LOCALIZATION OF EYE AND CORNEA ON IR THERMOGRAM USING GENETIC SNAKE FOR EARLY DETECTION OF EYE DISEASE

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Abstract:

Temperature has been used to diagnose human's health since 400 B.C. where Hippocrates reported disease is to be found whichever part of human body is in excess heat or cold. This idea is still widely applied nowadays and the advance in infrared thermography technology is furthering the idea into more sophisticated diagnosis techniques, such as detection of breast cancer. Detection of ocular disease may be another field where IR thermography can play an important role in, however, such approach is yet to be established and several issues in the approach are yet to be solved.

First among the all is localization of eye and more importantly, cornea, since temperature and its variation across cornea are the keys in identification of ocular health status. Until recently, localizing of cornea on studies of eye thermogram is still achieved through manual effort. Unlike optical image, eyes in infrared thermogram does not possess clear boundary in between iris and sclera (usually it is assumed the cornea sits perfectly just on top of iris), and this has brought difficulties in corneal segmentation from the rest of image. In most cases, researches approach to this problem is by estimating the centre of cornea and setup either a shape (a square, a circle, and etc) or a series of points based on the estimated centre to acquire thermal values of interest. The ways to obtain corneal temperature on an infrared thermogram are vaguely defined and vary among different literature.

In this study, an algorithm is developed in attempt to correctly locate cornea on an infrared thermogram through a standardized method. Under this algorithm, the corneal area and its corresponding temperature are better defined compared to approaches utilized in past by most of the researchers. Gradient Vector Flow SNAKE and genetic algorithm are the two main ideas behind in achieving such task.

The eye position is roughly estimated and a smaller image is generated having only the eye of interest in later processing (Fig. 1). Such estimation is achieved with the use of this property: the medial canthus has the highest temperature over the rest of image. Then Gaussian blur is applied and gradient vector flow on blurred image is calculated. SNAKE is used to localize an eye by deforming itself in conformity with the shape of eye, but only if parameters of initial SNAKE are of right appropriate values. The search of these values forms an optimization problem, which in this case is solved by genetic algorithm. As those values found through genetic algorithm, SNAKE deforms itself in conformity with the shape of eye, resulting the actual localizing of eye. Center of cornea is derived from the resulting SNAKE points and also the size of corneal diameter. Thus, localization of cornea completes.

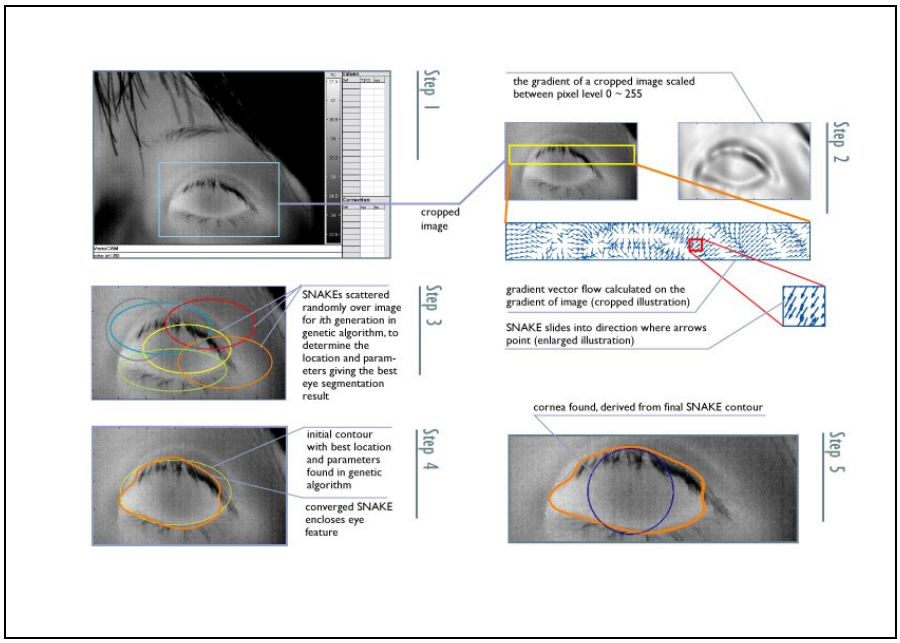

***Fig.1**, general flow for localization of eye and cornea on IR thermogram.*

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