FACE RECOGNITION USING DEEP LEARNING

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ABSTRACT

Face plays a vital role in identifying who we are and how people identify us. it's a human most original physical characteristic. Humans have had the flexibility to acknowledge and distinguish different faces for lots of years. Face recognition could be a widely used technology that is employed in several fields. instead of fingerprint scanning and different biometric technologies folks have shown a lot of interest in mistreatment biometric identification. This technology encompasses an immense demand currently, can still have in the future. The face is each of the ways that differentiate every individual and it's similar to a biometric technology like a fingerprint which varies from person to person. Nowadays in each smartphone, we've got the feature referred to as "face unlock" by that solely the registered face is employed as a key to unlock mobile. This feature provides security and therefore the user needn't waste his/her time by setting passwords and worrying to recollect them further as ever-changing them often for his/her security. Not solely in lifestyle, however, face recognition technology may be utilized in finding Criminals a lot of expeditiously and in less trip of all biometric face recognition is that the sole technology wherever the access is verified while not the presence of the person.

INTRODUCTION

Many people examine our phones to unlock them, when we examine the phone the lock opens because the phone identifies that it was you, biometric identification is that the methodology behind the face unlocks. for instance, after we examine somebody our eyes send a symbol to our brain by distinctive the face patterns then the brain matches those patterns with the one saved in our memory. In the same manner, biometric identification acts just like the human brain. So, When we unlock our phone camera detects the face patterns and checks with the pattern held on in its information, if the pattern matches with the pattern within the information then the phone unlocks. There area unit several advantages by mistreatment biometric identification a number of them area unit preventing crimes By increasing safety and security by mistreatment this we will additionally scale back redundant human interaction we will additionally use it in colleges and offices for group action and verification instead of fingerprint scanner and different life science our future goals are creating this software package a lot of User friendly and adding different options like police work the age of the person beside facial verification.

LITERATURE SURVEY

We might suppose this face recognition technology could be a new issue introduced within the past decade, that is wrong as a result of there has been analysis happening during this topic since the past forty years and there has been immense improvement and development within the systems these days and is simple and quick for the users. plenty of analysis has gone into this technology and varied strategies area unit used like image process, pattern recognition, deep learning, and neural networks and these varied disciplines have enabled today’s users to use these in several applications from life science and up to enforcement. although there has

been plenty of development there have additionally been some drawbacks like each technology out there and a few of those embody police work quite one person and these issues may be overcome by training the face pictures from people so classify the recently returning take a look at pictures into categories. the most obstacle that must be overcome is to discover faces from a disturbing background, and additionally perceive the various facial expressions of the user and analysis may be done to resolve these sub-issues. Their area unit varied strategies within which this downside may be approached and therefore the most ordinarily used methodology is mistreatment Neural Networks primarily based approaches as a result of it's a winning tool for these quite pattern recognition issues and this methodology is additionally according to possess been utilized in one in every of the foremost early cases and has been used since this methodology works by mistreatment little set of pictures and from these pictures an accurate cell can be reported even when the picture provided is very low in resolution and is not clearly visible and also when some of the portions of the input are missing. These neural networks have multiple techniques which will be used as single-layer adaptational neural networks wherever it wants two hundred to four hundred displays for training the classifier and distinctive the facial expressions

PROPOSED METHOD

Architecture/ Flow chart of the proposed work with a description

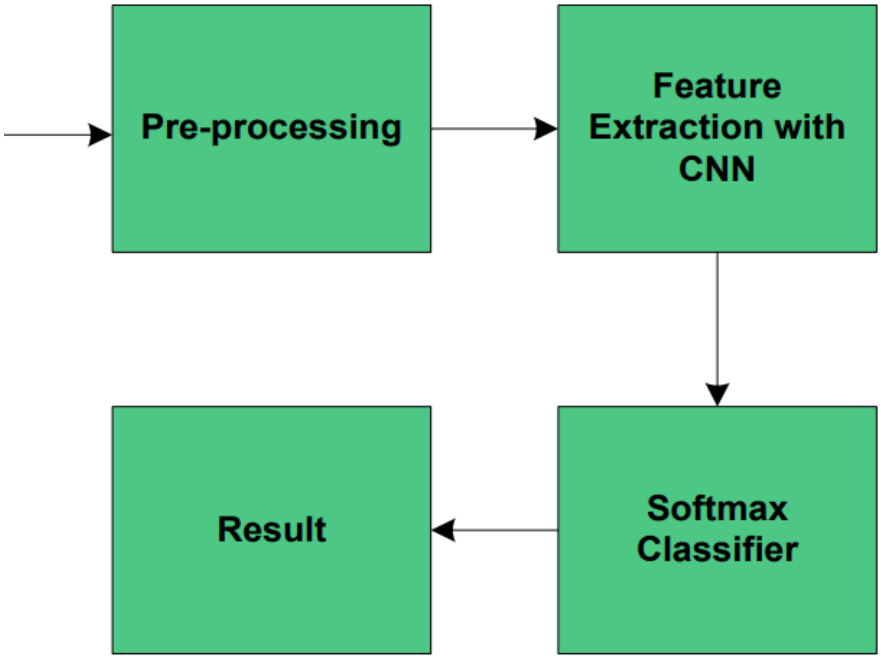
The block schema of the projected CNN recognition formula.

The formula is especially dispensed in 3 steps as below:

1) size the input pictures as 16x16x1, 16x16x3, 32x32x1, 32x32x3, 64x64x1, and 64x64x1.

2) Build a CNN structure with eight layers created from convolutional, scoop pooling, convolutional, scoop pooling, convolutional, scoop pooling, convolutional, and convolutional layers severally.

3) once extracting all options, use the Softmax classifier for classification. Feature Extraction with CNN Softmax Classifier Result Pre-processing. the structure of the feature extraction block of the projected CNN is illustrated. conv1 norm1 pool1 relu1 conv2 conv3 conv4 conv5 relu2 pool2 relu3 pool3 norm2. The structure of the feature extraction block of the projected CNN.



We can use many varieties of algorithms for this implementation a number of them are:

PCA with Artificial Neural Network:

PCA with ANN methodology that acknowledges options of the face pictures are extracted exploitation PCA during this purposed methodology. PCA is a spatiality reduction methodology and retains the bulk of the variations within the knowledge set. It captures the variations in the dataset and uses this info to write in code the face pictures. It computes the feature vectors for various face points and forms a column matrix of those vectors. . After calculating the feature vector it calculates the mean of the face then it will normalize each input face image by subtracting from the mean face then computing the covariance matrix for it, and calculate the eigenvalues of the covariance matrix and keep only the largest eigenvalues, then computing the eigenvector for covariance matrix using that matrix eigenface are computed contacting highest information of the face image according to that it will compute the projected image. PCA method computes the maximum variations in data by converting it from high dimensional image space to low dimensional image space.

Deep Convolution Neural Networks:

deep convolution neural network methodology for that they supply details of the formula and training method of their planned face detector, known as Deep Dense Face Detector (DDFD). The key ideas are to average the high capability of deep convolutional networks for classification and have extraction to be told one classifier for multiple views and minimize the process quality by simplifying the design of the detector. to extend the number of positive examples, randomly sampled sub-windows of the pictures and used them as positive examples if that they had over a 50%(intersection over union) with the bottom truth.

Radial Basis Function Neural Networks:

A Radial Basis Function Network (RBFN) may be an explicit variety of neural networks. I'll be describing its use as a non-linear classifier. Generally, once individuals point out neural networks or "Artificial Neural Networks" they're touching on the Multilayer Perceptron (MLP).

Convolutional Neural Network Cascade:

In the framework of deep learning, a fast large-area remote sensing image craft detection methodology of CNN was planned. the exploitation of the transfer-learning methodology, the parameters of the present target detection model were fine-tuned with a small number of samples, and a high-accuracy craft detection model was obtained. supported the geometric feature unchangeability of the craft within the remote sensing image, a district proposal process formula, GFC, was planned to enhance the potency. supported the on top of ways, a cascade specification was designed for large-area remote sensing pictures for craft detection. This methodology does not solely will directly handle large-area remote sensing pictures for craft detection, however, it conjointly overcomes the problem of training a high-accuracy model with a small number of samples.

Bilinear CNN:

The Bilinear CNN methodology for face identification that has shown dramatic performance gains on certain fine-grained recognition issues bridges the gap between the texture models and part-based CNN models. It consists of 2 CNN's whose convolutional-layer outputs are increased exploitation outer product at every location of the image. The resulting Bilinear feature is placed across the image leading to associate order less descriptor for the whole image. This vector is often normalized to produce extra unchangeability. If one in all the feature extractors was a section detector and also the different computed local options, the resulting Bilinear vector will model the representations of a part-based model. On the opposite hand, the Bilinear vector conjointly resembles the computations of a Fisher vector, wherever the native options are combined with the soft membership to a collection of cluster centers exploitation associate outer product. The ensuing design may be a directed acyclic graph (DAG), each of the networks is often trained at the same time by back-propagating the gradients of a task-specific loss operation.

A mathematical model with its description

Convolution neural network basic structure

Neural networks are often divided into 2 sorts, a biological neural network is one in all of them, and an artificial neural network is another kind. Here primarily introduces artificial neural networks. a man-made neural network may be a knowledge model that processes info and is analogous in structure to the conjugation connections within the brain. The neural network

consists of many neurons; the output of the previous neuron is often used because of the input of the latter neuron. The corresponding formula is as follows

$$h_{W,b}(x) = f\left(W^T x\right) = f\left(\sum_{i-1}^{3} W_i x_i + b\right)$$

This unit is additionally known as the logistic regression model. once several neurons are connected along, and after they were layered, the structure will currently be known as a neural network model. Figure one shows a neural network with hidden layers.

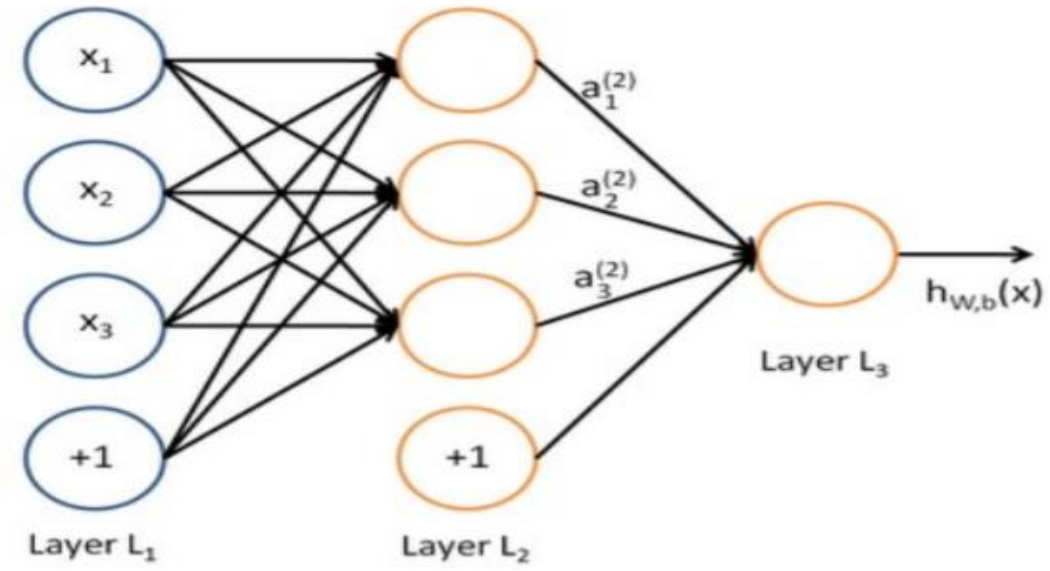


Figure 1. Neural Networks.

In this neural network, X1, X2, X3 are the input of the neural network. +1 is that the offset node conjointly referred to as the intercept term. The left column of this neural network model is that the input layer of the neural network, the right column of that is that the output layer of the neural network. the center layer of the network model may be a hidden layer, that is connected between the input layer and also the output layer. The values of all the nodes within the network model can't be seen within the training sample set. By observing this neural network model, we will see that the model contains a complete of three input units, three hidden units, and one output unit. Now, use it to represent the number of layers within the neural network, and also the range of layers during this neural network is three. currently mark every layer, the primary layer is often expressed by L1, then the output layer of the neural network L1, its output layer is L1, during this neural network, the subsequent parameters exist:

$$(\mathrm{W}, b) = \left(W^1, b^1, W^2, b^2\right)$$

Given that the set of parameters W and b are given, we can use the formula hw,b(x) to calculate the output of this neural network. the subsequent formulas square measure calculation steps:

$$a_1^2 = f\left(W_{11}^1 x_1 + W_{12}^1 x_1 + W_{13}^1 x_1 + b_1^{(1)}\right)$$
$$a_2^2 = f\left(W_{21}^1 x_1 + W_{22}^1 x_1 + W_{23}^1 x_1 + b_2^{(1)}\right)$$
$$a_3^2 = f\left(W_{31}^1 x_1 + W_{32}^1 x_1 + W_{33}^1 x_1 + b_3^{(1)}\right)$$
$$h_{W,b}(x) = a_1^3 = f\left(W_{11}^2 a_1^2 + W_{12}^2 a_2^2 + W_{13}^2 a_3^2 + b_1^{(2)}\right)$$

Algorithm with its description

Convolution layer: A "kernel" of size, for instance, 3X3 or 5X5, is passed over the image and a real number of the initial constituent values weights outlined within the kernel is calculated. This matrix is then passed through an activation function "ReLu" that converts every negative value in the matrix to zero.

Pooling layer: A "pooling matrix" of size, for instance, 2X2 or 4X4, is passed over the matrix to cut back the scale of the matrix therefore on highlight solely the necessary options of the image.

The types of pooling operations:

1. Max Pooling may be a sort of pooling during which the max value within the pooling matrix is placed within the final matrix.

2. Average Pooling may be a sort of pooling during which the type of all the values within the pooling kernel is calculated and placed within the final matrix.

Fully connected layer: the final matrix is flattened into a one-dimensional vector. This vector is then passed into the neural network.

EXPERIMENTAL SETUP AND RESULT ANALYSIS

Software/hardware - Google Colab
libraries used - Keras, TensorFlow, Numpy, Pandas, Matplotlib, Sklearn

Results

```
accuracy :
0.9375
Confusion matrix, without normalization
[[8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
 [0 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
 [0 0 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
 [0 0 0 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
 [0 0 0 0 6 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0]
 [0 0 0 0 0 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 8 0 0 0 0 0 0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 8 0 0 0 0 0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0 8 0 0 0 0 0 0 0 0 0 0 0]
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 [0 0 0 0 0 0 0 0 0 0 0 8 0 0 0 0 0 0 0 0]
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 [0 0 0 0 0 0 0 0 0 0 0 0 0 8 0 0 0 0 0 0]
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 [2 0 0 0 0 0 0 0 0 0 0 2 0 0 4 0 0 0 0 0]
 [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 8 0 0 0 0]
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 [0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 6 0 0]
 [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 8 8]]
```

	precision	recall	f1-score	support
0	0.80	1.00	0.89	8
1	1.00	1.00	1.00	8
2	1.00	1.00	1.00	8
3	1.00	1.00	1.00	8
4	1.00	0.75	0.86	8
5	1.00	1.00	1.00	8
6	1.00	1.00	1.00	8
7	0.67	1.00	0.80	8
8	1.00	1.00	1.00	8
9	1.00	0.75	0.86	8
10	1.00	1.00	1.00	8
11	1.00	1.00	1.00	8
12	0.80	1.00	0.89	8
13	1.00	1.00	1.00	8
14	1.00	1.00	1.00	8
15	1.00	0.50	0.67	8
16	1.00	1.00	1.00	8
17	0.80	1.00	0.89	8
18	1.00	0.75	0.86	8
19	1.00	1.00	1.00	8
avg / total	0.95	0.94	0.94	160