Cardiovascular diseases are projected to remain the single leading cause of death globally. Timely diagnosis and treatment of these diseases are crucial to prevent death and dangerous complications. One of the important tools in early diagnosis of arrhythmias is analysis of electrocardiograms (ECGs) obtained from ambulatory long-term recordings. The design of novel patch-type ECG recorders has increased the accessibility of these long-term recordings. In many applications, it is furthermore an advantage for these devices that the recorded ECGs can be analyzed automatically in real time. The purpose of this study was therefore to design a novel algorithm for automatic heart beat detection, and embed the algorithm in the CE marked ePatch heart monitor. The algorithm is based on a novel cascade of computationally efficient filters, optimized adaptive thresholding, and a refined search back mechanism. The design and optimization of the algorithm was performed on two different databases: The MIT-BIH arrhythmia database ( $Se=99.90\%$, $P^+(\%)=99.87\%$ ) and a private ePatch training database ( $Se=99.88\%$, $P^+(\%)=99.37\%$ ). The offline validation was conducted on the European ST-T database ( $Se=99.84\%$, $P^+(\%)=99.71\%$ ). Finally, a double-blinded validation of the embedded algorithm was conducted on a private ePatch validation database ( $Se=99.91\%$, $P^+(\%)=99.79\%$ ). The algorithm was thus validated with high clinical performance on more than 300 ECG records from 189 different subjects with a high number of different abnormal beat morphologies. This demonstrates the strengths of the algorithm, and the potential for this embedded algorithm to improve the possibilities of early diagnosis and treatment of cardiovascular diseases.

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