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FACIAL MICRO EXPRESSION, AGE AND GENDER RECOGNITION USING DEEP CONVOLUTIONAL NEURAL NETWORK

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Abstract: Identification of facial micro-expressions, emotions and these micro-expressions is a basic element of human and social interaction. Micro expressions are the result of voluntary and non-voluntary emotional reactions to stimuli that last for a few microseconds. Facial recognition and emotional identification is useful for biological medical applications such as surveillance, safety, brain monitoring of epilepsy and paralysis patients, and human computer interaction. The technology used in this paper is Convolutional Neural Networks (CNNs), which involve constructing characteristic maps using filtering data as input to do the convolution. The neural network is part of the artificial neural network, which is mainly applied to image detection and classification processes. The results obtained by testing a model composed of several input images give the output. The model recognizes the micro expressions of the face and highlights the output image. The accuracy of the group's image detection proves that the system saves time otherwise spent identifying each individual's emotions, but also have high accuracy for images of multiple people. Age assessment plays a leading role in applications such as biometric assessment, virtual makeup and virtual demonstration applications for jewelry and eyewear by mapping the face according to the found age. Lens Kart is an application that gives customers the option of trying it out. Age estimation is a subfield of facial recognition and facial tracking that in combination can predict individual health. Many medical applications use this mechanism to monitor their daily activities to keep track of their health. China uses this face detection technique for the identification of service drivers and the identification of Jaywalker. A number of essential machine learning algorithms to predict age and gender have been used. CNN methods are used to find an age and gender identification. In this implementation, Open CV and CNN has been used to predict the age and gender of a given person.

Index Terms **- Deep Learning, Image segmentation, Edge Detection, Neural Networks, face features, Convolutional Neural Network.**

I.INTRODUCTION

Facial recognition many applications such as user authentication, targeted advertising, video surveillance and interaction between human and robotics. As technology improves, advanced applications combine pattern recognition and image processing to find age, gender and expression. In today's world, age plays an important role when attending interviews and health checks. Age information is used by many governments, private organizations and advertising organizations to identify responsible persons, employment-qualified employees and target audiences for product advertising, respectively. However, difficult to find a person's age and some constraints pre- vent us from seeing the correct age in a sequence of images. The exploration for the model training for right data is significant task. Huge number of real-time data, the calculation time and model preparation time are high. After applying several methods of machine learning, difficult task, and accuracy increases drastically.

The technique divides facial micro expressions into categories such as surprise, neutral, happiness, disgust, fear, and anger. System is a productive way for people and robots to communicate through eye contact, facial expressions, cognitive modeling, face recognition and categorization are used here. A natural approach to communicate with both people and robots is through expression. The same individual's expressions do not alter over time since system intensity differs from person to person according on age, gender and shape of the face. To predict age and gender and expression, a number of critical machine learning algorithms are used. CNN (Convolutional Neural Network) used methods for recognize age and gender and expression. In this implementation, Open CV and CNN are used to predict the age and gender and expression of any individual.

II.LITERATURE REVIEW

In different fields, it is essential to find target objects and tracking them effectively when handling obstructions and other complex aspects the system. Different techniques for tracking things have been attempted by researchers. This technology depends mainly on the domain of application.

T.M.W. Vithanawasam [1], the author of the paper says that dynamic emotional expressions of the upper body are two of the main modes of non-verbal communication used by humans in communicating with each other. Service machine understand emotions by these two methods to better interact with humans when providing services. The paper presents an approach for recognizing the emotions and upper body through a RGB-D sensor (Kinect) for service robots that allows a robust detection of the upper body. The feeling of the face and upper body is recognized by the linear discrimination analysis (LDA) and pattern recognition neural network (PRNN) classifications. Service robots can be domestic, industrial, or scientific and are intended to support humans in many ways in performing various tasks. When performing their duties, interactions with humans are inevitable. Service robots must possess human under- standing non-verbal communication to communicate with humans similar to humans.

S. Mahjabin [2], proposed a method for estimating age on the basis of movement neural network (CNN) that could predict age with almost accuracy from facial images. Our approach used small learning set are related work, but maintains a low mean absolute error (MAE). To construct a model called ResNet 50 on top of a 50 layer residual network and apply age estimation as a regression problems.

Khan S [3], argues that proposing a method for estimating age based on facial images is a difficult problem to solve in computer vision systems. The study provides new method to predicting human age. Advanced methods are discrete cosine transformation to analyze the face and wrinkles (DCTs).

Rajesh K M [4], stated that the research presented a foundation for real-time Face identification and facial expression detection systems based on a person's face and actions. The main elements of the face images taken to predicting facial emotions and users. The variations of facial characteristic utilized to establish the different emotions in the face. Identify and classify different facial emotions through different image sets. In this context, the implementation of the algorithm is contributing too many areas of identification, psychological real-world research problems. The suggested method is executed using Open CV and Python machine learning. Analyzing faces and their characteristics has been empirical research over the past decades. The change in position, lighting conditions, bad lighting, etc., is still difficult factors to solve in all algorithms. Face recognition and emotional detection systems are the main applications of recognition systems and many algorithms are trying to solve these problems. Face identification is a fundamental part of modern authentication and identification applications, and this system should be highly accurate to achieve better results.

Dong Yoon Choi [5], Facial Micro-Expression Recognition Using Two-Dimensional Landmark Feature Maps. For efficient human-artificial intelligence (AI) interaction, such as with social robots, emotion identification based on facial expressions is crucial. Contrarily, facial micro expressions (FMEs) are far more difficult to identify in a real-world setting than face general expressions with complex emotions. For successfully identifying such FMEs, a two-dimensional (2D) landmark feature map is provided in this study. By converting traditional coordinate-based landmark information into 2D image information, the proposed 2D landmark feature map (LFM) is created. LFM is made to have a beneficial quality regardless of how much a facial expression changes. Additionally, a long short-term memory (LSTM) and convolutional neural network (CNN) integrated architecture is provided for emotion identification.

Cho-I Moon [6], Wrinkles form a network-like substructure on the skin's surface. Simple, reliable, and effective evaluation techniques for diagnosing skin conditions involve observing and examining the microstructure of the skin, which varies with skin condition and age. However, depending on the person or the level of age, the skin's surface has different morphological and topological alterations. Accurately extracting and analyzing a skin microstructure with these changes is challenging. Because of this, the skin microstructure is segregated and aging is analyzed using convolutional neural network (CNN) models. To extract the skin microstructure, first a fusion UNet model is suggested. With the use of deep learning models and an image processing technique, comparison and assessment of the segmentation performance is accomplished. Next, skin aging is categorized according to the microstructure of the skin.

Berkay Elagozi [7], states that Real Time Emotion Recognition from Facial Expressions Using CNN Architecture. Emotional states are important subjects in different disciplines fields of biomedical engineering, psychology, neuroscience, and health. Emotional recognition can help diagnose brain and mental disorders. Current years, deep machine learning is made significant progress in image classification. This study proposed LeNet architecture based on the convolutional neural network to identify facial expressions. Initially, three datasets are merged (JAFFE, KDEF and custom datasets). Emotion is the appearance or reflection of emotions. Unlike feelings, emotions can be real or rumors. Emotions psychologically present internal situations. Emotion is an important, complex and extensive research topic in the fields of biomedical engineering, psychology, neuroscience and health. Emotional detection is an important field of research in biomedical engineering. Research in this field focuses on predicting human emotions and computer-assisted diagnosis of psychological disorders.

Kang R Young Park [8], notes that the author of the paper explain the identification of fingerprints and 3D faces of mobile devices has price and size limitations of addition- al cameras, lighting and sensors. In addition, visible light, camera-based 2D

facial recognition, palm print recognition, touch less fingerprint recognition, finger nail print recognition hard to use mobile devices are some restriction to achievement in the recognition and user problems. Reply to question, conducted on finger-flip recognition in mobile devices, but image quality is often reduced due to movement blurs caused by camera or user finger movement, which reduces the effectiveness of recognition. The study proposes a method to restore and recognize motion-blurred finger curve images based on generative opposite networks and deep convolutional neural networks. The test was execute in two ways finger wrinkle databases (DMFW-DB1 and DMFW-DB2), made custom by 33 images captured by smartphone cameras. The outcomes reveal a high recovery and recognition performance comparison to latest methods.

Choon-Ching Ng [9], states that wrinkles are main part of face analysis. Applications such as facial retouching, facial emotional identification, and facial age assessment. Although some techniques for wrinkle analysis have been studied in the literature, bad detection limits the accuracy and reliability of wrinkle segmentation. For this reason, automated wrinkle detection is essential to maintaining consistency and reducing human errors. Hessian line tracking (HLT) find a detection problem. HLT consists of Hessian seeds and directional line tracking. Addition of Hessian filter, but it significantly improves the results location of the wrinkle compared to existing methods. During the experimental phase, three encoders were instructed to manually mark wrinkles. To evaluate manual annotation, both internal and external reliability was measured, with a 99 per cent or higher accuracy.

III.RESEARCH METHODOLOGY

Identification the seven universal emotions, such as Anger, Fear, Happiness, Sadness, Neutrality, Surprise, and Disgust and can be performed to Recognize Facial micro expressions and emotions. This approach integrates face detection modules, creating a neural network and training data sets and achieving greater accuracy using neural networks (CNN), customizing the three neural network architectures, training them and completing various classification tasks. Image entered data is provided the network, which returns the output layer performance matrix generated by the final model, highest value of the matrix is calculated, this value represents the current emotion of the input provided.

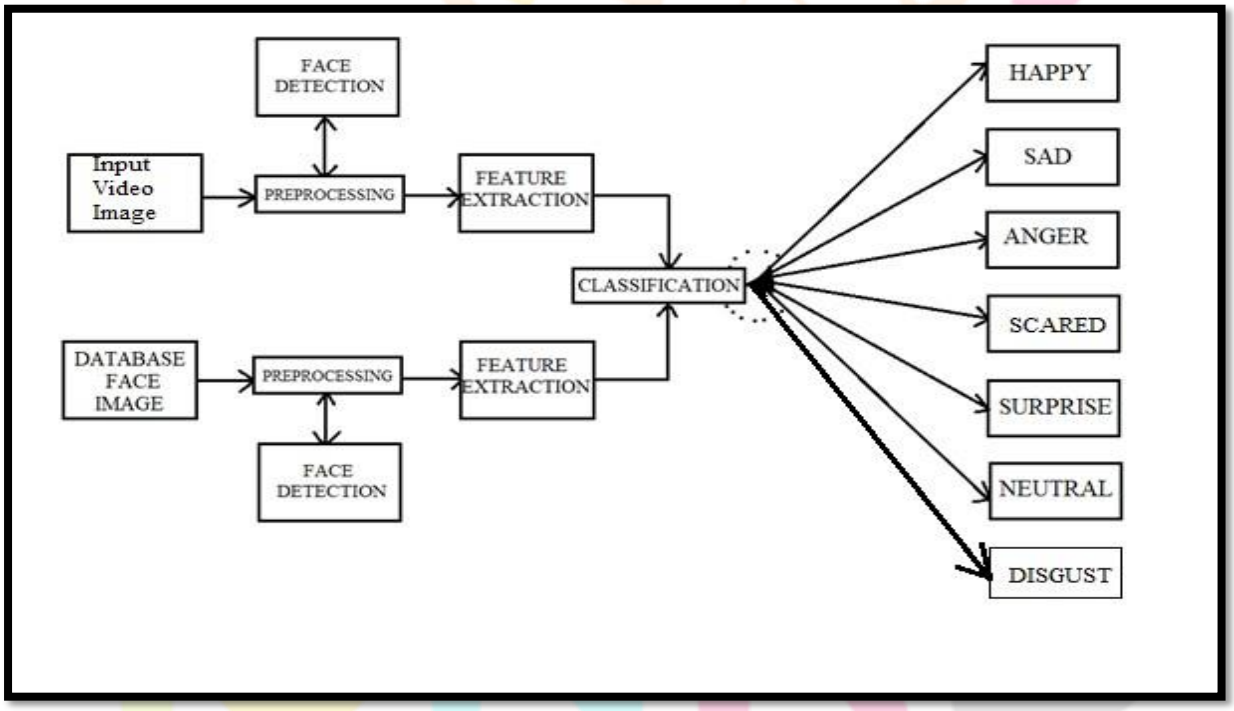

Figure 1. Proposed System Architecture for Expression

The Figure 1, 2 illustrates CNN architecture employs which works on three layers, two successive convolutions, pooling layer and a fully connected layer. Convolution layers remain layers in which filters remain functional to original images, or to additional features map in CNN. The greatest significant limitations are the amount of kernels in addition extent of kernels. A CNN layer takes a group of filters that remain be functional to input images and create dissimilar activation topographies. Pooling layer remain alike to CNN layers they achieve a precise purpose such as min- pooling that take maximum value in predefined filter area that receipts average cost in filter area. Such are classically castoff to decrease the dimension of network. In figure 5, max pooling is applied. Completely linked layer remain placed over the grouping outcome of CNN in addition are castoff to compress the consequences before grouping. This remains a like to outcome layers of an NLP.

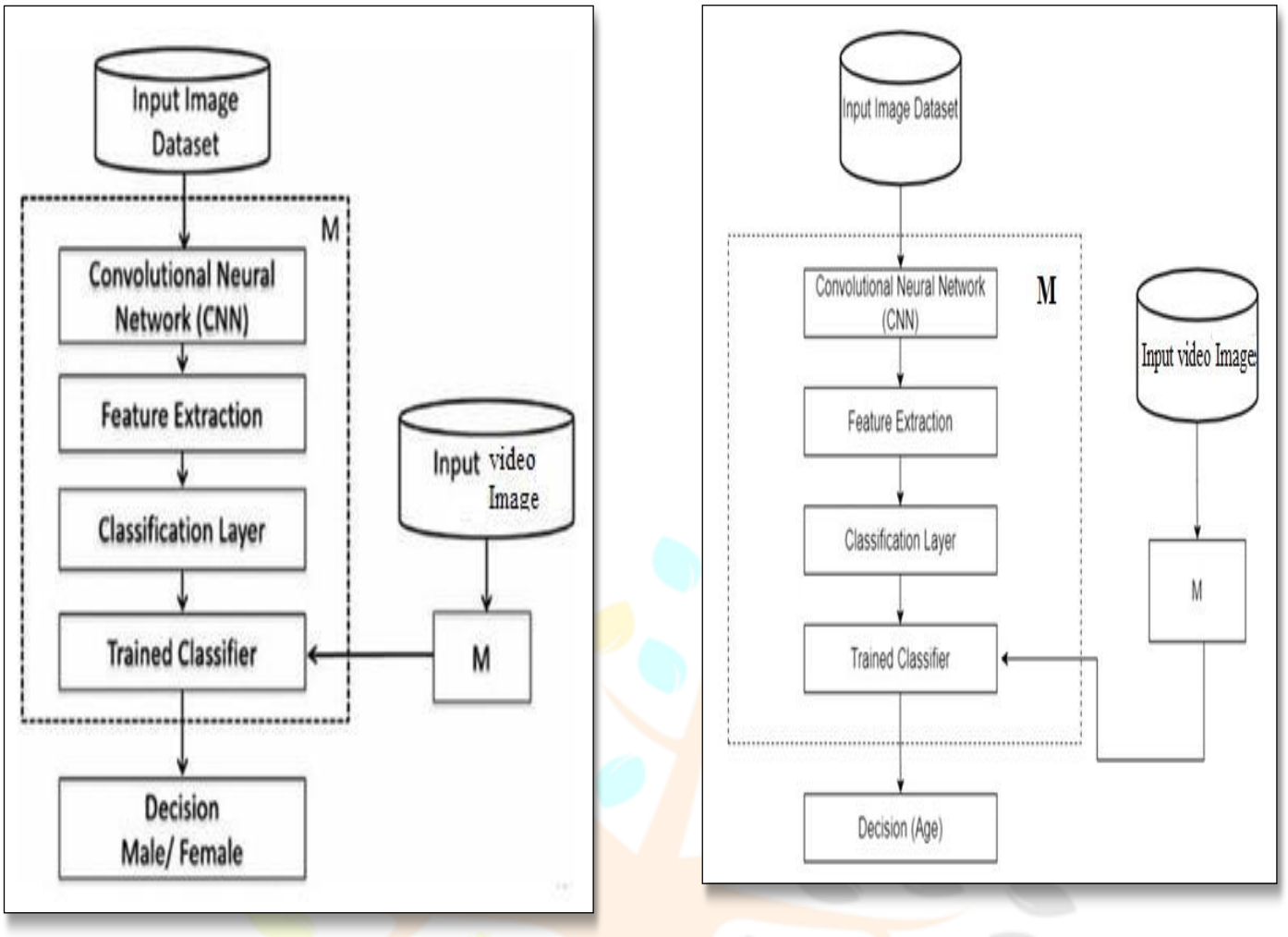

Figure 2. Proposed System Architecture for Gender and Age

The classification, grouping and segmentation is been easily done by the CNN. Here it is assumed a grouping layer and classification layers on top of information layer. These CNN help to cluster unlabeled information conferring to likenesses amongst the example contributions and categorize data if they partake a labeled database to train on. CNN can likewise accept topographies that remain served to additional procedures to categorization and clustering.

3.1 MODULES DESCRIPTION

i. **Image acquisition**: The image is captured or selected from a stored image, scanned and converted into a manageable entity is called image acquisition. In this face, images are given as input through the digital camera and stored in the hard disk. Two images have to be given as input, an old and young photograph of a person.
ii. **Face Detection**: The input images are checked for faces. If faces are detected, then the faces are cropped and are further passed on to the next process. Else, the user has been prompted to input a proper photograph.
iii. **Image Pre-processing**: The images are first converted into a grayscale image, then are resized to a specific shape and perform some filtering operations for image enhancement.
iv. **Feature extraction**: Feature extraction is a very crucial role in any machine learning task. It could be considered as a process of dimensionality reduction, where very relevant features are considered for training. Here, multiple models are considered, hence the model-specific feature extraction technique is applied to its corresponding model.
v. **Predictions using Multiple Models**: Another methodology involves utilizing cycle and to generate photos of various ages, extracting Face features from those images, then applying those features to the input images and performing predictions.
vi. **Final Predictions** from different models are obtained. The predictions will be binary classification from each model. Once all the predictions are collected, the maximum occurrence of a particular class of prediction, i.e., “Yes” or “No” will be predicted.

3.2 CONVOLUTIONAL NEURAL NETWORK (CNN)

CNN is a method of deep CNN, maximum of frequently functional to examine visual images in deep learning. These are likewise recognized as modification invariant or planetary invariant ANN, founded on communal weight construction of convolution filters that transparency laterally input topographies and deliver conversion equi-variant answers recognized as feature maps. Counter spontaneously, maximum CNN is only equi-variant, as different to invariant, to conversion. These have submissions in video and recognition, recommender schemes, image segmentation, medical image analysis, brain-computer interfaces, natural language processing, in addition financial applications.

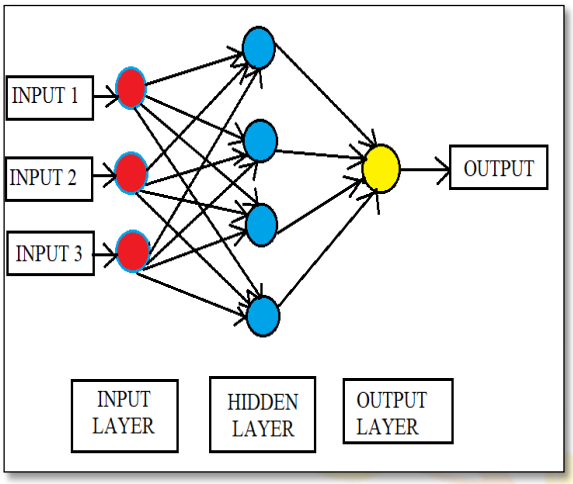

Figure 3. Sımple Neural Network

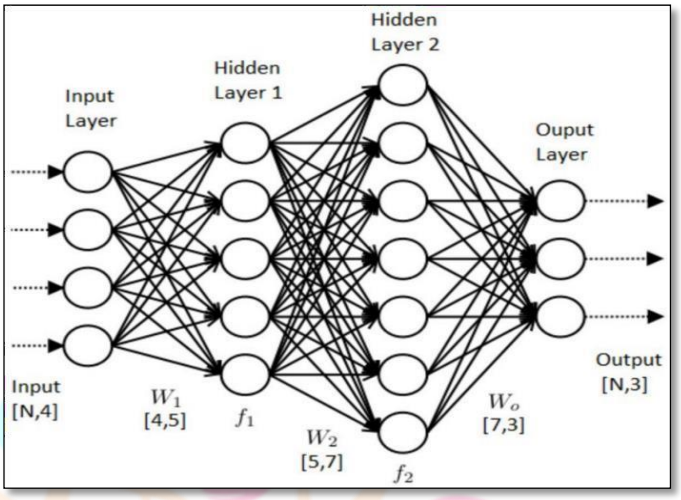

Figure 4. Neural Network Architecture

Deep learning refers to multiple layers in the network. It consists of three layers namely are Input layer, Hidden layer and Output layer .The hidden layer has a greater impact on network learning capability. CNN algorithm used Identification the Faces, Classify human expression, Identify emotions, Identify Age, Identify Gender.

IV. RESULTS AND DISCUSSION

This part, the different outcomes are detailed in our project execution and the system performance is shown as below.

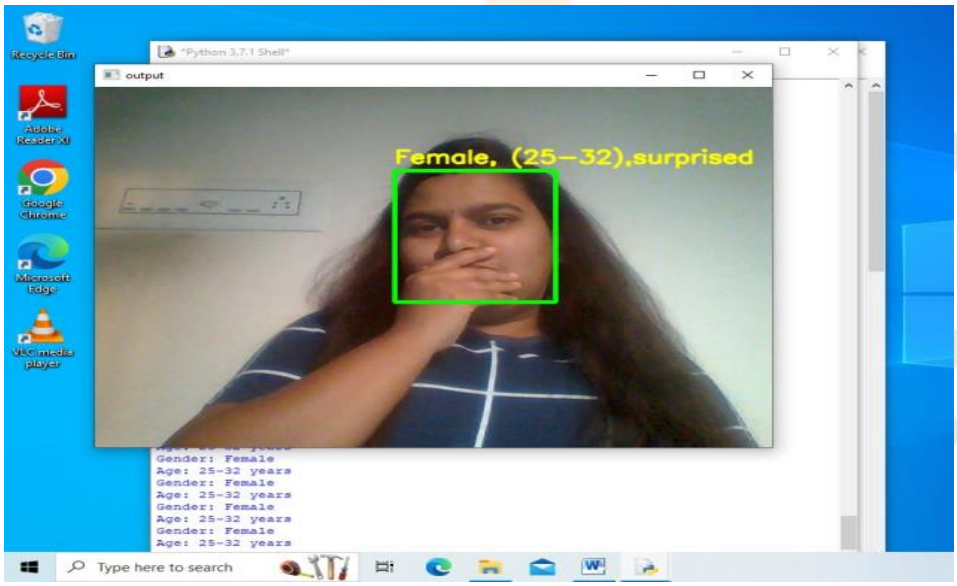

Figure 5. Results of Surprised for Female

The above figure 5 shows the output is Surprised for Female, The image shows Facial Micro Expression is recognize the Expression is “Surprised” and age is ranges from(25-32) and gender is Female

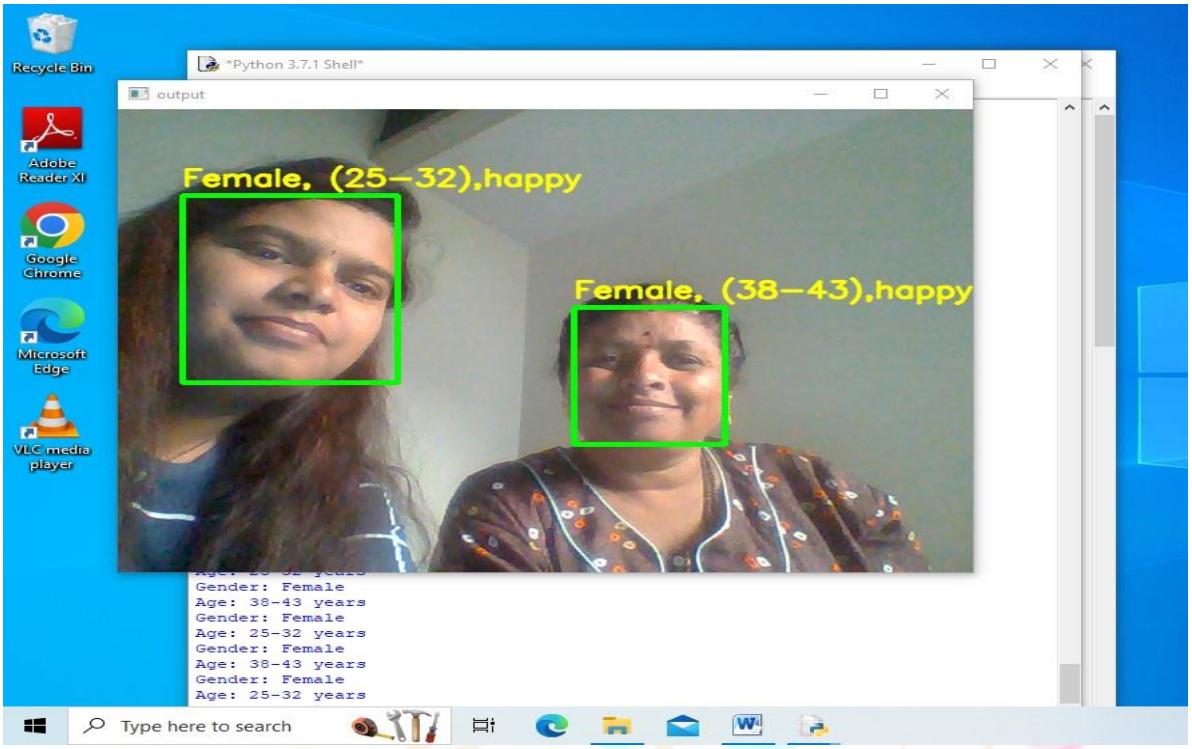

Figure 6. Results of Happy for Female

The above figure 6 shows the output is Happy for Female, The group image picture is showing Facial Micro Expression is recognize the Expression is “Happy” and age is ranges from (25-32) and gender is Female and another person gender is showing as Female, age is range from(38-43) and Facial Micro Expression is recognize the Expression is “Happy”.

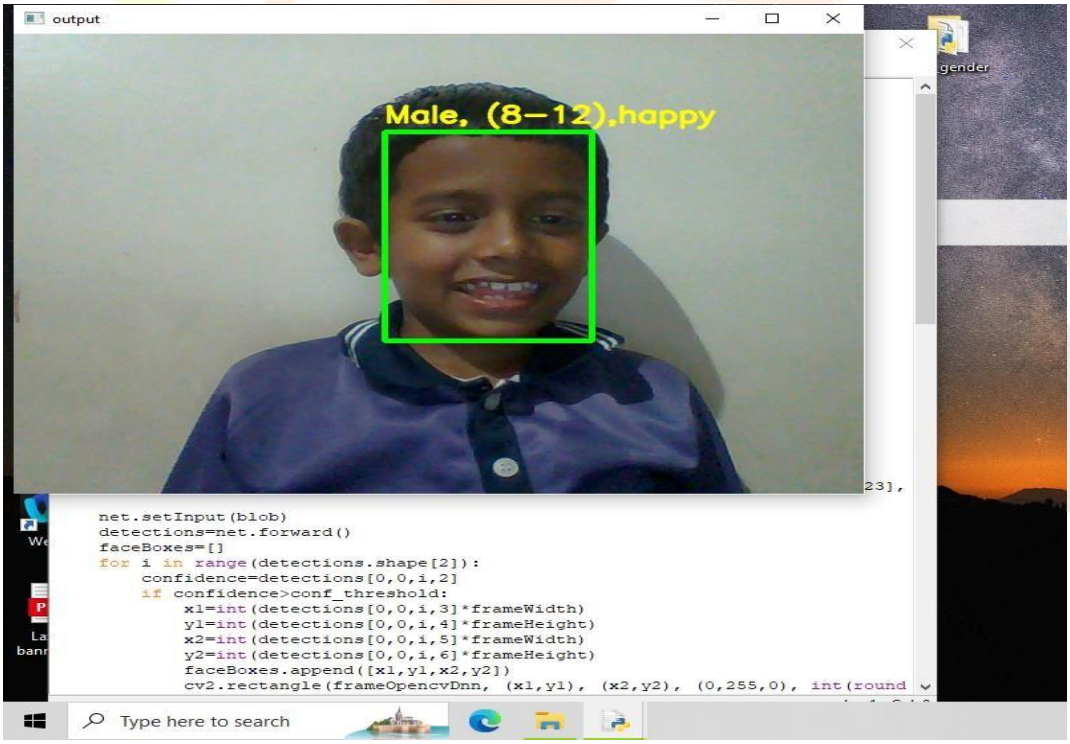

Figure 7. Results of Happy for Male

The above figure 7 shows the output is Happy for Male, The image shows Facial Micro Expression is recognize the Expression is “Happy” and age is ranges from (8-12) and gender is Male.

V. CONCLUSION

In this paper, a CNN and the digital image processing technologies like edge detection to detect and analyze the Facial micro expression of a human Face based on live face images has been proposed. The detection of emotion and age and gender level remained constantly skillful by the decision of dermatologists earlier. Technique is new approach for recognizing Facial micro expression and age and gender. CNN (Convolutional Neural Network) for classifying age and gender and Facial micro expression. First part of the implementation consists of creating a novel model by using sequential in CNN where models are created layer-by-layer in a step-by-step fashion. Later, the implementation of the identifier is done using CNN Architecture.

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