

DeepQ based Facial Recognition System in Vanish Lighting Condition using Convolutional Neural Network

S. Beski Prabaharan¹, A. Mary Subaja Christo², A. Arun³, A. Sasi Kumar⁴ and Nageswara Rao^{5†}
beski.prabaharan@galgotiasuniversity.edu.in, marysubc@srmist.edu.in, aruna2@srmist.edu.in, askmca@yahoo.com,

¹Professor, Department of Computer Science and Engineering, Galgotias University, Greater Noida, India.

²Associate Professor, ³Assistant Professor, Department of Computer Science, College of Engineering and Technology, Faculty of Engineering and Technology, SRM Institute of Science and Technology, Chennai, India.

⁴Professor, Department of Cloud Technology and Data Science, Institute of Engineering and Technology, Srinivas University, Mukka - 574146, Mangalore, Karnataka Stat, India

⁵Professor, Department of Computer Science and Engineering, Chitkara Institute of Engineering and Technology, Chitkara University, Punjab, India

Abstract

The main purpose of this method is to verify the hard light face by combining the intensity of the solid light, captions based on caption-based caption, kernel-based feature, and distance-based conversion, Gabor feature, phase component feature and many other features. to combine. This method removes unwanted light effects such as poor lighting - uniform, shadowing, noise, blurring and blurring. Also keep useful information such as Face Features, Eyes, Nose, Ridgets, Rinkles, Shade Area. Pre-chain chain, this method describes our standard lighting method that eliminates the effects of light change. Local ternary (LTP) patterns, typical binary local pattern (LBP) local terminology is very discriminatory and less sensitive to noise in the same areas. Gabor Features, this method is used to filter the image and find selected features. This filter acts as a band pass filter. The final method is Phase congruency features, which evaluates light intensity and identifies the category and size of features. This project was implemented using MATLAB. It is the dominant working language of computer technology. Image Processing Toolbox helps an easy way to work with images in MATLAB like working with any other format. Therefore, MATLAB is best suited for complex image processing applications.

Keywords:

Facial Recognition Systems, Vanishing Point, Lighting Conditions, Convolution Neural Network, Matlab

1. Introduction

To create a robust and effective face recognition system, the issue of light variation is one of the technical challenges facing system designers. Over the past few years, a number of visual-based approaches are expected to address this dilemma, as well as new ideas additionally almost as good as the results of recognition are reported. Face time in several lighting conditions means anytime (day or night) and anywhere (indoors or out) [1]. There are

six common ways to improve the quality of image verification. A series of pre-processing, native ternary patterns, traditional binary patterns, gabor wavelet, and local congruency unit system face recognition system [2].

This paper focuses on the difficulty of craving for lighting variations. Ancient methods of dealing with this problem can be broadly divided into 3 categories: appearance-based, conventional-based methods, and trait-based methods. In direct-based methods, training data is collected under different light conditions and precisely (i.e., without pre-processing light) used to study a global model of possible light variants but requires a large number of training images and a clear feature set, otherwise it is important to install a pre-processor good to reduce lighting variations [3][4]. Orientation-based methods seek to reduce the image to a “legal” type where lighting variation precludes it.

An excellent example of this method is the Histogram rating. These methods work very well but their ability to handle the diversity of living space remains limited. The third method produces a light-resistant element that is set directly on the given image [5]. These feature sets range from geometric to image-based features such as edge maps, local binary patterns (LBP), Gabor waves, and local filters for automatic links. Although such features offer significant improvements in mixed gray values, their opposition to the complex light variations that occur in real-world imagery is still limited [6].

Manuscript received August 5, 2025

Manuscript revised August 20, 2025

<https://doi.org/10.22937/IJCSNS.2025.25.8.4>

An integrated framework is proposed, which combines the strengths of all three of the above methods. The whole process can be viewed as a pipeline that combines imagery with normalization, element rendering, and under representation, as shown in Fig. 1. Each stage increases resistance to light variations and makes the information needed to be seen more visible [7][8]. This approach achieves significant improvements, with an alternative to ensuring 88.1% level with a 0.1% false acceptance rate.

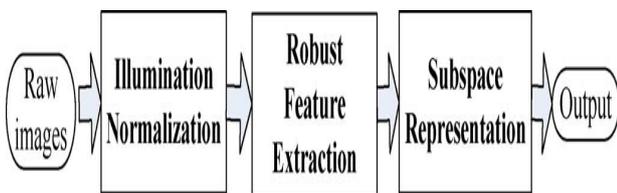


Figure 1: Stages of Facial Recognition System

A few parts of the relationship between image standard and feature sets, Strict feature sets and feature comparison techniques, the integration of multiple feature sets of the frame will be guaranteed [9][10].



Figure 2: Sample images of Vanishing lighting directions

Familiarity is known to improve the performance of simple subspace modes [e.g., key component analysis (PCA)] [11] or separators (e.g., nearby neighbors) [12] based on the representation of pixel images but its impact on more complex set of features has not received much attention [13]. The whole process can be considered as Figure 3.

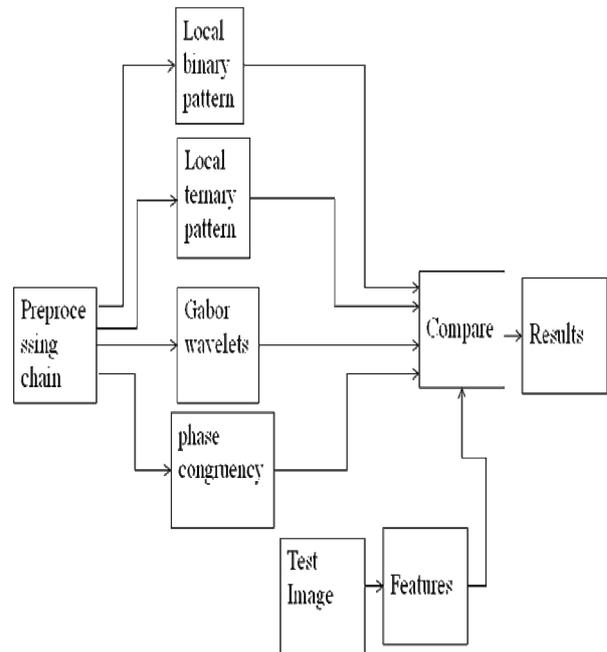


Figure 3: Face Recognition System – DeepQ Processing Systems

2. DeepQ Process

Several face recognition methods have been introduced to identify the face in a difficult light condition. Face recognition has received a lot of attention from scientific and industrial communities over the past few decades thanks to a wide range of information security and access control applications, public control, surveillance, and high-resolution imagery.

A number of methods have been proposed, including (among many others) DeepQ Process, fishing surface and laplacian faces, close-level feature-based subspace-based features, neural networks, elastic bunch graphical record, wavelets, and kernel methods .

For example, the mobile device authentication system should be able to authenticate the client anytime (day or night) and any location (inside or out). Unfortunately, facial expressions are highly dependent on local light and — as emphasized by the recent Face Recognition Vendor Test (FRVT) and the Face Recognition Grand Challenge (FRGC)

test, this is still one of the major challenges of current face recognition programs.

The DeepQ processalgorithm has proven to be very effective in face detection. This method uses facial images as raw data and removes certain vectors from these images. The divider can therefore be trained by these feature vectors. If the ambient light conditions change, the efficiency of the system will decrease because the number of pixels in the test image will change dramatically. This is a major problem with the DeepQ processmethod. We can see in Figure 1 that the information at the end of the DeepQ processimages is not destroyed. If the facial information is used in the DeepQ processmethod, instead of the face image, we expect that the light dependence problem of the DeepQ processmethod will be solved. This means that we want to exclude eigenvectors from facial information and not from facial images. The beauty of this idea is, if not used, the durability of the DeepQ processsystem under various light conditions.



Figure 3: 23 Images Dataset – After DeepQ process

DeepQ vanishing face is one of the most successful face recognition techniques. However, DeepQ vanishing face requires a lot of training images of all faces, so it cannot be used in face recognition programs anywhere where 1 model image is available for each person to be trained. To address this issue, DeepQ vanishing face's method is expanded using a 3D dynamic model to capture multiple face images in a single image. DeepQ vanishing face's law considers the ratio between 1 person difference to any other person. Increases the scatter matrix specificity in the middle of the phase at the same time, reducing the scatter matrix specification within the phase. Two continuous facial recognition techniques, DeepQ processand DeepQ vanishing faces, built on 2 separate techniques, have proven to be very successful. It is believed that, when it comes to finding patterns for pattern classification,

the PCA-based LDA-based algorithms, as the previous one, develops a low-level image with the aim of discriminating the main element and the latter only achieves the reconstruction of the object. . However, the serious disadvantage of LDA-based face recognition is the demand for a wide variety of training images taken in completely different perspectives and under different light conditions. These parts of the landscape are usually not purchased with real-world applications.

3. Kernel Linear Discriminant Analysis

The kernel contains only low-frequency components, finding that the first nine harmonics (low frequency) take up more than 99% of the energy shown. With the use of this nine-dimensional harmonic plane, a precise face recognition scheme can be developed, and the results are very positive. In facial recognition, it is widely accepted that discriminatory based methods provide high performance and improved durability in disturbances such as lighting variations and that kernel methods provide well-based methods for capturing domain information to a discriminator.

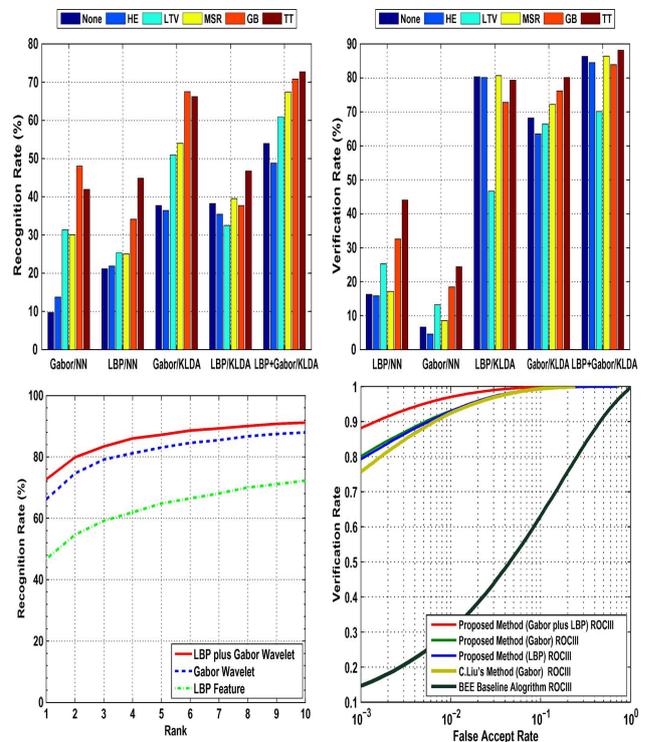


Figure 4: Performance of the full DeepQ CNN based methods

In our previous work we found that although the combination of feature level and resolution level works well, the combination of resolution level is better in this application. Kittler investigated a number of integration systems that included product, quantity, minute, and general rules, found that the total law was able to withstand measurement errors and provided the best performance overall.

In particular these methods were developed with images collected under well-controlled conditions compared to the original performance, having difficulty in coping with the wide range of visual acuity that occurs in natural photographs that are not forced due to light, shape, facial appearance, aging, partial. obstacles, etc.

In effective facial recognition systems, performing recognition under the control of uncontrolled light is an important challenge. In Extended B this set extremes lighting conditions still make it a challenging task in many face recognition methods. Light conditions are somewhat worse than those of Yale-B, but the resulting shadow is much sharper, probably because the angular light sources were less diffused.

4. CNN – Proposed Systems

Pre-chain chain, local ternary patterns, dual local patterns, Gabor wavelet and phase alignment these methods are used to improve the quality of facial verification and face recognition in difficult lighting conditions. A simple and efficient series of pre-screening removes most of the light-switching effects while still maintaining the important visual details needed for recognition. This is a series of pre-rendering processing that includes a series of sections designed to combat the effects of local shadow, light variation, and highlighting while maintaining the essential features of the visual appearance. These pre-assessments include: Gamma Fixing, Gaussian Filter Differences, Face Detection and Brightness Rate.

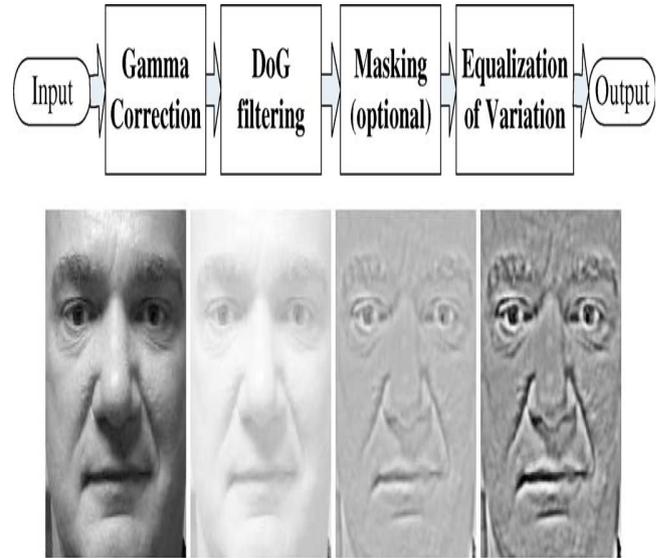


Figure 5: Stages of our image preprocessing pipeline, and example of the effect of the three stages.

- ✓ *Gamma correction is an indirect level change of gray. It used to enhance the brightness of an embedded image. The basic premise is that the intensity of the light emanating from an object is the product of the incoming L light (partially smooth in large part) and the local area indicator R (which contains detailed information on the appearance of the object level).*
- ✓ *Gamma correction does not remove the effect of large doses of solids as a result of the shade. Shading caused by landscape design is a useful indicator but it is a very low frequency information that is difficult to distinguish from the effects caused by light gradients. High-pass filtering removes both useful and risk information, thus making the problem of awareness easier and in many cases enhances the performance of the system as a whole. Similarly, pressing the highest frequency waves reduces both pronunciation and sound without damaging the lower alert signal.*
- ✓ *Difference Of Gaussian Filtering - DoG filtering is an easy way to achieve a band-effect effect. Due to the obvious convolution the filter is applied. Minimizing border effects. Border conditions greatly reduce overall performance, and introduce strong gradients across image borders that interfere with the next phase of measuring brightness. Previous gamma adjustment is still*

required: if DoG is run without this, the resulting images suffer from reduced spatial variability (and therefore loss of visual data) in shady regions.

- ✓ *If face masks (hair style, beards) that look thinner or more flexible should be removed, a mask should be used now. Otherwise, the strong edges of the gray scale presented in DoG convolution, are considered in all different exploits.*
- ✓ *The final stage of our previous processing series reduces image intensity to measure the solid life of a complete contrast or solidity variation. you need to use a solid computer because the signal usually contains excessively created values, dirt on the borders of the image, small black circles such as noses, etc.*

The following image is well rated but will still contain excess value. To minimize their impact on process results, we often use an indirect final map to press for larger values. The type with a specific purpose is not important. Here use hyperbolic tangent, therefore limiting the variance.

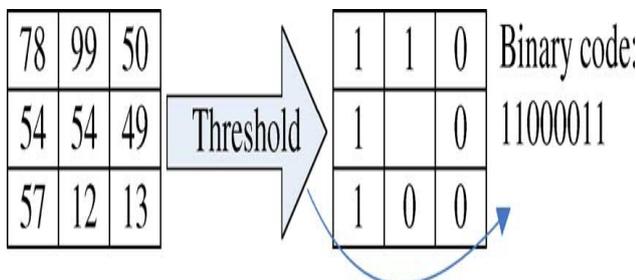


Figure 6: Illustration of the Low level bypass operation – CNN Decision Tree

The LBP user is one of the simplest definitions of playable texture and is widely used in various programs. Well-tried extremes and its important advantages, especially its consistency in changing the level of monotonic gray energy and process power, are positively constructing complex image analysis tasks. There are many ways to extract the most useful (processed) options for facial images to create facial recognition. One of all of these decoding methods is the traditional Binary Pattern (LBP) method. With LBP it has the ability to define the feel and way of digital image. This is usually done by dividing the image into several smaller circuits from the output

square size option. These options include binary patterns that define the location of pixels within regions.

The options found in the square measurement circuits are combined with a single feature bar graph, which creates an image. The images will then be compared with the same function (distance) between their histograms. According to several studies, facial recognition abuse the LBP method provides the best results, each depending on the speed and performance of the discrimination. Due to the way the mood and mood are different, the strategy looks strong against completely different facial images, completely different light conditions, image rotation and human aging. The native binary operator works with eight pixel neighbors, violating the average pixel value as a limit. If a neighbor's pixel includes a higher gray value than the average pixel (or the equivalent gray number) than the selected pixel, otherwise it gets zero. The middle pixel LBP code has been created by combining eight or zero in the code.

The LBP method can be used in photographs (facials) to exclude options that may be accustomed to experience similarity between these images. The main scheme is that for each part of the image the LBP-code is calculated. The spread of every possible pattern within the image is maintained. The bar chart for those patterns, also known as labels, forms the element vector, so it is a picture of the sound of the image. These histograms will then adapt lively to the similarities between the images, by adjusting the gap between the histograms.

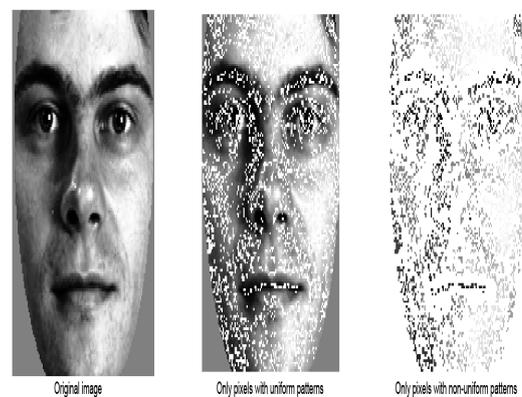


Figure 7: Final Optimized Images

Face image split in an image with only pixels with uniform patterns and in an image with only non-uniform patterns, by using LBP

4. Experimental Setup

Local ternary Patterns (LTP), typical of a binary location pattern (LBP) of a highly discriminating and very sensitive local texture dictionary, also indicates that instead of comparisons based on local histograms on distance-based change. Matching Match also enhances LBP / LTP-based face recognition functionality.

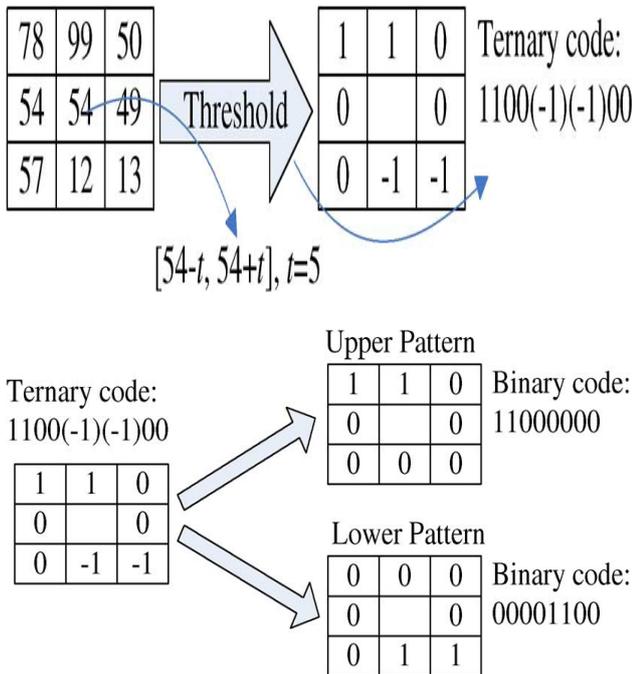


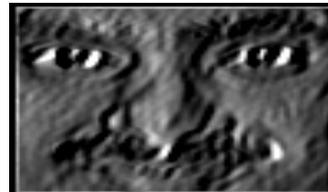
Figure 8. Splitting an LTP code into positive and negative LBP codes

Gabor filters, redesigned and universal in 2D, are now widely used in various computer vision systems. The Gabor filter serves as a bandwidth filter for local frequency distribution, achieving excellent adjustment in the same domains of space and frequency. The image can be represented by a Gabor velvet variant that allows your description to both the local frequency format and the geographical relationship. The Gabor wavelet is a sinusoidal wave wave with a certain frequency and shape, controlled by a Gaussian envelope. It can reflect the frequency of a local frequency in an image while preserving local relationship information and, thus, it is appropriate to extract frequent content based on pattern focus. The image shows Gabor facial features.

Gradient-based operators look for points of high intensity that can fail to see well and make



the bulk of the options between images. In contrast to the bite finders, which determine sharp changes in size, the congruency model of the section receives order points within the phase spectrum. Part of the section is much needed than the part of the size within the image reconstruction method from its Fourier domain. There is conclusive evidence of life, showing that the human nervous system responds strongly to points in the picture wherever the stage information is highly organized.



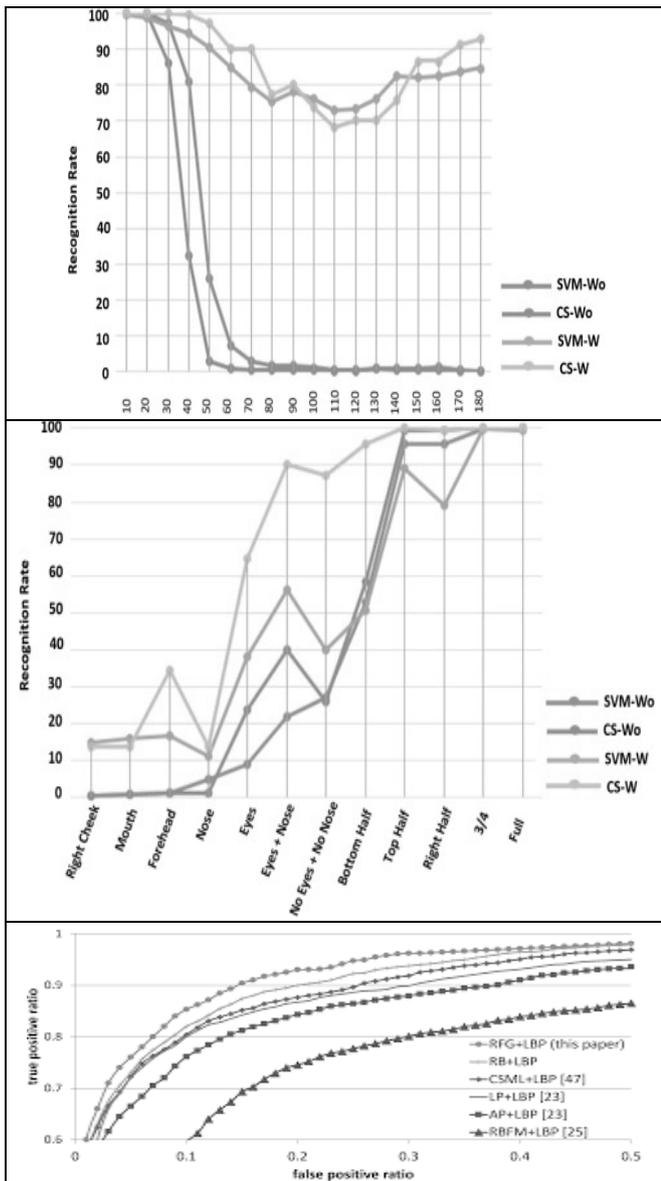


Figure 9. Experimental and Comparison result of input dataset using Matlab

Section alignment provides an independent measure of all signal size that makes it consistent in image brightness and / or brightness. The image shows the image of the corresponding phase and the corresponding firmness image. It has been shown that the features of the image such as the steps of the steps and lines produce points where the Fourier parts of the image are at the highest level. Fourier parts are covered in signal. It can be found that all parts of the Fourier have the same category. This

defines the concept of phase coherence. Features can therefore be identified based on the Fourier components in the section. Categories have been used as features for image recognition and facial recognition in particular.

6. Conclusion

New methods of facial recognition under uncontrolled light are based on rigorous pre-screening and extension of the LBP descriptions of local texture. The main contributions are as follows: 1) a simple, efficient chain for image processing for its comparable visual performance or better than current (usually more sophisticated) conventional lighting methods; 2) a rich definition of LTP texture that makes LBP normal while splitting slightly under sound in the same areas; 3) parallel matrix based on distance transformation that captures spatial and geometric variations of LBP / LTP facial images better than simple programs of histograms currently in use; and 4) a separate component-based component that combines two sets of popular features — Gabor waves and LBP — and the intensity of the solid light and how to extract the corresponding phase element. The combination of these enhancements gives modern performance to large-scale facial data sets containing very different light conditions.

References

- [1] Xiaoyang Tan and Bill Triggs “Enhanced Local Texture Feature Sets for Face Recognition Under Difficult Lighting Conditions” in Proc. IEEE, Vol. 19, No. 6, Jun 2019.
- [2] Jing-Ming Guo, Chen-Chi Lin, and Hoang-Son Nguyen “Face Gender Recognition Using Improved Appearance-Based Average Face Difference and Support Vector Machine” in conf. IEEE, 2018.
- [3] Jae Young Choi, Yong Man Ro, and Konstantinos N, “Color Face Recognition for Degraded Face Images” in Proc. IEEE, Oct 2019, Vol. 39.
- [4] Manikandan, S., Pasupathy, S., & Hanees, A. L., (2021) "Regression Analysis of Colour Images using Slicer Component Method in Moving

- Environments", *Quing: International Journal of Innovative Research in Science and Engineering*, 01(01), 01 - 05.
- [5] Hatice Gunes,, and Massimo Piccardi, "Automatic Temporal Segment Detection and Affect Recognition From Face and Body Display" in *Proc. IEEE*, Feb 2019.
- [6] Ngoc-Son Vu and Alice Caplier "Efficient Statistical Face Recognition across pose using Local Binary Patterns and Gabor wavelets" in *conf. IEEE*, 2018.
- [7] S. Manikandan, K. Raju, R. Lavanya, R. G. Gokila, "Bluetooth based Face-to-Face Proximity Estimation on Smart Mobile", *Journal of Android and IOS Applications and Testing*, Vol.2, Issue-1, pp-1-4,2017
- [8] Rojana Kam-art, Thanapant and Varin Khera, "Face Recognition using Feature Extraction based on Descriptive Statistics of a Face Image" in *conf. IEEE*, 2019.
- [9] Jun-Ying Gan, Jun-Feng Liu "Fusion and recognition of Face an Iris Feature based on Wavelet Feature and KFDA" in *conf. IEEE*,2017.
- [10] S.Manikandan, M.Chinnadurai, D.Maria Manuel Vianny and D.Sivabalaselvamani, "Real Time Traffic Flow Prediction and Intelligent Traffic Control from Remote Location for Large-Scale Heterogeneous Networking using TensorFlow", *International Journal of Future Generation Communication and Networking*, ISSN: 2233-7857, Vol.13, No.1, (2020), pp.1006-1012.
- [11] Gérard Medioni, Jongmoo Choi, Cheng-Hao Kuo, and Douglas Fialeo, "Identifying Non cooperative Subjects at a Distance Usig Face Images and Inferred Three-Dimensional Face Moels" in *Proc. IEEE*, Vol. 39, No. 1, Jan 2018.
- [12] Yong-Mei Zhang, Li Ma, Bo Li "Face and Ear Fusion Recognition based on Multi- Agent" in *conf. 2018*.
- [13] Kyu-Dae Ban, Jaeyeon Lee, Dae Hwan Hwang and Yun-Koo Chung, "Face Image registration methods are using Normalized Cross Correlation" in *conf. 2018*