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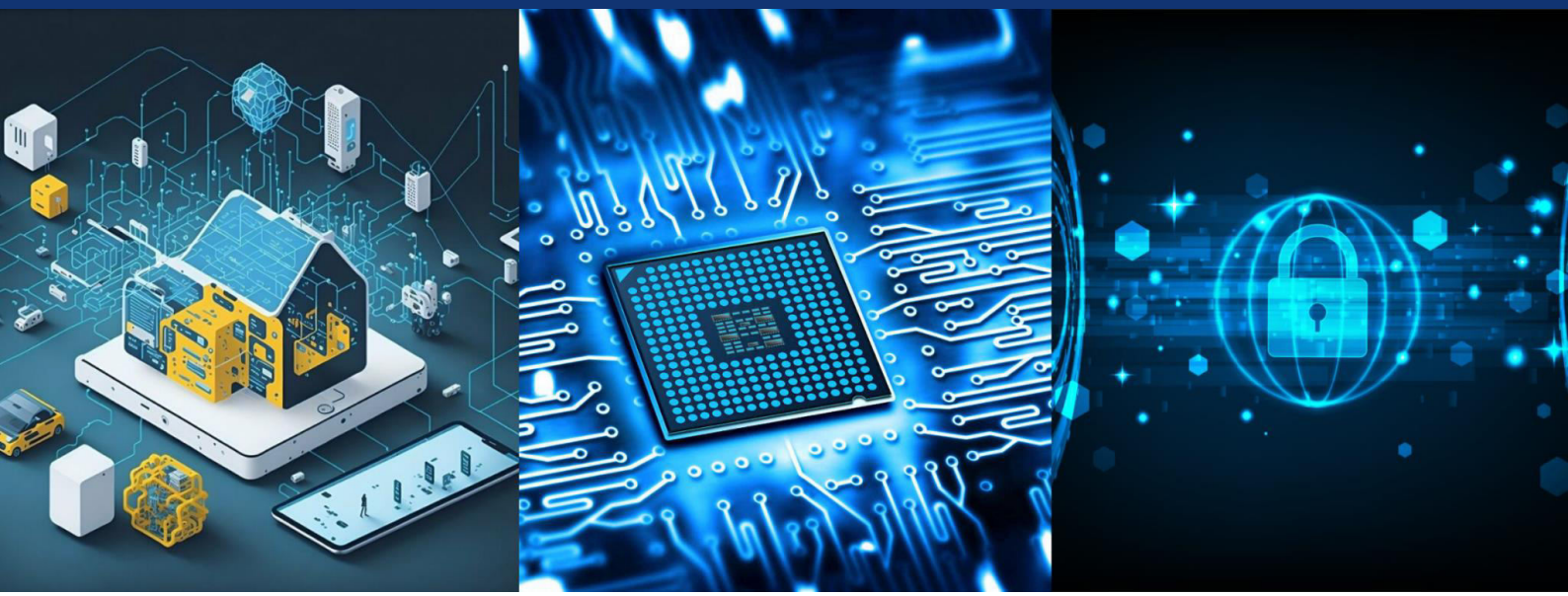

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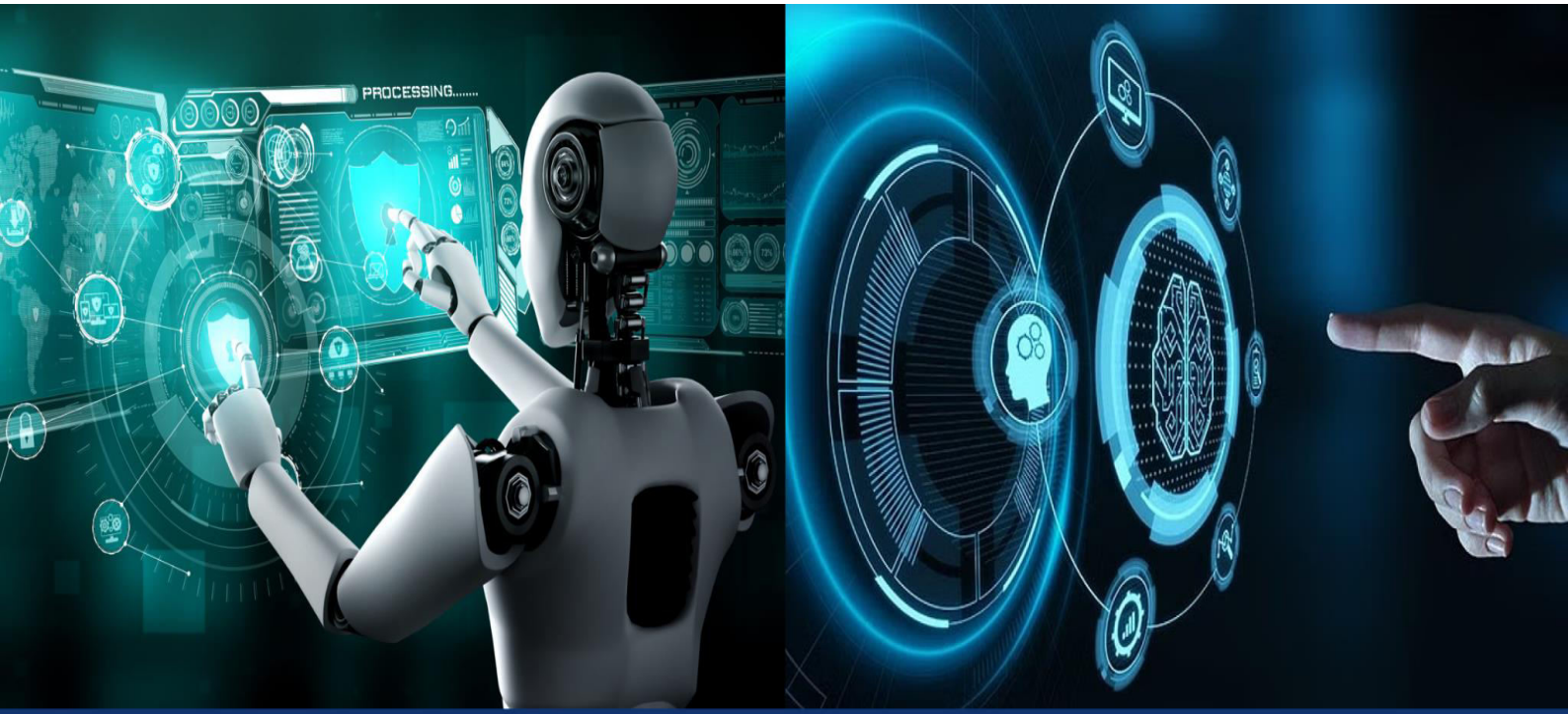

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Image Based Emotion Recognition using Deep Neural Network

P.Gayathri[1], K.Prasad[2], Ch.Sai Keerthi[3], R.Sambi Reddy[4], Y.R.K.Paramahamsa[5]

U.G. Student, Department of ECE, SVIET Engineering College, Nandamuru, Pedana, Andhra Pradesh, India[1,2,3,4]

Assistant Professor, Department of ECE, SVIET Engineering College, Nandamuru, Pedana, Andhra Pradesh, India[5]

ABSTRACT: Image-based emotion recognition using deep neural networks is important for understanding human emotions and improving human-computer interaction in areas like healthcare, education, and security. This project uses a Convolutional Neural Network (CNN) to automatically extract facial features and accurately classify emotions such as happiness, sadness, and anger. The system reduces the limitations of traditional methods by eliminating manual feature extraction and improving performance under different conditions. Compared to earlier techniques, this approach provides higher accuracy, better adaptability, and supports real-time emotion detection, making it effective for real-world applications.

KEYWORDS: Image-based emotion recognition, Deep Neural Network, Convolution Neural Network, Facial feature extraction, Emotion classification, Human-Computer Interaction.

I. INTRODUCTION

Emotion recognition plays a crucial role in enhancing human–computer interaction by enabling machines to understand and respond to human feelings effectively. With the rapid advancement in the field of Artificial Intelligence and Computer Vision, automated emotion detection from facial images has gained significant attention in recent years. This technology has wide-ranging applications in areas such as healthcare, education, security, entertainment, and social robotics.Facial expressions are one of the most natural and powerful ways for humans to convey emotions. However, accurately identifying emotions from images is a challenging task due to variations in lighting conditions, facial orientations, occlusions, and individual differences. Traditional machine learning techniques often struggle to achieve high accuracy in such complex scenarios.

To address these challenges, Deep Learning approaches, particularly Convolutional Neural Networks, have emerged as powerful tools for image-based emotion recognition. These models automatically learn hierarchical features from raw image data, eliminating the need for manual feature extraction and significantly improving performance. Deep neural networks can effectively capture subtle facial features and patterns associated with different emotional states such as happiness, sadness, anger, surprise, fear, and disgust.

The results demonstrate that the proposed model achieves high accuracy and robustness compared to traditional approaches. This study highlights the potential of deep learning techniques in developing intelligent systems capable of understanding human emotions, thereby contributing to more natural and effective human–machine interactions.

II. RELATED WORK

Early research in emotion recognition primarily relied on traditional machine learning techniques using handcrafted features. These methods required manual feature extraction and were limited in handling variations in facial expressions and environmental conditions.

With the advancement of Computer Vision and Deep Learning, Convolutional Neural Networks have become the dominant approach for emotion recognition tasks. CNNs automatically learn hierarchical features from facial images, significantly improving classification accuracy compared to conventional methods.

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Recent studies have focused on using advanced architectures such as ResNet and lightweight models, along with transfer learning techniques, to enhance performance and reduce computational complexity. Hybrid models combining CNN with other networks are also explored to further improve results.

Despite these advancements, challenges such as variations in lighting, pose, occlusion, and limited dataset diversity still affect the robustness of emotion recognition systems. Ongoing research aims to address these issues and develop more accurate and real-time solutions.

III. METHODOLOGY

The proposed system begins with the collection of a facial image dataset representing various emotions such as happiness, sadness, anger, surprise, fear, and disgust. The collected images undergo preprocessing steps including resizing, normalization, and noise removal to improve image quality. Face detection techniques are applied to extract the region of interest, ensuring that only relevant facial features are used for further processing.

The preprocessed facial images are then fed into a Convolutional Neural Networks model, a key approach in Deep Learning. The CNN automatically learns hierarchical features through layers such as convolution, pooling, and fully connected layers. The model is trained using labeled data, where each image corresponds to a specific emotion category.

Finally, the trained model is evaluated using performance metrics such as accuracy, precision, recall, and F1-score. The system is tested on unseen data to measure its effectiveness and generalization capability. This methodology ensures accurate and efficient emotion recognition from facial images.

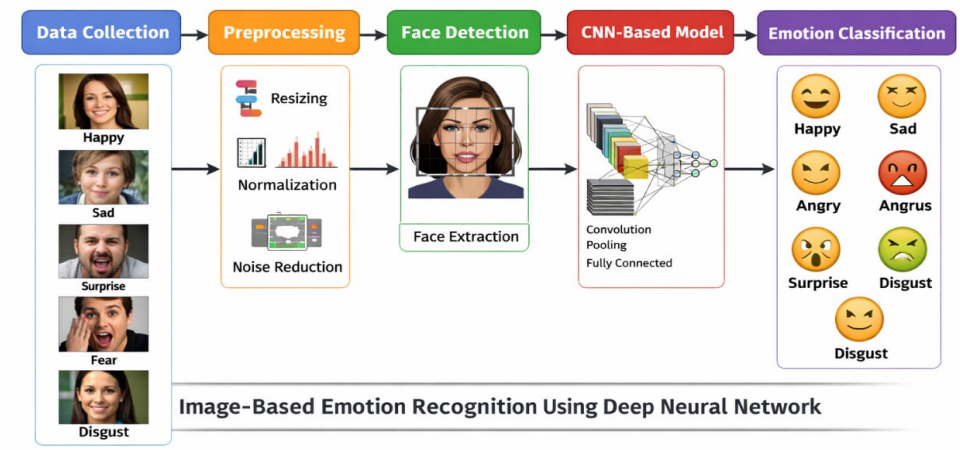

FIG 1: BLOCK DIAGRAM OF IMAGE BASED EMOTION RECOGNITON USING DEEP NEURAL NETWORK

The block diagram illustrates the process of image-based emotion recognition using a deep neural network, where a dataset of facial images with emotions such as happiness, sadness, anger, surprise, fear, and disgust is first collected and then preprocessed through resizing, normalization, and noise removal to ensure quality and consistency.

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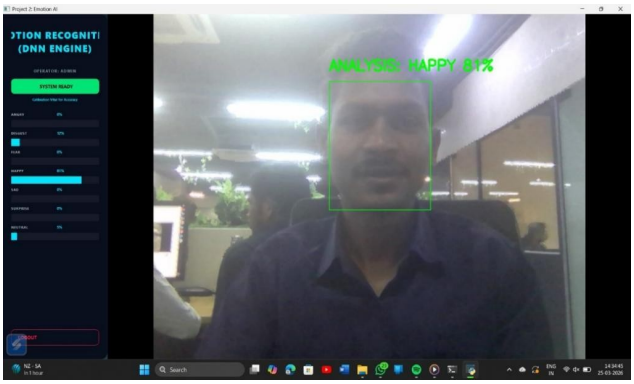
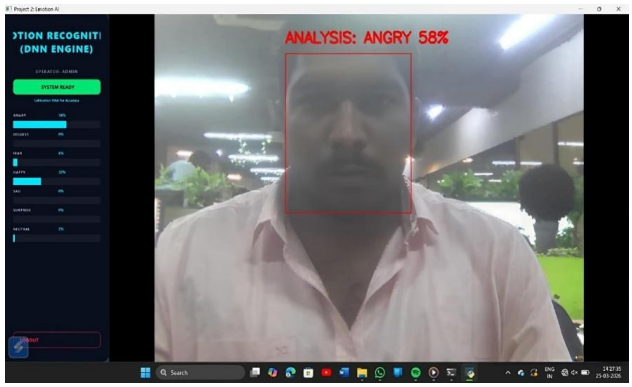
IV. EXPERIMENTAL RESULTS

The proposed image-based emotion recognition system using Deep Learning was evaluated on a standard facial expression dataset, where the Convolutional Neural Networks model achieved an overall accuracy of 68%, indicating moderate performance in classifying different emotions. The system was more effective in recognizing basic emotions such as happiness and surprise, while it showed lower accuracy for complex emotions like fear and disgust. Variations in lighting conditions, facial pose, and image quality contributed to some misclassifications.

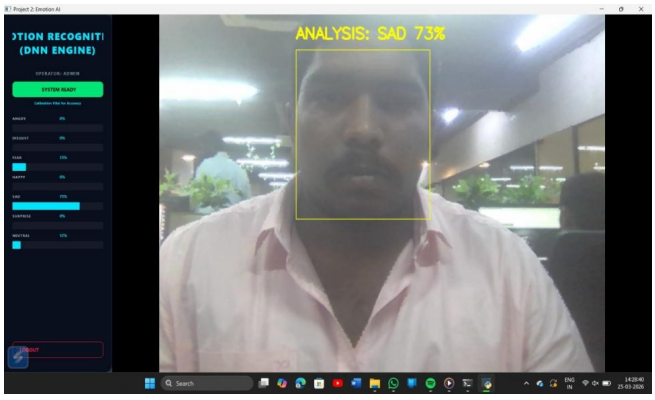
FIG 2:



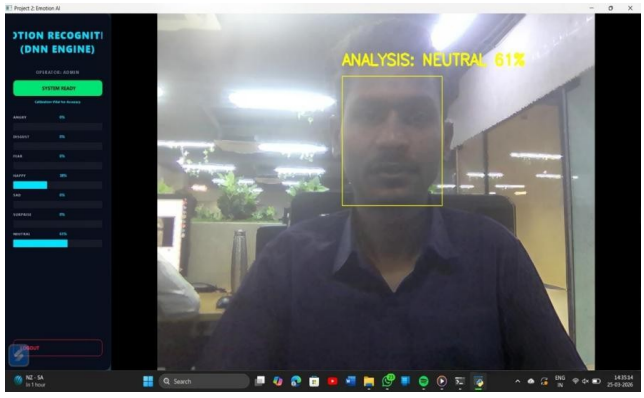
(a)Happy Emotion Detection (81%)



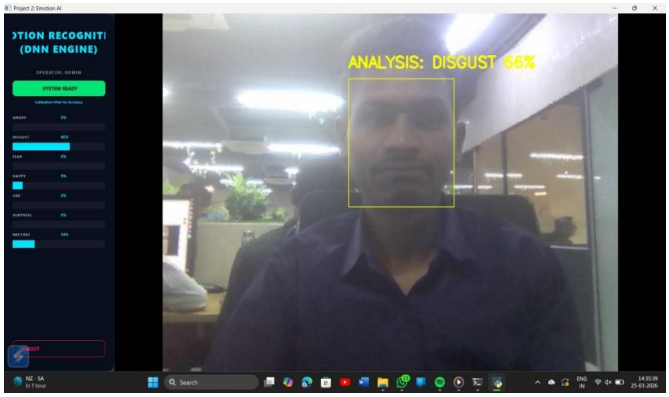
(b) Angry Emotion Detection (58%)



(c)Sad Emotion Recognition (73%)



(d) Neutral Emotion Recognition (61%)



(e) Disgust Emotion Recognition (66%)

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Fig 2 shows the results of Image Based Emotion Recognition using Deep Neural Network (a) Happy Emotion Recognition (81%),(b) Angry Emotion Recognition (58%),(c) Sad Emotion Recognition (73%),(d) Neutral Emotion Recognition (61%),(e) Disgust Emotion Recognition (66%).

V.CONCLUSION

In this work, an image-based emotion recognition system using Deep Learning techniques was developed to classify human emotions from facial images. The implementation of Convolutional Neural Networks enabled automatic feature extraction and effective learning of facial patterns associated with different emotional states. The experimental results, with an accuracy of 68%, demonstrate that the proposed system is capable of recognizing basic emotions, although performance is affected by variations in lighting, pose, and image quality.

Overall, the study confirms the feasibility of deep learning approaches for emotion recognition tasks and provides a strong foundation for future improvements. Enhancing dataset quality, increasing training data, and optimizing model architecture can further improve accuracy and robustness, making the system more suitable for real-world applications.

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