A Novel Product Evaluation Scheme Using Machine Learning

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***Abstract*—**Machine learning is one of the most powerful technologies that could be used in almost any unexpected problem and proper implementation of it can lead to remarkable results. Machine learning is the technology that enables machines to act and think alike human being. Machine learning, deep learning and computer vision together can be used to compute or evaluate the rating of products. In this paper we propose that the actual rating of products can be calculated by running some facial analysis on the live input of the user who is looking at the product and going through the product description.

Keywords*—neural networks; machine learning; model; expression*

I. INTRODUCTION

In general the reviews and rating given on the products on ecommerce sites and other websites are mostly paid ratings, done in order to make the product appear good, which would increase the sale of the product. To overcome this flaw, we think that if the rating of the products are evaluated or computed implicitly i.e. by not taking the ratings from the user and calculating it by own, this would reduce the false and paid rating situation to a great extent. Whenever a user looks at a product and goes through the product description, he or she tends to make some facial expression. Processing these facial expressions and computing rating, taking their expression as a parameter would be quite a good approach. Customer's rating is an important parameter for companies to know the point of view of the users about their products. Most of the users avoid rating the products, as it asks them to sign up or login. So by implementing our research, ratings can be evaluated automatically, eradicating the headache of asking the users to manually enter the rating. The facial expression of the user can be mapped to a certain a numeric value to compute the rating of product. A machine learning model could be made to classify the following expressions of the user:- surprise, happy, neutral, sad and anger. After predicting the expression of the user, the expressions can be mapped to certain numeric value:- surprise : 5, happy : 4, neutral : 3, sad : 2 and anger : 1. Then considering the time factor in account, a weighted average could be calculated, which could a be suitable rating for the product. In this paper we have used machine learning, deep learning and computer vision to compute the product rating. Machine learning is the field of science and technology in which machines are trained and prepared to learn things and take decisions, the way humans learn, think, observe and decide. Machine Learning is broadly divided into two main categories on the basis of the dataset provided, namely: supervised learning and unsupervised learning. Machine Learning problems are generally categorized as classification problems or regression problems. The main aim behind building a machine learning algorithm is to make a program that would take some input data and some statistical analysis to predict an output. Machine Learning is like imparting human intelligence, instincts, thinking capabilities to machine. Computer vision is the field of technology related to image processing. It is widely used to work with images like taking input image, changing their color, extracting their properties, displaying back images etc. Through computer vision, the system sees a colorful image as a 2D matrix of pixel, where each cell is an RGB value that corresponds to pixel color. As shown in Fig. 1, Deep learning algorithms are mirrors a nervous system structured where each neuron is connected to each other and they pass information among them.

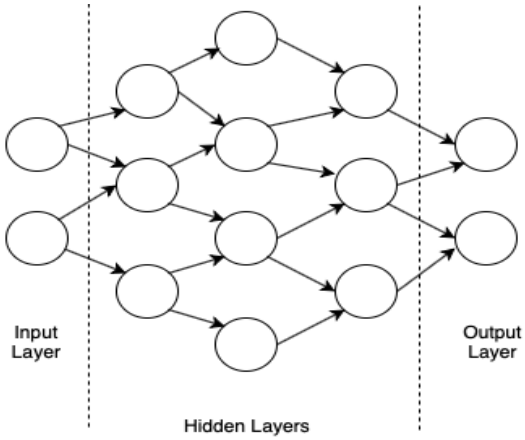

Fig. 1 Neural Network Structure

Deep learning is one of the most powerful learning till date. Deep learning models are a combination of nodes and layers. They try to simulate the working of neurons and brain. It replicates the functioning of the brain. It is one of the subfields of machine learning as shown in Fig. 2.

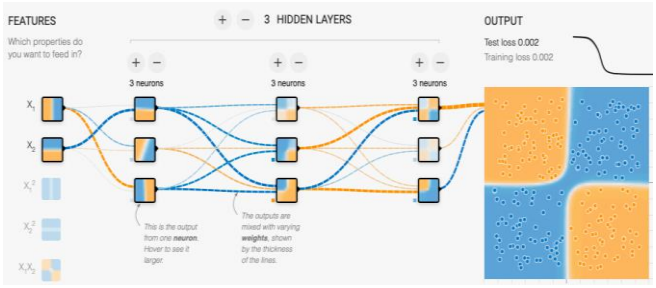

Fig. 2 Neural Network Visualization

II.RELATED WORK

In the paper [1], an instrumental function that accepts real time input via videos or cameras, recording and revealing faces can be utilised for versatile activities. A profound application of facet revelation with the help of OpenCV is the motive of this paper. A clear comprehension of the methods used is achieved with the tabular illustration. The ideology of preeminent methods such as Adaboost and Haar cascades is covered in it. This paper explicitly illustrates the preconditions of facet revelation system. The different approaches are expressed in this paper which can be considered for facet revelation and recording. It also analyses all the methods in the time and space criterion. It pinpoints Haar cascades as the most decisive approach to reveal facets. Difference in performances of facet revelation with OpenCV and MATLAB are also cited along with their pros and cons. The paper displays that the methods such as camshaft and haar cascades provide more efficiency with a verifiable output but in the time criterion camshaft method and revelation via gesture method is exceptional. Greater accuracy can be achieved in facial explanation via Haar cascades.

The paper by Li Cuimei [2], discuss the phenomenon of identifying human faces has been an arduous task in the pattern detection and image processing regions. A framework has been delineated in this paper providing an advanced individual facet identification method by fundamental Haar cascade data mixed with three supplementary fragile classifiers. The three fragile analyzers are built upon disclosure of eyes, mouth identification and skin tone diagram duplicating. Prior, roughly beyond false individual facet identification (mere low estimate of faulty negative), public figures are handled by fundamental Haar cascade analyzer but with some inaccurate acknowledgement (faulty affirmative). Furthermore, a fragile organizer placed on facet skin tone diagram duplicating is tested and a non-individual faces are expunged in bulk so as to exterminate falsely approved non-individual facets.

The paper by Tian Xuehong [3], discuss the_evolution of robots is the most prompt and active mechanism of individual-computer synergy, i.e., communicating with robots in the term of human beings. A face distinguishing mechanism is essential so as to comprehend this behavior. The considerable elements of a face distinguishing mechanism are discovery of facets, skin tone revelation, preparing figures, and so on. In this paper, two fundamental techniques of facet recognition are explained: advanced linear segregate interpretation and bi-linear presentation. The developmental analysis and inquiry of the significance that brilliant opportunities have on realization estimate are executed at the end of the paper.

A mechanism for real time individual facet recognition and trailing has been delineated in the paper by Jatin Chatrath [4] via few alterations in the method proposed by Paul Viola and Michael Jones. The preface of this paper includes the establishment of individual facet recognition and trailing following the premonition in the Viola Jones mechanism and further considering the real video operations. Abstraction of particular characteristics from the figures for the object identification was the basis of the Viola Jones mechanism. Similar concept is being adopted for real time individual facet recognition and trailing. The real time individual facet recognition and trailing assisting up to 50 individual facets are displayed in the imitating consequences of the explained method.

In the paper by Saad ALBAWI [5], the manifolds tier structure in the Artificial Neural Network (ANN) is attributed the term Deep Neural Network or Deep Learning. Due to its capability of administering data, it has been deemed as one of the most dynamic tools and has been favored in the literature. The engrossment of manifold layers obscured beneath has lately initiated to outperform the achievement of canonical mechanisms in varied regions, specifically in sequence detection. Convolutional Neural Network (CNN) is the most prominent deep neural network. Layout (VGG) is deployed for better outcomes. Its terminology is derived from the mathematical linear application among matrices called involution. Manifolds of layers are contained in CNN, covering non-linearity layer, pooling layer, fully-attached layer and involutional layer. Fully-attached and involutional layers are parameterized whereas the former two are not.CNN has an outstanding achievement in machine learning complexities.

Based on a novel Facial Decomposition, this paper by Khadija Lekdioui [6] suggests a facial expression recognition method. First, seven areas of interest, representing the important parts of face (left eyebrow, right eyebrow, left eye, right eye, between eyebrows, nose and mouth), are drawn out using facial landmarks detected by Intra-face algorithm. Then, different local labels, such as LBP, CLBP, LTP and Dynamic LTP, are used to draw out lineaments. At the end, feature vector, that represents face image, is delivered into a multiclass support vector machine to accomplish the recognition task. In this paper, we have proposed a new facial disintegration for basic emotion states acknowledgement. A preprocessing stage is then enforced on these AOIs for rearrangement of sizes and dividing them into blocks, before doing quality evocation to build face feature label. Finally, a multiclass SVM classifier is used to infer emotion state. A complete experimental study, using different features, is conducted; one depends on complete face as a single AOI and the other one uses facial disintegration with six AOIs. Experimental outcomes represented the efficiency of our

proposed method on all tested datasets using all tested descriptors. The suggested facial decomposition excelled the state of the art ones.

This paper by Abir Fathallah [7], discuss about the Electronic Facial Expression Detection, which has always been a very imposing and alluring issue in the field of computer vision. The contradiction in expressing oneself induces challenges in facial sentiments revelation using machine learning techniques. Machine learning introduces state-of-the-art method called as Deep Learning which can organize individual facet pictures into sentiment categories using Deep Neural Networks (DNN), therefore Convolutional Neural Network (CNN) is employed as a solution to reduce the complications in facial expression composition. A framework network has been discussed in this paper recently, built on facial expression detection via CNN. Our framework also attunes with Visual Geometry Group layout (VGG) in order to obtain better results. The predominant public databases (Ck+, MUG and RAFD) are utilized in the assessment of our composition. As observed in the outputs, CNN mechanism is powerful in transforming the figures in umpteen public databases which accomplish an enhancement in facial interpretation test.

The objective of this paper by Prashant K. Manglik [8] is to identify different individual facial statements. Every visage is noted by modification in the areas of features in facet which are placed in various regions of facet. Here, facial statements identification technique is studied in two phases. Figure transformation is covered in the first phase while the second phase includes framing and instructing the neural network. The figure assessment phase or the intriguing phase has certain number of steps. First step takes care of normalization of figures of the individual facets. In the second step, the normalized figures are converted to gray scale. In the third step, the altered figures are segregated in two parts: the upper half and the lower half frequency estimation of the catalogue figures is conducted in the next step.

Next in order, balanced non-individual facets are decided and dropped with the revelation of eyes, another frail analyzer in the paper by W. Zheng [9]. Eventually, the bogus affirmative rate is further curtailed with the implementation of mouth espial methodology on the residual non-individual facets. In both training and test data, conclusions of test on public figures under various barricades and brightness and a little extent of directions and revolutions state that the efficiency of the recommended algorithm is enhanced and an ultra modern achievement is made with the help of OpenCV. Moreover, it's ease and plainness in implementation results in enhancing its efficiency. In this paper, an advanced individual facet identification method is proffered grounding on cascade analyzers employing Haar-like characteristics. Three supplementary fragile analyzers are consequently adjoined to the fundamental Haar-like characteristics found outpouring analyzer including a judgement node built on skin tone diagram duplicating eyes and jaws identifications.

Adequately high identification is estimated and status of frail analyzers is satiated in the case of discussed two analyzers in the paper by K. R. Kulkarni [10]. The drawbacks of the fundamental Viola-Jones' outpouring analyzer is satisfied by the presented individual identification method and the entire individual facet identification estimated is raised, while maintaining approximately negligible elimination, as delineated in the experiential results. The beneficence of this effort may be winded up as: diagram can exclude a large fraction of non facets, earlier identified by the fundamental Haar-equivalent characteristics found outpouring analyzer and supplementary analyzers built on eyes and mouth identifications discards those non-facets whose skin tone corresponds with the individual skin tone excluding substances like eyes and mouth. Conclusively, the proffered individual facet identification scheme can be smoothly equipped due to accessible components.

Instantaneous data estimation and output yield has been achieved in this paper by Tianmei Guo [11]. Hence an advanced method is proposed in this paper, along with the illustrations and observations which are comprehensive and may have wider utilization in the field of computer and figure analysis. Eventually, this paper commences certain elaborated examinations on complicated facet recognition and trailing data set which have been considered broadly. Preconditions inclusive of this paper are: posture, radiance, camera alteration and scale. Nonetheless, the system employed under this method is imposed to similar set of situations and the method is sufficiently adjustable to accommodate the varying situations.

Particularly the operations that accord with illustrated abstracts, such as biggest figure arrangement data set, (Image Set), computer vision and NLP (Natural Language Processing) and the outcomes obtained were remarkable. In this paper by Neena Aloysius [12], an explanation and elucidation of all components and prominent issues in accordance with CNN will also be provided and how these components function. Moreover, guidelines concluding CNN efficiency will also be discussed. An assumption that the readers have sufficient knowledge both Artificial Neural Network and Machine Learning is also made in this paper.

An electronic approach for the facial interpretation has also been discussed in this paper by Ma Xiaoxi [13]. Advanced deep neural network engineering has also been delineated here for facial interpretation detection. The proffered structure can be expressed by four conventional layers, the prior three proceed with maximum pooling and the end layer is fully connected. Facial postures are accepted as the input and restricted to any one of the following interpretations: Angry, Dislike, Gloomy, Extent, Neutral and Amaze. Databases such as Ck+, MUG and RAFD are used for the evaluation of the proffered composition. Outcomes and identification estimates certify that our analysis surpasses the futuristic techniques. In this paper, a layout has been qualified with pictures in which the fact was in a fixed state. We would want to expand our layout to various facet postures

subsequently. Henceforth, it enables us to experiment the efficiency of pre-trained layouts as in VGGNet for facial sentiment detection.

This captures the location of the eyes and the eyebrow as proffered in the paper by Monika Dubey [14]. To capture the eyes and the eyebrows, bordering is done. In the fifth step of the first phase, the info regarding nose, mouth and cheeks are observed in the lower half frequency. Characteristic vector is achieved by coursing catalogues. Researchers confront many difficulties in facial statement identification. There are umpteen practical operations of facial statement identification in various fields. If it will be collaborated with neuroscience and human psychology, it will generate a field that binds the more abstract area of psychology and the more fresh area of estimation. The characteristic marks of a facet are placed at eyelids, lips, cheeks, eyebrows, forehead and chin.

III. PROPOSED WORK

After doing research and study, we came up with an idea of building a smart evaluator i.e. a smart evaluation system that is capable of giving suitable product rating to the products, after doing facial expression analysis. We propose that the users, when looking towards the specifications of the product, will make several facial reactions, these facial reactions can provide quite accurate product ratings and reviews. Product ratings and reviews can be processed and generated by analyzing the facial expression of the user. When the user will view or check out a product, the web camera of the device will detect the face of the user and will provide the input to the smart evaluator. The smart evaluator will run facial expression analysis on the input and identify the expression of the user. After the expression is identified, we can map the expression to a certain value, for example- Surprise: 5, Happy: 4, Neutral: 3, Sad: 2, Anger: 1 and this is how rating will be provided to the product.

A. Proposed Work

- Step 1: Importing all required libraries.
- Step 2: Getting real time input from the web camera.
- Step 3: Detecting facial region in the input.
- Step 4: Building model for detecting facial expression.
- Step 5: Detecting facial expression of the input by running the model prepared in the previous step.
- Step 6: Mapping the detected facial expression to its corresponding rating value.
- Step 7: Computing the results.

IV. IMPLEMENTATION

After proposing the above work, we implemented it using the python, jupyter notebook, machine learning techniques, tensorflow, keras, pandas and other python libraries and dependencies.

Following the steps mentioned in the proposed work:-

Step 1: Importing all required libraries.

```
import cv2
import time
import pandas as pd
from keras.models import load_model
from matplotlib import pyplot as plt
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Activation
from keras.layers import Convolution2D
from keras.layers import Reshape
from keras.layers import Flatten
from keras.layers import MaxPooling2D
from keras.layers import Dropout
from keras.utils import np_utils
```

Fig. 3 Importing required libraries

Step 2: Getting real time input from the web camera.

```
rgb = cv2.VideoCapture(0)
```

Fig. 4 Taking input from webcam

Step 3: Detecting facial region in the input.

```
facec = cv2.CascadeClassifier
('haarcascade_frontalface_default.xml')
```

Fig. 5 Using haar-cascades for facial region detection

Step 4: Building suitable model for detecting facial expression.

```
model = Sequential()

model.add(Convolution2D(64, 3, 3, input_shape =
                        (1, 48, 48), activation='relu'))
model.add(Convolution2D(64, 3, 3, activation='relu'))
model.add(Convolution2D(64, 3, 3, activation='relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))

model.add(Convolution2D(32, 3, 3, activation='relu'))
model.add(Convolution2D(32, 3, 3, activation='relu'))
model.add(Convolution2D(32, 3, 3, activation='relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.5))

model.add(Flatten())
model.add(Dense(128, activation='relu'))
model.add(Dense(64, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(7))
model.add(Activation('softmax'))

model.summary()

model.compile(loss='categorical_crossentropy',
                    optimizer='adam',
                     metrics=['accuracy'])
```

Fig. 6 Model

Layer (type)	Output Shape	Param #
convolution2d_7 (Convolution2D)	(None, 64, 46, 46)	640
convolution2d_8 (Convolution2D)	(None, 64, 44, 44)	36928
convolution2d_9 (Convolution2D)	(None, 64, 42, 42)	36928
maxpooling2d_3 (MaxPooling2D)	(None, 64, 21, 21)	0
convolution2d_10 (Convolution2D)	(None, 32, 19, 19)	18464
convolution2d_11 (Convolution2D)	(None, 32, 17, 17)	9248
convolution2d_12 (Convolution2D)	(None, 32, 15, 15)	9248
maxpooling2d_4 (MaxPooling2D)	(None, 32, 7, 7)	0
dropout_2 (Dropout)	(None, 32, 7, 7)	0
flatten_2 (Flatten)	(None, 1568)	0
dense_1 (Dense)	(None, 128)	200832
dense_2 (Dense)	(None, 64)	8256
dropout_3 (Dropout)	(None, 64)	0
dense_3 (Dense)	(None, 7)	455
activation_1 (Activation)	(None, 7)	0

Total params: 320999

Fig. 7 Model summary

Step 5: Detecting facial expression of the input by running the model prepared in the previous step.

```
model = load_model('face_reco.h5')
```

Fig. 8 Running the model

Step 6: Mapping the detected facial expression to its corresponding rating value. The mapping in the following table:

TABLE I. MAPPING

Expression	Value
Anger	1
Sad	2
Neutral	3
Happy	4
Surprise	5

```
emo = {1: 'Expression : Anger || Rating : 1',
       2: 'Expression : Sad || Rating : 2',
       3: 'Expression : Neutral || Rating : 3',
       4: 'Expression : Happy || Rating : 4',
       5: 'Expression : Surpise || Rating : 5'}
```

Fig. 9 Mapping results

The following were the results generated:

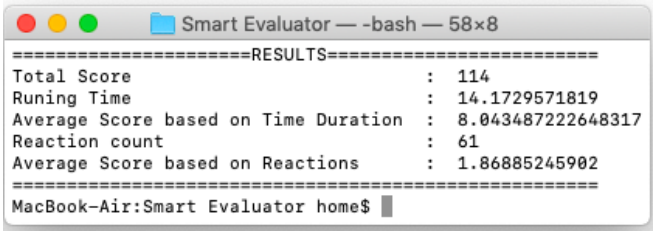

Fig. 10 Result summary

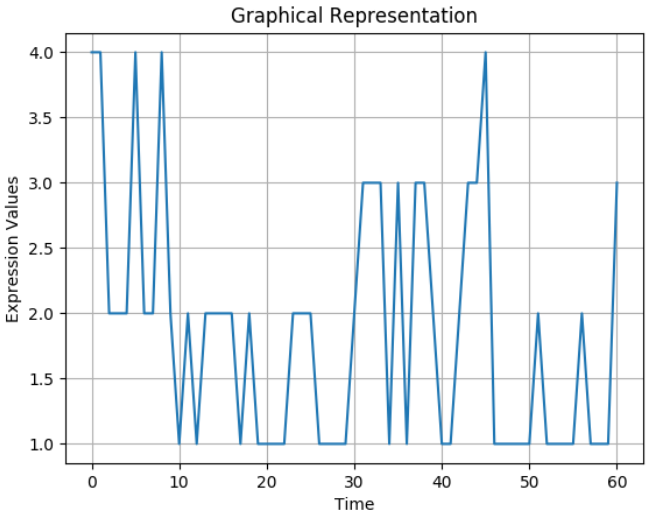

Fig. 11 Graphical Representation

V. CONCLUSION

The project aims at rating the product by performing facial expression recognition in real time. By far we have successfully implemented the complete project that is recognizing the face from a real time live input and detecting the facial expression of the user. At present the project is working on real time live input without any mistake or disparity, that too in a quite rapid manner. Lots of efforts has been put into it to make it work effectively. The project has been designed, implemented and tested with real devices by users successfully. The project helped in understanding the difficulties involved in establishing a machine learning project, different ways to overcome them and in better understanding the complexities of project development process. The project has also taught us programming skills, improving the design and implementation logic of the software at every step of the development life cycle to enhance the overall performance of the project.

VI. FUTURE WORK

Some of the possible ways of extending this project are :- it can be optimized so that it takes less space, time and low specification hardware to run, more reactions could be added to make it more accurate and current drawbacks would be fixed in the later updates.

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