



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 5, May 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Facial Emotion Recognition System (FERS) Using Machine Learning

Yogesh Helkar¹, Araju Sayyad², Prof.P.G.Patil³

Students, Dept. of Computer Science & Engineering, Sahakar Maharshi Shankarrao Mohite Patil Institute of
Technology and Research, Akluj, Solapur, Maharashtra, India^{1,2}

Assistant Professor, Dept. of Computer Science & Engineering, Sahakar Maharshi Shankarrao Mohite Patil Institute of
Technology and Research, Akluj, Solapur, Maharashtra, India³

ABSTRACT - Facial emotion recognition (FER) using machine learning techniques has gained significant attention in recent years due to its potential applications in various fields. This research paper provides an overview of FER systems, including data preprocessing, feature extraction, classification algorithms, and evaluation metrics. It also highlights the challenges in FER and proposes potential solutions. Through this study, we aim to contribute to the advancement of FER systems and promote further research in this domain.

KEYWORDS: Facial emotion recognition, machine learning, data preprocessing, feature extraction, classification algorithms, evaluation metrics.

1.INTRODUCTION

Facial emotion recognition (FER) is a rapidly evolving field that focuses on developing automated systems capable of accurately identifying and interpreting human emotions based on facial expressions. The ability to understand and analyze human emotions has significant implications in various domains, including affective computing, human-computer interaction, mental health monitoring, and market research. With advancements in machine learning techniques, FER systems have made significant progress in recent years, enabling more accurate and robust emotion recognition.

1.1 Background

Human emotions play a crucial role in our daily interactions and communication. Facial expressions are a primary means of conveying emotions, as they exhibit distinctive patterns and cues that are recognizable across cultures. Traditional approaches to FER relied on handcrafted features and rule-based systems, which had limitations in capturing the complexity and variability of facial expressions. However, with the advent of machine learning, particularly deep learning techniques, FER has witnessed significant advancements and achieved state-of-the-art performance.

1.2 Objectives

The primary objective of this research paper is to provide a comprehensive overview of facial emotion recognition systems using machine learning techniques. It aims to explore the key components involved in FER, including data preprocessing, feature extraction, classification algorithms, and evaluation metrics. The paper will also discuss the challenges faced in FER and propose potential solutions and future research directions.

1.3 Scope

This research paper focuses on the use of machine learning techniques, particularly deep learning algorithms, in FER systems. It aims to provide a detailed understanding of the methodologies and components involved in developing effective FER systems. The paper will review the existing literature, analyze state-of-the-art approaches, and discuss the challenges and future directions in the field. It will also highlight real-world applications and implications of FER systems.

II. METHODOLOGY

The methodology for facial emotion recognition (FER) using machine learning typically involves several stages, including data collection and preprocessing, feature extraction, model training, and evaluation. The following diagram illustrates the overall methodology:

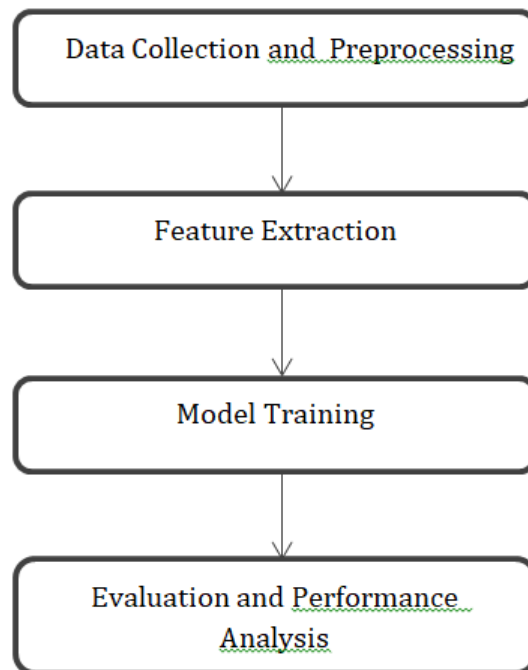


Fig. Facial Emotion Recognition System Flow Diagram

2.1 Data Collection and Preprocessing

1. Data collection:

For FER, a diverse and labeled dataset of facial images or videos displaying various emotions is essential. The dataset should cover a wide range of individuals, demographics, and environmental conditions.

2. Preprocessing:

Preprocessing steps ensure the data is in a suitable format for further analysis. This includes face detection, where techniques like Haar cascades or deep learning-based face detectors are used to locate and extract faces from images or frames of videos. Face alignment is performed to normalize the pose and scale of the faces, reducing variations caused by head movements. Image normalization techniques like histogram equalization or adaptive histogram equalization can enhance image quality and mitigate lighting variations. Data augmentation techniques, such as rotations, translations, scaling, or adding noise, can be applied to increase the variability of the dataset and improve model generalization.

2.2 Feature Extraction

Feature extraction aims to capture discriminative information from facial images that can effectively represent facial expressions. Local Binary Patterns (LBP) is a widely used technique that describes the local texture patterns of an image by comparing the pixel values with their neighboring pixels. LBP encodes the texture information useful for FER. Histogram of Oriented Gradients (HOG) is another popular method that captures the distribution of gradient orientations in an image. HOG can effectively capture shape and edge information from facial structures. Deep learning-based feature extraction using Convolutional Neural Networks (CNNs) has shown remarkable success in FER. CNN

architectures like VGGNet, ResNet, or Inception are used to automatically learn hierarchical features from raw pixel data, enabling the network to capture expressive representations.

2.3 Model Training

Model training involves training a machine learning algorithm to learn the mapping between the extracted features and the corresponding emotion labels. Support Vector Machines (SVM) are commonly used for FER tasks. SVMs aim to find an optimal hyper plane that separates different emotion classes in the feature space. They work well with high-dimensional feature representations.

Convolutional Neural Networks (CNNs) have gained popularity in FER due to their ability to learn complex features directly from raw pixel data. Pre-trained CNN models on large-scale datasets (e.g. ImageNet) can be fine-tuned or used as feature extractors for FER tasks. Recurrent Neural Networks (RNNs), particularly Long Short-Term Memory (LSTM) networks, can capture temporal dependencies in sequences of facial expressions. RNNs are useful for FER tasks involving video data, where the temporal dynamics of facial expressions are crucial.

2.4 Evaluation and Performance Analysis

The performance of the FER model is evaluated using various evaluation metrics such as accuracy, precision, recall, F1 score, or confusion matrix. Cross-validation or train-test splits are commonly used to assess the model's generalization capabilities and robustness. This ensures that the model performs well on unseen data. Misclassified samples or confusion matrices are analyzed to gain insights into the strengths and weaknesses of the model. This analysis helps identify areas for improvement in feature extraction or model training stages.

2.5 Fine-tuning and Optimization

Fine-tuning the model involves adjusting its parameters, hyperparameters, or architecture to improve performance specifically for the FER task. Transfer learning is a common technique where a pre-trained model on a large dataset, such as ImageNet, is used as a starting point for FER. By leveraging the knowledge learned from a large dataset, the model can achieve better performance on FER tasks with limited data.

III. RESULTS

3.1 Module Result

Facial expression recognition system is a technology which uses biometric/face detection scanner/Web cam to detect emotions in human faces. More precisely, this technology is a sentiment analysis tool and is able to automatically detect the six basic or universal expressions: happiness, sadness, anger, surprise, fear, and disgust.

3.1.1 Execution Steps

1. Open Anaconda navigator.
2. Open terminal with installed virtual environment.
3. Navigate to Project Directory.
4. Execute commands for output.

3.1.2 Image Prediction

1. To predict emotions from image store image in project directory
2. Execute image prediction command as shown in below image.
3. An Image will be opened up in a new window which will contain human faces highlighted with borders with respective emotions like happiness, natural and sadness etc.

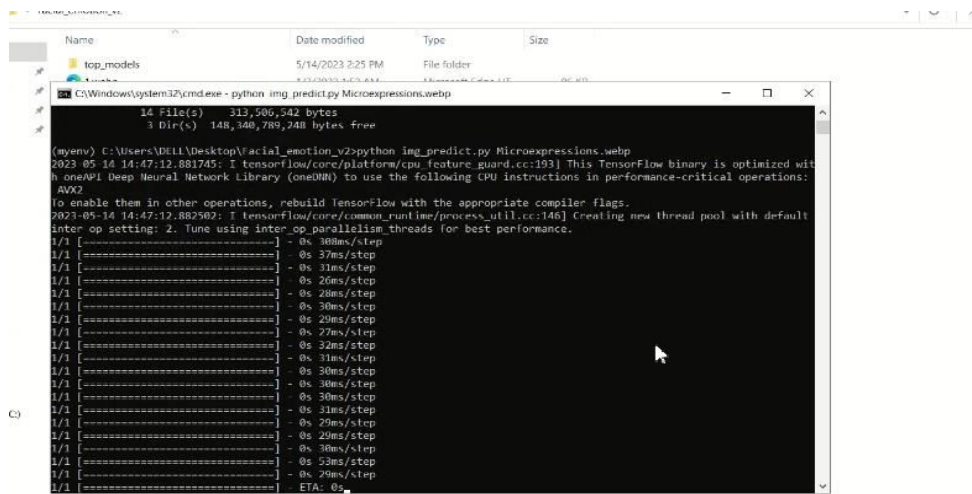


Figure 3.1.1 Training Dataset

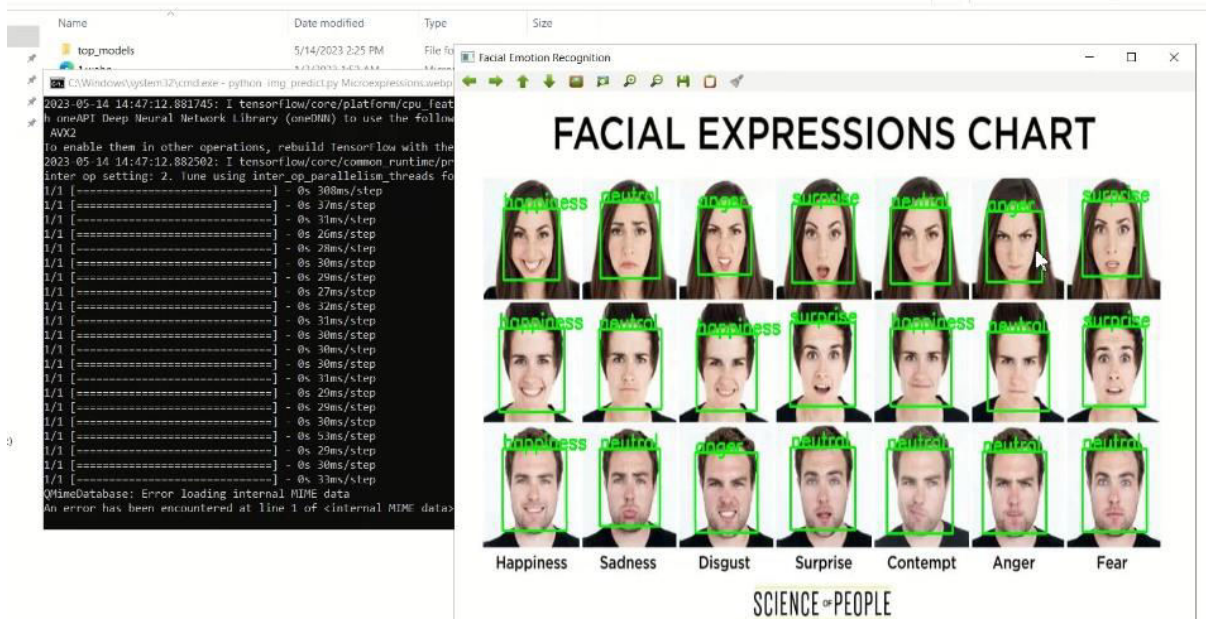


Figure. 3.1.2 Human faces highlighted with borders with respective emotions

3.1.3 Video Prediction

1. To predict the emotions from video execution steps are the same as image prediction.
2. The output will be the video playing with human faces along with their emotions for every video frame.
3. Following image shows the example

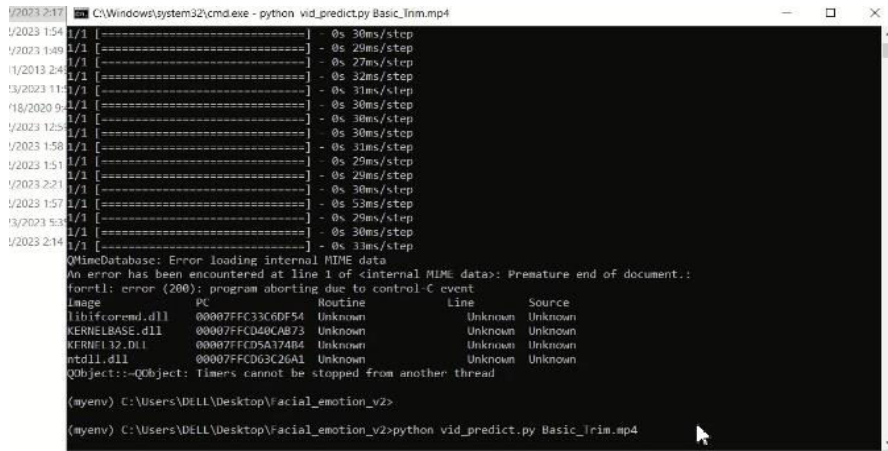


Figure 3.1.3 Training of Video Dataset

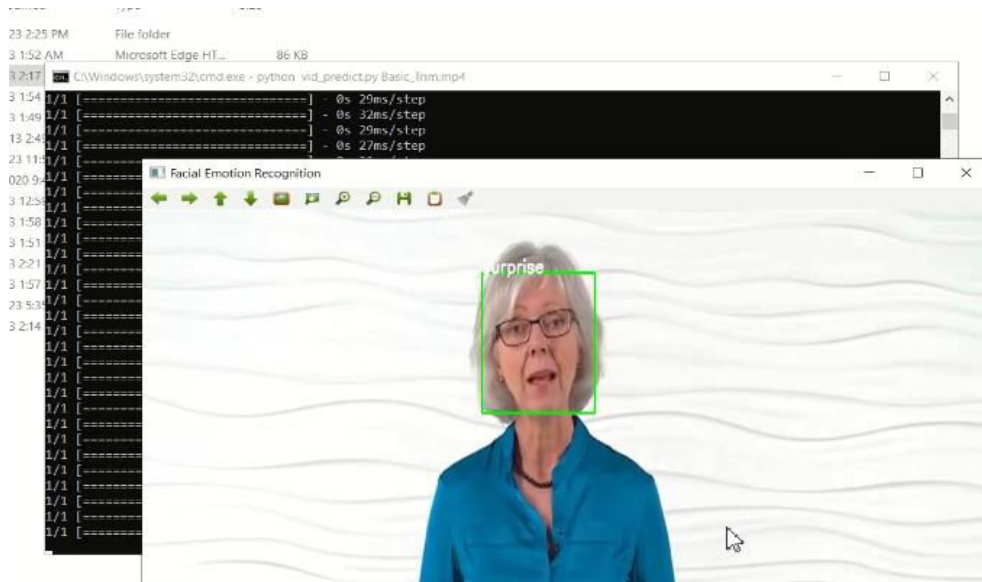


Figure 3.1.4 Output from Video Clip result 'Surprise'

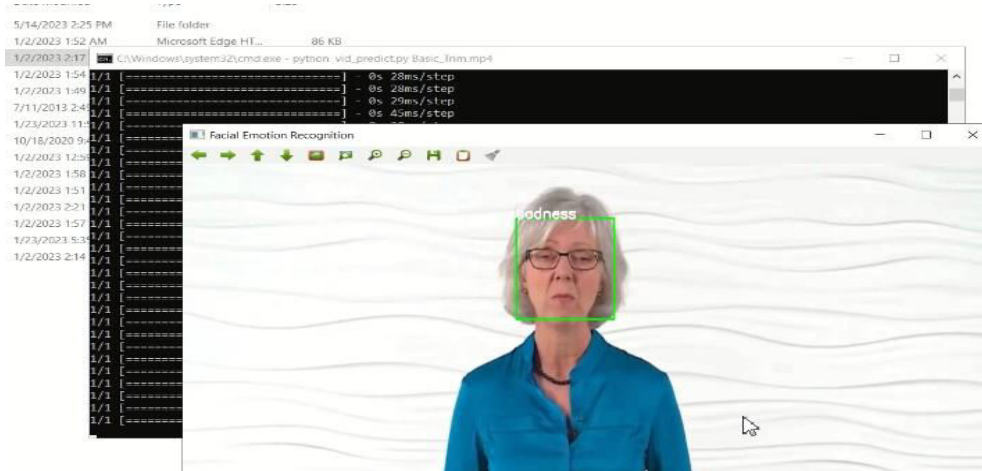


Figure 3.1.5 Output from Video Clip result 'Sadness'

IV. CONCLUSION

In conclusion, facial emotion recognition systems using machine learning techniques have shown remarkable progress in understanding and interpreting human emotions. Despite challenges such as dataset limitations and facial expression variability, advancements in deep learning algorithms and the availability of large-scale datasets have significantly improved FER accuracy. Future research should focus on addressing these challenges, exploring multi-modal fusion techniques, and ensuring the ethical use of FER technology.

REFERENCES

- [1]. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. MIT Press, 2016.
- [2]. Z. Zhang, P. Luo, C. C. Loy, and X. Tang, "Facial landmark detection: A literature survey," International Journal of Computer Vision, vol. 107, no. 2, pp. 178-220, 2014.
- [3]. R. Zhao, W. Ouyang, and X. Wang, "Unsupervised salience learning for person re-identification," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2013, pp. 3586-3593.
- [4]. T. Baltrušaitis, P. Robinson, and L.-P. Morency, "OpenFace: An open source facial behavior analysis toolkit," in Proceedings of the IEEE Winter Conference on Applications of Computer Vision, 2016, pp. 1-10.
- [5]. K. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition," in Proceedings of the International Conference on Learning Representations, 2015.
- [6]. D. Kollias, E. Nicolaou, S. Kotsiantis, and S. Tefas, "Multi-modal emotion recognition from facial expressions and electroencephalogram," IEEE Transactions on Affective Computing, vol. 9, no. 4, pp. 578-592, 2018.
- [7]. Junkai Chen, Zenghai Chen, Zheru Chi and Hong Fu (2020), "Facial Expression Recognition Based on Facial Components Detection and HOG Features". Scientific Cooperations International Workshops on Electrical and Computer Engineering Subfields 22-23 August 2014, Koc University, ISTANBUL/TURKEY.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.423



ISSN 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