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Classification of Image using Convolutional Neural Networks

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Abstract: ***Now a day, with the rapid advancement in the digital contents identification, auto classification of the images is most challenging job in the computer field. Programmed comprehension and breaking down of pictures by framework is troublesome when contrasted with human visions. A Several research have been done to defeat issue in existing classification system,, yet the yield was limited distinctly to low even out picture natives. Nonetheless, those approach need with exact order of pictures. This system uses deep learning algorithm concept to achieve the desired results in this area like computer. Our framework presents Convolutional Neural Network (CNN), a machine learning algorithm is used for automatic classification the images. This system uses the Digit of MNIST data set as a bench mark for classification of gray-scale images. The gray-scale images are used for training which requires more computational power for classification of those images. Using CNN network the result is near about 98% accuracy. Our model accomplishes the high precision in grouping of images.***
Keywords: Convolutional Neural Network (CNN), deep learning, MINIST, Machine Learning.

I. INTRODUCTION

Now a day, due to the intense development of digital content, auto classification of images has become most critical task in visual information indexing and retrieval systems. Computer vision is an synthesizing and sub-specialties of artificial intelligence (AI) that give similar capability of user to computer for better understanding information from the images. Several research were made to overcome these disadvantages, but these research consider the few features of image primitives and these image features will not helpful to process the images.

Image classification is a major problem in computer vision. The human's point of view, the image understanding is easy task, but in case of computer system it's too much hard and expensive. That is, each image is made up of set of pixels and each pixel is represented with different values.

For classification of images, it must perform large number of calculations. For that purpose it requires higher configuration systems and more computing power, time etc.

In [1], has detailed information of extraction of the features from Hyper Spectral Images (HSI) using Convolutional Neural Network (CNN) and deep learning. This also uses the various pooling layers in CNN for extraction of the feature like nonlinear, invariant etc. from the HIS. These are useful for image classification.

In this technique, the image pixels are clustered into groups or parts without intervention. In real world, the availability of labeled data is too much less. So that unsupervised classification is done in several cases. In [2] supervised classification techniques that examine and train the classifier on these labeled images and extracts features.

These days, Deep learning algorithms are provides correct and successful results in the areas like computer vision. The Convolutional Neural Network, a machine learning algorithm is widely used for the image classification. In [3], it uses deep learning algorithms for classifying the quality of wooden boards by using extracted data of texture from the different wood images. In [4], has discussed automated recognition of cattle images using CNN which is helpful to extract the required characteristic or features from the cattle images and Support Vector Machine (SVM) methods are used for classification of such images.

The Convolutional layer is more important and core building block and it has learnable filters as parameters. Each filter in layer is small but it extends across the depth of the input volume. The 2-dimensional activation map is calculated by using dot product of input and entries of filter for every filter. The pooling layer is used in down sampling process the image without losing any data from the image.

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II. MATERIALS AND METHODS

Image classification is a worldwide research area in the field of deep learning, Human Computer Interaction, Pattern recognition. In [5], classification of images is done by extracting the some features from these images. Most intermediate feature learning methods focuses on the process of coding, but in this case they emphasize the mechanism behind the image composition. It also strongly reflects the extraction of features from the image.

In [6], it has elaborate classification of different Natural images using biological stimulated model. It uses a well-known analogous progress in visual information system and inference procedure of human brain. This biological stimulated model primarily used for image analysis and Natural classification. It also uses the low-level features in the images to automated extraction of important relationships between those images. This system has limitation in the human visual system to achieve higher accuracy in classification of images.

In [7] it has detailed discussion about spoof finger print detection using Convolutional Neural Network (CNN), the aim of biometrics system is to differentiate automatically between subjects in a reliable way and as per target applications basing on one or more signals that are derived from traits like fingerprint, iris, face, voice or writing signature. Biometric technology has more advantages than the traditional security systems that is based on something we want to remember like PIN, PASSWORD and something physically like KEY, CARD etc.

In past years several [8, 9, 10] fingerprint detection algorithms has been proposed and they can be Hardware or Software. In hardware type algorithm specific device is connected to any hardware sensor device to detect the living attribute in the Human such as heart beat rate, blood pressure etc.

A. Proposed System Architecture For Image Classification

Computer vision is a multifaceted field of machine learning and artificial intelligence (AI) and it is concerned with the automated extraction, analysis and understanding the useful information from those images. In recent advancements of technology there is huge growth in digital contents regarding images and several videos. In this field of computer vision understanding and analyzing the images is a critical problem by the computer as compared to human. So that classification of images will be done with help of human intervention. The human uses the Real-time images datasets (MNIST digit images) for training and testing purpose.

Initially, the human will be train classifier to get the expected pattern from the images. Then the images classified with help of pattern accurately obtained from the previous stages. The produced results will vary with respect to the patterns that are observed and it is totally dependent on the knowledge of the person who classifies. In [11,12], has detailed research of deep learning architecture for classification of images also it uses various layers in Convolutional Neural Network (CNN) to extract the new features form the images. Figure 1 shows the components of CNN networks.

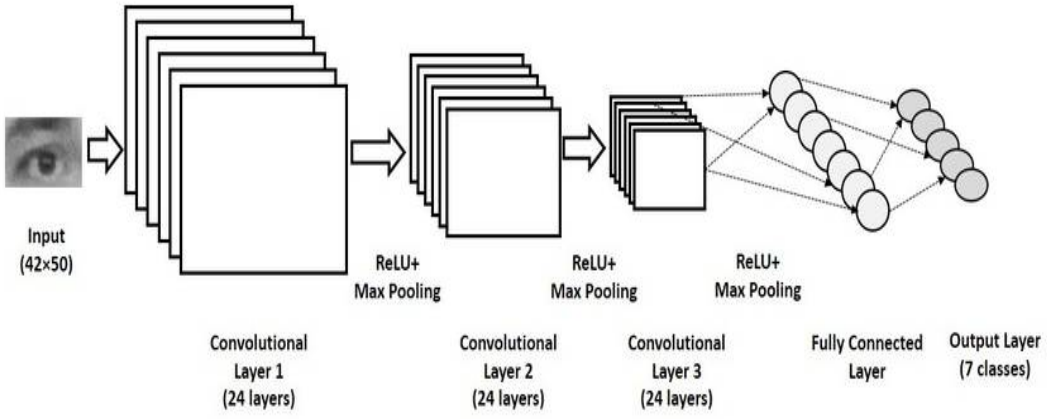


Figure 1: Architecture of Convolutional Neural Network (CNN)

In proposed system, it uses gray scale images as input having 42x50 sizes approximately. The first layer in CCN applied 32 filters on input images; each image size is 3x3 producing 32 feature maps. The second layer is applying 64 filters, each of size 3x3 producing 64 feature maps. Max pooling layer is act as third layer which is used to down sampling the Input Images. The layer four is fully connected layer having 128 neurons and it uses sigmoid activation function for classification of these images and produces the final output image.

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III. RESULTS AND DISCUSSION

A. *Algorithm of Proposed System*

1) Size of each batch =128 , No of classes in Batch = 10, number of epochs = 5,
2) Dimension of input image 42×50,
3) Loading process for the input images from MNIST data set
4) Variable exploration: X=test data set, Train data set
5) Creation and compilation of the models
6) Training of the network.

This algorithm elaborates the general steps that are involved in training and testing the MNIST data set for the image classification in CNN.

Table 1 The loss and accuracy of all epochs

EPOCH	LOSS	ACC	VAL_LOSS	VAL_ACC
1/5	0.3452	0.8957	0.0845	0.9739
2/5	0.3454	0.8957	0.0845	0.9618
3/5	0.0450	0.0877	0.0876	0.9744
4/5	0.0453	0.9856	0.0731	0.9789
5/5	0.0630	0.9813	0.0445	0.9862
Total loss	0.5414	0.9844	0.0444	0.986

IV. CONCLUSIONS

In our paper, we used Convolutional Neural Networks (CNN) for image classification using images form hand written MNIST data sets. These data sets used for both training and testing purpose using CNN. This provides the accuracy rate 97.98%. For training purpose we use small and Gray scale images. Computational time for processing these images is high as compare to other JPG images. The future scope will focus to classify the colored images of large in size.

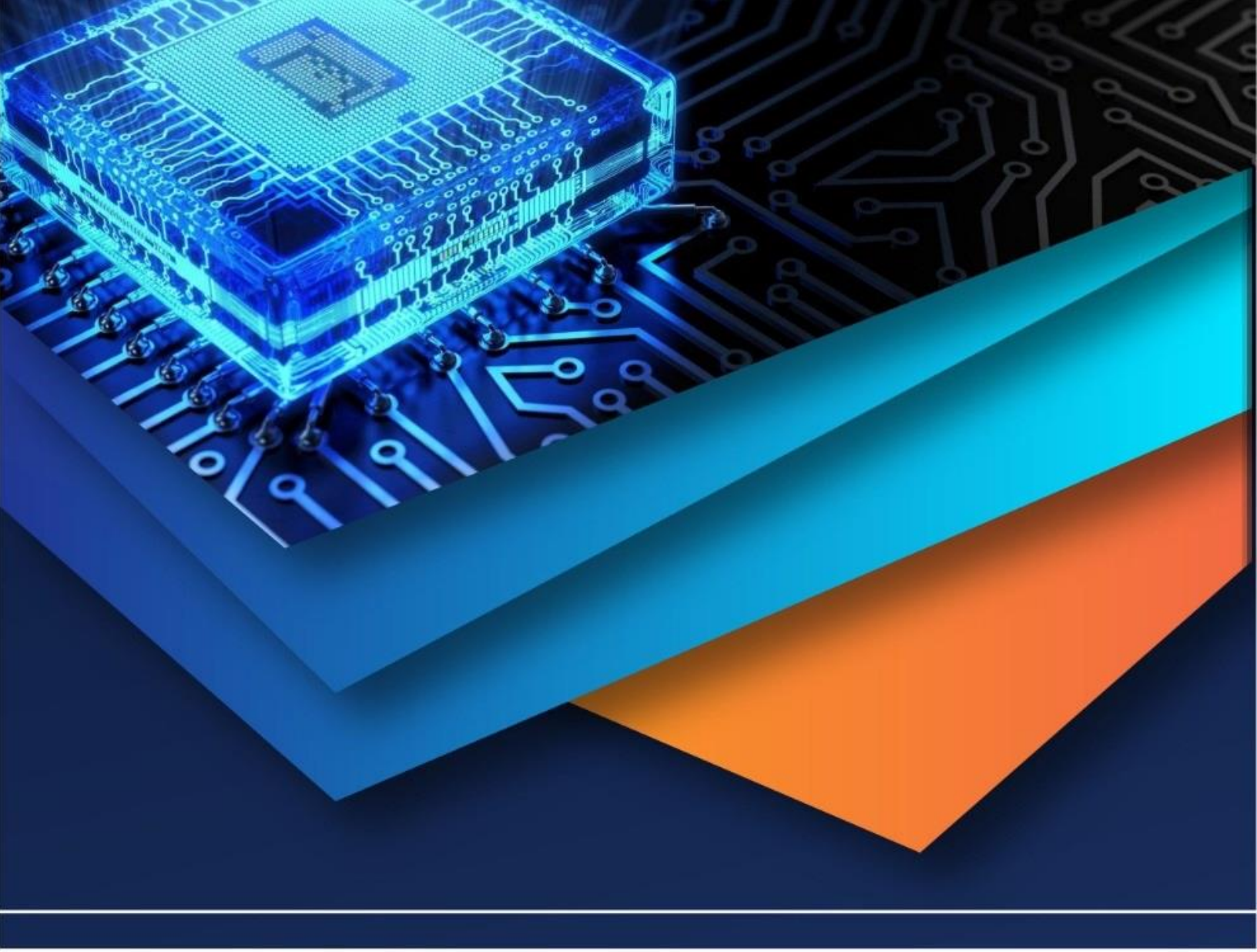
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