Progress in the Analysis of the Electrical Generator of the Heart

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Abstract - **Aim of study is to develop understanding of the heart electric generator based on classification of current density distribution (CDD) maps with help of information-extreme intellectual technology (IEIT). Error-free decision rules were obtained in learning population. Decision rule for test Healthy–CAD was examined based on 203 healthy volunteers and 256 CAD pts and sensitivity and specificity equal to 93% and 87 %, respectively, have been achieved.**

Keywords - **pattern recognition, information-extreme intellectual technology (IEIT), current density distribution.**

I. INTRODUCTION

Magnetocardiography (MCG) is the modern method for registration and analysis of the heart magnetic field. However, visual estimation of above maps are too complex and it is required considerable experience and high qualification from a doctor-cardiologist. Significant efforts are recently undertaken on development of methods of automatic classification of MCG data [1-6]. Aim of study is to develop advanced method for classification of CDD maps onto 4 classes which are typical for daily clinical practice and very frequently occur at unshielded environment, i.e. normal, ischemic, non-coronarogenic heart disease (myocarditis), maps with high level of noise.

II. METHOD OF PATTERN RECOGNITION

Here it is presented the first results based on IEIT maximization of ability of the pattern recognition system during learning process by introducing of additional restrictions [7]. After processing of maps in polar co-ordinates it was formed multi-dimension learning matrix in which every line involves 400 signs describing the brightness of red and blue color, and 100 signs – the map topology.

On Fig. 1 it is shown the dependence of criterion of functional effectiveness (CFE) (1), characterizing the width of the symmetric field of tolerances, which is obtained in the process of parallel optimization of control tolerances for the recognition signs. By the dark areas the work (acceptable) areas of CFE are marked.

Images processing within polar co-ordinates does them invariant to the shift, rotation and scaling. Additionally the alphabet of recognition signs includes geometrical characteristics. Forming of rectangles, area of which depends on length and direction of CDD vectors (Fig. 2). Thus, 100 numbers was additionally added to learning matrix for each class.

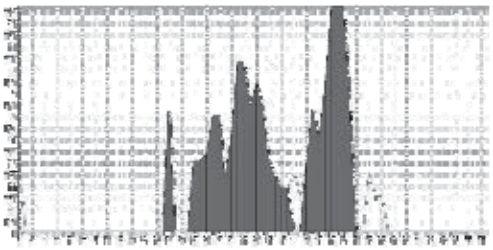

Fig. 1 Dependence of Kullback criterion from the parameter of the brightness gradation δ (optimum value is δ*=±51).

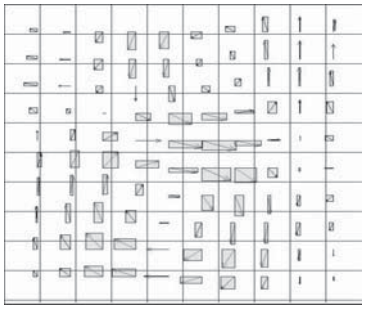

Fig.2 Additional signs of recognition

III. CONCLUSION

Approach based on the CFE basis showed high reliability of decision-making at presence of a priori uncertainty conditioned by the arbitrary initial conditions of registration of MCG maps.

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