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**АНАЛИЗ КАЧЕСТВА РАБОТЫ ДЕТЕКТОРОВ R-ПИКОВ
В СИГНАЛЕ ЭКГ В РЕЖИМЕ**

 **РЕАЛЬНОГО ВРЕМЕНИ**

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В работе предложен алгоритм обработки сигнала ЭКГ с помощью скользящего окна, позволяющий использовать и сравнивать качество существующих детекторов R-пиков в режиме реального времени. Исследование осуществлено на сигналах MIT-BIH в соответствии с парадигмой разбиения inter-patient на обучающую и тестовую выборку. На обучающей выборке исследовано влияние медианной фильтрации на качество работы детекторов и определена наилучшая конфигурация предложенного алгоритма обработки сигнала ЭКГ в режиме реального времени. Проведён количественный и качественный анализ существующих алгоритмов обнаружения R-пиков с целью определения их достоинств и недостатков.

***Ключевые слова:***реальное время, скользящее окно, медианный фильтр, детектор R-пиков, MIT-BIH.

**ANALYSIS OF THE QUALITY OF R-PEAK DETECTORS
IN ECG SIGNAL IN THE REAL-TIME MODE**

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**Purpose**: The author provides an algorithm of ECG signal processing via sliding window to use and compare existing R-peak detectors in real-time mode.

**Design / methodology / approach**: The paper chooses quality metrics to compare modern R-peak detectors from the Python module py-ecg-detectors. It also describes a dumb max detector that consequently searches local maximal value and trims it via threshold. Author introduces important parameter of radius *R*, which can be interpreted as a minimal distance between adjacent R-peaks or an appropriate radius of the area, surrounding truth positions of R-peaks, to take into account the tolerance of R-peak detectors. Paper also describes an algorithm of scanning and filtering signal in real-time mode via sliding window and explains how to decrease errors when moving it. Author uses inter-patient paradigm of MIT-BIH signal division to find out the best detectors configurations on train subset and evaluate final quality on test and all signals.

**Findings**: The paper finds out optimal value of optimal radius *R* in sense of mean for the majority of R-peak detectors. It also makes conclusions about advantages and disadvantages of each of detectors based on the chosen quality metrics.

**Research limitations/implications**: Research is limited to MIT-BIH signals database and using detectors only from Python module py-ecg-detectors. Nevertheless, the obtained results can be further used in systems of automatic ECG analysis such as arrhythmia detection.

**Originality/value**: The value of the whole paper is the uniform algorithm and environment that was used to compare existing R-peak detectors in real-time mode. In conclusion the paper shows that there is no single detector from analyzed set of detectors in this research that is the best on train, test and overall signals subsets simultaneously, based on chosen quality metrics. The paper also notes that for each R-peak detector there is at least one quality metric that is worse than the others obtain. As a conclusion the author suggests two perspective research directions to increase the final quality of the analyzed procedure or R-peak detection. First is joint using the results, obtained by several detectors simultaneously, to decrease their disadvantages and increase their advantages. The second one is about the development of new algorithms, adjusting the final R-peak positions, found by R-peak detectors, due to its importance to the problems of extraction of the R-peak morphological features or RR-intervals durations.

***Key words:*** real-time mode, sliding window, median filter, R-peak detector, MIT-BIH