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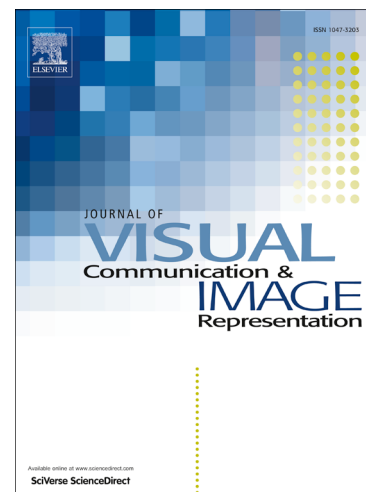
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Face spoofing detection based on color texture Markov feature and support vector machine recursive feature elimination

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Abstract

Aiming to counterstrike face spoofing attacks such as photo attacks and video attacks, a face spoofing detection scheme based on color texture Markov feature (CTMF) and support vector machine recursive feature elimination (SVM-RFE) is proposed. In this paper, the adjacent facial pixels discrepancy between the real and the fake face is analyzed, and texture information between the color channels is fully considered. Firstly, the directional difference filter is used to capture the facial texture difference between the real and the fake face, which can be regarded as low-level features of CTMF. Then, the facial texture difference is modeled by the Markov process to form a high-level representation of the low-level features. Meanwhile, the mutual information of facial texture between the color channels, which is ignored in the previous literature, is investigated. In addition, SVM-RFE is utilized to reduce the feature dimension and makes it suitable for real-time detection. Experiments on four public benchmark databases indicate that the proposed scheme can effectively resist photo and video spoofing attacks in face recognition.

Keywords: Face anti-spoofing, color texture Markov feature, adjacent facial pixels discrepancy, SVM-RFE

1. Introduction

With the development of biometrics, biometric information authentication has become popular. It has been extensively used in access control system, crime investigation and financial security protection. Among them, face recognition has received extensive attention because of its natural and intuitive recognition effect (in line with human visual effects), non-contact and easy to access. However, many studies have shown that the existing face recognition systems are vulnerable to spoofing attacks. For example, the use of photos or videos of legitimate users can easily fool the face recognition systems. Therefore, the study of face spoofing detection technology has become a research hotspot in recent years [1, 2].

Currently, there are three kinds of spoofing attacks: photo attacks [3], video attacks [4] and mask attacks [5]. According to whether extra equipment is used for face spoofing detection or not, the existing methods can be classified into two categories. The first category is the method based on sensors [6, 7] or multi-biometric fusion [8–10]. Generally, they require additional equipment, which increases the cost. The second category is called as feature-based method. It analyzes the difference between the real face and the fake face without extra equipment [11–35]. In most of the feature-based methods, local binary pattern (LBP) and its variants are widely implemented to describe the facial information. LBP is a simple and powerful representation of texture features, and has achieved fairly good results in face spoofing detection. Recently, facial feature information in color space represented by LBP variants and other texture descriptors have been used to characterize facial features and achieved good results [20, 21]. Nevertheless, these methods only took into account the facial information of each single channel of the color spaces, but ignored mutual information of facial texture between the color channels.

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