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Design Simulation of Predicting Age and Gender for Human using Machine Learning Approach

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Abstract:
The amount of audiovisual information that is now readily available in digital format has grown significantly in recent years. Terabytes of brand-new images, audio files, and video clips are produced and preserved every day, resulting in a vast, dispersed, and generally unstructured library of multimedia material that is primarily accessible via the Internet. Multimedia data may now be digitalized, compressed, and archived easily, cheaply, and with a variety of hardware and software supporting these processes. The subsequent recovery of the stored knowledge, however, could need a large amount of extra labor in order to be effective and successful. Searching the media for clues about the human emotions depicted in the photos, audio, or video snippets is known as emotion-based retrieval. This kind of intricate system takes user input and processes it to produce useful results. They can take into account the color of the image, the objects in it, its categorization (such as outdoors or inside), and its emotion (also called mood or feeling). Depending on how it is read, the final one can refer to either the emotional content of an image or the effect it has on a person. The proposed study emphasizes the use of SVMs for picture segmentation, emotion analysis, and age, gender, and mood identification via feature extraction and classification. The proposed study emphasizes the use of SVMs for picture segmentation, emotion analysis, and age, gender, and mood identification via feature extraction and classification.
Keywords- PSNR, IOT, Encryption, SVM, Image, Emotion, Image Processing, EBIR.

1. INTRODUCTION

Through the use of a digital computer, digital image processing manipulates digital pictures. Although it focuses on images, DIP is a subfield of signals and structures. It focuses on developing a computer system for image processing. The system receives a numerical picture as input, processes it using effective image algorithms, and outputs an image. The most popular illustration is Adobe Image Shop. One of the most popular uses for digital image processing is this.

Data formatting, data rectification, digital augmentation for better visual interpretation, and computer automation are only a few of the ways used to process the digital picture. In this way, the memory storage serves as the equivalent of a computer hard drive for the digital data. Another prerequisite for digital image processing is a computer system, usually referred to as an image analysis system, which comprises the proper data processing hardware and software. As a result, the processing of images is a sort of information processing in which the input and output are images like frames or plot diagrams.

The majority of image processing methods consider pictures as two-dimensional signals. The two-dimensional light intensities f (x, y), where x and y stand for the spatial coordinates, are what are used to define an image. The image's gray level or intensity at each given coordinate pair is referred to as F. (x, y). In this instance, the digital picture is known when the f values of the variables amplitude, x, and y are discrete and finite.

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2. LITERATURE REVIEW

[Wen Zhang, et al., 2018] condenses the research program for the use of watermarking technology and identifying such technology that is more readily available, less expensive, and less polluted. The designers defined three steps that result in the watermarks: printing, sweeping, separating, and differentiating watermarks, which were divided during the watermarking process. The computerized watermarking technology used on the advanced photographs makes the investigation difficult and prevents the development of any kind of relationship between the printing process factors and the watermarking computation. The scientists concluded that the link between intangibility and the ability to fend against printing-checking attacks may be altered in this way. The process of printing and verifying involves changing the shade area. [1]

For the presentation of shading watermarks, [David-Octavio Muoz-Ramirez, et al., 2018] presented a potent watermarking technique. Shaded images are employed as watermarks using the discrete cosine transform (DCT) and quantization index modulation (QIM) methods. The data needed to communicate to the shading is lowered by the way the shading watermark is encoded. To guarantee the strength of the watermark, the coded watermark is converted into mid-frequency coefficients of DCT. The suggested system has been compared to the productivity of the most fundamental attacks, such as JPEG pressure, reckless and Gaussian clamors, scaling, and so on, in terms of Peak-Signal-to-Noise Ratio (PSNR). Accordingly, the results are predicated on the assumption that the suggested framework achieves high indistinctness with typical estimates of PSNR as 40 dB and SSIM as 0.994 dB. When compared to the JPEG pressure, rash, and Gaussian clamor, this strength is also strong; even the watermark might be recovered up to a certain breaking threshold. [2]

By leveraging alpha mixing, [Anirban Patra et. al., 2018] developed yet another technique for covertly watermarking photos. The purpose of alpha mixing is to display a bitmap, and a bitmap that uses alpha is made up of simple and semi-simple pixels. The analysts have experimented with grayscale and shading images, with the grayscale serving as a watermark picture that is placed at a secret location of the primary scale image by using various estimates of alpha in alpha mixing. Each picture plane is subjected to this process. The second image has details about the shading image and the grayscale image, although the initial images are hardly noticeable. Hense, After post-processing, the approach can be used as picture stenography. [3]

2018 [Irshad Ahmad Ansari et al.] Square-based SVD image watermarking in spatial and change spaces was a computation for picture watermarking that was suggested in the study. This suggested tactic is used to keep electronic images away from unauthorized users. A robust picture watermarking technique is used to provide a clear indication of who the true owner of the host image is. The expert determines that the aggressive watermarking plan is faulty, and the flaws are now being focused. It is not the right choice to understand the accountability for the watermarked image because the plan is full of errors. The suggested technique thereby enhances the robustness and impalpability that are dependent on the SVD approach. Tragically, this methodology becomes futile and aimless owing to the proximity of a fake location. While using a square-based SVD strategy enhances the power and intangibility, this advantage is rendered unimportant by the security flaw (false positive error) that persists in their scheme. [4]

A flexible probability thresholding method was given by [Alexander S. Komarov, et al., 2018] for the computerized localization of ice and uncontrolled water using RADARSAT-2. When 0.95 edge static probabilities were used, it broke down misclassified ice and water tests, therefore the limit likelihood has to be changed. The misclassified ice and water tests were successfully described and distinguished by the examination of appropriation, which was directed. When the initial ice and water identification computation is presented with a static probability limit estimate of 0.95, this order is carried out. Because of this, the analyst assumes that when the ice and water finding calculation was made, the initial probability edge may be stretched, differentiated, and enhanced. [5]

3. OBJECTIVE

The goals met by the thesis are listed as follows:

- Preprocessing and analysis of facial expressions.

- Performance Analysis of Machine learning based age, gender and emotion detection framework.
- Performance Analysis of proposed system under parametric variation for various sample of images.
- Development of Graphical User Interface for the proposed system.

4. METHODOLOGY

Proposed Methodology

Extracted facial traits are categorized in order to provide a unique identity for each individual human face. The recognition of human faces has a number of flaws. Human motions, intentions, behavior, and position all affect facial expressions. The proposed strategy is based on the Feature invariant based method presented in the first chapter among several human facial detection techniques. The proposed approach uses the intensity of colour and texture of the skin in the facial image as a face detection characteristic. The proposed methodology is discussed in detail in the next section.

Extraction of Skin Color

Because skin tone is an invariant, it also serves as a distinguishing trait. Every person has a different skin tone and color complexion. Skin Color Extraction is commonly used to characterize a person's race. It is a color-space-based method of obtaining skin color from a facial image. For applications like face detection, face identification, hand tracking, and palm print detection, skin color extraction is critical. The suggested face detection is based on a feature invariant based technique, as mentioned earlier. As a result, the intensity of the tone value can be used to determine the face. Color space is important in the skin color determination process since it helps to distinguish the skin color region from the input image. The following section delves deeper into colour space.

Color Palette: A colour space is a mathematical analysis procedure that represents or provides colour signals for use in digital image processing. Red, Green, and Blue are the three fundamental or basic colour spaces used in this approach. These basic colours mix or intermingle with one another, adapt to the basic colours, and create a range of colour spaces. A large array of colour space models, including as RGB, YCbCr, HSV, YIQ, YUV, CIE, and XYZ, have been used to demonstrate skin colour detection. The most prominent colour space models are RGB, YCbCr, and HSV. The RGB colour space model is employed for face detection in this suggested work, which is detailed in the next section.

RGB Color Space: The RGB color space is the foundation for all color spaces. It was created with the goal of being used in display applications such as monitors.

All digital detection screens, including the scanner RGB is one of the most widely used colour spaces in digital image processing for managing and handling digital data. Red, Green, and Blue are the three primary colour peripherals. Each pixel in an image has three units of each peripheral, each of which is given a score based on the skin colour. The whole colour can be achieved in this colour space model by integrating all three peripherals. The skin pixel in a digital image can be easily detected using this concept. RGB is the native colour space in picture segmentation, despite the fact that other colour spaces are available. As a result, the RGB colour model and clustering approaches are used for skin colour segmentation in this suggested work. The proposed face detection methodology is described in depth in the next section.

The proposed title is face features-based age and gender estimation in humans. Face detection is the first step in extracting the face region, and facial features are then used to determine gender and age of an input facial image.

The Spectral Color Clustering based Face Detection (SCC-FD) approach is proposed in this proposed work with the goal of achieving efficient face detections and analysing behavioural patterns for human faces in digital images. The proposed technique SCC-FD is described in this section. Face Detection Using Spectral Color Clustering Block Diagram

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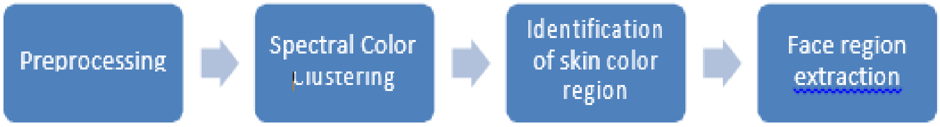

Figure 4.1: Technique for Robust Face Detection

Figure 4.1 depicts the intended work's four major phases. The facial photographs are obtained from several databases during pre-processing and are used as input images in this suggested study. The data is clustered into different levels using spectral colour clustering. The following step is to determine the skin colour region. The skin colour region of a spectral colour clustering image is extracted using RGB colour space. Finally, in the Face Region Extraction phase, the facial region of an input image is detected.

SVM-based Age Classification: A General Approach

On the supplied grey scale image, we first do pre-processing activities. Histogram equalisation and intensity normalisation are two of these processes. Due to variable lighting, histogram equalisation and intensity normalisation are applied to the image. Face features are extracted and used to construct a training dataset. The model is then created by training a classifier with the feature and the labelled data set pair.

The features are extracted in the same way for a test image. These characteristics are used by the model to determine the person's age group. Image conversion from colour to grayscale. In a picture, the grey value for pixel I is linear. Pixel I corresponds to a combination of three intensity values of three primary colours (Red, green, and blue, or (RGB).

0.2989 * R(i) + 0.5870 * G(i) + 0.5870 * G(i) + [Source: MATLAB help] 0.1140 * B(i) (4.1)

Where

Gray value I equals the grey level for pixel i.

R(i) = Red colour intensity in pixel i.

G(i) = Green colour intensity in pixel i.

Face Recognition

Face detection is done using the Open CV library. The location of human faces in grayscale photographs is determined using approaches that ignore other items in the image. There are numerous implementations available, and we use the Open CV implementation with haar features. For the extraction of facial features, we used a face detection algorithm. The algorithm's description is as follows: Viola-Jones suggested using Haar-like characteristics, which may be computed quickly using integral images. Face image vertical and diagonal intensity information at various positions and scales. The total number of pixels in a rectangle The difference between dark and light regions is used to construct Haar-like characteristics. They can be thought of as features that capture local edge information at various scales and orientations. Only a small portion of the set of Haar-like features is learned from positive and negative instances for face detection. Example: The difference between the sums of the pixels within two rectangular sections is the value of a two-rectangle feature for A.

Classification Steps are as follows-

- Convert colour or grayscale photographs to grayscale images in step one.
- Next, use Photoshop to pre-process the photos.
- Techniques for equalising histograms and normalising intensity.
- Using the Viola-Jones Method and the Open CV package, extract the image's frontal face.
- Pre-processing and feature extraction are the final steps.
- Use the SVM classifier to build a model. Step 6: Use the Trained Model to predict the group.

5. RESULTS ANALYSIS

The first learning set (LS1), which comprises of 20 images, was designed to aid in the differentiation of warm-cold, heavy-light, and positive-negative categories. It primarily features landscape photographs, thus expressing dynamism or wrath is not possible. The second learning set (LS2) is made up of 636 images and was designed to support the following categories that were not covered in the first: basic emotions, dynamic-static, and artificial-

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natural. It includes photographs retrieved by search engines like as Flickr and Google for emotional keyword searches. However, because the neural network trained on this set was unable to successfully categories any general images (for example, landscapes), the third (LS3) was created using photographs. It includes images from the preceding two sets in order to support all classifications.

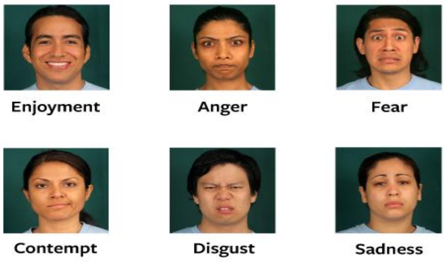

Figure 5.1 Example of Emotions

In the experiments, three image sets are used to test the system's performance. They all contain a variety of images from various genres. We tried to keep the number of representatives in each category balanced. The first collection (DB1) contains photos, most of which are landscapes. The second group (DB2) contains images that are largely emotionally charged and manufactured. It is clear that the network's performance is significantly reliant on the subsets picked for learning and testing . However, a high classification score for one category comes at the expense of lower classification scores for other categories: the network trained on the third subset correctly classified 86 percent and 92 percent of pictures according to the dynamic-static category, but had lower classification scores for all other categories. The SVM classification was successfully evaluated on a female facial expression database and a male facial expression image database.

To provide ease of access and analysis a graphical user interface was developed to enable easy execution of the process. Figure represents the image acquisition by internet enable mobile camera. This can be used for creation of dataset.

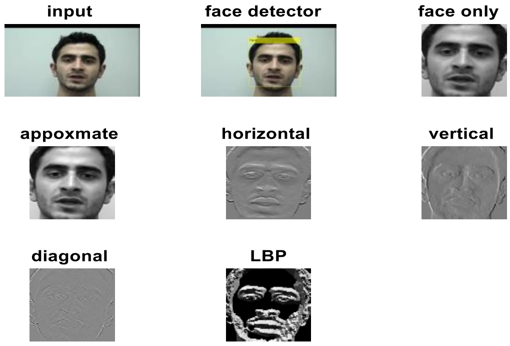

Figure 5.2 Pre Processing of Images

Figure 5.2 indicates the process of preprocessing of images through various process. Each process has been represented with the help of graphical user interface and the proposed model is explained in figure. To provide ease of access and analysis a graphical user interface was developed to enable easy execution of the process. Figure represents the complete process of preprocessing and feature extraction carried out in the proposed algorithm.

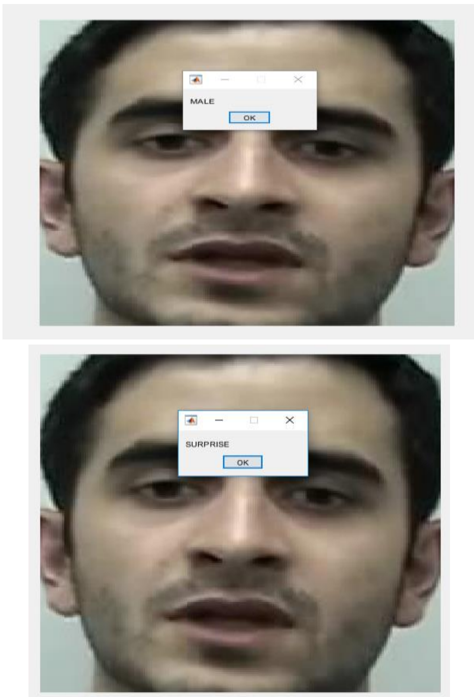

Figure 5.3 Detection of Gender Figure

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5.4 Detection of Emotion

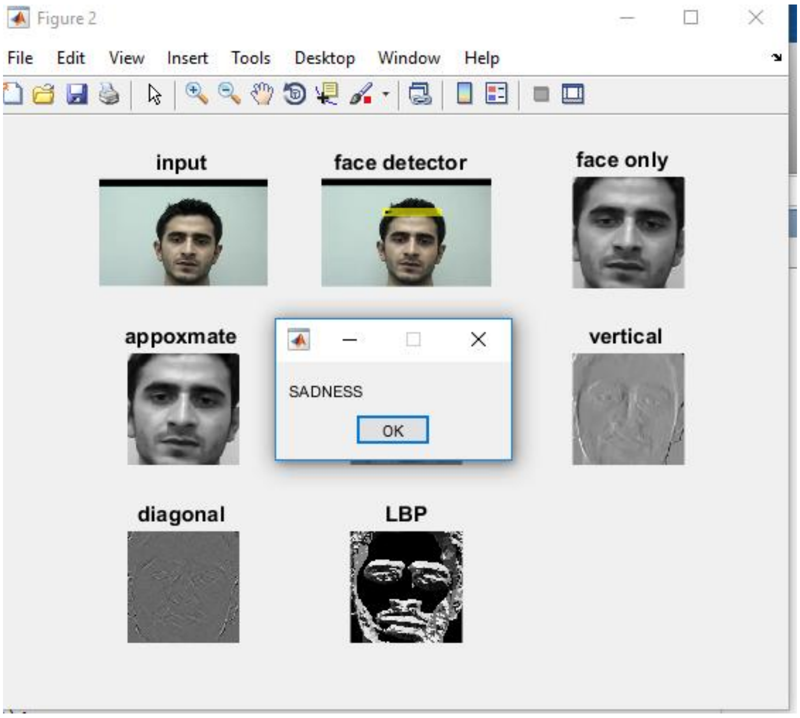

Figure 5.5 Detection of Emotion with GUI

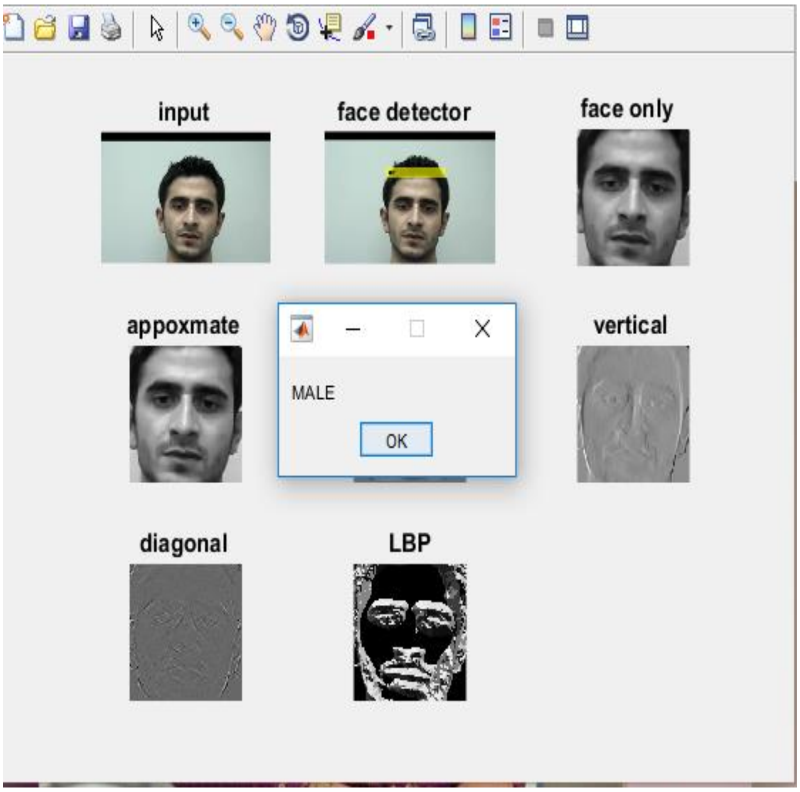

Figure 5.6 Detection of Gender with GUI

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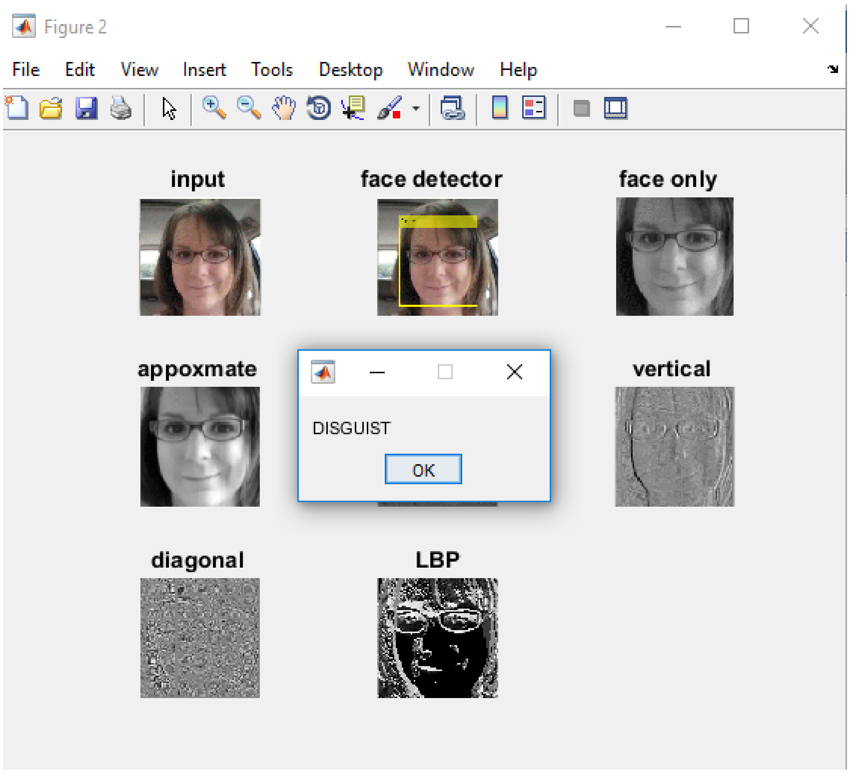

Figure 5.7 Emotion Detection Sample-2

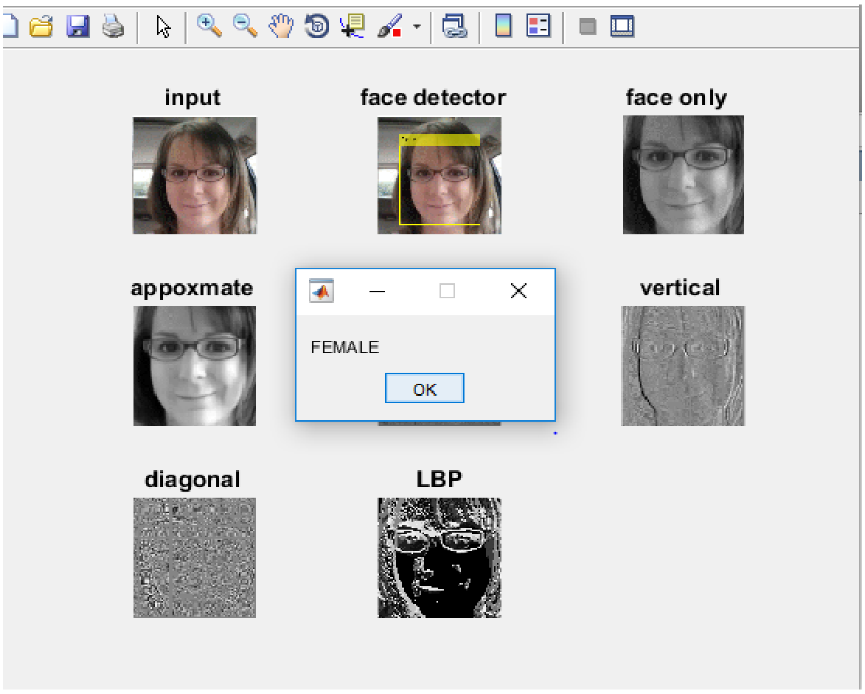

Figure 5.8 Gender Detection Sample-2

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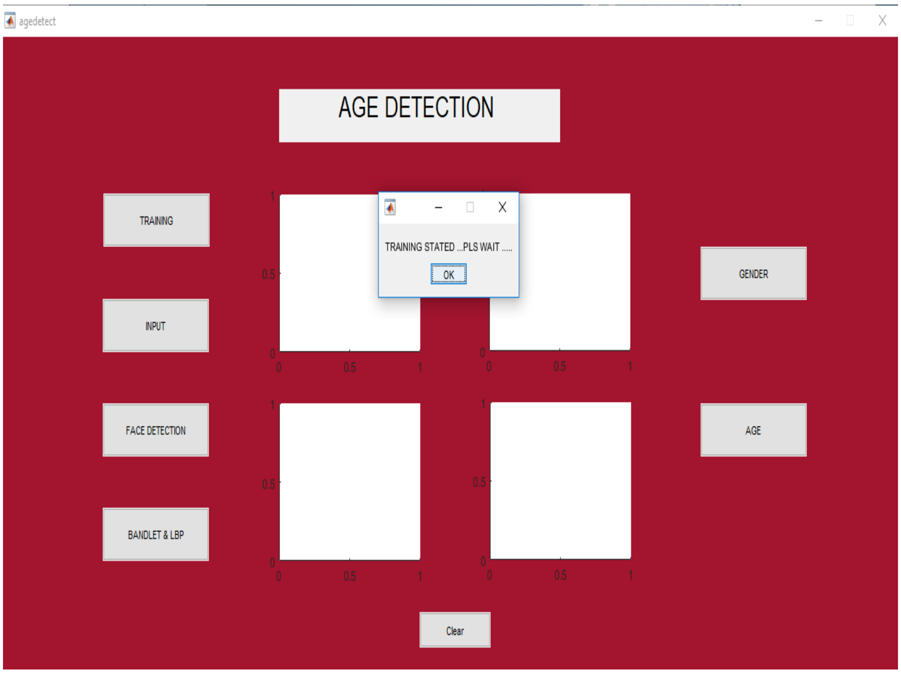

Figure 5.9 Graphical User Interface for Process of Age and Gender Detection

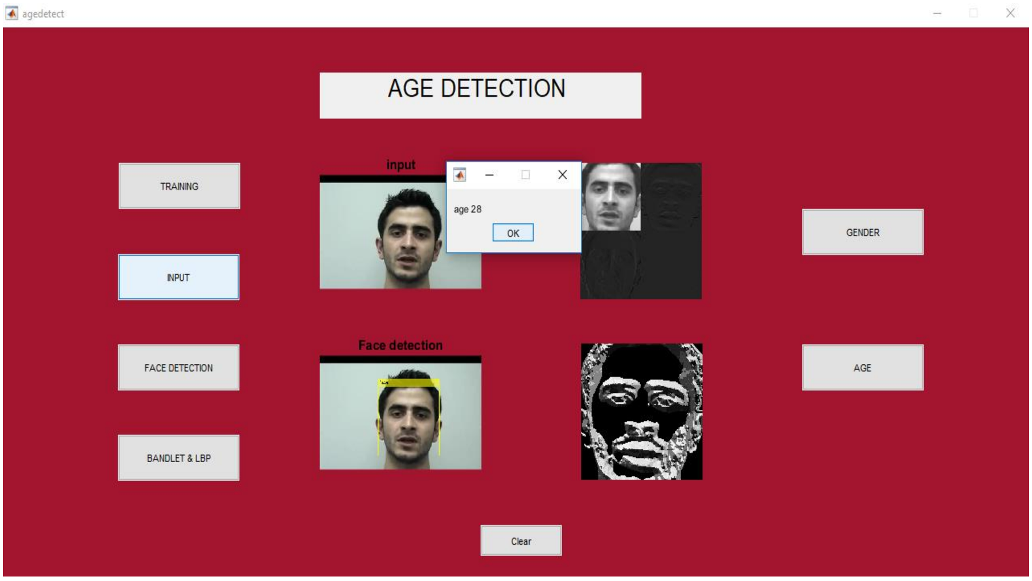

Figure 5.10 Detection of Age with the Proposed Process

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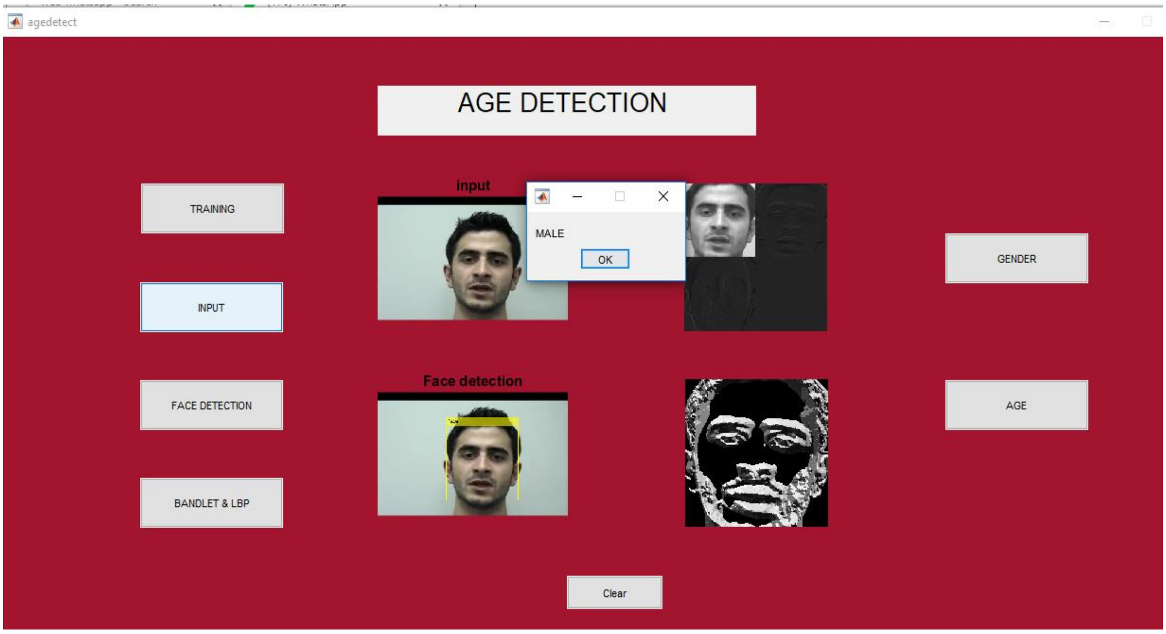

Figure 5.11 Detection of Gender with GUI

The figure indicates the developed GUI with different interface for emotion analysis and alertness system for analysis and execution of proposed system.

Table 5.1

Analysis of Accuracy of Gender and Age Detection

Parameter	Percentage Accuracy
Gender Detection	**93.21 %**
Age Detection	**90.88 %**

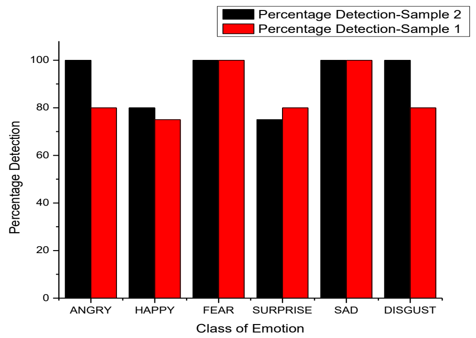

Figure 5.12 Analysis of Accuracy of Emotion Detection

This work presents a comprehensive practical investigation of LBP-based facial emotion recognition. Feature extraction, face representation, and classification make up its three main components. Face representation clarifies the ensuing algorithms of identification and detection and demonstrates how to model a face. In the feature extraction process, the distinguishing characteristics of face photos are extracted. The facial image is assessed among the photos in the database during the categorization or classification process. Face recognition is roughly 90% accurate, while face expression recognition is likewise within the same 90% accuracy level.

6. CONCLUSION& FUTURE SCOPE

Conclusion

There is presently relatively little practical application of emotion recognition technologies. In example, emotion recognition technology has so far had little effect on more general uses of photo searching, including journalism or home entertainment. In many situations, the searcher may find pictures of desired things or scenarios by using a little creativity. In general, specialized color or emotion matching applications may benefit from using current emotion detection systems. Furthermore, it is conceivable that they are working to enhance the effectiveness of general-purpose text-based image retrieval systems. Before autonomous semantic feature identification and indexing systems are accessible, nevertheless, significant technological breakthroughs will be needed.

Edge and SVM-LBP face classifiers can be distinguished using experimental results from the training phase. Data from both face-to-face and non-face-to-face training is included. With the assistance of internal weight modifications. Experiments on the effectiveness of these divides have shown that the images have equal generalisation abilities (true detection rate over the total number of false detections). SVM-LBP has a somewhat greater generalisation value accuracy than other techniques like counterpart. It is possible to prove that SVM-LBP is superior to Fusion skin method. Using a series of test photos and altering the Conditions and factors, face recognition and detection algorithms were fully investigated. All of the previous projects used real-time data. SVM-LBP and Edge success rates They were given out during face detection, with varied success rates for different photographs based on the exterior image. The proposed technique had a 92.5 percent overall success rate.

Future Works

The IoT stage faces a number of challenges, including those related to intensity, data transfer capacity, adaptability, security, and protection. Security and protection is the most important test that should be planned in order to maintain client confidence in IoT-based devices. Predefined security arrangements at each tier continue to be vulnerable to security-related attacks. As a result, current cryptography computations can be used to ensure security. In any event, the traditional substantial weight calculations are not ideal for IoT due to their harsh nature. As a result, lightweight cryptography configurations that are both symmetric and lopsided can be used. So many practical, lightweight security calculations can be produced in the future that use a reduced number of block size and key size with a financially smart nature and provide superior security to IoT-based devices.

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