International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

MONITORING OF PRIVATE SPACE WITH THE LOCAL BINARY PATTERN HISTOGRAM ALGORITHM

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Abstract–**The main goal of this project is to create an application for security purposes. Because of this, many individuals who may or may not know us are gaining access to our personal workspace. There are other difficulties, such as losing important papers and valuables. Even the most advanced technology, such as a fingerprint sensor lock, may be easily opened. As a result, we will create an AI-based security room and locker system to address this issue. This project used artificial intelligence to discover and evaluate people, as well as track them using our ongoing initiative. We tackle the current system problem in the proposed work using LBPH (local binary pattern) and machine learning approaches to lower the recognition time of many items in less time.**

Keywords— **Face Recognition,Face Detection, Local Binary pattern Histogram Algorithm,Media Pipe.**

INTRODUCTION:

Closed Circuit Television (CCTV) is used to create video surveillance systems, however the data stream mostly flows from the front-end camera to the control center. For this reason, it is also known as the CCTV system in certain publications. In the realm of security, surveillance cameras were originally integrated into the Physical Protecting System (PPS) to replace the patrol guard in verifying the intrusion detector's alert. During the investigation of the 2005 London bombings, surveillance footage provided crucial information that helped to identify the culprits and reveal their criminal activity. The importance of video surveillance systems to the security of city life was first recognised by governments. Since then, video surveillance systems have become one of the most important components of urban security infrastructures. It is widely agreed that video monitoring is beneficial in crime prevention and in significantly lowering certain crimes. Robbery, violent assault, and motorbike theft are the top three forms of crime tracked and prosecuted using video surveillance, according to data. For example, once video monitoring was installed in public spaces such as parking lots and streets, there was a 51 percent drop in crime. With the growing use of video surveillance systems, both governments and the general public pay considerably greater attention to the input-output ratio and its rationale. There is little question that additional surveillance cameras will be installed in public locations for public safety reasons, but the system size, which is often measured by the number of front-end cameras, is restricted by limited investment. Furthermore, public anxiety is growing in response to concerns about personal privacy following the widespread deployment of surveillance cameras.Finally, we will improve our accuracy by using the techniques Linear binary pattern histogram and Media Pipe.

OBJECTIVE:

Safety has been a priority, particularly in metropolitan areas. Most individuals must install a slew of locks or alarms with various sorts of sensors to combat the security issue. The sensor system may not work all of the time since it can detect various sorts of changes in the environment, which are then processed to provide an alert based on the pre-set value. So we're utilizing machine learning to construct an AI-based security system, and we can forecast user faces using the LBPH Algorithm and machine learning approaches, which are used to minimize the recognition time of many objects in the least amount of time with the least amount of time complications.

PROPOSED SYSTEM:

Our processor was taught in this suggested system via Watchman and Bank Officer Images. The processor constantly records the video. If an unfamiliar individual tries to enter the room, the camera will use machine learning to assess and relay information through email. Local binary pattern algorithm is used in this project (LBPH). Face detection and identification will be investigated by LBPH. We will use AI and OPENCV to locate people in real time in our suggested system. The image must be pre-processed and compressed once it is captured. The model is trained using images. It is learned by extracting the desired pattern from the image using feature extraction. The picture is then compressed using feature fusion and dimension reduction for dependable and real-time performance. Finally, the data is saved in an Excel spreadsheet for future use.

FEATURE EXTRACTION:

The study of data gathering, organization, analysis, and interpretation is known as statistics. It covers every facet of this, including data collection strategy in terms of survey and experiment design. This is what statistics are all about. • Mean • Variance • Skewness • Standard deviation are all statistical features of the picture.

The Gray-Level Co-Occurrence Matrix is used to analyze texture (GLCM). The gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependency matrix, is a statistical approach of assessing texture that takes into account the spatial

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connection of pixels. 16 gray levels with a window size of 30 or 50 pixels on each side is a typical compromise. We can now analyze.

CLASSIFICATION:

The link between the data and the classes into which they are categorized must be properly understood in order to classify a piece of data into distinct groups or categories. To do so using a computer, the computer must first be educated. Training is essential for categorization success. Initially, classification techniques were established. Features are characteristics of data components that determine which classes they belong to. 1). The picture classifier acts as a discriminant, discriminating between different classes. 2). Discriminant value is highest in one class and lowest in others (multiclass) 3). Positive discriminant value for one class, negative for another (two class).

IMAGE PROCESSOR:

The image processor is used to capture the picture that is detected in the camera, after which it is processed.

Image capture, storage, preprocessing, segmentation, representation, recognition, and interpretation are all performed by an image processor, which then displays or records the generated pictures.

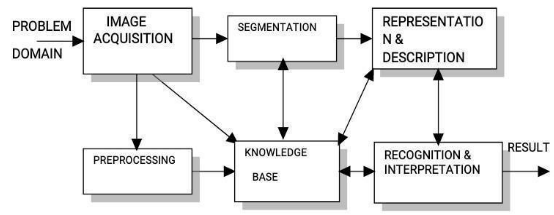


Figure 1 Block Diagram of Fundamental Sequence Involved in an Image Processing System

The block diagram above depicts the basic steps involved in an image processing system.

The first phase in the process, as shown in Figure 1, is picture acquisition using an imaging sensor and a digitizer to digitize the image. The picture is then enhanced before being provided as an input to the subsequent operations in the preprocessing stage. Enhancement, noise removal, area isolation, and other preprocessing tasks are common. The process of segmentation divides a picture into its component components or objects. Segmentation generally produces raw pixel data, which consists of either the region's boundary or the pixels within the region. The process of translating raw pixel data into a format suitable for further processing is known as representation.

IMAGE PREPROCESSING:

The input picture in the preprocessing stage may be of various sizes, contain noise, and be in various color combinations. These parameters must be adjusted based on the process's requirements. Image noise is especially noticeable in low-signal areas of an image, such as shadows or underexposed photographs. There are many other sorts of noise, such as salt and pepper noise, film grains, and so on, which are all eliminated using filtering algorithms. A wiener filter is used among the many filters. The picture collected will be processed for proper output during preprocessing. Some algorithms were used for pre-processing. Pre-processing should be carried out on all photographs in order to improve the end outcome.

DATASET CREATION:

The dataset for the authorized individual is built in this module using Opencv-python. A dataset was created by collecting 1,000 photos from each and every authorized individual.

MEDIA PIPE:

The Media Pipe is used for data collecting. With this Media Pipe, we can record our side faces at a frame rate of 20fps, however with other data collection methods, we can't even obtain more than 10fps. At the same time, we'll have higher accuracy with a 95 percent accuracy rate.

Face Detection by MediaPipe is a fast face detection system with 6 landmarks and multi-face support. It's built on BlazeFace, a fast and lightweight face detector optimized for mobile GPU inference. Because of the detector's super-realtime performance, it may be used in any live viewfinder experience that demands a precise face region of interest as an input for other task-specific software.

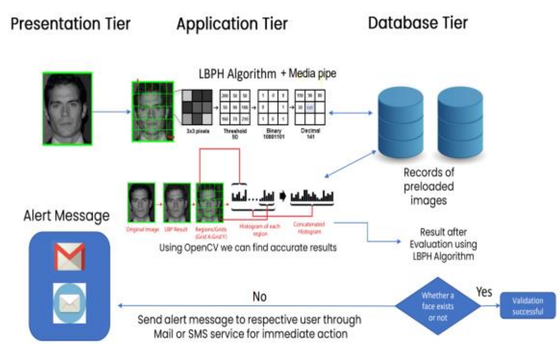
Face area segmentation, facial characteristics or expression categorization, and 3D facial keypoint estimate MediaPipe Face Mesh.

CONFIGURATION OPTIONS:

Naming style and availability may differ slightly across platforms/languages.

MODEL_SELECTION:

An integer index 0 or 1. Use 0 to select a short-range model that works best for faces within 2 meters from the camera, and 1 for a full-range model best for faces within 5 meters. For the full-range option, a sparse model is used for its improved inference speed. Please refer to the model cards for details. Default to 0 if not specified.



Proposed solution workflow with database.

MIN_DETECTION_CONFIDENCE:

Minimum confidence value ([0.0, 1.0]) from the face detection model for the detection to be considered successful. Default to 0.5.

DETECTIONS:

Collection of detected faces, where each face is represented as a detection proto message that contains a bounding box and 6 key points (right eye, left eye, nose tip, mouth center, right ear tragion, and left ear tragion). The bounding box is composed of xmin and width (both normalized to [0.0, 1.0] by the image width) and ymin and height (both normalized to [0.0, 1.0] by the image height). Each key point is composed of x and y, which are normalized to [0.0, 1.0] by the image width and height respectively.

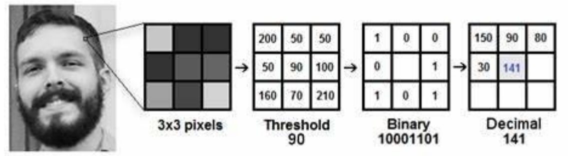
LOCAL BINARY PATTERN HISTOGRAM :

We compare and match the faces of known and unknown people using the LBPH algorithm.

The (LBPH) algorithm is a face recognition algorithm based on a local binary operator, designed to recognize both the side and front face of a human. However, the recognition rate of the LBPH algorithm is limited, if the conditions, such as in the expression diversification, disorientation, and a change in the lighting performance manifest.

The LBPH algorithm typically makes use of 4 parameters:

- ***Radius:*** The distance of the circular local binary pattern from the center pixel to its circumference and usually takes a value of 1.
- ***Neighbors:*** The number of data points within a circular local binary pattern. Usually, the value of 8.
- ***Grid X:*** The number of cells in the horizontal plane is usually a value of 8.
- ***Grid Y:*** The number of cells in the vertical plane is usually a value of 8.



LBPH Algorithm

Given the above-mentioned parameters, LBPH works as follows;

A data set is created by taking images with a camera or taking images that are saved, and then provisioning a unique identifier or name of the person in the image and then adding the images to a database. It is recommended to take many samples from a single individual. A portion of the data set is used for the training of the algorithm, while the rest is used for testing.

Using a circular neighborhood concept (which takes non-integer pixel points around a selected area), the number of appearances of LBP codes in the image is put together to form a histogram. The classification is then carried out through the calculation of the basic similarities of the histograms under comparison.

This histogram contains a description of an individual at three different levels: at a pixel-level, labels are combined in a small area to create a regional level, the regional histograms in combination build a general description of the person.

RELATED WORKS:

Cheng et al.1 introduced a facial recognition system that uses a deep sparse representation classifier to detect facial characteristics and identify a person's face. It was also used in schools to answer key questions for individual kids. 2 Kadambari et al.3 have presented a system that uses face recognition to collect automated attendance. The Local Binary Patterns Histogram (LBPH) facial recognizer is a pre-trained facial recognition classifier that can recognize faces provided enough data about the face it needs to distinguish is given. 4–6 Face recognition algorithms are used in most real-time applications and are used by security corporations and military organizations all over the world. 7 Remote monitoring and other applications that need a hardware platform such as the Raspberry Pi are common. 8,9 Sharma and Jain10 presented an alternative.

CONCLUSION:

We will construct an AI-based security monitoring system in this project. Face recognition and machine learning are used in this safe system. It is safer than the current system. The standard assessment approach concentrates on detection accuracy at the pixel or area level and ignores the amount of relevant data. The convolutional neural network supports the analytics with higher performance time and boosts the correctness of the application since the classification system deals with a huge number of datasets.

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