IJCSE International Journal of Computer Sciences and Engineering Open Access

Research Paper Vol.-7, Issue-3, March 2019 E-ISSN: 2347-2693

Measuring The Accuracy of The Facial Images Using Convolutional Neural Networks in Deep Learning

Kuppili Rakesh[1*], Marepalli Kamala Kumari [2]

[1,2]Dept. of Computer Science, College of Engineering, Adikavi Nannaya University, Rajahmundry, India

DOI: https://doi.org/10.26438/ijcse/v7i3.476480 | Available online at: www.ijcseonline.org

Accepted: 07/Mar/2019, Published: 31/Mar/2019

***Abstract*—** Deep learning methods are good in achieving success while dealing with the computer vision and face recognition problems. In deep learning, convolutional neural network is a step head while comparing with other methods. Till now face recognition has done with large dataset to learn face representations, which has low efficiency because of the large dataset. The proposed convolutional neural networks fringe deep learning neural networks to learn face representations from small data set. This system consists of four layers convolution, ReLu, pooling and fully connected layers. Here the training set has to be synthesized and augmented then make the data set double in size for efficient power of generalizing the data with convolutional neural network.

***Keywords*—** Deep learning, face recognition, small dataset, small training dataset, augmented dataset, synthesized data, convolution neural networks

I. INTRODUCTION

Face recognition is the path toward seeing the substance of an appropriate individual by a fantasy structure. It has been a basic human-PC association mechanical assembly in light of its use in security structures, get the opportunity to control, video surveillance, business districts also, even it is used in casual associations like Face book as well. After quick headway of man-influenced awareness, to go up against affirmation has in reality pulled in thought as a result of its nonintrusive nature and since it is essential method for person recognizing verification for human when it is differentiated and distinctive sorts of biometric strategies. Face recognition can be adequately checked without the subject person's data in an uncontrolled condition.

As the historical backdrop of face acknowledgment is studied, it is seen that it has been tended to in many research papers. Conventional techniques dependent on deep learning have been confronting difficulties like posture variety, facial masks, lighting of the scene, the unpredictability of the picture foundation, and changes in outward appearance. Deep learning based strategies can remove increasingly confounded face highlights. Deep learning is making pivotal advances in taking care of issues that have limited the best endeavors of the computerized reasoning network for a long time. It has turned out to be astounding at uncovering complex structures in high-dimensional information and in this way material to bunches of spaces of science, business and government. It tends to the issue of learning various leveled portrayals with a solitary calculation or a couple of calculations and has principally beaten records in picture acknowledgment, normal dialect preparing, semantic division and numerous other true situations.

Starting late, significant convolution frameworks have gained exceptional ground in the domain of computer vision. Face affirmation has been one of its generally investigated and most captivating applications. The importance of face affirmation is a direct result of its specific troubles and wide potential application in video surveillance, character confirmation, blended media applications, home and office security, law prerequisite and differing human-computer association works out. The nearness of a person in an image is an outcome of the regular effects of the illumination, present, 3-D structure of face, obstacle and establishment which are uncontrolled confinements that are knowledgeable about real applications. As of late, profound learning strategies, explicitly CNN has accomplished amazing outcomes on face acknowledgment in unconstrained condition [1]. CNN learning based highlights are stronger to complex intra-individual varieties. Another difficult issue is the hypothesis capacity of the face affirmation structures. The readiness of CNN models demonstrates incredible execution with generous getting ready datasets, yet they are not sensible for picking up from couple of precedents. In such cases the usage of significant learning is put off as the framework will over fit truly with smaller getting ready data [2].

To manage this issue, age of additional synthetic training data has been examined by various scientists. The basic focal points of synthetic training data is that there is an uninhibited control over the unsettling influence factor of tests and needed number of getting ready tests can be generated. Data synthesis has also been associated with other affirmation issues like, object revelation, content affirmation and scene understanding. Data augmentation is one other basic system which has been used to deal with the issue of lack of getting ready data [2]. It is particularly like data blend, anyway less requesting to execute. It is progressively limited in, that available getting ready pictures are turned without affecting the semantic class names. These consolidate turn, altering, scaling, applying uproar, etc.

In this work, we generally propose a response for training deep CNNs using small dataset. The proposed balanced deep learning neural network uses the data augmentation system to manufacture the amount of getting ready tests. Face recognition rate is upgraded liberally by means of setting up the CNN on augmented data [3]. We likely display that the augmented getting ready datasets truly upgrades the power of CNNs.

Rest of the paper is organized as follows, Section I contains the introduction of CNN and measuring the face accuracy while testing, Section II contain the related studies that which are helpful to the research, Section III contain the related work which tells about the previous research work related to face recognition, Section IV contain the proposed approach, section V explain the experimental analysis and results, Section VI describes conclusion, Section VII contain references.

II. RELATED STUDIES

A. Face recognition using deep learning

Deep learning strategies are a piece of machine learning techniques dependent on learning different dimensions of portrayal and deliberation that understands information, for example, pictures, sound, and content. Deep learning replaces high quality component extraction with effective calculations for unsupervised or semi-administered highlight learning and various levelled highlight extraction.

In past couple of years, deep learning has demonstrated extraordinary execution in characteristic dialects or natural languages, speech recognition and computer vision. Deep learning these days is commonly fixated on multilayered neural networks. The deep neural models are: feedforward neural systems, recurrent neural systems and convolutional neural systems. Feedforward systems sends unstructured information from one end called input to the contrary end called output; so they are called feedforward. Where face recognition is going to execute by utilizing convolutional neural networks.

B. Data augmentation and synthesis

Large training datasets can be made effectively accessible for some recognition issues, the accessibility of large supervised dataset is the key for machine learning to succeed, and this is valid specifically for amazing deep CNN models with a large number of parameters. To help data lack in visual recognition endeavours, data augmentation has been used to incorporate more models by applying clear image changes that don't impact the semantic level image label. Data augmentation, be that as it may, is restricted to moderately straightforward image changes.

The proposed approach relies upon extending the training datasets with noisy samples gotten by applying Poisson noise or Gaussian noise on every case of the training set.

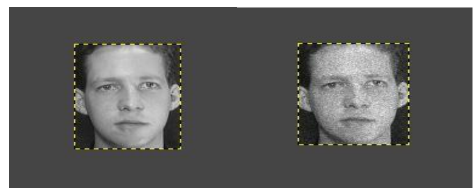

Figure 1. Image without synthesis and with synthesis

III. RELATED WORK

A. Face Recognition using Modified deep learning neural network

This face recognition structure was essentially revolved around recognizing the faces that are given even those images contains the noise, in this proposed system dataset used for training the model is little when appeared differently in relation to the datasets that are used in other face recognition strategies.

Here this framework utilized Convolutional neural system to get prepared by the train dataset. This face recognition framework comprises of one set of CNN layers that are utilized to extricate the highlights of the facial images, in this data augmentation has been finished by integrating the image samples from the training dataset. By this methodology for constrained training data, generous improvement in recognition rate 95% is accomplished.

B. Face Recognition based on the Convolutional neural networks

In this face recognition structure face will be recognized by using the Convolutional neural network, where it has used Georgia Tech database which contains huge data or images. If the data is huge, by then it is hard to run the estimation and make model to learn face precedent will take extra time. It may gives the better results anyway in case it will use bundle of time to run the estimation then its best to pick the best computation in time point of view. It has used Convolutional, normalization, pooling, ReLU, Fully related as the layers in the deep neural networks.

The essential burden of this structure is, it won't get acquainted with the face representations of the noise data. This will decrease the precision while there is any noisy image has given to recognize.

C. Face Recognition based on the Convolutional neural networks and Support Vector machine

In this feature extraction of the faces have been done by a one of artificial neural network, CNN acknowledges the image as its information, which remarkably keeps up a vital separation from huge data proliferation and complex feature extraction in the ordinary recognition estimations. The weight sharing is the major favoured stance of CNN that makes it progressively like the biological neural network. Likewise, the weight sharing unimaginably reduces the multifaceted nature of the CNN system and decreases the amount of parameters to be resolved. Weight sharing is recognized through the convolution system, which is useful for the consequent treatment to the facial feature map. Convolution is the system that channels the image until it explores the whole image.

$$y_j^l = f\left(\sum_{i \in M} x_i^l - 1 \times k_{ij}^l + b_j^l\right)$$

SVM to recognize faces as its splendid execution in handling straight inseparable issue. SVM may find an optional detaching hyper plane, which makes the division of the training samples close it development. SVM is wanted to restrain observational danger and sureness between time to achieve incredible quantifiable fundamentals of samples and improve the theory limit of machine learning. For straight undefined issue, SVM maps commitment to low estimations into a higher estimation feature space that makes division more straightforward.

D. Research on face Recognition based on Deep learning:

This examination essentially depends on the recognizing faces using deep learning thought, it has accomplished the accuracy of the 87% by using the religious network, it has used LFW dataset for achieving that accuracy.

The primary artificial neural network used to recognize the face is a single layer flexible network. In any case, its capacity to impediment factors, for instance, sentiments, movements, establishments and refuges, cannot improve yield. Deep learning deals with this issue, not only to ensure accuracy, yet notwithstanding ensure the generosity of the figuring.

The face recognition for the LFW (labeled face in the wild) database with unsupervised feature learning systems that practiced 87% recognition. Deep learning has a key favoured outlook over machine learning for other face recognition methodologies. To begin with, low-level features can be picked up from rough data that is no planning. Second, complex joint efforts can be distinguished from the features.

IV. PROPOSED APPROACH

In order to address the issue of low recognition rate on more diminutive datasets in deep learning based face recognition systems; we propose a modified deep learning technique. In this approach, we use the data augmentation technique for extending the amount of training data and improve the generalization power of network. The best feature of this approach is that it is direct and easy to complete. The augmented training set contains additional images made by applying Poisson and Gaussian noise on the principal training samples. This combines the range of the training set. Here we are utilizing olivetti faces dataset by AT&T Laboratories which has accomplished 79% of the face recognition rate while training the CNN model with standard AT&T face database. By the data augmentation approach we will accomplish 96.5% of recognition and the block diagram of the approach has been shown in Figure 2.

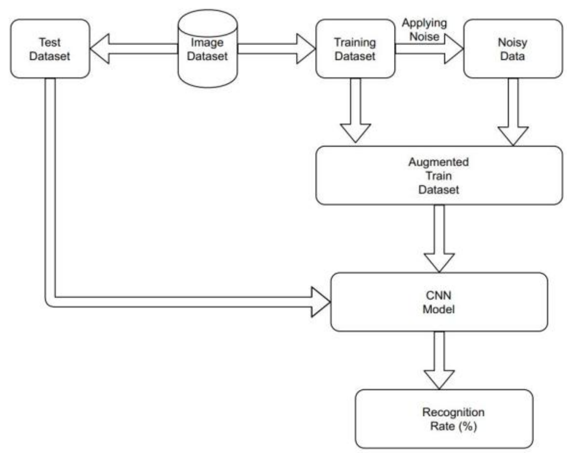

Figure 2. Block Diagram of the Proposed Approach

A. Convolutional Neural Network Architecture:

Our entire overview of machine learning and neural networks so far have been making ready to this point: understanding Convolutional Neural Networks (CNNs) and the activity they play in deep learning.

In customary feedforward neural networks, each neuron in the data layer is connected to each yield neuron in the accompanying layer – we look at this as a fullyconnected (FC) layer. In any case, in CNNs, we don't use FC layers until indisputably the last layer(s) in the network. We would in this manner have the capacity to describe a CNN as a neural network that swaps in a specific "convolutional" layer rather than "fully-connected" layer for no short of what one of the layers in the network.

A nonlinear commencement work, for instance, ReLU, is then connected to the yield of these convolutions and the strategy of convolution => activation continues (close by a mix of other layer types to help diminish the width and stature of the data volume and help decline over fitting) until we finally accomplish the completion of the network and apply a couple FC layers where we can get our last yield groupings. The architecture of the convolutional neural networks has been shown in the Figure 3. And the layers functionality has been described.

Image Input Layer 1: 112 × 92
Convolution Layer 2: 3 × 16 × 1, padding – 16
RELU Layer 3:
Maxpooling Layer 3: 2×2, stride – 2
Convolution Layer 4: 3 × 32 × 1, padding – 32
RELU Layer 5:
Maxpooling Layer 6: 2×2, stride – 2
Fully Connected Layer 7: 40
Softmax Layer 8:
Classification Layer 9:

Figure 3. CNN Architecture

1. Convolutional Layers:

The CONV layer is the middle building square of a Convolutional Neural Network. The CONV layer parameters contain a set of K learnable filters (i.e., "kernels"), where each filter has a width and a stature, and are nearly for each situation square. These filters are pretty much nothing (to the extent their spatial dimensions) yet connect all through the full depth of the volume.

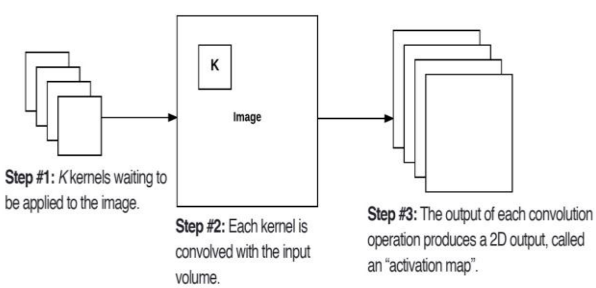

Figure 4. At each convolutional layer in a CNN, there are K kernels applied to the input volume. **Middle:** Each of the K kernels is convolved with the input volume. **Right:** Each kernel produces an 2D output, called an activation map.

2. RELU Layer:

After each CONV layer in a CNN, we apply a nonlinear activation function, for instance, ReLU, ELU, or any of the other Leaky ReLU varieties referenced We consistently imply activation layers as RELU in network diagrams as since ReLU activations are most commonly used, we may moreover fundamentally state ACT in either case, we are illuminating that an activation function is being connected inside the network architecture.

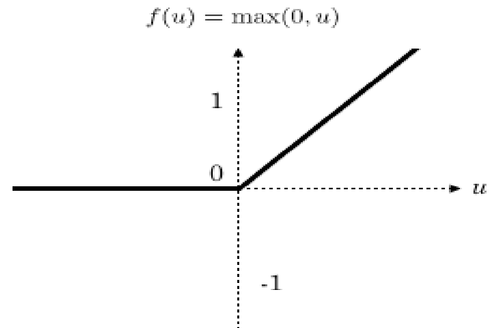

Figure 5. ReLu Activation Function

3. Pooling Layers:

The fundamental function of the POOL layer is to progressively reduce the spatial size (i.e., width and height) of the data volume. Doing this empowers us to decrease the proportion of parameters and figuring in the network – pooling moreover causes us order over fitting.

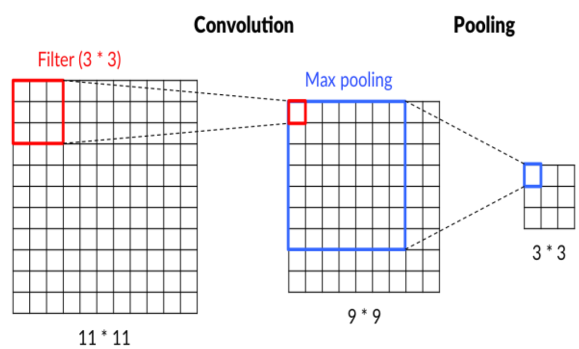

Figure 6. Pooling Layer

4. Fully-connected Layers:

Neurons in FC layers are fully-connected to all activations in the past layer, similar to the standard for feedforward neural networks. FC layers are constantly set toward the finish of the network (i.e., we don't make a difference a CONV layer, at that point a FC layer, trailed by another CONV) layer.

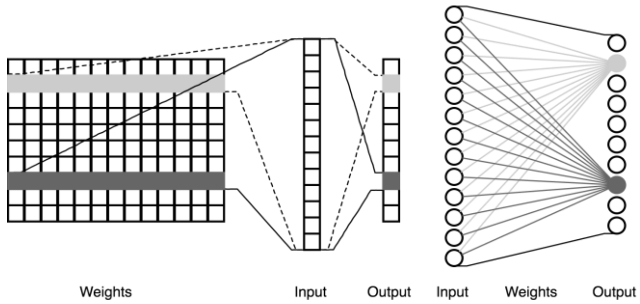

Figure 7. Fully Connected Layer

V. EXPERIMENTAL ANALYSIS AND RESULTS

For this framework the examinations are facilitated on AT&T face database. The function of the above cleared up technique of using augmented training set made by data augmentation to the training set is recognized. The dataset contains forty subjects, with each subject having ten image samples of size 112 X 92 each. In this examination, the execution of the proposed procedure has been surveyed reliant on the rate recognition rate of the network for the testing set.

Our usage depends on MATLAB. For this we need to pick some the image samples as the training set and from training set we will choose a portion of the image samples of each subject, at that point apply Poisson noise or blend the image samples. At that point add those blend data to the training samples for making the augmented dataset. This implies multiplying the size of the training samples. Here noisy images are going to help in recognizing the noisy data that we have given.

Now this augmented data is given to the CNN model or network to train the model. For training the model we have to set our choices with learning rate as 0.001, and quit training after 80 epochs. We keep the batch size as 30 and momentum as 0.9 for not getting degraded execution with little dataset. Ensuing to training the CNN model with the augmented dataset then the testing set is recognized by the trained model and the execution is constrained by the rate recognition rate.
This whole methodology is repeated on various occasions to find the better performance. The performance is used to compare in between the other methods and the recognition rate for different ratios of training and test datasets have been showed up in the underneath table 1.

Table 1. Recognition rate for different ratios of training and test datasets

CNN Model Accuracy	Number of images in Augmented dataset							
	1	2	3	4	5	6	7	8
	42.78	65.94	89.5	96.25	97	97.5	95.83	98.75

VI. CONCLUSION AND FUTERSCOPE

Starting late, convolutional neural networks have pulled in a ton of consideration in the field of face recognition. In any case, deep learning methods vivaciously depend upon colossal training data, which is not continually available. To deal with this issue in the field of face recognition, we propose another face synthesis technique which swaps the facial pieces of different face images to generate noisy data. Later on, we will apply this technique to more employments of face analysis. For instance, the proposed data synthesis technique can without a lot of a stretch be used in training CNN-based face area, facial property recognition, and so on. Even for the most part, the strategy applies to any things which are all around sorted out. The constraint of this system is that it uses supervised learning with human-remarked on data. The deep learning models are regularly huge, so they demand large memory and increasingly computational power which can be satisfied with the use of GPUs.

REFERENCES

[1] V.P. Vishwakarma, "Illumination normalization using Fuzzy Filter in DCT Domain for Face Recognition," International Journal Of Machine Learning and Cybernetics, Vol. 6(1), pp. 17-34, February 2015.

[2] V. P. Vishwakarma, "Deterministic learning machine for face recognition with multi-model feature extraction," Ninth International Conference on Contemporary Computing (IC3), Noida, 2016, pp. 1-6, 2016.

[3] G. Hu, X. Peng, Y. Yang, T. Hospidales, and J. Verbeek. "Frankenstein: Learning Deep Face Representations using Small Data," arXiv:1603.06470v2, 2016.

[4] M. Jaderberg, K. Simonyan, A. Vedaldi, and A. Zisserman. "Synthetic data and artificial neural networks for natural scene text recognition," arXiv:1406.2227, 2014.

[5] K. Simonyan and A. Zisserman. "Very deep convolutional networks for large-scale image recognition," In ICLR, 2015.

[6] Zur, Richard M. et al. "Noise Injection for Training Artificial Neural Networks: A Comparison with Weight Decay and Early Stopping." Medical Physics 36.10 (2009): 4810–4818. PMC. Web. 15 Apr. 2017.

[7] J. Papon and M. Schoeler. "Semantic pose using deep networks trained on synthetic rgb-d," arXiv:1508.00835, 2015.

[8] G. Hu, Y. Yang, D. Yi, J. Kittler, W. J. Christmas, S. Z. Li, and T. M. Hospedales, "When face recognition meets with deep learning: an evaluation of convolutional neural networks for face recognition," CoRR, abs/1504.02351, 2015.

[9] Umme Aiman, Virendra P. Vishwakarma "Face Recognition using Modified Deep Learning Neural Network," 8th International Conference on Computing Communication and Networking Technologies, pp. 3-5, July 2017.

