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METHOD OF INDICATORS FORECASTING OF BIOMEDICAL IMAGES USING A PARALLEL-HIERARCHICAL NETWORK

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Анотація

Медицина має поглиблене вивчення розвитку патологічних змін в людському тілі в наших часах, тому, є великий виклик, щоб створити сучасні інформаційні пристрої і методи для обробки біомедичної інформації. Вона - добре відомий факт, що впродовж діагнозу, що встановлює і проводить докторів лікування все більше і більше, покладаються на біомедичні зображення отримав користування різним технічним забезпеченням і системами програмного забезпечення. Це стосується автоматичної обробки зображень томографій і термографічних для сегментації зображень і завдань класифікації.

Ключові слова: ієрархічна мережа, біомедична інформація, біомедичні зображення, термографічні зображення, патологічні процеси.

Abstract

Medicine has in-depth study of the development of pathological changes in the human body in our times, therefore, there is a big challenge to create modern information devices and methods for processing biomedical information. It is well known fact that during the diagnosis establishing and conducting treatment doctors increasingly rely on biomedical images obtained using various hardware and software systems. This concerns the automatic processing of tomographic and thermographic images for segmentation of images and classification tasks.

Keywords: hierarchical network, biomedical information, biomedical images, thermographic images, pathological processes.

Introduction

Medicine has in-depth study of the development of pathological changes in the human body in our times, therefore, there is a big challenge to create modern information devices and methods for processing biomedical information. It is well known fact that during the diagnosis establishing and conducting treatment doctors increasingly rely on biomedical images obtained using various hardware and software systems. In particular, this concerns the automatic processing of tomographic and thermographic images for segmentation of images and classification tasks [1,2,3].

It is good to take into account that ophthalmology tasks include optical coherence tomography tasks, Heartland retinal tomography tasks, polarimetry of lasers tasks, scanning retinal thickness analyzer tasks, and others. The most common of them are one-dimensional, two-dimensional, and three-dimensional images of the eye, including the bottom part of the eye, so the interpretation of which requires doctors a lot of effort and time. There is a big need for biomedical imaging and processing algorithms to help doctors handle a large amount of data, providing them with reliable support for diagnosis and treatment [4,5,6].

During last 10 years prospects for research in this area were identified, especially the development of models for the analyzing, comparison and processing of biomedical images. On the one hand, a large number of works subject points to the practical necessity of such methods, and on the other hand, the lack of sufficiently general and universal methods of processing large bulk of biomedical images at present (R. N. Weinreb, S. A. Alpatov, L. Glass, N. N. Bojkova, A. S. Liebman, L. Timchenko, S. V. Pavlov, K. V. Sudakov, A. P. Rothstein, V. P. Kozhemyako, E. N. Zakhrabov, R. Gonzalez and others). Using such optoelectronic expert systems, it is possible to identify pathological processes that are necessary for the analysis of the pathogenesis of many diseases and their complications. Therefore, to help doctors to do their work it

is necessary to create a biomedical system for the analysis of structural changes in the diagnosis of eye abnormalities, in particular, the discoloration of the macula. This will increase the accuracy and speed of processing complex biomedical images of the eye based on special automated procedures for segmentation and recognition of detected pathologies and will enable to determine the stage of progression of the existing pathology [7,8,9].

The results of research

The application for assessing the dynamics of changes in biomedical parameters obtained from a biomedical image is used in the study, conducting discriminant or correlation processing of image data to calculate the results of the diagnosis. The structure of such a system is shown in Figure 1. Thus, the system provides an opportunity for conducting the survey using a discriminant and correlation analysis to form the average sample result among other characteristics or attributes to compile a more optimal sample of more informational features and a more effective learning sample of features based on steps pathologies or pathologies [10,11,12].

The algorithm provides the user with the opportunity to manage the process of conducting research. The user interacts with the program through system interface, which allows you to save and download samples, display 2D images, set parameters for system operation.

The proposed system for predicting eye diseases can detect problems, pathologies and other diseases in the early stages and predict the possible progression of diseases. This method is completely based on the theory of parallel-hierarchical network, which, with the appropriate modifications, allows user to obtain the most accurate result of forecasting. The forecasting process is based on key stages such as image analysis, segmentation and optimization (reducing noise in the image, selecting the contours of the main elements of a biomedical image). To ensure the work of the neural network, a base of images with known eye diseases has been selected, which gave rise to the study. From the results of experimental studies, it was found that the average error of prediction using different types of neural networks is practically the same (about 1.62%). And the maximum value of forecasting error using different types of known neural networks varies within 4.74-5.81%. In addition, the development of an eye recognition and prediction system based on the phase correlation of images will continue to be developed, which will allow more accurately and efficiently to recognize and process the parameters of a biomedical image. Experimental investigations of the location of the pathology area and the calculation of its area are carried out. Among the examined pathologies of the eye, experimental studies of the congenital hamartoma of the retinal pigment epithelium, characterized by black or pink color, clearly distinguished from the general color scheme of the biomedical image, were performed. With a total area of the fundus that varies from 5000 mm2 to 6000 mm2, the pathology of an average area of 600 mm2 is considered, and a predicted increase in the pathology ranging from 13.88% -24.52% is obtained. The relevant prediction data will help the ophthalmologist decide on the prevention or treatment of the disease [18,19].

Conclusion

A brief analysis of modern approaches, ideas, methods for the evaluation of biomedical images of the fundus is carried out. The functional scheme of the system for the estimation of biomedical images is proposed and the system for determining dynamic changes in the fundus images is developed on its basis. The approach to prediction of indicators of biomedical images is described. A brief overview of the structure of the system for solving the question of processing the parameters of biomedical images. The possibility of constructing such a system using a parallel-hierarchical network is described.

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