Age Classification with Motif Shape Patterns on Local Binary Pattern

P Chandra Sekhar Reddy[1], Bhanu Sreekar Reddy Karumuri[2]
[1]Professor, CSE Dept., GRIET
[2]B.Tech Final year, CSE Dept., GRIET

Abstract*---*Age classification from facial images into different age groups is increasingly receiving attention in age based computer vision applications. Humans also cannot classify people into different age groupsprecisely. To address this problem, the present paper proposes an innovative method of agegroup classification based on motif shape patterns on thelocal binary pattern. LBP on theimage is computed and motif shape patterns are evaluated on this LBP image. The change of age of different persons can be observed with these shape patterns. The proposed method is evaluated on facial image datasets FG-Net and other scanned images. The experimental results demonstrate the excellent performance of our proposed method against the other existing methods.

Keywords : *Age classification, LBP, Motif shape patterns*

I. Introduction

Automatic age estimation has attracted much attention due to its potential applications like Human computer interaction, electronic customer relationship management, video surveillance monitoring and so on. The age estimation with texture feature [1, 2], contour features and texture features separately [3, 4]. An extraction of skin feature for automatic skin aging estimation [5]. Age classification methods are categorized into three categories[6]. They are ananthropometric model[3,7], aging pattern subspace[8], and age regression[9-12] categories. The Cranio–facial development model and wrinkle analysis of face are used in theanthropometric model. In this model shape features of theface are measured to classify human face into several age groups. In aging pattern subspace (AGES) method, a sequence of individual aging face images is modeled for learning a subspace representation. This is more useful to handle incomplete data such as missing ages in the training sequence. The Active Appearance Model (AAM) is used in age regression methods to extract facial features related to shape and appearance. Recently facial emotion algorithms based on spectral features in ECG signals[13], LBP models[14] are developed. Recently various methods for age classification and age grouping are developed by Vijaya Kumar et al. [15], JangalaSasiKiran et al.[16] and Chandra Sekhar Reddy et al.[17]. To address this very important area of research, the present paper carried out the task of age classification with two groups child and adult. The present paper evaluates motif shape patterns on LBP of facial images. The present paper is organized as follows. In section2, proposed methodology is described, section3 includes results and discussions and conclusions are given in section4.

II. Methodology

In this proposed method the color image is converted to gray image, on this image the Local Binary Pattern(LBP) is computed and then shape parameters are evaluated for age classification and this method is illustrated in figure 1.

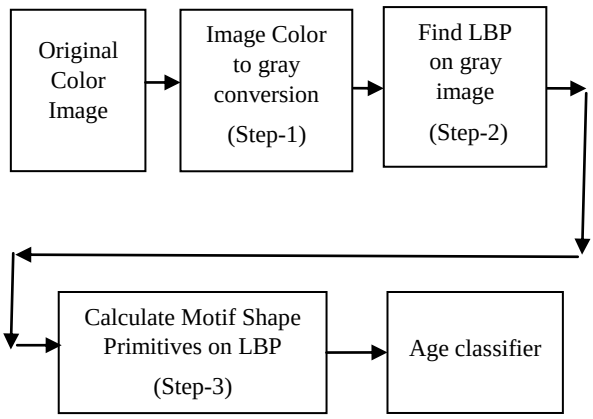


Fig.1: Age Classification using Motif Shape Patterns on LBP images.

Step -1: Conversion from color image to gray Image

The given color image is converted into agrey level image using RGB color quantization method.

Step-2: Local Binary Pattern

The LBP is computed on the image for obtaining local neighborhood information of pixels[18]. The computation of LBP with an example is illustrated in figure2. A 3×3 neighborhood consists of a set of nine elements, P = {p_c, p_0, p_1,…, p_7}, where $p_c$represents the gray level value of the central pixel and p_i ($0 \le i \le 7$) represent the gray level values of neighbor pixels. Each 3×3 neighborhood then can be characterized by a set of binary values b_i($0 \le i \le 7$) as given in equation1.

$$b_i = \begin{cases} 0 & \Delta p_i \ge 0 \\ 1 & \Delta p_i < 0 \end{cases} \quad (1)$$

where $\Delta p_i = p_i - p_c$.

For each 3×3 neighborhood, a unique LBP is derived from the equation2.

$$LBP_{P,R} = \sum_{i=0}^{i=7} b_i \times 2^i \quad (2)$$

Every pixel in an image generates an LBP code. A single LBP code represents local micro texture information around a pixel by an integer code in between 0 and 255.

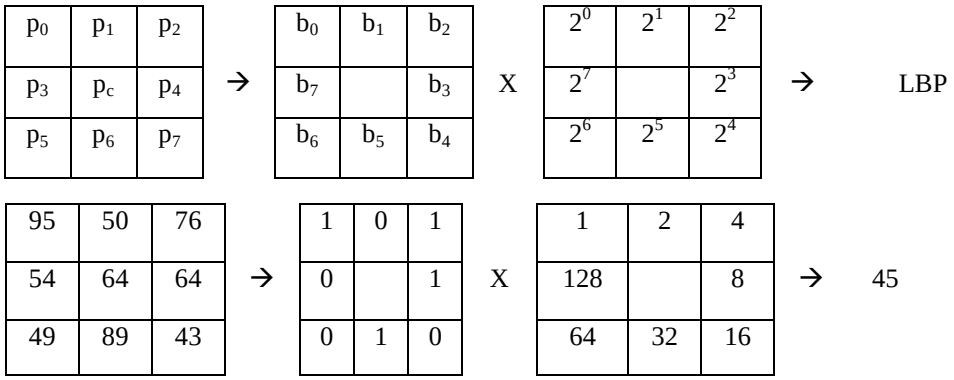


Fig. 2: Computation of LBP.

Step-3 : Motif Shape patterns

The LBP image is divided into 2 x 2 grids. These grids are then replaced by a particular Peano scan motif which would traverse the grid in the optimal sense. Here, the optimality of the Peano scan is with respect to the incremental difference in intensity along the scan line minimizing the variation in the intensities in a local neighborhood. In general, 24 different Peano scans (motifs) could traverse a 2x2 grid. But we consider only the Peano scans (motifs) which start from the top left acorner of the grid because they represent a complete family of space filling curve, reducing the number of motifs to only six [19].The motif shape patterns are defined over a 2×2 grid, each depicting a distinct sequence of pixels starting from the top left corner as shown in figure 3 for age group classification and are denoted as Z, N, U, C, Gamma, and Alpha respectively. The present paper considers motif shape patterns on LBP of thefacial image. The frequency occurrences of all these shape patterns are evaluated on LBP of theimage with a 2 x2 grid from left to right and top to bottom in non-overlapped fashion.The process of finding motif shape patterns on LBP is shown in figure 4.

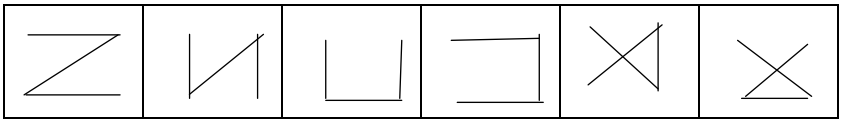
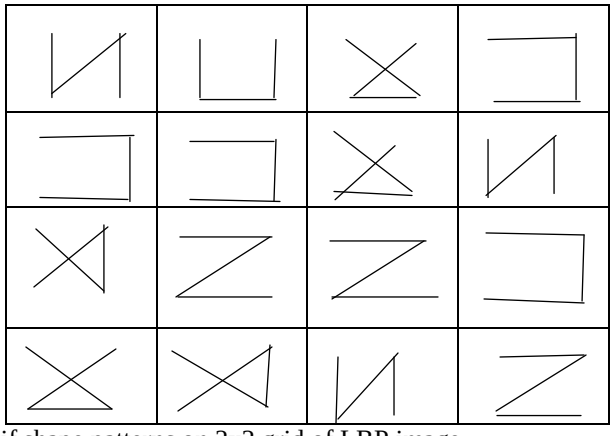


Fig 3: Motif Shape Patterns Z, N, U, C, Gamma and Alpha

205	56	79	65	89	255	255	90
110	48	78	90	187	145	57	64
54	111	219	99	89	74	34	46
210	203	65	90	75	84	38	76
98	73	87	43	67	80	77	87
199	88	200	208	99	105	109	64
97	45	89	79	119	94	154	109
49	99	29	98	97	78	68	255

(a) LBP on Image



(b) Motif shape patterns on 2x2 grid of LBP image

Fig 4: Computation of Motif Shape Patterns on LBP images

III. RESULTS AND DISCUSSIONS

The proposed method is established on adatabase of 1002 face images collected from FG-NET database and other 600 images collected from the scanned photographs and sample of these images are shown in figure 5. In this method, images are classified into two groups as achild (upto 18 years) and adult (above 18 years) based on frequency occurrences of these shape patterns andSum of Motif Shape Patterns(SMSP). The proposed method is investigated on considered database of facial images and the results are shown in table 1.The frequency occurrences of Z, N, C, U, GAMMA, and ALPHA are represented with FZ, FN, FC, FU, FGAMMA, and FALPHA respectively. From the results, it is observed that frequency occurrences motif shape patterns are increasing when there isan increase in age of facial images of different persons. By considering this trend algorithm 1 is proposed.This algorithm has given 97% correct classification rate for age groups into adult and child.

Fig 5: Sample images from FG-NET Database

Table 1: The Frequency Occurrences of Motif Shape Patterns on LBP Images

IMAGE	FZ	FN	FC	FU	FGAMMA	FALPHA	SMSP
001a02	12410	11181	13500	12584	7880	7748	65303
011A02	14754	12726	15396	14002	9647	9431	75956
002A04	16233	14024	18897	17459	8969	8765	84347
002A05	12780	11017	14700	13111	9398	8506	69512
002A07	10437	10427	12489	12510	8104	7119	61086
002A15	14588	13607	16330	16058	8595	8228	77406
011A07	12964	11235	15194	13726	6543	6480	66142
007A01	16068	10285	19097	14667	7981	7919	76017
008A08	12400	10169	14637	12829	6440	6228	62703
012A04	7625	7816	8904	9056	6080	5563	45044
013A00	10137	7347	13323	11253	6507	6079	54646
001A33	23388	19356	26613	23455	12498	12014	117324
002A36	21188	16097	22211	18388	13363	12568	103815
037A19	20539	18411	22463	21200	11992	11473	106078
008A35	19522	18149	20806	20307	11998	11656	102438
011A40	25931	19614	29986	24405	13128	12763	125827
013A25	18157	16531	19969	19602	11016	10262	95537
025A22	18658	15059	20574	17840	10216	9993	92340
027A41	19692	18257	21695	20875	12315	11824	104658
030A26	19965	18328	21895	21463	12499	11857	106007
035A21	19487	18533	21402	21477	11402	11008	103309

Algorithm 1: Age classification using frequency occurrences of Motif Shape Patterns on LBP images

Let FZ, FN,FC,FU,FGAMMA, and FALPHAbe frequency occurrences of z, n, c, u, gamma and alpha Motif Shape Patterns and SMSP is thesum of frequency occurrences of all Motif shape patterns.

Begin

if ((FZ <17000) & (FN < 14500)& (FC <19500) & (FU <17600) & (FGAMMA <10000) & (FALPHA <9500)& SMSP < 88000))

write ("Child Image")

else write ("Adult Image")

End

The algorithm classified the considered database images into two groups with 97% correct classification rate. The proposed method for age classification is compared with the existing methods. Age classification with shape features on lbp based texton byP. Chandra Sekhar Reddy et al.[20]. Child and adulthood classification with geometrical features by Chandra Mohan et al.[21] and other age classification methods Young H.Kwon et al. [3], Tsuneo Kanno et al.[22] and Wen-Bing Horng Cheng et.al.[4]. The percentage of classification of proposed method and other existing methods are listed in table2. The results indicate that the proposed scheme outperforms with other methods.

Table 2: Comparison of the proposed method with other methods.

S.no	Authors	Name of the method	% of Classification Rate	Category of age classification
1	Proposed method	Motif Shape patterns on -LBP	97	Child and Adulthood
2	P. Chandra Sekhar Reddy et.al.[20]	Shape features on IT-LBP	95	Child and Adulthood
4	Chandra Mohan et.al.[21]	Child and Adulthood Classification based on Geometrical Features	94.5	Child and Adulthood
3	Young H. Kwon et.al.[3]	Age classification from facial images	78	Babies, adults, and Senior adults.
4	Tsuneo Kanno et al.[22]	Classification of age group based on facial images of young males by using neural networks	80	Only young males are age groups considered for classifications are 12,15,18 and 22 years
5	Wen-Bing Horng Cheng et.al.[4]	Classification of age groups based on facial features	90.52	Babies, young adults, middle-aged adults, and old adults

4. CONCLUSION

The present paper developed a new direction for age group classification using motif shape patterns on LBP ofhuman facial images. The proposed method extracts the local information of each pixel of animage using LBP. The motif shape patterns are used as features for age grouping. The algorithm 1 classified images with a good classification ratecompared to other existing methods. This method is very simple and efficient for age classification. The LBP with new shape patterns and textural properties can be extended in future work.

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AUTHORS PROFILE

Dr.P. Chandra Sekhar Reddy completed his B.Tech in Computer Science & Engineering from Sri Krishna Devaraya University. He received the Master's Degree in M.Tech in Computer Science & Engineeringfrom Jawaharlal Nehru Technological University Hyderabad.He receivedhis Ph.D. Degree in Computer Science & Engineering from Jawaharlal Nehru Technological University Anantapur. He is currently working as Professor in GRIET, Hyderabad.He has more than 16 years of teaching experience. His research interests include Image Processing, Pattern Recognition, and Data Mining. He has more than 10 publications in various international journals and conferences. He is also reviewer and editorial board member for many international journals. He is the member of professional bodies like IEEE, IAENG, CSI and CSTA.

K.BhanuSreekar Reddy is pursuing his B.Tech final year in Computer Science and Engineering at GokarajuRangaraju Institute of Engineering and Technology, Hyderabad, India. He has participated in various college and university technical events.His research areas are Image Processing and Pattern Recognition. He is a member of professional bodies like Code chef.