Automated Smiley Face Extraction Based on Genetic Algorithm

Md Alamgir Hossain[1], Debabrata Samanta[2] and Prof (Dr) Goutam Sanyal[3]

[1]Department of MCA, Calcutta Institute of Technology, West Bengal, India
[2,3]Department of CSE, National Institute of Technology, Durgapur, West Bengal, India
[1]*alamgir_sim@yahoo.com*,[2]*debabrata.samanta369@gmail.com*

Abstract

Facial expression scrutiny has attracted tremendous consciousness in the area of computer vision because it plays a prime role in the domain of human-machine communication. Smiley face expressions are generated by slimming down of facial muscles, which results in temporally buckled facial features such as eye lids, eye brows, nose, lips, and skin texture. These are evaluated by three characteristics: those portions of the face that will take part for facial action, the intensity of facial actions, and the dynamics of facial actions. In this paper we propose a real-time, accurate, and robust smile detection method based on genetic algorithm. We generated leaf-matrix to extract target expression. Finally, we have compared our methodology with the smile shutter function of Canon Camera. We have achieved better performance than Sony on slight smile.

Keywords

Leaf-matrix, genetic algorithm, pattern matching, smile detection.

I. INTRODUCTION

In the recent past many researchers are involved to extract the facial expression in a diversity of ways. There are two main methodological approaches to gauge the aforesaid three characteristics of facial expressions: sign-based approaches and judge-based approaches. The sign-based approaches are dealing with the facial actions in the way it is being coded, where the facial actions are extracted and described by their locations and intensities in the facial action-coding methodology

In this paper we propose a real-time, accurate, and robust smile detection methodology based on genetic algorithm. We have generated a leaf-matrix to take out target expression. Finally, we have made the comparison of our methodology with the smile shutter function of Canon Camera. Naturally we have proved that a better performance can be acquired with the help of smile shutter function than that of a Sony on slight smile.

Natarajan Meghanathan, et al. (Eds): SIPM, FCST, ITCA, WSE, ACSIT, CS & IT 06, pp. 31–37, 2012.
 DOI : 10.5121/csit.2012.2304

II. RELATED WORK

The problem related to smile detection is one of the ways we can recognize the facial expressions. There are many scholastic researches who have paved their ways on facial expression recognition, but there is not much researchers who have shown their interest in the process of smile detection. Sony's smile shutter algorithm and detection rate are not in the position to access fully. Sensing Component Company Omron has lately released smile measurement software. It can automatically detect and identify faces of one or more people and assign each smile a factor from 0% to 100%. Omron uses 3D face mapping technology and claims that its detection rate is more than 90%. But since it is not accessible and we are not in the position to test how it could be performed. Therefore, we have tested our program with normal camera and have proved that we have a better performance on detecting slight smile and lesser false alarm rate on grimace expressions.

III. GENETIC ALGORITHM

The modeling or representation of any problem related to a specific domain in module wise with the help of genetic algorithm demands tremendous effort along with full devotion. Modeling accompanies the selection of free model parameters, their genetic coding, and the formulation of an objective function in the optimized way.

A straightforward genetic algorithm can be represent- ted with the help of five steps as follows:

1. Initially, start with an arbitrarily generated population of N chromosomes, where N is the size of population, L length of chromosome C.

2. Compute the fitness value of function η(C) of each chromosome C in the population.

$$F(p)=\begin{cases} 0 & p=0 \\ F(p-1)+f(p-1) & 1\le p\le K_{\max}-K_{\min} \end{cases} ---(1)$$

Where $K_{\max}$ and $K_{\min}$ represent maximum and minimum intensity values.

Repeat until N off springs is created:

3. Probabilistically select a pair of chromosomes randomly from population in stock by using value of fitness function.

4. Construct an offspring Qm using crossover and mutation operators, where m = 1, 2, , N. WVDF filters use a positive real weight coefficient vector V= (V1, V2,….., VN) coupled of test images' vectors C1,C2,…..CN. Each weight-vector component consists of one image pixel. Weighted coefficients' vector is analogous to the feature vector considered for testing. The output of filter Q=Cm ∈ V minimizes the summation of the total angular distances to supplementary test images inside the window V.

$$\min \arg_{C_m \in V} \sum_{p=1}^{N} VpZ\ (Cm, Cp) \text{ for } m=1, 2, \ldots\ldots\ldots..,N \qquad \text{---------- (2)}$$

Where Z (Cm, Cp) represents the angle between the two color vectors CL= (Cm1, Cm2, Cm3) and

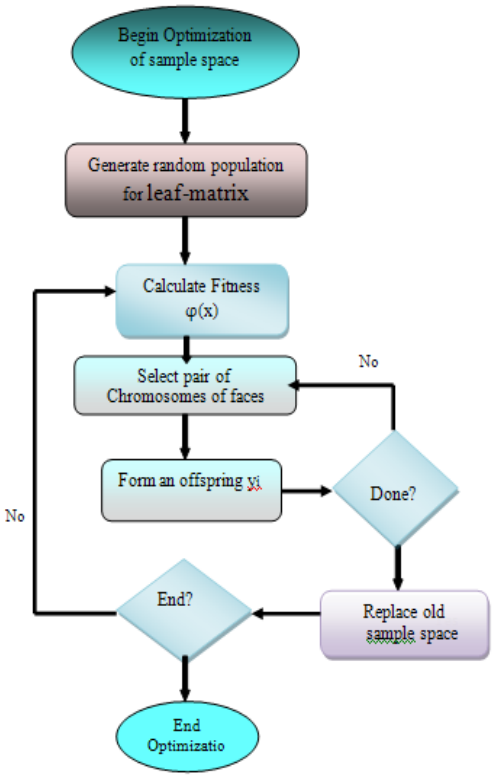
5. Replace present population with recently formed one.

6. Go to step 2.

III. A. TRIAL CODING

The fuzzy pattern matching methodology is considered in our study with the consideration of color based fuzzy segmentation and its implication. Although, it is obvious that this is quite simple method yet it is complex enough to solve the problem. Moreover, the FPM system is optimized to one target class at a time. The simpler the model is the faster and more reliable will be the optimization. This justifies the annulled of overindulgence free parameters such as conjunction method in the GA model. That is why a number of parameters can be preferred at random provided the results are satisfactory.

IV. FLOWCHART OF GENETIC ALGORITHM



V. FEATURES EXTRACTION

To extract features from a face firstly, we have to convert it the image into binary form. From this binary image the centroid (Y_m, Y_n) of the face image is calculated using equation below

$$Y_m = \frac{\sum pq}{\sum p} \text{---------(3)}$$

$$Y_n = \frac{\sum pt}{\sum p} \text{---------(4)}$$

where (Y_m, Y_n) is the co-ordinate value and

p = g (g, t) = 0 or 1.Then from the centroid, exclusively the face has been cropped and converted into the gray level and the features have been collected.

VI. EXPERIMENTAL RESULT

Now, Face images are used to test our proposed algorithm. First we have a get the Normal face (Fig1, Fig 3, Fig 5) and another Smile face (Fig2, Fig4, Fig6). Extraction a smile face based of Genetic Algorithm.

Fig1: Normal face

Fig2: Smile face

Fig3: Normal face

Fig4: Smile face

Fig5: Normal face

Fig6: Smile face

No. of Face Image	Successfully Recognized Smiley Face Image	Unrecognized Face Image	Efficiency (%)
7	5	2	71.42%
21	20	1	95.23%
25	17	8	68%
29	29	0	100%
34	31	3	91.17%
48	37	11	77.08%

Table I: Results for GA for Smiley Face extraction

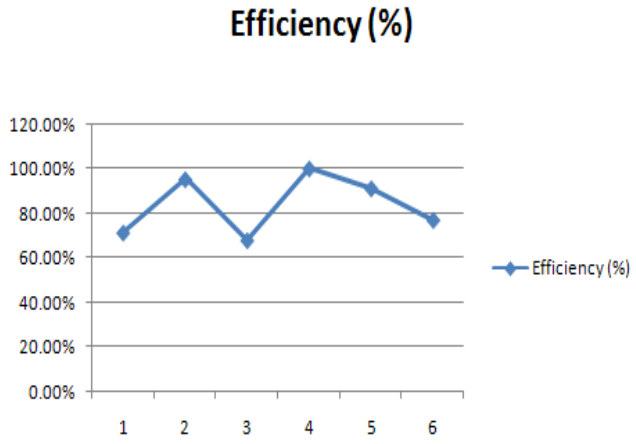


Table II: Efficiency Chart

VII. CONCLUSION

In our present thesis, a methodology of Smiley Face Recognition System using the concept of Genetic algorithm and leaf-matrix and digital image processing has been discussed. A static Smiley Face Recognition system has been developed here. The maximum efficiency is 100% for Face Recognition System by using Genetic algorithm and the minimum efficiency is 68% .The efficiency can be increased by using better face scanner, better technique of scaling, efficient technique of edge detection such as advanced edge detection technique and feature extraction of the face image.

REFERENCES

[1] J.T. Alander. Indexed bibliography of genetic algo-rithms in signal and image processing. University of Vaasa, Department of information technology and production economics, 2003.

[2] Rafael C. Gonzalez and Richard E Woods," Digital Image Processing Using MATLAB7", Person Education Asia.

[3] Charles L. Karr and L. Michael Freeman, "IndustrialApplications of Genetic Algorithms".

[4] S. Rajasekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms" Prentice-Hall of India Private Limited, 2003.

[5] Md. Murad Hossain and Md. Shamsul Alam,"BD FINE READER: A Bangla Character Recognition System for Converting Printed Bangla Text Documents into Editable Electronics Documents", ICCIT-2006.

[6] Y. Wang, H. Ai, B. Wu, and C. Huang, "Real time facial expression recognition with adaboost," in *Proceedings of the 17th International Conference on Pattern Recognition (ICPR 2004)*, 2004.

[7] M. Pantic and J. Rothkrantz, "Facial action recognition for facial expression analysis from static face images," *IEEE Transactions on Systems, Man and Cybernetics*, vol. 34, no. 3, 2004.

[8] Y. Tian, T. Kanade, and J. Cohn, "Recognizing action units for facial expression analysis," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 23, no. 2, 2001.

[9] A. Kapoor, Y. Qi, and R. Picard, "Fully automatic upper facial action recognition," in *IEEE International Workshop on Analysis and Modeling of Faces and Gestures*, 2003.

[10] I. Kotsia and I. Pitas, "Facial expression recognition in image sequences using geometric deformation features and support vector machines,"*IEEE Transactions on Image Processing*, vol. 16, no. 1, 2007.

[11] L. G. Shapiro, and G. C. Stockman, *Computer Vision*,Prentice-Hall Inc., 2001.

[12] R. Chellappa, C.L. Wilson, S. Sirohey (1995), "Human and machines recognition of faces: a survey", Proc. IEEE 83(5): 705-740.

[13] A.Samal and P.A.Iyengar (1992): "Automatic recognition and analysis of human faces and facial expressions: A survey. Pattern Recognition".

[14] Tian, Y., Kanade, T., Cohn, J.F.: Recognizing Action Units for Facial Expression Analysis. IEEE Transactions on Pattern Analysis and Machine Intelligence 23(2), 97–115 (2001).

[15] Tian, Y., Kanade, T., Cohn, J.F.: Robust Lip Tracking by Combining Shape, Color and Motion. In: ACCV 2000, pp. 1040–1045 (2000).

[16] M. Gudmundsson, E.A. El-Kwae, M.R. Kabuka. Edge detection in medical images using a genetic algorithm. IEEE transactions on medical imaging, 1998, Vol.17, No.3, 469 – 474.

[17] J. Guzaitis, A. Verikas. Image analysis and informa-tion fusion based defect detection in particleboards. Electronics and electrical engineering, Kaunas: Tech-nologija, 2006, No. 7(71), 67 – 72.

[18] N.R. Harvey, S. Marshall. The design of different classes of morphological filter using genetic algorithms. IEE fifth international conference on image processing and its applications, 1995, 227 – 231.

[19] J. Holland. Adoption in natural and artificial systems. The MIT press, 1975, 211.

Authors

Md. Alamgir Hossain has acquired the degree of MCA from University of North Bengal and M Tech from Bengal Engineering and Science University, Shibpur (BESUS),West Bengal. He is working his PhD in Computer Science and Engg. In the year 2012 from National Institute of Technology, Durgapur, India in the area of Image Processing .He is presently working as an Asst Professor of Calcutta Institute of technology under the department of MCA, Uluberia, Howrah, West Bengal, India. His areas of interest are Artificial Intelligence, Natural Language Processing and Image Processing.

Debabrata Samanta is a member of the IAENG, Board member of the Seventh Sense Research Group Journals (SSRGJ), member of Editorial Board of IJSCE. He obtained his B.Sc. (Physics Honors) in the year 2007, from the Vivekananda Collage,Takurpukur, under Calcutta University; Kolkata, India .He obtained his MCA in the year 2010, from the Academy Of Technology, under WBUT. He is working his PhD in Computer Science and Engg. In the year 2010 from National Institute of Technology, Durgapur, India in the area of Image Processing .He is presently working as a Guest Faculty of CSE in University Institute of Technology, Burdwan, West Bengal, India. His areas of interest are Artificial Intelligence, Natural Language Processing and Image Processing. He has guided 6 PG and 15 UG thesis. He has published 31 papers in International Journals / Conferences

Gautam Sanyal is a member of the IEEE. He has received his B.E and M.Tech degree from National Institute of Technology (NIT), Durgapur, India. He has received Ph.D.(Engg.) from Jadavpur University, Kolkata, India, in the area of Robot Vision. He possesses an experience of more than 25 years in the field of teaching and research. He has published nearly 98 papers in International and National Journals / Conferences. 3 Ph.Ds (Engg) have already been awarded under his guidance. At present he is guiding six Ph.Ds scholars in the field of steganography, Cellular Network, High Performance Computing and Computer Vision. He has guided over 10 PG and 130 UG thesis. His research interests include Natural Language Processing, Stochastic modeling of network traffic, High Performance Computing, Computer Vision. He is presently working as a Professor in the department of Computer Science and Engineering and also holding the post of Dean (Students' Welfare) at National Institute of Technology, Durgapur, India.