ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

Hybrid Technique for Template Based Face Detection and Gender Classification using Histogram of oriented gradient (HOG)

N.Naga Supriya [1], N.V.K.Maha Lakshmi [2]

P.G. Student, Department of ECE, SRKIT, Enikepadu, Vijayawada, A.P, India[1]

Assistant Professor, Department of ECE, SRKIT, Enikepadu, Vijayawada, A.P, India[2]

ABSTRACT: Gender Classification is the hot research topic from last two decades but still a gap exist between the requirements and actual performances. This gap lies due to the variation in pose, expression and illumination condition etc. Gender classification of face images is the process of identification of gender by their facial images. In this paper color segmentation , template matching as well as Histogram of oriented gradient(HOG) in order to determine the more efficient approach for gender classification from face images.

KEYWORDS: Color segmentation, template matching, Gender classification, ,Histogram of oriented gradient(HOG)

I. INTRODUCTION

A person is a male or female is an easy task for human to recognize but it is very difficult for a machine or robot. Gender identification using voice of a person is comparatively easier than that from facial images. This is a binary classification which is useful in many applications such as targeted advertising, surveillance system, human machine interaction, content based indexing and searching, demographic collection, biometrics etc. In the present scenario identification of a face, gesture recognition and gender classification plays an important role in order to meet the secure, reliable and individualized services. In the previous time, gender recognition is based on the recognition and psychology regions but in present time people began to start thinking about this problem more technically. Now, the gender recognition is receiving more and more attention. Gender classification research started in 1990s. Golomb et al and Cottrel and Metcalfe first used the face images manually and used neural network classifier to classify the gender. Generally features can be broadly classified into 2 categories: geometric based feature and appearance based feature. They are also known as local feature and global feature respectively. Appearance based methods are based on the pixels in an image and geometric based methods are related to various properties of face such as eyes, nose, chin, eyebrow etc. Many feature extraction methods have been used for the classification of gender. The global feature method which we present in this paper has the potential to identify the gender. In this paper Histogram equalization is used to equalize the illumination effects for color images. Firstly, histogram equalization is applied to equalize the illumination changes. HOG feature methods are applied for the facial feature extraction.

II. RELATED WORK

Face Detection is the technique where, in a given arbitrary image, the work is to determine whether or not, there are any faces in the image and, if present, return the image location and extent of each face. The challenges associated with face detections are

1) Pose: The images of a face vary due to the relative camera-face positions and some facial features such as an eye or the nose may become partially or wholly occluded.

2) Presence or absence of structural components: Facial features such as beards, mustaches, and glasses may or may not be present and there is a great deal of variability among these components including shape, color, and size.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

3) Facial expression: The appearance of faces is directly affected by a person's facial expression

The existing algorithm consists primarily of three distinct steps. The first step being the pre-processing step. The second step is to detect the distinct faces in the processed image by using template matching .Lastly, the third step is a refinement step which attempts to recover faces that were missed in the previous step by applying further processing and then determining possible facial regions. Since a given picture can have variations of the light incident on it, we had to first make sure that we could cancel the distortions caused by this variation. In order to achieve this, we had to look at other color spaces. After looking at the major color spaces, we decided to go with a hybrid color space formed by subtracting the Hue channel from the Chrominance channel obtained from the HSV & NTSC color spaces, respectively . This gives us a segmented image that has only the skin segments represented. Once the two dimensional matrix is obtained, it is then converted to black and white. A complemented edge is also obtained from this black and white image. After filling small holes in the image, a pass of erosion and dilation is applied on the image to make the target blobs more prominent. This is followed by a noise removal step. Finally the image found from the last step is combined with the complemented edge that was found in one of the previous step and the face mask is obtained .

A. COLOR-SEGMENTATION:
With Color Segmentation, face and non-faces are differentiated and separated. For this, we perform the following steps: Convert the RGB image into HSV, NTSC color spaces Extract H from HSV and I from NTSC. We then subtract H from I to boost the skin colored pixels and make them more prominent.

B. TEMPLATE MATCHING & CORRELATION ANALYSIS:
Once the pre-processing is done, we proceed to the next step. In this step, we apply blob analysis technique to the binary image obtained from the previous step. We then apply template matching and set an appropriate threshold for the faces. At this step however, some faces, especially in group images are clustered and marked as a single face with low matched template coefficient. In order to recover faces and improve accuracy, we apply a further refinement step to the classified clustered faces. In this step, we take the individual clustered faces and apply further processing to distinguish the faces. For this we take the clustered region and convert to edge directly from the RGB color space . This allows us to detect the weaker edges of the faces which help in segmenting them from the clustered or occluded faces and gives us more prominent segmented faces. This is then dilated to make the edges more prominent and then combined with the original fused blobs from the second step of our algorithm . Noise that might have crept in, are then removed and blob analysis is then applied to demarcate the possible facial masks. This additional step boosts the face detection rates for pictures that have people in group and are standing very close by with parts of their faces being occluded.

C. GENDER DETECTION:
Once the facial regions are detected, we proceeded to implement an additional gender detection feature in our algorithm. For this two ways were possible. The first way, which is using template matching, with templates created from Female and Male faces only. In other words, using gender specific templates.The second way was an extension of our basic algorithm, which uses Histogram of oriented gradient(HOG) which counts occurrences of gradient orientations in localized portions of an image.

a) Using Gender Specific Template Matching - For this two separate templates of Male faces & Female faces are used. After the faces were detected, we ran template matching with both the templates of Male & Female. We then compared the coefficients detected and assigned a face as Male or Female. If we increase the data set, the detection rate would expectedly go up.
b) Using HOG Technique - For this two separate feature vectors of Male faces & Female faces are used. After the faces were detected, we apply HOG technique for both the faces of Male & Female. We then compared the vector orientations and assign the face as Male or Female.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

III. IMPLEMENTATION

Histogram of oriented gradient(HOG) features were initially developed for the pedestrian detection but here we used HOG feature for gender classification. This technique counts occurrences of gradient orientation in localized portions of an image. Implementation of this method can be divided into following stages:

1). Image normalization: It is suitable to normalize the input image in order to make the descriptor less sensitive to the illumination changes. We apply a histogram equalization normalization technique to the intensity values so that whole range of the intensity values (i.e., values from 0 to 255) is represented in the normalized image.
2). Gradient computation: Gradient is Computed by applying convolution between the normalized image and the filter [-1,0,0] in both of the vertical and horizontal directions. The gradient is represented by the magnitude M(x ,y) and an angle θ(x ,y).
3). Creating cells: Dividing the image into the small connected region, called cells, for each cell compiling a histogram of gradient directions for the pixels within the cell. The whole image is divided into cells of square grid whose edges are formed by cell Size pixels.
4). Cell histogram computation: The gradients in Cell are histogramed. Let H_I where i=1,2,.....n Bins, which denote histogram bins and (hr, hq) denote the smallest possible interval where angle θ (x, y) fits. Every pixel with an angle and magnitude votes into histogram bins hr, hq by a linear combination.

$$H(r) = H(r) + \frac{\theta(x,y) - h_q}{h_q - h_r} M(x,y)$$

$$H(q) = H(q) + \frac{h_q - \theta(x,y)}{h_q - h_r} M(x,y),$$

$$\text{Where} \quad h_r \le \theta(x,y) < h_q$$

5. Creating block: Two main block geometry exist: rectangular R-HOG block and circular C-HOG block. In this paper R-HOG block is used. Blocks have the squared shape and their edge is formed by block size. Overlapping Concept of block is used to improve accuracy.
6. Normalize block histogram: A block histogram is formed by all its cell histogram.
7. Stacking histogram together: All block histograms are stacked together into one feature vector .

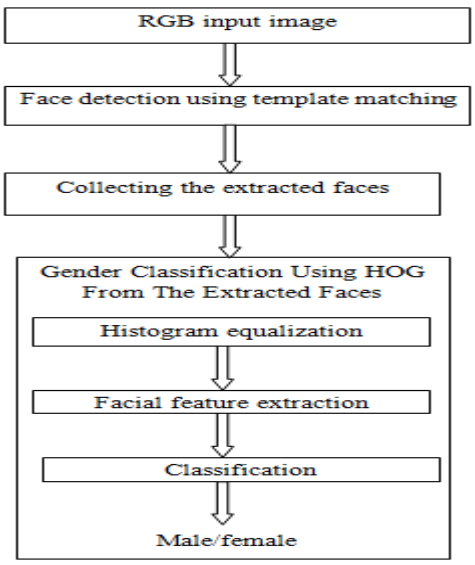

Fig.1 **Histogram of Oriented Gradients**

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

The processing steps for the proposed technique shown in the above fig.1:
Step1:Gathering the data base
Step2:Applying template matching to detect the faces for the given image.
Step3:Applying HOG for the detected faces to classify the gender
The Histogram of Oriented Gradient (HOG) feature descriptor is popular for object detection. In the following we compute the HOG descriptor and display a visualization.

HOG overview: Compute a Histogram of Oriented Gradients (HOG) by
1. (optional) global image normalization
2. computing the gradient image in x and y
3. computing gradient histograms
4. normalizing across blocks
5. flattening into a feature vector

The first stage applies an optional global image normalization that is designed to reduce the influence of illumination effects. In practice we use gamma (power law) compression, either computing the square root or the log of each color channel. Image texture strength is typically proportional to the local surface illumination so this compression helps to reduce the effects of local shadowing and illumination variations. The second stage computes first order image gradients. These capture contour, and some texture information, while providing further resistance to illumination variations. The locally dominant color channel is used, which provides color invariance to a large extent. The third stage aims to produce an encoding that is sensitive to local image content while remaining resistant to small changes in pose or appearance. The adopted method pools gradient orientation information locally in the same way as the SIFT feature. The image window is divided into small spatial regions, called “cells”. For each cell we accumulate a local 1-D histogram of gradient or edge orientations over all the pixels in the cell. This combined cell-level 1-D histogram forms the basic “orientation histogram” representation. Each orientation histogram divides the gradient angle range into a fixed number of predetermined bins. The gradient magnitudes of the pixels in the cell are used to vote into the orientation histogram. The fourth stage computes normalization, which takes local groups of cells and contrast normalizes their overall responses before passing to next stage. Normalization introduces better invariance to illumination, shadowing, and edge contrast. It is performed by accumulating a measure of local histogram “energy” over local groups of cells that we call “blocks”. The result is used to normalize each cell in the block. Typically each individual cell is shared between several blocks, but its normalizations are block dependent and thus different. The cell thus appears several times in the final output vector with different normalizations. This may seem redundant but it improves the performance. We refer to the normalized block descriptors as Histogram of Oriented Gradient (HOG) descriptors. The final step collects the HOG descriptors from all blocks of a dense overlapping grid of blocks covering the detection window into a combined feature vector for use in the window classifier.

IV .SIMULATION RESULTS

The results have been derived by considering a test image as shown the bellow fig.2

Fig:2.Test Image

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

And detected the faces by using the template matching and marked the detected faces in the image as shown in fig.3

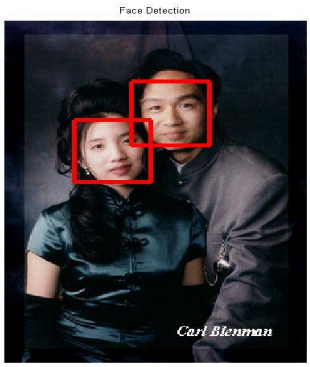

Fig.3: Face Detected Image

The detected faces are been extracted from the images and saved into the folder for further processing of gender classification

Fig.4:Extracted Male and Female faces

The genders has be classified by using HOG from the extracted faces

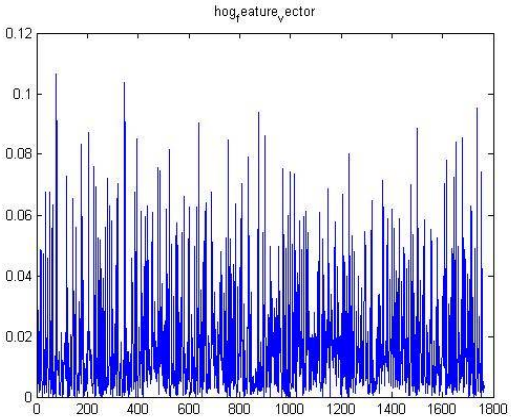

Fig.5(a): Gender Classification Using HOG From The Extracted Faces

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

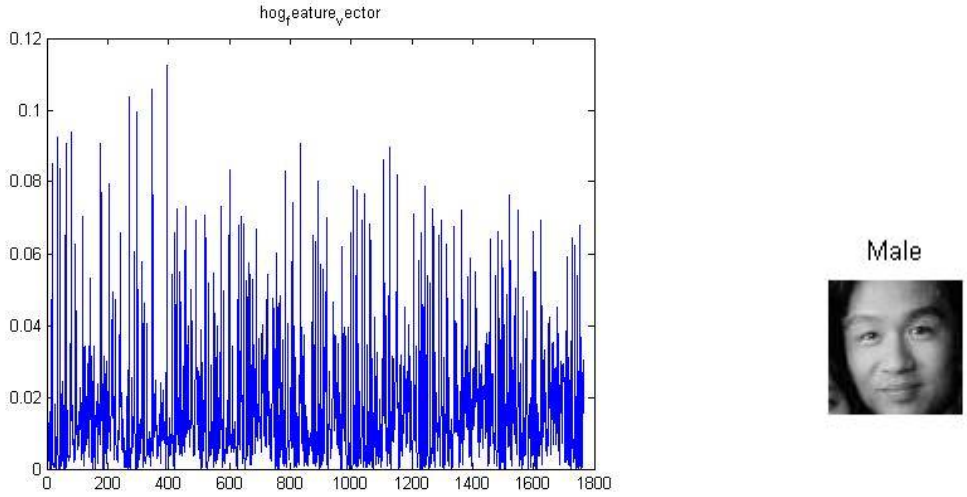

Fig.5(b): Gender Classification Using HOG From The Extracted Faces

V. CONCLUSION

The results of this implementation can be concluded that the method, which involves multi-resolution template matching, region clustering and colour segmentation works with high accuracy with the training images which actually reflect worse-than average face-detection conditions due to the high clustering factor of the faces, presence of profile faces, tilted faces etc. Additionally, the feature extraction methods is presented, based on pixels for the classification of the gender. From the experimental point view it is clear that HOG feature gave more accurate and faster results for gender classification. So HOG approach is more efficient and more accurate.

REFERENCES

1. Partha Das1, Anirban Sarkar2, Soumyadeep Halder3, Debasish Kundu4, Sudipta Ghosh5, Sauvik Das Gupta6 A Novel Approach towards detecting Faces and Gender using Skin Segmentation and Template Matching 2015 2nd International Conference on Signal Processing and Integrated Networks (SPIN) Year: 2015 Pages: 431 - 436, DOI: 10.1109/SPIN.2015.7095256
2. Z. Xu, L. Lu, and P. Shi, "A hybrid approach to gender classification from face images," in Pattern Recognition, 2008.ICPR 2008. 19th International Conference on, 2008, pp. 1–4.
3. Golomb, D. T. Lawrence, and T. j. Sejnowski. SEX-NET: A neural network identifies sex from human faces. In Advancds in Neural Information Processing Systems, pp. 572-577, 1991
4. G. w. Cottrell and J. Metcalfe. EMPATH: Face, emotion, and gender recognition using holons. In Advances in Neural Information Processing Systems, pp. 564-571, 1991
5. P. Viola and M. Jones, "Rapid object detection using a boosted cascade of simple features," in Computer Vision and Pattern Recognition, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on, 2001, vol. 1, pp. I-511-518.
6. Ojal T.,Pietikinen M. and Harwood D.,"A Comparative Study of Texture measures with classification based on featured distributions",Pattern recognition, Vol 29,No.1,PP. 51-59,1996.
7. T.Ahonen ,A.Hadid and M.Pietikainen,"Face recognition with Local Binary Pattern." In the Eur. Conference on Computer vision, pages 469-481,2004.
8. B. Xia, H. Sun, and B.-liang Lu, "Multi-view Gender Classification based on Local Gabor Binary Mapping Pattern and Support Vector Machines," in Neural Networks, 2008. IJCNN 2008.(IEEE World Congress on Computational Intelligence). IEEE International Joint Conference on, 2008, pp. 3388-3395.
9. Z. Yang and H. Ai, "Demographic classification with local binary patterns," Advances in Biometrics, pp. 464–473, 2007.
10. N. Dalal and B.Triggs, " Histogram of oriented gradient for human detection," In Conference on computer vision and pattern recognition, pages 886-893,2005.
11. C. Cortes and V. Vapnik, "Support-Vector Networks," Machine learning, vol. 20, no. 3, pp. 273–297, 1995.
12. B. Moghaddam and M. Yang, "Gender Classification with Support Vector Machines," Fourth IEEE International Conference on Automatic Face and Gesture Recognition, pp.306–311, 2000.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 1, January 2017

13. S.M.Pizer and E.P.Amburn, "Adaptive histogram equalization and its ariations,"Comput.Vis. Graph., Image process.,vol 39,no.3,pp.355-368,1987
14. Shan, W.Gao, B.Cao, and D.Zhao,"Illumination normalization for robust face recognition against varying lighting conditions," in Proc. IEEE Workshop on AMFG,2003,pp 157-164.
15. Erno and Roope "An experimental comparison of gender classification methods," Pattern recognition 2008,pp:1544-1556.
16. Indian database downloaded from http://vis-www.cs.umass.edu/~vidit/AI/dbase.html
17. en.wikipedia.org/wiki/Histogram_of_oriented_gradients[18] Chang, C .C.,Lin ,C.J. LIBSVM: " a library for support vector machines," http://www.-csie.ntu.edu.tw/~Cjlin/papers/libsvm.ps.gz.
18. T.Ojala.,M.Pietikainen,T.Maenpaa,"Multiresol-ution gray-scale and rotation invariant texture classication with local binary patterns,". IEEE Transactions on Pattern Analysis and Machine Intelligence vol24 pp. 971-987,2002
19. Shan,Gong and McOwan, "Facial expression recognition using local binary pattern: a comprehensive study," Image and vision computing (2009) 803-816

BIOGRAPHY

N,Naga Supriya received B.Tech degree in Electronics and communication Engineering from Aditya Engineering College, Surampalam in 2006 and pursuing M.Tech in SRK Institute of Technology, Vijayawada, Andhra Pradesh, India. Research interests are Image Processing , and Wireless Communications.

N.V.K.Maha Lakshmi received B.Tech Degree in Electronics and communication engineering from Nimra college of Engineering and Technology, jupudi in 2005 and M.Tech Degree in communications and signal processing from Godhavari institute of Engineering and technology, Andhrapradesh, India in 2012.Now working as an Asst.Professor in S.R.K Institute of Techology,Vijayawada, Andhrapradesh, India. research interests are Digital image processing, and Antennas.