*R. KANDEMİR and G. ÖZMEN / IU-JEEE Vol. 13(2), (2013), 1667-1673*

# FACIAL EXPRESSION CLASSIFICATION WITH HAAR FEATURES, GEOMETRIC FEATURES AND CUBIC BÉZIER CURVES

Rembiye KANDEMİR[1], Gonca ÖZMEN[2]

[1]Computer Engineering Department,Trakya University, Turkey
[2] Computer Programming Department at Technical Science Vocational School, Kirklareli University, Turkey,
rembiyeg@trakya.edu.tr, gonca.ozmen@kirklareli.edu.tr

***Abstract:*** *Facial expressions are nonverbal communication channels to interact with other people. Computer recognition of human emotions based on facial expression is an interesting and difficult problem. In this study, images were analyzed based on facial expressions and tried to identify different emotions, such as smile, surprise, sadness, fear, disgust, anger and neutral. In practice, it was used Viola-Jones face detector used AdaBoost algorithm for finding the location of the face. Haar filters were used in finding the eyes and mouth. In cases where erroneous detection of the mouth and eyes, facial geometric ratios were used. Cubic Bézier curves were used in determining emotion. FEEDTUM facial expression database were used for training and testing. The seven different emotions used for the study, the recognition success rates ranged from 97% to 60%.*
***Keywords:*** *Emotion Recognition, Facial Expression Recognition, AdaBoost, Haar Features, Bézier curves.*

***Özet:*** *Yüz ifadeleri insanlar arası etkileşimde sözsüz iletişim kanallarıdır. Bilgisayarla insanın yüz ifadesine dayalı duyguları tanıma ilginç ve zor bir problemdir. Bu çalışmada resimlerdeki yüz ifadelerinden gülümseme, şaşkınlık, üzgünlük, korkma, iğrenme, kızgın ve nötr gibi farklı duygular tespit edilmeye çalışılmıştır. Uygulamada yüz yerinin bulunmasında AdaBoost algoritmasını kullanan Viola-Jones yüz detektöründen yararlanılmıştır. Gözlerin ve ağzın bulunmasında haar filtreleri kullanılmıştır. Ağız ve gözlerin hatalı tespit edildiği durumlarda, yüzdeki geometrik oranlarından faydalanılmıştır. Duygu tespitinde Kübik Bézier eğrileri kullanılmıştır. Eğitim ve test için FEEDTUM yüz ifadesi veritabanından yararlanılmıştır. Çalışma için belirlenen yedi farklı duygunun, tanıma başarı oranları %97 ile %60 arasında değişmektedir.*
***Anahtar Kelimeler:*** *Duygu tanıma, Yüz ifadesi tanıma, AdaBoost, Haar özallikleri, Bézier eğrileri*

## 1. Introduction

In face-to-face interactions, people express themselves through a number of different modalities, such as speech, facial expression, body gestures etc. Speaking is not only moving the lips, but also includes the eye-contact, eyebrow-raise, and other facial movements [1]. Facial expression is related to many sources used by human being as seen in Figure 1, From the psychology perspective, an emotion expressed by facial features deformation contributes to the communication between humans and can help in cases when the verbal communication is not sufficient or impossible to be performed.

In psychological research have established that the affective information in human communications is delivered at different ratio by different modalities: the verbal expression (i.e. spoken words) only accounts for 7% of the affective meaning of speakers' feeling and attitude. The vocal expression (i.e., prosody, stres, voice information) conveys 38%

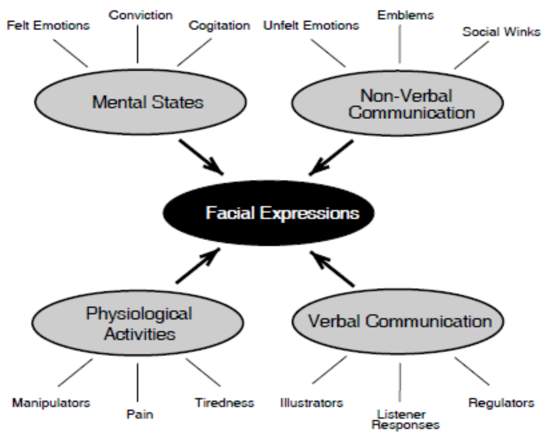



**Figure 1.** Sources of f acial expressions[2].

**Received on: 06.05.2013**
**Accepted on: 18.08.2013**

of the affective message. By marked contrast, the facial expression accounts for 55% of the affective information [3]. That means, facial expression is one of the most effective ways for human to express their intentions, attitude, inner emotional states and other nonverbal messages in speech communications.

The interface and interaction between humans and computers has received much attention nowadays of researchers in the computer vision community with a target focused on development a natural human interaction with the computers based on the normal human to human behaviour interaction.

Facial expression has studied for many researchers that work in different fields such as psychologists [3,5,6], biologists [7], computer engineers, and artists [8]. The studies on these fields can be classified as below: *Visual surveillance and security*(i.e. automatic assessment of boredom, inattention, and stress in situations where firm attention is essential) [11], *Driver safety* (i.e. an intelligent automobile system with a fatigue detector could monitor the vigilance of the driver and apply an appropriate action to avoid accidents) [13], *Medical diagnose* (i.e. diagnosing early psychological disorders, or identifying specific mental processes from facial expression)[12,14], *Emotion-related research* (behavioural science, neurology, psychiatry,etc): improving the processing of emotion data by providing more efficient, reproduceable and accurate measurements of emotional expressions) [5,6,7]. *Law enforcement*: providing reliable cues in establishing credibility and concealing deceit [9], *Education*: automated tutoring system that can recognize the emotional and cognitive states of pupils.

Different approaches have been tried in automatic facial expression analysis systems. Most approaches include three steps: face acquisition, facial extraction and representation, and facial expression classifier (Figure 2).

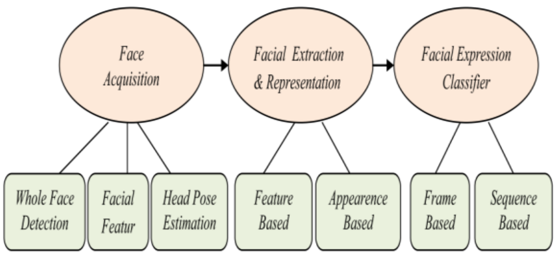



**Figure 2.** Basic structures of facial expression analysis systems.

First step, before a facial expression can be analyzed, the face must be detected in an input images or sequences. To handle large head motion, head tracking, and pose estimation can be applied to a facial expression analysis system. Second step, the extraction of the facial expression information from the video and localizing (in static images) or tracking (in image sequences) these features under different poses, illumination, ethnicity, age and expression. In facial feature extraction for expression analysis, there are mainly two types of approaches: geometric feature-based and appearance-based methods. The geometric facial features present the shape and locations of facial components, which are extracted to form a feature vector that represents the face geometry. On the other hand the appearance-based methods, using image filters such as Haar wavelets or Gabor wavelets, which generate the facial feature for either the whole-face or specific regions in a face image. The facial feature extraction process is followed by the recognition of the expression. This final step is a classification stage where the expression is classified into one of the predefined classes of expressions.

In this study, we used appearance-based (haar features) and geometric feature-based methods for extraction facial features. Then, we used Cubic Bézier curves for facial expression recognition.

## 2. Related Word

Many methods have been used in the past to classify emotional facial expressions, such as Artificial Neural Networks, Bayesian Networks, Support Vector machines, Optical Flow, PCA etc.[2]. In 2004, Ma and Khorasani [4] proposed facial expression recognition system using Constructive Fees Forward Neural Networks with accuracy in recognition rate is 93.75%. Cohen et al. [18] proposed a classification driven stochastic structure search algorithm for learning a Bayesian Network classifier to recognize facial expression from both labeled and unlabeled data. Zeng et al.[32] used Support Vector Data Description (SVDD) with Kernel Whitenning to avoid influence of nonhomogeneous data distributions in input space. The accuracy of a system is approximately 83%. Littlewort et al.[33] introduces method called AdaSVM where facial expression is represented by Gabor wavelet coefficients. Their study obtains 97% accuracy of generalization to novel subjects. Visutsak described the emotion classification through lower facial expressions using the Adaptive-Sapport Vector Machines (A-SVMs)**.** The system extracts the motion of eight feature points of a lower face, as displacements vector, and feed it into the A-SVMs classifier to categorize result expression. The average classification rate of all six basic emotions is 75% approximately [34]. Mase [35] used optical flow (OF) to recognize facial expressions. He was one of the firsts to use image-processing techniques to recognize facial expressions. Cohn et al. [36] developed geometric feature based system in which the optical flow algorithm is performed only in 13x13 pixel regions surrounding facial landmarks. Essa and Pentland [37] create the "face space" by performing Principal Component Analysis of eigenfaces from 128 face images. Face is detected in the image if its distance from the face space is acceptable. Facial geometry analysis has been widely exploited in facial representation, where shapes and locations of facial components are extracted to represent the face geometry [24,29,30,31]. Khan and Bhuiyan [19] presented a facial expression recognition system employing Bézier curves approximation technique. For face detection they used color segmentation and for facial features extraction used the knowledge of the face geometry and approximated by $3rd$ order Bézier curves representing the relationship between the motion of features and changes of expressions.Viola and Jones constructed a fast face detection system using rectangle features trained by the AdaBoost algorithm [16,17]. Wang et al. applied this method to facial expression recognition and distinguished 7 class facial expressions in real-time [20]. Adaboost algorithm has also been applied for facial expression recognition in [21,23].

## 3. Proposed Methodology

The inputs to our proposed automatic facial expression recognition algorithm are a sequence of images since dynamic images can provide more information about facial expressions than a single static image. Our algorithm includes the following three main steps: face detection, feature extraction and classification of facial expressions. The second step, feature exraction, contains two parts. Flow chart used for this study is shown in Figure 3.

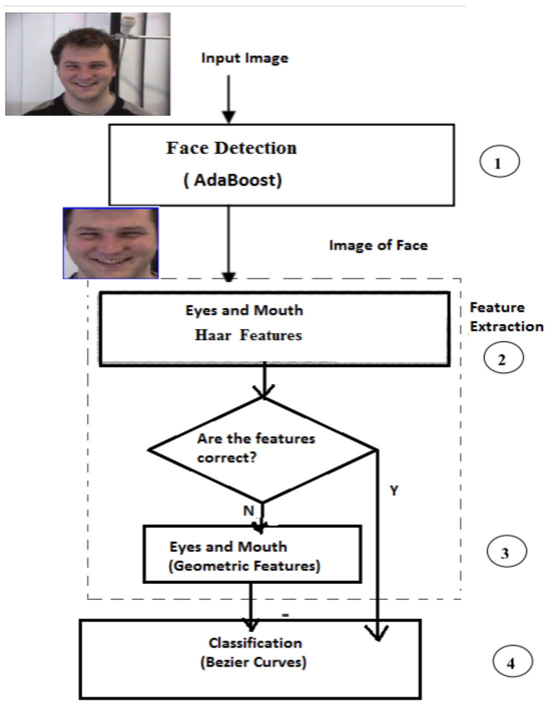



**Figure 3.** Flow chart of facial expression recognation.

### 3.1. Face Detection

Face detection is the first stage which is desired to be automated. In most of the research, face is already cropped and the system starts with tracking and feature extraction. In others, vision-based automated face detectors or pupil tracking with infrared (IR) cameras are used to localize the face. Alternatively, a face detector can be used to detect the faces in a scene automatically.

Some free face detection softwares are available to researchers for usage and improvement. Most popular of these is the face detector of Open Source Computer Vision Library (OpenCV) [15]. This face detector depends on Haar-like wavelet-based object detection proposed by Viola and Jones.

In this paper, we used the method proposed by Viola and Jones to detect faces from images and to extract facial features [16,17]. This face detection method can minimize computational time while achieving high detection accuracy.

### Haar Features

In 1998, Papageorgiou et al [26] proposed a method to analyze image features using a subgroup of Haar-like features, derived from the Haar transforms. This subgroup was extended later by Lienhart et al [10] to also detect small rotations of the sought-after object . The Haar-like features shown in Figure 4.

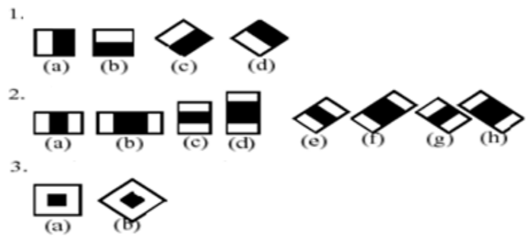



**Figure 4.** Haar features.

Viola and Jones constructed a fast face detection system using rectangle haar features trained by AdaBoost. The sum of the pixels which lie within the white rectangles are subtracted from the sum of pixels in the grey rectangles. Rectangle features can be computed very rapidly using an intermediate representation for the image called integral image. Using the integral image any rectangular sum can be computed in four array references. This is illustrated in Figure 5.

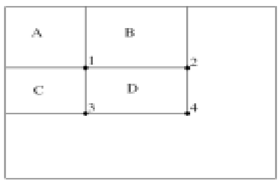
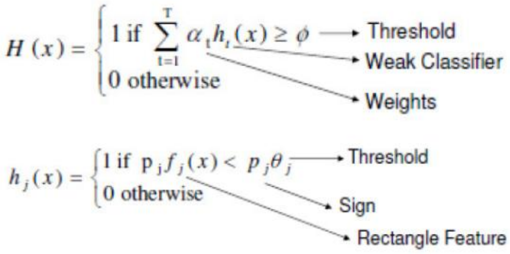



**Figure 5.** Calculation of the rectangular regions.

The value of the integral image at location 1 is the sum of the pixels in rectangle A. The value at location 2 is A+B, at location 3 is A+C, and at location 4 is A+B+C+D. The sum within D can be computed as 4+1-(2+3).

### Feature Selection Using AdaBoost

The AdaBoost boostining algorithm as a means of feature selection by constructing a weak classifier out of each Haar feature. Specifically, a threshold-based binary classifier is created from each Haar feature so that the weighted training error is minimized.




During each round of boostining, the single best weak classifier for that round is choosen. The final result of boostining is a strong classifier whose output is computed as a thresholded linear combination of the weak classifiers (see Figure 6).

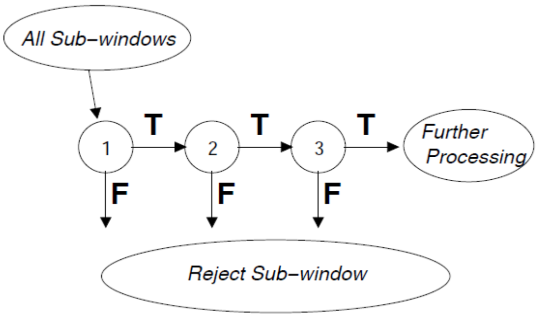



**Figure 6.** Cascade of classifiers [16].

## 3.2. Feature Extraction

After the face has been located in the image or video frame, it can be analyzed in terms of facial action occurrence. There are two types of features that are usually used to describe facial expression: geometric features and appearance features. Geometric features measure the displacements of certain parts of the face such as brows or mouth corners. Appearance features describe the change in face texture when particular action is performed. The task of geometric feature measurement is usually connected with face region analysis, especially finding and tracking crucial points in the face region. Possible problems that arise in face decomposition task could be occlusions and occurrences of facial expressions with hair or glasses. Furthermore, defining the feature set is difficult, because features should be descriptive and possibly not correlated [25].

In this study, both systems, geometric-based features and appearance-based features, were used for facial feature extraction. Firstly, location of eyes and mouth were dedected using haar features based on appearence-based methods. If facial features obtained from algorithm are not correct, then the other feature extraction algorithm is used for determining the location of eyes and mouth by using face geometry.

### 3.2.1. Haar Features

As mentioned in section 3.1, locations of eyes and mouth are detected using same Haar features. Finding of eyes and mouth location is shown in Figure 7. Determination of location of nose is not included for this study.

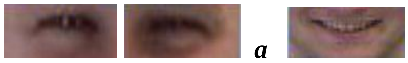



**Figure 7**. Segmented eyes in ***a*** and mouth in ***b*** by haar features.

### 3.2.2. Geometric Features

The feature vector that represents face geometry is obtained from facial components or face feature points. There are some exceptable well- proportioned features in human face as in human body. Some of gold proportions in human face are-(See. Figure 8) [27,28]:

- Face height/ Face width
- Lips-where the eyebrow joint/Length of nose
- Face height/the border of end point of chain between eyebrow
- Nose weight/distance of between two nostrils
- Distance of between pupils/distance of between two eyebrow

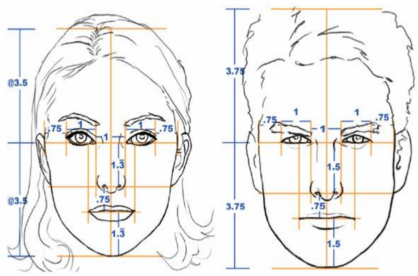


**Figure 8**. Face proportions.

Some ratios belong to head with face:

- Human eyes are located in half of head length
- Mouth, chin, and nose width is almost the same
- The width of each eye is width of the face 2/5 times as much
- The distance between the two eyes is the length of an eye.

In the study, these geometric ratios, eyes is located in half of head length, there is one eye distance between two eyes and face length is one and half times the width of face, are used determination of locations. Nose were excluded from the study.

## 3.3. Facial Expression Clasification

Last section of the proposed methodology includes the classification of expression. Bézier curves are used for classifing of expressions.

Bézier curves are the most fundamental curves, used generally in computer graphics and image processing. These curves are mainly used in interpolation, approximation, curve fitting, and object representation. Bézier curves are parametric curves which are pretty much customizable and smooth. They are well suited for many applications. They were named after Pierre Bézier, a French mathematician and engineer who developed this method of computer drawing in the late 1960s

Bézier curve is related to the most efficacious corners of poligon that is described with bezier curve. First and last corners of poligon exist on the curve. The other corners contribute to determine of ratio of curve and shape of curve can be described. Bézier curves are shown for different points in Figure 9 [28].

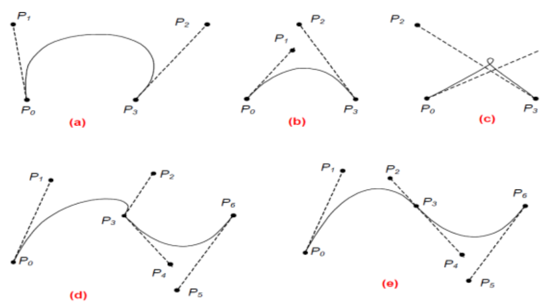
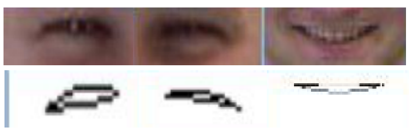


**Figure 9**. Examples of Bézier curves.

It is possible to use many control points for describing comprehensive Bézier curves. But, It is not prefered to increase the size of control points because of the commputational complexity. At the same time, increasing the degree of polinom makes the computation processes more difficult. To avoid this negativeness, detail curves are constituted by combining successively bezier curves which have four control points. For this reason, cubic Bézier curves are used more commenly than others Bézier curves are . The equation of Cubic Bézier curves is given in equation (1).

$$P(t) = \sum_{k=0}^{n} P_k B_k^n(t) = (1-t)^3 P_0 + 3t(1-t)^2 P_1 + 3t^2(1-t) P_2 + t^3 P_3 \quad (1)$$

Bezier curves which have four control points were used to determine facial expression for this study, expressions of eyes and mouth.(See Figure 10)



a

b

**Figure 10.** Facial featurs in ***a***, bezier curves in ***b***.

## 4. Feedtum Database

The main dataset employed in this study is the FEEDTUM facial expression database [22]. Because the basic facial expressions are annotated in the database manually, the FEEDTUM is widely used by researchers.

FEEDTUM Database consists of 10 male and 9 famale subjects, and all of subjects are from European. The subjects range in age from 20 to 35 years. The images size of Database are 320x240. The FEEDTUM database consists of approximately 5700 image sequences from 19 subjects. There are 3 sequences for each expression. Each sequence contained between 99-151 frames. The image sequences expressing different stages of an expression development, starting from a low arousal stage and then reaching a peak of arousal. The facial expressions of each subject represented seven basic emotions: neutral, anger, disgust, fear, happiness, sadness and surprise. The FEEDTUM facial expression data is built by image sequence as shown in Figure 11.

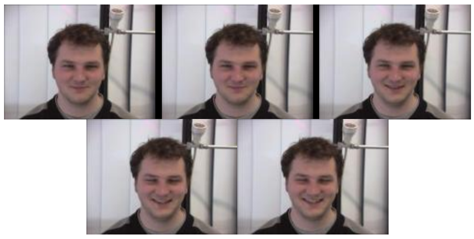


**Figure 11.** Sample image sequences of FEEDTUM facial expression database [22].

## 5. Implementation

EmguCV Library which OpenCV adopted in C# was used to face detection for this study [15]. Facial expression image sequences from the FEEDTUM database were used to train and test the facial expression recognition system. In this study, 580 images are selected randomly for training and 30 facial images for each facial expression are selected manually for testing of model accuracy. The training set contained approximately the same number of image sequences for each expression. The subjects represented in the training set were not included in the testing set of images.

## 6. Conclusion and Future Work

This paper presented an automatic system for facial expression recognition. A hybrid approach is used for facial features extraction as a combination between geometric and appearance facial features. Bezier curves are used for facial expression recognition. The proposed system was tested on FEEDTUM database. Different facial expression results obtained are 97% happiness, 77% neutral, 90% surprise, 71% sadness, 80% fear, 73% anger and 60% disgust respectively.(see Table 1.)

**Table 1.** Results of facial expressions recognition

| Facial Expression | Happiness | Neutral | Surprise | Sadness | Fears | Anger | Disgust | Accuracy % |
|---|---|---|---|---|---|---|---|---|
| Happiness | 36 | | 1 | | | | | 97 |
| Neutral | | 23 | 1 | 1 | | 2 | 3 | 77 |
| Surprise | | | 27 | | 1 | 1 | 1 | 90 |
| Sadness | 3 | 1 | | 22 | | 2 | 2 | 71 |
| Fears | 1 | | 2 | | 24 | 1 | 2 | 80 |
| Anger | 2 | | | 4 | | 22 | 2 | 73 |
| Disgust | | | 2 | | 9 | 1 | 18 | 60 |

The feeling of disgust, recognition success rate is low. Because, the system recognized it as a fear expression. The percentage of accuracy of happiness and surprise are high. Percentage of accuracy of each emotional expressions change based on facial expressions database and classification methods used for studies in literature. Results obtained in our study are about similar percentage of accuracy of previous studies (as mentioned in section 2).

In the future, we will try to improve accuracy of facial expression using more parameters of geometric features.

## 7. References


[1] Ekman, P., "About brows: emotional and conversational signals. In: Human ethology: claims and limits of a new discipline: contributions to the Colloquium", pp. 169–248. *Cambridge University Press,* England,1979

[2] B. Fasel and J. Luettin, "Automatic facial expression analysis: a survey," *Pattern Recognition*, vol. 1, no. 30, pp. 259–275, 2003.

[3] Mehrabian A**.**, "Communication without Words", *Psychology Today*, vol. 2,no. 4, pp. 53-56, 1968.

[4] L. Ma and K. Khorasani, "Facial Expression Recognition Using Constructive Feedforward and Neural Networks", *IEEE transactions on systems, man and cybernetics- part B: Cybernetics*, vol.34, No. 3, June 2004.

[5] Ekman, P., Rosenberg, E.L., "What the face reveals: basic and applied studies of spontaneous expression using the facial action coding system (FACS)", *Oxford University Press*, US, 2005

[6] Russell, J.A., Fernez-Dols, J.M. (eds.), "The Psychology of Facial Expression", *Cambridge University Press*, Cambridge, 1997

[7] Darwin, C., " The expression of the emotions in man and animals", *University of Chicago Press*, Chicago, 1965

[8] Faigin, G., "The Artist's Complete Guide to Facial Expression", *Watson-Guptill*, 2008

[9] Bartlett M, Littlewort G, Frank M, et al., " Automatic recognition of facial actions in spontaneous expressions [J]", *Journal of Multimedia*, 1(6): 22–35, 2006.

[10] R. Lienhart, J. Maydt. "An extended set of haar-like features for rapid object detection", *Proceedings of the IEEE International Conference on Image Processing*, Rochester, New York, vol. 1,pp. 900-903, 2002.

[11] Ryan, A., et al.,"Automated Facial Expression Recognition System", *Proc. Int. Carnahan Conf. on Security Technology*, 2009, p. 172-177.

[12] Ashraf, A.B., et al., "The painful face-Pain expression recognition using active appearance models", *Image and Vision Computing*, 2009. 27(12): p. 1788-1796.

[13] Vural, E., et al., "Automated Drowsiness Detection For Improved Driving Safety*", in Proc. of the Int. Conf. on Automotive Technologies* ,2008.

[14] P. Ekman, D. Matsumoto, and W.V. Friesen, "Facial Expression in Affective Disorders, What the Face Reveals", *P. Ekman and E.L. Rosenberg, eds*., pp. 429-439, 2005.

[15] OpenCv,*http://www.cognotics.com/opencv/servo_2007_series/part_2/sidebar.html#fig_1*(Access: 13.07.2012)

[16] Jones, M. ve Viola P., "Rapid Object Detection using a Boosted Cascade of Simple Features", 2001

[17] P. Viola and M. J. Jones, "Robust real-time object detection", *International Journal of Computer Vision*, Vol. 57, No. 2, p.137–154, 2004.

[18] Cohen, I., N. Sebe, F. G. Gozman, M. C. Cirelo, T. S. Huang, "Learning Bayesian network classifiers for facial expression recognition both labeled and unlabeled data", *IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, vol. 1, pp. I-595 - I-601, 2003

[19] Khan, M., İ., Bhuiyan A., "Facial Features Approximation for Expression Detection in Human-Robot Interface", *Sixth International Conference on Intelligent Information Hiding and Multimedia Signal Processing*, 2010

[20] Y.Wang, H.Ai, B.Wu, and C.Hung, "Real time facial expression recognition with adabost", *Proceengs of the 17th International Conference on Pattern Recognition*, vol 3, pp 926-929,2004

[21] J.Whitehil, C.W.Omlin, "Haar Features for FACS AU Recognition*", Proceengs of the 7th International Conference on Automatic Face and Gasture Recognition*, 2006

[22] *http://www.mmk.ei.tum.de/~waf/fgnet/feedtum.pdf* (Access: 13.07.2012)

[23] S. U. Jung, D.H. Kim, K. H. An, M. J. Chung, "Efficient rectangle feature extraction for real-time facial expression recognition based on adaboost", *IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS),* 2005.

[24] C.Shan, S.Gong, P.W. McOwan, "Facial expression recognition based on Local Binary Patterns:A comprehensive study", *Image and Vision Computing* 27 (2009) 803–816

[25] N.Sarode, S.Bhatia, "Facial Expression Recognition", *(IJCSE) International Journal on Computer Science and Engineering* ,Vol. 02, No. 05, 2010, 1552-1557

[26] C. Papageorgiu, M. Oren, T. Poggio, "A general framework for Object Detection", *Proceedings of the International Conference on Computer Vision*, Bombay, India, pp. 555-562, 1998.

[27] Kurt, B., "Bilgisayar ile psikolojik durum değerlendirmesi", Yüksek Lisans Tezi, *KTÜ Fen Bilimleri Enstitüsü Bilgisayar Mühendisliği Anabilim Dalı*, 2007

[28] G.Özmen, R.Kandemir, "Haar Dalgacıkları ve Kübik Bezier Eğrileri İle Yüz İfadesi Tespiti", *ELECO'2012*, Bursa/Türkiye, 2012

[29] Y. Tian, T. Kanade, J. Cohn, "Recognizing action units for facial expression analysis", *IEEE Transactions on Pattern Analysis and Machine Intelligence* 23 (2) (2001) 97–115.

[30] M. Pantic, L.J.M. Rothkrantz, "Facial action recognition for facial expression analysis from static face images", *IEEE Transactions on Systems, Man, and Cybernetics* 34 (3) (2004) 1449–1461.

[31] Z. Zhang, M.J. Lyons, M. Schuster, S. Akamatsu, "Comparison between geometry-based and Gabor-wavelets-based facial expression recognition using multi-layer perceptron", *in: IEEE International Conference on Automatic Face & Gesture Recognition (FG)*, 1998.

[32] Z. Zeng, Y. Fu, G. I. Roisman, Z. Wen, Y. Hu and T. S. Huang, "Spontaneous Emotional Facial Expression Detection", *Journal of Multimedia*, Vol. 1, No. 5, p. 1-8, 2006.

[33] G.C. Littlewort, M.S. Bartlett, J. Chenu, I. Fasel, T. Kanda, H. Ishiguro, J.R. Movellan, "Towards social robots: Automatic evaluation of human-robot interaction by face detection and expression classification", *Advances in Neural Information Processing Systems*, Vol 16, p. 1563-1570, 2004.

[34] P. Visutsak, "Emotion Classification using Adaptive SVMs", *World Academy of Science, Engineering and Technology 63*, 2012

[35] K. Mase, "Recognition of facial expression from optical flow", *IEICE Transactions*, pp. 3474-3483, 1991

[36] J.F. Cohn, A.J. Zlochower, J.J. Lien, and T. Kanade, "Feature-Point Tracking by Optical Flow Discriminates

Subtle Differences in Facial Expression”, *Proc. Int'l Conf. Automatic Face and Gesture Recognition*, p. 396-401, 1998

[37] I. Essa and A. Pentland, “Coding, Analysis Interpretation, Recognition of Facial Expressions”, *IEEE Trans. Pattern Analysis and Machine Intelligence*, Vol.19, No. 7, p. 757-763, July 1997

**Rembiye KANDEMİR,** received the Ph.D. degree in Computer Engineering from the University of Trakya, Turkey. She is currently an assistant professor in the Department of Computer Engineering, University of Trakya. Her research interests include image analysis, computer vision and machine learning applied to face and body gesture recognition, multimodal human-computer interaction HCI).

**Gonca ÖZMEN,** received B.S. degree in Computer Engineering Department at Kocaeli University, Turkey, and M.S. degree in Computer Engineering Department at Trakya University, Turkey. She is currently working in Computer Programming Department at Technical Science Vocational School, Kırklareli University, Turkey, as a lecturer.