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Identification and Prediction of Heart Disease Based on the Analysis Electrocardiosignals Using a Neural Network

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***Abstract*— At the same time image processing as well as the actual calculations combined with a large volume of incoming information in terms of distortion. Artificial Neural Networks has been selected on the basis of networks for research.In this article had heen given application technique of neural network technology.Radial base network was used for the analysis of cardiosignals. Defining of algorithms according to three groups of cardiosignalswere offered: norm signals, bradycardia and tachycardia.**

***Index Terms*—Medical Images, Cardio, Artificial Neural Networks, Radial Basis Network, Cardio Recognition Algorithm.**

I. INTRODUCTION

In medical practice the provision of information in images plays the most important role. These are both graphics,tissues and blood products also tomography, colorful iris and so on even if inserting and processing the one-dimensional signals-cardiogram or encephalogram are sometimes recommended. Analyzing and interpretation of them by doctor diagnostician are based on descriptive form and known features (objects).

II. THE STRUCTURE OF PROBLEM

During the processing of pictures, spectral analysis method based on wavelet of signal also geometric method based on the structure of choosgram are defined [1]. Spectral method is based on a simple harmonic oscillation in a different frequency of cardiorhythm (fast Fourier transformation). In this case the length of the interval consisting of the sequence of cardiac contractility the sequence of frequency characterizing cardiorythm turn into power spectrum oscillations. During spectral analysis of cardiosignal it is possible to say about adaptation capabilities of organism according to spectrum indicators [2,3].

Recently wavelet transformation has been more powerful alternative for Fourier transformation.Wavelet methods is mainly used for determination and detection of diagnostic symptoms. Identification efficiency and accuracy is the most important demand for detection system (modifier). This kind of utilized computer algorithms require provision of practical sustainability to high efficiency and distortions. So that for searchs discovering systems selected during artifical neural networks [4,5].

The most important requirements detection (modifier) are efficiency and accuracy of identification system.At the same time image processing as well as the actual calculations combined with a large volume of incoming information in terms of distortion.The implementation of these algorithmis of the computer realization will require against the provision of high efficiency and sustainability practice. Limited amount of memory allocated to the machine with standard space as well as demand of detector images sensitivity, the parallel variant highlights of detection algoritms for changes, scalability and rotation.Therefore artificial neural networks (ANN) has been selected on the basis of networks for research

III. THEORY

In comparison neural networks and typical algorithms, the advantage of neural networks is their learning opportunity. Considering the normal exact reflection of each cardiocycle in ECG (small fluctuations at 0.02 second limits), for enforcing of electrocardiocomplex segmentation according to time, R-tooth with high amplitude is chosen from all other support time points as sychronize points (R, Q, S, T-teeth).

According to the operation effectiveness of neural network systems entry characteristics of the object depend on choosing the correct area, the quality and completeness of databasa. That's why creating the experimental database of ECS(electrocardiosignal) and learning selected ANN, forming entry parameters for testing, as well as choosing estimation criterion of activity effectiveness of ANNand researching secret layer neurones according to their number are considered direction for the next research

IV. OPERATION PRINCIPLE

For the creating the database of the ECG which is important ANN learning and standard testing of algorithms, Physical-Techical Association ECG's archives printed by Germany's National Metrology Institute in www.PhysioNet.org is used 549 notes taken from 290 persons at the age of 17-87 (notes from 1 to 5 at patient) are included its content. In ECG 12 standard seperation and 1000

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Hs with sampling for Frank is registered in 3 seperation synchronously.

Description of the ECG signal is shown in the Fig1 [4]. One of thetypical signal fragments is R-tooth which appears during weak shrinking of auricles. QRS-it has 80 ms length because of shrinking of heart ventricles and segment according to weakness phase of ventricles.

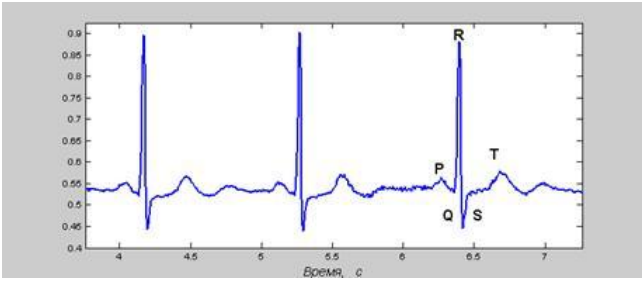

Fig 1. ECG's Normal Signal

ECG's normal amplitude is about 1mB, ECG's clinical frequency stripe is equal 0.05-100 Hs. Processing level of ECG signal is shown in the Fig2.

Neural networks (NN-Neural Networks) are using to solve different problems [6]. The developing sections of NN are these: the processing of analog and digital signals, the synthesize of systems and electron chains and identifying of these. The application of the theory and the basis of technology was described at MATLAB 6.0 packet, and NN-NNTool had been shown for GUI (Graphical User Interface). (Graphic interface of the user had been shown here firstly).

According to the application of neural networks we can shown these for signals digital processing: the filtering of parameters, assessment, adapting of systems, knowing of the images, reconstruction of signals, analysis rows of time and pressing. Kinds of this processing are about different kind of signals: voice, video, speech, image, passing of the information, geophysical, local, medical measures (cardiogram, ensefalogram, pulse) and others.

In this article had been given application technique of neural network technology.

As a rule, impuls and multilevel perseptrons and radial base networks according to parameters are applying specifying for description objects form. Radial basis neural networks had been organized direct passing of signals learning anti-spreading method error and more neurons, but less time is required for their creation. These networks are effectives for gaining training vectors [7].

As a rule radial functions has the following pattern: $f(\|x-c\|)$, in here c-is a centre vector.

A typical example of such a function for the argument of a scalar have the following analytical representation and it is a Gaussian function:

$$f(x) = \exp\left(-\frac{(x-c)^2}{\sigma}\right)f$$

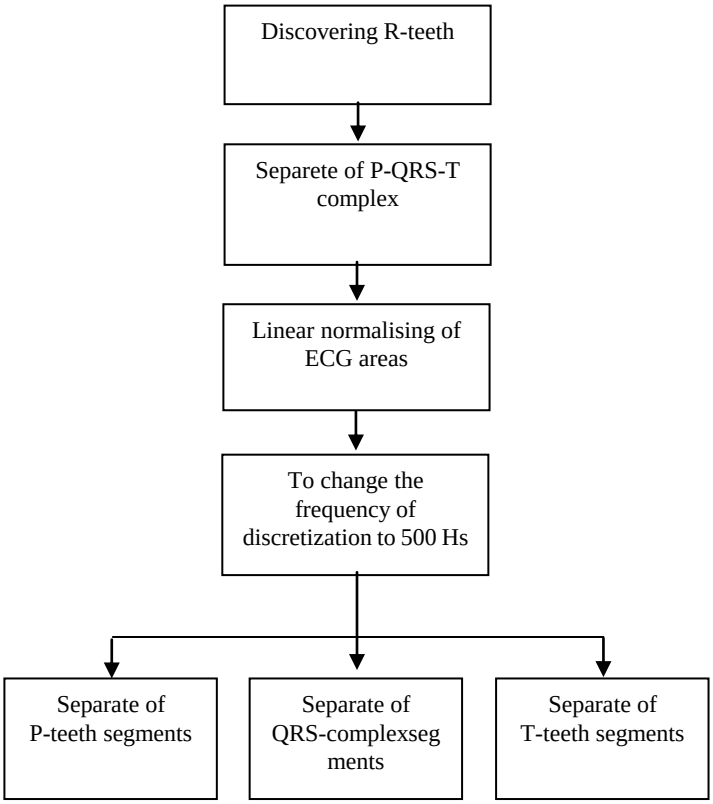

Fig 2. EKG Signal Processing Level

Radial method consist of distribution of vectors in space with the help of hypersphere's around a central point. And it is allows you to use as a local approximator from a radial neural network.

Standard radial neural network consist of 3 layers: input layer which transmitted input signals, a hidden layer which consisting of neuronal radial type and output layer performs a weighted summation result the operation of the hidden layer.

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$$w^T\varphi(x) > 0\ x\epsilon\ X^+$$

$$w^T\varphi(x) < 0\ x\ \epsilon X^-\text{as}$$

İf the weight vectors are existed for

$$\varphi(x) = (\varphi_1(x), \varphi_2(x), \ldots \varphi_M(x))$$

function of w vectors which are given N-measured to the space, this space is considered X+and X-is divided nonlinear φ two class of the area.

So can be determine limit between these classes by solving the following equation:

$$w^T\varphi(x) = 0$$

İt was also confirmed that if M size of the φ (x) vectors is greather than or equal to dividing the number of vectors, and any excess of vectors are considered φ divisible. İn accordance with the neural networks it shows that if the number of hidden layer neurons is greather than the size of the input vector, while the output signal consist of weight ratios of fulfillment neurons with w weighted only one of neurons and any classification of characters multimensional issue is resolved with radial neural networks.

Therefore used to architecture of the radial basis network for cardioanalysis. PNN network architecture is based on the architecture of the radial basis network but as an entry vector of the second layer or the other takes account of the possibility of class and the class is comparable to a high probability of belonging to the vector. Network structure PNN is shown in the Fig3.

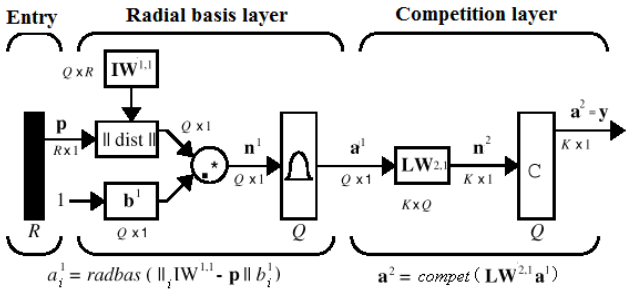

Fig3.The structure of the PNN network

V.ALGORITHM

For the stimulation of the neural network, its study and testing Neural Network Toolbox applied packet program was used among MATLAB [8] programming. The creation of Neural Network is required for the defining of three signal types: ECS-norm, ECS-pathology (bradycardia, tachycardia) (Fig4, 5). Each of the signals is shown in the shape of 1000x1 measured template. Projected neural network must define ideal entry vectors correctly and must produce maximal accurate noisy vectors again. It is supposed that noise is random quantity 0 mid-value and equal low or 0,2standard going out.

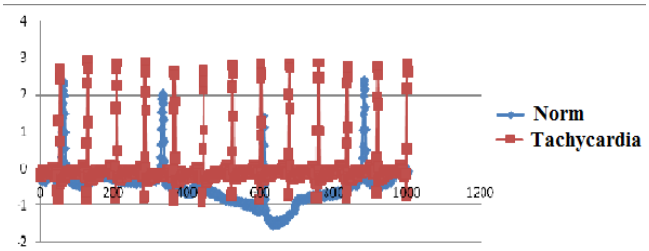

Fig4. Comparison Of Norm And Tachycardia Cardiosignals

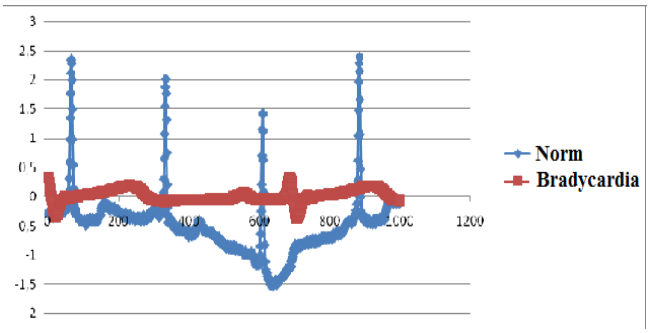

Figure5. Comparision Of Cardiosignals. Norm And Bradycardia

To create operational algorithm:

1. EksİnputsandEksTargesneed to include a description which is encoder (eneryption) to database.
2. Image has been included to database and after the following operator must perform for work with its:

loadEks_dataset

3. We enter the following command to crate a network (Fig6.)

net=newpnn (EksİnputsEksTargets, 20)

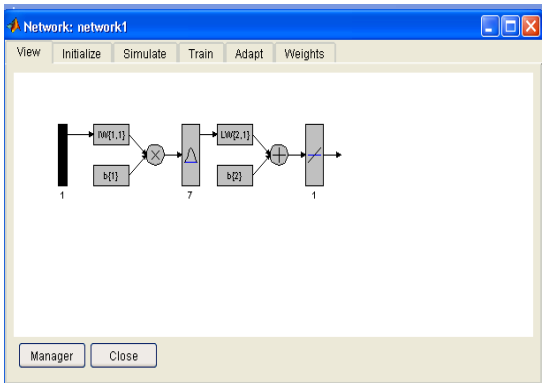

Fig 6: PNN network

4. Learning network. Additions divided input and target vectors into 3 parts:

60%-for study;

20%-for control testing;

20%- is used for testing.

For the studying of the network we enter the following order:

net=train (net, EksİnputsEksTargets)

5. The result of the program is shown in the 3 divisions in the Fig 7.

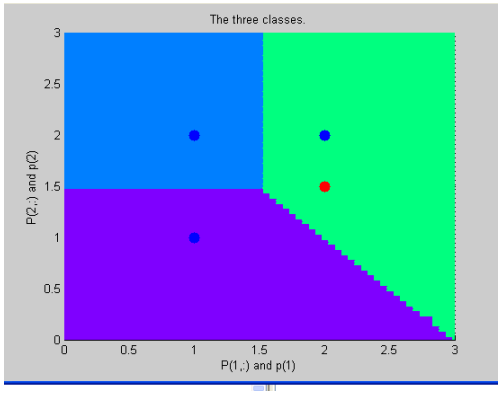

Fig 7. The Division Area Of Three Vector Types Of The ECG Signals: Norm, Bradycardia, Tachycardia

VI. CONCLUSION

For the analysis of the cardiosignals in the current operation the application possibilities of the radial base neural network architecture were analyzed. As a rule, multi-layer perceptrons are used in the defining of description objects according to shape and radial base network is used in the defining of description objects according to parameters. These networks, especially differ with high teaching frequency, this, give opportunity to use them in the identification of the time sequence in the real time routine and even differ with the opportunity of getting useful results incorrect existence of the data in the small selection of teaching. For this reason, radial base network was used for the analysis of cardiosignals. Defining of algorithm according to three groups of cardiosignalswere offered: norm signals, bradycardia and tachycardia.This algorithm also may be used in the classification of other biosignals.

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