

Human Facial Expression Recognition Model Using Convolutional Neural Network

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Abstract- Facial expression is that the most powerful and natural non-verbal emotional communication methodology. the popularity of facial expressions isn't a simple downside. folks will vary considerably within the approach they show their expressions. Hence, the face expression recognition remains a difficult downside in pc vision. To propose an answer for face expression recognition that uses a mix of Convolutional Neural Network and specific image preprocessing steps. It delineate the innovative resolution that has economical facial expression and deep learning with convolutional neural networks (CNNs) has achieved nice success within the classification of assorted face feeling like happy, angry, unhappy and neutral.

Keywords- Face Expression, deeplearning, Tensor flow.

I. INTRODUCTION

Makes the network invariant to little transformations, distortions and translations at intervals the input image (a little distortion in input won't amendment the output of face analysis has been attracting hefty attention at intervals the advancement of human machine interface since it provides a natural and efficient thanks to communicate between humans.

Some application areas associated with face and its expressions embody personal identification and access management, video phone and word, rhetorical applications, human-computer interaction, automatic investigating, cosmetology then on.

However the performance of the face detection beyond question affects the performance of all the applications. some ways ar planned to appear at external half in photos, they will they will into four categories: knowledge-based ways that, feature-based ways that, example primarily based wholly ways that and appearance-based ways that. once used on a non-public basis, these ways that cannot solve all the issues of face detection like cause, expression, orientation and occlusion. thence it's higher to work with many sequent or parallel ways that. Most of the face recognition ways that according up to presently unit of measuring centered on recognition of six primary expression classes such as: happiness, sadness, fear, anger, disgust and angry.

A face is that the visible manifestation of the emotive state, psychological feature activity, intention, temperament and psychopathology of a person and plays a communicative role in social relations. Human facial expressions ar progressing to be simply classified into

seven basic emotions: happy, sad, surprise, fear, anger, disgust and neutral. Our facial emotions are expressed through activation of specific sets of facial muscles.

These usually delicate, however advanced, signals in Associate in Nursing expression sometimes contain Associate in Nursing copious quantity of information relating to our state of mind. Automatic recognition of facial expressions ar progressing to be a significant part of natural human-machine interfaces. it'd put together be used in activity science and in clinical apply. it's been studied for a protracted amount of a while and getting the progress recent decades. tho' lots of progress has been created, recognizing face with a high accuracy remains to be powerful thanks to the standard and kinds of facial expressions.

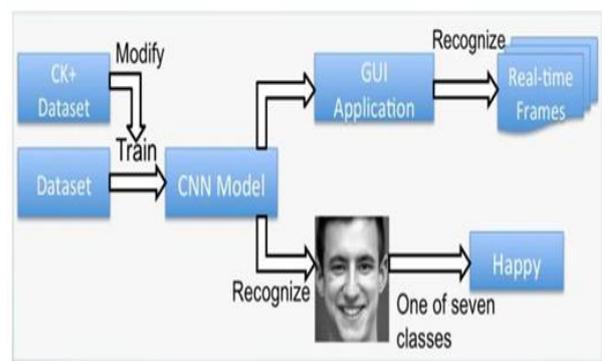


Fig.1 CNN Algorithm.

On day-to-day basics humans commonly recognize emotions by characteristic decisions, displayed as a section of a face. as associate example happiness is undeniably related to a smile Oran upwardmovement of the corners of the lips. equally variousemotions unit of measuring characterised by alternative deformations

typical to a selected expression. analysis into automatic recognition of facial expressions addresses the issues shut the illustration and categorization of static or dynamic characteristics of those deformations of face pigmentation.

ConvNet is a type of feed-forward artificial neuralnetwork in which the connectivitypattern betweenits neurons is inspired by the organization of the animal visual cortex. Individual cortical neurons respond to stimuli in a restricted region of space known as the receptive field. The receptive fields of different neurons partially overlap such that they tile the visual field. The response of an individual neuron to stimuli within its receptive field can be approximated mathematically by a convolution operation. Convolutional networks were inspired by biological processes and are variations of multilayer perceptron designed to use minimal amounts of preprocessing. They have wide applications in image and video recognition, recommender systems and natural language processing.

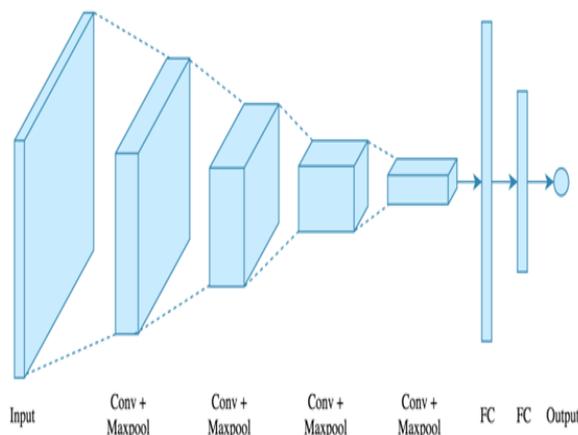


Fig.2 Steps For Image Recognition

The primary purpose of Convolution in case of a CNN is to extract features from the input image. Convolution preserves the spatial relationship between pixels by learning image features using small squares of input data. The convolution layer's parameters consist of a set of learnable filters. Every filter is small spatially (along width and height), but extends through the full depth of the input volume.

For example, a typical filter on a first layer of a CNN might have size 3x5x5 (i.e. images have depth 3 i.e. the color channels, 5 pixels width and height). During the forward pass, each filter is convolved across the width and height of the input volume and compute dot products between the entries of the filter and the input at any position. As the filter convolve over the width and height of the input volume it produces a 2-dimensional activation map that gives the responses of that filter at every spatial position.

Intuitively, the network will learn filters that activate when they see some type of visual feature such as a3 edge of some orientation or a blotch of some color on the first layer, or eventually entire honeycomb or wheel-like patterns on higher layers of the network. Now, there will be an entire set of filters in each convolution layer (e.g. 20 filters), and each of them will produce a separate 2-dimensional activation map.

II. DOMAIN OVERVIEW

1. Zero-Padding:

Typically, it's convenient to pad the input matrix with zeros round the border, so filter is applied to bordering components of input image matrix. victimization zero artefact size of the feature map is controlled.

2. Pooling (Sub-Sampling):

Spacial Pooling (also known as subsampling or down sampling) reduces the spatiality of every feature map however retains the foremost vital data. spacial Pooling is of various types: easy lay, Average, Sum etc. just in case of easy lay Pooling, a spacial neighborhood (for example, a 2x2 windows) is outlined and therefore the largest component is taken from the corrected feature map among that window. Just in case of average pooling the typical or add of all components therein window is taken.

In apply, easy lay Pooling has been shown to figure higher. The perform of Pooling is to increasingly scale back the spatial size of the input illustration.

Especially, pooling.

- Stride is that the size of the filter, if the scale of the filter is fivex5 then stride is 5.
- Depth corresponds to the quantity of filters we tend to use for the convolution operation.
- A convolutional neural network (CNN or ConvNet) may be a form of feed-forward artificial neural network during which the connectivity pattern between its neurons is galvanized by the organization of the animal visual area.

Individual animal tissue neurons answer stimuli during a restricted region of area called the receptive field. The receptive fields of various neurons partly overlap such they tile the field of regard.

The response of a personal vegetative cell to stimuli among its receptive field is approximated mathematically by a convolution operation. Convolutional networks were galvanized by biological processes and square measure variations of multilayer perceptron designed to use token amounts of preprocessing. they need wide applications in image and video recognition, recommender systems and language process.

3. Convolution:

The first purpose of Convolution just in case of a CNN is to extract options from the input image. Convolution preserves the spacial relationship between pixels by learning image options victimization tiny squares of computer file.

The convolution layer's parameters incorporates a collection of learnable filters. each filter is tiny spatially (along breadth and height), however extends through the total depth of the input volume. as an example, a typical filter on a primary layer of a CNN may need size 3x5x5 (i.e. pictures have depth three i.e. the colour channels, five pixels breadth and height). throughout the passing, every filter is convolved across the breadth and height of the input volume and work out dot product between the entries of the filter and therefore the input at any position. because the filter deform over the breadth and height of the input volume it produces a 2-dimensional activation map that offers the responses of that filter at each spacial position.

Intuitively, the network can learn filters that activate once they see some form of visual feature like a3 fringe of some orientation or a blotch of some color on the primary layer, or eventually entire honeycomb or wheel-like patterns on higher layers of the network. Now, there'll be a whole set of filters in every convolution layer (e.g. twenty filters), and every of them can manufacture a separate 2-dimensional activation map. The size of the Feature Map (Convolved Feature) is controlled by 3 parameters.

III. EXISTING SYSTEM

Face recognition is being employed during a type of globe applications these days. Despite of its importance, face recognition method still contains several problems like changes in face expressions, create variations, occlusions and illumination. Face is implausibly an important part of flesh that's visually used for recognition purpose. A face expression could be a suggests that of nonverbal communication that plays a significant role to exchange impressions between each other.

Its importance implausibly will increase for hearing impaired individuals wherever face expression is that the solely thanks to communicate with one another. The face region is any divided into native and world options. Facial expressions vary from person to person thanks to totally different cultures, inborn ability could adapt from their fore fathers or additional significantly because of distinctive facial muscles behavior of people. The studies of facial muscles reveals that paralyze patients don't have the power to supply emotions so as to guage and analyze the outer look of face like facial expressions and one's social feeling human face assessment is employed.

Through out face recognition facial muscles behavior is controlled mistreatment parameterization committal to writing schemes supported muscles actions. 2 basic parameterization schemes ar (FACS) and (FAPS). because the facial muscles contract and relax with the looks of emotions on face, they're accustomed visibly assess the facial movement. primarily FACS is employed for psychological analysis. every face expression is pictured mistreatment forty four action units (AUs) outlined by FACS customary. These customary AUs ar exploited as face markers that ar sometimes termed as management points on face. The action units ar any classified into twelve AUs on the premise of higher portion of the face and eighteen lower face AUs and ar used as controlled fiducially points on face whereas remaining ar the additive AUs. Ying-li et al in 2001 conferred transient options as higher AUs and in transient options as lower AUs .

Ashish Kapoor examined automatic AUs by localizing the attention pupil .Pantic acknowledge countenance in static faces still as in expose faces. Similarly, Yongmian and Tibeto-Burman combined Dynamic theorem Network (DBNs) with FACs. FAPS could be a customary of MPEG-4 really accustomed synthesize pictures. The animation or expressions created on faces is one among the most contributions of FAPS in face recognition technology. historically, hexangular image process is employed to boost the sides of any object.

IV. PROPOSED APPROACH

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V. ARCHITECTURAL DIAGRAM

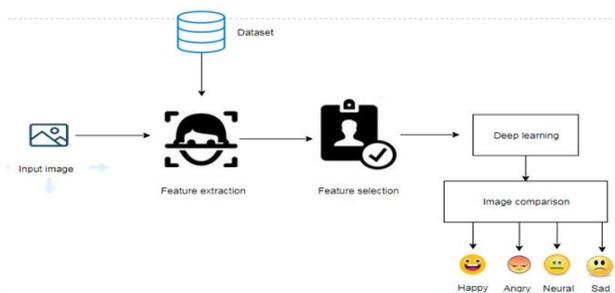


Fig.3 Architectural Diagram.

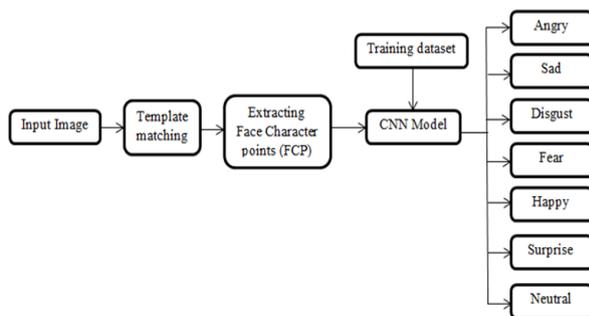


Fig.4 Training Image With Inbuilt Expression

VI. MODULES

- Detection of human face recognition (Module-01)

- To capture the face expressions (Module-02)
- To train a given dataset by CNN model (Module-03)
- Classification of human face expression through given input image (Module-04)

1. Detection of Human Face Recognition:

A operating digital camera Opencv (Open supply pc Vision) may be a pc vision library that contains numerous functions to perform operations on pictures or videos. Opencv library may be accustomed perform multiple operations on videos.It comes with several powerful written material functions. In current situation, techniques like image scanning, face recognition may be accomplished mistreatment opencv.

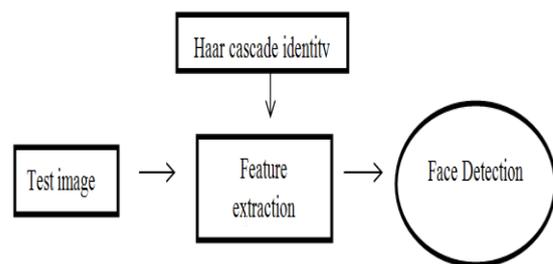


Fig.5 Usecase Diagram (Module 1)

This library may be accustomed perform multiple operations on videos. Let's try and do attention-grabbing mistreatment cv2 or cv supported python version package. Take a video as input by digital camera and break the video into frame by frame and save that frame. Now, variety of operations may be performed on these frames like reversing the video file or crop the video etc.□ Opencv put in □Real-time face detection involves detection of a face from a series of frames from a video capturing device. whereas the hardware needs for such a system area unit much more tight, from a pc vision stand purpose, time period face detection is really a so much less complicated method than detecting a face in a very static image. Frame work: Tensor flow Pre-requisites.

2. To Capture the Face Expressions:

2.1 Procedure to capture the given image: To import the mandatory libraries. Then 'cv2. Video Capture (0)' starts capturing from the default camera(here zero suggests that default camera).Capturing frames in AN infinite loop are next step. After that, we have a tendency to convert the captured video into a gray-scale via 'cv2. COLOR_BGR2GRAY' command (Open -CV captures in Blue-Green-Red as against Red-Green-Blue).We output each the frames(original video and gray-scaled video) by 'cv2.imshow' command To quit from the setup, we'd like to outline a key. In our case "s" is that the key we've outlined to interrupt the loop.

Lastly we have a tendency to unleash all the cameras from the open-CV and destroy all the windows opened within the background. this can be wiped out order to unleash all

the background method happening when quitting the setup.

2.2 Gray Scale Base: Gray data among a face can even be treating as necessary options. facial expression like eyebrows, pupils, and lips seem typically darker than their close facial regions. numerous recent feature extraction algorithms search for local grey minima among metameric facial regions. The input images are first increased by contrast-stretching and gray-scale morphological routines to improve the quality of native dark patches and thereby create detection easier. The extraction of dark patches is achieved by low-level gray-scale threshold. primarily based methodology and consist 3 levels. Faces grey scale behavior in pyramid pictures and it utilizes stratified Face location consist 3 levels. Higher 2 level supported pictures at totally different resolution and therefore the lower level, edge detection methodology.

2.3 Edge Base: This work was supported analyzing line drawings of the faces from images, planning to find facial expression. To at first the photographs square measure increased by applying median filter for noise removal and bar chart leveling for distinction adjustment. Step by step procedure of capture the given image.

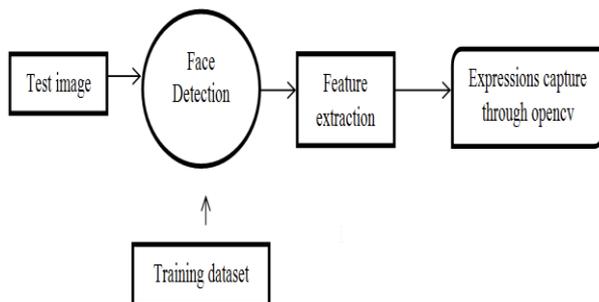


Fig.6 II. Use Case Diagram (Module 2).

3. To Train A Given Dataset Using Cnn Model:

Neural networks gaining way more attention in several pattern recognition issues, seeing, and autonomous automaton driving. Since face detection with category pattern recognition drawback, numerous neural network algorithms are projected. The advantage of exploitation neural networks for face detection is that the feasibility of coaching a system to capture the complicated category conditional density of face patterns.

However, one demerit is that the spec must be extensively tuned (number of layers, variety of nodes, learning rates, etc.) to urge exceptional performance. The primary stage having 2 parallel sub networks during which the inputs area unit filtered intensity values from an inventive image. The inputs to the second stage network encompass the outputs from the sub networks and extracted feature values. associate degree output at the second stage shows the presence of a face within the input region. Their network consists of four layers with one, 024 input units,

256 units within the initial hidden layer, eight units within the second hidden layer, and 2 output units.

3.1 Libraries Required: numpy : To method the image matrices open-cv: To method the image like changing them to grayscale and etc. os: To access the filing system to scan the image from the train and check directory from our machines random: To shuffle the information to beat the biasing matplotlib: To show the results of our prognosticative outcome. tensorflow: simply to use the tensor board to check the loss and adam curve our result information or obtained log.

3.2 Opencv: Opencv (Open provide portable computer Vision Library) is associate open provide portable computer vision and machine learning package library. Opencv was built to provide a regular infrastructure for portable computer vision applications and to accelerate the use of machine perception at intervals the economic merchandise. Being a BSD-licensed product, Opencv makes it straightforward for businesses to utilize and modify the code. The library has over 2500 optimized algorithms, that encompasses a comprehensive set of every classic and progressive portable computer vision and machine learning algorithms.

These algorithms is also accustomed realize and acknowledge faces, establish objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, prove 3D purpose clouds from stereo cameras, sew photos on to provide a high resolution image of a full scene, notice similar photos from an image information, subtract red eyes from photos taken practice flash, follow eye movements, acknowledge scenery and establish markers to overlay it with increased reality, etc. Opencv has over forty seven thousand of us of user community and countable form of downloads exceptional fourteen million. The library is used extensively in companies, analysis groups and by governmental bodies.

3.3 Numpy: NumPy is associate descriptor for "Numeric Python" or "Numerical Python". it's associate open provide extension module for Python, that has fast precompiled functions for mathematical and numerical routines. Moreover, NumPy enriches the substitute language Python with powerful info structures for economical computation of multi-dimensional arrays and matrices. The implementation is even aiming at Brodningnagian matrices and arrays. Besides that the module provides Associate in Nursing outsized library of high-level mathematical functions to figure on these matrices and arrays. it is the basic package for scientific computing with Python. It contains varied choices in conjunction with these important ones, a robust N-dimensional array object subtle (broadcasting) functions Tools for integration C/C++ and algorithmic language code helpful pure mathematics, Fourier rework, and

random selection capabilities Numpy Array: A numpy array may well be a grid of values, all of constant kind, and is indexed by a tuple of and integers. the amount of dimensions is that the rank of the array. the shape of associate array may well be a tuple of integers giving the size of the array on each dimension.

3.4 SciPy: SciPy (Scientific Python) is typically mentioned at intervals constant breath with NumPy. SciPy extends the capabilities of NumPy with extra useful functions for decrease, regression, Fourier-transformation and plenty of others. NumPy is based on two earlier Python modules managing arrays. one of these is Numeric. Numeric is like NumPy a Python module for superior, numeric computing, but it's obsolete of late. Another forerunner of NumPy is Numarray, that would be a whole rewrite of Numeric but is deprecated additionally. NumPy may well be a merger of those two, i.e. it's built on the code of Numeric and additionally the choices of numarray.

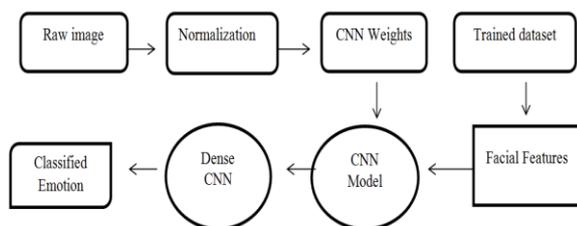


Fig.7 III.Use Case Diagram (Module 3)

3.5 Tensor Flow: Tensor Flow may well be a Python library for fast numerical computing created and discharged by Google. it is a foundation library which will be accustomed manufacture Deep Learning models directly or by practice wrapper libraries that modify the tactic built on prime of Tensor Flow.

4. Classification of Human Face Expression Through the Given Input Image:

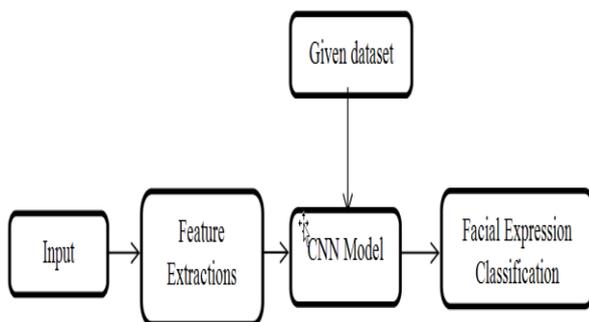


Fig.8 IV.Use Case Diagram (Module 4).

VII. SOFTWARE INVOLVED

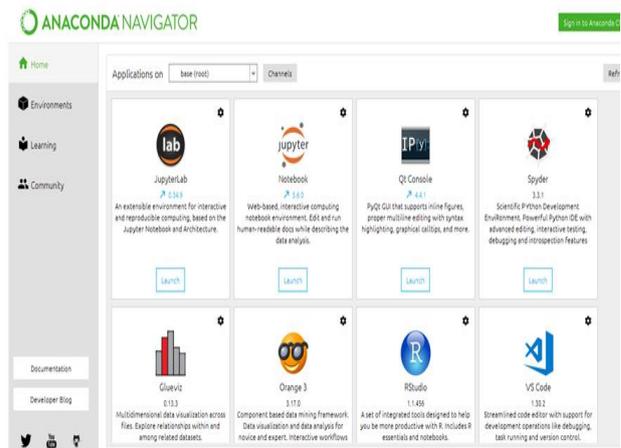


Fig.9 Anaconda Navigator

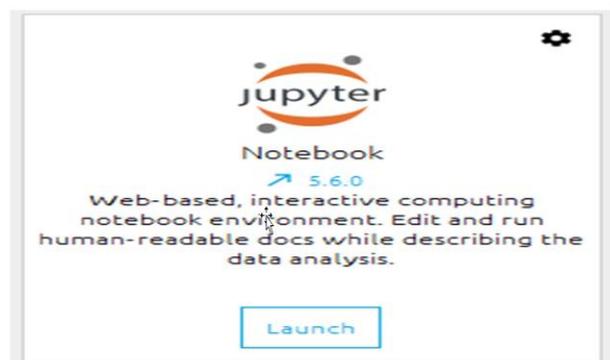


Fig.10 Jupyter

VIII. WORKING

Download and install Euneetes murinus and obtain the foremost helpful package for machine learning in Python. Load a knowledge set and perceive its structure victimisation applied math summaries and data visualisation. Machine learning models, choose the simplest and build confidence that the accuracy is reliable. Python could be a common and powerful taken language.

Unlike R, Python could be a complete language and platform that you just will use for each analysis and development and developing production systems. There also are a great deal of modules and libraries to decide on from, providing multiple ways in which to try and do every task. It will feel overwhelming.

The best thanks to start victimisation Python for machine learning is to complete a project. It can force you to put in and begin the Python interpreter (at the terribly least). It can provide you with a bird's eye read of a way to step through atiny low project. It can provide you with confidence, perhaps to travel on to your own incomes work to implement in Artificial Intelligence environment.

IX. CONCLUSION

Inconvolution neural network is enforced to classify human facial expressions i.e. happy, sad, surprise, fear, anger, disgust, and neutral and that we self-addressed the task of face expression recognition. It classified the image of faces into any of seven distinct feeling classes that represent universal human emotions and experimented with numerous techniques, like fine-tuning and half max-pooling.

X. FUTURE WORK

To extend our model to color images. This will allow us to investigate the efficacy of pre-trained models for facial emotion recognition. To automate this process by show the prediction result in web application or desktop application. To optimize the to implement the artificial intelligence environment.

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