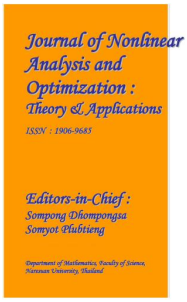
Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 15, Issue. 1, No.15 : 2024
ISSN : **1906-9685**



Paper ID: ICRTEM24_104 **ICRTEM-2024 Conference Paper**

MOODFLIX:MOVIE RECOMMENDER USING FACIALEXPRESSION RECOGNITION

[#1]B.Shanmukh, ***UG Student,***

[#2]M.V.Goutham, ***UG Student,***

[#3]K.Srija, ***UG Student,***

[#4]Dr. E.Guru Moorthi, ***Associate Professor,***

Department of Information Technology

CMR College of Engineering and Technology, Hyderabad, India

ABSTRACT: In the actual world, emotions have a significant impact on how people interpret information, form views, and reach conclusions. Our primary purpose in business is to bring joy. Entertainment provides a compelling sanctuary in which individuals can escape reality and engage in stimulating and entertaining activities. This event allows attendees to relax, have fun, and learn about new artistic, musical, film, and other forms of art. The most essential thing is to discover what makes you grin and giggle. Another issue is that movie recommendations do not work well enough to keep people's interest. The CNN and KNN approaches are being utilized to address this issue. Finally, we examine the outcomes of our datasets and compare them to those of the collected datasets.

Keywords: *Convolution Neural Network, K Nearest Neighbor, Recommender System, Facial expression detection.*

1. INTRODUCTION

With new products and technologies coming out all the time, the IT business is changing the market. This study also shows that the emotional states of workers make the standard much higher. Even though a lot of companies have mental health programs for their employees, the problem still exists. Our goal is to find the factors that affect workers' emotions the most and use image processing and machine learning to look for emotional trends. This makes it possible to look at the current situation in a very thorough way.

The process of putting emotions into groups uses KNN classifiers and other machine learning methods. The camera takes a picture of the worker, which is first processed in the early steps of image recognition. Image processing is the process of turning a picture into a computer file and then

using different methods to improve it or get useful information from it. CNNs stand for "convolutional neural networks." They are a type of deep neural network that is used to analyze and make sense of images. It is often used for jobs that need to identify things in pictures and videos. Convolutional neural networks (CNNs) are what make facial recognition systems work, which is a necessary and important trait.

pictures or movies can be used to accurately identify and confirm people. In order to analyze video footage, neural networks can be made to do things like activity recognition, scene comprehension, and object tracking in a certain amount of time.

Fig 1:A Picture Depicting Emotions [16]

2. EXISTING SYSTEMS

Saraswat et al. developed a new recommender system that incorporates both collaborative filtering (CF) and content-based filtering. Following that, fuzzy IF-Then rules are generated from the training data and a structure designed specifically for fuzzy rules. This methodology is based on the Mamdani model as well as the learning method developed by Wang and Mendel. The findings reveal that, in contrast to discrete emotion data, fuzzy emotion components do not improve estimate accuracy.

Raut developed a system that employs machine learning to detect emotional responses on the face. K-Nearest Neighbors (KNN), Hidden Markov Models (HMM), and Support Vector Machines (SVM) were utilized to detect sentiment and group data. When it comes to shifting information from the training to the testing sets, our strategy outperformed Support Vector Machines (SVMs) and other approaches. With a cross-validation value of 5, the mood recognition algorithm achieved 86% accuracy on the RaFD database and 87% on the CK+ database. If you evaluated the model using the RaFD dataset, adding cross-validation did not improve its accuracy because the groups were evenly distributed.

Sharama's video recommendation system makes use of the VGG16 model and convolutional neural networks (CNNs) to detect face expressions.The recommender system is divided into two key parts: one for music and one for movies. To do this, algorithms for facial recognition and segmentation are applied. These algorithms can determine a person's emotional state based on their facial movements. The next stage is for the participant to select the appropriate group depending on their feelings. The information for the multimedia output, which could be a movie or a piece of music, is automatically retrieved from the internet via a technology such as Beautiful Soup.

Sunitha and her colleagues developed a method for recommending music based on facial movements using Convolutional Neural Networks (CNN) and deep learning. Using computer vision and machine learning, they discovered a correlation between potential musical compositions and how people's expressions

expressed their emotions. The primary purpose of the technique is to employ Deep Neural Networks (DNN) to find good feature abstractions. Deep neural networks, or DNNs, are a novel and intriguing approach to solving a wide range of issues. People can identify items in photographs, determine their location, and affirm that they are who they claim to be simply by glancing at their faces. Convolutional Neural Networks (CNNs) excel at tasks such as image recognition and classification, as demonstrated by real-world examples. The written text

The suggested method involves using a Convolutional Neural Network (CNN) model to recognize and group the user's facial expressions. The song will begin playing as soon as it detects an emotion.

Mazhar et al. [5] utilized a classification algorithm to analyze movie reviews. This technique employs machine learning algorithms to accurately identify emotions from facial expressions. In this exam, the CNN approach accurately answered 90.6% of the questions, 90% of them precisely, and 84.8% of them correctly. The primary purpose of this study was to determine how frequently the individuals said they went to the movies. The thesis writers created a training module that teaches people how to find out what viewers are trying to do. This lesson is based on extensive research on how people experience and express emotions through their faces.

In their study, Aishwarya Shetty and her colleagues demonstrated a method for suggesting music to people based on how they look [6]. Using Python software to create a recognition system necessitates the integration of numerous technologies, which needs a significant amount of effort. People who enjoy technology and music will benefit greatly from this. This approach could be improved, but the effort has only partially achieved its primary purpose of using music to make people feel things. However, keep in mind that there is no perfect way to grow. The method distinguishes between a variety of emotions, including surprise, rage, happiness, and melancholy.

Choudhary et al. employed facial analysis to suggest movies and tunes. This system makes use of several complicated algorithms, including CNN and HAAR Cascade. This article discusses how to choose music using convolutional neural networks (CNNs). People employ a variety of strategies to gather information regarding emotions, such as immediately assessing actions and facial expressions to determine meaning. Convolutional Neural Networks (CNNs) excel in extracting significant elements from complex and large datasets and applying them. Other machine learning algorithms may be useful for specific jobs. CNN employs a training sample to improve the system. A model's capacity to classify objects is determined by what it has already learned, which influences how well it performs with new or unique information.

3. PROPOSED SYSTEM

The proposed method categorizes emotions using KNN classifiers and other machine learning techniques. At the beginning of image processing for recognition, the user's image from the browser is used as input. Picture processing includes digitizing a picture and utilizing various methods to increase its quality or extract relevant information from it. After entering an image, the output could be the image itself or its associated attributes. A spherical container represents feelings. Sad, terrified, furious, and disgusted all generate powerful emotions. The recommended system consists of three parts: The first category includes programs that preprocess data. Second, there is a model that employs convolutional neural networks to determine how people are feeling in photos of their faces. Finally, there's a computer that employs K-nearest neighbors (KNN) to recommend movies depending on how individuals feel.

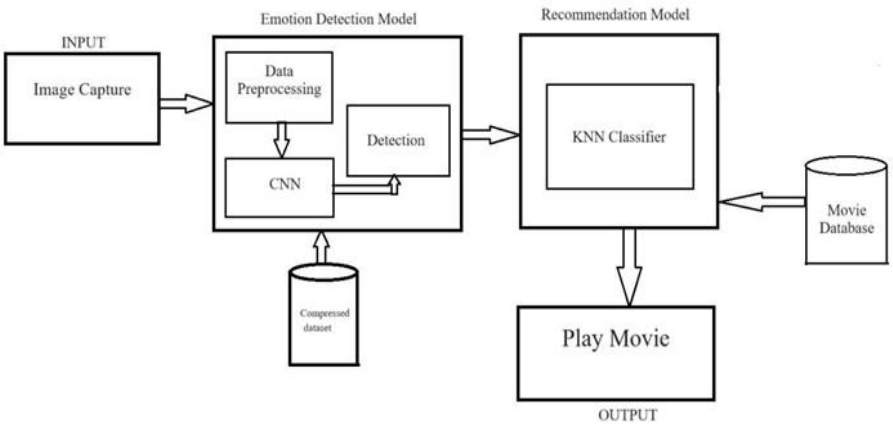


Fig 2: Proposed System Architecture

i.Input:

Image Capture: This Python program uses the openCV module to capture and save a live video feed from a camera. The fundamental goal of using an emotion recognition model for image analysis is to recognize and evaluate the emotional components in the image, particularly for item detection.

ii.Emotion Detection Model: The model is made up of the CNN object recognition model and data preprocessing.

a).Data Preprocessing:

Data preprocessing is a crucial step in preparing emotion images for analysis or training machine learning models. Emotion images typically refer to images that capture facial expressions or other visual cues associated with emotions. It handles tasks such as Data exploring, collecting and cleaning, Image resizing, Gray Scaling, Face detection and alignment.The ideal image size processed is 227*227.

def data_preprocessing(images, labels):# Step 1: Data Cleaning

images, labels = remove_duplicates(images, labels) images, labels = remove_corrupted(images, labels) # Step 2: Image Resizing

images = resize_images(images, target_size=(224, 224))# Step 3: Normalization

images = normalize_images(images)# Step 4: Data Augmentation

images, labels = augment_data(images, labels)# Step 5: Face Detection and Alignment images = detect_and_align_faces(images)

Step 6: Gray Scaling (optional) images = convert_to_grayscale(images)# Step 7: Handling Imbalanced Data

images, labels = balance_data(images, labels)# Step 8: Data Splitting

train_images, val_images, test_images, train_labels, val_labels, test_labels =split _ data(images, labels)# Step 9: Pre-trained Models and Transfer Learning

base_model = load_pretrained_model('VGG16')

Step 10: Label Encoding train_labels, val_labels, test_labels = encode_labels(train_labels, val_labels, test_labels) return train_images, val_images, test_images, train_labels, val_labels, test_labels, base_model.

a).CNN for Facial Emotion Detection:

Convolutional Neural Networks (CNNs) can easily extract hierarchical information from images. As a result, they are perfect for recognizing and interpreting emotions and facial expressions.Convolutional neural networks (CNNs) are used to perform image processing operations such as feature extraction, convolutional layer generation, pooling, flattening, and dense layer formation.

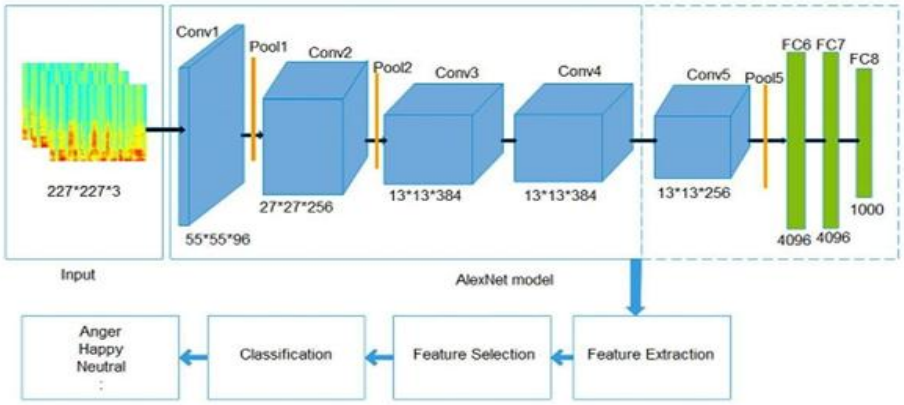


Fig 3.CNN Architecture for emotion detection[19]

Equation (1) represents CNN Formula :

$$n_{out} = \left\lfloor \frac{n_{in} + 2p - k}{s} \right\rfloor + 1$$

.....> (1) [20]

n_{in}: number of input features
n_{out}: number of output features
k: convolution kernel size
p: convolution padding size
s: convolution stride size

Algorithm(1):CNN

```
def create_emotion_cnn(input_shape,

num_classes):model = models.Sequential()

# Convolutional layers

 model.add(layers.Conv2D(32,(3,3), activation='relu',

 input_shape=input_shape))model.add(layers.MaxPooling2D((2, 2)))

 model.add(layers.Conv2D(64, (3, 3), activation='relu'))
 model.add(layers.MaxPooling2D((2, 2)))
 model.add(layers.Conv2D(128, (3, 3), activation='relu'))
 model.add(layers.MaxPooling2D((2, 2)))

 # Flatten layer

 model.add(layers.Flatten())
```

```
# Fully connected layers

model.add(layers.Dense(128, activation='relu'))

model.add(layers.Dropout(0.5)) # Optional dropout for

regularizationmodel.add(layers.Dense(num_classes,

activation='softmax'))

return model
```

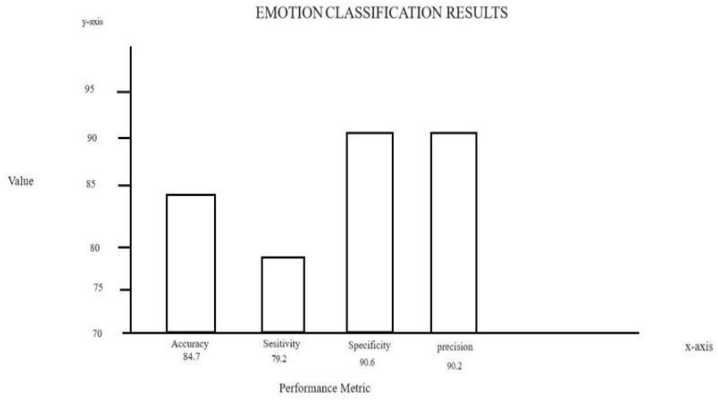


Fig 4 .The results for CNN algorithm testing

The fig.4 depicts a graph of CNN algorithm, Performance metrics based on Accuracy, Sensitivity,Specificity, Precision and on x-axis and Value in percentages on y-axis.

Table 1: Confusion Matrix for CNN

N = 10,018	Predicted Yes	Predicted No
Actual Yes	TP 4127	FP 450
Actual No	FN 1081	TN 4360

The Table.1 describes the confusion matrix for CNN.

b).Detection:

When the Convolution function is applied to the preprocessed image, its emotion is detected and connected with a certain emotion. This allows recommenders to categorize it..

Fig 5. Captured Image Detected emotion as Sad.

i.Recommendation Model:

to propose movie. To use the KNN classifier, you must first have access to the compressed dataset, which contains both the training data and the movie database.

iii a) KNN for Recommending movies:

The k-Nearest Neighbors (KNN) technique, which employs supervised machine learning to detect human emotions, is a simple and effective method for movie recommendation. The K-NN algorithm uses a distance metric, such as the Euclidean distance, to find the K closest neighbors of a given data point. The data item's class or value is then determined by the average of its K neighbors or by a majority of votes. This approach allows the computer to predict outcomes by examining each input characteristic and responding to varied patterns.

Equation (2) represents KNN Euclidean formula:

$$d(x_i, x_j) = \sqrt{\sum_{r=1}^{n}(a_r(x_i) - a_r(x_j))^2}$$

.....>(2) [21]

Where d (x_i, x_j) is euclidean distance, x_i is record ti i, x_j record to j and a_r data to r.

Algorithm(2):KNN Classifier

1. Load movie dataset and emotion labels

   - movies_data, emotion_labels = load_movie_dataset()

2. Load and preprocess the captured image

   - captured_image = preprocess_image(captured_image)

   - captured_feature_vector = extract_features(captured_image)

3. Split the dataset into training and testing sets

   - X_train, X_test, y_train, y_test = train_test_split(movies_data, emotion_labels, test_size=0.2, random_state=42)

4. Standardize the feature vectors

   - scaler = StandardScaler()

   - X_train_scaled = scaler.fit_transform(X_train)

   - X_test_scaled = scaler.transform(X_test)

   -captured_feature_vector_scaled = scaler.transform(captured_feature_vector.reshape(1, -1))

5. Train the KNN model

- knn_model = KNeighborsClassifier(n_neighbors=5)
- knn_model.fit(X_train_scaled, y_train)

6. Make predictions on the captured image

- predicted_emotion = knn_model.predict(captured_feature_vector_scaled)[0]

7. Recommend movies based on the predicted emotion

-recommended_movies = recommend_movies_based_on_emotion(predicted_emotion)

8. Display the recommended movies

- print("Recommended Movies:", recommended_movies)

Tools:

It contains 16 GB of RAM, a 1TB hard drive, and an IDE connection. The processor is an Intel Core i5-6200U. Microsoft Visual Studio is a tool for creating software. It supports various programming languages, including Python, HTML, CSS, JavaScript, and Django. Python is the programming language used to create packages such as Pandas, NumPy, and OpenCV. K-Nearest Neighbors (KNN) techniques are used to classify items, whereas Convolutional Neural Networks (CNN) algorithms are utilized to locate them. The sets are made out using Kaggle datasets with photographs depicting various emotions.

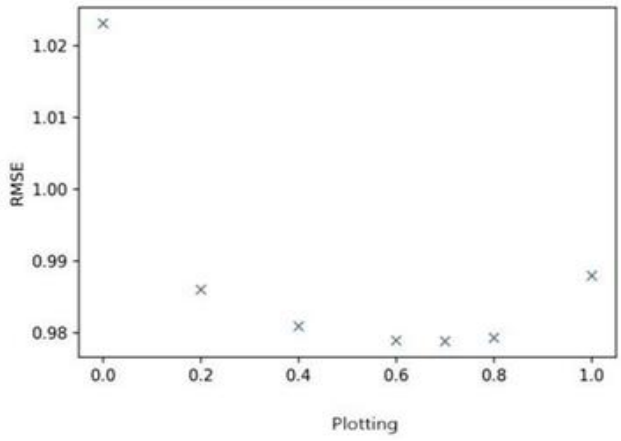


Fig 6. RMSE values difference

The fig.6 shows the root mean squared error for KNN, on x-axis w1 plotting and on y-axisRMSE values.

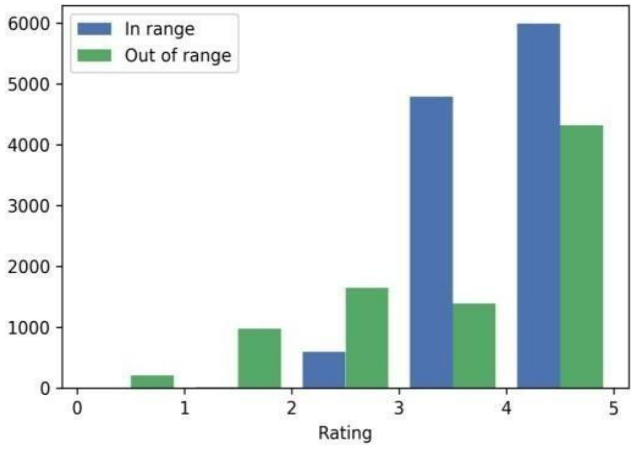


Fig 7. Histogram predictions using TF-IDF , on x-axis Rating

The fig.7 depicts the KNN histogram prediction using TF-IDF i.e., term frequency- inverse document frequency. Rating on x-axis and Values on y-axis.

Following the execution of the KNN Classifier, the movie is provided in MP4 format based on the emotion detected from the captured image. For example, if the emotion was recognized as sadness, a comedy film would be shown.The VLC (VLC Media Player) module is used to watch the movie.

Fig 8. Output showing a comedy movie

4. CONCLUSION

The secure Emotion Detection System is designed to forecast emotions via a complete analysis of images taken by verified users. Following a successful login, an automated process for gathering photos is launched within a defined time frame. The collected photos go through normal conversion and image processing methods to determine the user's level of stress. The system will then use machine learning algorithms to analyze users' emotional states in order to generate more effective outcomes.

REFERENCES

[1] Saraswat, M., Chakraverty, S., & Kala, A. (2020). Analyzing emotion based movie recommendersystem using fuzzy emotion features. International Journal of Information Technology, 12, 467-472.

[2] Raut, N. (2018). Facial emotion recognition using machine learning. Master's Projects. 632. [3]Sharma, P. (2020). Multimedia recommender system using facial expression recognition. InternationalJournal of Engineering Research & Technology (IJERT), 9(5), 674-676.

[4] Sunitha, S., Jyothi, V., Ramya, P., & Priyanka, S.(2023).Music Recommendation Based On FacialExpression By Using Deep Learing.Volume 5,Issue 1.

[5] Mazhar, T., Malik, M. A., Nadeem, M. A., Mohsan, S. A. H., Haq, I., Karim, F. K., & Mostafa, S. M. (2022). Movie Reviews Classification through Facial Image Recognition and Emotion Detection Using Machine Learning Methods. Symmetry, 14(12), 2607.

[6] Aishwarya Shetty1 Apeksha Prabhu2, Prof. Suparna3 Dr. M. Shahina Parveen4.(2023). Song Recommendation Based on Facial Expression.Volume 15,Issue 2.

[7] Choudhary, H., Khatave, P., Gawali, P., Bankhele, S., & Gite, B. B.(2023) MUSIC AND MOVIE RECOMMENDATION SYSTEM BY FACIAL EMOTIONS.Volume 11,Issue 11.

[8].Zhang Chen.(2019) Research on some key technologies of facial microexpression recognition [D] [9].Xiaowei Tang, Fang li,V. Sakthivel.(2021) Deep Learning Approach to Automated Data Collection andProcessing of Video Surveillance in Sport Activity Prediction, J. of Mult.- Valued Logic & Soft Computing, Vol. 36, pp. 61–82,.

[10]. Dhahri, C., Matsumoto, K., & Hoashi, K. (2018, August). Mood-aware music recommendation via adaptive song embedding. In 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM) (pp. 135-138). IEEE.

[11]. Wakil, K., Bakhtyar, R., Ali, K., & Alaadin, K. (2015). Improving web movie recommender system based on emotions. International Journal of Advanced Computer Science and Applications, 6(2), 218-226.[12]. Moscato, V., Picariello, A., & Sperli, G. (2020). An emotional recommender system for music. IEEE Intelligent Systems, 36(5), 57-68.

[13]. Gilda, S., Zafar, H., Soni, C., & Waghurdekar, K. (2017, March). Smart music player integrating facial emotion recognition and music mood recommendation. In 2017 international conference on wireless communications, signal processing and networking (wispnet) (pp. 154-158). IEEE.

[14]. Mollahosseini, A., Chan, D., & Mahoor, M. H. (2016, March). Going deeper in facial expression recognition using deep neural networks. In 2016 IEEE Winter conference on applications of computer vision (WACV) (pp. 1-10). IEEE.

[15].Guo Fangliang, “Research on Video Facial micro-expression Recognition Based on Deep Learning”,Dalvi, C., Rathod, M., Patil, S., Gite, S., & Kotecha, K. (2021). A survey of ai-based facial emotionrecognition: Features, ml & dl techniques, age-wise datasets and future directions. Ieee Access, 9,165806-165840.

[16] KUMAR, S. P., MOUNIKA, G., PAVITHRA, I., KALPANA, U., ALEKYA, K., & PARAMESWARA, S. (2021) Stress Detection In IT Professional by Image Processing and Machine Learning. JES.Vol 12 Issue 06.43P.13.

[17] Vinay, D. R., Kumaraswamy, B. V., & Basavaraddi, C. C. S. (2021, July). Machine learning based recommendation system on movie reviews using KNN classifiers. In Journal of Physics: Conference Series (Vol. 1964, No. 4, p. 042081). IOP Publishing.

[18] Farooq, M., Hussain, F., Baloch, N. K., Raja, F. R., Yu, H., & Zikria, Y. B. (2020). Impact of featureselection algorithm on speech emotion recognition using deep convolutional neural
network. Sensors, 20(21), 6008.

[19] Hien, D. H. T. (2017). A guide to receptive field arithmetic for convolutional neuralnetworks. medium. com.

[20] Isnain, A. R., Supriyanto, J., & Kharisma, M. P. (2021). Implementation of K-Nearest Neighbor (K- NN) Algorithm For Public Sentiment Analysis of Online Learning. IJCCS (Indonesian Journal of Computing and Cybernetics Systems), 15(2), 121-130.