

Object Recognition using Linear Binary Pattern

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Abstract: Object Recognition is widely used in nowadays. The Local binary Pattern (LBP) is the techniques to analysis the shape, size and colour of Object. LBP uses the Edge Detection Techniques. This Paper presents a little survey on recent used LBP types and techniques along with the edge detection techniques. The transformation of image into grayscale image, then divided image into little blocks are the part of LBP. Nowadays LBP is becoming a popular technique for image representation.

Keywords- Local binary patterns, Texture analysis, Object Recognition, Colour Recognition.

I. INTRODUCTION

a) Object Recognition

Object recognition is the method to finding the real world objects like car, human, facial expressions, animals, motor bikes etc. Basic applications of object detection are industrial automation, digital cameras, robotics, security and video surveillance etc.

b) LBP

LBP is used for the texture classifications of various objects. It designs different decimal codes for different features. The illumination variation does not effects on the LBP operation.

Nowadays the LBP become one of the most useful technique for image analysis. In LBP intensity of neighbouring pixels is compared with centre pixel and it gives the pattern of 8 bit binary code. Uniform pattern LBP is popular version of LBPs [1]. Verification and identification are 2 modes by which an image can be analysis. Determining the object shape and colour for human being is easy one, but for machine computer vision it's necessary to define each and every essential parameter of object. Shape and objects in image care identify using histograms [2]. The similarity and the difference between different objects are defined by Principal Component Analysis. LBP implementation faces 3 major issues. One of them is to defining and extraction of properties of the object. Another one issue is to threshold the essential information from the entire image. Third one is to introduce effective operator [3].

II. Edge Detection Techniques

a) The Marr-Hildreth Edge Detector

Gaussian Smoothing Operator is used in Marr-Hildreth edge detector. It operates with the help of convolution of Laplacian of Gaussian function and step change of Gaussian. Then edges are detected by detecting zero crossing [4].

b) The Canny Edge Detector

The Canny edge detector is one of the best edge detection techniques. Canny edge detector uses Multistage Algorithms for the detection of edges. Initially Smooth the Digital image and determine the gradient magnitude and orientation. Use Non-maxima suppression and double thresholding to detect edges. It was introduced by John Canny in his Master's thesis at Massachusetts Institute of Technology (MIT) in 1983 [5].

c) Local Threshold and Boolean Function Based Edge Detection

This Edge Detection Technique converts the pixels of digital image into blocks. Every digital block is converted into binary form. The thresholding mask is apply on every block and detects the Edge. To remove noise it does not need to smooth the edges in this detection techniques [6].

d) Colour Edge Detection Using Euclidean Distance and Vector Angle

In Other Edge Detection Techniques the digital image is converted into grayscale image. Due to this some information of image lost. To overcome this the colour edge detection techniques is used which can detect edges in high colour variations. Colour edge detector has two operators. One is Euclidean Distance, used for detection of edges on intensity basis and other one is Vector Angle, used for detection of edges on hue and saturation [6].

e) Local Binary Pattern (LBP)

LBP converts the digital image in grayscale image and then develop the various histogram of various parameters like shape, size and colour etc. of objects. It develops a bit code from thresholding and then it converts the bit code to decimal. This decimal code is new LBP code the new centre pixel. Usually LBP operates on 3×3 pixels [7].

f) Local Ternary Pattern

LTP is an extension of LBP operator. In LTP, Pixels are not threshold into 0 and 1. It calculate 3 values of pixels by using threshold constant.

$$\text{Thresholding Result} = \begin{cases} 1, & \text{if } p > c + k \\ 0, & \text{if } p > c - k \text{ and } p < c + k \\ -1, & \text{if } p < c - k \end{cases}$$

Where k is threshold constant, c is value of centre pixel and p is neighbour pixel. Neighbouring pixels are combined after thresholding into a ternary pattern [7].

g) 3D Local Binary Pattern

In 3D LBP central pixel is modified by its circular neighbours and the neighbourhood pixels are defined as a sphere shape [7].

III. LBP METHODOLOGY

Initially the digital colour image is converted to grayscale image. Depending on the feature extraction the filter needs to

be introduced. Now the grayscale image is divided into blocks usually in 3×3 pixels. Now operate the filter on the each block on image from top left. Value above the threshold level is assigned as 1 and other are assigned as 0 as shown in Fig.1. Develop the binary code from resultant image, using top left bit as Most Significant Bit (MSB). Convert this binary code into decimal form which is the new centre pixel for the next block. On this way the LBP keeps operating on entire image.

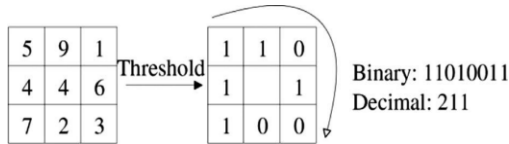


Fig. 1: LBP Operator

IV. TYPES OF LOCAL BINARY PATTERNS

a) The Original LBP

The LBP was introduced by Ojala et al., by using 3×3 pixels operator, used for the texture classification. IT shows the comparison of the neighbourhood pixels with the centre pixels as shown in Fig. 1 [8]. Following equation expresses the decimal form of the result:

$$LBP(x_c, y_c) = \sum_{n=0}^7 s(i_n - i_c) 2^n \quad (1)$$

Where i_c defines the grey value of the centre pixel (x_c, y_c) and function $s(x)$ is defined as:

$$s(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ 0 & \text{if } x < 0 \end{cases} \quad (2)$$

b) The Multi-Scale LBP

It was also introduced by Ojala et al. when it makes the variation in radius size. To Multi-Scale LBP, he assigns the notation as $LBP_{P,R}$, in which P is referred as on a circle of radius R, with equally spaced pixels [8]. Fig.2 shows the $LBP_{8,2}$ operator:

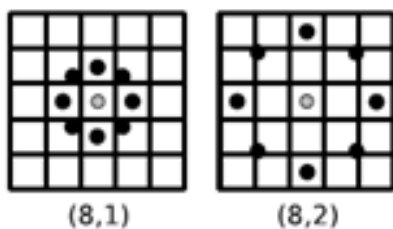


Fig. 2. Extended LBP operators

c) The Uniform LBP

Small subsets of LBP contains the most of the information of the digital image, which are known as uniform patterns. Micro-features such as edge, line and corners etc. are described by these subsets. The introduction of $LBP_{P,R}^{u^2}$ as extended LBP operator where u^2 is defined for uniform patterns [9].

d) The Improved LBP (ILBP)

Under some certain circumstance LBP some structural features. To overcome this the ILBP introduced. Mean of the pixels in kernel describes the difference of LBP and ILBP. ILBP is of 9-bit decimal code, expressed as:

$$ILBP(x_c, y_c) = \sum_{n=0}^8 s(i_n - i_m) 2^n \quad (3)$$

Where i_m the mean grey value of all pixels and function $s(x)$ is defined as in Equation 2 [9].

e) The Extended LBP (ELBP)

The extended version of LBP i.e. ELBP was introduced by Huang et al. when the remark that LBP describes the only properties in first derivative of image, there is no information about the rate of change of local variation. The ELBP extracts the more information by convoluting the gradient image and original image [9].

f) Census Transforms

Census Transform introduced by Ojala, Zabih and Woodfill, which converts the bit strings of centre pixels by using neighbour pixels. The only difference between LBP and Census Transform is only in Bit String. Now Modified Census Transform (MCT) is extended form of the Census Transform [10].

V. CONCLUSION

Object Detection and identifying is used in various application, for example automation, robotics, digital cameras, security and human machine interface, video surveillance etc. Here LBP is introduced as the suitable techniques for these application. LBP is easy to apply and easy to modified according to various conditions. In Future we are going to introduce the real time detection and identification of objects using LBP.

REFERENCES

- [1] R. Garg, R. S. Rajput, "Review on Local Binary Pattern for Face Recognition," International Journal of Advance Research in Computer Science and Technology, vol. 1, issue no. 2, pp. 201-204, 2014.
- [2] R. P'eteri and D. Chetverikov, "Dynamic Texture Recognition using Normal Flow and Texture Regularity," Proceedings Iberian Conference on Pattern Recognition and Image Analysis, pp. 223-230, 2005.
- [3] F. Bourel & C.C. Chibelushi's "Facial Expression Recognition: A Brief tutorial Overview," School of Computing, Staffordshire University, Beaconside, Stafford ST18 0DG, UK, ORSYN, 101 quartier Boieldieu, La Défense 8, F-92042 Paris La Défense Cedex, France, 2002.
- [4] Rashmi, M. Kumar, R. Saxena, "Algorithm and technique on various edge detection: A Survey," Signal and Image Processing: An International Journal, vol. 4, issue No. 3, pp. 65-75, 2013.

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- [5] J. F. Canny, "A Computational approach to edge detection," IEEE Transactions on Pattern Analysis and Machine intelligence, vol. PAMI-8, issue no. 6, pp.679-697, 1986.
 - [6] E. Nadernejad, "Edge Direction Techniques: Evaluations and Comparisons," Applied Mathematical Sciences, vol. 2, issue no. 31, pp. 1507-1520, 2008.
 - [7] A. Hussain, M. S. Khan, M. Nazir, M. A. Iqbal, "Survey of Various Feature Extraction and Classification Techniques for Facial Expression Recognition," Recent Researches in Communication, Electronics, Signal Processing and Automatic Control, pp. 138-142.
 - [8] T. Ojala, M. Pietikainen, and T. Maenpaa, "Multiresolution grey-scale and rotation invariant texture classification with local binary patterns," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 24, issue no. 7, pp. 971-987, 2002.
 - [9] S. Marcel, Y. Rodriguez, G. Heusch, "On the Recent use of Local Binary Patterns for Face Authentication," International Journal of Image and Video Processing, pp. 1-9, 2007.
 - [10] B. Frowba and A. Ernst, "Face detection with the modified census transform", IEEE Conference on Automatic Face and Gesture Recognition, pp. 91-96, 2004.