Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

EXPERIMENTAL INVESTIGATIONS TO FACE RECOGNITION USING OPENCV FOR MONITORING TURNOUT TIME

[1]DR. J. RAVINDRA BABU, [2]MR. TATA BALAJI, [3]DR. SURYA PRASADA RAO BORRA, [4]DR.S. HRUSHIKESAVA RAJU [5]M. VENKATA SUBBA RAO, [6]DR. A.GEETHA DEVI [*]DR K KOTESWARA RAO

[1]Associate Professor, Dept of ECE, PVP Siddhartha Institute of Technology, Vijayawada India.
[2]Sr. Assistant Professor, Dept of ECE, PVP Siddhartha Institute of Technology, Vijayawada India.
[3]Assoc Professor, Dept. of ECE, PVP Siddhartha Institute of Technology, Vijayawada. India.
[4]Assoc Professor, Dept. of CSE, Koneru Lakshmaiah Education Foundation, Vaddeswaram, India.
[5]Dept.of ECE, Shree Vishnu Engineering College for women, Bhimavaram, India.
[6]Associate Professor, Department of ECE, PVP Siddhartha Institute of Technology, India.
[*]Dept. of CSE, PVP Siddhartha Institute of Institute of Technology, Vijayawada, India.

E-mail: jrb0009@gmail.com, balu170882@gmail.com, suryaborra1679@gmail.com, hkesavaraju@gmail.com, mandava.decs@gmail.com, geetha.agd@gmail.com, koteswara2003@yahoo.co.in,

ABSTRACT

Face Recognition is becoming an increasingly important technology in the present world. There are various types of biometric identifications including DNA, fingerprints, signature recognition, hand geometry, palm print, etc. For this type of recognition, some action has to be done by the user like placing a finger on the machine to detect. While, Face Recognition does not require any user actions. So, we can say that face recognition is one of the most successful biometric identification methods. We have been already engaging with facial recognition in our daily life without even realizing it. Face recognition plays a vital role in fields such as identifying the retail crimes, finding missing person, to help the blind, protects law reinforcement, aids forensic investigations, to diagnose diseases, unlocks smart phones, facilitates secure transactions, validates identity at ATMs, control access to sensitive areas and a lot more. The challenge that can be encountered in face recognition is to detect the face from single image that is stored in the database. Face detection is a challenging task as the faces are not rigid and they will be changing in size, shape, colour, etc. Face detection become more challenging task when given image is not clear and not containing a proper lightning, not facing camera etc.

In this work we are building a face recognition system for monitoring turn out time using OpenCV. A facial recognition system is a computer application. This technology is used for identifying or verifying a person from a digital image. This digital image can be obtained from a video frame or from live images detected by the camera/webcam. Facial recognition involves two stages. First we have to detect the face. For this process, a photo is searched to find a face, after finding the face in the image, the image is processed to crop and extract the person's face in a square box. And the second phase is Face Recognition, where the face detected by the above process is compared with the images in the dataset, to decide who that person is. In this work, we are using the HOG (Histogram of Gradients) algorithm. A Face can be detected by cropping the face and removing the noise using the HAAR cascade classifier. Later the features of the face can be extracted by using the HOG extractor. Then we will run an SVM model for face recognition. The results show that the system can recognize the faces captured automatically by the camera are accurate and efficient

Keywords: *Open CV, Face Recognition. Monitor*

1. INTRODUCTION

1.1 What is Face Recognition?

We humans can recognise the faces that are very familiar to us. Although we may fail or confuse to recognise people sometimes. Sometimes we remember that we have seen the person but fail to recollect their name. In this model what we are going to do is recognising faces with the help of computer. Face Recognition is a system that is used to confirm or identify the identity of an individual.

The picture of the individual may be captured live using a web cam or it can be an image that is recorded through a video [1][2].

It was believed that Woodro Wilson Bledsoe was the father of face recognition. He used tablet named as RAND to record the coordinates of the face. This tablet is equipped with a stylus that releases electromagnetic waves. He used that system to manually record the coordinates then by making use of database he tried to recognise the faces but it does not able to produce accurate results. Later many people proposed their systems in the field of face recognition. Now even Facebook also uses the face recognition that help the people to detect the faces in the images uploaded by the Facebook users [7].

There are different kinds of techniques used to implement a facial recognition system like HOG algorithm, R-CNN (region based convolution neural networks). The image-based face recognition is widely divided into four categories like holistic method, feature based method, model-based method, hybrid method. Holistic methods take whole face as input and face recognition is done by converting them into vectors. There are different types of holistic methods like Eigen faces, principal component analysis (PCA), Linear discriminant analysis (LDA) etc. The second category is feature based methods. From the name itself we can understand that these methods extract features of the face for face recognition. The third category is model based methods. These methods train a model and introduce face into the model. The parameters in the model will be used to recognise the face. Hybrid methods use a combination of holistic and feature extraction methods.

In this paper we are using HOG algorithm for the purpose of face recognition. It basically involves two stages face detection and face recognition. Face detection can be done by removing unnecessary or noise from image. For this purpose we are using HAAR cascade classifier. Classifier means a model or an algorithm that classifies the given input to different categories based on attributes. There are different types of classifiers like naïve Bayes, perceptron, Decision trees, logistic regression etc. The use of classifier depends on the problem to be solved. Likewise we are using HAAR cascade classifier for face detection. Once the face is detected we are extracting the features from the face using HOG (Histogram of Oriented Gradients). Here gradient is nothing but an arrow like structure used to identify the basic structure of face including the position of eyes, lips, nose etc. Then we are using SVM (Support vector Model) to recognise the face and produce the recognition label (here the label is the name of identified person). SVM is a well-known machine learning approach used for classification and regression problems. Support vector machine is used to analyse data and classifies the data using a hyper plane concept that is used to draw a line between two classes. This line will act as separator between the two classes.

When we see a person we try to store the picture in our memory so that when we again see that person we can be able to recollect. Now our question is how actually the computer be able to see?

1.2 OpenCV

At first OpenCV is used as Intel research initiative in CPU intensive application. It was officially launched in 1999. The first major version is OpenCV 1.0 was released in the year 2006. The second major version is OpenCV 2.0 was released in October 2009. Later in 2012 it was taken by a non-profitable that is open-source organisation OpenCV.org.

The full form of OpenCV is open-source computer vision. It is a machine learning library that is used to provide the environment to build computer vision applications and to enhance the way computers are being used in the field of computer vision. OpenCV is used for duplicating the human vision using computer hardware and software. It is also used for reconstructing and understanding the three dimensional images from its 2 dimensional images. It may look similar to image processing .But image processing means image to image transformation, whereas computer vision produces the interpretation of structures in three dimensional scene. Computer vision is a field of study of how computers sees and understands the digital images and videos. It also involves seeing, sensing what it has seen and extracting the useful information that will be used in different machine learning activities [9][8][13][16][18].Because of these advanced features it has future scope. It can be used in different fields like face recognition to identify the identity of an individual, self- driving vehicles to capture the obstacles that come in the way, and also in the field of robotics as the robot need to see its surroundings etc[21][32][32-34].

2. LITERATURE SURVEY

Mohammed Kabiru Halidu, et'al proposed a Face Recognition with the Image Enlargement Technique. It uses Principal Component Analysis (PCA) algorithm for the purpose of

face recognition. Face recognition is being used in the fields of security and entertainments. Recognizing the person through the surveillance system has become difficult due to the low quality of the footage caused by distance and angle of the camera. To overcome this difficulty, the image resolution has to be enhanced for the accurate recognition of a person. Then this enhanced image is compared with the images in the database and can identify the individuals. In this research, for the purpose of image enlargement, three well know techniques namely Nearest Neighbour, Bilinear and Bicubic are investigated. First, an input image is down sampled to six different resolutions. The down-sampled image is then enlarged to its original size using above mentioned three image enlargement techniques. The enlarged image is then used as input to the PCA face recognition system for the process of recognizing the person. The results from the SC Face database shows that PCA based face recognition gives great results when the input images are enlarged using Nearest Neighbour technique, whereas the performance of Bicubic and Bilinear techniques is slightly lower than Nearest Neighbour method.

I Gede Pasek Suta Wijaya, et'al proposed a Face Recognition system using Discrete Cosine Transforms (DCT) coefficients-based face descriptor. The face descriptor consists of dominant frequency content extracted by discrete cosine transforms (DCT), shape information extracted by hu-moment and local features information extracted by zone DCT. The aim of this DCT coefficients-based face descriptor is to obtain the great results for real-time face recognition. In this research, dimensional size of face descriptor is decreased by using Predictive Linear Discriminant Analysis (PDLDA) and the KNN is implemented for verification. From accuracy, false negative and positive data, the proposed real time face recognition seems to provide good performances.

Changjiang Jiang, et'al proposed a Face Recognition system based on sparse representation and feature fusion to improve the accuracy of face recognition. Firstly, the training samples and test samples are pre-processed by Gray image conversion, histogram equalization, scale scaling, smooth filtering. Secondly, the LBP, Gabor and HOG features of face images are extracted. And then the RSC classification test is carried on the partial samples. A loss function is defined according to the recognition result and the classification residual, then the weight vector is obtained by using the regularized least square method to minimize the loss function. Finally, the final residual is calculated according to the weight vector so as to obtain the final classification result. The experimental results on AR face dataset and LFW face dataset show that the accuracy rate of this algorithm is higher than the single feature recognition method.

Jiang Xiao, et'al proposed Face Recognition algorithm based on Prewitt and Convolutional Neural Network (CNN) to increase the rate of recognizing the faces. For this process at first, image has to be pre-processed by the histogram equalization and Prewitt operator. And then, the pre-processed images are used as input to the CNN for training and exponential decay method is used to set the learning rate to improve the convergence rate. It used L2 regularization and Dropout methods are used to prevent overfitting.

Liping Chang, et'al proposed a Face recognition system based on Stacked Convolutional Auto encoded and Sparse Representation (SCAE) is used to extract the deep features as the features extracted by traditional methods are simple and elementary. Sparse representation is a general classification algorithm which has shown the good performance in the field of have shown that the proposed system can give more deep and abstract features and has high accuracy.

Face recognition system based on improved Local Binary Pattern Histogram (LBPH) algorithm is proposed by Xu Mei Zhao and Cheng Bing Wei. LBPH algorithm is a simple face recognizing system which gives decreased recognition rate under the conditions of illumination diversification, expression variation and attitude deflection. In order to prevail over this problem, a modified LBPH algorithm based on pixel neighbourhood Gray median (MLBPH) is proposed. The Gray value of the pixel is replaced by the median value of its neighbourhood sampling value and then the feature value is extracted by the sub blocks and the statistical histogram is established to form the MLBPH feature, which is used to recognize the human by comparing it with images in the database. Experiments are carried on FERET standard face database and the results show that MLBPH algorithm produces better results

compared to LBPH algorithm in recognition rate.

Yerzhan Kerimbekov, et'al proposed a face recognition via Lorentzian metric. In this system, a new Lorentz Face Recognition (LFR) method based on special properties of Lorentz space was developed. The proposed method produces a similarity value for new test sample according to Lorentz distance. A similarity value is determined by nearest neighbour method as 1 or 0, namely, the true or false face image respectively. Moreover, we propose the Lorentz Feature Selection (LFS) based on Lorentz metric. The LFS is used for dimensionality reduction. The experimental results taken from face data sets show that the proposed LFR method is usable.

M. Sushama, et'al proposed a Face Recognition using DRLBP and SIFT feature extraction. To yield the better performance of face recognition, various computational and mathematical models are proposed for classifying the faces including Scale Invariant Feature Transform (SIFT) and Dominant Rotated Local Binary Pattern (DRLBP). In this paper, the authors have proposed a novel method of classifying the human face using Artificial Neural Network (ANN). At first the images of face need to be pre-processed and then the face features are extracted using SIFT. Then the detection of human faces is done using Back Propagation Network (BPN). The process of combining SIFT and DRLBP gives better accuracy, rather than using them separately.

Vinita Bhandiwad, et'al proposed a Face recognition and detection using neural networks. As, Face detection is one of the challenging problems in Image processing. It is the first step towards creating an automated system which may involve other face processing. The neural network is created & trained with training set of faces & non-faces. Later all the results are implemented in the MATLAB environment.

The Automatic attendance management system using face detection which is proposed by S. Hema Latha, et'al proposed about the biometric attendance management. This helps in replacing the manual method i.e., the attendance without human interference. Here a camera is fixed and it will capture the image, the faces are detected and then it is recognized with the database and finally the attendance is marked. If the attendance is marked as absent the message about the student's absent is send to their parents. There are various methods for comparing the faces. Here they used Eigen face method where Eigen faces set of Eigen vectors which are used in computer vision.

The Face detection and recognition using Raspberry Pi is proposed which by Ishita Gupta, et'al is to explore the feasibility of implementing Raspberry Pi based face recognition system using conventional face detection and recognition techniques such as Haar detection and PCA. This mainly aims at taking face recognition to a level in which the system can replace the use of passwords and RF I- Cards for access to high security systems and buildings. With the use of the Raspberry Pi kit, helps in making the system cost effective and easy to use, with high performance.

S. N. Sujay, et'al proposed Face recognition using extended LBP features and multilevel SVM classifier. They proposed a novel method for Face recognition by using features of extended LBP. The LBP is applied to each 3×3 matrix obtained from detected face through Viola-Jones algorithm to get the features. The Face image is rotated for 15 different angles and LBP Features are taken, then SVM is used for classification for FERET and Yale face database. The parameters such as FAR, FRR, TSR and EER are measured.

As, there is a requirement of feature extraction in such a way that it reduces the chance of data redundancy and system complexity. Ravi Kanth Kumar, et'al proposed Enhancing Face Recognition through Overlaying Training Images. This presents a facial recognition technique by inclusion of superimposed version of all relevant images which improves the accuracy of the model by roughly 43 percent. The algorithm aims to establish the importance of superimposition strategy in the field of face recognition. The HAAR feature based classifier is used, where a cascade function is trained from a set of images.

Face detection and recognition using Open CV which is proposed by Maliha Khan and Rani Astya where PCA (Principal Component Analysis) is one of the methods of facial recognition system. PCA helps to reduce the large amount of data storage to the size of the feature space that is required to represent the data economically. The wide 1-D pixel vector made of the 2-D face picture in compact main elements of the space function is designed for facial recognition by the PCA. This is called a

projection of self-space. The proper space is determined with the identification of the matrix's own vectors, which are centred on a collection of fingerprint images. A camera-based real-time face recognition system is developed and set an algorithm by developing programming on OpenCV, HAAR Cascade, Eigenface, Fisher Face, LBPH, and Python.

3. MOTIVATION BEHIND THE WORK

In today's worlds security is one of the major issue. There are many technologies being developed to enhance the security issues. One of the technology is face recognition. Why it has more significance means it does not need any wanted action from the user in the process of identification. Using this technology many real world cases are being solved like criminal identification etc. Now we are going to discuss about the different techniques of face recognition and the limitations of these techniques. One of the technique used to implement face recognition is principal component analysis (PCA). Principal component analysis uses eigen vectors for the purpose of removing noise and then by using eigen faces generated it will magnify the image to recognise. It does not extract any facial features. Proper centred face is necessary that means it can be able to recognize the face in only front view. It also fails to recognise the faces in different orientations and lightning conditions. In this proposed work we are overcoming this limitation.

Linear discriminant analysis is also used for face recognition. In this technique projections of images are defined by fisher faces and this is known as fisher space. When we want to recognise a face it is fed into the fisher space and then uses KNN (k nearest neighbours) algorithm for identification. It works better under lightning conditions but accuracy is a limitation.Face recognition is also done by using artificial neural networks. A function named as radial basis function artificial neural network is integrated with a non-negative function matrix factorisation. For the simplification of this process computation has been speed up. It is used for recognising face images with partial distortion and occlusion. The main disadvantage of this approach uses more number of samples which makes it more complex. The results are also not accurate.

In this work we are using HOG algorithm for the purpose of face recognition. It basically involves two stages face detection and face recognition. Face detection can be done by removing unnecessary or noise from image. For this purpose we are using HAAR cascade classifier. Once the face is detected we are extracting the features from the face using HOG (Histogram of Oriented Gradients).Then we are using SVM (Support vector Model) to recognise the face and produce the recognition label (here the label is the name of identified person). The proposed system have following extra feature like Face recognition with high accuracy, Also introducing attendance system to record turnout time, recognising the face in different lightning conditions and different orientations.

4. DESIGN AND TECHNICAL DESCRIPTION

The block diagram of the model is as follows:

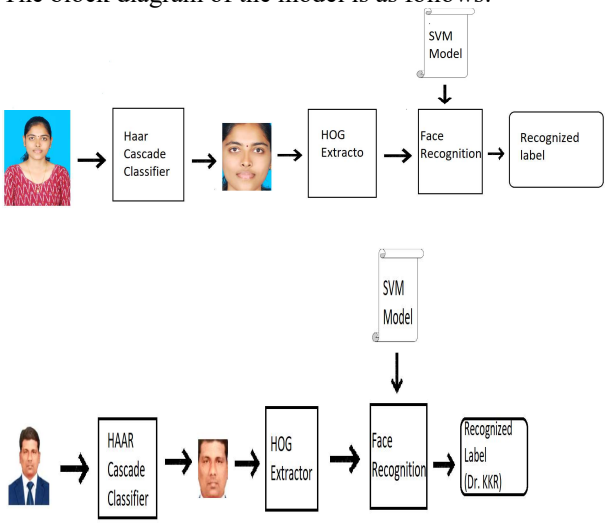

Figure 4.1 Block Diagram

In the above block diagram we can see the flow of process. First we provide image then the HAAR cascade classifier will detect the face by removing noise. Later HOG extractor is used to extract the features and SVM model is used to recognise the face and provide name of the person as recognized label.

OpenCV has more than 2500 libraries that consists of different machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track moving objects, extract 3D models of objects, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, etc.

Different features of OpenCV library are capture video and images, processing images means like filtering and transforming, read and write images, detection of faces, objects, eyes, cars etc in the image, analysing video in slow

motion etc. Some of the main libraries are highgui, objdetect, features2d, calib3d, video I/O, video etc.

OpenCV is also used by companies like Google, IBM, Microsoft. The real time applications of OpenCV are, detecting intrusions in surveillance video in Israel, monitoring mine equipment in China, helping robots navigate and pick up objects at Willow Garage, detection of swimming pool drowning accidents in Europe, running interactive art in Spain and New York, checking runways for debris in Turkey, inspecting labels on products in factories around the world on to rapid face detection in Japan. It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and MacOS. The required modules are

5. PROBLEM METHODOLOGY AND SOLUTION

Here, we are going to explain the step by step process of the model.

5.1 PROVIDING INPUT:

The first and the fore most step in any of the model is to provide the input. There are many kinds of input like the input may be in form of text, numbers, images etc depending on the type of the problem. As our problem is face recognition we are taking the images of the people as input to our problem.

Figure 5.1 Input image Figure 5.2 Input image

5.2 Face Detection:

In order to recognise the face first we have to detect where the face is located in the image. Because we always not make sure that the provided image consists of only the face of the person. There may be some other objects in the image. Moreover, many of the images will contain the entire image of the person. But we do not need the entire image of the person to recognise his/her face. So we need to remove the unnecessary things in the image. This step is known as removing noise or noise removal. Noise is nothing but the corrupted pixels in the image that may lead to inaccurate results. Noise can be created during the time of photo capture or during the time of the transmission. Here we are going to use HAAR cascade classifier for the purpose of face detection.

5.3 Haar Cascade Classifier:

Paul Viola and Michael Jones in their paper "Rapid object detection using boosted cascade of simple features" discussed about the HAAR cascade classifier in the year 2001. A cascade function is used to train lot of positive and negative images. Positive images are the images contain the images which we want our classifier to identify. Negative images are the Images of everything else, which do not contain the object we want to detect. For the purpose of noise removal HAAR features are used. Different HAAR features are edge features, line features, four rectangle features. HAAR Cascades use the ADABOOST learning algorithm which selects a small number of important features from a large set to give an efficient result of classifiers. HAAR features are used to detect the features in the given image. Each feature produces a single value calculated by subtracting the number of pixels under the white rectangle from the number of pixels under the black rectangle. HAAR like features is done on the image to detect human faces starting from the upper left corner and ending in the lower right corner. Scanning is done several times to detect human faces in an image.

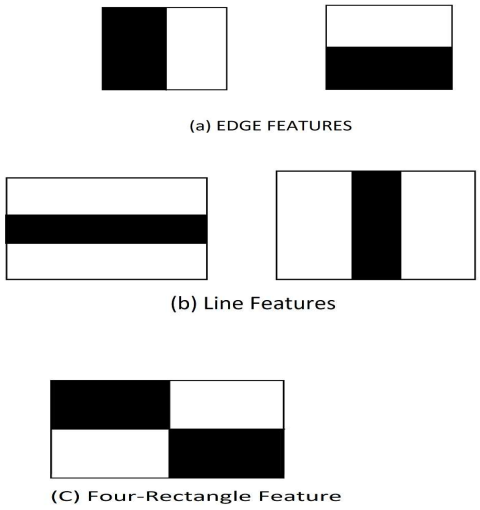

Figure5 .3 Haar Features

By applying the above features the result will be as following.

Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Figure 5.4 HAAR features applied to input image (Fig: 6.1)

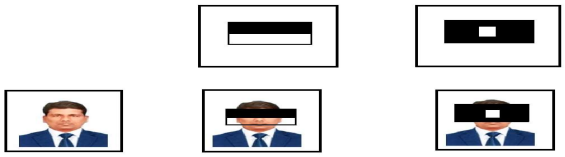

Figure 5.5 HAAR Features Applied To Input Image(Fig: 6.2)

The flow of process in HAAR cascade is as shown in the below figure.

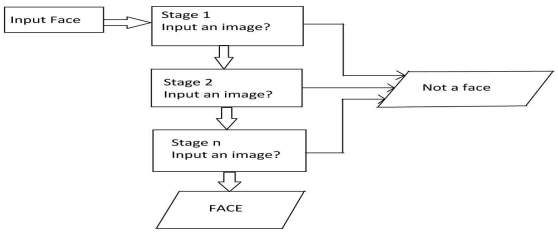

Figure 5.6 Flow Chart of HAAR classifier

The process of flow in HAAR cascade classifier is as shown in above figure. First it will take the input and try to detect whether it is a face or not. If it is not a face then it will exit from the algorithm. Otherwise it will be passed on to the next stage to detect face.The output of the above step will be as shown in the picture:

Fig:5.7 Output Of Face Detection Stage (Fig 6.1) *Fig:5.8 Output Of Face Detection(Fig 6.2)*

5.4 HOG (Histogram of Gradients Algorithm):

Now we will take the detected face and extract features from the face using histogram of gradients. For that first we need to find the gradients in the image. We all know that image is a collection of pixels. When we move from left to right pixel by pixel, we will find that after some steps, there is a sudden change in the pixel value i.e, from a black pixel (lower pixel number) to a white pixel (higher pixel number). This sudden change in the colour is called a gradient and going from a darker tone to a lighter tone is called a positive gradient and vice versa. From left to right gives us the horizontal gradient and as expected going from top to down gives a vertical gradient.

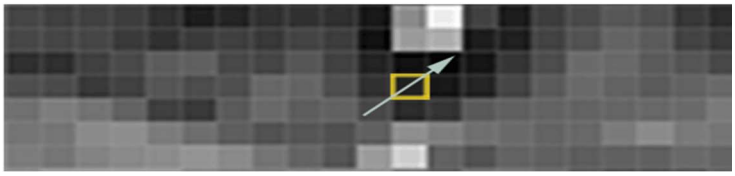

Figure 5.9 Pixel Representation Of Image

The end result gives the basic structure of a face in a simple way.

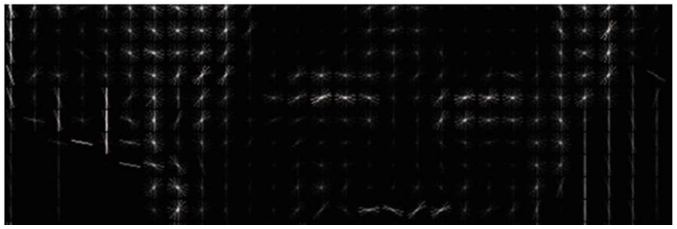

Figure 5.10 Marking Gradients

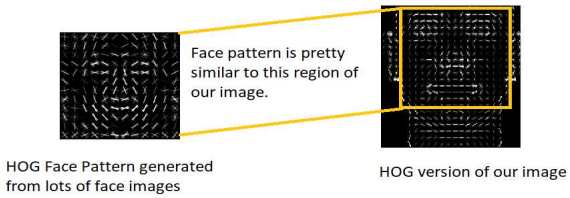

Figure 5.11 HOG Representation

The position of the image is not always the same. In some images the face of the person may be slightly tilted or only the side portion of the face may be visible. Even in that case also we should be able to recognise the face. For that reason, we wrap each picture so that the eyes and lips are always in the sample place in the image. We will come up

Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

with 68 specific points (called *landmarks*) that exist on every face like the top of the chin, the outside edge of each eye, the inner edge of each eyebrow, etc.

Figure 5.12 Face Landmarks Estimation

Now we will generate the features of the face that means measurements of the face.

Figure 5.13 Generating measurements of above image

These are the 128 Measurements Generated from above Image.

0.05159706622362 0.15245945751667
0.09749608486890 0.10281457751989
0.00403376808390 -0.01941452734172
0.04522323608398 0.020220354199409
0.10904195904732 0.06030917912721 -
0.00980397313833 0.061989940702915
-0.0198147725313 0.02353501506149 -
0.12113650143147 0.065554238855839 -
0.0572239346802 0.04674149677157
0.12262628972539 -0.024210374802351
-0.0614187717437 0.03675030916929 -
0.05813925713300 0.125671759247783
0.14114324748516 0.00936793349683 -
0.04854054003953 -0.061901587992907 -
0.0110141513869 -0.14131525158882 -
0.10568545013666 0.018298890441656 -
0.0066401711665 -0.07428703457117 -
0.02140785194933 -0.09748688340187
0.00617618812248 0.08794511109599
0.03605059906843 -0.21055991947651
0.08393460512161 0.030809439718723
0.11345765739679 -0.12216668576002
0.12529824674129 0.19372203946114
0.08485303074121 0.00648112967610 -
0.16582328081131 -0.00727777555584 -
0.59730969369411 0.11478432267904
0.14841195940971 0.04952542483806 -
0.05101629719138 -0.06281276792287
0.00486387405544 -0.11443792283535
0.01468386966735 -0.08175235986709
0.03702203556895 0.12788131833076 -
0.09439801424741 -0.10034311562777 -
0.1281466782093 0.17521631717682
0.10801389068365 0.07313060015441
-0.0296268742531 -0.15958009660244 -
0.03135158494114 -0.15042643249035
0.12728653848171 -0.06536523252725
0.14746543765068 0.00410912279039
0.02135222405195 -0.08672623336315
0.09463594853878 0.21180312335491
-0.03557794168591 -0.03690129145979 -
0.07002684473991 -0.0896214917302
0.07833375781774 0.13227833807468 -
0.14132921397686 -0.13407498598099 -
0.03949107602238 0.07199795544147
0.05228154733777 -0.03170992061495
0.11009479314089 0.18632389605045 -
0.11768248677254 -0.04097725823521
0.03208494186401 0.02097608521580 -
0.00052163278451 -0.1318951100111
0.00595575105398 0.04337451234459
0.05334361270070 0.07819810509681
-0.0762896165251 0.12369467318058
0.05641842260956 0.08972764760255
0.08972764760255 -0.00858432985842 -
0.02238819748163 0.02069604955613 -
0.0505843982100 -0.07237645238637
0.03436527773737 -0.0450139567255 -
0.0139551078900 0.17898085713387 -
0.072600327432156 0.00505119282752
0.01482939533889 -0.04376548901200 -
0.012062266469002 0.01277449540793
0.06983336061239 0.11638788878918 -
0.015336792916059 -0.08204133808612

5.5 Running SVM (support vector machine) Classifier:

This last step is actually the easiest step in the whole process. All we have to do is find the person who has the closest measurements to our test image. We will use a simple linear SVM classifier. It does some extremely complex data transformations, then figures out how to separate your data based on the labels or outputs you've defined. Running this classifier takes milliseconds. The result of the classifier is the name of the person!Support vector machines (SVMs) are formulated to solve a

Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

classical two class pattern recognition problem. We adapt SVM to face recognition by modifying the interpretation of the output of a SVM classifier and devising a representation of facial images that is concordant with a two class problem. Traditional SVM returns a binary value, the class of the object. To train our SVM algorithm, we formulate the problem in a difference space, which explicitly captures the dissimilarities between two facial images. This is a departure from traditional face space or view-based approaches, which encodes each facial image as a separate view of a face. In difference space, we are interested in the following two classes: the dissimilarities between images of the same individual, and dissimilarities between images of different people. These two classes are the input to a SVM algorithm. A SVM algorithm generates a decision surface separating the two classes. For face recognition, we re-interpret the decision surface to produce a similarity metric between two facial images. This allows us to construct face-recognition algorithms.

6. RESULTS

Now we will look at the results that are obtained for different images.

6.1 Variation With Aging:

Sometimes our system may enter into a situation where there is a need of identifying the person but we don't have the recent image of that person rather we have the old image of the person. That means we have to identify the image from the old picture.

Figure 6.1 Images Of A Person At Two Different Ages

From the above images we can see the variation between old images and new image. Sometimes it is even difficult for the normal people also to identify the person with old images.The following image is the result when we try to recognise the old image with a recent image.

Figure 6.2 Result Of Face Recognition With Childhood Image

7.2 VARIATIONS WITH FACIAL EXPRESSIONS: A small change in our facial expression will result in a large variation in the features of our face. For example in a normal picture the space occupied by our lips is different from the space occupied in an image with a big smile on the face. The following are some the images recognised with different facial expressions.

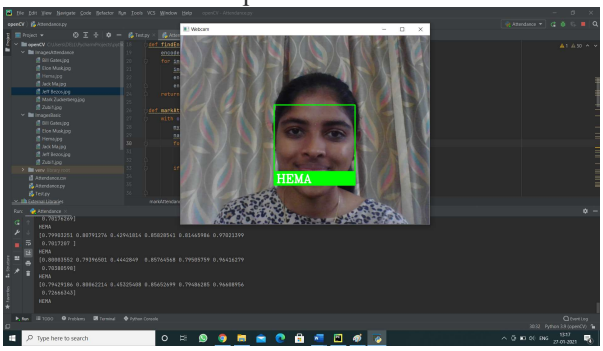

Figure 6.3 Result Of Face Recognition When Facial Expression Is "Happy"

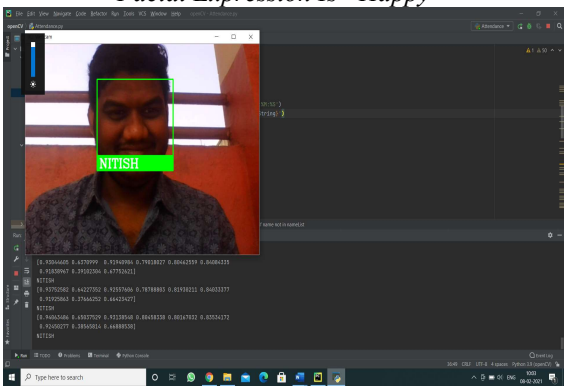

Figure 6.4 Result Of Face Recognition When Facial Expression Is "Happy"

Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

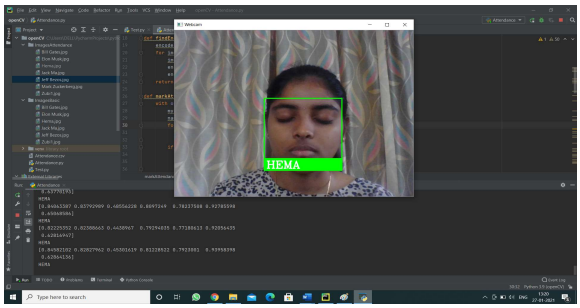

Figure 6.5 Result Of Face Recognition When Eyes Are Closed

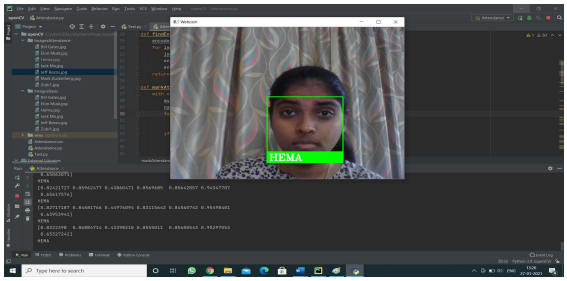

Figure 6.6 Result Of Face Recognition When Facial Expression Is "Sad"

Now we will look at the extrinsic features to be considered by the face recognition system.

6.3 Variations In Different Lightning Conditions:

Lightning conditions plays an important role in identifying the person. It could be easier to identify the person in light whereas it becomes difficult to identify the person in low lightning. The following are the results of our face recognition in different lightning conditions.

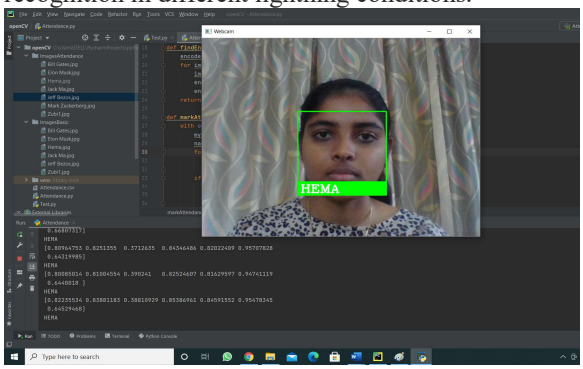

Figure 6.7 Result Of Face Recognition In Lightning

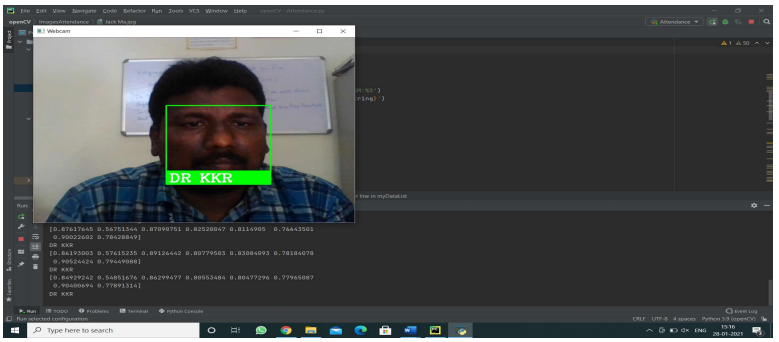

Figure 6.8 Result Of Face Recognition In Low Lightning

6.4 Variation With Occlusion:

Occlusion occurs when some part of the face is hides. For example some part of the face may be covered with the object like eyes can be hidden by goggles, spectacles and face can be hidden by masks, scarf etc.

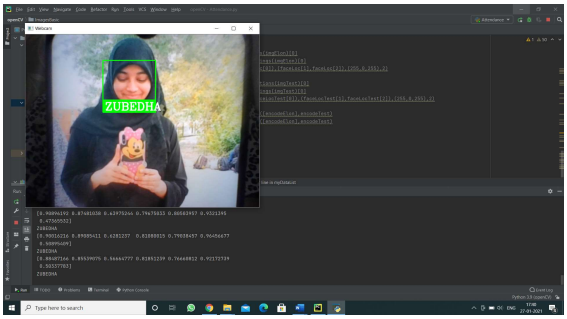

Figure 6.9 Result Of Face Recognition With Scarf

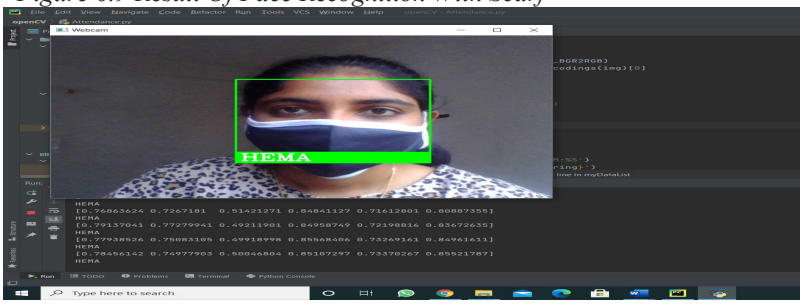

Figure 6.10 Result Of Face Recognition With Mask

6.5 Variation With Different Poses:

Images of different poses is nothing but the images taken in different orientations or different view etc. Following image is the result of our face recognition system in side view.

Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

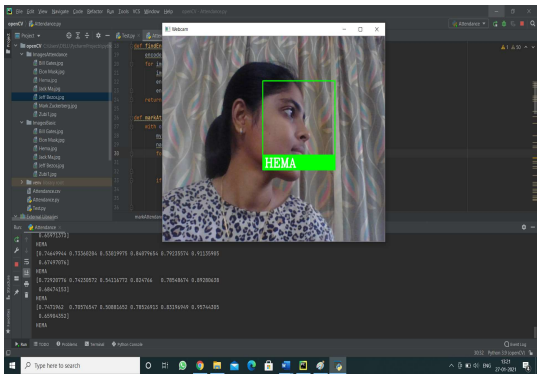

Figure 6.11 Results Of Face Recognition In Side View

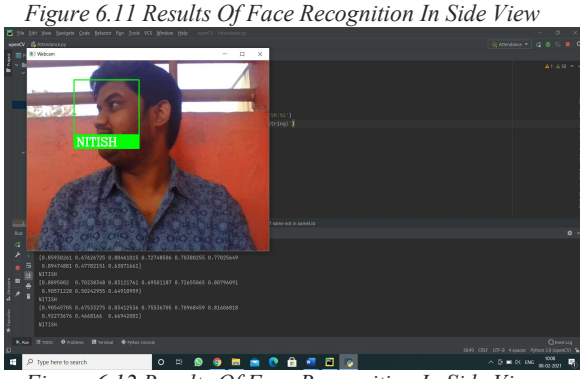

Figure 6.12 Results Of Face Recognition In Side View

Now we will analyse the accuracy of different face recognition models based on a research. A research done by Khan using PCA principal component analysis with NCR_IIT database gives an accuracy of 69-86%. Later Abdullah also uses PCA with real video stream which gives an accuracy of 80%. A study done by Fuo using guided convolution neural network gives an accuracy of 91%. A research made by Huang using point to set correlation algorithm gives an accuracy of 50-53%. Banerjee uses viola jones method which gives accuracy of 88%. Lei uses adaboost algorithm which gives an accuracy of 95%. And the face recognition system using HOG algorithm produces an accuracy of 98%.

Table 6.1 accuracy of different algorithm

Researcher	Algorithm	Accuracy
Khan	Principal component analysis	69-86%
Fuo	Guided convolution neural network	91%
Huang	Point to set correlation algorithm	50-53%
Lei	Adaboost algorithm	95%
Banerjee	Viola Jones algorithm	88%
	HOG ALGORITHM	98%

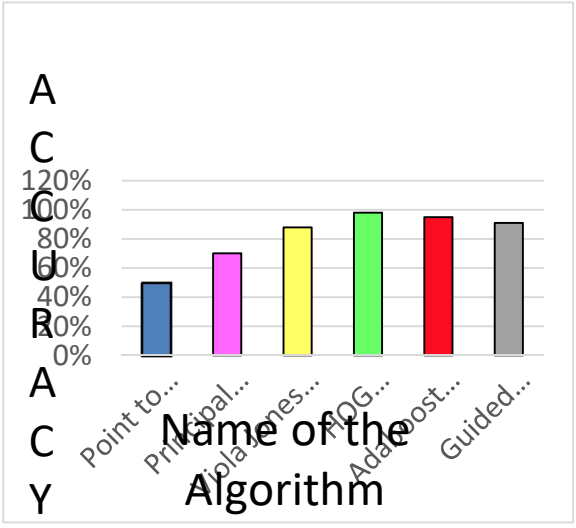

Figure 6.13 Graph Plotted For Different Accuracies

The above graph shows the accuracy of different algorithm in percentage by taking Algorithm on X-axis and accuracy on Y-axis.

7. CONCLUSION & FUTURE SCOPE:

Finally, we conclude that in this paper we have introduced a better methodology for face recognition that provide high accuracy, identifies person in different angles, in different lightening conditions. This model also records the turn out time when the face of the person appears for the last time. At present also face recognition is widely used in various fields. In the future also it may be extended further. It can be used in schools and hospitals, and can be used for different purposes like preventing the frauds activities of ATM, identifying duplicate voters can also be done using face recognition technology, driving license verification, identify and verify terrorists at airports, railway stations and malls the face recognition technology will be the best choice. Now-a-days the world is growing in a fast manner in social media platform, there also face recognition is used for finding persons. This work gives only the turnout time when the user recently appeared in webcam. We are trying to extend by calculating the total duration the user spends in front of webcam. Today, one of the fields that uses facial recognition the most is security. Facial recognition is a very effective tool that can help law enforcers

recognize criminals and software companies are leveraging the technology to help users access their technology. This technology can be further developed to be used in other avenues such as ATMs, accessing confidential files, or other sensitive materials. This can make other security measures such as passwords and keys obsolete. Another way that innovators are looking to implement facial recognition is within subways and other transportation outlets. They are looking to enhance this technology to use faces as credit cards to pay for your transportation fee. Instead of having to go to a booth to buy a ticket for a fare, the face recognition would take your face, run it through a system, and charge the account that you've previously created. This could enhance the process and optimize the flow of traffic drastically.

REFERENCES

[1] Khan, Maliha, et al. "Face Detection and Recognition Using OpenCV." 2019 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS). IEEE, 2019.

[2] Boyko, Nataliya, Oleg Basystiuk, and Nataliya Shakhovska. "Performance evaluation and comparison of software for face recognition, based on dlib and opencv library." 2018 IEEE Second International Conference on Data Stream Mining & Processing (DSMP). IEEE, 2018.

[3] Salihbašić, Alen, and Tihomir Orehovački. "Development of android application for gender, age and face recognition using opencv." 2019 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO). IEEE, 2019.

[4] Jagtap, A. M., et al. "A Study of LBPH, Eigenface, Fisherface and Haar-like features for Face recognition using OpenCV." 2019 International Conference on Intelligent Sustainable Systems (ICISS). IEEE, 2019.

[5] Prasanna, D. Mary, and Ch Ganapathy Reddy. "Development of Real Time Face Recognition System Using OpenCV." Development 4.12 (2017): 791.

[6] Khan, Sikandar, Adeel Akram, and Nighat Usman. "Real Time Automatic Attendance System for Face Recognition Using Face API and OpenCV." Wireless Personal Communications 113.1 (2020): 469-480.

[7] Abad, Bienvenido Bartido. "Proposed Image Pre-processing Techniques for Face Recognition Using OpenCV." Proceedings of the 3rd SPUP International Research Conference, Cagayan, Philippines. Vol. 14. 2017.

[8] Goyal, Kruti, Kartikey Agarwal, and Rishi Kumar. "Face detection and tracking: Using OpenCV." 2017 International conference of Electronics, Communication and Aerospace Technology (ICECA). Vol. 1. IEEE, 2017.

[9] Mazumder, Mohammed Arif, and Rosalina Abdul Salam. "Feature extraction techniques for speech processing: A review." (2019).

[10] VMK, Srikanth. "Portable Attendance Monitoring System Using Face Recognition." (2018).

[11] Swaminarayan, Priya, Mr Manoj Nath, and Miss Bipasha Mandal. "Face Detection with Machine Learning and Open CV Classifier."

[12] Popoola, J. A., and C. O. Yinka-Banjo. "Comparative analysis of selected facial recognition algorithms." Nigerian Journal of Technology 39.3 (2020): 896-904.

[13] Boyko, Nataliya, Oleg Basystiuk, and Nataliya Shakhovska. "Performance evaluation and comparison of software for face recognition, based on dlib and opencv library." 2018 IEEE Second International Conference on Data Stream Mining & Processing (DSMP). IEEE, 2018.

[14] D Deshmukh, A., et al. "Face Recognition Using OpenCv Based On IoT for Smart Door." Proceedings of International Conference on Sustainable Computing in Science, Technology and Management (SUSCOM), Amity University Rajasthan, Jaipur-India. 2019.

[15] Ismael, Khansaa Dheyaa, and Stanciu Irina. "Face recognition using Viola-Jones depending on Python." Indonesian Journal of Electrical Engineering and Computer Science 20.3 (2020): 1513-1521.

[16] Puthea, Khem, Rudy Hartanto, and Risanuri Hidayat. "The Attendance Marking System based on Eigenface Recognition using OpenCV and Python." Journal of Physics: Conference Series. Vol. 1551. No. 1. IOP Publishing, 2020.

[17] Wakurdekar, Sachin, et al. "REAL TIME FACIAL RECOGNITION USING OPENCV PYTHON TECHNIQUES."

[18] Arya, Zankruti, and Vibha Tiwari. "Automatic Face Recognition and Detection Using OpenCv'Haar Cascade and Recognizer for Frontal Face." ECE Department Medi-Caps University Indore (MP), India (2020).

[19] Rao, N. Koteswara, et al. "FACE DETECTION AND RECOGNITION USING OPENCV AND PYTHON."
[20] Zhu, Zhiguo, and Yao Cheng. "Application of attitude tracking algorithm for face recognition based on OpenCV in the intelligent door lock." Computer Communications 154 (2020): 390-397.
[21] Kasiselvanathan, M., V. Sangeetha, and A. Kalaiselvi. "Palm pattern recognition using scale invariant feature transform." International Journal of Intelligence and Sustainable Computing 1.1 (2020): 44-52.
[22] Suma, S. L., and Sarika Raga. "Real Time Face Recognition of Human Faces by using LBPH and Viola Jones Algorithm." International Journal of Scientific Research in Computer Science and Engineering 6.5 (2018): 6-10.
[23] Wirdiani, Ni Kadek Ayu, et al. "Real-Time Face Recognition with Eigenface Method." International Journal of Image, Graphics and Signal Processing (IJIGSP) 11.11 (2019): 1-9.
[24] Humne, Snehal, and Prachi Sorte. "A Review on Face Recognition using Local Binary Pattern Algorithm." International Research Journal Of Engineering And Technology (IRJET) Volume 5 (2018).
[25] Kushal, M., et al. "ID Card Detection with Facial Recognition using Tensorflow and OpenCV." 2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA). IEEE, 2020.
[26] Khan, A., et al.: Forensic video analysis: passive tracking system for automated Person of Interest (POI) localization. IEEE Access 6, 43392–43403 (2018)
[27] Abdullah, N.A., et al.: Face recognition for criminal identification: an implementation of principal component analysis for face recognition. In: The 2nd International Conference on Applied Science and Technology 2017 (ICAST'17) (2017)
[28] Fu, T., Chiu, W., Wang, Y.F.: Learning guided convolutional neural networks for crossresolution face recognition. In: 2017 IEEE 27th International Workshop on Machine Learning for Signal Processing (MLSP) (2017)
[29] Banerjee, S., et al.: To frontalize or not to frontalize: do we really need elaborate pre-processing to improve face recognition? In: IEEE Winter Conference on Applications of Computer Vision, pp. 20–29 (2018)
[30] Baggio, Daniel Lelis, et al. Mastering OpenCV 3. Packt Publishing Ltd, 2017.
[31] Joshi, Prateek, David Millán Escrivá, and Vinicius Godoy. OpenCV By Example. Packt Publishing Ltd, 2016.
[32] Kaehler, Adrian, and Gary Bradski. Learning OpenCV 3: computer vision in C++ with the OpenCV library. " O'Reilly Media, Inc.", 2016.
[33] Beyeler, Michael. OpenCV with Python blueprints. Packt Publishing Ltd, 2015.
[34] Villán, Alberto Fernández. Mastering OpenCV 4 with Python: a practical guide covering topics from image processing, augmented reality to deep learning with OpenCV 4 and Python 3.7. Packt Publishing Ltd, 2019.
[35] Gollapudi, Sunila. Learn computer vision using OpenCV. Apress, 2019.
[36] Datta, Samyak. Learning OpenCV 3 Application Development. Packt Publishing Ltd, 2016.
[37] Shilkrot, Roy, and David Millán Escrivá. Mastering OpenCV 4: A comprehensive guide to building computer vision and image processing applications with C++. Packt Publishing Ltd, 2018.
[38] Spizhevoi, Aleksei, and Aleksandr Rybnikov. OpenCV 3 Computer Vision with Python Cookbook: Leverage the power of OpenCV 3 and Python to build computer vision applications. Packt Publishing Ltd,