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A Novel Approach to Real Time Face Detection and Recognition

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***Abstract*—** The proposed approach represents novel and simple model approach based on a mixture of techniques and algorithms in a shared pool based on Viola–Jones object detection framework algorithm combined with geometric and symmetric information of the face parts from the image in a smart algorithm. The study is a continued part of previous work, the proposed model is modestly applied with hundreds of face images taken under different lighting conditions, a number of general assumptions used in this research field are identified. The proposed algorithm goes beyond the limits of all existing technologies as it obtains the unique functional features by enabling the proposed model to work with different skin color tone, applying it to low-quality images, detecting faces with eye glasses, determining the position of facial parts (e.g. eye pupils, nose, lips, etc.) and detect several faces on one image is typically designed to deal with single images.

***Keywords*—**Face Detection, Face Recognition, Viola-Jones Algorithm, Object Detection

I. INTRODUCTION

In order to seek better face detection algorithm, this paper describes the use of new structure features which is more in line with face structure, and combined with the existing Haar-Like features by Adaboost a1gorithm to select features and build the cascade classifier. New features more in line with the texture features of the human face, it forms strong classifier can effectively exclude non-face faces a large number of similar background child window and keep high detection rate of the original algorithm. Under the same experimental conditions proposed by authors , using the same training samples to train two classifiers test containing 601 human face image the results show that, classifier based on the new features compared with the original Haar-Like feature classifier, the average detection rate is only 0.19% difference, the error detected total number of original Haar-Like features classifier, and the error detected total number of classifier based on the new features is dropped to 78, both the average detection time are respectively 374ms and 128 ms, this shows that, in this research work detection speed of algorithm is also not a small improvement. In detail, viola jones face detection algorithm and camshift has been adopted to obtain the face and recognition.

Feature selection in pattern recognition technique depends on the input data feature extraction process and the discrimination power of features in classification. The number of features required for recognition process is kept as small as possible due to the measurement cost and classification accuracy, which also useful to make the system work faster with minimal memory usage. Continuously, using a wide feature set causes "curse of dimensionality" being the need for growing number of samples exponentially

In the proposed approach of feature extraction, four different facial components - two eyes, nose and mouth of the face are extracted manually from pre-processed face image (all face images to be trained or tested in recognition process are cropped by using same corner points, „micro" function in MATLAB is being used for cropping required part from each face image). Dimensionality of these face components are then reduced by down sampling different face components with different resolution ratios based on significant of the component in recognition process. Then feature vector is obtained by scanning two dimensional image patches of different face components in lexicographical order and combining them into a column vector. The size of the final image column vector is N x 1, where N is the total number of pixels obtained from all the four image patches, N depends on the size of face image, resolution and down sampling ratios and which is very much less than the original full image data size.

The organization of the paper is as follows. Section II emphasizes on the proposed approach wherein the detailed explanation of the block schematic, proposed algorithm, pseudo code and testing of code is mentioned. Section III focuses on the obtained results wherein the obtained results

are compared with Viola Jones Method. Section IV describes the Conclusions followed by future scope of our approach.

II. PROPOSED APPROACH

A. Block Schematic of the Approach

The AT&T Dataset or Camera is used as input for this approach. The Face Identification block is used to first detect the face of specified user by ignoring the background details, then the identified single faced image is input for Face Registration block where the image is first register to database and then it is ready for scan the database image.

The scanned image is now used for feature extraction where various classification model is used to differentiate between the images using calculated distance measures. Now the Similarities Identification is used to identify the same similar image from database to show correctly identified person.

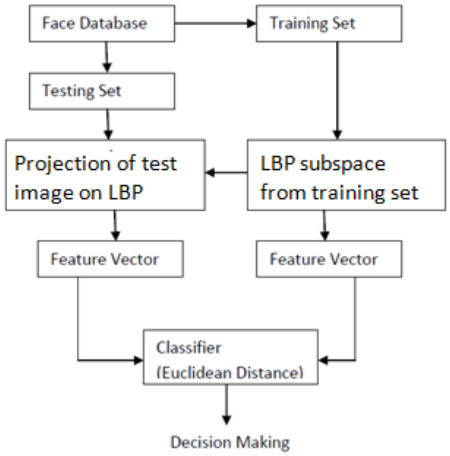

Figure 1: Block Schematic Approach for Face Detection

B. Algorithm

The proposed approach represents novel and simple model approach based on a mixture of techniques and algorithms as given as

Face Detection Algorithm (Real Time)

Step1: Select camera device and input resolution.

Step2: Specify Face registration for an detected facial image.

Step3: Scan database for newly registered image.

Step4: Get the current image from webcam for matching

i. Find similarities between current image and database image.

ii. If image identified in database go to step 5.

iii. If image not identified in database go to step2.

Step 5: Enter the identified person details into .mat file.

Step6: End of algorithm.

Figure 2: Algorithm of Real Time Face Detection

It is used to first select the camera device and input resolution to get facial image as an input. The specified Region of Interest (ROI) from an input image is identified to get required facial image. Then the database is scanned for newly registered image. Now the user required to detect the exact person record by using two different features that is, whether by using real time detection through camera or from a dataset.

The Viola-Jones object detection algorithm is used to identify different features from current image such as Frontal Face CART, Frontal Face LBP, Upper Body, Single Eye Pair, Eye Pair, Mouth, Nose etc. Then it is used to identify pair wise distance between pair of objects by computing Euclidean distance, it is nothing but calculating cluster points.

Face Detection Algorithm (Dataset)

Step1: Get the single faced image from dataset file.

Step2: Specify Face registration for an detected facial image.

Step3: Scan database for newly registered image.

Step4: Get the precaptured image from dataset for matching

i. Find similarities between current image and database image.

ii. If image identified in database go to step 5.

iii. If image not identified in database go to step2.

Step 5: Enter the identified person details into .mat file.

Step6: End of algorithm.

Figure 3: Algorithm of Face Detection using Dataset

Identify distance measures between two ehdHistograms which is used for calculating neighboring clusters by edge classification. The similarities are again calculated between pair wise and ehdHistograms followed by calculating mean and adjusting a threshold. The required similarities between Current image and Database image are sorted. Now the identified person details are identified from .mat file. The output shows the exact personal detail to be identified.

Three more detectors were introduced by the algorithm based on the ones already provided: left profile detector, tilt to right detector, and tilt to left detector. Left profile detector is based on the same classifier as right profile detector. However, before using the classifier the image is mirrored and only after that the classifier is applied.

If the face is found the coordinates of box containing the image are flipped back to correspond to actual image. Almost the same idea is used for two other new detectors. Tilt to right and tilt to left detectors are based on the frontal face classifier. However, in this case, the images are rotated by 30 degrees to left or to right.

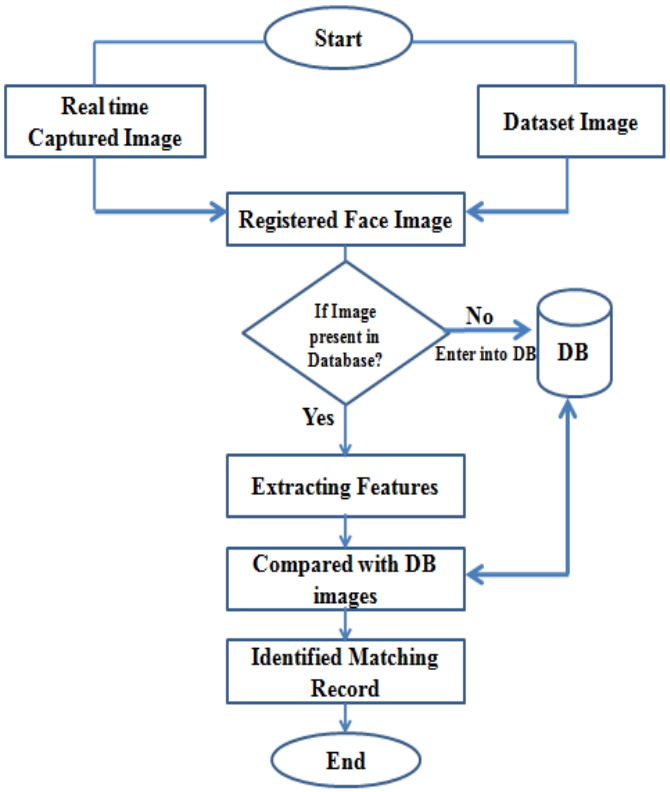

Figure 4: DFD for Face Detection & Recognition

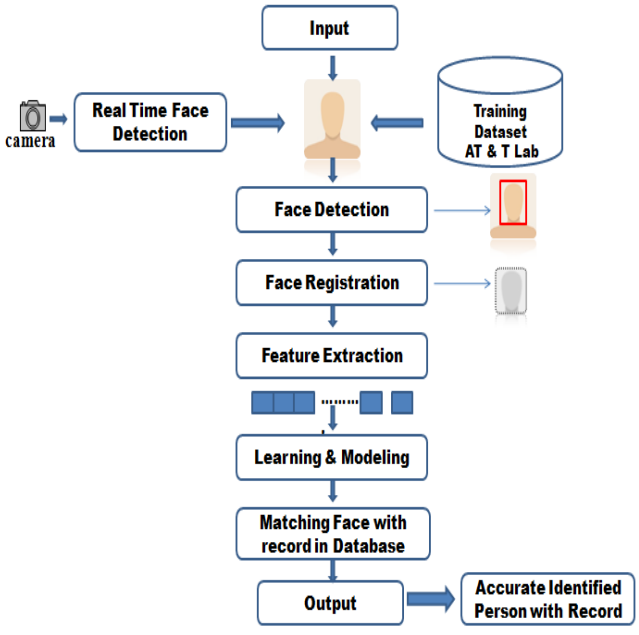

Figure 5: AFD for Face Detection & Recognition

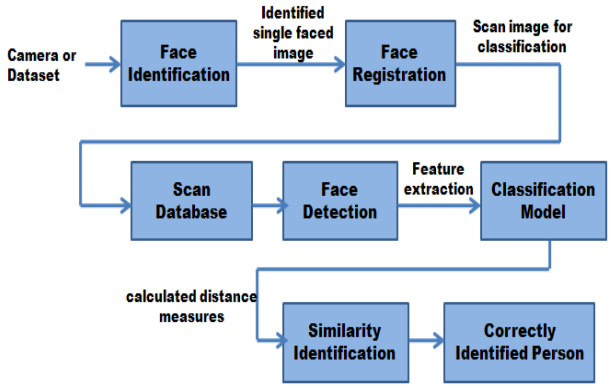

Figure 6: CFD for Face Detection & Recognition

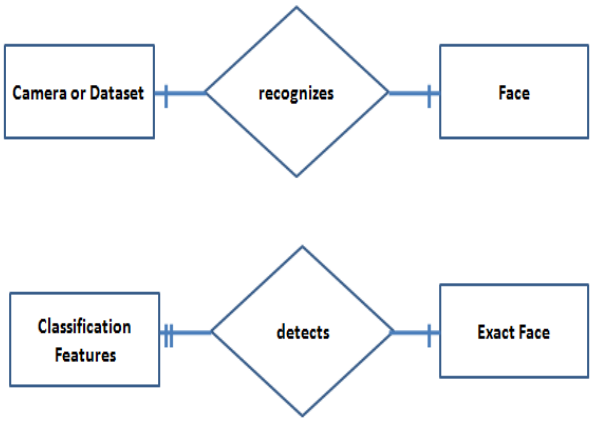

Figure 7: E -R Diagram for Recognition and Detection

C. Pseudo Code

The given code is used to detects faces that are upright and forward facing. This model is composed of weak classifiers, based on a decision stump. These classifiers use local binary patterns (LBP) to encode facial features. LBP features can provide robustness against variation in illumination.

1. fd = vision.CascadeObjectDetector();

2. did = cell2mat(did);

The Computer Vision System Toolbox cascade object detector can detect object categories whose aspect ratio does not vary significantly. Objects whose aspect ratio remains fixed include faces, stop signs, and cars viewed from one side. The vision.CascadeObjectDetector System object detects objects in images by sliding a window over the image. The detector then uses a cascade classifier to decide whether the window contains the object of interest.

The size of the window varies to detect objects at different scales, but its aspect ratio remains fixed. The detector is very

sensitive to out-of-plane rotation, because the aspect ratio changes for most 3-D objects. Thus, you need to train a detector for each orientation of the object. Training a single detector to handle all orientations will not work.

It create system objects which detects objects using Viola Jones Algorithm and provide various different classification model such as Frontal Face :- CART (Classification and Regression Tree Analysis) LBP(Local Binary Pattern), Upper Body , Eye Pair Single Eye Pair ,Profile Face , Mouth , Nose etc.

```
1. immxx = imx;
2. zz = findsimilar(immxx);
3. zz = strtrim(zz);
4. fxz = imread(['database/'  zz]);
5. q1= ehd(immxx,0.1);
6. q2 = ehd(fxz,0.1);
7. q3 = pdist([q1 ; q2]);
8. disp(q3)
9. if q3 < 0.5
10. axes(handles.axes2)
```

The cascade classifier consists of stages, where each stage is an ensemble of weak learners. The weak learners are simple classifiers called decision stumps. Each stage is trained using a technique called boosting. Boosting provides the ability to train a highly accurate classifier by taking a weighted average of the decisions made by the weak learners.

Each stage of the classifier labels the region defined by the current location of the sliding window as either positive or negative. Positive indicates that an object was found and negative indicates no objects were found. If the label is negative, the classification of this region is complete, and the detector slides the window to the next location. If the label is positive, the classifier passes the region to the next stage. The detector reports an object found at the current window location when the final stage classifies the region as positive.

The stages are designed to reject negative samples as fast as possible. The assumption is that the vast majority of windows do not contain the object of interest. Conversely, true positives are rare and worth taking the time to verify.

- A true positive occurs when a positive sample is correctly classified.
- A false positive occurs when a negative sample is mistakenly classified as positive.
- A false negative occurs when a positive sample is mistakenly classified as negative.

To work well, each stage in the cascade must have a low false negative rate. If a stage incorrectly labels an object as negative, the classification stops, and you cannot correct the mistake. However, each stage can have a high false positive rate.

- Load features and then calculate feature from image
- Indentify pair wise distance between pair wise object (It is nothing but calculating cluster points).
- Identify distance measures between two ehdHistograms which is used for calculating distance of neighboring clusters for edge classification.
- Calculate similarities between pair wise and ehdHistograms.
- Calculate mean of similarities by adjust threshold to 0.8.
- Sort similarities required.

D. Testing of Code

The varargout is an output variable in a function definition statement that allows the function to return any number of output arguments. Specify varargout using lowercase characters, and include it as the last output argument after any explicitly declared outputs. When the function executes, varargout is a 1-by-N cell array, where N is the number of outputs requested after the explicitly declared outputs.

```
1.  global co
2.  clc
3.  warning off
4.  st = version;
5.  if str2double(st(1)) < 8
6.  beep
7.  hx  = msgbox('PLEASE RUN IT ON MATLAB 2013 or Higher','INFO...!!!','warn','modal');
8.  pause(3)
9.  delete(hx)
10. close(gcf)
11. return
12. end
13. co = get(hObject,'color');
14. addpath(pwd,'database','codes')
15. if size(ls('database'),2) == 2
16. delete('features.mat');
17. delete('info.mat');
18. end
19. % Get default command line output from handles structure
20. varargout{1} = handles.output;
```

The Outputfcn field of options specifies one or more functions that an optimization function calls at each iteration. Typically, you might use an output function to plot points at each iteration or to display optimization quantities from the algorithm. Using an output function, you can view, but not set, optimization quantities.

III. EXPERIMENTAL RESULTS

The main panel is consisting of four sections with two individual buttons of Get Details and Check Database this is

used to generate the report and shows the content of database. The first section Face Recognition shows two option for user that is from camera or dataset. The scan database is used to validate the content of database each time it must needed to be scanned. Face Detection block is used to detect the exact face using real time and from dataset to get its specified record on second axes.

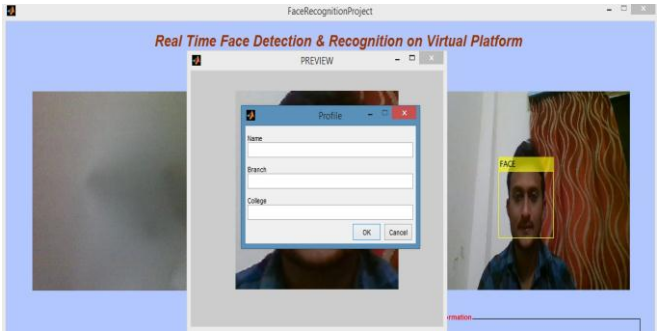

Figure 8: Face Registration

Face recognition panel is used to get the details from used to first register the individual record using two options that is from live camera or dataset so that record is get inserted into database with its default record content containing name, branch, and college name. This content is required to identify each person with its specified record.

Face detection panel second option is used to detect face of an individual from dataset with its database record. If the match is found depending upon the feature extraction and classification model it also used to differentiate the different possess of individual as shown in figure. This option is provided to test the efficiency of algorithm with precaptured or predefined set of record.

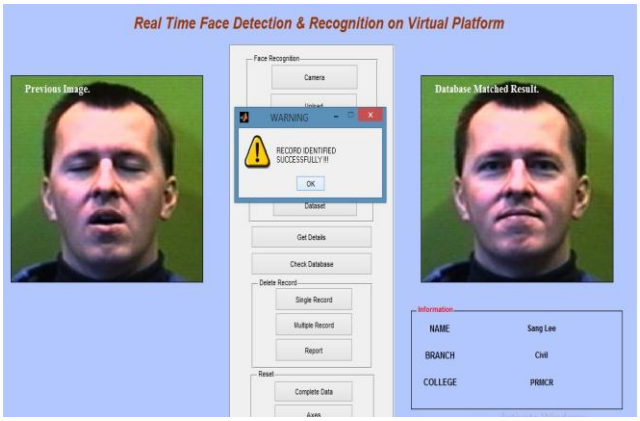

Figure 9: Dataset Matched Image

Face detection panel is used to detect the face image, where real time detection is used to detect the exact match of individual with live camera from database. The feature extraction technique of viola jones algorithm is used for this purpose which matches record based on its eyes, mouth, nose features, the exact record to be found from database with its details is showed in second axes as shown in above figure.

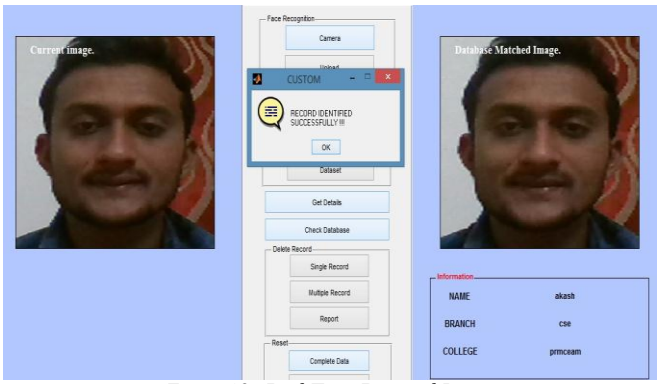

Figure 10 : Real Time Detected Image

Every time when individual is registered to this software their record with its specified details is inserted into database which is nothing but MATLAB .mat file which contain different cells depending upon number of rows and column specified by user. In this project we have 1 × 4 cell record contain details like image label, name, branch, college.

The model is able to detect approximately 5 times faster than Viola approach while the detection rate is improved about 37.2%. The second contribution of this study, is to build fully automated accurate human facial measurements systems from images or video with complex backgrounds. The experimental part in the study was implemented using MATLAB environment, presenting a set of experiments on a difficult face detection dataset which has been widely studied. This research work was initiated as a part of research project for Human Actions Detection in Content-based Video Retrieval System.

TABLE 1: Comparison of Face Part Detection Accuracy

Performance Evaluation Parameter	Viola and Jones System	Our Proposed Approach
False Positive Rate	30.09	10.94
False Negative Rate	8.09	2.07
Accuracy	61.81	98.98

From the above table, it is clear that our proposed approach has better accuracy when compared with Viola Jones System.

IV. CONCLUSION AND FUTURE SCOPE

A. Conclusion

The proposed approach shows that the algorithm is Face part division; based on physical approximation of location of eyes, nose and mouth on face and can find out the face part rapidly. It is also useful in a wide range. The resulting detector automatically returned bounding-boxes fitting detecting faces parts appearing in images. The proposed method improved

face detection especially for people in different poses and difficult backgrounds which reduces false negative rates and detected face poses from the images at different imaging resolution and at different lighting conditions.

B. Future Scope

In this paper, we performed set of experiments on a difficult face detection dataset and at real time which has been widely studied. The proposed work was initiated as a part of research project for Human Actions Detection in Content-based Video Retrieval System. In the future this algorithm will be an essential part of a system which will identify human presence in video stream.

REFERENCES

[1] A.Maghraby M.Abdalla O.Enany, "*Hybrid Face Detection System using Combination of Viola - Jones Method and Skin Detection"*, International Journal of Computer Applications (0975 – 8887) Volume 71– No.6, May 2013

[2] P. Viola and M. J. Jones, "*Robust real-time face detection*", International Journal of Computer Vision, 57 (2004), pp. 137–154.

[3] L. Sirovich and M. Meytlis. "*Symmetry, probability, and recognition inface space*", PNAS - Proceedings of the National Academy of Sciences,106(17):6895–6899, April 2009.

[4] Fugat Ashlesha G., Gaikwad Shital S., Gangurde Jyoti P. and Sawant Aishwarya S., "*A Survey on Secured Online Voting System Using Face Recognition*", International Journal of Computer Sciences and Engineering, Vol.3, Issue.9, pp.214-216, 2015.

[5] Prabhjot Singh and Anjana Sharma, "*Face Recognition Using Principal Component Analysis in MATLAB*", International Journal of Scientific Research in Computer Science and Engineering, Vol.3, Issue.1, pp.1-5, 2015.

[6] Phillip I.W.,Dr. John F. "*Facial Feature Detection Using Haar Classifiers*",Jcsc 21, (2006)

[7] Zhang, J., Yan, Y., and Lades, M., "*Face Recognition: Eigenfaces, Elas-tic Matching, and Neural Nets"*, Proc. IEEE, vol.85, no.9, pp.1423-1435, 1999

[8] Z.H. Zhou and X. Geng, "*Projection functions for eye detection*", Pattern Recognition 37, no 5, pp. 1049-1056, 2004

[9] Daugman J (2006) *"Probing the uniqueness and randomness of IrisCodes: Results from 200 billion iris pair comparisons*." Proceedings of the IEEE, 94(11),

[10] Albiol,A., Albiol,A., Oliver,J., Mossi,J.M.(2012), "*Who is who at different cameras: people re- identification using depth cameras*", Computer Vision, IET. Vol 6(5), 378-387.

[11] M. Hassaballah,KenjiMurakami, and Shun Ido, "*Eye and Nose Fields Detection From Gray Scale Facial Images*", MVA2011 IAPR Conference on Machine Vision Applications, June 13-15, 2011, Nara, JAPAN

[12] S.Gurumurthy,B.K.Tripathy, "*Design and Implementation of Face Recognition System in Matlab Using the Features of Lips*", I.J. Intelligent Systems and Applications,2012,8,30-36.

[13] A.Vora, A.Raj, K.Manikantan, and S.Ramachandran, "*Enhanced Face Recognition using 8-Connectivity-of-Skin-Region and Standard- Deviation-based-Pose-Detection as preprocessing techniques*", International Conference on Medical Imaging, m-Health and Emerging Communication Systems,pp.364-369, 2014.

[14] B. Dahal, AbeerAlsadoon, "*P.W.C. PrasadandAmrElchouemi, Incorporating Skin Color for Improved Face Detection and Tracking System*", 2016 IEEE Southwest Symposium on Image Analysis and Interpretation (SSIAI), pp.-173 – 176, 2016

[15] M. DwisnantoPutro, TeguhBharataAdji, Bondhan Winduratna, "*Adult Image Classifiers Based On Face Detection Using Viola-Jones Method"*, 2015 1st International Conference on Wireless and Telematics (ICWT), pp. 1-6

[16] Lin, S.-H., Kung, S.Y., and Lin, L.-J., "*Face Recognition/ Detection by Probabilistic Decision-Based Neural Network*", IEEE Trans. Neu-ral Networks, vol. 8, No. 1, pp.114-132, Jan. 1997

[17] Chellappa, R., Wilson, C.L., and Sirohey, S., "*Human and Machinr Recognition of Faces: A Survey*", Proc. IEEE, vol.83, pp.705-741, May 1995.

[18] Donghe Yang, Jinsong Xia, "*Face Tracking Based on CamshiftAlgorithm and Motion Prediction*", International Workshop onIntelligent Systems and Applications, 2009. ISA 2009.

[19] Corporation, *"Open Source Computer Vision Library Reference Manual*", 123456-001, 2001.

[20] G. R. Bradski. "*Computer vision face tracking for use in a perceptual user interface*", Intel Technology Journal, 2nd Quarter, 1998.

[21] Vikramsingh R. Parihar & Nileshsingh V. Thakur, "*Graph Theory Based Approach For Image Segmentation Using Wavelet Transform*", International Journal of Image Processing (IJIP), Volume (8) : Issue (5) : 2014

[22] Vikramsingh R. Parihar, Roshani S. Nage, Atul S. Dahane, "*Image Analysis and Image Mining Techniques: A Review*", Journal of Image Processing and Artificial Intelligence, MAT Journals Volume 3 Issue 2, 2017

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