EZ Rhythm: ECG Diagnosis Framework Using Novel Patient-Specific Morphology Comparison To Screen Disadvantaged Populations

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Early detection is the key to preventing arrhythmia-related complications. However, developing countries do not have the infrastructure, educated personnel, or devices to screen for arrhythmia, leaving millions of people suffering from undiagnosed rhythm disorders. EZ Rhythm addresses this problem as an affordable electrocardiogram (ECG) population screening system capable of automated arrhythmia detection and increasing cardiologist review efficiency. EZ Rhythm consists of three components: an affordable and portable continuous ECG monitor, a context-based classification system, and a cloud-based web server. The EZ Rhythm continuous event recorder allows for extended periods of ECG data to be wirelessly uploaded. The classification system applies a novel timed series biosignal technique “Patient-Specific Morphology Comparison” (PSMC) to strengthen its final diagnostic neural network against the errors commonly introduced by interpatient variation of normal rhythms. The EZ Rhythm web server collects ECG data, flags diseased patients, and improves cardiologist efficiency by highlighting abnormal segments. PSMC allows the diagnostic model to reach a cardiologist-level sensitivity and specificity of 91.3% and 99% (73.0% and 98.7% without PSMC) while also significantly increasing model accuracy on low-prevalence arrhythmia classes. Additionally, the EZ Rhythm web server creates a filtered summary of monitoring sessions to immensely decrease the amount of manual cardiologist review required. With a production cost of $13.61 (2% of existing equivalents), EZ Rhythm can provide vital early arrhythmia diagnosis to developing countries.

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