

# Analyzing the Effectiveness of Convolutional Neural Networks and Recurrent Neural Networks for Recognizing Facial Expression

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## Abstract

Now a day's facial expression recognition is becoming hot research for identifying the human mental state and his ability. As every individual try to express his feelings through his facial expression, it is becoming very difficult to identify the current state. In this proposed work, we use AI, expressly a deep neural network to figure out what are the potential results that a companion demand is trustworthy is or not. Each condition at every neuron (focus) is put through a Sigmoid cutoff. We utilize a plan enlightening record by Facebook or other social affiliations. This would permit the familiar huge learning calculation with get to know the examples of bot lead by back extension, confining the last expense work and changing every neuron's weight and propensity. Each data neuron would be a substitute, actually picked part of each profile changed over into a mathematical worth and if indispensable, bound by a discretionary number to limit one section merely affecting the outcome than the other. The proposed application try to split the human face into several parts and each and every part is assumed to be CNN and this will be undergo very precise examination and then come for conclusion. The CNN focuses on each middle point would be in danger for precisely one exceptional coordinated effort.

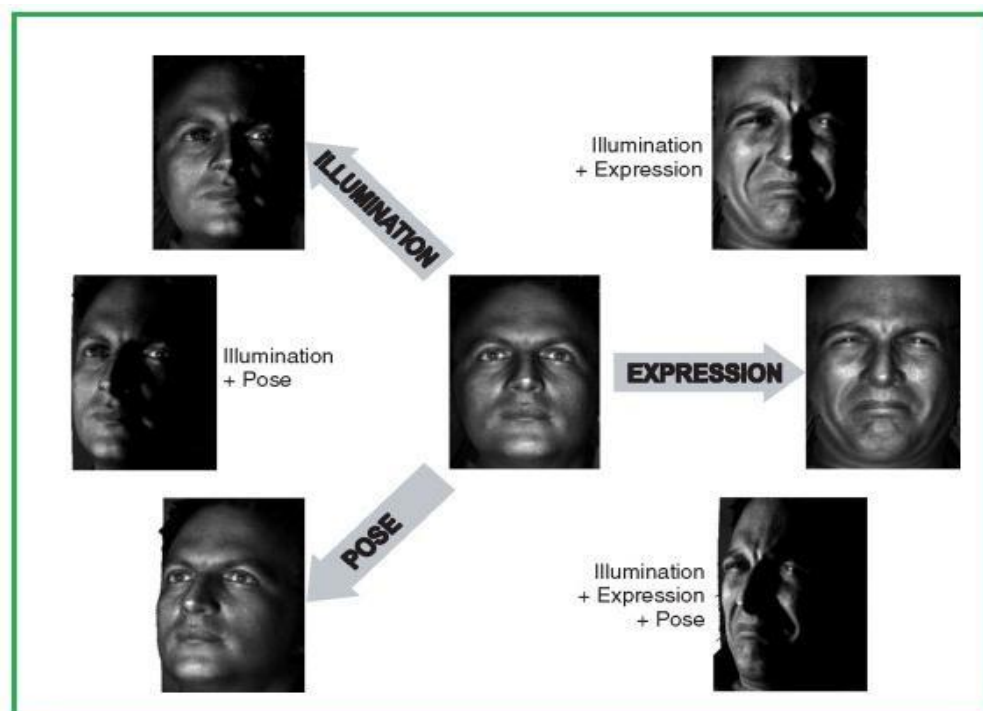
**KEYWORDS:** Sigmoid, Mathematical Worth, Artificial Intelligence, Neurons Weight, Deep Neural Networks.

## 1. INTRODUCTION

Despite the way that there are numerous assessments in the composition on feeling, till now there could be no genuine definition in the expounding on feeling<sup>1</sup>. Feeling is in a general sense which describes as an appearance or impression of a tendency. This can be displayed in

two ways either certifiable or joke.

For example, one side of feeling can be imparted at the circumstance of impression of misery, which is very real. But these sentiments are not felt exactly, some sentiments will be reliably present inside the human and this will be accessible internal conditions intellectually<sup>2</sup>. Recently this inclination affirmation has become one of the huge, research subjects in the fields of biomedical planning<sup>3</sup>, mind science<sup>4</sup>, neuroscience<sup>5</sup> and prosperity<sup>6</sup>. Emotion recognition refers to identifying human emotions typically from facial expressions<sup>7</sup>. In the past several approaches have been tried to classify human emotions from facial images<sup>8-11</sup>. Many of them have also achieved decent accuracies<sup>11-14</sup>. This is generally focused on the ability to expect the human inclination and endeavor to give assistance to the PC to finding of mental issues. Generally speaking there are a couple of kinds of sentiments recorded as a hard copy which can be used to recognize excited states, for instance, electroencephalography (EEG), galvanic skin response (GSR), talk assessment, and essentially more.



**Figure 1. Represent the Several Factors which are considered for Face Recognition**

From the above figure 1, we can clearly see there are lot of factors which try to influence the facial recognition such as physical characteristics, sex, genes, and age. The main step for any face processing system is the ability to classify the face accurately and then try to detect the face which is matched accurately with database. This system need to work on any environments like dark light, bright light, moon light, sunlight, face with spectacles, presence of mustache present of beard, without beard and presence of facial hair etc.<sup>1-6</sup>.

These are some problems that the system should be able to overcome to create an ideal system. In this current work we endeavor to use the limit of significant learning computations or models to perceive the sensation of human and endeavor to find the internal vibe of the human ward on the sentiments.

Recently there was a huge load of significant learning work that is going on during the time spent picture portrayal. One of the most inconceivable significant learning methodologies is Convolutional neural associations (CNNs)<sup>7</sup>. This is for the most part used for picture request, affirmation and picture segmentation. This CNN is generally founded on the most noteworthy mark of phony neurons and include different evened out increment stowed away layers. This CNN essentially take input from a model picture, increment weight, add inclination and subsequently apply establishment work. So that, fake neurons can be used in picture request, affirmation, and division by perform direct convolutions.

Gathering of customers sentiments have demonstrated to be crucial and find applications in many fields. There are structures which achieve the work with very few sentiments shock, fulfillment, fear and inconvenience. This structure can be made to work with more sentiments which have not been joined previously and use significant learning for additional created efficiency. If this kind of model is arranged we can use this model as proposition model for the end customer to recommend different sorts of employments which work dominantly reliant upon sentiments. In this undertaking we are presenting the consistent look affirmation of seven most fundamental human enunciations like Anger, Disgust, Fear, Happy, Neutral, Sad and Surprise. Here we endeavor to use RNN and CNN models and a while later investigate the models on 7 kinds of sentiments and find which picture is having which territory of expression. Finally we endeavor to wrap up the one which is giving more accuracy to distinguish the facial inclination reliant upon verbalizations and endeavor to recommend that model for the end customers to send in a couple of uses.

## 2. LITERATURE SURVEY

Literature survey is that the most vital step in software development process. Before developing the new application or model, it's necessary to work out the time factor, economy and company strength. Once all these factors are confirmed and got an approval then we can start building the application. The literature survey is one which is mainly deal with all the previous work which is done by several users and what are the advantages and limitations in those previous models. This literature survey is mainly used for identifying the list of

resources to construct this proposed application.

## MOTIVATION

1) A real time face emotion classification and recognition using deep learning model

**Creators:** Dr. Shaik Asif Hussain, Ahlam Salim Abdallah Al Balushi<sup>2</sup>

The proposed makers endeavor to inspect about face feeling request and affirmation under continuous way by using significant learning model. In this paper the makers endeavor to isolate the rule features with significant learning, Haar course and VGG 16 model to see face and endeavor to collect the portrayal and recognition. From the preliminary outcomes the makers obviously exhibit that the association designing which was planned for this current paper has favored types of progress over differentiated and existing estimations. Here the proposed significant learning models are comparably having more improvement than differentiated and one or two models which were used in the composition of look disclosure.

2) Multimedia Recommender System using Facial Expression Recognition

**Creators:** Prateek Sharma<sup>1</sup>.

In this paper the maker endeavor to design a CNN, determined backslide for picture and feeling request and HAAR course for incorporate extraction and web robotization. This is in a general sense dependent on the most elevated place of CNN and taking into account this CNN we can prepared to beat standard on numerous endeavors and datasets outside of ImageNet. The proposed system can find incredible precision for the end customers in arranging the proposed application. The rule limitation of this proposed application is this can simply prepare only 3 enunciations and anyway this is failed to recognize the extra expressions. In this proposed structure can't see all of the human verbalizations and along these lines this is having a future work to perceive various explanations which are accessible in human face.

3) Emotion Recognition using Feed Forward Neural Network & Naïve Bayes in real time

**Creators:** Rahul Mahadeo Shahane and Ramakrishna Sharma<sup>4</sup>

In this paper we endeavor to design a Nave Bayes to portray sentiments, Feed forward neural associations (RNN) to additionally foster accuracy of taking care of picture. Guileless Bayes gives a best precision over various estimations, to assemble the accuracy we foster a hybrid model for instance using Feed Forward Neural Network similarly as Naive Bayes. Right when picture is changed over to pixels we can't bunch the inclination as the dataset involve picture pixels of different people and this pixel is extremely astounding from all others. Ought to use multi-layer perceptron and keep on invigorating weights.

### 3. EXISTING SYSTEM AND ITS LIMITATIONS

In the current system, there was no thought like plan of the large number of various classes if appearances and sentiments from human faces. In the current structure there are no methods which can portray all of the 7 classes or sentiments from the human face. Furthermore in the current structure there is an unimaginable limitation in describing the human faces exactly with no agitating impacts.

#### Limitation of Existing System

All of the current plans are limited to the two or three classes' request figuratively speaking. All of the current structures are failed to organize the facial pictures and thereafter endeavor to find the sentiments reliant upon different kinds of poses. There is no exact model to arrange the persistent facial detection. The current application is limited with simply specific sort of classifiers and this couldn't give precise portrayal from human faces. In the current system there is ML groupings to describe the photos subject to not many arranged images. But no application is expected to affirm all of the 7 sentiments and learn the precision of the model.

### 4. PROPOSED SYSTEM AND ITS ADVANTAGES

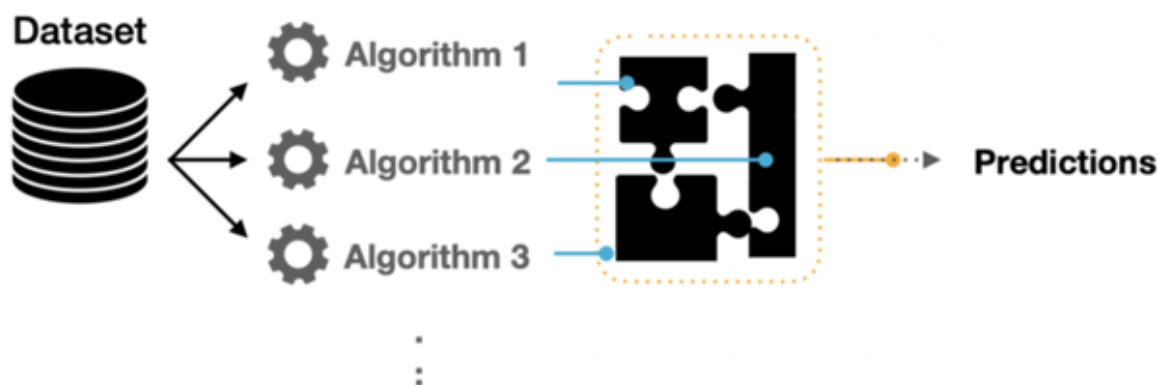
In this proposed work we endeavor to design applications which can be used for figure of explanations of both still pictures and thereafter truly investigate the display of CNN close by monotonous neural network(RNN) model. At the point when the image is gotten from the video groupings the structure will normally perceives face using HAAR course then its yields it and resize the image to the predefined viewpoint and accommodate the model for conjecture. The model will create seven probability regards contrasting with seven explanations. By differentiating the two models we endeavor with close which model gives more accuracy for lookaffirmation for that image dataset.

#### 4.1. ADVANTAGES OF THE PROPOSED SYSTEM

The proposed plot is incredibly careful in game plan of pictures. The proposed system gives careful results when differentiated and different models. I.e. CNN and RNN. The proposed system is prepared for request of looks definitively and endeavor to recommend in capable manner. The proposed model can prepared to isolate all of the 7 classes of human sentiments shorttime later gathering the sentiments careful way.

## 4.2. PROPOSED ALGORITHMS

Here in this section we try to discuss about the performance of CNN and RNN ( Neural Networks Models )using face recognition which are used for facial recognition and try to find out the accuracy of current model. Here we try to load facial images into the application and then try to train the model using RNN and CNN and check which one is having best accuracy in terms of performance and efficiency and finally proceed with that model.



**Figure 2. Represent the Proposed Model for Face Recognition by Using Feature Extraction**

From the above figure 2, we can clearly identify that we try to load facial expression dataset as input and try to compare that with several classification and clustering algorithms<sup>15,16</sup> to check accurate predictions. Now we can check the process for verifying the performance of our proposed application. This is described as follows:

### a) Upload Facial Emotion Dataset<sup>17</sup>

A large portion of the photos were extended by OpenCV. We have coordinated tests on FER\_2013 Data set which we accumulated from KAGGLE site and endeavor to set up the system to recognize the sentiments exactly. Here in this dataset there are just around 28709 pictures and before applying feature extraction computation complete pictures features/pixels are 3072 and a while later right after applying features reduces to 2352 as PCA kill irrelevant pixels and used simply huge pixels/features.

### b) Data Pre-Processing Module

In this module we endeavor to pre-process all of the photos into two classes: One is for test stage and another is: Train Phase. At the point when the photos are divided into test and train stage, as of now we can prepared to set up the structure with all pre-arranged dataset and subsequently we can acquire capability with the CNN and RNN models with these pre-arranged look pictures.

### c) Training The Deep Learning Module<sup>18</sup>

Once the data is pre-processed, now we try to construct a CNN model and then apply the CNN model to training data. In this current application when we use CNN model to train the current dataset, we got an accuracy of 48 and this is almost less than 50 percent of accuracy for detecting facial expressions in accurate and efficient manner.

### d) Train The RNN Module

Once the data is pre-processed, now we try to construct a RNN model and then apply the RNN model to training data. In this current application when we use RNN model to train the current dataset, we got an accuracy of 88 and this is almost greater than 80 percent of accuracy for detecting facial expressions in accurate and efficient manner.

### e) Accuracy Comparison Graph Module

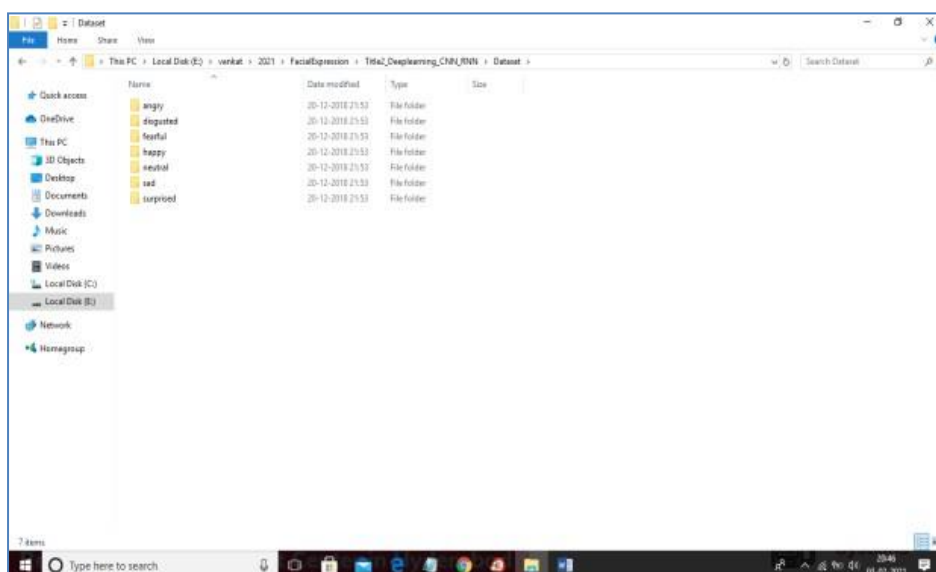
In this module we try to find out the accuracy comparison graph which contains x-axis represents epoch/iteration and y-axis represents accuracy and in above graph orange line represents RNN accuracy and green line represents CNN accuracy and from above graph we can see with further epoch/iteration both algorithm accuracy get better and better and from above graph we can conclude that RNN is giving better result.

### f) Predict Facial Expression Module

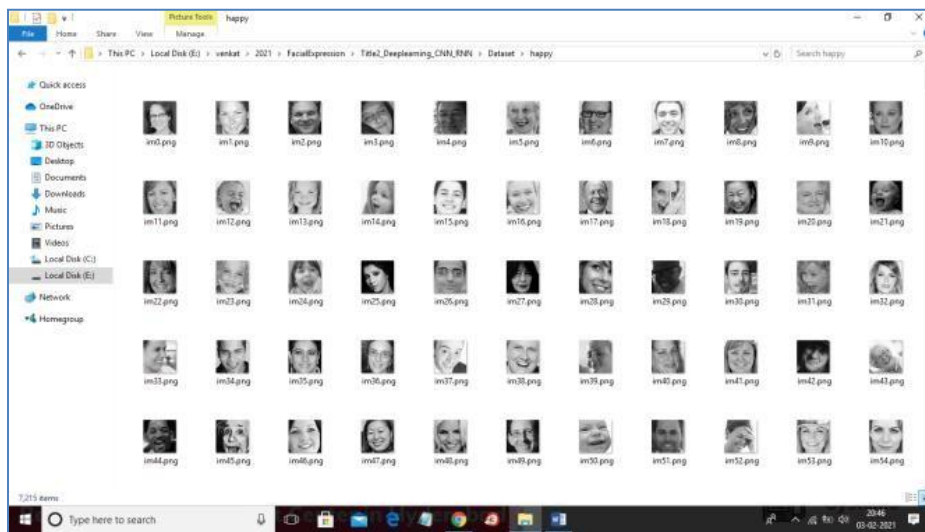
Now click on 'Predict Facial Expression' button to upload new test image and the application predict emotion from it. Here we can take any image which contain facial part as input and then check the expression of that image based on the corresponding features

## 5. EXPERIMENTAL RESULTS

### MAIN WINDOW



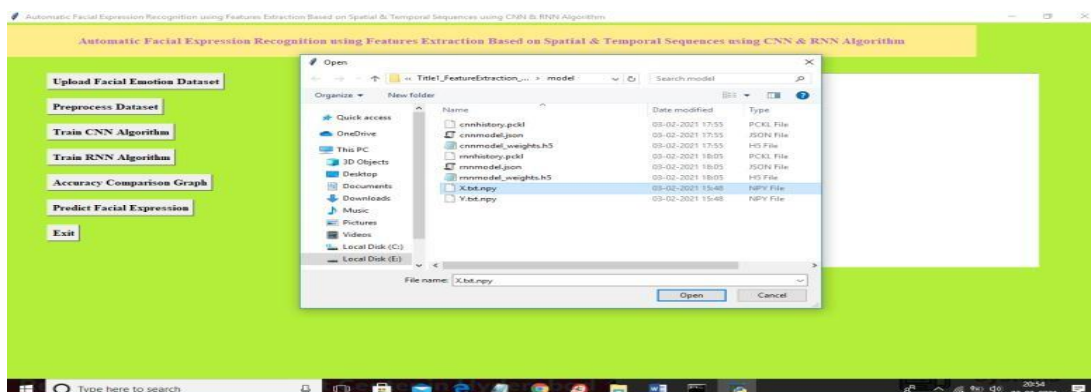
**DETAILED VIEW OF FOLDERS**



**MAIN WINDOW**



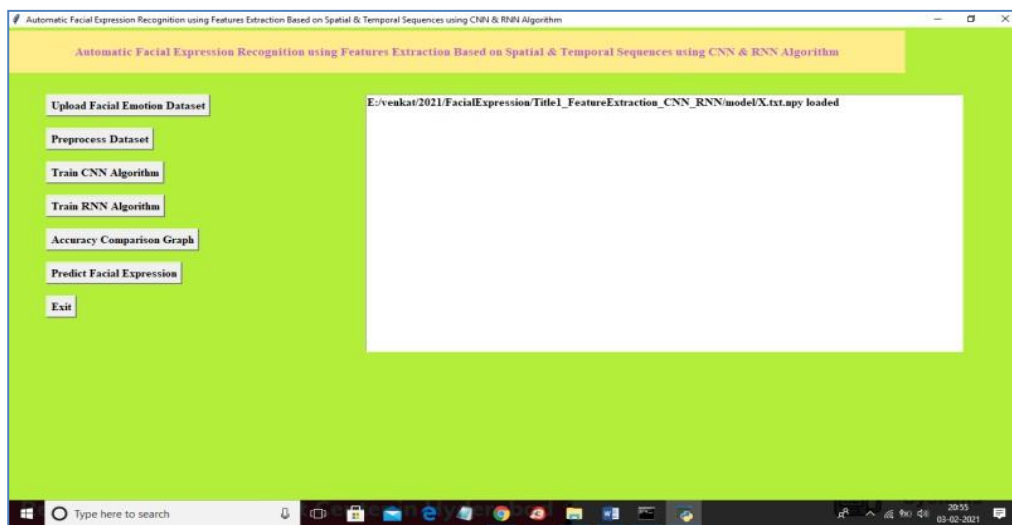
In above screen click on 'Upload Facial Emotion Dataset' button to upload dataset  
**UPLOAD FACIAL EMOTION DATASET**



In above screen selecting and uploading 'X.txt.npy' file which contains images of all emotion faces and then click on 'Open' button to load dataset and to get below screen

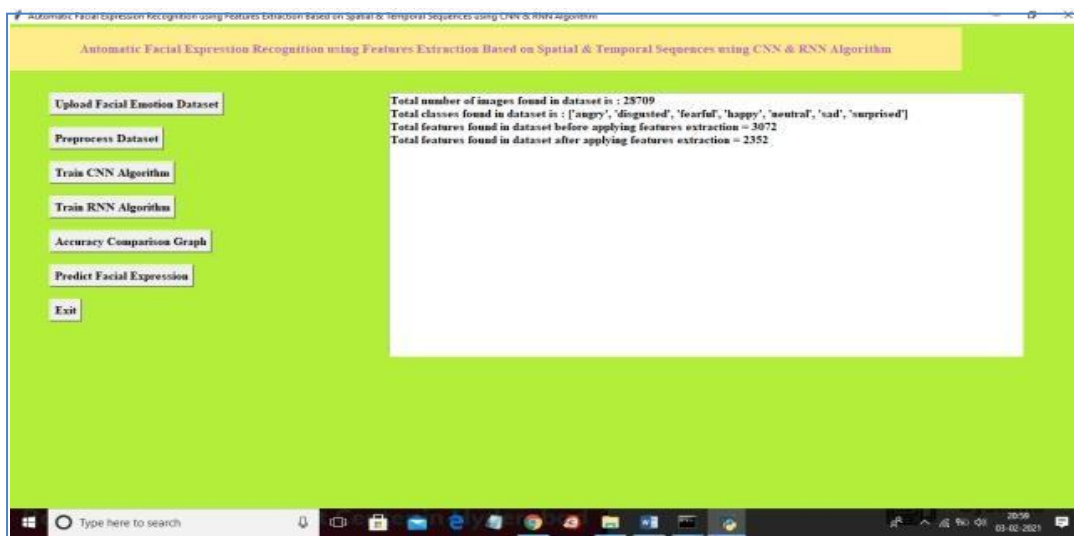


## APPLICATION LOADED



In above screen dataset loaded and now click on 'Preprocess Dataset' button to read all images and then apply feature extraction algorithm called PCA to read important features from dataset and to get below screen. This module may take 5 to 8 minutes time to give output so please wait till process complete like below screen.

## PRE-PROCESSING OF IMAGES



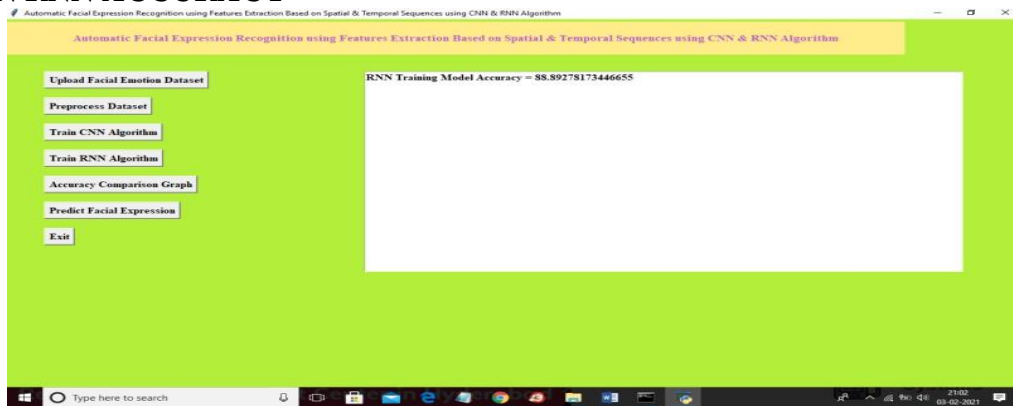
In above screen we can see dataset contains total 28709 images and before applying feature extraction algorithm total images features/pixels are 3072 and then after applying features reduces to 2352 as PCA remove unimportant pixels and used only important pixels/features. Now image data is ready and now click on 'Train CNN Algorithm' button to train CNN with process image features.

### CNN ACCURACY

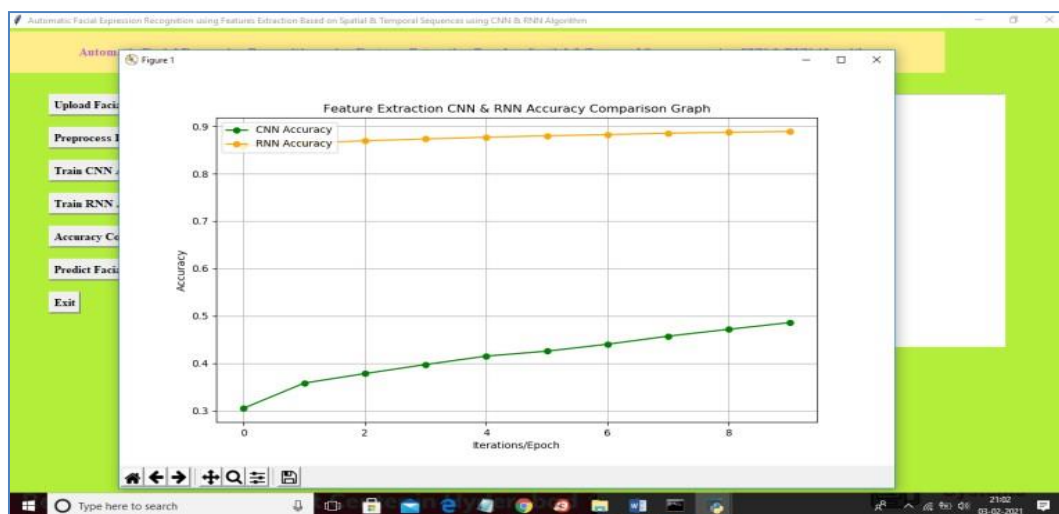


In above screen CNN accuracy is 48 and now click on 'Train RNN Accuracy' button to train dataset with RNN

### TRAIN RNN ACCURACY



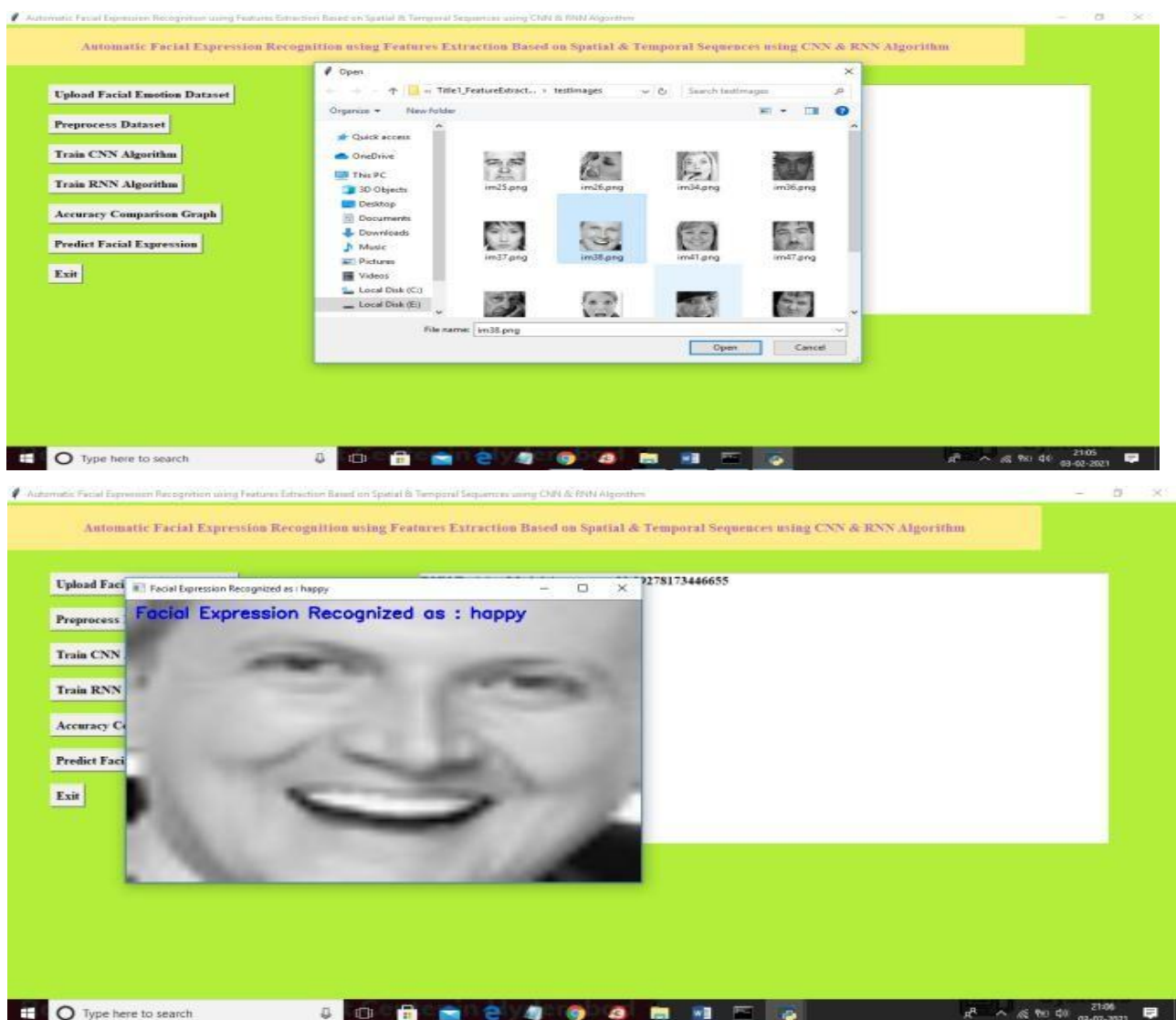
In above screen RNN accuracy is 88% and now click on 'Accuracy Comparison Graph' to get below graph of both algorithms



### ACCURACY COMPARISON GRAPH

In above screen x-axis represents epoch/iteration and y-axis represents accuracy and in above graph orange line represents RNN accuracy and green line represents CNN accuracy and from above graph we can see with further epoch/iteration both algorithm accuracy get better and better and from above graph we can conclude that RNN is giving better result. Now click on 'Predict Facial Expression' button to upload new test image and the application predict emotion from it

### PREDICT FACIAL EXPRESSION



In above screen selecting and uploading im38.png image and then click on 'Open' button to get below result

### TEST THE SAMPLE IMAGE

In above screen we got detected emotion as 'happy' and similarly you can upload any image and then predict emotion. So this is the output of TITLE 1. Now run title 2 project by double

click on 'run.bat' file from 'Title2\_Deeplearning\_CNN\_RNN' folder to get below screen



In above screen click on 'Upload Facial Emotion Dataset' button to load dataset and to get the result.

#### 4. CONCLUSION

The results of our study indicate that the suggested CNN and RNN model is more efficient and accurate than all unrefined ML models in recovering the disposition from face images. Furthermore, our CNN and RNN model provides greater precision than all raw ML models. Therefore, this is suitable for the majority of applications that intend to use this Facial disposition system. In the future, we would like to expand the comparative section to include additional models that can improve the accuracy of our proposed model, and we would also like to enhance the CNN's utility by incorporating additional features.

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