CHAPTER 21

Face Recognition Using Deep Neural Network

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Abstract: Abstract: There is rapid development in the field of image processing. Now, there are a lot of models for face recognition in the whole world. In the field of image recognition, the arrival of deep learning theory has evolved drastically. In today's world, biometric is used everywhere and the expectations from the system are that it provides positive results in any kind of situation as the quality, alignment, facial expression, and reflection of the picture make it difficult for the machine to validate it. Thus, there is an alternative model to the traditional neural network model which is Convolutional Neural Network (CNN) models which are deep learning models. This model includes the process in which at first the machine is trained with the data set and then the validation is done.

Keywords: Convolutional Neural Network, Deep Learning, Face Recognition, Machine Learning, Microsoft Azure.

INTRODUCTION

Image Processing has a significant stage named Image Segmentation [1]. As we know today's scenario, there are various projects/guides developed on face recognition using Artificial Intelligence and deep learning. Hence, Deep Learning is based widely on training and database collection [2]. Face Recognition is a difficult issue in the field of vision and biometric recognition because of different changes such as present varieties and outward appearances in face recognition the key issue is face extraction [3]. Also, it is quite unpredictable but deep learning makes it easier. Deep Learning makes facial information much accurate and improves the technology. So, a better result is achieved [3]. Also, CNN (Convolutional Neural Network) in the era of Deep Learning has been improved compared to the traditional ones based on precision, capacity, and speed of identification, clarification. To identify the face properly one first needs to be" clear the picture" in a sense to remove the blurriness. Hence, the equation to the motion blurring problem is generated [4]. CNN concentrates on highlight data of

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

the image, which can successfully lessen the element of image information, and don't have to diminish the element image information independently [5]. Computer vision-based deep learning techniques are used to recognize human facial expressions [6]. An enormous technique of figuring out the gender classification, the iris recognition, the lip, the mouth, *etc*. have been examined. Therefore, the difference between the male and female is generated through the researches [7]. In the following paper, we have discussed the following methods using Microsoft Azure, whereas the first step is collecting a database whereas for example for a single human face we collected pictures in a way that every angle and feature is visible and then the next step is the model preparation using Microsoft Azure Machine Learning software and the accuracy of the model is observed. Feature extraction is one of the major factors that is considered as a major factor as the model accuracy depends on them. Also, a histogram is prepared to check and stick to the accuracy of the extracted feature of the human faces.

LITERATURE REVIEW

The work based on CNN was used and the realization on the face was divided into two parts which are network training and implementation. Whereas the recognition speed and accuracy are specified by 99.4% [2]. The program and implementation of each feature of the face are taken by the algorithm that is prepared, the database, and the implementation done by the common face database, but the result is not always improving [3]. DNN training system, which takes a favorable position of both the SoftMax misfortune and triplet misfortune capacities, has been proposed for productive face recognition. The viability of the proposed DNN preparing structure on the LFW dataset and four distinctive face datasets [4]. Also, the designs of both DNN and CNN were compared based on the performance and the quality in terms of the recognition rates. The face is being recognized in a way that it was taken in the real-time facial expression with emotions *etc*. and hence the recognition rate was specified [6]. The classifier determines the Euclidean distance between datasets using the K-Nearest Neighbor algorithm [8]. The local features are used to recognize the objects [9].

METHODOLOGY

Azure Machine Learning Studio (AMLS) is an Azure-based software. Azure is Microsoft's Cloud service. In 2015 Microsoft introduced AMLS, which is too new a technology. With AMLS, machine authorization models are exploited, verified, and used. Some identical technologies are Google Cloud Machine Learning Engine and Amazon Sage Maker. Getting started with the use of AMLS, one

needs to have a Microsoft Account. You can create and analyze all types of non-Azure models subscriptions.

Model Description

Creating what is called a prepared data is a tedious process. Specific modules of preprocessing data are added to the raw data. It takes a long time to create prepared data from raw data. It may take a long time to select the raw data. The algorithm of the machine to run is selected by the data scientist. It also decides on the data aspects being prepared for use, and ultimately examines the outcome. The ultimate aim is to evaluate the composition of the algorithm of machine learning and trained data that provide the most valuable results. Fig. (**1**) represents the process of Model building and execution.

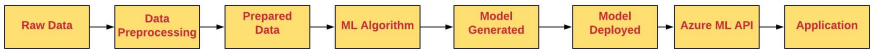

Fig. (1). Process of model building and execution.

For the creation of the model. Following steps must be taken and are shown in Fig. (**2**).

Fig. (2). Block diagram of the process.

Import Data

The feature excel sheet that is generated is provided to the model as input. In the paper, the features are taken from the image analyzer tool in MATLAB.

Selection of Columns in the Dataset

The features that should be taken from the excel sheet is sorted out and are then processed further.

Split Data

The data and the features that are selected from the above set are then split for the training and testing of the model. Further, the datasets are divided into train, test, and validate the model.

Algorithm of Machine Learning

According to the expected accuracy, the algorithm is hence developed.

Train Model

Make your data available to the configured model to learn from the patterns and generate statistics that is be used for predictions. The Studio "Train Model" module is intended to form a classification or regression model. The training takes place as soon as we defined a model and its parameters and need marked data. The model is created to generate an existing model with new data. To use the trained model to predict new values, connect it to the specified model module with the new input data.

Score Model

The evaluation model produces an anticipated incentive for the class and the likelihood of the anticipated worth. Include a prepared model and a record with new information. The information must be in an organization that is perfect with the kind of prepared model. The construction of the information record ought to for the most part additionally coordinate the mapping of the information used to assemble the model. For picture grouping models, the rating is the article class in the picture or a Boolean worth that shows whether a specific component is found.

Evaluate Model

Measure the accuracy of a trained model or compare several models.

The algorithms used in the Machine learning for calculation of the accuracy and get the results accordingly:

Multiclass Decision Forest

A decision tree is a fixed model that quickly creates a series of decision trees and learns from the marked data. The algorithm creates multiple decision trees and then selects the most popular output category. Such histograms are obtained by the averaging process and the result is transformed to determine the "possibilities" for each mark. Trees with a high degree of predictive credibility are more appropriate for the final set decision.

Multiclass Logistic Regression

It is used to predict many values. It is used to forecast the possibility of an outcome, which is especially important for scheduling tasks. The algorithm

estimate that an event occurs by adapting the data to an accounting function. It also predicts several outcomes.

Multiclass Decision Jungle

This module analyzes the model and its parameters, and then connects a set of labeled training data to train the model using one of the training modules. By merging tree branches, a decision DAG generally has less memory and better generalization performance than a decision tree, but at the expense of a slightly longer training.

Multiclass Neural Network

Create a neural network model that predicts a multiple-value target. Classification through neural networks is a supervised learning method and therefore requires data entry marked with a label column. Train the model by providing the model and the log entry for the educational model. One can add many hidden layers between the input and output layers. Most anticipation work is simplified easily with a single layer or with a few hidden layers. All nodes in one layer are connected to nodes in the next layer with weighted edges. The value is determined by calculating the weighted sum of the node values from the previous level. Fig. (**3**) represents the model based on a Multiclass Decision Forest for face recognition.

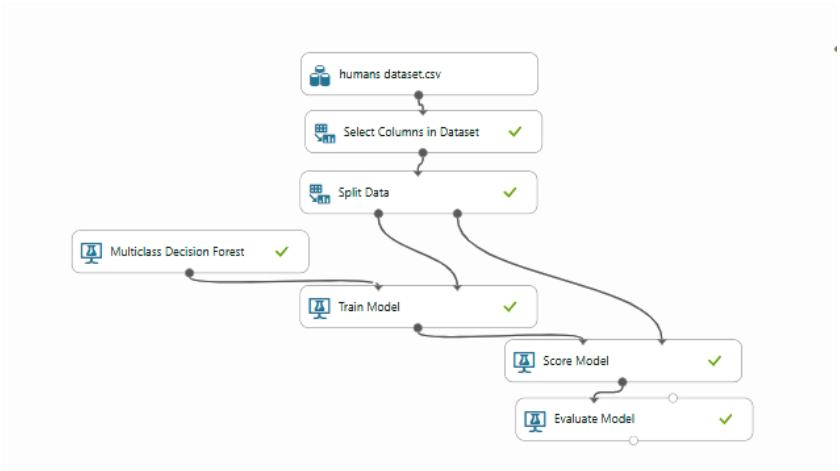

Fig. (3). Evaluating a multiclass decision forest model in microsoft azure training experiment.

The predictive experiment of the multiclass model is shown in Fig. (**4**).

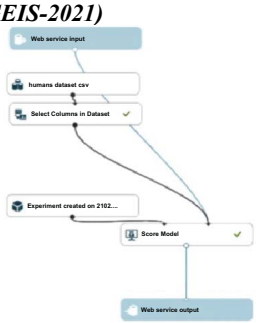

Fig. (4). Evaluating a multiclass model in microsoft azure in predictive experiment.

ANALYSIS AND RESULT

The result obtained by running an ML algorithm for prepared data is a model. The first model created is not the most suitable. Data scientists continue to test the best machine learning algorithm and have prepared data combinations that make up the best model. Once an effective model has been obtained, the next step is to implement that model. Implementation is important because the application is used for the algorithm generated by the model. Deployment helps in recognizing patterns that help in resolving the issue much effectively than it could have been done manually. Fig. (**5**) shows the parameters and prediction of sample data. Thus, machine learning generates an effective and time-saving solution. The confusion matrix is shown in Fig. (**6**). The histogram of the model is shown in Fig. (**7**).

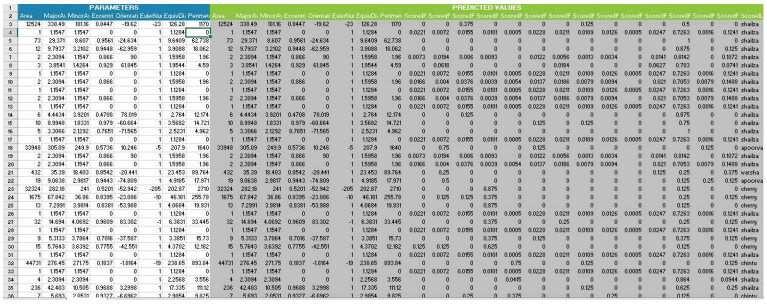

Fig. (5). Parameters and prediction of sample data.

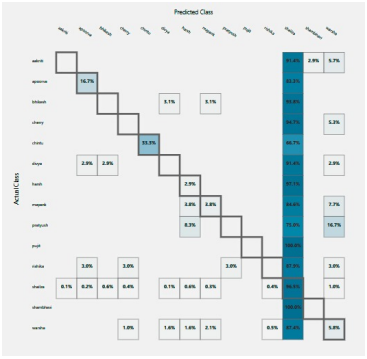

Fig. (6). Classification model of the confusion matrix.

Metrics

Inspecting evaluation results of Fig. (**8**) after running the experiment and observed the performance of the model. The available estimation parameters for the regression models are as follows: mean absolute error, absolute base error, relative absolute error, quadratic relative error, and decision coefficient. Here the word "under" reflects the difference between the foretold value and the actual value. In general, the absolute value or square of this difference is determined to represent the entire extent of the error in all cases, since in some cases the difference between the expected value and the real value are negative. Error calculations calculate the efficiency of a regression model as the average deviation from the real values of its predictions. Each row shows the instances of the true or real class in its record, and each column represents the instances of the class that the model predicted. The importance of using different methods in the Microsoft azure Learning studio is to ensure the best result with the most appropriate accuracy is obtained. Hence both the Training experiment and the Predictive Experiment helps to get the appropriate result. The maximum accuracy obtained in the model is through the multiclass decision forest algorithm.

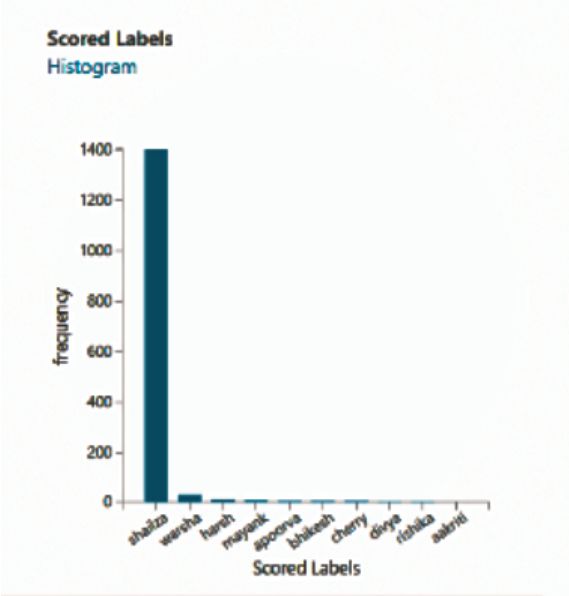

Fig. (7). Histogram of model.

rows 1489 columns 24

ties	Scored Probabilities for Class "mayank"	Scored Probabilities for Class "pratyush"	Scored Probabilities for Class "pujit"	Scored Probabilities for Class "rishika"	Scored Probabilities for Class "shailza"	Scored Probabilities for Class "shambhavi"	Scored Probabilities for Class "warsha"	Scored Labels
	0.010947	0.012578	0.000459	0.024727	0.726275	0.001595	0.124128	shailza
	0.010947	0.012578	0.000459	0.024727	0.726275	0.001595	0.124128	shailza
4	0.001257	0.003437	0	0.014098	0.814199	0	0.107234	shailza
	0	0	0	0	0.375	0	0	apoorva
	0	0	0	0	0.125	0	0.25	harsh
	0	0	0	0	1	0	0	shailza
	0	0	0	0	0.25	0	0.5	warsha
	0.010947	0.012578	0.000459	0.024727	0.726275	0.001595	0.124128	shailza
	0.010947	0.012578	0.000459	0.024727	0.726275	0.001595	0.124128	shailza
	0	0	0	0	0.625	0	0.25	shailza

Fig. (8). Multiclass Decision Forest Evaluation.

SUMMARY AND CONCLUSIONS

The working and the best result could be achieved by Deep Learning. Hence the face was recognized and the most accurate algorithm that is observed by the accuracy is Multiclass Decision Forest. In the future, transfer learning based on the deep neural network can be applied for face recognition for better performance with a very large amount of datasets. Model parameters optimization and standardization can also improve the model accuracy and minimize the cost function.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENT

Declared none.

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