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Implementation of CNN Algorithm for Real Time Facial Expression Recognition

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Abstract: ***In the real time of e - commerce, customer satisfaction and engagement play a pivotal role in driving sales and fostering long - term relationships. Recognizing the importance of understanding customers' emotions, facial expression detection has emerged as a valuable tool. This paper presents an implementation - focused approach utilizing Convolutional Neural Networks (CNNs) for facial expression detection in the context of e - commerce. By accurately identifying and interpreting customers' facial expressions, businesses can gain valuable insights into their emotions, enabling them to personalize the shopping experience and optimize customer satisfaction.***

Keywords: Convolutional neural network, Deep neural networks, Deep structured learning, Machine learning

1. Introduction

This paper presents an implementation framework for integrating facial expression detection using CNN algorithms into e - commerce platforms. Understanding customers' emotions is crucial for e - commerce businesses to provide personalized experiences and enhance customer satisfaction. Facial expressions serve as rich indicators of emotions, offering valuable insights that can be leveraged to tailor marketing strategies, product recommendations, and customer support. By implementing facial expression detection, e - commerce platforms can adapt in real - time, ensuring an engaging and tailored experience for every customer. CNNs have emerged as a powerful tool for image analysis and recognition tasks. Their ability to automatically learn and extract meaningful features from images makes them well - suited for facial expression detection. This section provides an overview of CNN architecture, explaining the various layers involved and their role in identifying and classifying facial expressions accurately

2. Literature Survey

1. A facial expression is a gesture created by the facial muscles that can convey human emotions. Facial expression recognition system is used to recognize different emotions of a face. A facial expression is exhibited by the movement of muscles underneath the face skin. Facial expression Recognition comprises of three main phases viz. face detection using Haar classifier, feature Selection using Local Binary Pattern algorithm and Expression Classification using Support Vector Machines. The image files for training are stored in the form of pixels in CSV file and are then converted by the algorithm to form images which subsequently decreases the size of the training data set. The proposed system predicts various emotions from a single image rather than predicting only one kind of emotion as done by the existing systems. Training of the system is done using the neural network. [**1]**

2. The paper presents a real - time facial emotion recognition system using Convolutional Neural Networks (CNNs) and OpenCV. The system processes video frames in real - time to detect faces and recognize emotions from the facial expressions. The CNN model is trained on a large dataset of facial images and emotions, and the results demonstrate accurate and fast emotion recognition performance. The integration of OpenCV with the CNN model enables real - time processing of video frames, making the system suitable for various practical applications. One use of machine learning is the identification of facial expressions of emotion. That were extracted from an image based on the features, It assigns a face emotion image to one of the facial emotion classes. Among the classification techniques, convolutional neural network (cnn) also pulls patterns from a picture. In this study we used the CNN model to recognize the facial expressions. To increase the precision of facial emotion detection, the wavelet transform is then used. There are seven different face emotions represented in the facial emotion image dataset that was gathered from Kaggle. The accuracy of the experimental facial emotion recognition utilizing the CNN and wavelet transform increases. [**2]**

3. Facial expression plays a serious role in every aspect of human life for communication. It has been a boon for the research in facial emotion with the systems that produce to the terminology of human - computer interaction in real world. Humans socially interact with each other via emotions. In this research paper, we've proposed an approach of building a system that recognizes facial emotion employing a Convolutional Neural Network (CNN) which is one among the foremost popular Neural Network available. It is said to be a pattern recognition Neural Network. Convolutional Neural Network reduces the dimension for giant resolution images and not losing the standard and giving a prediction output what's expected and capturing of the facial expressions even in odd angles makes it stand different from other models also i. e. it works well for non - frontal images. But unfortunately, CNN based detector is computationally heavy and may be a challenge for using CNN for a video as an input. We will implement a facial emotion recognition system employing a Convolutional Neural Network employing a dataset. Our system will predict the output supported the input given thereto. This

system can be useful for sentimental analysis, can be used for clinical practices, can be useful for getting a person's review on a certain product, and lots of more. [**3]**

4. In this paper, we propose a method for improving the robustness of real - time facial expression recognition. Although there are many ways to improve the accuracy of facial expression recognition, a revamp of the training framework and image pre - processing allow better results in applications. One existing problem is that when the camera is capturing images in high speed, changes in image characteristics may occur at certain moments due to the influence of light and other factors. Such changes can result in incorrect recognition of the human facial expression. To solve this problem for smooth system operation and maintenance of recognition speed, we take changes in image characteristics at high speed capturing into account. The proposed method does not use the immediate output for reference, but refers to the previous image for averaging to facilitate recognition. In this way, we are able to reduce interference by the characteristics of the images. The experimental results show that after adopting this method, overall robustness and accuracy of facial expression recognition have been greatly improved compared to those obtained by only the convolution neural network (CNN). **[4]**

3. Working Methodology

Real - time facial expression recognition using a Convolutional Neural Network (CNN) involves several steps. Here's a high - level overview of the methodology:

Data Collection: Gather a labelled dataset of facial images with corresponding expressions. The dataset should cover a diverse range of individuals and expressions to ensure generalization.

Data Pre - processing: Clean and pre - process the collected images to enhance the model's performance. Common pre - processing steps include resizing the images to a consistent size, normalizing pixel values, and augmenting the dataset through techniques like rotation, scaling, and flipping to increase its size and variability.

Model Architecture: Design a CNN architecture suitable for facial expression recognition. Common choices include variations of the LeNet, VGGNet, or ResNet architectures. The architecture should consist of convolutional layers for feature extraction and fully connected layers for classification.

Training: Split the dataset into training and validation sets. Train the CNN model on the training set using backpropagation and gradient descent optimization algorithms. During training, the model learns to recognize patterns and features that correspond to different facial expressions.

Hyper parameter Tuning: Experiment with different hyper parameter settings such as learning rate, batch size, and regularization techniques (e. g., dropout) to find the optimal configuration that minimizes the loss function and maximizes accuracy.

Evaluation: Evaluate the trained model on the validation set to assess its performance. Metrics such as accuracy, precision, recall, and F1 - score can be used to measure the model's effectiveness.

Real - time Implementation: Deploy the trained model to perform real - time facial expression recognition. Capture video frames from a webcam or video stream, pre - process the frames similarly to the training data, and feed them into the CNN model for inference. The model will predict the facial expression based on the extracted features.

Post - processing and Visualization: Apply any necessary post - processing steps to the predicted facial expressions, such as smoothing or filtering. Visualize the recognized expressions on the video frames or in a separate output display.

Fine - tuning and Optimization: Continuously improve the model's performance by iteratively refining the architecture, exploring different training strategies, collecting additional data, or applying transfer learning techniques if available.

Algorithm CNN

A Convolutional Neural Network (CNN) is a type of deep learning algorithm that is particularly well - suited for image recognition and processing tasks. It is made up of multiple layers, including convolutional layers, pooling layers, and fully connected layers.

The convolutional layers are the key component of a CNN, where filters are applied to the input image to extract features such as edges, textures, and shapes. The output of the convolutional layers is then passed through pooling layers, which are used to down - sample the feature maps, reducing the spatial dimensions while retaining the most important information. The output of the pooling layers is then passed through one or more fully connected layers, which are used to make a prediction or classify the image

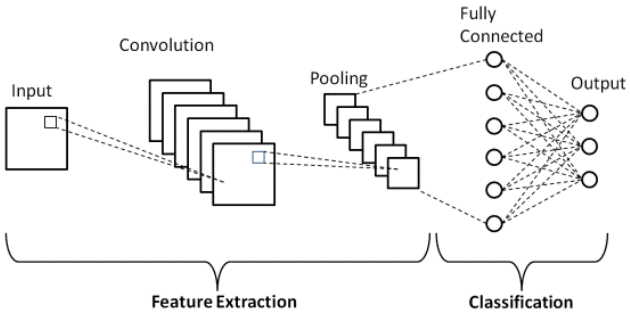

Figure: CNN Algorithm for E - Commerce

4. System Diagram

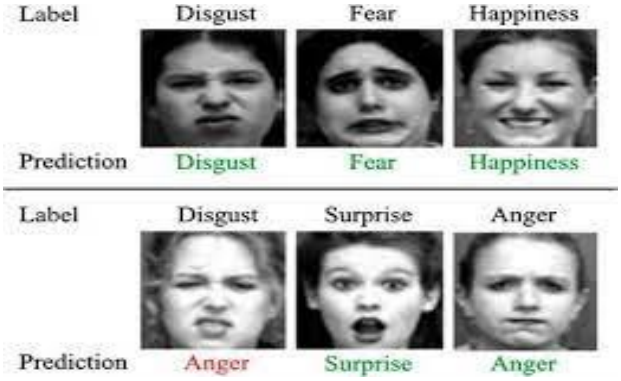

Figure: Real Time Facial Expression Recognition using CNN Algorithm for E - Commerce

5. Conclusion

In conclusion, this paper presents an implementation - focused approach for integrating facial expression detection using CNN algorithms into e - commerce platforms. By accurately identifying and interpreting customers' facial expressions, businesses can unlock valuable insights to enhance customer satisfaction and optimize their marketing strategies. The proposed framework provides a roadmap for businesses aiming to leverage facial expression detection to create personalized and engaging e - commerce experiences

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References

[1] Gowri Prasad, Prakruthi S. T, Dr. V. Hanuman Kumar. "Expression Recognition using Neural Network", Volume 7 Issue VI, June 2019.
[2] Mr. L. SIVAPRASAD, E. GIRIBABU GOUD, V. HARSHITHA, C. PAVAN SAI, P. THARUN KUMAR "REAL - TIME FACIAL EXPRESSION RECOGNITION USING CONVOLUTIONAL NEURAL NETWORK" Volume 11, Issue 4 April 2023.
[3] Raheena Bagwan1, Sakshi Chintawar1, Komal Dhapudkar1, Alisha Balamwar1, Mr. Sandeep Gore "FACIAL EMOTION RECOGNITION USING CONVOLUTION NEURAL NETWORK" | Volume 9, Issue 11 November 2021.
[4] Keng - Cheng, Liu Chen - Chien, Hsu Wei - Yen Wang, Hsin - Han Chiang "Real - Time Facial Expression Recognition Based on CNN" 2019 International Conference on System Science and Engineering
[5] Ahmed, F., Bari, H., & Hossain, E. (2014). Person - independent facial expression recognition based on compound local binary pattern (CLBP). Int. Arab J. Inf. Technol., 11 (2), 195 - 203.
[6] Happy, S. L., George, A., &Routray, A. (2012, December). A real time facial expression classification system using Local Binary Patterns. In Intelligent Human Computer Interaction (IHCI), 2012 4th International Conference on (pp.1 - 5). IEEE.
[7] Zhang, S., Zhao, X., & Lei, B. (2012). Facial expression recognition based on local binary patterns and local fisher discriminant analysis. WSEAS Trans. Signal Process, 8 (1), 21 - 31.30
[8] Chibelushi, C. C., &Bourel, F. (2003). Facial expression recognition: A brief tutorial overview. CVonline: On - Line Compendium of Computer Vision, 9.
[9] Sokolova, M., Japkowicz, N., &Szpakowicz, S. (2006, December). Beyond accuracy, F - score and ROC: a family of discriminant measures for performance evaluation. In Australasian Joint Conference on Artificial Intelligence (pp.1015 - 1021). Springer Berlin Heidelberg.
[10] Michel, P., & El Kaliouby, R. (2005). Facial expression recognition using support vector machines. In The 10th International Conference on Human - Computer Interaction, Crete, Greece.
[11] Michel, P., & El Kaliouby, R. (2003, November). Real time facial expression recognition in video using support vector machines. In Proceedings of the 5th international conference on Multimodal interfaces (pp.258 - 264). ACM.