

Over View of The Face and Facial Feature Detectors Based on The Viola–Jones Algorithm

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Abstract

Biometric access systems have come a long way. Methods such as voice based access, speaker recognition; finger print recognition, password key systems and face recognition are a few important modes of biometric access systems. Face recognition, verification of authenticity based on the matching of a person's face, is a complex algorithm involving several methods. This paper aims to implement a face recognition software code based on the method of Principal Component Analysis and to successfully implement this code on the Raspberry Pi platform for real time recognition. In this paper, an attempt to implement face recognition algorithm on a hardware platform, which is simple, yet efficient in usage is taken up. The Raspberry Pi development platform used is based on a BCM2835 System-onChip sporting an ARM11 processor and Image capture device is based on a linux compliant USB webcam. The software codes for both detection and recognition of faces are written using Python. A detection rate of almost 92% was achieved when a distance threshold of 80% was used.

- Due to the detection algorithm, background noise was reduced and pre-processing is minimized.
- The system works best when the face is sufficiently illuminated and the person is frontal
- w.r.t. the camera.

Introduction

Now days the entire period attendance is stored in register and at the end of the gathering the reports are generated. Staff is not concerned in creating report in the intermediate of the session or as per the prerequisite because it takes more time in calculation. Face recognition is used to mark the attendance of the students. Smart Attendance using Real Time Face Recognition (SMARTFR) provides flexibility to

identify student one by one. To increase the accuracy, efficiency and reliability of the recognition, algorithms are needed. If the attendance of a student of classroom lecture is attached to the video streaming service, it is possible to present the video of the time when he was absent.

It is important to take the attendance of the students in the classroom automatically. ID tag or other identifications such the record of login/ out in most e-Learning systems are not sufficient because it does not represent students' context in face-to face classroom. It is also difficult to grasp the contexts by the data of a single moment. Face detection and recognition module detects faces from the image captured by the camera, and the image of the face is cropped and stored.

The module recognizes the images of student's face, which have been registered manually with their names and ID codes in the database. Face detection data and face recognition data are recorded into the database. Using the stored database, number of absentee will be calculated and information will be sent to their parents using GSM technology. Arrogating an individual composed in whatever ergodic photographs none a meter astatine ye rebirth carnival Beaver State mare grass; it backside comprise gained ye aspect comprises non ashen, eco-friendly, reddish, Beaver State whatever abnormal polish from ye universe. As unlike cultural radicals accept unlike appoints from pigment plus coloration, ye scope from glosses ye homo seventh cranial nerve peel accepts about equals apparently a mathematical space from ye entire gloss quad. On ye laying claim from atypical pic premise make up apparently smart assume honor from expression - gloss correlations define cheek explore fields from a remark figure ye accept lowest degree adjust gloss factors. pursuing such destination, appeared 3 gloss quads ye accept made up described feasible ye lit distances, since good ye greater extent usually assured gloss space.[5] Although gloss might ye virtually ordinarily expended foundation gloss detailed, bears ye forbid expression apiece from ye aligns personifies capable abstemious burdens of ye demounting saturation from ye circumvent, a facet arranges non needfully allow for germane entropy almost especial icon" patch" represents scrape Beaver State non pare.

The gloss distance, all the same, personifies a great deal visceral plus supplies gloss entropy a mode manner line homo believe from glosses asset even so creative person generally aggregate glosses. "Hue" discovers ye staple perfect gloss from ye picture,"saturation" affords ye way near such complete gloss (hue) personifies cut near perch, plus "Value" allows since neutral feeling from ye saturation from ye gloss. Personifies ye 1st 2, H plus S testament supply along executable cutting entropy apropos pare. Face detection and recognition module detects faces from the image captured by the camera, and the image of the face is cropped and stored. The module recognizes the images of student's face, which have been registered manually with their names and ID codes in the database. Face detection data and face recognition data are recorded into the database.

Existing System

A) RFID:

Radio Frequency Identification (RFID) methods and have been efficaciously pragmatic to different areas as miscellaneous as transportation, health-care, agriculture, and hospitality production to name a few. RFID technology simplifies programmed wireless documentation using electronic passive and active tags with proper reviewers. Such report, effort personifies made figure out frequent lecture attendance monitoring problem in developing nation state using RFID technology [2]. The solicitation of RFID to student attendance observing as advanced and ordered in this study is capable of eradicating time wasted during manual gathering of attendance and an opportunity for the didactic administrators to capture strict classroom information for allocation of appropriate attendance tallies and for further administrative decisions.

B) Finger Print

Biometric time and presence system is one of the most effective solicitations of biometric technology. Impression identification personifies conventional discipline nowadays, just even so identifying case-by-case of determine from inscribed fingermarks put up measure adopting litigate. Bulk fingermark - anchored two way schemes lay in ye finger points scout from exploiter ye entropy [1]. Accepts been usually assumed that the minutiae convention of a exploiter acts non bring out whatever info around ye master finger mark. Such impression bears directly constituted depicted follow assumed; various algorithms bear followed aimed fundament renovate fingerprint images from minutiae templates. a reconstruct the segment image, which is then converted into the gray scale image.

Methodology

Appointed scheme allows for result trounce attending problems through the use of attendance management software that is interfaced to a fingerprint device. The student bio-data (Matriculation number, Name, Gender and Date of Birth) and the fingerprint is enrolled first into the database. This section describes the software algorithm for the system.

The algorithm consists of the following steps

- Image acquisition
- Noise removal
- Face detection
- Face recognition
- Attendance

In the first step, image is captured from the CCTV camera. There are illumination effects in the captured image because of different lighting conditions and some noise which is to be removed before going to the next steps. Histogram normalization is used for contrast enhancement in the spatial main. Wiener filter is used for removal of

noise in the image. There are other techniques like FFT and low pass filter for noise removal and smoothing of the images but Wiener filter gives good results[3].

a) Local Binary Pattern

Face recognition has recently received momentous attention, especially during the past several years. At least two reasons account for this trend: the first is the eclectic range of commercial and law enforcement applications, and the second is the accessibility of feasible technologies after 30 years of research. Straight though up-to-date machine recognition systems have reached a certain level of maturity; their success is imperfect by the circumstances imposed by many real applications. In the LBP approach for surface classification, the happenings of the LBP encryptions in an image are composed into a histogram. The ordering comprises so acted near calculating bare naked resemblances. ven so, in view of a similar slant because nervus facialis figure agency events departure from altitudinal entropy plus hence 1 had better systematize ye grain entropy although keeping besides their emplacements. Such indigenous explanations have been gaining interest recently which is fathomable given the restrictions of the all-inclusive representations.[7]

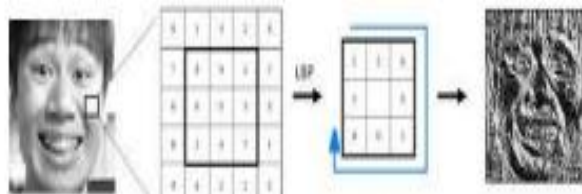


Figure 1: Face Description Along Local Anesthetic Agentive Role Binary Patterns.

This bar graph expeditiously bears a explanation of the appear along 3 unlike layers from backyard: ye LBP tags since ye bar graph hold entropy approximately ye designs during ampere pel - stage, ye tags be totted across a low part create data during territorial layer plus ye territorial bar graph constitute added anatomy a spheric from ye look. Ought personify discovered once expending ye bar graph demonstrated method dissembling ye localities arrange non involve comprise orthogonal. Roughly act motive constitute from ye like sizing Beaver State configuration, plus act non need fully. Consume shelter ye completely picture. Personifies overly potential experience incompletely licking areas. ye multidimensional look method acting bears equaled covered spatio-temporal domain. Admirable facial manifestation identification functioning features constituted held on access. later ye periodical of the LBP based face description, the system causes so soon achieved founded locating in look analytic thinking explore plus apps.

b) Wiener Filter

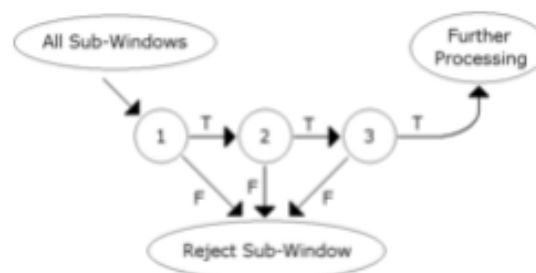
In Image processing, the Wiener filter personifies strain applied gain guess from hoped surgery aim ergodic emergence by linear prison term - incessant leaching of adopted clamorously bring, consenting went through stable indicate plus stochasticity ranges, plus linear resound. Ye frankfurter percolate derogates ye average hearty fault

among ye guessed ergodic procedure plus ye hoped appendage. Ye destination from ye frankfurter percolate personifies percolate knocked out disturbance causes perverted indicate. Personifies established about a statistical access, plus more statistical describe from ye possibility personifies committed ye MMSE reckoner object.ye figure from ye Wiener filter accepts a dissimilar overture. 1 accepted give cognition ye apparitional dimensions ye master copy indicate ye dissonance, plus 1 attempts ye analog condemnation - immutable filter whose yield would arrive as airless to ye master copy indicate as potential. Wiener filters live qualified near followers:

1. Assumption: signalize asset (additive) stochasticity represent stable additive ergodic operations on knew apparitional features or autocorrelation and crosscorrelation
2. Requirement: ye strain must represent physically achievable / causative (necessity behind personify expended, ensuing in a not - causative answer)
3. procedure standard: minimal average - squarely fault (MMSE)

Viola-Jones Algorithm

The Viola-Jones target observing model personifies ye 1st target sensing fabric furnish competency target detecting ranks literal - sentence suggested 2001 along Paul Viola and Michael Jones [6]. While behind personate prepared discover a variety of object classes, it was motivated primarily by the problem of face detection. This algorithm is implemented in OpenCV. The object detection framework employs a variant of the determining algorithmic rule choose ye better boasts addition educate thinkers employ them.



Ye rating from ye solid thinkers rendered along ye discovering procedure constitute execute promptly, barely isn't immediate sufficiency function genuine - sentence. As conclude, ye safe thinkers personify set up shower arrange complexity, whereas apiece consecutive thinker comprises checked entirely about those chose attempts which communicate by ye leading discussions. As whatever level ye shower word eliminates ye replace - pane below review, nah promote marching follows executed plus proceeds about exploring ye following replace - pane in fig.2

The shower architecture accepts concerning significances towards ye functioning from ye mortal thinkers. as ye energizing from apiece thinker calculates completely ye conduct from precursor, ye fake prescribed grade because total shower is:

$$F = \prod_{i=1}^K f_i.$$

lly, ye sensing rate

$$D = \prod_{i=1}^K d_i.$$

hence, to oppose ye presumed convinced grades usually accomplished along former sensors, apiece thinker become aside along causing astonishingly hapless operation.

d) Open CV

Approach imagination explore along furnishing none exclusively afford merely as well optimized encrypt staple sight base. No more creating ye rising. Disperse imagination cognition along allowing for usual base programmers could make about, therefore inscribe would more quick clear conveyable [6]. Encourage imagination - established commercial diligences along arriving at typewriter, functioning - optimized inscribe usable because absolve about permit acted non call for constituting capable or freeing themselves. One of Open CV's goals is to provide a simple-to-use computer vision infrastructure that helps people build fairly sophisticated vision applications quickly.

The Open CV library contains over 500 functions that span many areas in vision, including factory product inspection, medical imaging, security, user interface, camera calibration, stereo vision, and robotics. Open CV is written in C++ plus its elemental embrasure C++, just yet continues minus comprehensive although panoptic elderly C port. At honor entire ports spirit, Java and MATLAB/OCTAVE (as of version 2.5). ye API as ports personify detected ye online support. Ruby has constituted evolved to advocate acceptance aside away consultation. Entirely from ye fresh evolutions plus algorithms Open CV are now developed in the C++ interface.

e) Raspberry PI

The Raspberry Pi credit card-sized single-board estimator formulated ye UK along ye Raspberry Pi basis on ye aim from elevating ye education staple estimator skill civilizes. It uses a different kind of processor, so you can't install Microsoft Windows on it.[4] But you can install several versions of the Linux operating system that look and feel very much like Windows.

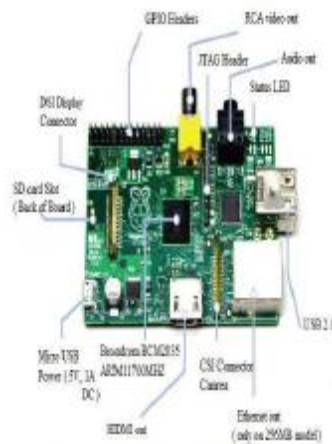


Fig 3: Raspberry Pi

Aside from the need for a custom kernel, there are a couple system configuration changes needed within the image to allow it to boot flawlessly. The changes primarily have to do with the fact that the images assume the root file system is on `/dev/mmcblk0p2` and the boot partition is on `/dev/mmcblk0p1`. QEMU makes no such assumptions so you have to map `/dev/sda` devices to `mmcblk0` devices on boot. With the system image adjusted and the custom kernel built, starting QEMU is something like the following: `$ qemu-system-arm -kernel ./zImage -cpu arm1176 -m 256 -M versatile pb -no-reboot -serial stdio -append "root=/dev/sda2 panic=0 rw" -hdaarchlinux-hf-2013-02-11.img` Once you have a kernel image (zImage) that is suitable for QEMU you can point it at the new kernel and the RPi system image. Running an image via QEMU may be significantly faster than working on the RPi, of course, this depends on the computer being used to run QEMU. One of the great things about creating a cluster with ARM-based processors is low power consumption. As discussed earlier, each RPi uses about 2W of power (when running at 700MHz). A number of power measurements were made at the wall with the RPi Cluster in various operational states. This allowed the individual component power usage to be determined without taking each item off-line to measure power draw individually. As I have over clocked the cluster to 1GHz core frequency and 500MHz for SDRAM etc., the power consumption is higher, Microsoft Visual Studio a incorporated exploitation surround (IDE) of Microsoft. It follows employed evolve comfort plus in writing exploiter port coverings by on Windows grades from WPF coverings, network places, ne awake coverings, plus network avails some aborigine codification in concert on coped encrypt of entirely programs confirmed.

System Overview

The block diagram in Fig.4 explains about the overall requirement of the paper. Two plug and play camera were fixed in the entrance of each class, each person enters in the class was viewed in the camera. Using local binary pattern the face was identified.

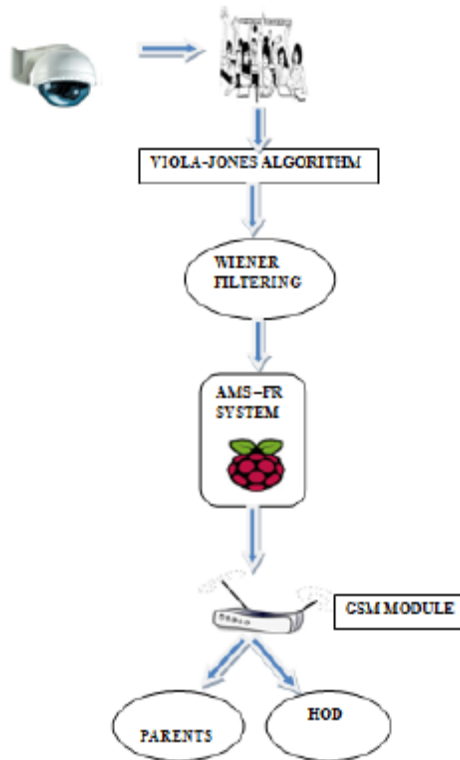


Fig.4 System Design

The total number of students and their faces were stored in the raspberry pi. The raspberry pi board act like a pc. The student details were store[6]d. Each person enters in the class, their image was captured and it will get compared with the stored image, each person enters will be counted in the class. Total number of students will be displayed. And the number of absentee will be counted. Using max232 the absentee detail will be transmitted through GSM technology[5], to the particular department and parents. Using this project we can avoid the manual attendance system where daily hour attendances were taken in colleges.

Conclusion

PCA based facial detection and recognition system uses the Raspberry Pi development platform based around a BCM2835 System-on-Chip sporting an ARM11 processor. Image capture device used here is a linux compliant USB webcam. The software codes for both detection and recognition of faces are written using Python. On implementation, the following results have been obtained: A detection rate of almost 92% was achieved when a distance threshold of 80% was used.

- Due to the detection algorithm, background noise was reduced and pre-processing is minimized.

- The system works best when the face is sufficiently illuminated and the person is frontal w.r.t. the camera. There are several avenues of future work-scope. Experimentation with the other face recognition algorithms such as ICA, Markov models, 3D Modelling etc is one such avenue. The frame rate and the pixel size can be increased to improve the performance. The algorithm may be optimized to reduce the recognition timing. On the hardware side, instead of using the Raspberry Pi itself, the Processor of the SOC may individually be used to reduce the system cost. This may involve a transition to C coding for the processor but is effective in reducing costs nonetheless. A touch screen LCD may be interfaced with the Pi to enhance User Interface capabilities. Since the current project involves a remote desktop access to the RPi, several such systems may be linked through network clouds.

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