International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

Design & Development of Face Detection based Online Attendance Management System

Prashant Sharma[1], Shubham Mittal[2], Sudhanshu Singh[3], Sumit Kumar[4], Binu Kuriakose Vargis[5]

[1]Student, Dept. of Information Technology, Inderprastha Engineering College, Uttar Pradesh, India
[2]Student, Dept. of Information Technology, Inderprastha Engineering College, Uttar Pradesh, India
[3]Student, Dept. of Information Technology, Inderprastha Engineering College, Uttar Pradesh, India
[4]Student, Dept. of Information Technology, Inderprastha Engineering College, Uttar Pradesh, India
[5]Professor, Dept. of Information Technology, Inderprastha Engineering College, Uttar Pradesh, India

---

Abstract - *Marking the attendance of students on a daily basis is a very common and important activity in schools and colleges for maintaining the record of students' presence. Manual Attendance maintenance is a difficult and time consuming process, especially for a large group of students. Some automated systems developed to overcome these difficulties but they have drawbacks like cost, fake attendance, low accuracy, intrusiveness. And to overcome these drawbacks, there is a need for a smart and automated attendance system. The existing face recognition systems employ methods to identify faces from the given input images or videos but the accuracy or precision level is not upto the level as desired. The system described in this paper aims to move from these existing systems and introduce a new approach to identify a person using a face recognition system which will generate a facial Model along with the working of this face recognition system which can be deployed in any classroom environment.*

Key Words: Face Recognition, Face Detection, Convolution Neural Network, Haar Classifier, Cascading Classifier, Feature Extraction

1. INTRODUCTION

Face recognition is an important application of Image processing owing to its use in many fields. Identification of individuals in an organization for the purpose of attendance is one such application of face recognition. Maintenance and monitoring of attendance records plays a vital role in the analysis of performance of any organization. The purpose of developing attendance management systems is to computerize the traditional way of taking attendance. Automated Attendance Management System performs the daily activities of attendance marking and analysis with reduced human intervention. The prevalent techniques and methodologies for detecting and recognizing faces fail to overcome issues such as scaling, pose, illumination, variations, rotation, and occlusions. The proposed system aims to overcome the pitfalls of the existing systems and provides features such as detection of faces, extraction of the features, detection of extracted features, and analysis of students' attendance. The system integrates techniques such as image contrasts, integral images, color features and cascading classifier for feature detection. The system provides an increased accuracy due to use of a large number of features (Shape, Color, LBP, wavelet, Auto-Correlation) of the face. Better accuracy is attained in results as the system takes into account the changes that occur in the face over the period of time and employs suitable learning algorithms.

2. LITERATURE SURVEY

A Chris Xiaoxuan Lu(et-al), 2019 used Ambient Wireless Cues approach. In this work, they described Auto Tune, a novel pipeline to simultaneously label face images in the wild and adapt a pre-trained deep neural network to recognize the faces of users in new environments.

Xi Peng (et-al), 2017 The State University of New Jersey proposed a new reconstruction loss to regularize identity feature learning for face recognition and also introduced a data synthesization strategy which will enrich the diversity of pose without requiring any additional training data.

Chaoyang Zhang (et-al), 2013 used Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), and Elastic Bunch Graph Matching (EBGM) approach resulting detection accuracy was 95% proved. Also Salem Alelyani, Huan Liu used a Filter-based feature selection approach which resulted in very high accuracy, 99%.

Viola(et-al), 2001 Adaboost and Haar cascade method brought together new algorithms and insights to construct a framework for robust and extremely rapid visual detection. The system was definitely different from the previous approaches in its ability to detect faces extremely rapidly. Operating on 384 x 288-pixel images, faces were detected at 15 frames per second on a 700MHz Intel Pentium 3 Processor.

3. METHODOLOGY

Our system mainly consists of four fundamental processes namely face detection, face alignment, face cropping and feature extraction. Face alignment and feature extraction is the crucial task in the face recognition systems.

3.1 Creating the dataset

The dataset is created using the webcam or the camera attached to the computer.

The camera will take 30 samples of photos per person and store it in the dataset. And We will provide a unique id number to each person in the dataset.

3.2 Face detection

The next step is face detection. The faces are detected by using the Viola-Jones face detection algorithm. It involves four steps:

i. Haar-like features ii. Integral image

iii. Adaboost training iv. Cascading classifier

3.2.1 Haar feature selection

All human faces share some comparable properties and Haar like features use those properties to extract features. And those features are obtained by calculating the differences in the black and white portion of the image. Some of these types of features are shown in fig 3.

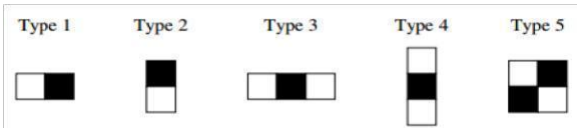


Fig-1: Different type of Haar features

We will use the two rectangle Haar like features. Some of those comparable properties common to human faces are:

1. The eye region is often darker than the nose and upper-cheeks.
2. The eyes are even darker than the bridge of the nose.

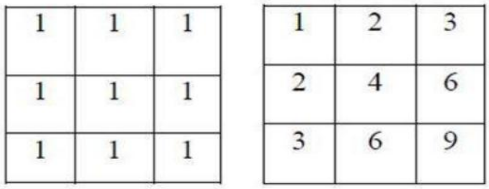
Composition of properties forming matchable facial features are:

- Location and sizes of: eyes, mouth, bridge of nose
- Value: oriented gradients of pixel intensities

The system takes an image, converts it into a 24X24 window and smears each Haar feature to that window pixel by pixel. The value calculated by applying Haar features is**- Σ (pixels in white area).**

3.2.2 Integral images

The second step of the Viola-Jones face detection algorithm is to convert an input image into an integral image as shown in fig 4. The integral image at the location (x,y) contains the sum of the pixels to the above and to the left of (x ,y).



(a) (b)

Fig-2: (a) input image (b) integral image

This simplifies the calculation of the addition to the entire pixels within any specified rectangle using only four values. In the integral image, these values are the pixels that resemble the edges of the rectangle in the input image.

3.2.3 Adaboost machine learning method

Even if we consider a 24X24 window as the base window size to evaluate all the features in an image then we will have 160,000+ features, but all the features are not important to us. So we eliminate some features which are not important.

Adaboost helps in choosing only the most outstanding features from 160,000+ features. After these features form a weighted arrangement of all the features which are used in gaging and deciding any given window has face or not. These features are called weak classifiers.

3.2.4 Cascading Classifier

The cascading classifier helps in employing an efficient way to apply the features in different stages so as to save time and find positive regions(regions with faces) more effectively. The work of this stage is to combine the weak classifiers and perform extraction.

3.3 Feature Extraction

Feature extraction from the facial images is the most crucial task in face recognition and features are extracted by a convolutional neural method,this is a variance of deep learning. Since deep learning neural networks are the best solution for object detection, pattern recognition and face recognition.

Convolutional neural network is one of the widely used deep neural networks because it is well adapted to the translation invariance of images.

How does CNN work?

So basically, Convolution neural network has following layers:

i. Convolution layer ii. ReLU layer

iii. Pooling layer iv. Fully Connected layer

3.3.1 Convolution layer

The steps involved in Convolution layer are:

1. First we need to line up the feature and image.
2. Multiply the image pixel with the corresponding feature pixel.

After the multiplication we will follow one more step.

3. Add them up and divide it by the total number of pixels in the feature.

After that we need to create a map and put the value of the filter at that place and follow the same process for the other features or filter, sliding the filters throughout the image and we will obtain matrices for different filters we have chosen in the convolution layer and these matrices with be the output of convolution layer.

3.3.2 Rectified Linear Unit layer

The ReLU layer is used to remove the negative values from the filtered images and replace it with the zero's and this is done in order to avoid the summing up to zero. This function works with the use of a threshold that is if an input value is zero, then the output is zero, but if the input value rises above a certain threshold then it has a linear relationship with the dependent variable.

$$f(x) = \begin{cases} 0 \text{ if } x<0 \\ x \text{ if } x >=0 \end{cases}$$

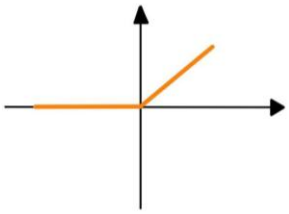


Fig-3: Threshold function graph.

Table -1: Threshold function table

x	f(x) = x	F(x)
-3	f(-3) = 0	0
3	f(3) = 3	3
-5	f(-5) = 0	0
5	f(5) = 5	5

So, we are using this ReLU layer to remove all the negative values from our output that we got from the convolution layer.

3.3.3 Pooling layer

We use Pooling layer to shrink the image stack into a smaller size and for this we follow some steps which are:

1. We pick a window size (usually 2 or 3).
2. Pick a stride (usually 2).
3. Walk the window across the filtered images.
4. From each window, take the minimum value.

Finally, after doing this process for the entire image we will obtain a matrix of small size and similarly for all the features we will get the shrinked matrices and now comes the difficult part of stacking up of these Convolution layer, ReLU layer and Pooling layer. And performing the functions of these layers again we will obtain a more shrunken image.

3.3.4 Fully Connected layer

This is the final layer where the classification actually happens and we take the filtered and shrinked images and put them on a single list.

From this list we can see that there will be some element in the vector which will be high. And for different images, there will be different elements that will be high.

4. IMPLEMENTATION

This system uses a webcam (or any other image input source) to capture images for the dataset. After that it will extract the features from the input image using haar like features and store it in the dataset.

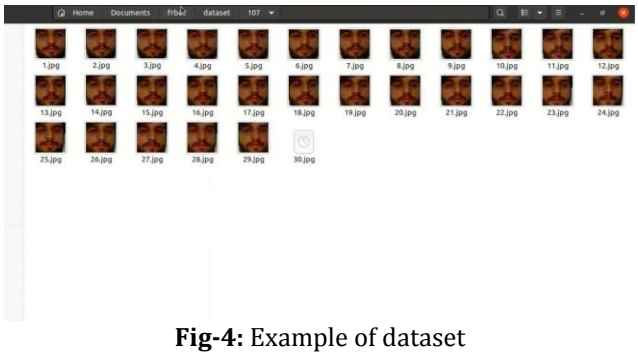


Fig-4: Example of dataset

Now we will further proceed to training the dataset in which each image from the dataset will be processed in CNN and its corresponding output will be stored in a trained dataset that is encodings.pickle.

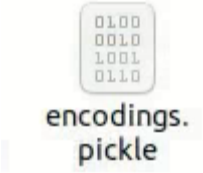


Fig-5: Trained dataset file

This encodings.pickle file will store the information of each image from the dataset.

In the recognition part, the input provided using a webcam or any other device will be processed in CNN and its features will be extracted then these features will be matched with the features of trained dataset. If the extracted features have high confidence value with the trained dataset features, then we can suggest that the face in the input image belongs to the particular person in the dataset.

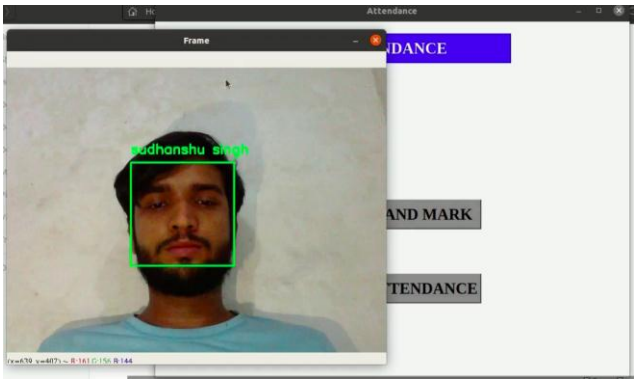


Fig-6: Illustration of facial recognition

5. RESULT

We evaluated the false alarm on the dataset for face recognition.
False alarm is the major of likelihood that the recognition system will incorrectly accept an unauthorised person. It is the ratio of the number of false acceptance to the number of recognition attempts.

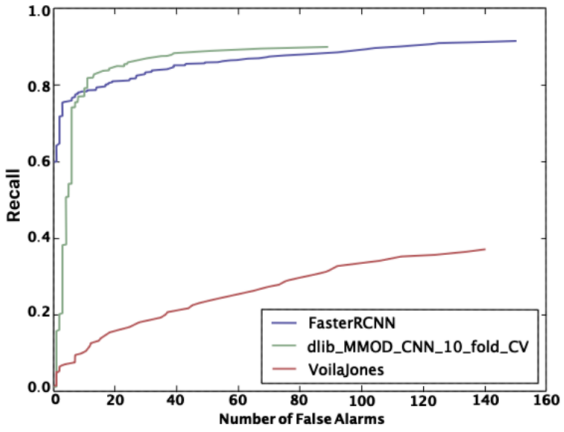


Fig-7: Accuracy comparison of different algorithms

6. CONCLUSION

This paper proposes a novel method for face recognition for effective recognition of the person.
We have addressed the advantages of the CNN approach in minimization of analytic functions. In the future, it will extend to address the problems by pose variation and intensity variation.

ACKNOWLEDGEMENT

The authors would like to extend their esteemed thanks to Mr. Binu Kuriakose Vargis, Professor, IT Department, IPEC. Special thanks to Dr. Pooja Tripathi, HOD, IT Department, IPEC.

REFERENCES

[1] M. Turk, A. Pentland, Eigenfaces for Recognition, Journal of Cognitive Neuroscience, Vol. 3, No. 1, Win. 1991, pp. 71-86.

[2] B.S. Manjunath, R. Chellappa, and C. von der Malsburg, “A Feature based approach to face recognition,” Proc. IEEE CS Conf. Computer Vision and Pattern Recognition, pp. 373-378, 1992.

[3] C. Kotropoulos and I. Pitas, “Rule-based face detection in frontal views,” Proc. Int’l Conf. Acoustics, Speech and Signal Processing, vol. 4, pp. 2537-2540, 1997.

[4] E. Saber and A.M. Tekalp, “Frontal-view face detection and facial feature extraction using color, shape and symmetry based cost functions,” Pattern Recognition Letters, vol. 17, no. 8, pp. 669-680, 1998.

[5] Face Recognition Using Line Edge Map Yongsheng Gao, Member, IEEE, and Maylor K.H. Leung, Member, IEEE (IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 24, NO. 6, JUNE 2002) 28.

[6] Discriminant analysis for recognition of human face images Kamran Etemad and Rama Chellappa.

[7] Sanjay singh et.al, “A robust skin color based face detection algorithm”, Tamkang Journal of Science and Engineering vol.6, no.4,pp227-234, 2003.

[8] OpenCV. Available: http://sourceforge.net/projects/ opencv library/.

[9] Activity zones for context-aware computing, Lecture Notes in Computer Science, Volume 2864/2003, pp. 90-106, 2003.

[10] Z. Zhou, X. Chen, Y. â“C. Chung, Z. He, T. X. Han, and J. M. Keller, "Activity analysis,summarization, and visualization for indoor human activity monitoring,â IEEE Transactions on Circuits and Systems for Video Technology, Volume 18, Issue 11, pp. 1489- 1498, 2008.

[11] Jose M.Chaves-Gonzalez, Miguel A Vega-Rodríguez,Juan A.Gomez-Pulido,Juan M.Sanchez-perez,” Detecting skin in face recognition systems: A color spaces study”, Digital signal processing, 20(2010) 806-823.

[12] Technical Paper on â_ Image Based Intelligent Attendance Logging System, IEEE Technical Paper by Hary Oktavianto, Hsu Gee-Sern Chung Sheng-Luen, June 30-July 2, 2012, Dalian,China.

[13] International Journal of Information Technology and Knowledge Management JulyDecember 2012, Volume 5, No. 2, pp. 361-3639(Face Recognition Techniques: Classification and Comparisons).

[14] Face Recognition using Line Edge Map Vipin Kumar and Mohit Mehta Department of Electronics and Communication, Punjab College of engineering and technology, India Accepted 01 January 2014, Available online 10 January 2014, Vol.2 (Jan/Feb 2014 issue).

[15] International Journal of Computer Applications (0975-8887) Volume 98-No.20,July 2014(Adjacency Matrix based Face Recognition Approach).

[16] International Journal of Advanced Computer Research (ISSN (Print): 2249-7277 ISSN (Online): 2277-7970) Volume-4 Number-4 Issue-17 December-2014 939 Study of Face Recognition Techniques Sangeeta Kaushik1*, R. B. Dubey2 and Abhimanyu Madan3.

[17] International Journal of Innovative Research in Computer and communication Engineering(Vol.3,Issue 8,Aug 2015)(Automated Attendance System Using Face Recognition).