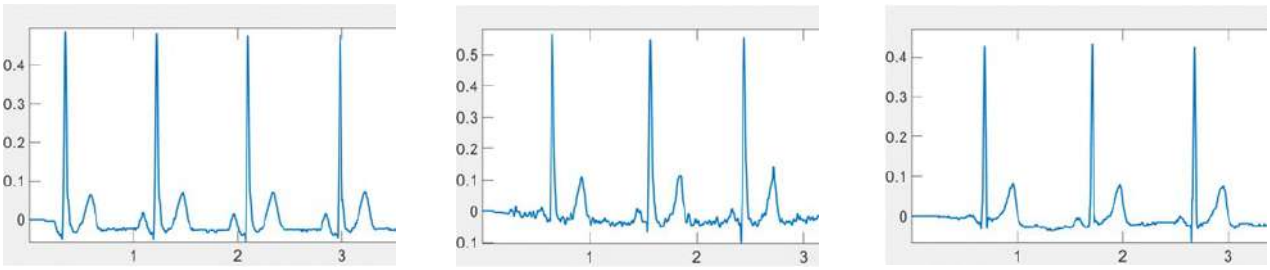
MORPHOLOGICAL ANALYSIS OF SIGNALS IN CARDIAC DECISION SUPPORT SYSTEMS

Nosachenko B.P., Filatova A.E.
National Technical University "Kharkiv Polytechnic Institute", Kharkiv

The aim of the research is to identify the factors affecting the accuracy of ECG analysis; to formulate and solve problems that ensure the process of improving the quality of automatic morphological analysis of ECG based on an integrated biomedical signal with locally concentrated features in cardiac decision support systems (DSS). In the context of the implementation of the "Telemedicine" project [1] in the Ukrainian healthcare system, the creation of cardiac DSS, which should be based on automatic morphological analysis of the ECG, is of particular importance [2]. In cardiology practice, ECG recording is performed using 12 standard leads. However, to improve the accuracy of ECG analysis, it is necessary to consider the location of the QRS axis, as it significantly affects the shape of the main ECG waveforms in a particular standard lead. The QRS axis is the total ventricular depolarization vector projected onto a horizontal plane, so changes in the orientation of the main momentum vector in the frontal plane lead to changes in the projection onto the axis of the leads from the extremities located in this area. Normally, the QRS axis is located at an angle of +30° to +69°, so in this case, the main calculations are performed using the amplitude and time parameters of lead II waves. The deviation of the QRS axis from the normal position is not in itself a sign of pathology, but it can significantly affect the appearance of waves in all standard leads [2]. The authors developed a method for synthesizing an integrated ECG signal from all limb leads, taking into account the angles of the leads in the hexaxial reference system and the position of the QRS axis. The integral signal (Fig. 1) obtained in this way can be used for further interpretation of the ECG instead of lead II in the classical approach [2]. This approach allows to improve the quality of the ECG morphological analysis in cardiological DSS and reduce the number of medical errors.



a b c

Figure 1 – The integral signal for ECG with the QRS axis: a) +54° ; b) −11° ; c) +14°

References:

1. Про підвищення доступності та якості медичного обслуговування у сільській місцевості: Закон України від 14.11.2017 р. №2206-VIII. URL: https://zakon.rada.gov.ua/laws/show/2206-19#Text

2. Filatova A. Ye., Povoroznyuk A. I., Nosachenko B. P., Fahs Mohamad. "Synthesis of an integral signal for solving the problem of morphological analysis of electrocardiograms". Herald of Advanced Information Technology. 2022; Vol. 5 No. 4: p263–274.