http://www.jctjournals.com ISSN(ONLINE):2278 – 3814

Volume-15, Issue-05, May 2026
JOURNAL OF COMPUTING TECHNOLOGIES (JCT)
International Journal
Page Number: 01-06

Artificial Intelligence and Machine Learning in the Sentiment Recognition Based On Convolution Neural Network Model: A Review

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***Abstract*— The classification of objects into the right classes has long been one of the most crucial objectives of machine learning or deep learning. Due to the similarities between various things, their textures, colors, and other physical properties, object recognition still presents significant challenges despite the importance of categorizing specific groups of images. In computer vision, object detection has a wide range of uses, such as face detection and vehicle detection. Facial expression recognition (FER) has emerged as an important research area over the last two decades. Facial expression is one of the immediate, natural, and powerful means for humans to communicate their intentions and emotions The FER system can be used in many important applications such as driver safety, health care, video conferencing, virtual reality, and cognitive science etc. Generally, facial expression can be classified into neutral, anger, disgust, fear, surprise, sad, and happy. Recent research shows that the ability of young people to read the feeling and emotion of other people is getting reduced due to the extensive use of digital devices. Therefore, it is important to develop a FER system which accurately recognizes facial expression in real time. An automatic FER system commonly consists of four steps: Preprocessing, feature extraction, feature selection, and classification of facial expressions. Face recognition underpins numerous applications; however, the task is still challenging mainly due to the variability of facial pose appearance. The existing methods show competitive performance but they are still short of what is needed. This article presents an effective three-dimensional pose invariant face recognition approach based on subject-specific descriptors. This results in state-of-the-art performance and delivers competitive accuracies. The proposed model use convolution neural network model to improve the accuracy and other quality of services parameters for the facial expression recognition.**

***Keywords*— Machine learning, Supervised classification, Sentiment recognition, Convolution neural network, Accuracy, Loss.**

I. INTRODUCTION

Human behavior analysis from big multimedia data has become a trending research area with applications to varied domains like surveillance, medical, sports, and entertainment. Facial expressions are employed by humans to convey various kinds of meaning in various contexts. The range of meanings spans basic possibly innate socio-emotional concepts like “surprise” to complex and culture specific concepts like “carelessly.” The range of contexts during which humans use facial expressions spans responses to events within the environment to particular linguistic constructions within sign languages. during this mini review we summarize findings on the use and acquisition of facial expressions by signers and present a unified account of the range of facial expressions employed by concerning three dimensions on which facial expressions vary: semantic, compositional, and iconic. Facial expression is one of the non-verbal communication methods between individuals and plays an important role as a communicative source to convey non-verbal cues [1, 2]. These cues can identify the mood/mental state of a private and convey a weighted mean of communication and spoken words. Behavior understanding through countenance recognition could also be a natural way which performs a crucial role in meaningful conversation and social interaction [3].

Human behavior understanding has many lifestyle applications in various domains like entertainment, security, and healthcare. Researchers have presented various techniques for countenance recognition with considerable accuracy; however, it's still a challenging task to acknowledge countenance for faces captured from different angles and of varied nationalities [4]. Countenance is one of the beneficial sources for analyzing human attitude and

behavior. A psychological study proved that features of facial expressions are located around mouth, nose, and eyes whichare important for countenance recognition. The face is liable for communicating not only thoughts or ideas, but also emotions.

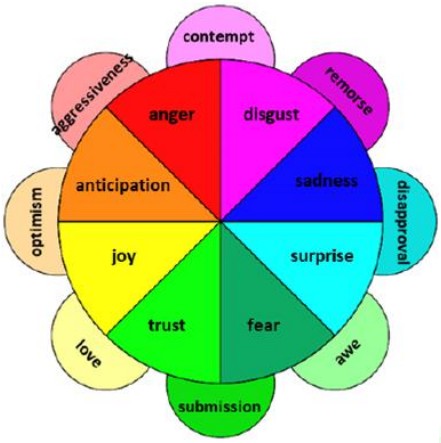

Fig. 1: Object detection process

A. Emotion Recognition

Emotion recognition may be a method utilized in software that allows a program to "examine" the emotions on a person's face by utilizing sophisticated image dispensation. Firms are testing with an amalgamation of advanced formulas with image processing practices that have materialized within the last decade to understand more regarding what a video or a picture of an individual‟s face tells us concerning how they're feeling. With current innovation, emotion identification software has developed very adeptly. Moreover, its aptitude to trace first facial looks for emotions like happiness, sadness, surprise, anger, etc., emotion detection software also can capture what specialists describe as "micro-expressions" or restrained cues of visual communication which may reveal a person‟s feelings barren of their knowledge. Emotion recognition also concurs with other sorts of face recognition technologies and bio-metric image identification. These two sorts of technologies are often applied in many sorts of security cases. For instance, authorities can utilize emotion recognition software to further investigation efforts concerning someone at some point in an interview or interrogation. Emotion detection continues to travel forward on par with other innovations like tongue processing and these signs of progress are for the foremost part made probable by the blending of ever more dominant processors, the scientific growth of complex algorithms, and other associated technologies.

B. Types of Features

Facial feature extraction plays a crucial step in automated visual interpretation of face expression. Detecting facial feature may be a crucial role during a big variety of application like human computer interface, facial animation and face recognition, etc. Different method for feature point extraction and their applications on face image identification and highlight the performance regarding these methods. Detection of countenance may be a major concern during a big variety of applications like human computer interaction, facial animation, and facial expression, face recognition, and face image management.

C. Color feature:

Color space represents the color within the sort of intensity value. It can specify, visualize and make the color by using color space method. There are different color feature extraction methods. Color feature extraction methods:

a. **Histogram Intersection Method:** Histogram Intersection (HI) considers global color features. The duos of color histograms X and Y with k bins for every, HI is defined as, In Histogram Intersection method; the number of bins makes impact on performance. The massive no of bins represent the image in very complex manner it increases the computational complexity.

b. **Zernike Chromaticity Distribution Moments:** It‟s derived from chromaticity space. This method gives fixed length and computation effective representation of a picture which contains the color content of an picture but, their size is invariant under rotation and flipping.

c. **Color Histogram:** Color histogram represents the image from different perspective. The image during which color bins of distribution are represented by color histogram and it counts the pixels which are similar and store it. Color histogram analyzes every statistical color frequency in a picture. The change occurred within the translation, rotation and angle of view these problems are solved by color histogram and also it focuses on individual parts of a picture. The computation of local color histogram is straightforward and it's immune to minor variations within the image so for indexing and retrieval of image database it's vital. Fig. 2.

d.

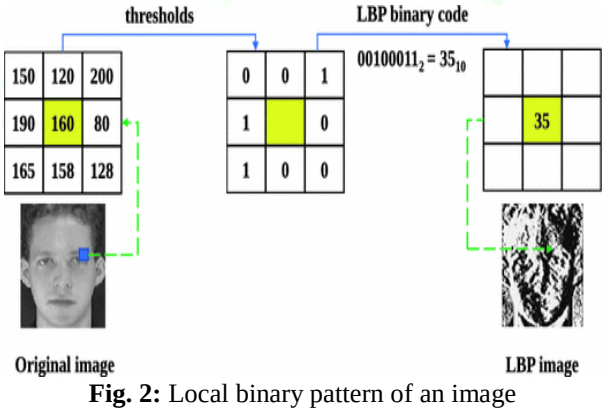

Fig. 2: Local binary pattern of an image

It proceeds thus, as illustrated in Fig.2: Each pixel is compared with its eight neighbors during a 3x3 neighborhood by subtracting the middle pixel value; The resulting strictly negative values are encoded with 0 and therefore the others with 1; A binary number is obtained by concatenating of these binary codes during a clockwise direction ranging from the top-left one and its

corresponding decimal value is employed for labeling. The derived binary numbers are mentioned as Local Binary Patterns or LBP codes. One limitation of the essential LBP operator is that its small 3x3 neighborhood cannot capture dominant features with large scale structures as shown in **Fig. 3.** To affect the feel at different scales, the operator was later generalized to use neighborhoods of various sizes [1]. An area neighborhood is defined as a group of sampling points evenly spaced on a circle which is centered at the pixel to be labeled, and therefore the sampling points that don't fall within the pixels are interpolated using bilinear interpolation, thus allowing any radius and any number of sampling points within the neighborhood. Fig 3 shows some samples of the extended LBP operator, where the notation (P, R) denotes an area of P sampling points on a circle of radius of R.

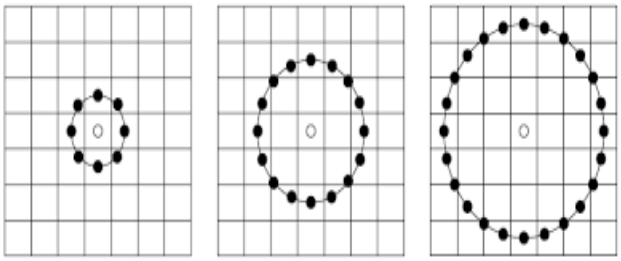

Fig. 3: Extended local binary patterns

D. Applications Of Sentiment Analysis

The countenance provides advantages for automotive system and artificial intelligent machines to supply a basic mechanism. Lot of integrated environment today's innovations uses countenance for his or her preprocess input like sentiment analysis of consumers , patients, interviewers and other application. Basic theme of advantage is that lot of image processing and have extraction has been already been wiped out field of image processing in order that the effective countenance recognition is feasible. The categorization of sentiment based classified countenance images helps for supposed system. Detecting emotions with technology is sort of a challenging task, yet one where machine learning algorithms have shown great promise. By using Facial Emotion Recognition, businesses can process images, and videos in real-time for monitoring video feeds or automating video analytics, thus saving costs and making life better for his or her users. At Sightcorp, we've combined the science of psychology, human expressions and AI to acknowledge different emotions on an individual‟s face automatically. Our face analysis algorithm can identify seven differing types of emotional states in real-time: happiness, sadness, disgust, surprise, anger, and fear.

E. Face Recognition Approach

Face recognition itself can be divided based on its approach. Those approaches are the feature-based approach, holistic-based approach, and hybrid-based approach. All three are explained below.

a. Feature-based approach: A feature-based approach to input image processing to identify and extract unique features in the face, such as eyes, mouth, nose and so on, then calculating the geometric relationship between the points of the face, so that the input face image is converted into a geometric feature vector. Feature-based itself is divided into Geometric feature-based matching or template based, and elastic bunch graph. The geometric feature analyses facial features and their geometric relation. Elastic bunch graph is a technique based on dynamic link structures. For each face, a graph is generated by using fiducial points, with each fiducial point represents a node of a fully connected graph, and labelled using Gabor filter response.

b. Active shape model: Active Shape Model (ASM) focus on complex non-rigid features like actual physical and higher level appearance of features. Main aim of ASM is automatically locating landmark points that define the shape of any statistically modeled object in an image. For examples, in an image of human being face, extracted features such as the eyes, lips, nose, mouth and eyebrows. The training stage of an ASM involves the building of a statistical facial model containing images with manually annotated landmarks. ASMs is classified into three groups i.e. Snakes, Point Distribution Model (PDM) and deformable templates.

c. Snakes The first type uses a generic active contour called snaks. Snakes are used to identify head boundaries. In order to achieve the task, a snake is first initialized at the proximity around a head boundary. It then looks onto nearby edges and subsequently assumes the shape of the head. The evolution of a snake is achieved by minimizing an energy function, Esnake (analogy with physical systems), denoted as **Esnake=Einternal + Eexternal** where Einternal and Eexternal are internal and external energy functions. Internal energy is the part that depends on the intrinsic properties of the snake and defines its natural evolution. The typical natural evolution in snakes is shrinking or expanding. The external energy counteracts the internal energy and enables the contours to deviate from the natural evolution and eventually assume the shape of nearby features-the head boundary at a state of equilibria. Two main considerations for forming snakes i.e. selection of energy terms and energy minimization. Elastic energy is used commonly as internal energy. Internal energy is varying the distance between control points on the snake, through which we get contour, an elastic-band characteristic that causes it to shrink or expand. On other side external energy relay on image features. Energy minimization process is done by

optimization techniques such as the steepest gradient descent, which needs the highest computations. Fast iteration methods by greedy algorithms are also used. Snakes have some demerits like contour often become trapped onto false image features and another one is that snakes are not suitable in extracting non convex features.

II. LITERATURE REVIEW

Dataset has taken from Amazon which contains reviews of Camera, Laptops, Mobile phones, tablets, TVs, video surveillance. After preprocessing they applied machine learning algorithms to classify reviews that are positive or negative. This paper concludes that, Machine Learning Techniques gives best results to classify the Products Reviews. Naïve Bayes got accuracy 98.17% and Support Vector machine got accuracy 93.54% for Camera Reviews. Face recognition has become one of the most frequently used topics in many areas, including the use of an alternative to the password in opening some applications and other applications. In this research work

A suggested algorithm was proposed to increase the efficiency of the Elman neural algorithm in face recognition. First step creates dataset of faces, second step convert color space to HSI and using saturation layer, image decomposition using curvelet transform, feature extraction using Principle component analysis, and final step face recognition using Elman neural network. after applying proposed algorithm, the rate of face recognition 94%. Human behavior analysis from big multimedia data has become a trending research area with applications to various domains such as surveillance, medical, sports, and entertainment. Facial expression analysis is one of the most prominent clues to determine the behavior of an individual, however, it is very challenging due to variations in face poses, illuminations, and different facial tones. In this research work

They analyze human behavior using facial expressions by considering some famous TVseries videos. Firstly, they detect faces using Viola-jones algorithm followed by tracking through Kanade-Lucas-Tomasi (KLT) algorithm. Secondly, they use histogram of oriented gradients (HOG) features with support vector machine (SVM) classifier for facial recognition. Next, they recognize facial expressions using the proposed light-weight convolutional neural network (CNN). Various factors such as identity-specific attributes, pose, illumination and expression affect the appearance of face images. Disentangling the identity-specific factors is potentially beneficial for facial expression recognition (FER). Existing image-based FER systems either use hand-crafted or learned features to represent a single face image. In this research work

They propose a novel FER framework, named identity-disentangled facial expression recognition machine (IDFERM), in which they untangle the identity from a query sample by exploiting its difference from its references (e.g ., its mined or generated frontal and neutral normalized faces). They demonstrate a possible „recognition via generation‟ scheme which consists of a novel hard negative generation (HNG) network and a generalized radial metric learning (RML) network. Student attendance is essential in the learning process. To record student attendance, several ways can be done; one of them is through student signatures. The process has several shortcomings, such as requiring a long time to make attendance; the attendance paper is lost, the administration must enter attendance data one by one into the computer.

To overcome this, the research work [6] proposed a web-based student attendance system that uses face recognition. In the proposed system, Convolutional Neural Network (CNN) is used to detect faces in images, deep metric learning is used to produce facial embedding, and K-NN is used to classify student's faces. Thus, the computer can recognize faces. Face plays a major role in social intercourse for conveying identity and feelings of a person. Human beings have not tremendous ability to identify different faces than machines. So, automatic face detection system plays an important role in face recognition, facial expression recognition, head-pose estimation, human–computer interaction etc. Face detection is a computer technology that determines the location and size of a human face in a digital image. Face detection has been a standout amongst topics in the computer vision literature.

This research work presents [7] a comprehensive survey of various techniques explored for face detection in digital images. Different challenges and applications of face detection are also presented in this paper. At the end, different standard databases for face detection are also given with their features. Human computer interface is the methodology for providing interaction to the computer. For interaction human brain is to be responsible for providing connectivity. Machine learning focuses on computer program that learn from them. In this research work

They study how the machine learning technique used to provide analytical approach for developing human computer interface. Some of the methodologies used to analyze magnetic resonance images to find the interaction. There are different techniques like K-Nearest Neighbour, Support Vector Machine, and Artificial Neural Network that are used to analyze the human brain images. Facial expression recognition plays an important role in communicating the emotions and intentions of human beings. Facial expression recognition in uncontrolled environment is more difficult as compared to that in controlled environment due to change in occlusion, illumination, and noise. In this research work

Present a new framework for effective facial expression recognition from real-time facial images. Unlike other methods which spend much time by dividing the image into blocks or whole face image, our method extracts the discriminative feature from salient face regions and then combine with texture and orientation features for better representation. As an emerging research topic for proximity service (ProSe), automatic emotion recognition enables the machines to understand the emotional changes of human beings which can not only facilitate natural, effective, seamless, and advanced human robot interaction or human computer interface but also promote emotional health. Facial expression recognition (FER) is a vital task for emotion recognition. However, significant gap between

human and machine exists in FER task. In this research work

Present a conditional generative adversarial network-based approach to alleviate the intra-class variations by individually controlling the facial expressions and learning the generative and discriminative representations simultaneously. Facial expression recognition (FER) is a very challenging problem in computer vision. Although extensive research has been conducted to improve FER performance in recent years, there is still room for improvement. A common goal of FER is to classify a given face image into one of seven emotion categories: angry, disgust, fear, happy, neutral, sad, and surprise.

In this research work [12] they propose to use a simple multi-layer perception (MLP) classifier that determines whether the current classification result is reliable or not. If the current classification result is determined as unreliable, we use the given face image as a query to search for similar images. In particular, facial action units are used to retrieve the images with a similar facial expression. Then, another MLP is trained to predict final emotion category by aggregating classification output vectors of the query image and its retrieved similar images

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III. CONCLUSION AND FUTURE WORK

Facial Expression Recognition is a computer-based technology that uses mathematical algorithms to analyze faces in images or video. Facial emotion recognition and sentiment analysis by finding the knowledge from facial multimedia is helpful in many scenarios where the human skill effort can minimize at primary level while working with devices monitoring. Emotion recognition may be a method utilized in software that allows a program to "examine" the emotions on a person's face by utilizing sophisticated image dispensation. The present work has different sentiment analysis accuracy using convolution neural network for the respective images. At last the movement of facial features and classifies them into emotion or attitude categories, also taking the name of Facial Emotion Recognition, a topic of emotion recognition that involves the analysis of human facial expressions in multimodal forms. After performing experiment and result collection it has been found the proposed work using deep learning CNN model work optimally in related area. The prediction of appropriate region, finding its suitability for detection and report analysis has been completely done using proposed work. After simulated proposed work against stated problem concluded following conclusions persisting the high computation in performance parameters.

- Accuracy over face selection help in minimizing the time, as it needs the selected area and working with the provided area features.
- Better face detection algorithm can helps in classifying the accurate sentiment class & expected with high accuracy.
- The proposed algorithm utilizes different part of segment of image and its analysis. Thus the observation of output of each stage provides good results.
- A feature extraction data processing helped in finding the desired feature by providing the input on demand.
- Data Augmentation helped in minimizing loss and improves accuracy of obtained results.
- A proper binaries approach and thresholding step minimized the pre-processing effort and thus saves time of usage.

The CNN with custom configuration helps in overall computation and possesses low computation time with high accuracy**.**

References

[1]. Alaa Alslaity, Rita Orji, "Machine learning techniques for emotion detection and sentiment analysis: current state, challenges, and future directions", Behaviour & Information Technology, 2024, pp. 1-126.

[2]. Tata Sutabri, Pamungkur, Ade Kurniawan, Raymond Erz Saragih, "Automatic Attendance System for University Student Using Face Recognition Based on Deep Learning", International Journal of Machine Learning and Computing, 2019, pp. 668-674.

[3]. Ashu Kumar, Amandeep Kaur, Munish Kumar, "Face detection techniques: a review", Artificial Intelligence Review, Springer 2018, pp. 1-22.

[4]. Amit Kumar, Naveen Tewari, Rajeev Kumar, "Study towards the Analytic Approach for Human Computer Interaction using Machine Learning", The International journal of analytical and experimental modal analysis, 2019, pp. 1-11.

[5].] Michele Merler, Nalini Ratha, Rogerio Feris, John R. Smith, "Diversity in Faces", 2019, pp. 1-29.

[6]. Awais Mahmood, Shariq Hussain , Khalid Iqbal, Wail S. Elkilani, "Recognition of Facial Expressions under Varying Conditions Using Dual-Feature Fusion", Hindawi Mathematical Problems in Engineering, 2019, pp 1-13.

[7]. Jia Deng, Gaoyang Pang, Zhiyu Zhang, Zhibo Pang, Huayong Yang, Geng Yang, "cGAN Based Facial Expression Recognition for Human-Robot Interaction", IEEE Access 2018, Vol-7, pp. 9848-9859.

[8]. Trinh Thi Doan Pham, Sesong Kim, Yucheng Lu, Seung-Won Jung, Chee-Sun Won, "Facial Action Units-Based Image Retrieval for Facial Expression Recognition", IEEE Access 2019, pp. 5200-5207.

[9]. Gaurav Goswami, Akshay Agarwal, Nalini Ratha, Richa Singh, Mayank Vatsa, "Detecting and Mitigating Adversarial Perturbations for Robust Face Recognition", 2017, pp. 1-37.

[10]. Abdulqadir Ismail Abdullah, "Facial Expression Identification System Using fisher linear discriminant analysis and K- Nearest Neighbor Methods", ZANCO Journal of Pure and Applied Sciences, 2019, pp. 9-13.

[11]. R. Martínez Ruiz, Covid-19 and "Stay at Home": A Contrast Dye That Highlights Gender Violence and the Violence of Inequity, in: R.E. Hagengruber (Ed.), Women Philosophers on Economics, Technology,

Environment, and Gender History, De Gruyter, 2023: pp. 361–370.
[12]. A. Sutton, H. Beech, The impact of stay-at-home orders on safety and stability for women: A topical review of intimate partner violence and intimate femicide in the United States during the initial phase of COVID-19, J Fam Viol. 2023, pp. 1-7.
[13]. An Economic Snapshot of the Bronx, the Office of the State Deputy Comptroller for the City of New York, Albany, NY, 2018. www.osc.state.ny.us (accessed September 18, 2023).
[14]. N. Abbasabadi, M. Ashayeri, R. Azari, B. Stephens, M. Heidarinejad, An integrated data-driven framework for urban energy use modeling (UEUM), Appl. Energy, 2019, pp. 1-8.
[15]. C. Zanocco, T. Sun, G. Stelmach, J. Flora, R. Rajagopal, H. Boudet, Assessing Californians‟ awareness of their daily electricity use patterns, Nat. Energy, 2022, 1191–1199.
[16]. Tata Sutabri, Pamungkur, Ade Kurniawan, Raymond Erz Saragih, "Automatic Attendance System for University Student Using Face Recognition Based on Deep Learning", International Journal of Machine Learning and Computing, 2019, pp. 668-674.
[17]. Ashu Kumar, Amandeep Kaur, Munish Kumar, "Face detection techniques: a review‟, Artificial Intelligence Review, Springer 2018, pp. 1-22.
[18]. Amit Kumar, Naveen Tewari, Rajeev Kumar, "Study towards the Analytic Approach for Human Computer Interaction using Machine Learning", The International journal of analytical and experimental modal analysis, 2019, pp. 1-11.
[19]. Michele Merler, Nalini Ratha, Rogerio Feris, John R. Smith, "Diversity in Faces", 2019, pp. 1-29.
[20]. Awais Mahmood, Shariq Hussain , Khalid Iqbal, Wail S. Elkilani, "Recognition of Facial Expressions under Varying Conditions Using Dual-Feature Fusion", Hindawi Mathematical Problems in Engineering, 2019, pp 1-13.

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