



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 5, May 2025

Machine Learning Face Expression with AI Techniques using CNN Algorithm

Rithiga.A, Sankari.V, Baranika.G,Subasri.K

Department of CSE, Sir Issac Newton College of Engineering and Technology, Pappakovil, Nagapattinam, India

Nagulan.M, Mohamed Faisal.M

Assistant Professor, Department of CSE, Sir Issac Newton College of Engineering and Technology, Pappakovil,
Nagapattinam, India

HOD, Department of CSE, Sir Issac Newton College of Engineering and Technology, Pappakovil, Nagapattinam, India

ABSTRACT: Stress detection from facial emotions is an emerging and valuable application, particularly for IT employees, as stress can significantly affect their well-being, job satisfaction, and productivity. The ability to identify stress through facial expressions offers a non-invasive method for organizations to monitor employee mental health and intervene when necessary. This technology utilizes machine learning algorithms, particularly Convolutional Neural Networks (CNNs), which are well-suited for analysing facial features and expressions in real time. These algorithms are trained on large datasets containing facial images labeled with corresponding stress levels, enabling them to recognize patterns that indicate emotional distress. However, one of the main challenges lies in the variability and subjectivity of facial expressions—individuals may express stress differently, and certain expressions can be ambiguous. Therefore, it is crucial to use a diverse and extensive dataset and ensure the model is validated across various individuals and scenarios. In practical implementation, companies could integrate this system into workplace environments by installing cameras that capture employees' facial expressions throughout the day. The real-time video feed would then be analyzed by the CNN-based algorithm to detect signs of stress, allowing the organization to offer timely and personalized support or resources. By doing so, IT companies can foster a healthier work environment, enhance employee support systems, and ultimately boost productivity and job satisfaction.

KEYWORDS: Stress Detection, Deep Learning, Convolutional Neural Network, Facial Emotions, Features

I. INTRODUCTION

In today's fast-paced work environment, stress has become a common issue for IT employees. Due to the nature of their work, IT professionals are often subject to long hours, tight deadlines, and constantly changing technologies, which can lead to high levels of stress. If left unmanaged, stress can negatively impact employees' well-being and job satisfaction, ultimately leading to a high turnover rate and decreased productivity. Therefore, it is crucial to detect and manage stress in the workplace to maintain the well-being of employees and the success of the organization. There are various stress detection techniques that can be implemented in the workplace to identify when employees are experiencing stress. One approach is to monitor workloads. When employees are overburdened with work, they may become overwhelmed and stressed, leading to decreased productivity and job satisfaction. Employers can monitor workloads to ensure that employees are not taking on more work than they can handle.

Another technique is to monitor performance. When employees are under stress, their performance may suffer. Employers can monitor performance metrics, such as quality and quantity of work, to identify employees who may be struggling. This can help employers offer support or adjust workloads as needed. Absenteeism can also be a sign of stress. When employees are experiencing stress, they may take more sick days than usual or take longer to recover from illnesses. Employers can track absenteeism rates to identify employees who may be struggling and offer support or resources as needed. Changes in an employee's behaviour or mood can also be indicators of stress. When employees are under stress, they may exhibit behaviors that are out of character or experience mood changes such as anxiety or irritability. Managers can observe these changes and offer support or resources as needed. Surveys or interviews can also be conducted to gather information about employee experiences with stress in the workplace. This information can help employers identify patterns of stress and take proactive steps to reduce stressors in the workplace. By using a

combination of techniques to detect stress in IT employees, employers can better support their employees' well-being and improve the overall health and productivity of their organization. It is also important for employers to create a culture that supports open communication and offers resources for stress management, such as counselling or employee support programs. By prioritizing the well-being of their employees, employers can create a positive work environment that promotes productivity and job satisfaction. In addition to detecting stress, it is also important to address it proactively. Employers can implement stress management training programs to help employees recognize and manage stress. These programs can provide education on stress management techniques, such as mindfulness, exercise, and time management, as well as resources for employees to access if they are experiencing stress. Employers can also create a supportive work environment by offering flexible schedules, remote work options, and other benefits that promote work-life balance. This can help employees better manage their stress and reduce the negative impact of work-related stressors. In addition, employers can take steps to reduce workplace stressors. This can include creating clear job responsibilities, providing adequate resources and support, and fostering a positive work culture that promotes open communication and collaboration. In conclusion, detecting and managing stress in IT employees is crucial for maintaining their well-being and the success of the organization. Employers can use a variety of techniques to detect stress, including monitoring workloads, performance, absenteeism, changes in behavior or mood, and conducting surveys or interviews. By addressing stress proactively and creating a supportive work environment, employers can reduce the negative impact of stress on their employees and promote a positive workplace culture that supports productivity and job satisfaction.

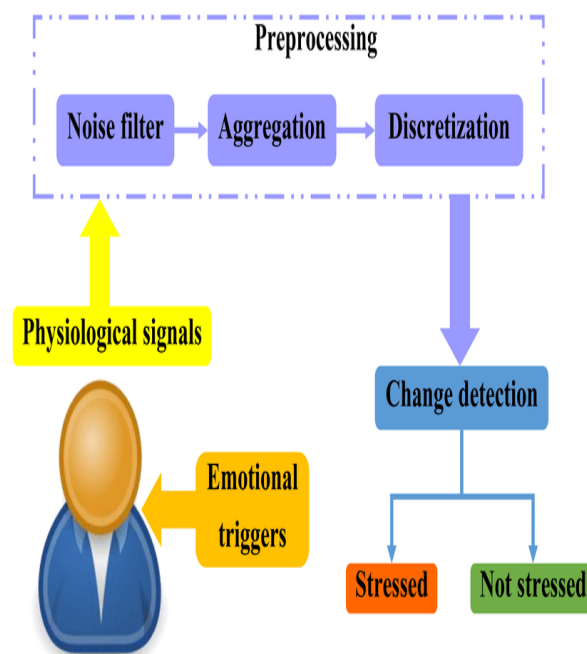


Fig 1: Stress detection methods

II. RELATED WORK

Yingruo fan, et.al.,[1] well-designed CNN trained on millions of images can parameterize a hierarchy of filters, which capture both low-level generic features and high-level semantic features. Moreover, current Graphics Processing Units (GPUs) expedite the training process of deep neural networks to tackle big-data problems. However, unlike large scale visual object recognition databases such as ImageNet, existing facial expression recognition databases do not have sufficient training data, resulting in overfitting problems. The goal of automatic FER is to classify faces in static images or dynamic image sequences as one of the six basic emotions. However, it is still a challenging problem due to head pose, image resolution, deformations, and illumination variations. This paper is the first attempt to exploit the local characteristics of different parts of the face by constructing different sub-networks.

Despite the training size of RAF-DB, it is still insufficient for training a designed deep network. Therefore, we utilize both offline data augmentation and on-the-fly data augmentation techniques. The number of training samples increases fifteen-fold after introducing methods including image rotation, image flips and Gaussian distribution random perturbation. Generally, our method explicitly inherits the advantage of information gathered from multiple local regions from face images, acting as a deep feature ensemble with two single CNN architectures, and hence it naturally improves the final predication accuracy.

Feng-ju chang, et.al,...[2] assumed by modern face recognition systems where even state of the art landmark detection accuracy is insufficient to discriminate between individuals based solely on the locations of their detected facial landmarks. In other applications, however, facial landmarks prevail. This work follows recent attempts, most notably by proposing landmark free alternatives for face understanding tasks. This effort is intended to allow for accurate expression estimation on images which defy landmark detection techniques, in similar spirit to the abandonment of landmarks as a means for representing identities. We propose to estimate facial expression coefficients using a CNN applied directly to image intensities. A chief concern when training such deep networks is the availability of labelled training data. For our purposes, training labels are 29D real-valued vectors of expression coefficients. These labels do not have a natural interpretation that can easily be used by human operators to manually collect and label training data. We next explain how 3D shapes and their expressions are represented and how ample data may be collected to effectively train a deep network for our purpose. Another way of addressing the training data problem is by utilizing a face landmark detection benchmark. That is, taking the face images in existing landmark detection benchmarks and computing their expression coefficients using their ground truth landmark annotations in order to obtain 29D ground truth expression labels. Our approach estimates expressions without the use of facial landmarks, suggesting that facial landmark detection methods may be redundant for this task.

Aishwarya kulkarni, et.al,...[3] analysed and presented a system which can be used in intelligent feedback system, which classifies the facial images based on emotions. The systematic architecture provides automatic facial expression recognition and analysis process effectively. The intelligent feedback system classifies the images based on emotions. The Support Vector Machine (SVM) is used for classifying feature set as expressions. The SVM classifies the input data into seven classes based on emotions. A multiclass SVM is considered, which has two types of classification scheme, say One Against One (OAO) and One Against All (OAA). The OAO considers one class and classifies against all possible combinations. Similarly, the OAA is also classified and here, one of the classes is used for training and others are classified. This procedure will repeat until we complete all the known classes of emotions. The article introduced here has mainly concentrated on the creation of smart framework with the inherent capabilities of drawing the inference for emotion detection from facial expressions. Recently, the notion of emotion recognition is attaining mostly the researcher's mind in the area of exploration on smart system and interaction between human and computer. Based on facial attributes the facial expression recognition can be classified one of the six well known fundamental emotions: sadness, disgust, happiness, fear, anger and surprise.

Dhwani Mehta, et.al,...[4] considered as a universal language. These emotions surpass cultural diversities and ethnicity. Facial expressions are responsible for conveying the information, which was difficult to perceive. It gives the mental state of a person that directly relates to his intentions or the physical efforts that he must be applying for performing tasks. As a result, automatic recognition of emotion with the help of high-quality sensors is quite useful in a variety of areas such as image processing, cyber security, robotics, psychological studies, and virtual reality applications to name a few. Efforts in this area are being made to gather information of high-quality to meet the demands of the system so that it can read process and simulate human emotions. Geometric and machine learning based algorithms for an effective recognition are being refined, emphasizing emotion recognition in real-time and not just ideal laboratory conditions. Hence, building a system that is capable of both face detection and emotion recognition has been a crucial area of research. It works on facial motion and the deformations of facial features to classify them into emotion categories. This classification is based on visual information and may not be the sole indicator of emotion. Other factors also contribute to the recognition of a person's emotional state such as voice, body language, gestures or even the direction of the gaze. Emotion recognition, therefore, demands a more precise knowledge of all these factors together with contextual information to convey more accurate results. It measures rotational movements of the yaw, pitch, and roll. For facial emotion recognition, the algorithms that use the video camera are susceptible to elements such as facial illumination environment (caused due to bad lighting or unevenly lightened scene), which affects the accuracy of the algorithm. A possible solution to this problem is to have a sensor with a scene depth information.

Tautkute, et.al,...[5] ability to correctly identify human emotions, such as happiness or sorrow. This is a highly challenging task, as people express their emotions in a multitude ways, depending on their personal characteristics, e.g. people with an introvert character tend to be more secretive about their emotions, while extroverts show them more openly. Although some simplifications can be applied, for instance reducing the space of recognized emotions, there is an intrinsic difficulty embedded in the problem of human emotion classification. In this work, we hypothesize that DAN's ability to handle images with large variation and provide robust information about facial landmarks transfers well to the task of emotion recognition. To that end, we extend the network learning task with an additional goal of estimating expressed facial emotions. We incarnate this idea by modifying the loss function with a surrogate term that addresses specifically emotion recognition task and we minimize both landmark location and emotion recognition terms jointly. In this paper, we overview a work-in-progress method for emotion recognition that allows to exploit facial landmarks. Although the results computed on the JAFFE dataset show that there is still place for improvement, we believe that this approach has a strong potential to outperform currently proposed methods. In future work, we will therefore focus on improving our method by using attention mechanism on facial landmarks and experiment with additional loss function terms. We also plan to investigate other applications of our method, e.g., in the context of autistic children with incapacities related to emotion recognition.

Wafa Mellouk, et.al,...[6] presented recent research on FER, allowed us to know the latest developments in this area. We have described different architectures of CNN and CNN-LSTM recently proposed by different researchers, and presented some different database containing spontaneous images collected from the real world and others formed in laboratories (See Table.1), in order to have and achieve an accurate detection of human emotions. We also present a discussion that shows the high rate obtained by researchers that is what highlights that machines today will be more capable of interpreting emotions, which implies that the interaction human machine becomes more and more natural. FER are one of the most important ways of providing information about the emotional state, but they are always limited by learning only the six-basic emotion plus neutral. It conflicts with what is present in everyday life, which has emotions that are more complex. This will push researchers in the future work to build larger databases and create powerful deep learning architectures to recognize all basic and secondary emotions. Moreover, today emotion recognition has passed from unimodal analysis to complex system multimodal.

Iyanu Pelumi Adegun, et.al,[7] appears to be the most expressive means through which humans show their emotions. The vital role of facial expressions in day-to-day life of humans has made several researchers to develop automated systems for their recognition and interpretation. For instance, Vural et al. proposed a system that identifies the level of drowsiness in drivers. Another example of facial expression recognition system is that of Whitehill et al. which was used to get response/feedback from students while being taught. In this study, SVM is used as the baseline recognition model, but because of its slow learning speed, ELM which has a faster learning speed is also explored for micro-expression recognition. Features are extracted from apex micro-expression frames using Local Binary Patterns (LBP) and extracted from the entire micro-expression videos using (LBP-TOP). The performance of the two models (SVM and ELM) are compared on both static and temporal features and their overall training time was compared. The models were evaluated using CASME II micro-expression database.

D. Yang, et.al,[8] analyse feelings of subjects, to make appropriate responses possible. Such data may be obtained from different physical features such as face voice, body movements, and other biological physical signals. However, learners' emotions are expressed first through facial expressions which can be divided into six kinds of categories: sadness, happiness, surprise, fear, anger and disgust. The facial recognition process consists of three main stages: acquisition, feature extraction, and emotion classification. This paper is organised along the three stages. This paper provided a proposed model to solve the problems of emotion recognition based on facial recognition in virtual learning environments, and the efficiency and accuracy are considered at the same time. Using HAAR Cascades to detect eyes and mouth and identify all kinds of emotion through the neural network method, the combination of efficiency and accuracy is achieved. It can be applied to real distance education. The application of emotion recognition in virtual learning environments is a much-researched topic. In addition to the change of uncertainty factors makes teachers and students face pattern is more complex, so the emotion recognition in the online learning network application mode is a very challenging topic.

III. BACKGROUND OF THE WORK

There are numerous areas in human-computer interaction that could effectively use the capability to understand emotion. The problem of face detection can be viewed as a problem of binary classification of image frame as either containing or not containing a face. In order to be able to learn such a classification model, we first need to describe an image in terms of features, which would be good indicators of face presence or absence on a given image. The existing approach is generally involving two tasks: The first is for extracting ASM motion based a pyramid ASM model fitting method and the second for the projected motion classification obtained by applying Adaboost classifiers. After the segmentation of face candidates, 68 feature points in each face are then extracted using ASM fitting technique. The system then lines up three extracted feature points, eyes and nose part, to the mean shape of ASM, and ignore the other portion of the ASM against the mean face shape of ASM to estimate the geometrical dislocation information between current and mean ASM points coordinates. Then, facial expressions recognition is the obtained based on this geometrical motion using Adaboost classifier. And also extracting features using viola jones. The features that Viola and Jones used are based on wavelets. Wavelets are single wavelength square waves (one high interval and one low interval). Fig 2 specifies the active shape model for facial features extraction.

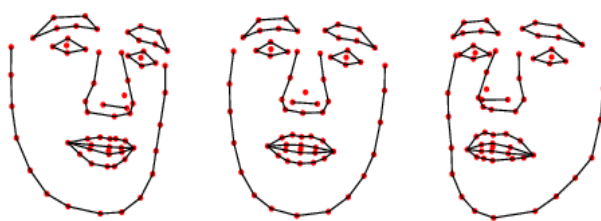


Fig 2: Emotion features model using Active shape model

IV. PROPOSED WORK

Employee stress detection using deep learning algorithms is a promising approach to identify and manage stress in the workplace. The proposed steps for developing this system involve collecting and pre-processing data on employee behavior, extracting relevant features, training the deep learning algorithm, evaluating its performance, and implementing it in the workplace. By detecting stress early on, employers can take proactive measures to manage it and promote employee well-being. This can lead to a positive work environment and reduce absenteeism and turnover rates. Additionally, integrating the algorithm into existing workplace technology can provide real-time feedback and enable employers to make data-driven decisions to manage employee stress. Overall, implementing an employee stress detection system using deep learning algorithms can improve the mental health of employees and foster a positive work culture. In addition to the proposed steps, it is important to consider ethical and legal implications of implementing a stress detection system in the workplace. Employers should ensure that the system is transparent and that employees are informed about how their data is being collected, processed, and used. Privacy concerns should also be taken into account, and appropriate measures should be put in place to safeguard employee data. Furthermore, it is important to note that stress is a complex issue that cannot be fully addressed by technology alone. Employers should also prioritize creating a supportive work environment and promoting work-life balance to reduce stress levels in employees. Regular communication with employees about stress management strategies, and providing resources for mental health support can also be beneficial. It is also important to acknowledge that stress detection algorithms may not be fool proof and may produce false positives or negatives. Employers should consider this when interpreting the results of the stress detection system and avoid making decisions based solely on the output of the algorithm. Overall, employee stress detection using deep learning algorithms is a promising approach to managing stress in the workplace. However, it should be implemented with caution, and employers should also prioritize creating a supportive work environment and promoting employee well-being. Fig 3 specifies system architecture diagram.

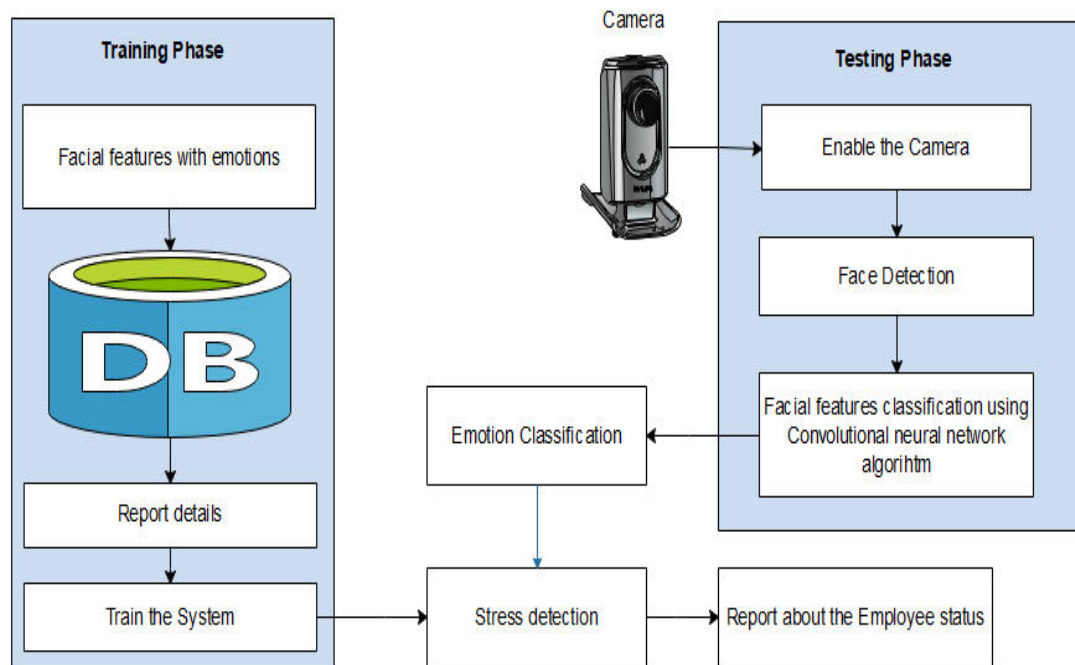


Fig 3: Proposed architecture diagram

FRAMEWORK CONSTRUCTION: Stress is a common problem among IT employees due to the fast-paced nature of the industry and the high demands placed on them. Detecting and managing stress among IT employees is crucial for maintaining their mental and physical health, as well as their job performance. In this module, we can design the framework for employees and admin. Employee can login to the system with their details. Admin can view the details about employees

FEATURES EXTRACTION

Facial features extraction using Convolutional Neural Networks (CNN) is a popular approach for stress detection from facial images. CNNs are deep learning models that can automatically extract features from images and learn complex patterns. The first step in using CNN for stress detection is to collect a dataset of facial images of individuals under different stress conditions.

MODEL BUILDING

The next step is to select a CNN architecture that is suitable for facial feature extraction. Popular CNN architectures for image recognition tasks include Sequential model. This model is pre-trained on large datasets and can be fine-tuned for stress detection. The CNN is then used to extract features from the facial images. This is done by passing the images through the CNN and extracting the activations from one of the last convolutional layers.

STRESS CLASSIFICATION

Deep neural networks possess key advantages in their capabilities to model complex systems and utilize automatically learning features through multiple network layers. As such, deep neural networks are used to carry out accuracy-driven tasks such as classification and identification. Design a CNN architecture that takes in a facial image as input and predicts whether the person in the image is stressed or not. The architecture typically consists of multiple convolutional layers followed by max-pooling layers to extract features from the images. The final layers of the network are fully connected layers that classify the image as "stress" or "no stress."

REPORTS

In this module, provide the reports for all employees about stress levels. And stress details stored in database for future verification

V. EXPERIMENTAL RESULTS

Accuracy (ACC) is found as the fraction of total number of perfect predictions to the total number of test data. It can also be represented as $1 - \text{ERR}$. The finest possible accuracy is 1.0, whereas the very worst is 0.0.

$$\text{ACC} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{TN} + \text{FN} + \text{FP}} \times 100$$

True positive (TP): number of true positives - perfect positive prediction

False positive (FP): number of false positives - imperfect positive prediction

True negative (TN): number of true negatives - perfect negative prediction

False negative (FN): number of true negatives - imperfect negative prediction

ALGORITHM	ACCURACY
Random forest	65%
Adaboost classifier	85%
CNN classifier	98%

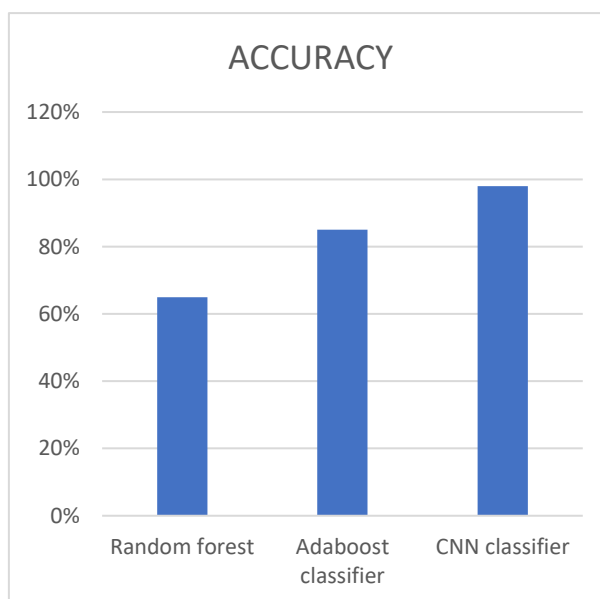


Fig 4: Accuracy rate

From the above graph, proposed system provides improved accuracy rate than the existing machine learning algorithm

VI. CONCLUSION

In conclusion, employee stress detection from face features image using deep learning algorithms is a promising approach to identifying and managing stress in the workplace. By analysing specific facial features, such as eye movements or muscle tension, the system can provide real-time feedback to employers about employee stress levels, allowing for proactive measures to be taken to manage stress and promote employee well-being. However, it is important to consider ethical and legal implications, including issues related to privacy, bias, and the limitations of the technology. Employers should also prioritize creating a supportive work environment and promoting work-life balance, as stress is a complex issue that cannot be fully addressed by technology alone. By combining technology with other

strategies for promoting employee well-being, employers can create a positive work culture that prioritizes employee mental health and well-being.

REFERENCES

- [1] Fan, Yingruo, Jacqueline CK Lam, and Victor OK Li. "Multi-region ensemble convolutional neural network for facial expression recognition." International Conference on Artificial Neural Networks. Springer, Cham, 2018.
- [2] Chang, Feng-Ju, et al. "Expnet: Landmark-free, deep, 3d facial expressions." 2018 13th IEEE International Conference on Automatic Face & Gesture Recognition (FG 2018). IEEE, 2018.
- [3] Kulkarni, Aishwarya, et al. "Intelligent emotion detection system using facial images." Int. Res. J. Eng. Technol (2015): 2395-0072.
- [4] Tautkute, Ivona, Tomasz Trzcinski, and Adam Bielski. "I know how you feel: Emotion recognition with facial landmarks." Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops. 2018.
- [5] Mehta, Dhvani, Mohammad Faridul Haque Siddiqui, and Ahmad Y. Javaid. "Facial emotion recognition: A survey and real-world user experiences in mixed reality." Sensors 18.2 (2018): 416.
- [6] Mellouk, Wafa, and Wahida Handouzi. "Facial emotion recognition using deep learning: review and insights." Procedia Computer Science 175 (2020): 689-694.
- [7] Adegun, Iyanu Pelumi, and Hima Bindu Vadapalli. "Facial micro-expression recognition: A machine learning approach." Scientific African 8 (2020): e00465
- [8] Yang, Dongri, et al. "An emotion recognition model based on facial recognition in virtual learning environment." Procedia Computer Science 125 (2018): 2-10.
- [9] Vaish, Ashutosh, and Sagar Gupta. "Employing Kaze features for the purpose of emotion recognition." Progress in Computing, Analytics and Networking. Springer, Singapore, 2018. 679-685.
- [10] Ko, Byoung Chul. "A brief review of facial emotion recognition based on visual information." sensors 18.2 (2018): 401.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details