



Effectiveness of new algorithms for facial recognition based on deep neural networks

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Abstract

The applications of image classification occupied a wide field in the recognition of faces using the Convolutional Neural Network (CNN) with the mathematical aspect of deep learning based on the MATLAB program. This is not only facial recognition, but also recognizing the parts of the face, eye, mouth, and nose after designing programs in addition to the new algorithms with the theory of CascadeObjectDetector and trainCascadeObjectDetector. The benefit of this work emerges in the areas of security, airports, markets, and so on.

Keywords: Convolutional, Neural Networks, face detection, MATLAB, eyes, mouth, nose, deep learning.

1. Introduction

Image data features that are represented by using deep learning of neural networks where they are dealt with between the layers that are formed by creating a program in the MATLAB program. The idea of the neural network is inspired by the biological neural network.

The great role that the neural network plays in machine learning is due to the advantage that the neural network has the ability to address nonlinear problems in data models. The technique is multilayer sensory perception (MLP) one of the most important typical techniques for the neural network. This type of neural network has a role in high-quality connections that produce a completely complete structure with fully connected inputs to the following layers in architecture, the result is that the structure of the input is ignored. That work with deep learning have used CNN hierarchy for

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facial recognition [5]. The importance of deep learning in medical applications is evident in detecting mammography blocks [17].

The Basic Learning feature is shown using Sparse Convolutional Neural Networks CNN Where this technique was used to scan the image to search for objects [26]. using the mathematical operations to sense the vision of moving objects intended to monitor the movement of cars, bicycles and pedestrians on the road, a limited number of objects was reached with limits 8 per second [4].

and develop a complete system of face recognition [9]. A MATLAB-Based Convolutional Neural Network Approach for Face Recognition System), [7]. Age Classification based on RBF Neural Network [23]. A MATLAB-based Convolutional Neural Network Approach for Face Recognition [10]. For microorganism discovery and semantic segmentation, a hierarchy is used due to the rich feature [24]. A convolutional neural network approach with object recognition [19].

All previous sources or works that delved into the field of images and deep learning in which the face and objects in the image were distinguished, lack interest in using the time spent and the amount of information.

The development in the field of deep learning has taken place in Image Net Classification with Deep Convolutional Neural Networks [22]. 'Max-Pooling Convolutional Neural Networks for Vision-based Hand Gesture Recognition'[18]. Neural Networks from Overfitting in [12]. Batch normalization: Accelerating deep network training by reducing internal covariate shift. [6]. In [20] the diversity was made in the aforementioned field, for example, skin, face, colour, and gender.

As for [21] the problem has been further complicated by the lighting of the face and its expression algorithms interested in detecting face and image data have many applications, for example monitoring the driver's face [11].

[15] An algorithm that detects the face, which contains two stages, namely, learning and the feature that is specific to facial features without the need for light. In the grey level after the vertical projection in the displayed image of the face, the location of the face is highlighted [16]. The image data is dealt with in face recognition with the help of the power of the neural network, which is one of the multi-layer techniques to complete the file for the design to produce the flat structure to be completely connected with the input due to the stacking of the huge nodes in addition to the big data of the input that led to the permutations all in the vector training for input [2].

In recent periods, the rapid development of technology has been taken advantage of to be able to reach and achieve difficult and distant goals to facilitate areas of life, including artificial intelligence and machine learning to solve complex problems through computer technology and vision, and through the creation and creation of algorithms to analyze and classify images such as discovering objects with the YOLO algorithm and the Fast Detector YOLO [3]. In [8, 13], the PCA theory is used to detect the face after training the network quickly and Viola Jones theory for a number of faces are as for the Coronavirus, it has a large share in this field, in which technology has played an important role in detecting the (Covid-19) epidemic and adapting to this epidemic [1].

[25] Kanade Lucas Tomasi (KLT) which is a simple way to recognize the face during the movement of the head and track it using different methods and functions with the help of the Matlab program. The importance of deep learning in the field of images in facial recognition, and the many advanced technologies such as assisting the driver in discovering lanes, discovering pedestrians and parking lots, demonstrate the importance of MATLAB in this field, as it is easy to create and connect network layers together.

In this work, how to create a convolutional neural network (CNN) through deep learning classification for image recognition is developed. With MATLAB software, the problem of big picture data is solved, where this data that cannot be stored is stored, as more than one image is efficiently recognized by building a convolutional neural network (CNN).

In this work, new and fast algorithms have been proposed that have proven their efficiency through the results in Table 1, and the role of mathematics in dealing with colour images and the detection of face parts in different times and place has been highlighted. Finally, the threshold factor and its role in programming MATLAB to reveal the face of images was revealed.

2. Research Method

The goal in this work training a simple deep neural network to classify digits constructed by the network layers and train the network with a test this network finally evaluated the accuracy and confusion matrix of the network. The large group of data that can be stored in training neural networks that are the convolutional layers that contain it from the training features is computationally intensive and contains GPU high performance that helps to accelerate the process Figure1 Ability to automatically learn many images using the convolutional neural networks. Millions of image files have deep learning that helps in accessing these files efficiently. One of the most important applications for deep learning is image files. The MATLAB program provides important functions for this purpose. Computer vision and machine learning are applications that help expedite the processing of reading groups Pictures automatically.

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Computer vision and machine learning are applications that help expedite the processing of reading groups Pictures automatically. Figure 1 represents a process of CNN.

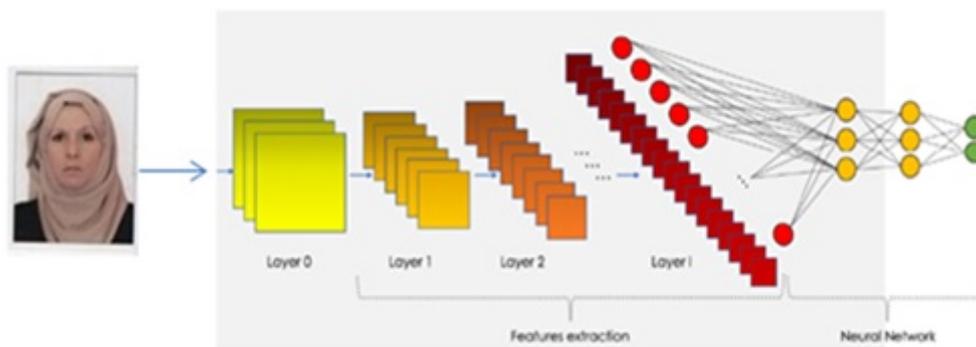


Figure 1: many images using the convolutional neural networks

2.1. Mathematical Aspects

In this section, a new algorithm is created using convolutional neural networks suitable for face recognition, where the data store is the a number of images to be displayed, and algorithm 1 is stored to calculate and store data for a large number of images, in the last layer the example can show the efficiency of the proposed algorithm. The data is used for training using the software application

that was designed. A 28x28 pixel image was used. N represents the nucleus of the single filter for the centre of each pixel to pass over all channels in equation (2.1). The dimensions of the filter are calculated DF.

$$DF = (F, F, m_c) \tag{2.1}$$

To represent the mathematical process in equations (2.2)-(2.6)

$$C(I, N)_{x,y} = \sum_{i=1}^{m_H} \sum_{j=1}^{m_W} \sum_{N=1}^{m_C} N_{i,j-N} I_{x+i-1,y+j-1,N} \tag{2.2}$$

$$\dim(C(I, N)) = \left(\left[\frac{m_H + 2P - F}{S} + 1 \right], \left[\frac{m_W + 2P - F}{S} + 1 \right] \right) \quad S > 0, \tag{2.3}$$

If $S = 1$ equation (2.3) will be

$$(m_H + 2P - F, m_W + 2P - F), \tag{2.4}$$

$$\dim(P(I, N)) = \left(\left[\frac{m_H + 2P - F}{S} + 1 \right], \left[\frac{m_W + 2P - F}{S} + 1 \right], m_C \right) \quad S > 0, \tag{2.5}$$

If $S = 1$ equation (2.5) will be

$$(m_H + 2P - F, m_W + 2P - F, m_C) \tag{2.6}$$

Layers will be reduced by the CNN process that takes place after training. The Work planning provided in Figure 2

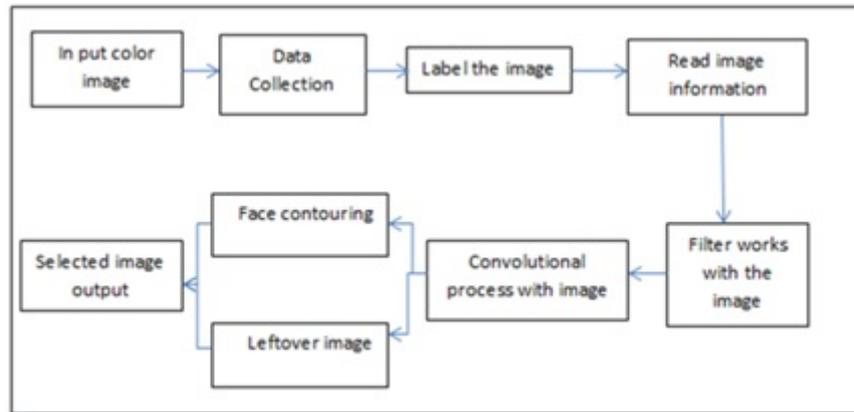


Figure 2: Work planning provided

The technology used to combine layers for facial recognition in Figures 3 and 4.

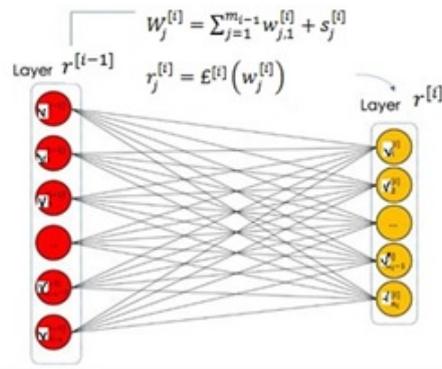


Figure 3: Layer Connection



Figure 4: Program effect

2.2. Face Part Identification (FPI) Algorithm

Input color image
 Output Face Part Identification (FPI)

Step 1: Read the image in the program MATLAB Determine the size of the image and with the three layers of the basic beech

Step 2: The image work is underway with The image size will change with the effect of the filter used

Step 3: Under the influence of programming the properties of the object are determined

Step 4: In this step, a threshold that directly affects an array of values is determined

Step 5: The face is determined and by repeating the same steps by controlling the threshold value, the eyes, mouth and nose are determined respectively

3. Application of the algorithm (FPI)

Using the MATLAB program and using the convolutional neural network (CNN) training process, samples of the same person are used with changing time and state and by the influence of the threshold factor. Figure 5 illustrates the process of identifying the face, eyes, mouth and nose

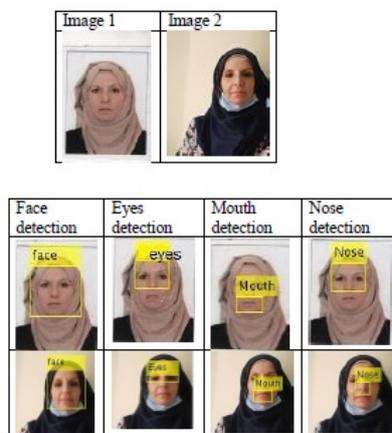


Figure 5: illustrates the process of identifying the face, eyes, mouth and nose

4. Discussion of results

The program designed with the Matlab program in its modern version to recognize the faces of a group of people in Figure 6 and 7, which shows the result is 98%

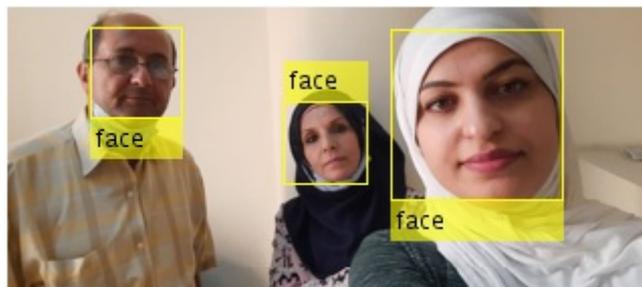


Figure 6: recognizing faces with new design

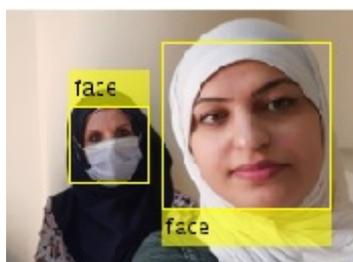


Figure 7: shows the efficiency of Face recognition despite wearing a mask

Display the results reached for results for recognition of the face and its parts. The new algorithm proved its correctness through has been reached. The program was designed on the basis of MATLAB of parts of the face with the effect of the threshold factor. After training the convolutional neural network, the effect of the threshold was proven on the matrix in Table 1 the efficiency and validity of the new algorithm In this work, new and fast algorithms have been proposed that have proven their efficiency through the results, and the role of mathematics in dealing with colour images and the detection of face parts in different time and place has been highlighted. Finally, the threshold factor and its role in programming Matlab to reveal the face of images was revealed that consist of Detected face parts.

Table 1: shows the values that consist of BB box of the faces whose parts are to be revealed.

Image 1	Face detection	Eyes detection	Mouth detection	Nose detection
<i>threshold</i>	11	[1,6]	7,8,...	9,10
<i>BB box</i>	[19,40,50,50]	[26,43,33,28]	[30,71,27,10]	[26,43,33,28]
Image 2	Face detection	Eyes detection	Mouth detection	Nose detection
<i>threshold</i>	11	1,2,3	4,5,....	10
<i>BB box</i>	[74,103,58,58]	[79,120,47,11]	[90, 143, 27, 16]	[93,128,21,17]

5. Conclusion

The convolutional neural networks (CNN) is a developed technology derived from the traditional neural network (ANN), but it overcomes the problem of the limited number of hidden layers, which contributed to obtaining solutions results faster and with high accuracy.

In light of the results obtained, a number of conclusions were reached, namely:

- use of the convolutional neural network system resulted in abandoning the trial and error method in choosing the number of hidden nodes that make up an industrial neural network.
- use of deep learning in training the neural network freed it from falling into the problem of partial solutions (Local minima) that appears when using the backward propagation algorithm. The time required to train the artificial neural network using the CNN less than the time required to train the same neural network if used the back propagation algorithm in the training process, as well as the number of operations executed during training is less than the one executed through the use of the back propagation algorithm (BP).
- The possibility of developing artificial intelligence techniques for the purpose of producing a new technology that can provide the best and optimal in finding solutions to scientific and applied problems.

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