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INFORMATION TECHNOLOGIES FOR THE ANALYSIS OF THE STRUCTURAL CHANGES IN THE PROCESS OF IDIOPATHIC MACULAR RUPTURE DIAGNOSTICS

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Анотація

В даний час відбувається розширення знань щодо розвитку патологічних змін в організмі людини, тому виникає необхідність створення сучасних інформаційних пристроїв та методів переробки біомедичної інформації, зокрема, зображень.

Ключові слова: макулярна діагностика, топографічне зображення, технічні дані, біомедичні образи.

Abstract

Nowadays the enlargement of knowledge concerning the development of the pathologic changes in human organism occurs, that is why, there appears the necessity to create modern information devices and methods of the processing of biomedical information, in particular, images.

Keywords: macular diagnostics, topographic image, technical data, biomedical images.

Introduction

It is known that while making a diagnosis and carrying out treatment doctors often use biomedical images, obtained by means of various hardware – software complexes. In the field of the ophthalmology these complexes include optic coherent tomography, Heidelberg Retinal Tomography, Laser-based Retinal Polarimetry, Rectal Thickness Scanner analyzer, etc.

Methods of the Fundus of the eye visualization and processing of results obtainer

The authors made the assessment of the characteristics of various types of the equipment, in particular, their technical data, characteristic features, advantages and disadvantages. Such diagnostic devices were considered:

1. HPT – Heidelberg Retina Tomography, Heidelberg Engineering, Heidelberg, Germany;
2. GDx x VCC – Glaucoma Diagnostics Variable Cornea Compensation, till 2004 it was manufactured by the company Laser Diagnostics Technologies, San Diego, USA, after 2004 by the company Carl Zeiss Meditec, Dublin, USA;
3. OCT – Optical Coherence Tomograph, Carl Zeiss Meditec, Dublin, USA;
4. RTA – Retinal Thickness Analyzer, Talia Technology, Neve – Ilan, Israel.

Image obtaining is performed applying non-invasive method, quickly, at a low level of lighting that enables to use the technology in every-day clinical practice. The accuracy of CSLO is based on the optic law of the confocality, when the beam, reflected from the preset plane, by-passes the diaphragm, located in front of the detector and is taken into account by the device and the beam, reflected from the plane, located outside the investigated zone – is absorbed by the diaphragm.

For obtaining the images of HRT the diode laser is used (wave length – 670 nm). In HPT the system of automatic control of measurements quality is built-in, the system reveals and reshapes the scanned images of a poor quality, which are connected with possible winking or the change of gaze fixation of the patient. This enables to obtain for the analysis three series of scans. In order to create the necessary topographic image the program automatically centers and averages the scanned images for each series of the scanning.

Unlike the smoothing filters and filters that increase the contrast rate, which do not change average intensity of the image, as a results of using difference operators the images with the average value of the pixel close to zero are obtained. Pixels with large by modulus values on the finite image correspond to the vertical boundaries of the output image.

That is why difference filters are also called filters that find the boundaries. As it is seen from fig. 5,a Sobel filter allocated the contours, we invert the colors for obtaining distinct lines (fig. 5,b) that can be plotted as a mask on the initial biomedical image.

Conclusions

The given research further develops the mathematical models for the analysis of the biomedical images of the macular area of the retina using the methods of fuzzy sets on the base of the experimental knowledge bases that allowed to carry out complex qualitative diagnostics and improve its reliability by 22 % as well as the developed method of processing the fundus of eye, which, unlike the existing one, has the possibility to create the sliceable mask, that enables to determine more exactly the contours of the macular region of the eye retina.

The expediency of application the methods of image brightness correction, in case of its general blurring and the technique of the sliceable masking for the improvement of the image definition was proved practically. Better quality of the periodic noise elimination by the median filtration as compared with adaptive Wiener filtering is established. Minor advantage in speed of realization the adaptive Wiener filtering over the median filtration in MATLAB package is practically determined, that is why the given peculiarity must be taken into account when creating new methods of the space processing of the images, which will use the above mentioned filters.

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