Operator Certification Using Face Recognition Technique

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Abstract – A facial recognition system is a technology capable of identifying or verifying a person from a digital image or a video frame from a video source. There are multiple methods in which facial recognition systems work. But in general, they work by comparing selected facial features from given image with faces within a database. Real time video face recognition will happen using Raspberry pi 3 and web camera. This technique is used for operator verification using operator's face.

Keywords: Raspberry pi, Web camera, Algorithm- Local Binary Pattern Histogram.

I. INTRODUCTION

A facial recognition system is a technology capable of identifying or verifying a person from a digital image or a video frame from a video source. There are multiple methods in which facial recognition systems work. But in general, they work by comparing selected facial features from given image with faces within a database. Real time video face recognition will happen using Raspberry pi 3 and web camera. This technique is used for operator verification using operator's face. This system is fully based on Artificial Intelligence and it is perfectly fitted on Industry 4.0 criteria. Now a day's company wants to improve our product quality with less investment. This system is also having less cost. For recognizing an operator's face used a Local Binary Pattern algorithm using python programming.

A. Existing System

The existing system is supervisor decides who is operated a particular machine and sometimes it happens that operator do not have enough knowledge to operate this machine so that's why it directly affects to a quality of product or get some injury of operator. So, verification for who is handling of a machine is in supervisor level. And there is no automatically verification tool is there for verifying an operator.

B. Proposed System

Before we explaining our system, why we need this? For using this system we create a new verification method based on Artificial Intelligence. In our system operator is verified using his face recognition and this system is easily integrated with any other machine or system.

II. LITERATURE REVIEW

In [1] Extracting Information of face using Local Binary Pattern algorithm.

- In [2] convert different resolution images into gray scale and then classify a rotation invariant texture with local binary pattern algorithm.
 - In [3] Recognition of face with local binary pattern.
- In [4] Real Time Face Recognition of Human Faces by using LBPH and Viola Jones Algorithm
- In [5] real time face recognition using Eigen face in Java Environment.

III. SYSTEM DESCRIPTION

A. Block Diagram:

Following figure 1 shows a block diagram of hardware used in system.

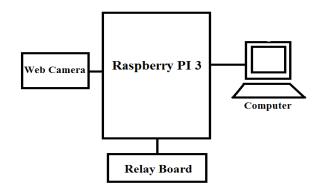


Fig. 1. Block diagram of a system

System has not required more complex hardware configuration. It consists of Raspberry Pi 3, Web Camera, Computer monitor, Relay Board. Relay board is used for understanding that using this system. We can easily integrate to a Programmable Logic Controller or any other thing operated in a switch concept.

1) Design and Implementation:

a) Flow Chart:

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For this project, Raspberry pi and web camera are used to verify an operator using his face recognition. And then gives permission for operating a particular machine.

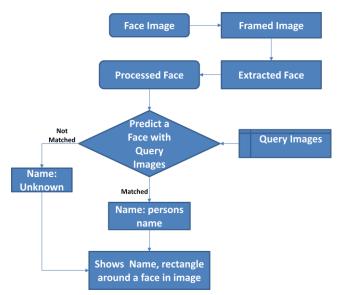


Fig. 2. Flow chart of a system

In the above figure 2 shows, a process of our system. After starting a system web camera starts capturing video and when operator comes in front of the camera then system detects his face and starts extracting features of this input image, then using LBPH algorithm is predicts the operator name and his verification for operating a particular machine using a confidence, if confidence is less than threshold then using a ID shows a name of person and give verification, print operator is verified, then triggering a relay i.e. Relay will be ON state and if confidence is greater than threshold then shows a name "Unknown" and print operator is not Verified and relay will still OFF state.

b) Implementation:



Fig. 3. Hardware of a system

Above figure 3 shows hardware of a system, Web camera is connected to a Raspberry Pi 3 and Relay Board is attached to the Raspberry Pi3. Camera captures a video and using this system recognizes faces of a person and w.r.t. Relay should be change it state (ON-OFF).

For recognizing a operator's Local Binary Pattern Algorithm is used which can be explained in detailed below.

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

This method has powerful feature for texture classification and if it combines with histograms of oriented gradients (HOG) descriptor, it improves the detection

performance considerably on some datasets. Using the LBP combined with histograms we can represent the face images with a simple data vector.

1. LBPH USES 4 PARAMETERS:

- Radius: the radius is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.
- Neighbors: the number of sample points to build the circular local binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.
- Grid X: the number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.
- Grid Y: the number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.

2. Training the Algorithm:

We need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID. With the training set already constructed.

3. Applying the LBP operation:

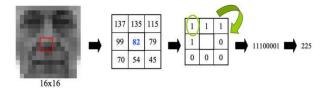


Fig. 4. Sliding window technique

Above fig. shows a representation of facial extraction of an image using sliding window technique, to extract each pixel in 3*3 matrices. matrices containing the intensity of each pixel (0~255).

Then take the central value of the matrix to be used as the threshold. Threshold is used to define the new values from the 8 neighbors. For each neighbor of the central value (threshold), we set a new binary value. We set 1 for values equal or higher than the threshold and 0 for values lower than the threshold, the matrix will contain only binary values (ignoring the central value). Then concatenate each binary value from each position from the matrix line by line into a new binary value (e.g. 11100001). Then, we convert this binary value to a decimal value and set it to the central value of the matrix, which is actually a pixel from the original image. The same procedure performed for every pixel, using these final pixels, we get new image which represents better the characteristics of the original image.

4. Extracting the Histograms:

Using the image generated in the last step, we use the Grid X and Grid Y parameters to divide the image into multiple grid, as seen in a following figure.

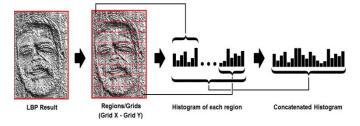


Fig. 5. Histogram of extracted face image

5. Performing the face recognition:

In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and create a histogram which represents the image. So for finding a matching face image we just compare an input image histogram to all the training dataset images histograms and return a image which one is a closest. A comparing operation is performed using a Euclidian distance formula,

$$D = \sqrt{\sum_{i=1}^{n} (hist1_i - hist2_i)^2}$$

An algorithm output is ID from the image which one is closest Histogram. This also returns a 'Confidence' which is nothing but a distance between two histograms.

We set a threshold for this distance for finding a perfect match and unknowns.

IV. HARDWARE AND SOFTWARE REQUIREMENT:

A Logitech 270 web camera and raspberry pi3 B+ is used. The programming language is used in this project is PYTHON in Raspberry Pi. PYTHON 3.5 version is used for programming in Raspberry pi 3.

V. RESULT

After all connection are done, through putty login pi is start in laptop and run a command sudo python filename. Once a command executed project starts our execution in step wise which is mentions a flow of project in previous section. To store a recorded data used for Thingspeak and firebase. Thingspeak cloud server is displaying these data in a graph format. Following Figure 4 shows a Thingspeak web screen. Which is displaying a data of level of water in tank and both flow sensors recorded data in separate graphs. These graphs are used for monitoring and using these graphs further predication is easily done.

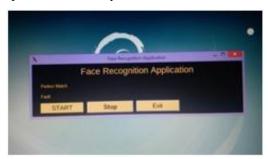


Fig. 6. Starting window of application

The above fig. 6 shows a application's starting window in this windows there are 3 buttons Start, Stop and Exit. Start button is used for start a capturing video through Web Camera, stop button is used for pause a system or stop recognizing and Exit button is used for close application. When camera starts capturing then a real time video display should be ON then window is converted into a display of operator's face. Like this.

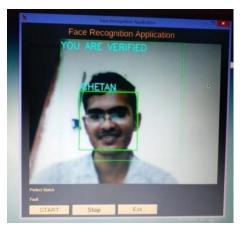


Fig. 7. Known operator output

Above figure shows a real time video for operator's face. If an operated is verified then in a rectangle is drawn to a face of operator and just above a rectangle his name is to be print and also print a Operator is verified. And if operator is not verified then draw a rectangle to operator's face and above the rectangle print "Unknown" and print You are not verified that type of output is shows in a fig. 8. Mentioned in below.



Fig. 8. Unknown operator output

VI. CONCLUSION

Our proposed system is truly based on artificial Intelligence and is related to Industry 4. Using this system operator is verifying using his face. This is a smart verification method.

In future this system is used for a machine for idtifying a operator with his skill so, perfect worker is operating a particular machine then we increase a quality of production in company.

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