

Hearables: Heart Rate Variability from Ear Electrocardiogram and Ear Photoplethysmogram (Ear-ECG and Ear-PPG)

Edoardo Occhipinti¹

Haozhe Tian, Amir Nassibi and Danilo Mandic

¹ Imperial College London

This work aims to classify physical states using heart rate variability (HRV) features extracted from electrocardiograms recorded in the ears (ear-ECG). The physical states tested in this work are: (a) normal breathing, (b) controlled slow breathing, and (c) mental exercises. Since both (b) and (c) cause higher variance in heartbeat intervals, breathing related features (SpO2 and mean breathing interval) from ear Photoplethysmogram (ear-PPG) are used to facilitate classification. This work 1) proposes a scheme that, after initialization, automatically extracts R-peaks from low signal-to-noise ratio ear-ECG; 2) verifies the feasibility of extracting meaningful HRV features from ear-ECG; 3) quantitatively compares several ear ECG sites; and 4) discusses the benefits of combining ear-ECG and ear-PPG features.