FACE RECOGNITION OFFICE SECURITY SYSTEM USING LAB VIEW 8.6

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ABSTRACT

Facial recognition (or face recognition) is a type of biometric software application that can identify a specific individual in a digital image by analyzing and comparing patterns. Facial recognition systems are commonly used for security purposes but are increasingly being used in a variety of other applications. In this context, nodal points are end points used to measure variables of a person’s face, such as the length or width of the nose, the depth of the eye sockets and the shape of the cheekbones. These systems work by capturing data for nodal points on a digital image of an individual’s face and storing the resulting data as a face print. The face print can then be used as a basis for comparison with data captured from faces in an image or video. This paper presents a novel face detection approach in color images. We employ spatial histograms as robust features for face detection. The spatial histograms consist of marginal distribution of color image information. Facial texture and shape are preserved by the spatial histogram representation. A hierarchical classifier combining histogram matching and support vector machine is utilized to identify face and non-face. The experiments show that this approach performs an excellent capability for face detection, and it is robust to lighting changes.

KEYWORDS: Eigen Faces, Histogram, LABVIEW 8.6

INTRODUCTION

Facial recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Some facial recognition algorithms identify faces by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face detection. A probe image is then compared with the face data. Facial recognition systems based on face prints can quickly and accurately identify target individuals when the conditions are favorable. However, if the subject’s face is partially obscured or in profile rather than facing forward, or if the light is insufficient, the software is less reliable. Nevertheless, the technology is evolving quickly and there are several emerging approaches, such as 3D modeling, that may overcome current problems with the systems.

VIRTUAL INSTRUMENTATION

A virtual instrument consists of an industry –standard computer of workstation equipped with powerful application software, cost – effective modular hardware such as plug-in boards with appropriate driver software, and the unit under test (UUT) and sensors, all of which work together to perform the function of traditional instruments. Virtual
instrument is about redefining what an instrument is and empowering users to build powerful instruments and flexible measurement systems never before possible. Application that incorporates many kinds of I/O, such as data acquisition, motion control, image acquisition, and disturbed I/O. Virtual instruments represent a fundamental shift from traditional hardware-centered instrumentation systems to software-centered systems that exploit the computing power, productivity, display, and connectivity capabilities of popular desktop computers and workstations. Software is the cornerstone of a virtual instrumentation system. Its flexibility, combined with powerful modular hardware solutions, creates the ultimate in user-defined, scalable instrumentation systems. Lab VIEW is designed and developed by National Instruments. It provides easy interface for the programming. It gives us graphical programming with drag and drop functions and online help. Lab VIEW provides a platform to develop test and measurement, date acquisition, instrument control, date logging, measurement analysis and report generation applications. Lab VIEW programs are called ‘virtual instruments’ or ‘VI’s because their appearance and operation imitate physical instruments such as oscilloscopes and multi meters, indicators and so on.

FACE RECOGNITION TECHNIQUES

Pattern recognition and matching consists of classifying, processing the input and matching it with a known pattern. Face recognition is a very complex form of pattern recognition. It consists of classifying highly ambiguous input signals, with multiple dimensions and matching them with the know ‘signals’. Classifying a pattern with high dimensions requires a restrictively large number of training samples. A number of ways have been proposed to solve this problem. Finding an effective means to reduce the dimensionality is the first step in face recognition. Considering the face to be a matrix of values reduces the dimensions to a single dimension. Bit such an approach would be helpful in solving the problem if we were interested in faces that vary by certain transformations, such as magnification translation etc. But biological systems, such as faces do not vary just by transformations, for example changed expression on a face cannot be captured by simple transformations in one-dimensional space.

The design for the Face Recognition System using the Histogram Comparison technique consists 3 main parts. They are:-

- Providing a GUI(Graphical User Interface) Menu to the user.
- Database Modification.
- Face Recognition by Histogram Technique.

Providing a GUI (Graphical User Interface) Menu

The GUI is made such that it caters to all the needs of a user. It gives a list of options that can be exercised by the user. Based on the option the user chooses the program performs the necessary operations.

A typical view of the GUI provided to the user is given below:-

![Figure 1: Block Diagram for GUI Menu in Lab VIEW](image-url)
When the user presses ‘2’ in the GUI Menu that appears at the start of the program, the control is shifted here. An image is taken with the help of the USB Webcam and it is determined whether the person in the picture is there within the authorized people or not. A password authentication system is added to it for additional security.

Database Appending

Generally most Face recognition systems don’t have the direct flexibility of adding new images to the database, this issue has been taken care of in this design by adding it as an additional feature. The user on his requirement can add new images to the database after going through a test of authentication.

This process contains 2 major steps:-

- Taking an Image from a USB Webcam.
- Storing the image to Database and writing data to Spreadsheet

Acquiring Image from USB Webcam

Using NI-IMAQ-USB Camera to Capture Face Image

In this project HP Pavilion Web camera 1000 is used to capture face images and this is because webcam is the most cheapest and due to it availability in common Notebook PC, it is always ready for usage.

Web camera using LABVIEW software application will be explained out in details. But first we shall look at the block units used for creating and activating Web Camera to capture an image.

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### Figure 2: 8 Block Diagram of Capturing Face Images Using USB Web Camera

A *grab* is a continuous, high-speed acquisition of data to a single buffer in host memory. This function performs an acquisition that loops continually on one buffer. We can get a copy of the acquisition buffer by grabbing a copy to a LabVIEW image buffer. We must use two VIs—IMAQ USB Grab Setup and IMAQ USB Grab Acquire—for a grab acquisition in LabVIEW. Call IMAQ USB Grab Setup once to initialize the acquisition and start capturing the image to an internal software buffer. We can call IMAQ USB Grab Acquire multiple times to copy the image currently stored in the internal buffer to a LabVIEW image buffer. After the program finishes copying images, call IMAQ USB Close once to shut down the acquisition. Figure 2 shows a simplified block diagram for using IMAQ USB Grab Setup and IMAQ USB Grab Acquire.

Storing the Image to Database and Writing Data to Spreadsheet

The image taken from the USB Webcam is stored in the database and after processing that image the characteristic value of the calculated array of the image is written to a spreadsheet file, which is used in the face recognition part of the design.
FACE RECOGNITION

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This process contains 4 important parts:

- Acquiring image from the webcam using NI-IMAQ
- Processing the acquired image and calculating the characteristic value.
- Reading the data from the spreadsheet and comparing it with the current image.

**Acquiring Image from the Webcam Using NI-IMAQ**

The same block diagram used previously for acquiring image in the database appending module is used here as well.
The above shown block diagram is used to calculate the characteristic value of the image taken from the webcam before the process of comparison starts.

**Reading from the Spreadsheet File and Comparison**

Before going through the block diagram implemented for reading from the spreadsheet and comparing it with the image taken from the webcam, let’s go through the basic units required for building it.

**Block Diagram for Reading from Spreadsheet and Comparison**

Using the Read from Spreadsheet VI, the data from the spreadsheet specified in the file path is read. The output of it is provided as an n-dimensional array, using Array Size VI the size of the array coming out of Spreadsheet VI is determined, which is then converted into an integer and it is wired to the count terminal. The spreadsheet array is converted to a one-dimensional array using Reshape Array VI. Index Array sub VI is used to access each element of the array individually, it is done by wiring the row and column terminals of the VI, they are kept in a loop so that one value is retrieved for each iteration of the loop.

This value is compared with value calculated for the image taken from the webcam for a variance level of ‘500’, based on which it is decided that whether the person in the image exists in the database or not. The output of this block is wired to the password authentication block, if the face recognition is passed then a message is displayed that ‘Face Recognition Passed, Enter Password to Proceed’, if recognition fails program ends.
FRONT PANEL FOR FACE RECOGNITION SYSTEM

PROVIDING GUI MENU AND DATABASE APPENDING

RESULTS

Using 15 images taken from the webcam connected to computer, the PC based face recognition system is able to achieve up to 88% recognition rate for real time and 93% for standalone systems. This PC based system serves as a proof-of-concept of the proposed face recognition method, which has rooms for further improvements and research. Taking 3 images of a person with different facial expressions and are stored in the database in the form of code books. We took images of 3 persons in the database and if in real time when a person image is taken, system will give output, “FACE RECOGNITION PASSED”, and will display the image of that person present in the database. If he is not present in the database the message “FACE RECOGNITION FAILED” as output. The time taken for recognition is 10 seconds.

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