

Iris Region and Bayes Classifier for Robust Open or Closed Eye Detection

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Abstract

This paper presents a robust method to detect sequence of state open or closed of eye in low-resolution image which can finally lead to efficient eye blink detection for practical use. Eye states and eye blink detection play an important role in human-computer interaction (HCI) systems. Eye blinks can be used as communication method for people with severe disability providing an alternate input modality to control a computer or as detection method for a driver's drowsiness. The proposed approach is based on an analysis of eye and skin in eye region image. Evidently, the iris and sclera regions increase as a person opens an eye and decrease while an eye is closing. In particular, the distributions of these eye components, during each eye state, form a bell-like shape. By using color tone differences, the iris and sclera regions can be extracted from the skin. Next, a naive Bayes classifier effectively classifies the eye states. Further, a study also shows that iris region as a feature gives better detection rate over sclera region as a feature. The approach works online with low-resolution image and in typical lighting conditions. It was successfully tested in 9 image sequences (2,210 frames) and achieved high accuracy of over 92% for open eye and over 86% for closed eye compared to the ground truth. In particular, it improves almost 15% in terms of open eye state detection compared to a recent commonly used approach, template matching algorithm.

Keywords : human-computer interaction, open or closed eye detection, eye blink detection, iris region, naive Bayes classifier

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