Research Paper　　　　**Engineering**

Human Face Detection Using Image Segmentation

B. ANANTHI | Vellalar College for women, Erode, Tamil Nadu, India

S. BALAMOHAN | Vellalar College for women, Erode, Tamil Nadu, India

ABSTRACT The objective of this paper is to Detect human face in the given color image. The model consists of two processes for face detection. Skin pixels are detected using clustering concept. Using feature extraction , a region based technique is applied to detect face from the previous results. The proposed model has been tested on various images and achieved higher face detection rate.

KEYWORDS : Image processing, K -means cluster, Skin detector, Region segmentation, Face detection.

Introduction

Image Processing applied in various systems like image segmentation, image compression, security of image during transmission etc. Image segmentation is a difficult task in image processing. Research undergoing in various forms particularly in medical images[7]. Segmentation allows to segment particular objects in images based on colour[8][10][11], texture, region etc.

Image security is becoming more important in storage and transmission of image data. Images are widely used in several processes. Therefore, the protection of image from unauthorized access is very important. Image security of image during transmission is also possible in image processing[12].

Clustering refers to the process of grouping samples so that the samples are similar within each group. The groups are called clusters. According to Mike chapple, clustering is a data mining technique used to place data elements into related groups without advance knowledge of the group definitions. Clustering is a way to separate groups of objects. Siddheswar Ray and Rose H. Turi [4] 1999, proposed a model for a determination of number of clusters in K-Means clustering.

Vladimir Vezhnevets [5] gathered as much published techniques describe their key ideas

and try to find out and summarize their advantages, disadvantages and characteristic features. Also summarized the detail description of different color spaces used for skin detection and the existing skin color modeling methods used. R.L.Hsu, M.Abdel-Mottaleb and A.K.Jain [1] proposed a model to detect face in color images using YCbCr color space

Detecting human faces in color images is an important task for many applications. A recent surge in image processing related research, on face recognition, poses estimation, face tracking and gesture recognition. A large number of algorithms have been put forward by researchers [2][3]. All face detection techniques requires a priori knowledge of the face. Feature based technique depend on feature derivation and analysis about faces like skin color, face shape or facial features like eyes, nose etc.

Proposed System for Face Detection

Face detection system consists of two steps. The I[st] step is to segment the skin pixels[6][9] in the given color image. In the 2nd step, identify the face region using region and face feature techniques.

1. Skin Detection using cluster based technique.

a. Read color human image
b. Convert to L*a*b* color space
c. Classify the colors in 'a*b*' space using K-means clustering under city block measuring distance.
d. The resulted image is a clustered image.
e. Label every pixel in the image using the results from k-means.
f. Each label is referred as regions.

g. Verify all the regions with the criteria of identifying the skin pixels.
h. Identify the skin pixel objects from the different color objects. Assume 0's to the regions which is not a skin.
I. Display the segmented image which contains skin pixels in the binary form and RGB form

2. Detect face using region and face feature techniques

The segmented binary image is taken for consideration. Create a label matrix for the binary image to find the number of regions. Identify the regions which contain holes. Select the regions which contain more than one hole. Because one of the facial features is face contain eye, nose, etc. Then determine the cross-correlation value between the image region that might indicate a face and the face model if the number of holes is greater than one. If we have holes, and the result of the cross-correlation above 1.6, declare the region is a face region. The face regions are segmented and displayed in RGB form. Also the face regions are marked by rectangle in the given original image for clarity.

Explanation
Read the given color image.

The color image is covert into an L*a*b* color space. Classify the colors using K-means clustering under cityblock measuring distance. The resulted image is a clustered image. The given RGB image is segmented into k objects with different colors. For every object in the input, k-means returns an index corresponding to a cluster. Label every pixel in the image with its cluster index.

After the clustering, according to the index there are number of regions. Check each region. Verify all the regions with the skin detection criteria. If any of the regions belongs to skin then the region is assumed as a skin region. Among the different k object, detect the skin objects.

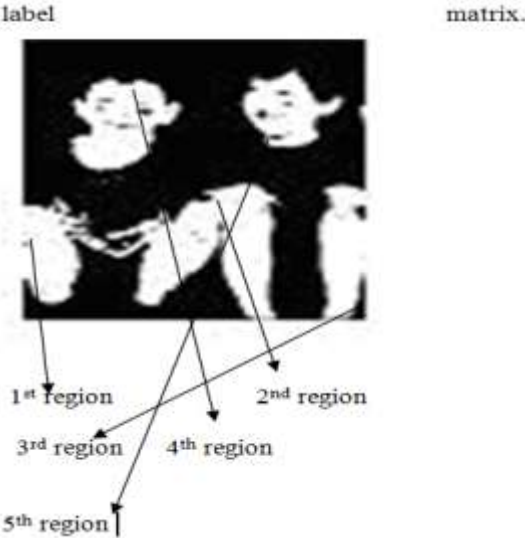Detected Skin objects

Binary form　　　　**RGB form**

Create a label matrix
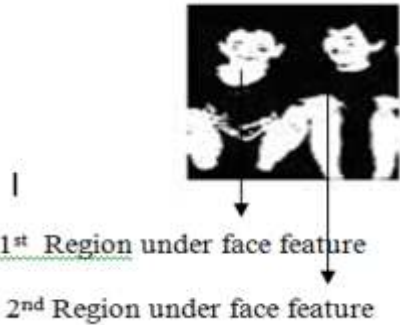**Sample label matrix**

```
1 3 3 3 3  3  3  3  3  3  3  3  3
1 3 3 3 3  3  3  3  3  3  3  3  3
1 1 3 3 3  3  3  3  3  3  3  3  3
1 1 3 3 3  3  3  3  3  3  3  3  3
1 1 1 3 3  3  3  3  3  3  3  3  3
1 1 1 3 3  3  3  3  3  3  3  3  3
1 1 1 1 3  3  3  3  3  3  3  3  3
1 1 1 1 1  3  3  3  3  3  3  3  3
```

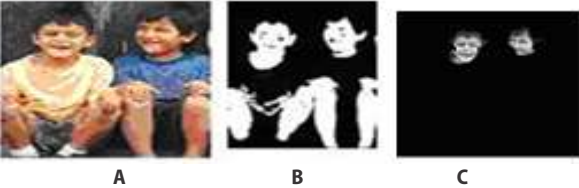**Identify the number of regions by creating a**

Find the regions which contain holes. Selecting Regions based on face feature Criteria.

Selected region is a face region displayed in RGB form and faces are marked by rectangle.

A few images are show below

D

A   B   C

D

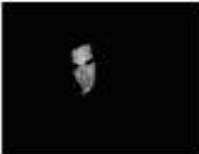A   B   C

D

A   B   C

D

A-Original image, B-Skin image , C- Face image, D- Face with rectangle in original image

Conclusion
Using the algorithm described above has produced reasonable results when applied to the various images. This algorithm was applied on a variety of Images. Around 50 images are tested. The algorithm was implemented in MATLAB.7 on Pentium IV, system. This model accurately detects more than 80 present results. The results may be viewed in Figure I.

REFERENCES

[1] Hsu R. L., Abdel-Mottaleb M., Jain A.K., "Face detection in color images", IEEE Trans. on Pattern Anal. and Machine Intell. 24(5): 696-706, 2002. || [2] Jordao L., Perrone M., Costeira J., Santos-victor J., "Active face and feature tracking", In proceedings of the 10th international conference on image analysis and processing, 572–577, 1999.|| [3] Peer, P., Kovac.J., and Solina,F,2003. Human skin colour clustering for face detection. EUROCON 2003-International Conference on Computer as a Tool.|| [4] Siddheswar Ray and Rose H.Turi, "Determination of Number of Clusters in K-means clustering and application in Color image segmentation", Proc. Of fourth International conference on Advances in Pattern Recognition and Digital Techniques, pp:137-143,1999.|| [5] Vladmir Vezhnevets, vassili Sazonov and Alla Andreeva , " A Survey on Pixel-Based Skin Color Detection Techniques".|| [6] Dr.K.S.Ravichandran, B.Ananthi, "Color Skin Segmentation Using K-Means Cluster", International Journal of Computational and Applied Mathematics, Volume 4 Number 2 (2009), pp. 153–157.|| [7] Dr.B.Ananthi,Dr.S. Balamohan and Dr. M. Hemalatha, "Melanoma Detection Using RGB Color Model in Medical Imaging", Middle-East Journal of Scientific Research 21 (11): 1982-1987, 2014|| [8] P.Kavitha,Dr.B.Ananthi, " Segmentation Of Unhealthy Region Of Plant Leaf Using Image Processing Techniques: A Survey", IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308|| [9] B.Ananthi, Dr.K.S.Ravichandran , "Comparison of Color Models for Human Skin Detection", International Journal of Computational Intelligence Research, Volume 5, Number 3 (2009), pp. 241–246.|| [10] B.Ananthi, Dr.K.S.Ravichandran, "Skin Detector Using RGB Vector Under Mahalanobis Distance", Journal of Advanced Research in Computer Engineering: An International Journal, volume 3, number 2, 2009, pp.295-297.|| [11] "Skin Segmentation in Combination Color Space Model COM-RMHYN", International Journal of Computer Applications in Engineering, Technology and Science, Volume 3, Issue 1,0ct 2010 - March 2011, pp.115-119.|| [12] Dr.B.Ananthi,V.Priya, "Comparative Analysis Of Image Encryption And Decryption For Securing Medical Images", Journal of Nano Science and Nano technology ,Vol 2 | Issue 6 | Spring Edition | DOI : February 2014 | Pp 636-639 | ISSN 2279 – 0381