EMOTION DETECTION USING INTEGRATION OF DEEP LEARNING AND SVM

Rupali J.Dhabarde[1], Dr. D.V. Kodavade[2], Dr. Sheetal Zalte[3], Aditya Konnur[4]
Department of Technology, Shivaji University, Kolhapur[1,4] , DKTE society's Textile & Engineering Institute Ichalkaranji[2], Department of Computer Science, Shivaji University, Kolhapur.[4]
[1]dhabarderupali7@gmail.com , [2]dvkodavade@gmail.com
, [3]sheetal.zaltegaikwad@gmail.com, [4]adityakonnur9999@gmail.com

Abstract— Emotion detection from facial expressions is a challenging yet crucial task in various fields including human-computer interaction, healthcare, and psychology. In this paper, we propose a novel approach for emotion detection by integrating the RESNET50 deep convolutional neural network (CNN) architecture with a Support Vector Machine (SVM) classifier. The RESNET50 CNN is employed for feature extraction from facial images, capturing hierarchical representations, while SVM is utilized for effective classification. Experimental results on benchmark datasets demonstrate the effectiveness of the proposed approach in accurately recognizing emotions from facial expressions, outperforming existing methods in terms of classification accuracy and robustness.

Index Terms—Emotion detection, RESNET50, Support Vector Machine (SVM), deep learning, machine learning.

I. INTRODUCTION

Emotion detection from facial expressions plays a vital role in numerous applications such as human-computer interaction, affective computing, and mental health diagnosis. With the advancements in deep learning techniques, convolutional neural networks (CNNs) have shown remarkable performance in various computer vision tasks, including facial expression recognition. However, traditional CNNs often require large amounts of labeled data for training and may suffer from overfitting. In this paper, we propose a hybrid approach that combines the powerful feature extraction capabilities of the RESNET50 CNN with the discriminative classification ability of the Support Vector Machine (SVM) classifier for emotion detection.

II. LITERATURE REVIEW

Deep learning algorithms offer a promising avenue for exploring the automated extraction of complex data representations, particularly at higher levels of abstraction. These algorithms employ a layered and hierarchical architecture that enables the learning and representation of data. In this architecture, higher-level features are defined based on the lower-level features, promoting a progressive abstraction of information [4].

By leveraging this layered approach, Deep Learning algorithms excel at capturing intricate patterns and structures within data. The initial layers of the network learn simple and local features, while subsequent layers build upon these representations to extract more sophisticated and abstract features. This hierarchical arrangement enables the system to automatically uncover increasingly complex and meaningful representations of the input data [5].

The ability of Deep Learning algorithms to learn and represent data in this hierarchical manner has proven highly effective in various domains. Applications such as computer vision, natural language processing, speech recognition, and many others have witnessed significant advancements due to the capacity of Deep Learning models to extract abstract and discriminative features from raw data [6].

The layered and hierarchical nature of Deep Learning algorithms enables them to handle the complexities of real-world data, leading to improved performance in tasks such as classification, regression, and generation. By automatically learning high-level abstractions from raw input, these algorithms offer a powerful tool for solving complex problems and advancing our understanding of data in a more interpretable and generalizable manner [7].

Deep Learning algorithms offer significant advantages when it comes to handling extensive volumes of unsupervised data, as they typically adopt a greedy layer-wise approach to learning data representations [8].

III. METHODOLOGY

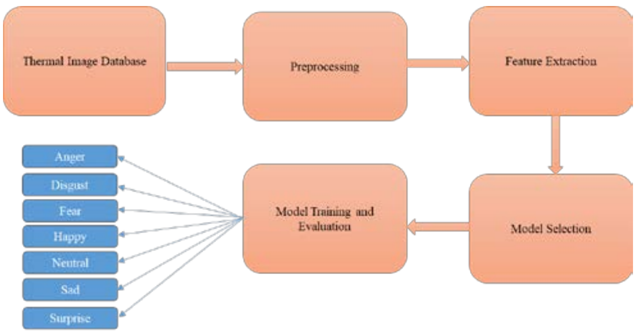


Fig. 1 Proposed Methodology

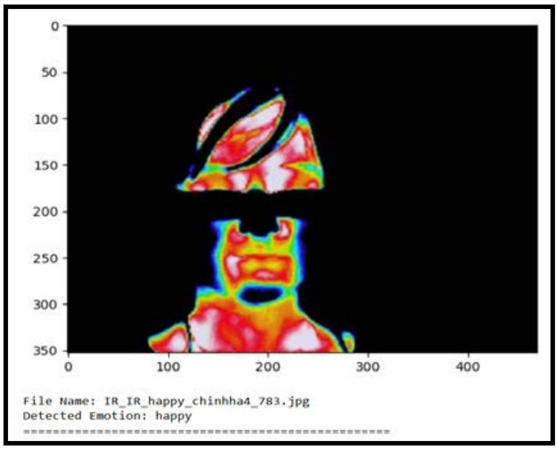
The proposed research work is mainly focused on development of an improved deep learning algorithm for processing of thermal images which will overcome drawbacks of previous approaches. It should actually works by image acquisition from the dataset. And then preprocessed to remove unwanted information, then feature extraction will be carried out by for capturing the patterns of each emotions. Then by using RESNET50 algorithm for processing thermal image data in combination with any classification algorithm will be applied. At last trained the modified deep learning model on preprocessed thermal image datasets, with cross-validation to assess model performance on validation datasets to detect different emotions.

IV. EXPERIMENTAL SETUP

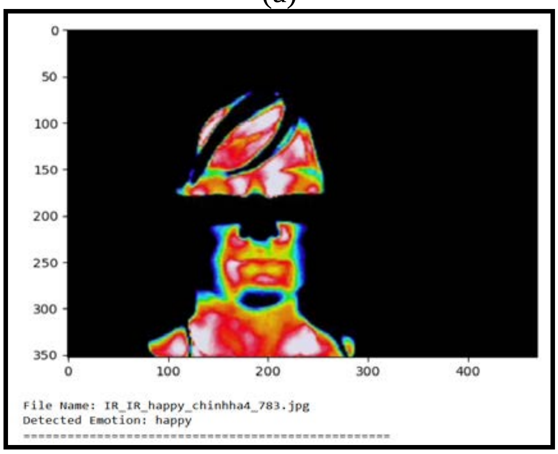
A. *Dataset*

We evaluate the proposed approach on dataset for facial expression recognition, the dataset used in this research is taken from Kaggle (Chia theo nguoi_KTFEV2-7 emotions) which is carefully curated to include a diverse range of examples that cover various emotions. The dataset contains two directories, one for thermal images and other for normal/visual images of which we have used the thermal directory. The datasets consist of 2538 labeled thermal facial images corresponding to different emotional expressions such as happiness, sadness, anger, fear, surprise, and disgust. We compare the performance of our method with accuracy, precision, recall, and F1-score.

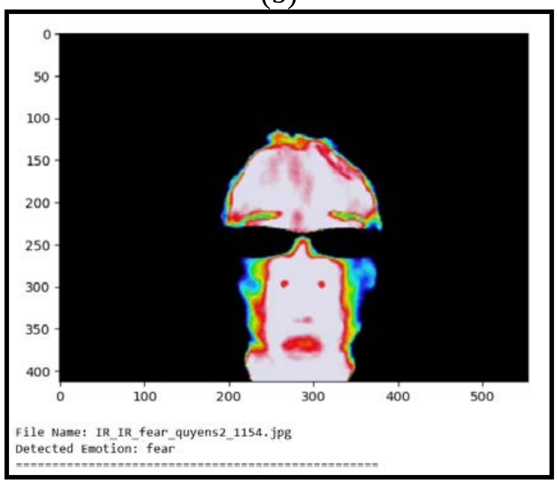
B. *Implementation Details*



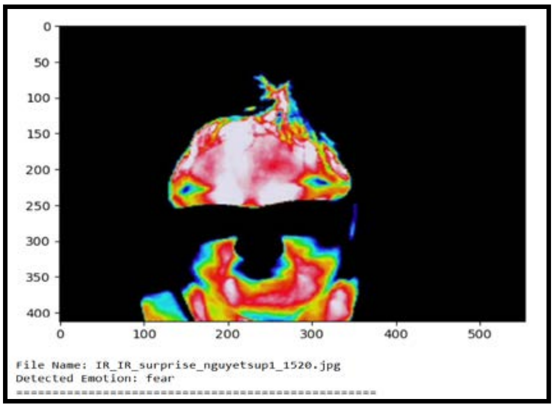
(a)



(b)



(c)



(d)

Fig. 2 prediction performance of model
(a) Anger (b) Happy (c) Fear (d) Surprise

Fig. 2 shows the prediction performance of the Resnet50_SVM model through the predictions of sample images. Fig. 2 (a) shows the sample image of anger which has been predicted correctly as anger. Fig. 2 (b) shows the sample image of happy which has been predicted correctly as happy. Fig. 2 (c) shows the sample image of fear which has been predicted correctly as fear. Fig. 2 (d) shows the sample image of surprise which has been predicted incorrectly as fear.

V. RESULTS AND DISCUSSION

Experimental results demonstrate that the proposed approach achieves superior performance compared to existing methods in terms of accuracy and robustness. An integrated model RESNET50 for feature extraction and SVM for classification effectively captures discriminative features from facial images and accurately recognizes emotions. This section presents the results of the experiments conducted using the proposed RESNET50-SVM framework. It includes performance evaluation metrics such as accuracy, precision, recall, and F1-score.

A. *Accuracy, Precision, Recall and F1 Score*

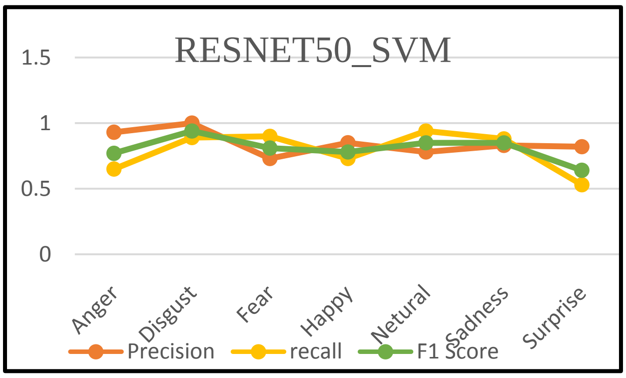


Fig. 3 Precision, Recall and F1-Score of an integrated Model

These evaluation metrics provide the details of model's performance for each emotion category by using an integrated approach. High precision values indicate accurate predictions, high recall values signify the model's ability to capture instances of a particular emotion, and the F1 score provides an overall assessment of the model's performance by considering both precision and recall.

B. *Accuracy*

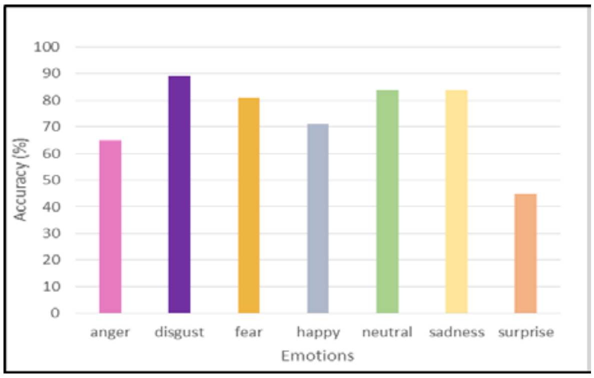


Fig. 4 Accuracy of the proposed model to detect different emotions

Fig. 4 is the graphical representation of the percentage of accuracy of the model to detect and classify different emotions.

VI. CONCLUSION

In this paper, we proposed an approach for emotion detection by integrating the RESNET50 CNN architecture with a Support Vector Machine (SVM) classifier. The experimental results using this approach have demonstrated promising performance i.e. 87.23% training accuracy and 82% test accuracy. Our findings highlight the potential of an integrating deep learning and traditional machine learning techniques for detecting emotions.

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