consecutive R waves or heartbeats	ECG, PPG	8	8	9	9
Sleep	Classification of sleep stages as well as estimation of total sleep time, time in bed, sleep latency, and sleep quality	EEG, ECG, PPG	6	7	9	9
SpO_2	Arterial oxygen saturation measured with a pulse oximeter	PPG with at least 2 wavelengths	7	7	7	7
Stress level	Autonomic nervous system balance (sympathetic vs parasympathetic)	ECG, PPG	8	7	8	8
Stroke volume	Non-invasive estimation of stroke volume	combined chest-EIT/ECG	N/A	N/A	3	N/A
Stroke volume variation	Non-invasive estimation of stroke volume variation	combined chest-EIT/ECG	N/A	N/A	3	N/A

[1] ECG (Electrocardiogram), EIT (Electrical Impedance Tomography), PPG (Photoplethysmography).
[2] Various quality indices indicate the sample-by-sample estimation of the signal-to-noise ratio, e.g., of a detected QRS complex in ECG.
[3] Numbers in the table indicate the Technology Readiness Level (TRL) according to ISO 16290:2013.
[4] Library compliant with IEC 62304 Medical Software.
[5] ECG-based cardiac beat detection is compliant with ANSI/AAMI EC-57 and validated against MIT-BIH, NST, AHA, and ESC databases.

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