Facial Expression Recognition using Improved Adaptive Local Ternary Pattern

Sumeet Saurav[1, 2], Sanjay Singh[1, 2], Ravi Saini[1, 2] and Madhulika Yadav[3]

[1] Academy of Scientific & Innovative Research (AcSIR), Chennai, India
[2] CSIR-Central Electronics Engineering Research Institute, Pilani, India
[3] Department of Electronics, Banasthali Vidyapith, Rajasthan, India
sumeetssaurav@gmail.com

Abstract. Recently, there has been a huge demand for assistive technology for industrial, commercial, automobile and societal applications. In such applications, there is a huge requirement of an efficient and accurate system for automatic facial expression recognition (FER). Therefore, FER has gained enormous interest among the computer vision researchers. Although there has been a plethora of work available in the literature, automatic FER system has not yet reached the desired level of robustness and performance. In most of these works, there has been the dominance of appearance-based methods such as local binary pattern (LBP), local directional pattern (LDP), local ternary pattern (LTP), gradient local ternary pattern (GLTP) and improved local ternary pattern (IGLTP) have been shown to be very efficient and accurate. In this paper, we have proposed a new descriptor called Improved Adaptive Local Ternary Pattern (IALTP) for automatic FER. This new descriptor is an improved version of ALTP which have been proved to be effective in face recognition. We have investigated ALTP in more details and have proposed some improvements like the use of uniform patterns and dimensionality reduction via principal component analysis (PCA) are proposed. The reduced features are then classified using kernel extreme learning machine (K-ELM) classifier. In order to validate the performance of the proposed method, experiments have been conducted on three different FER datasets. The performance has been observed using well-known evaluation measures such as accuracy, precision, recall, and F1-Score. We have compared our proposed approach with some of the state-of-the-art works in literature and found it to be more accurate and efficient.

Keywords: Facial Expression Recognition (FER), Adaptive Local Ternary Pattern (ALTP), Improved Adaptive Local Ternary Pattern (IALTP), Principal Component Analysis (PCA), and Kernel Extreme Learning Machine (K-ELM).

1 Introduction

Recently, there has been a huge demand for assistive technology for industrial, commercial, automobile and societal applications. An efficient and accurate automatic facial expression recognition (FER) system is often desired in bringing up such a system to reality. This is because facial expression provides an important cue which reveals the actual intention and state of mind of a person.

The techniques available in the literature for automatic FER can be broadly classified into two main categories: geometric-based methods and appearance-based meth-