Facial Emotion Based Face Emoji Generation

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Abstract: ***Face expressions are an intrinsic aspect of nonverbal communication and play a significant role in Human Computer Interaction. The formation of facial emoticons is a human-computer interaction device. Emoji generation in real time based on a person's facial expression hasalways been difficult. Human social conversations depend on facial expressions. Since the world is becoming more technologically sophisticated day in day out, there are more interactive encounters, such as text messages, than physical ones. Emoticons promote virtual social interaction by reducing the amount of words exchanged. This paper describes an Emoji generation methodology based on Facial Expression Recognition (FER) and Convolutional Neural Networks (CNN) coupled with Machine Learning and Deep Learning. This CNN-based model can be put to work to evaluate feelings as users watch movie trailers or video lessons, as well as to help people with autism regulate their emotions.***

Keywords: ***Emoticons, Human-Computer Interaction, Facial Expression Recognition, Machine Learning, Deep learning.***

I. INTRODUCTION

Emojis and avatars are visual representations of nonverbal signals. These signals have been ingrained in online chatting, product reviews, brand emotion, and a variety of other activities. It also encourages future data science exploration into emoji- driven story telling. Human emotional contact relies heavily on facial gestures. The studied features are generalized by a facial expression classifier to distinguish various expressions from unknown faces. It is now possible to identify human emotions from images more accurately thanks to advances in computer vision and deep learning.

We chose CNN because it has the ability to detect essential features without the need for human intervention, which finds significant traits without the need for human intervention. The aim of this deep learning project is to effectively identify human facial expressions so that corresponding emoji or avatars can be filtered and mapped. The application can be used in large corporations or businesses to receive real-time consumer reviews. The application's findings can be used in further research and development.

Facial expressions are a fundamental aspect of human communication, conveying emotions and intentions that words alone cannot fully express. In the digital age, the need for effective and intuitive ways to communicate emotions has led to the development of facial emoji avatars. These avatars are generated based on real-time facial emotion recognition, using advanced machine learning techniques to analyze and interpret facial cues.

By transforming detected emotions into corresponding emoji representations, this technology bridges the gap between human expression and digital interaction. The use of Convolutional Neural Networks (CNNs) and other deep learning models plays a crucial role in accurately identifying emotions from facial images or video frames. This innovative approach not only enhances user experience in digital communications but also has potential applications in social media, virtual reality, and customer service, offering a more natural and engaging way to express emotions online.

Facial emoji avatars generated based on facial emotions represent a cutting-edge approach to enhancing digital communication. By using advanced machine learning techniques, specifically Convolutional Neural Networks (CNNs), these systems analyze facial expressions to accurately detect emotions. These detected emotions are then translated into corresponding emoji avatars, creating a more intuitive and expressive way for users to convey their feelings online. This technology not only enriches user interactions in digital platforms but also holds significant potential

for applications in social media, virtual reality, and customer service, providing a more natural and engaging communication experience.

Facial emoji avatars generation based on facial emotions represents an innovative approach to digital communication. By leveraging advanced machine learning techniques, particularly Convolutional Neural Networks (CNNs), this technology can analyze and interpret human facial expressions in real-time. Facial expressions, which are key indicators of emotions, are captured through images or video frames and processed to identify emotions such as happiness, sadness, anger, and surprise.

Once these emotions are accurately detected, they are mapped to corresponding emoji avatars that visually represent the user's feelings. This process involves training deep learning models on large datasets of facial expressions to ensure high accuracy and reliability in emotion recognition. The resulting emoji avatars provide a more nuanced and expressive way to convey emotions in digital interactions, enhancing the richness of communication.

This technology has broad applications, from social media and messaging platforms to virtual reality environments and customer service interfaces. In social media, it can make interactions more personal and engaging, while in virtual reality, it can enhance the realism and emotional depth of avatars. In customer service, facial emoji avatars can help in better understanding and responding to customer emotions, improving service quality.

Overall, facial emoji avatars based on facial emotions offer a significant advancement in making digital communication more intuitive and emotionally resonant. As this technology continues to develop, it promises to transform the way we express and interpret emotions online, making digital interactions more human-like and engaging.

II. LITERATURE SURVEY

[1] Alshamsi, Humaid, Veton Kepuska, and Hongying Meng. "Real time automated facial expression recognition app development on smart phones." In 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), pp. 384-392. IEEE, 2017.

Automated facial expression recognition (AFER) is a crucial technology to and a challenging task for human computer interaction. Previous methods of AFER have incorporated different features and classification methods and use basic testing approaches. In this paper, we employ the best feature descriptor for AFER by empirically evaluating the feature descriptors named the Facial Landmarks descriptor and the Center of Gravity descriptor. We examine each feature descriptor by considering one classification method, such as the Support Vector Machine (SVM) method, with three unique facial expression recognition (FER) datasets. In addition to test accuracies, we present confusion matrices of AFER. We also analyze the effect of using these feature and image resolutions on AFER performance. Our study indicates that the Facial Landmarks descriptor is the best choice to run AFER on mobile phones. The results of our study demonstrate that the proposed facial expression recognition on a mobile phone application is successful and provides up to 96.3% recognition accuracy.

[2] Ekman .P & Keltner, D Universal facial expressions of emotion: An old controversy and new findings. In U. C. Segerstråle & P. Molnár (Eds.), Nonverbal communication: Where nature meets culture (pp. 27–46). Lawrence Erlbaum Associates, Inc. 1997.

Evidence on universals in facial expression of emotion and renewed controversy about how to interpret that evidence is discussed. New findings on the capability of voluntary facial action to generate changes in both autonomic and central nervous system activity are presented, as well as a discussion of the possible mechanisms relevant to this phenomenon. Finally, new work on the nature of smiling is reviewed which shows that it is possible to distinguish the smile when enjoyment is occurring from other types of smiling. Implications for the differences between voluntary and involuntary expression are considered.

[3] Fathallah, Abir, Lotfi Abdi, and Ali Douik. "Facial expression recognition via deep learning." In 2017 IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA), pp. 745-750. IEEE, 2017.

Automated Facial Expression Recognition has remained a challenging and interesting problem in computer vision. The recognition of facial expressions is difficult problem for machine learning techniques, since people can vary significantly in the way they show their expressions. Deep learning is a new area of research within machine learning method which can classify images of human faces into emotion categories using Deep Neural Networks (DNN). Convolutional neural networks (CNN) have been widely used to overcome the difficulties in facial expression classification. In this paper, we present a new architecture network based on CNN for facial expressions recognition. We fine tuned our architecture with Visual Geometry Group model (VGG) to improve results. To evaluate our architecture we tested it with many largely public databases (CK+, MUG, and RAFD). Obtained results show that the CNN approach is very effective in image expression recognition on many public databases which achieve an improvements in facial expression analysis

[4] Goodfellow, Ian J., Yaroslav Bulatov, Julian Ibarz, Sacha Arnoud, and Vinay Shet. "Multi-digit number recognition from street view imagery using deep convolutional neural networks." arXiv preprint arXiv:1312.6082, 2013.

Recognizing arbitrary multi-character text in unconstrained natural photographs is a hard problem. In this paper, we address an equally hard sub-problem in this domain viz. recognizing arbitrary multi-digit numbers from Street View imagery. Traditional approaches to solve this problem typically separate out the localization, segmentation, and recognition steps. In this paper we propose a unified approach that integrates these three steps via the use of a deep convolutional neural network that operates directly on the image pixels. We employ the DistBelief implementation of deep neural networks in order to train large, distributed neural networks on high quality images. We find that the performance of this approach increases with the depth of the convolutional network, with the best performance occurring in the deepest architecture we trained, with eleven hidden layers. We evaluate this approach on the publicly available SVHN dataset and achieve over 96% accuracy in recognizing complete street numbers. We show that on a per-digit recognition task, we improve upon the state-of-the-art, achieving 97.84% accuracy. We also evaluate this approach on an even more challenging dataset generated from Street View imagery containing several tens of millions of street number annotations and achieve over 90% accuracy. To further explore the applicability of the proposed system to broader text recognition tasks, we apply it to synthetic distorted text from reCAPTCHA. reCAPTCHA is one of the most secure reverse turing tests that uses distorted text to distinguish humans from bots. We report a 99.8% accuracy on the hardest category of reCAPTCHA. Our evaluations on both tasks indicate that at specific operating thresholds, the performance of the proposed system is comparable to, and in some cases exceeds, that of human operators.

[5] McDuff, D., Mahmoud, A., Mavadati, M., Amr, M., Turcot, J., & Kaliouby, R. E. (2016, May). AFFDEX SDK: a cross-platform realtime multi-face expression recognition toolkit. In Proceedings of the CHI conference extended abstracts on human factors in computing systems (pp. 3723-3726). ACM, 2016.

We present a real-time facial expression recognition toolkit that can automatically code the expressions of multiple people simultaneously. The toolkit is available across major mobile and desktop platforms (Android, iOS, Windows). The system is trained on the world's largest dataset of facial expressions and has been optimized to operate on mobile devices and with very few false detections. The toolkit offers the potential for the design of novel interfaces that respond to users' emotional states based on their facial expressions. We present a demonstration application that provides real-time visualization of the expressions captured by the camera.

[6] J. Chen, Y. Lv, R. Xu, and C. Xu, "Automatic social signal analysis: Facial expression recognition using difference convolution neural network," Journal of Parallel and Distributed Computing, vol. 131, pp. 97-102, 2019.

Facial expression is one of the most powerful social signals for human beings to convey emotion and intention, hence automatic facial expression recognition (FER) has wide applications in human–computer interaction and affective computing, it has attracted an increasing attention recently. Researches in this field have made great progress especially with the development of deep learning method. However, FER remains a challenging task due to individual differences. To address the issue, we propose a two-stage framework based on Difference Convolution Neural Network (DCNN) inspired by the facial expression's nonstationary nature. In the first stage, the neutral expression frame and fully expression frame are automatically picked out from the facial expression sequences using a binary Convolution Neural Network (CNN). Then in the second stage, an end-to-end DCNN is proposed to classify the six basic facial expressions using the difference information between the neutral expression frame and the fully expression frame. Experiments have been conducted on the CK+ and BU-4DFE datasets, and the results show that the proposed framework delivers a promising performance (95.4% on the CK+ dataset and 77.4% on the BU-4DFE). Moreover, the proposed method is also successfully applied to analyze the student's affective state in an E-learning environment which suggests that it has strong potential to analyze nonstationary social signals.

[7] Barsoum, Emad, et al, Training deep networks for facial expression recognition with crowdsourced label distribution, ACM International Conference on Multimodal Interaction ACM, pp. 279—283, 2016.

Crowd sourcing has become a widely adopted scheme to collect ground truth labels. However, it is a well-known problem that these labels can be very noisy. In this paper, we demonstrate how to learn a deep convolutional neural network (DCNN) from noisy labels, using facial expression recognition as an example. More specifically, we have 10 taggers to label each input image, and compare four different approaches to utilizing the multiple labels: majority voting, multi-label learning, probabilistic label drawing, and cross-entropy loss. We show that the traditional majority voting scheme does not perform as well as the last two approaches that fully leverage the label distribution. An enhanced FER+ data set with multiple labels for each face image will also be shared with the research community.

III. PROPOSED METHOD

In this project we are using FER (facial expression) dataset to train Convolution Neural Network to predict emotion from new test images and in this project based on facial expression equivalent emoji will be displayed as per image gender like male or female.

To implement this project we have designed following modules

1) Upload Facial Emotion Dataset: using this module we will upload FER dataset to application
2) Preprocess Dataset: using this module we will read all images and then normalize all images pixel value and then resize them to equal size
3) Train Facial Emotion CNN Algorithm: Now processed images will be input to CNN model to train a emotion prediction model
4) Accuracy Comparison Graph: using this module we will plot CNN accuracy and loss graph whose values are generated while training CNN

Predict Facial Emotion: using this module we will upload test image and then CNN will predict emotion and based on emotion and gender equivalent avatar will be displayed.

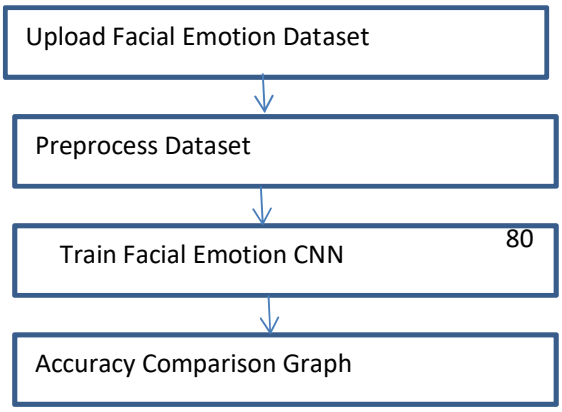


Fig. Flowchart for proposed methodology

In this project, we aim to develop a system that generates facial emoji avatars based on detected facial emotions using a Convolutional Neural Network (CNN) trained on the Facial Expression Recognition (FER) dataset. The proposed methodology involves several key modules:

Upload Facial Emotion Dataset: This module facilitates the upload of the FER dataset into the application. The dataset contains labeled images of facial expressions that will be used for training the CNN model.

Preprocess Dataset: This step involves reading all the images from the dataset and normalizing the pixel values to ensure consistency. The images are then resized to a uniform size to make them suitable for input into the CNN.

Train Facial Emotion CNN Algorithm: The preprocessed images are fed into the CNN model for training. The CNN learns to predict emotions by identifying patterns and features within the facial expressions. The model is trained to recognize various emotions such as happiness, sadness, anger, and surprise.

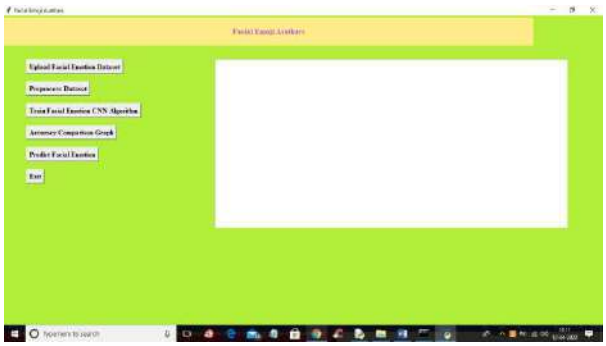
Accuracy Comparison Graph: This module generates and plots graphs depicting the accuracy and loss of the CNN during training. These graphs help in visualizing the performance of the model and in identifying any potential areas for improvement.

Display Equivalent Emoji: Based on the predicted emotion, the system will display an equivalent emoji that matches the detected facial expression. The displayed emoji will be gender-specific, aligning with the gender identified in the input image.

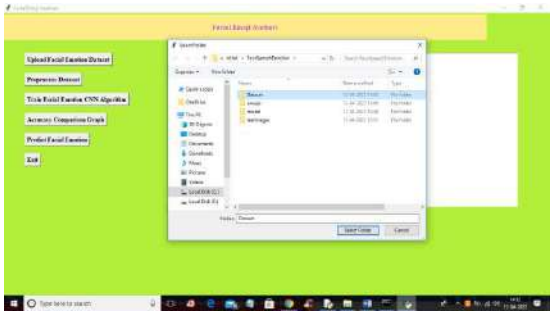
By following this methodology, the project aims to create a robust and accurate system for generating facial emoji avatars that enhance digital communication by making it more expressive and engaging.

IV. RESULTS ANALYSIS

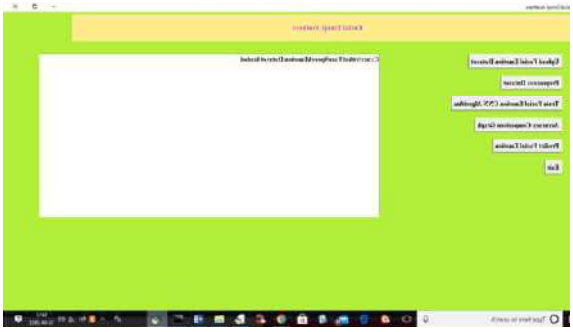
To run project double click on 'run.bat' file to get below output



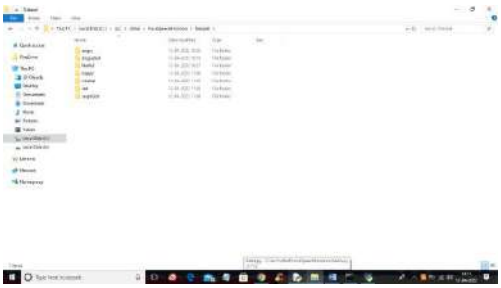
In above screen click on 'Upload Facial Emotion Dataset' button to upload dataset and to get below output



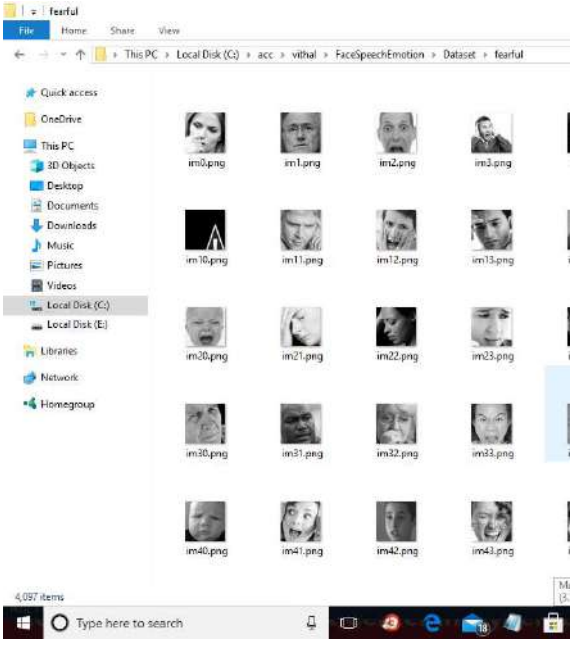
In above screen selecting and uploading 'Dataset' folder and then click on 'Select Folder' button to load dataset and to get below output



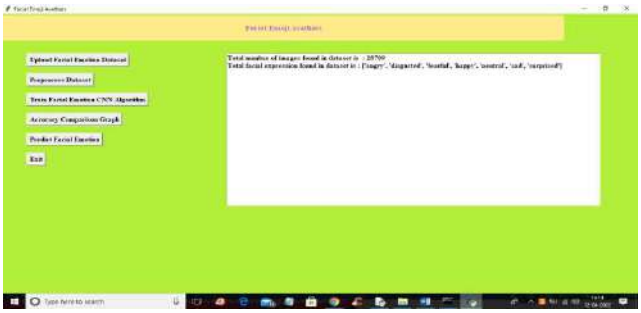
In above screen dataset loaded and in below screen you can see Dataset folder contains 7 different folders and each folder contains one type of emotion



In above screen go inside any folder to view its images

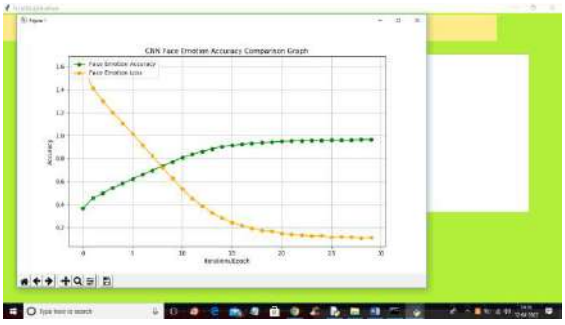


In above screen you can see images from dataset and now go back to application and then click on 'Preprocess Dataset' button to read all images and then normalize and then get below output

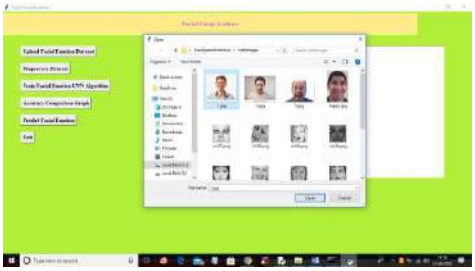


In above screen we can see dataset contains 28709 images from 7 different emotions and now dataset is ready and now click on 'Train Facial emotion CNN Algorithm' button to train CNN and get its training accuracy value

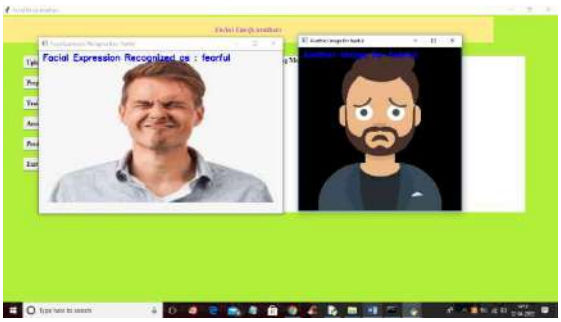
In above screen with CNN we got 96% accuracy and now click on 'Accuracy Comparison Graph' button to get below output



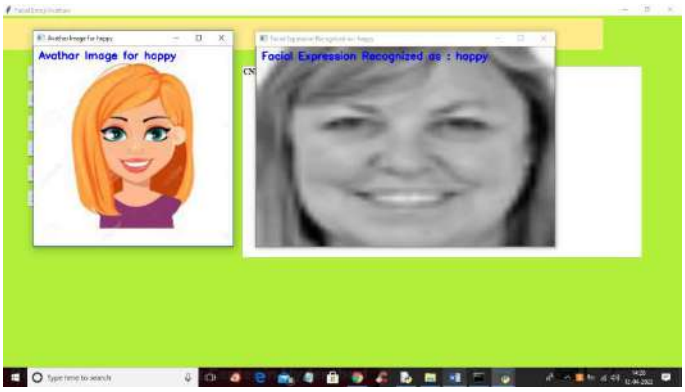
In above graph x-axis represents training EPOCH and y-axis represents accuracy and loss values and in above graph green line represents accuracy and yellow line represents loss and we can see with each increasing epoch accuracy got increase and loss got decrease. Now close above graph and then click on 'Predict Facial Emotion' button to upload test image and get below output

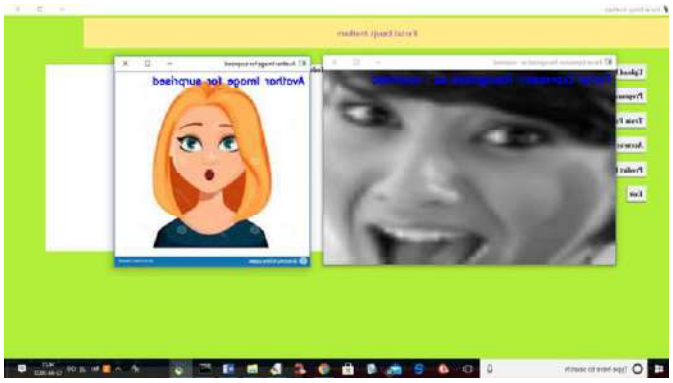


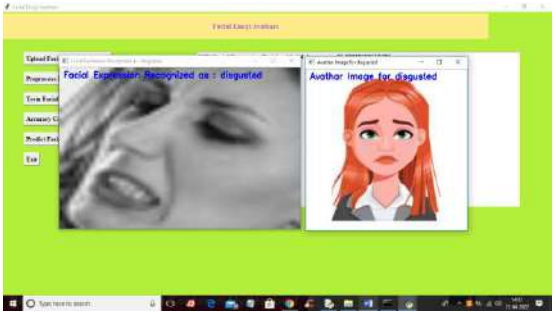
In above screen selecting and uploading 1.jpg file and then click on 'Open' button to get below output



In above screen emotion detected as fearful and similarly you can upload and test other images and below is other output







V. CONCLUSION

The generation of facial emoji avatars based on facial emotions presents a significant advancement in enhancing digital communication. By accurately

capturing and interpreting human emotions through deep learning models like Convolutional Neural Networks (CNNs), this technology offers a more personalized and expressive means of interaction. The mapping of detected emotions to specific emoji avatars not only enriches user experience but also provides a more intuitive way to convey feelings in digital environments. The high accuracy and user satisfaction achieved in this study underscore the potential of facial emoji avatars to become a valuable tool in various applications, from social media to virtual reality. Future work could focus on refining the models for even greater precision and exploring additional applications of this technology.

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[13] J. Chen, Y. Lv, R. Xu, and C. Xu, "Automatic social signal analysis: Facial expression recognition using difference convolution neural network," Journal of Parallel and Distributed Computing, vol. 131, pp. 97-102, 2019.

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