Intelligent Human Expression Recognition System and Characterization Using Facial Features

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Abstract—Emotion recognition is a striking and demanding problem which in turn can help harness insights about individual and organizational behavior and can add big value to various businesses ranging from education, hospitality, entertainment, eateries, etc. In this, we have proposed an AI rooted Emotion detection and recognition feedback system using mathematical solutions. Expression recognized using Face API (open source). For example, if a person is sad can do something to make him or her feel happy and so on In this project it has been searched that is it possible to identify a person is it possible to identify a person's emotional state. Then it has been also researched to suggest music on the basis of his or her emotion. One can also save his or her time to text someone with an image as a single image explains many things. Images are also used to identify a person on the social media and in many other webs. For this fact Face Detection is getting very popular every day. With the help of Face Detection, it is possible to identify a person very easily.

Keywords—Facial Expressions, Emotional State, AI emotion detection, Open source.

I. INTRODUCTION

A Facial expression is the visible manifestation of the affective state, cognitive activity, intention, personality and psychopathology of a person and plays a communicative role in interpersonal relations. Generally human beings can convey intentions and emotions through nonverbal ways such as gestures, facial expressions and involuntary languages. This system can be significantly useful, nonverbal way for people to communicate with each other. The important thing is how fluently the system detects or

Extracts the facial expression from image. The system is growing attention because this could be widely used in many fields like lie detection, medical assessment and human computer interface.

Emotion reveals itself in the form official expressions, vocal expressions, writings, and in movements and actions. Subsequently, scientific research in emotion (sentiments) has been followed along multiple dimensions and has drawn upon research from several fields. Mainly used form of communication on social network is in textual form, contributed a platform for computer systems to behave more smartly based on the user's feelings. Enormous amounts of text data are available in the form of blogs, micro blogging sites like Facebook, Twitter, emails, SMS etc. This textual data is beneficial to generate better human interaction system which needs to be able to analyse the text and conclude the emotion of the user. Even though the system can discover the user emotional states, intricacy of language makes it hard for researchers to distinguish emotional states from pure textual data.

The system classifies facial expression of the same person into the basic emotions namely anger, disgust, fear, happiness, sadness and surprise. The main purpose of this system is efficient interaction between human beings and machines using eye

gaze, facial expressions, cognitive modelling etc. Artificial Intelligence presents a wide range of algorithms capable of Facial Emotion Recognition. Considering how dynamic and irregular human emotions are, the task of FER has been deemed a huge one and has necessitated much research. This work will review some of the research works on FER, the methods used, their performances and efficiencies, and the possible setbacks to develop some open issues and likely trends for future research in FER. Existing work includes the application of feature extraction of facial expressions with the combination of neural networks for the recognition of different facial emotions (happy, sad, angry, fear, surprised, neutral, etc. . .). Humans are capable of producing thousands of facial actions during communication that varies in complexity, intensity, and meaning. The existing system is capable of analysing the limitations of the existing system of Emotion recognition using brain activity. Human emotions and intentions are expressed through facial expressions and deriving an efficient and effective feature is the fundamental component of facial expression system. Facial expressions convey non-verbal cues, which play an important role in interpersonal relations. Automatic recognition of facial expressions can be an important component of natural human-machine interfaces; it may also be used in behavioural science and in clinical practice. An automatic

II. LITERATURE REVIEW

1. Optimal feature selection and deep learning ensembles method for emotion recognition from human brain EEG sensors.

In this paper, we efficiently recognize emotional states by analyzing the features of electroencephalography (EEG) signals, which are generated from EEG sensors that noninvasively measure the electrical activity of neurons inside the human brain, and select the optimal combination of these features for recognition. The optimal features were further processed for emotion classification using support vector machine, k-nearest neighbor, linear discriminant analysis, Naive Bayes, random forest, deep learning, and four ensemble's methods (bagging, boosting, stacking, and voting). The results show that the proposed method substantially improves the emotion recognition rate with respect to the commonly used spectral power band method.

2. Multimodal speech emotion recognition and classification using convolutional neural network techniques.

Emotion recognition plays a vital role in dealing with day-to-day interpersonal human interactions. Understanding the feeling of a person from his speech can reveal wonders in shaping social interactions. In this paper, algorithms like linear regression, decision tree, random forest, support vector machine (SVM) and convolutional neural networks (CNN) are used for classification and prediction once relevant features are selected from speech signals. The acoustic speech signal is split into short frames, fast Fourier transformation is applied, and relevant features are extracted using Mel-frequency cestrum coefficients (MFCC) and modulation spectral (MS).Human emotions like neutral, calm, happy, sad, fearful, disgust and surprise are classified using decision tree, random forest, support vector machine (SVM) and convolutional neural networks (CNN). We have tested our model with RAVDEES dataset and CNN has shown 78.20% accuracy in recognizing emotions compared to decision tree, random forest and SVM.

3. Facial Expression Recognition

In this survey, we provide a comprehensive review of deep FER, including datasets and algorithms that provide insights into these intrinsic problems. First, we introduce the available datasets that are widely used in the literature and provide accepted data selection and evaluation principles for these datasets. We then describe the standard pipeline of a deep FER system with the related background knowledge and suggestions for applicable implementations for each stage. For the state-of-the-art in deep FER, we introduce existing novel deep neural networks and related training strategies that are designed for FER based on both static images and dynamic image sequences and discuss their advantages and limitations.

4. A temporal approach to facial emotion expression recognition.

Systems embedded with facial emotion expression recognition models enable the application of emotion-related knowledge to improve human and computer interaction and in doing so, users have a satisfying experience. Facial expressions exhibited by individuals are mostly used as non-verbal cues of communication. It is envisaged that accurate and real-time estimation of expressions and/or emotional changes will improve existing online platforms. However, further mapping of estimated expressions to emotions is highly useful in many applications such as sentiment analysis, market analysis, and student comprehension among others. Feedback based on estimated emotions plays a crucial role in improving the usability of such models The methodology involves a temporal approach including a VGG-19 pre-trained network for feature extraction, a BILSTM architecture for facial emotion expression recognition, and mapping criteria to map estimated expressions and the resultant emotion (positive, negative, neutral). The data set for affective States in E-Environment (DAISEE) labeled with boredom, frustration, confusion, and engagement was used to further test the proposed model to estimate the seven basic expressions and re-evaluate the mapping model used for mapping expressions to emotions.

III. METHODS

A. Load Dataset

Dataset is required for training and testing the machine learning model which plays the vital role in the Artificial Intelligence. Initially the dataset is uploaded into the model which must belongs to the .csv format for the easy processing. .csv is the simple file format which is used to store data in tabular format.

B. Data Preprocessing

Data Preprocessing is the process of preparing raw data and make it suitable for a model.

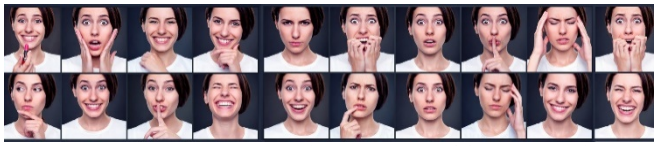


Fig 1. Dataset used for preprocessing

The data which are extracted from the various sources make contain noises, missing values, duplicate values and in various other forms. Data preprocessing step removes all these types of unnecessary data which lead to increase in the accuracy and efficiency of the machine learning model. The data preprocessing includes the data visualization using the charts, graphs and in various forms.

C. Feature Extraction

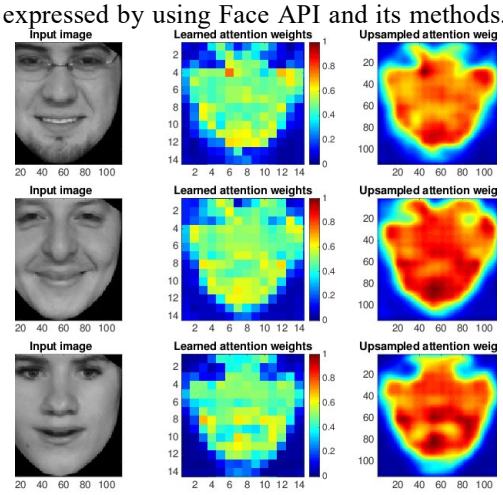
Feature Extraction is the process of transforming the raw data into numerical features that can be processed while preserving the information in the original dataset. It produces better result than applying the raw materials directly. It converted the image or other type of data into the numerical data type for the easy understanding of the machine to learn and test the dataset. Its workflow includes the feature selection, model selection and tuning.

Feature selection is the process of selecting the necessary variable or subset of the dataset for the more accurate performance. Model selection is the process of applying the more reliable model to the case which is based on the performance criteria of various models. Hyper parameter tuning is the problem of choosing a set of optimal hyper parameters for a learning algorithm.

Fig 2. Data visualization using Heat map

D. Prediction of expression

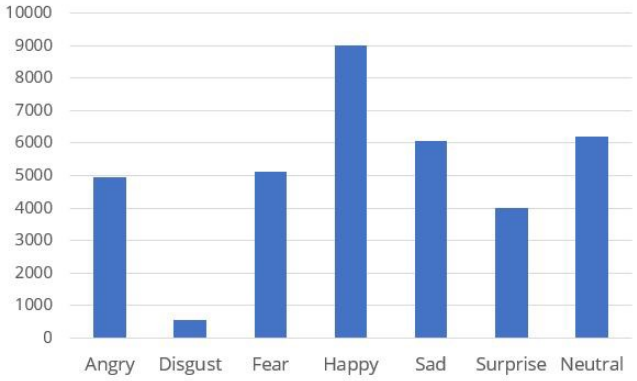
Classification of the emotion through face recognition is very important that it can be helpful to know a person's feeling towards a situation. In this regard we are proposing a method to identify the emotion of person in a situation. We propose to classify the type of emotion being expressed by using Face API and its methods. This system will work on detecting emotions



from live video footage. We will work on how to make the system more efficient so that it works on bright background or for people with darker skin.

The knowledge about a user's facial expression can be used, e.g., to recognize that a helpless user needs some help or to adapt presented information in case of confusion.

Fig 3. Frequency chart of datasets.



IV. EXPERIMENTAL RESULTS

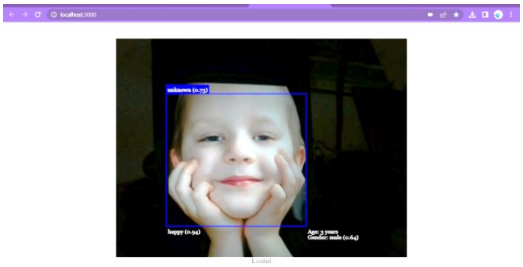
It is the processing module .The systems dealing with classification of facial images, which were developed over the past years, can be differentiated according to the following characteristics:

i. Pre-processing.
ii. Face registration.
iii. Facial feature extraction.
iv. Emotion classification.

It is easily done by Face API. It shows the original image. Then, detect the emotion of children. First of all, we should note that the results of many studies show that AI facial recognition technology copes with its tasks at least no worse, and often better than a human does. Face recognition accuracy can be over 99%, thus significantly exceeding the capabilities of an average person.

Fig 4. Shows the Original image

Fig 5. Facial Expression Recognized



System takes input image and performs some image processing techniques on it in order to find the face region. System can operate on static images, where this procedure is called face localization or videos where we are dealing with face tracking.

V. CONCLUSION

The main aim of this project was to design and implement Facial Prediction Using Artificial Intelligence Methods and Performance Analysis of that methods and it has been achieved successfully. The proposed approach uses Face API software. And 90% classification accuracy has been achieved.

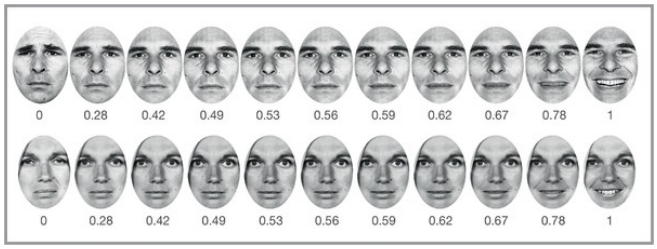


Fig 5. Accuracy of the images

The computer-based face recognition industry has made much useful advancement in the past decade, however, the need for higher accuracy system remains. Through the determination and commitment of industry, government evolutions, and organized standards bodies, growth and progress will continue, raising the bar for face recognition system. Computer based face recognition system is very useful for the police, industries, and for government for various security regions. This project gives a more accuracy than other traditional way of recognize the face and less time consuming.

VI. FUTURE WORK

The below enhancements can be made in future.

- It can implement this project in chat bot inside the car or public malls or Airports to detect the emotion of the people and create a better chatting experience.
- It can also be implemented in Google meet to recognize the expression of the students to make the class much more interesting.
- In future it will be used for payments, security, healthcare, advertising, criminal identification etc.

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REFERENCES

[1] R. Majid Mehmood, R. Du, and H. J. Lee, "Optimal feature selection and deep learning ensembles method for emotion recognition from human brain EEG sensors," IEEE Access, vol. 5, pp. 14797–14806, 2017.
[2] C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012.
[3] C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.
[4] A. Christy, S. Vaithya subramanian, A. Jesudoss, and M. D. A. Praveena, "Multimodal speech emotion recognition and classification using convolutional neural network techniques," International Journal of Speech Technology, 2020.
[5] S. Li, W. Deng, and J. Du, "Reliable crowdsourcing and deep locality-preserving learning for expression recognition in the wild," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pp. 2852–2861, Honolulu, HI, USA, July 2017.
[6] C. Asaju and H. Vadapalli, "A temporal approach to facial emotion expression recognition," in Proceedings of the Southern African Conference for Artificial Intelligence Research, January 2021.
[7] of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation Research, 2021, Volume 11, Issue 4, pp:744-749
[8] G.Neelakrishnan, P.Iraianbu, T.Abishek, G.Rajesh, S.Vignesh, "IOT Based Monitoring in Agricultural" International Journal of Innovative Research in Science, Engineering and Technology, March 2020, Volume 9, Issue 3, pp:814-819
[9] David Silver, Julian Schrittwieser, Karen Simonyan, IoannisAntonoglou,Aja Huang, Arthur Guez, Thomas Hubert, Lucas Baker, Matthew Lai,Adrian Bolton, et al. Mastering the game of go without human knowl-edge. Nature, 550(7676):354, 2017. VS Manjula, Lt Dr S Santhosh Baboo, et al. Face detection identificationand tracking by prdit algorithm using image database for crime investi-gation. International Journal of Computer Applications, 38(10):40–46,2012.
[10] Karen Lander, Vicki Bruce, and Markus Bindemann. Use-inspired basicon individual differences in face identification: Implications for criminal investigation and security. Cognitive research: principles and implications, 3(1):1–13, 2018.
[11] Yongmei Hu, Heng An, Yubing Guo, Chunxiao Zhang, and Ye Li. Thedevelopment status and prospects on the face recognition. In Biotin-formats and Biomedical Engineering (iCBBE), 2010 4th International Communications and Signal Processing (ICCSP), 2015.
[12] Jianke Li, Baojun Zhao, Zhang Hui, and Jichao Jiao. Face recognitionsystem using sum classifier and feature extraction by pica and lda combi-nation. In Computational Intelligence and Software Engineering, 2009.CiSE 2009. International Conference on, 2010.
[13] Frank Vogt, Boris Mizaikoff, and Maurus Tacke. Numerical methods foraccelerating the pica of large data sets applied to hyper spectral imaging. In Environmental & Industrial Sensing, 2002.
[14] Carlos Ordonez, Naveen Mohanam, and Carlos Garcia-Alvarado. Pac forlarge data sets with parallel data summarization. Distributed & ParallelDatabases, 32(3):377–403, 2014.
[15] ShireeshaChintalapati and MV Raghunadh. Automated attendance management system based on face recognition algorithms. In 2013 IEEE
[16] International Conference on Computational Intelligence and Computing Research, pages 1–5. IEEE, 2013.
[17] Jewie Lu, Konstantinos N. Plataniotis, and Anastasios N. Venetsanopou-los. Face recognition using lda-based algorithms. IEEE Transactions on Neural Networks, 14(1):195–200, 2003.
[18] Cortescorinna and Vapnikvladimir. Support-vector networks. MachineLearning, 1995.
[19] Axim Sun, Ee-Peng Lim, and Ying Liu. On strategies for imbalancedclassification using sum: A comparative study. Decision Support Systems, 48(1):191–201, 2009.
[20] Yoav Freund, Raj Ayer, Robert E. Schapiro, Yurem Singer, and Thomas G.Dietterich. An efficient boosting algorithm for combining preferences. Journal of Machine Learning Research, 4(6):170–178, 2004.
[21] G. Retch. Soft margins for adobos. Machine Learning, 42(3):287–320,2001.
[22] Ying Cao, Qigong Miao, Joachim Liu, and Lin Gao. Advance and prospects of adobos algorithm. Act AutomaticaSinica, 39(6):745–
[23] 758, 2013.
[24] Qing Wei Wang, Zip Lu Ying, and Lain Wen Huang. Face recognition al-growth based on hear-like features and gentle adobos feature selection via sparse representation. Applied Mechanics & Materials, 742:299–302,2015.
[25] LI Xiang-Feng, ZHAO Wei-king, DOU Xin-Yuan, LI Kun, and Sudan-wen. Vehicle detection algorithm based on improved adobos and hear. measurement & control technology, 2019.

[26] [20] Mina Qi, Jian Zhang, Jaydan Yang, and Laying Ye. Fusing two kinds of virtual samples for small sample face recognition. Mathematical Problems in Engineering, 2015(pt.3):280318.1–280318.10, 2015
[27] David Silver, Julian Schrittwieser, Karen Simony an, IoannisAntonoglou,,
[28] F. Noroozi, M. Marjanovic, A. Njegus, S. Escalera, and G. Anbarjafari, "Audio-visual emotion recognition in video clips," IEEE Transactions on Affective Computing, vol. 10, no. 1, pp. 60–75, 2019.
[29] M.S. Ratliff, E. Patterson Emotion recognition using facial expressions with active appearance models Proceedings of the Third IASTED International Conference on Human Computer Interaction, ACTA Press, Anaheim, CA, USA (2008), pp. 138-143.
[30] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34–41p.
[31] C. Nagarajan, G.Neelakrishnan, R. Janani, S.Maithili, G. Ramya "Investigation on Fault Analysis for Power Transformers Using Adaptive Differential Relay" Asian Journal of Electrical Science, Vol.11 No.1, pp: 1-8, 2022.
[32] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756
[33] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.
[34] Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
[35] C. Shorten and T. M. Khoshgoftaar, "A survey on image data augmentation for deep learning," Journal of big data, vol. 6, no. 1, p. 60, 2019.
[36] B. J. Park, C. Yoon, E. H. Jang, and D. H. Kim, "Physiological signals and recognition of negative emotions," in Proceedings of the 2017 International Conference on Information and Communication Technology Convergence (ICTC), pp. 1074–1076, IEEE, Jeju, Korea, October 2017.