

Ear Biometrics and Face Mask Detection Using Haar Features

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Abstract— *The world depends on systems to provide secure environments and services to the people. Biometrics authentication (or realistic authentication) is employed in applied science as a style of identification and access control. Biometric System for authentic identification of a private. My motto is to make a biometric system using the ear as the main object. It also has no changes as expression change. The human ear are neither affected by expressions like faces are nor do need closer touching like finger-prints do, which is more useful in the situation where the protection mechanism is needed as like in the pandemic Covid19 situation. Ear biometrics appears to be an accurate approach to an ever increasing demand for security in the common spaces. Then the robust feature extraction method is often accustomed determine personality of some individuals, as an example terrorist at the airport terminals. Ear as biometrics is often used in multimodal systems to improve the performance of some other known biometrics. In this paper, a novel algorithm was proposed to do face mask detection and ear recognition using deep convolutional neural network and provide a visualization of the learned network. Also a temperature sensor is included. Only after the checking of facemask the subject is allowed to ear biometrics for more security reason.*

Index Terms— Ear biometrics, Artificial Intelligence, Identification, machine learning, Convolutional neural networks.

I. INTRODUCTION

BIOMETRICS authentication (or sensible authentication) is hired in carried out technology as a fashion of identity and get admission to manipulate. It's additionally accustomed become aware of people in corporations which can be beneath surveillance. Today in lots of regions identification of a personal ought to be proven, wanted to apply ATM, for gaining get admission to over a constrained place. Hence, we follow Biometric System for genuine identity of a personal. The principal cause at the back of the inclination closer to ear biometrics is because of the lifestyles of all residences i.e., universality, uniqueness, permanence in ear biometric. The developing call for for modern-day strategies in the subject of biometrics has caused the occasion of Ear Biometrics to such an high-quality extent. The major reason behind the inclination towards ear biometrics is due to the existence of all properties i.e., universality, uniqueness, permanence in ear biometric. The growing demand for brand new techniques within the field of biometrics has led to the event of Ear Biometrics to such an excellent extent.

A. Ear As Biometric

As a biometric, the ear has a huge wide variety of wonderful and particular trends that permit for human identification. According to clinical literature, ear increase after the primary 4 months of existence is proportionate. While ear increase seems to be proportionate, gravity seems to be able to increasing the ear withinside the vertical direction. The ear lobe is the place in which the stretching has the maximum great effect, and measurements have found out

that no linear changes have occurred. Stretching pace is about 5 instances quicker than common among the a while of 4 and eight, and then it stays constant till across the age of 70, while it will increase as soon as extra. As a person's age advances, it rises proportionally in length and starts to hump closer to down, but that is a detectable consequence. According to studies, the ear slightly grows 1.22 mm each year. In addition, not like the face, distribution withinside the color of ear is pretty uniform. A. Anatomy of the ear Unlike outside frame part, ear has no expression adjustments, makeup outcomes and furthermore the color is regular for the duration of the ear. The human ear has 3 most important sections, which consists of with it the outside ear, the centre ear, and inner ear.

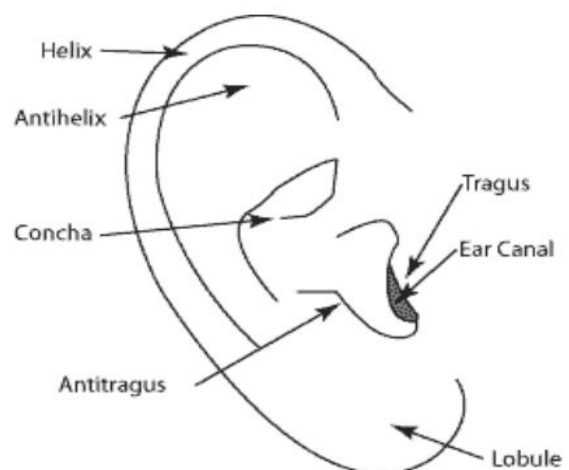


Fig 1.1: Anatomy of ear

The opportunity of figuring out human beings through the form in their outer ear changed into first determined through the French criminologist Bertillon, and delicate through the American police officer Iannarelli, who proposed a primary ear reputation device primarily based totally on most effective seven features. The specified shape of the ear isn't always most effective particular, however additionally everlasting, as the arrival of the ear does now no longer alternate over the path of a human existence. Additionally, the purchase of ear snap shots does now no longer always require a person's cooperation however is though taken into consideration to be nonintrusive through maximum human beings. Because of those qualities, the hobby in ear reputation structures has grown extensively in current years. Human ear is the particular and sincerely seen trait this is everlasting Biometric generation has now emerge as a feasible and extra dependable opportunity to conventional authentication structures in lots of authorities packages. Ear is one of the maximum appropriate candidate for use for biometrics. It does now no longer alternate with emotions, states of mind, sadness, worry or beauty adjustments. Ear may be without difficulty captured at a distance, despite the fact that the issue isn't always absolutely cooperative. This makes ear reputation mainly exciting for clever surveillance obligations and for forensic photograph evaluation as well.

II. LITERATURE REVIEW

Tian Ying[7] proposed an set of rules the usage of deep convolutional neural community for enhancing the popularity of human ear. Dropout generation is used withinside the remaining related layer for stopping the community over-fitting. Mary Ann F. Harrison [8] proposed an ear detection device the usage of Haar capabilities in a Adaboost classifier with accuracy 95%. A. Abaza [9] proposed an ear detection device the usage of quicker CNN in which Alex internet version is used for segmenting the layers of ear and checking out accuracy is round 98%. M. Saranya[10] proposed a totally computerized ear reputation device in which the function extraction is carried out primarily based totally on the 'Adaptive blocks' method and performance is improved. Thirimachos Bourlai[11] proposed a CNN primarily based totally ear detection technique via way of means of thinking about manyimage degradations factors, in which the versions blanketed are brightness, contrast, additive noise etc. Aman Chhabra [12] proposed ear function extraction method primarily based totally on picture processing techniques like segmentation, function extraction via way of means of the usage of the MATLAB tool. Karim Faez [13] designed a biometric device (ear, face, gait) the usage of Gabor and PCA (important factor evaluation) technique and done an accuracy of 97.5%. M. Usman Akram [14] proposed a biometric device the usage of Haar wavelets and go correlation method and picture dataset from USTB and were given an accuracy of 97.2%. MiguelLopez [15]

proposed a modular structure primarily based totally on 2D wavelet evaluation and Global Thresholding Method and the outcomes are correct to 97%.

Liang Tian [16, 20] recommend an set of rules the usage of deep CNN with 3 layers of convolution and the classifier used for type is Soft Max. Junbin Gao [18] proposed an ear reputation technique the usage of nearby capabilities of ear and part detection is carried out and subsequently a neural community is used for function extraction. Erhardt Barth[17, 19] proposed a deep CNN set of rules for ear detection the usage of Resnext101 version and t-SNE set of rules is used to examine the capabilities. N.Hamdy [21] proposed a low-price ear reputation device via way of means of lowering the fake rejection prices and discrete cosine ameliorations are carried out for function getting to know and won an accuracy of 96.67%. A neural community and Adaboost done nearly as desirable type prices because the assist vector system and will be utilized in programs in which type pace is taken into consideration greater crucial than the most type accuracy.

III. EXISTING SYSTEM

Till date there are numerous biometric strategies existed like fingerprint recognition (with the assist of styles which can be gift at the top layer of palm), hand geometry (thinking about duration of hands and width of hand), face recognition, iris recognition, retinal identification, voice verification, Handwritten signature, gait (strolling style), DNA matching etc.

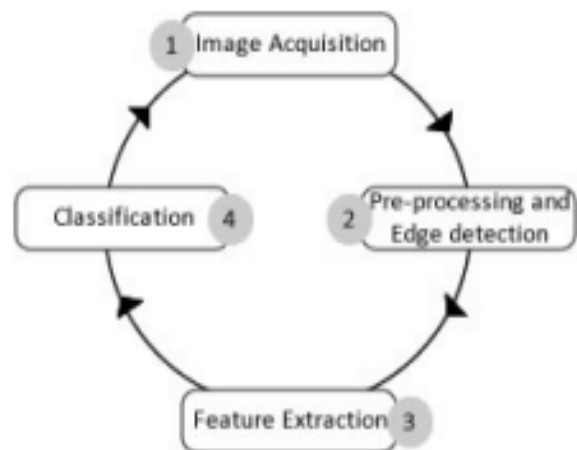


Fig. 3.1. Ear biometrics system

One greater new rising biometric machine is ear biometrics. It is existed however has now no longer come to shape and has many benefits over the already existed biometrics withinside the coming days. The Fig.3.1 describes diverse biometrics which can be gift. The method we've got long gone thru is figuring out and detecting the person through the usage of the strategies of Image Processing and Convolutional Neural Networks.

IV. PROPOSED SYSTEM

A. Block Diagram

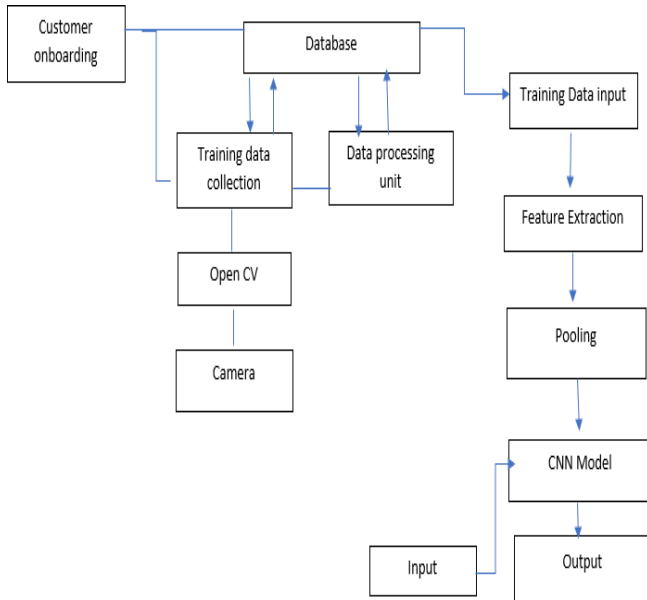


Fig4.1: The Block diagram of Ear Biometrics

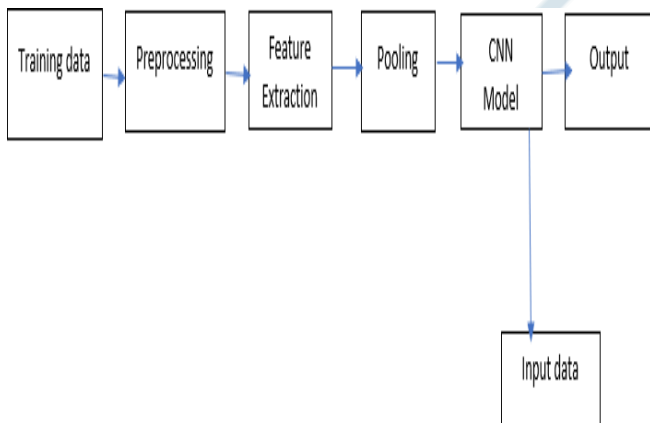


Fig4.2: The Block diagram of Face Mask detection

B. Viola Jones Algorithm

The **Viola–Jones object detection framework** is an object detection framework which was proposed in 2001 by Paul Viola and Michael Jones. Although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of face detection. The algorithm has four stages:

1. Haar Feature Selection
2. Creating an Integral Image
3. Adaboost Training
4. Cascading Classifiers

The features sought by the detection framework universally involve the sums of image pixels within rectangular areas. As such, they bear some resemblance to Haar basis functions, which have been used previously in

the realm of image-based object detection. However, since the features used by Viola and Jones all rely on more than one rectangular area, they are generally more complex. The figure on the right illustrates the four different types of features used in the framework. The value of any given feature is the sum of the pixels within clear rectangles subtracted from the sum of the pixels within shaded rectangles. Rectangular features of this sort are primitive when compared to alternatives such as steerable filters. Although they are sensitive to vertical and horizontal features, their feedback is considerably coarser.

C. Ear Detection

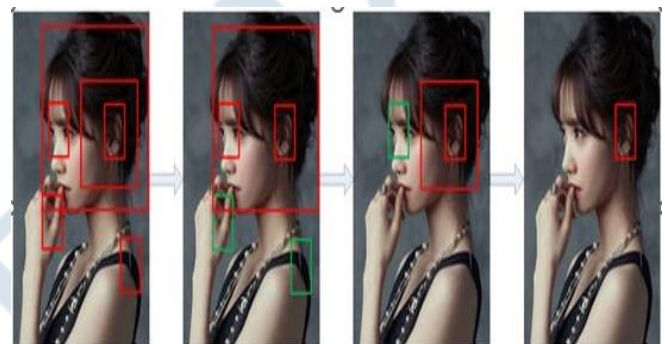


Fig.4.4: detection of ear images in various angle OpenCV

Nearly profile view is gift withinside the photograph. I propose at growing actual-time ear detectors primarily based totally on the overall item detection framework supplied with OpenCV.

V. NETWORK ARCHITECTURE

A. Convolutional Neural Network (CNN)

In deep learning, a convolutional neural community (CNN or ConvNet) is a category of deep neural networks, maximum normally implemented to analysing visible imagery [20]. CNNs are regularized variations of multilayer perceptron's. Multilayer perceptron's normally consult with completely related networks, this is, every neuron in a single layer is hooked up to all neurons withinside the subsequent layer. The completely-connectedness of those networks makes them susceptible to over becoming facts. Typical approaches of regularization consists of including a few shape of value dimension of weights to the loss feature. However, CNNs take a exceptional technique toward regularization: they take gain of the hierarchical sample in facts and gather extra complicated styles the use of smaller and less complicated styles. Therefore, on the size of connectedness and complexity, CNNs are at the decrease extreme. A convolutional neural community includes an enter and an output layer, in addition to a couple of hidden layers. The hidden layers of a CNN commonly include convolutional layers, RELU layer i.e. activation feature, pooling layers, completely related layers and normalization layers.

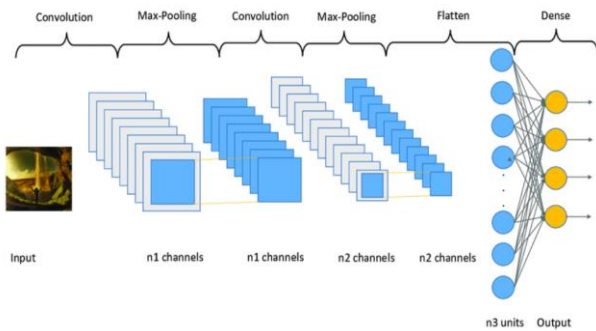


Fig 5.1: Network architecture of convolutional neural network

VI. SOFTWARE

A. Python

Python is an incredible and effective programming language it is smooth to use (smooth to study and write) and with Raspberry Pi helps you to join your venture to the actual world. Python syntax could be very clean, with an emphasis on clarity and makes use of Standard English keywords. Start via way of means of commencing IDLE from the desktop. IDLE offers you a REPL (Read-Evaluate-Print-Loop), that's a set off you could input Python instructions into. Because it is a REPL, you even get the output of instructions revealed to the display with out the usage of print. Python is an interpreter, high-level, general- motive programming language. Created via way of means of Guido van Rossum and primary launched in 1991, Python's layout philosophy emphasizes code clarity with its excellent use of big whitespace. Its language constructs and object-orientated technique pursuits to assist programmers write clear, logical code for small and large-scale projects.

B. Data Set

In this segment for ear biometrics dataset I had organized the dataset with the aid of using amassing a 500 photos of ear of myself, my buddies and my relatives. For facemask detection too. For ear biometrics, detection in addition to popularity is wanted wherein withinside the case of facemask. And I even have carried out this detection on the premise of Viola Jones algorithm.



Fig 6.1 Ear data set



Fig 6.2 Dataset of with mask and without mask

VII. RESULTS AND DISCUSSION

The customer is firstly subjected for the detection of facemask,. After the verification of facemask , the person is allowed for ear biometrics. For a person without mask the system displays as 'no mask' and his entry will be restricted. In the same way, a person with mask is displayed as 'mask', and he will be subjected to ear biometrics and if he is recognised by the system displays as person1 is matched and authenticated , otherwise not matched and rejected.

If there is no object system will display the room temperature in Fahrenheit. If the person is on boarded the then his temperature gets detected. For that the range is set up as between 90F and 98F. If the body temperature is normal, the authentication will be successful. And then the camera gets ready to capture the image for face mask detection. If there is no mask, then the authentication gets failed. Otherwise, the camera again gets ready to capture the image of ear for the final recognition of the person. If it recognises the person, his/her name in the database gets displayed in the LCD display. And the authentication is successful.



Fig 7.1 Result of the system

VIII. CONCLUSION

The purpose of this studies is to create a biometric machine that used photographs of human ears. Ear biometrics seems to be a correct technique to an ever increasing call for safety withinside spaces. Then the strong characteristic extraction approach is regularly accustomed decide character of a few individuals, for example terrorist on the airport terminals. Other feasible programs consist of get entry to manage to numerous homes and spectators monitoring. Ear as biometrics is regularly utilized in multimodal structures to enhance the overall performance of a few different acknowledged biometrics. For example, airports utilise a combination of iris and face biometrics to confirm a passenger's identity; nevertheless, one ear biometric machine is regularly used to confirm a passenger's authenticity with the identical precision. Person's behaviour the usage of written textual content is used to decide if someone is lying, amongst different things. Likewise, the ear may be used to evaluate someone's uniqueness. Some different capabilities of ear lobe helped in this.

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