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Attendance System Using Face Recognition by eliminating Shadows

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Abstract - *In recent years, research has been carried out in various fields. One of these fields of our interest is face recognition and detection. Many systems have been developed in this field and some of which are used on social media platforms, banking apps, government offices e.g. the Metropolitan Police, facebook ,etc. The system proposed of our interest is related with Educational institutions and is concerned with student attendance on a daily basis.*

There are primarily two traditional marking approaches that name the roll call or take the student sign on paper. Both have become time consuming and more difficult. There was thus a need for a student attendance program based on computers that helps the faculty automatically to maintain records. This work is done by our proposed system, where the working algorithm compares the test image and the training picture and decides the present and absent students. The attendance record is held in an excel sheet that is automatically changed in the program.

The results generated can thus be further used for evaluation as per the requirements

Key Words*: *Face recognition, Shadow detection, Shadow Removal, HOG, AGCWD

1. INTRODUCTION

Attendance system is a application which is used to keep the attendance records of a particular person and is applied in the industries, schools, universities or working places. Empirical evidence shows that the attendance and academic performance of students was closely related. The argument claimed that students with weak attendance records are generally associated with poor retention. The faculty must also maintain an accurate attendance record. The traditional attendance monitoring systems has faced the following challenges:

- Largely manual – register based systems
- Silos use electronic systems which are difficult to monitor across various levels
- Card-based systems are liable for misuse or proxies.
- Several officials working across various localities, or move elsewhere for official duties to different locations. In such cases their presence cannot be detected by systems.

Going through all these shortcomings, it was decided to have a program to address the question of student accreditation by the measurement of average student attendance. Face of a person is the preliminary scheme for identification. Therefore the suitable solution to have time and cost efficiency with no human involvement is facial recognition. With the rapid development in the fields of image processing, the efficiency of this system is kept on increasing.

2. LITERATURE SURVEY

The literature survey examines various existing similar types of systems so as to find out the shortcomings which can thus be implemented in the proposed system as an improvement.

Dr.S.B.Thorat Director, Institute of Technology and Mgmt proposed in their paper titled Facial Recognition Technology: An analysis with scope in India." ,that the attendance is taken by facial recognition, which works better than the existing systems, which include biometrics, RFID's and iris recognition. It overcomes the challenges like physical disabilities, infection carriers which can be caused by biometrics; faulty attendance or proxies which can be caused by the use of RFID's. Also, iris recognition systems are very expensive and require a huge amount of memory for the data. This makes facial recognition the cheapest and it gives faster and more accurate results.

Thus, taking all these things into account, the added feature of the proposed system is to recognize the image with the shadow also.

Vijay Chondagar Student of Msc.(IT) Uka Tarsadia University proposed in the paper titled "Shadow Detection and Removal" that there are various types of shadows i.e. self shadow and cast shadow. And also there are different techniques for the detection and removal of shadows such as:

1. Model Based Techniques
2. Image Based Techniques
3. Colour/Spectrum Based Detection
4. Texture Based Detection
5. Geometry Based Detection

3. PROPOSED SYSTEM

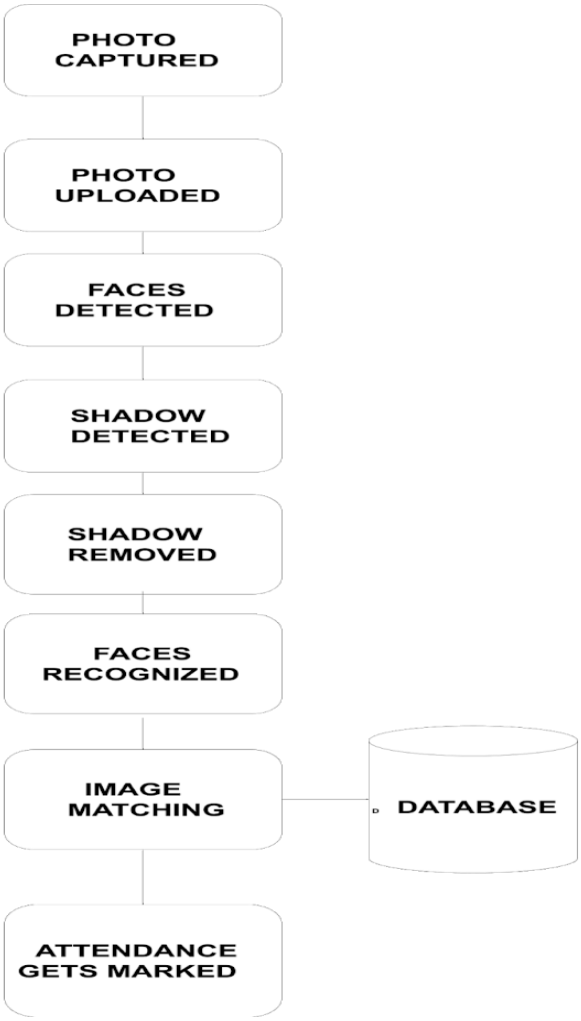


Fig -1: The Proposed System

4. METHODOLOGY

Facial recognition is a way of recognizing a human face through technology. A facial recognition system uses biometrics to map facial features from a photograph. It compares the information with a database of known faces to find a match.

Face recognition is really a series of several related problems, such as

- Finding the faces in the picture
- Focusing on each face and trying to understand that even if a face is turned in a different direction or in bad lighting, it still recognizes the same person.
- It should be able to tell few characteristics like size, pattern of the eyes, lips, nose, etc
- Finally it compares the unique features of that face to all the people you already know to determine the person's name.

The proposed system for a successful detected of the required face input undergoes the following steps:

Step 1: Finding all the Faces

The first step in the pipeline is face detection where the method invented is called Histogram of Oriented Gradients (HOG). To find faces in an image, first make the image black and white since color data is not required to find faces. Then consider every single pixel in the image one at a time and look at the pixels surrounding it directly. The goal is to figure out how dark the current pixel is compared to the pixels directly surrounding it. Then draw an arrow showing the direction in which the image is getting darker. After repeating this process, every pixel is replaced by an arrow. These arrows are called gradients and they show the flow from light to dark across the entire image.

Then, break up the image into small squares of 16x16 pixels each. In each square, count how many gradients point in each major direction (how many point up, point up-right, point right, point left, etc…). Then, replace that square in the image with the arrow directions were it is the strongest. In this way, the original image is turned into a very simple representation that captures the basic structure of a face. To find faces in this HOG image, find the part of the image that looks the most similar to a known HOG pattern that is extracted from the other training faces.

Step2: Posing and Projecting Faces

Now the faces in the image are isolated. But the problem is that, faces of the students appearing in the group photo are totally in different directions which can be difficult to recognize.

For this, we try to wrap each picture so that the eyes and lips are always in the sample place in the image. This will make it a lot easier to compare faces in the next steps.

To do this, use an algorithm called face landmark estimation. The basic idea is to plot 68 specific points (called landmarks) that exist on every face — the top of the chin, the outside edge of each eye, the inner edge of each eyebrow, etc. These 68 points are used to recognize the face with different directions.

Step3: Encoding Faces

Now, to tell the faces apart, The next step of working is to generate the encodings from the pictures present in dataset and saving the encodings in to the pickle file this is done to extracting the images encodings in the form of dictionary having the key as the name of the image for which the encodings are to be generated and the values as the list

which contains the encodings of the each images. In the encodings 128 measurements of each face are considered.

Step 4: Finding the name of the person from the encodings generated.

Now, to find the person from the database of known people who has the closest measurements to our test image using any basic machine learning algorithm of classification . The result of the classifier is the name of the student whose face is recognized.

Shadow Removal:

Since the environment for capturing the images will not be always ideal or due to many limitations in the image capturing devices the quality of digital image gets degraded. There are some existing methods for removing the shadows from the images which mainly focus on either global or local enhancement.

Like in global enhancement each pixel of image is transformed using a single transformation function whereas in local the transformation of each pixel depends on the neighbouring pixel .There are some methods from traditional gamma correction to some complex methods utilizing the depth image histogram pixel contextual information etc., for analyzing image context and pipelining of different stages to speed up the process. There are also some methods where inter pixel contextual information is used and enhancement is performed is smoothed 2d histogram but these results into very large process. Whereas Adaptive gamma correction with weighting distribution (AGCWD) derives a hybrid histogram modification function by combining traditional gamma correction and histogram equalization methods.

So this system applies the Adaptive Gamma Correction (AGCWD) which is one of the global enhancement techniques. In Adaptive Gamma Correction (AGC), parameters are set dynamically based on the image information enhancements that cover aspects of image correction such as saturation, sharpness, denoising, tonal adjustment, tonal balance, and contrast correction/enhancement.

Adaptive Gamma Correction with Weighted Distribution (AGCWD):

Due to the certain limitations of the image-capturing devices or if the environment is non ideal the quality of digital images goes on degrading. Mostly the existing methods mainly focus on global or local enhancement which may not be suitable for all the images. Different types of degraded images get solved with different treatments, as these methods do not consider the nature of the image.

This system thus proposes an automatic image classification technique based on the statistical information of an image.

AGCWD is a gamma correction method where the gamma value is found automatically by a weighted distribution function.

The simple form of the transform-based gamma correction is derived by,

$T(l) = l_{max} (l / l_{max})^{\Upsilon}$ (1)

Where ,

l_{max} is the maximum intensity of the input.

Thus intensity of each pixel is transformed into T

When directly or manually modify contrast by gamma correction then different images will result in the same changes in intensity as a result of the fixed parameter.

So this problem can be solved by probability density of each intensity level in a digital image. As the density function of the image will be different thus the intensity of each image will be different.

The probability density function (pdf) can be calculated as:

$Pdf(l) = n1 / (MN)$

Where,

n1 = number of pixels that have intensity l

MN =is the total number of pixels in the image.

Now, based on pdf the cumulative distribution function(cdf) is calculated as:

$Cdf(l) = \sum pdf(k)$.

Traditional Histogram Equalization (THE) directly uses cdf of the digital image calculated from above

$T(l) = cdf(l) l_{max}$. (4)

The below figure shows the working flow for Adaptive Gamma Correction :

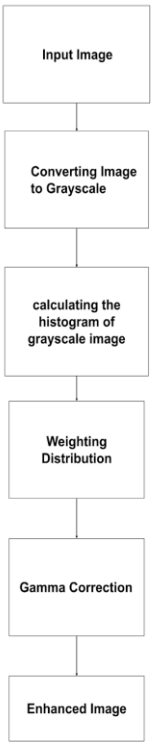


Fig -2: Flowchart of working of AGCWD

In the Adaptive Gamma Correction, first convert image from BGR to HSV i.e. colored image to grayscale image. After that the histograms of the grayscale images are calculated. Weighted Distribution function is calculated using the pdf and the cdf functions as given below:

$$Pdf_w(I) = Pdf_{max}\left(\frac{\text{pdf(I)} - \text{pdf}_{\text{min}}}{\text{pdf}_{\text{max}} - \text{pdf}_{\text{min}}}\right)^{\alpha}$$

Where

Pdf_{max} = maximum pdf of statistical histogram

Pdf_{min} = minimum pdf of statistical histogram

$$Cdf_w(I) = \sum_{I=0}^{I_{max}} Pdf_w(I) \Big/ \sum pdf_w$$

Where ,

$$\sum pdf_w = \sum_{I=0}^{I_{max}} pdf_w(I)$$

Thus gamma correction parameter which is based on the cdf of Equation is modified as follows:

$$\gamma = 1 - cdf_w(I)$$

So, with the upper equations of AGCWD that provides us Adaptive Gamma Correction helps to enhance the dimmed images and thereby remove the shadow part.

5. RESULTS:

The test images so selected were faces with self shadows. The result pair has the input test image along with the available detected image after shadow removal.

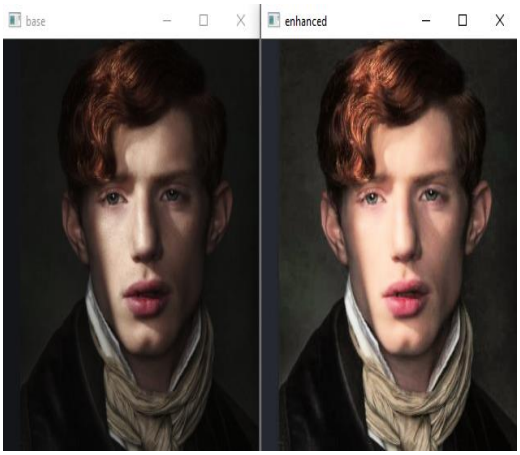


Fig -3: Result (i)

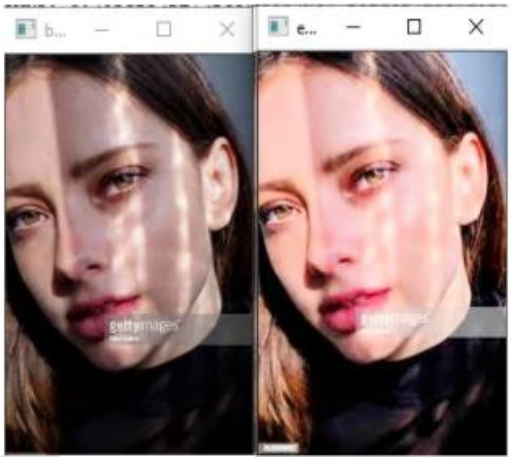


Fig -4: Result (ii)

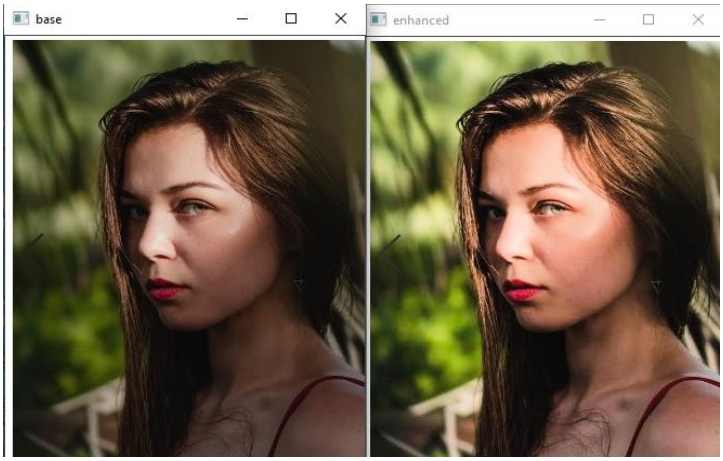
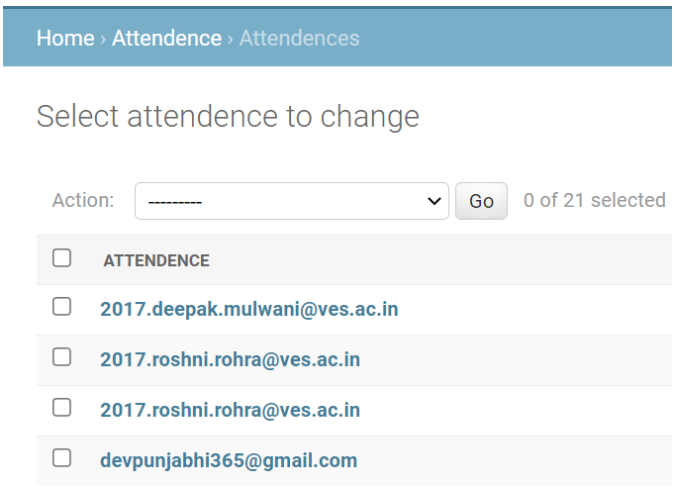


Fig -5: Result (iii)

INTERMEDIATE RESULTS:

Attendance Records of the students in the database.



Attendance Report of the Students.

student	WN Lec	CCS Lec	DMBI Lec	DF Lec	SEL Lec	SEPM Lec	DMBI Lab	CCS Lab	SEPM Lab	WN Lab	Total
Deepak Mulwani	0	0	0	29	0	17	0	0	0	0	7.14

6. CONCLUSIONS

Thus, our solution for Intelligent Attendance successfully minimizes Human-Interference, Enhances transparency and completely eliminates the Gaps of the current system. The automation helps in eliminating the Fraudulent entries and finally we can receive the real-time attendance and reliable evaluations and scrutiny checks can be performed to ensure that the entries are fail-safe. Also, the faces of the unidentified people can also be stored for further inspections and evaluations. The Automated Classroom Attendance System thus contributes to increasing the precision and speed of the attendance marking process and assures a high level of accuracy in real time to meet the needs of automation required for present and future assessment.

7. FUTURE SCOPE:

The System can further be updated by adding one more feature of the image i.e. the face should also be recognized only if the half side of the face is present in the image.

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