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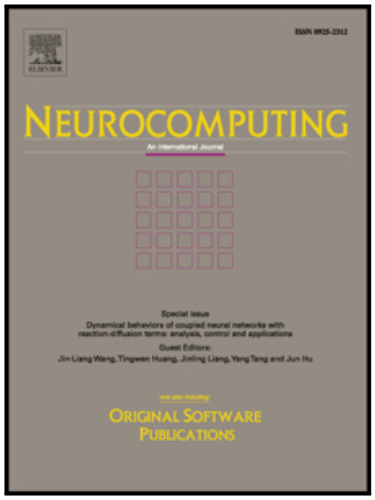

Face Recognition under Varying Illuminations with Multi-scale Gradient Maximum Response

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Face Recognition under Varying Illuminations with Multi-scale Gradient Maximum Response

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Abstract

Illumination variations significantly affect the performance of face recognition systems. This paper presents a multi-scale method based on the maximum response (MR) filter bank and the gradient of faces. The proposed method first scales the face image using a simple log function to expand darker pixels and compress brighter pixels. It then effectively employs a subset of the MR filter bank to enhance edges and partially reduce illumination. Finally, it applies an enhanced multi-scale Gradientface method, which increases discriminating abilities and captures different characteristics of the face image to produce illumination invariant feature representation. Our extensive experiments on four closed-universe face databases and one open-universe database show the proposed method achieves the best recognition accuracy when comparing with 14 recently proposed state-of-the-art methods and its four variant methods. Our evaluations using receiver operating characteristic (ROC) curves on the four closed-universe face databases and precision and recall (PR) curves on the open-universe face database also verify the proposed method has the best verification and discrimination ability compared with other peer methods.

Keywords: Face Recognition, Multi-scale Gradientface, Maximum Response Filter Bank, Multi-Scale Gradient Maximum Response

1. Introduction

It is easier to remember people by their facial components such as nose, eyes, eyebrows, lips, and ears than by their names or identification IDs. However, changes in pose and illumination can significantly alter the appearance