A Survey on Local Textural Patterns for Facial Feature Extraction

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ABSTRACT

Over the last two decades retrieving an accurate image has become a challenging task. Regardless, texture patterns address this problem by decreasing the significant gap between the actual image over the user expectation rather than other low-level features. This article represents the comprehensive survey of the recent achievements and relevant publications investigated in different directions of the textural areas in CBIR. These consist of triggered methods for image local texture feature extraction, numerical illustration and similarity measurement. In addition, challenges are discussed in comparisons of textural patterns. Retrospectively, concluded with a few recommendations based on generic survey and demand from the

KEYWORDS

CLBP, Content-Based Image Retrieval (CBIR), DBC, Face Recognition, Facial Expression Analysis. LBP, Local Patterns, LTP, LTrP, Texture

1. INTRODUCTION

The-state-of-art escalation in the digital data production steadily due to the dominant use of internet and digital equipment in various fields such as medical (Mitra, Murthy, & Pal, 2004; Zhang, Brady, & Smith, 2001), entertainment, education, media, online business etc. becoming by keywords. This makes the system cumbersome to manage the abundant data is and human annotations as if in text-based systems. Therefore, here is a tremendous call for an efficient system to retrieve the precise images from the massive database rather than labels. Today Content based image retrieval (CBIR) system is the most well-known system for some applications, CBIR consists the important and essential steps such as feature extraction, relevance feedback, similarity measurements etc., and here feature extraction is the most prominent step in preprocessing that depends on the technique make use of extract the features from the only image like local data as color, texture, shape, human faces etc., further features are categorized into local features such as color features, layout, shape features and texture (Deng, Manjunath, Kenney, Moore, & Shin, 2001; Manjunath, Ohm, Vasudevan, & Yamada, 2001) and high-level features such as faces, biometric, neural networks etc. To retrieve an accurate image with the help of one and only feature is arduous due to the probability of user taking photographs in any direction like several regions which include random direction of capturing of image, optical device, uneven illumination and that of posing expressions, relevance feedback etc. (Jing, Li, Zhang, & Zhang, 2004; Su, Zhang, Li & Ma, 2003) so the system demands the combination of two or multiple features and filtering process. A general and upgraded survey is typified in the further sections.

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2. RELATED WORK

The paper presents the comprehensive survey on the texture-based image retrieval techniques, local patterns such as LBP, LTP, LTRP etc. texture analysis and retrieval are important and to be in a tight corner in the field of CBIR (Kokare, Chatterji, & Biswas, 2007). Textures are most useful in retrieving of tiles, facial expressions, fabric, clouds, animal skin etc. Yong Rui reviewed the image retrieval directions extensively with color, texture, layout, segmentation etc. (Rui & Huang, 1999). Moghaddam have proposed the Gabor wavelet correlogram (GWC) to overcome the rotational variance in horizontal and vertical directions (Tarzjan, & Moghaddam, 2007) and further improved results by optimizing the weights (Moghaddam & Tarzjan, 2006). Pietikainen and Ojala introduce the concept of feature distribution, in this every sample image is scan for texture using local texture operator (2000). Ying Liu presents and analyzes high level features for CBIR such as machine learning tools, object ontology, semantic template, and neural networks to reduce the semantic gap (n.d.). Dynamic texture is used for face recognition with facial expressions using the volume local binary patterns (vlbps) (Zhao & Pietikainen, 2007). Face representation and recognition used in multiscale and multi-orientation gabor responses and then evaluated relationship between neighbor pixels using lbp (Lei, Liao, Pietikäinen & Li, 2011). Cluster based retrieval done by unsupervised learning (Chen & Wang, 2002), color representation based on clustering in a given region (Chen, Wang, & Krovetz, 2005), feature sets are proposed based on local texture for face recognition in different illuminations (Murula, Maheshwari & Balasubramanian, 2012). Ojala had introduced a novel method i.e., local binary patterns(lbps) for texture retrieval (Ojala, Pietikainen, & Harwood, 1996), B. Zhang, Y. Gao proposed nth order local derivative patterns to retrieve the more required information than LBP (n.d.). Subrahmaniyam Murala describes local tera patterns and local extrema patterns (2012). detection of potholes for independent vehicle in an unstructured environment based on road images taken from sensors was published in IET (institute of engineering and technology) intelligent transport systems (Varaprasad & Murthy, 2013). amalgamation of color and texture features used for feature extraction from an image in content-based image retrieval (CBIR) system that extended to retrieve sub images (Varaprasad et al., 2013). Majumder Majumder et al. (2018) presented a new automatic facial expression recognition system is the combination of geometric feature extraction, regional LBP extraction, fusion of both features and classified using som classifier.

3. LOCAL PATTERNS

3.1. Local Binary Patterns(LBPs)

Ojala T et al. (2002) has introduced Local Binary Pattern operator (LBPs) and used for classification and retrieval and it has been a break in the clouds in 2D texture field based CBIR. Local Binary Patterns are the simple and efficient technique to describe the local feature from an image by comparing each pixel gray value with neighboring pixels gray values. As shown in Figure 1 the given center pixel and calculates the difference between the surrounding neighbor pixels and threshold the value encodes ‘1’ for positive (> 0) difference and ‘0’ for zero or negative (≤ 0) difference. For example in Figure 1(a) assume ‘5’ as center pixel and remaining ‘9’, ‘7’, ‘4’, ‘6’, ‘2’, ‘1’, ‘5’, ‘3’ as the neighboring pixels, Figure 1(b) and Equation (1) describes the differences between the neighboring pixels, Figure 1(c) and Equation (2) shows the threshold binary values. So we evaluated the local binary pattern as ‘11010010’.

Using Equation (2) substitution the calculated LBP value from binary 
\( 1 \times 2^7 + 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \) to decimal is ‘210’.

\[
LBP_{p, R} = \sum_{n=0}^{P-1} 2^n \times h_i(g_n - g_{center})
\]  

(1)
Introduction to Speech Recognition
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