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Detecting the Excessive Activation of the Ciliaris Muscle on Thermal Images*

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Abstract

Sight problems occur in very wide range of the human population. The traditional treatment of the problem is to perform refractometric analyses to adjust the bend (dioptre) needs of an affected patient. However, this investigation is not able to detect other side-effect that influences the accuracy of this adjustment. Such an effect is the excessive activation of eye muscles that try to correct the inappropriate bending of the eye lens. Improper dioptre adjustment may keep these muscles under activation, whose persistent cramp status may lead e.g. to regular head-ache.

In this paper, we present some results regarding a clinical observation that can be derived using the thermal description of the eye. Our aim is to detect the malfunction of the ciliaris muscle influencing the bend of the eye lens which makes traditional dioptre measurement inaccurate. This malfunction is caused by the excessive activation of the muscle which can be tracked down by checking the temperature of the eye surface.

Our primary aim in this field is to set up a system which is able to alert, if the activity of the ciliaris muscle is suspected to be excessive. The larger activity of the muscle is proportional to the higher temperature observed in these regions of the eye. Thus, we consider high quality thermal images for detection with specializing machine learning approaches to this novel problem. For this classification we follow the general recommendations [1, 2] in the field of thermal imaging.

Since thermal images are rather patch-like and the border of the investigated areas are blurred, global directives [1] suggest extracting descriptive features based on statistical approaches. Thus, to create feature vectors for the classification algorithms, we considered the first-order statistical descriptors as features derived from the intensity histogram.

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For classification, a training and test database was created. From the whole database of 40 images 10 healthy and 10 diseased images were manually labeled by a clinical expert for training. The remaining 10 healthy and 10 diseased images were used for testing, and cross-validation was considered.

We present a machine learning approach to identify the excessive activity of an eye muscle. Our motivation is to validate and exploit a novel clinical tool based on thermal image analysis. We found that general guidelines of thermal image analysis can be applied after some specialization to our case, as well.

Keywords: Biomedical infrared imaging, Visual system, Infrared image sensors, Thermal variables measurement

References

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