



# CSEM's algorithm portfolio for wearables

CSEM delivers tailored embedded solutions for health & fitness monitoring. The algorithms have gone through a strict validation and are ready for tomorrow's wearables.

PARAMETER	DESCRIPTION	BODY LOCATION*
Activity	Automatic classification of sleep, rest, walk, run, bike, and swim	
Posture	Automatic classification right/left lateral decubitus, ventral/dorsal decubitus, and standing	
Step count	# steps during walking and running	
Cadence	Instantaneous steps/min for walking, running, and cycling	
Stride length	Length of single step from each gait cycle	
Traveled distance	Total distance covered during walking, running, and swimming	
Speed	For walking and running	
Swim: Stroke count	Total number of left and right hand strokes in a lap	
Swim: Lap count	Number of pool lengths covered	
Swim style	Automatic classification of butterfly/crawl, backstroke and breast stroke	
Swim efficiency	SWOLF (stroke count + lap time)	
Workout	Duration of vigorous physical exercise or training session	
Fall event	Automatic detection of falls in daily life	
Energy expenditure	Instantaneous MET or cumulated kcal of burned energy	
Foot impact strength	Maximum vertical impact absorbed by the foot when landing	
Foot impact zone	Distribution of the impact strength between heel, midfoot, and toes	
GCT	Ground contact time (in ms and %). Time a foot stays on the floor during a running gait cycle	
Right/left GCT balance	Distribution of the ground contact time between right and left feet	
Running efficiency	Overall performance and quality factor	
Jump count	Detection of forward and vertical jumps	
Impact count	Detection of individual large amplitude shocks	

\*number stands for Technology Readiness Level (TRL)





RR intervals	Interval of time between successive R waves (cardiac contractions)	
Heart rate	Number of beats per minute (bpm)	
Heart rate variability	Variation in the time interval between heartbeats	
Perfusion	Rate of blood delivery to a capillary bed	
SpO <sub>2</sub>	Blood oxygen saturation	
VO <sub>2</sub>	Instantaneous oxygen consumption	
VO <sub>2</sub> max	Maximum oxygen consumption	
EPOC	Excess post-exercise oxygen consumption after exercise	
Breathing rate	Number of breaths taken in a minute	
Blood pressure	Non-occlusive systolic/diastolic blood pressure measurement	
Arrhythmia detection	Detection of various cardiac arrhythmias (atrial and ventricular fibrillations, ventricular premature beats)	
Stress level	Feature derived from autonomous nervous system balance (sympathetic vs parasympathetic)	
Pulmonary artery pressure	Non-invasive blood pressure in the pulmonary artery	
Pulmonary edema	Non-invasive determination of fluid accumulation in the lungs	
Stroke volume	Non-invasive measurement of the blood volume pumped each beat	
Stroke volume variation	Non-invasive stroke volume variation measurement	

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Drowsiness	Detector of sleepiness or lethargy	
Total sleep time	Duration of actual sleep time during a sleep episode	
Sleep stage scoring	Classification of sleep (wake, deep and light)	
	Classification of sleep (wake, REM and NREM)	
Time in bed	Time from "Lights Out" to "Lights On"	
Sleep latency	Duration of time from bedtime to the onset of sleep	
Sleep quality	Sleep duration, sleep fragmentation and sleep cycles	