MORPHOLOGIC ANALYSIS OF THE ENDOTHELUM CORNEAL TISSUE USING MATHEMATICAL MORPHOLOGY

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Summary: An effective method for the analysis of donated corneas consists in the evaluation of the indexes of cellular density, pleomorphism and polimegatism. We have developed a system attached to the Slit Lamp and dedicated software for image treating and analysis of the referred indexes using the Mathematical Morphology procedure. The results of automatic determination of the cellular density has a correlation coefficient of 0.95798 compared to measurements done by the interactive counting method and for the polimegatism and pleomorphism indexes the preliminary visual results are in good agreement with the presented processed image.

1-Introducion

In this work it is presented an automatic computational method to analyze the patterns of the endothelium cells from donated cornea to supply important information for a report of the cornea for transplant. The evaluation of corneal endothelium estimates the density, the size and the shape of the cells. The minimum density of cells required for a cornea indicated for transplant is 2000cels/mm², the normal size is around 20µm and the shape should be a regular hexagon. Variations in size and shape is denominated polimegatism and pleomorphism, respectively. An optical system for observing the endothelium has been developed at the Laboratório de Física Oftálmica [1]. A CCD detector attached to a slit lamp obtains the image and presents it in a PC screen by a video capture board. The captured image is stored in the hard disk for later processing using 256 gray tones.

2-Applying morphology

We have used the binary image of the area corresponding to each cell of the image, identified by the watershed[1] technique. The polimegatism index has been obtained as follows: initially it is obtained the value of all the cellular areas on the image. Then, the identified areas are organized in groups according to a variation criterion and each group is labeled. In order to obtain the pleomorphism index, it has been necessary to calculate the rate between the maximum internal circle and minimum external circle to each cellular area. The internal circle radius is obtained using the distance transforming technique and the external circle radius is estimated by calculating the value of one half of the largest side of the smallest rectangle that contains the cellular area. Figure 1a presents the similar sizes cells organized in groups, using different colors and figure 1b presents the cells’ image with the respective internal and external circles.

Figure 1: (a) Polimegatism groups, (b) Pleomorphism

3-Results

The results of automatic determination of the cellular density are in good agreement with measurements done by the manual counting method (correlation coefficient is 0,95798) and for the polimegatism and pleomorphism indexes the preliminary visual results are in good agreement with the presented processed image. The system is being used in a public eye bank in Brasil.

4-References: