Comparisons of Image Classification Using LBP with CNN and ANN

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Abstract

In image classification techniques CNN (convolutional neural networks) has a strong feature extraction capability, which has been used to extract the feature from different class image datasets. Various techniques have been applied to compare the images and to gain the accuracy level. Convolutional neural network and many other algorithms can be for feature extraction like Decision tree, K-Nearest neighbor, and nearest clustering algorithms. In this paper, we performed image classification using CNN and an artificial neural network (ANN) with local binary pattern (LBP) feature extraction technique. One-dimensional (1-D) CNN is implemented to process the feature extraction. The network is trained using the Kaggle dataset of birds and airplanes. The trained classifier model can classify the images into either birds or airplanes. The experimental outcome shows that the proposed technique can provide 77.50 and 62.42 classification accuracy, and the proposed method can also achieve better performance using different datasets.

Keywords

Convolutional Neural Network, Artificial Neural Netwrok, Local Binary Pattern, Image Classification

1. Introduction

The classification technique is the problem of allocating an object into the predefined classes based on attributes extracted from an object. A classifier is built based on a training set with well-known class labels. In deep and machine learning classification is characterized as a supervised learning technique [1]. Classification is used in many real-world techniques like object classification, biometrics, face recognition, text recognition, speech recognition, and cancer detection [2-3]. The neural network (NN) is a computational model which is inspired by the biological nervous system [4]. A neural network works like the human brain. The neural networks are broadly used with applications for business analytics, financial operations, and product maintenance, etc. The neuron is a mathematical function in a neural network that assembles and classifies information according to a particular architecture. It contains layers of interconnected nodes. The different layers may do different types of transformations. The first layer transfers the data from the input layer to the last output layer by traversing many hidden layers. CNN is the most popular technique to improve the accuracy of image classification [5].

The supervised learning technique is used for image classification. It has two phases training and classification phase. In the training phase classifier is used to give the information about the classes and in the training phase learning of a model takes place. The classification phase uses the information which is provided by the training data and classifies the images into the predefined classes. Various algorithms are used for image classification like Decision tree classification, K-Nearest

neighbor classification algorithm, nearest clustering algorithm, ANN and CNN, and so on.

In this paper, local binary pattern (LBP) is used with artificial neural network (ANN) and convolutional neural network (CNN) for classification.LBP was used to extract the feature by comparing the value of its pixel with the neighbor pixel values. At that moment, new values are acquired through every pixel which will be the histogram categorized by the birds and airplane images. The main work of the paper is to build a real-world ANN and CNN network with LBP and used Keras and Tensorflow library. This paper also compared the accuracy level using LBP with ANN and LBP with CNN. It shows that LBP with CNN gives the highest accuracy than LBP with ANN.

2. Related Work

Texture classification contains computer vision and image processing happenings that can be used in many fields, like computer-based medical analysis, etc [6]. The texture feature extraction method LBP is a widely used technique. This is presently combined with the deep learning method which gives better performance in estimating the research results [7]. In the deep learning methods, the convolutional neural network has the greatest important results in image recognition compared to the ANN. Facial recognition was implemented by using the LBP and CNN and the accuracy of the calculation exhibited 95.33% as linked to only CNN presentation assessment with an accuracy of 91.83 [8]. The combined dual-channel CNN +LBP shows better accuracy performance results with a one-dimensional CNN [9]. LBP+ANN is also used to compare the performance evaluation accuracy level [10].

3. Proposed Methods

3.1 Local Binary Pattern (LBP)

LBP was 1stintroduced by T. Ojala (1996), et al., for texture features extraction. The LBP is a nonparametric worker used for the descriptor of local texture features of an image [11]. Main benefit of the local binary pattern remains easiness of execution, in hold grayscale images and object rotation. Histogram can be used to summarize the LBP probability of texture patterns. The value of the LBP is equally calculated on every pixel of the image. Local Binary Pattern has a set of neighbor pixels which range circularly with the middle of pixels in the central. The mean of all neighbor pixels and a middle pixel is usage for the edge value to change the neighbor pixel values to acquire the binary code. This shows in the LBP operation Fig. 1.

The binary codes are multiplied by the binary weight to locate the LBP value in Fig1. The LBP binary patterns reflect the many points, edge patterns, etc. LBP values are denoted through the histograms, it displays the recurrence of existence of many LBP values. Afterward receiving the local binary pattern value from every neighborhood (block x,y) for the dimensions of N*M image. The image texture is denoted through creating a histogram.

Pattern = 00010111
LBP = 16+4+2+1 =23

Figure 1. Example LBP value Calculation.

3.2 Artificial Neural Network (ANN)

ANN is a set of an input-output connected networks in which weight is associated with every connection. ANN contains of one input layer, one or more hidden or intermediate layers, and a output layer. The learning of NN is performed by adjusting the weight connection. Its performance can be increase by updating the weight iteratively based on its connection. Neurons of NN are active by using the sum of input weight. To produce a single output of neurons the activation signal is passed over the transfer function. In the training phase, the interconnection weight is optimized till the network reaches its identified accuracy level. ANN is used in many applications like speech recognition [12], pattern recognition [13], business applications, and medical.

3.3 Convolutional Neural Network (CNN)

As we know that the CNN is a deeplearning classical, in which convolutional channels and pooling layer processes are applied alternatively on local community of each pixel in raw information. It is primarily used for two-dimensional (2D) images, it has achieved a better performance accuracy level in image classification. A one-dimensional is used to process a one-dimensional input, the one-dimensional-CNN is applied for pixel-wise HIS classification which only operates a pixel supernatural vector as the input [14]. Usually, the convolution kernel and pooling procedure scale are one-dimensional. The two pooling layers define by mean and maxpooling are applied succeeding the convolutional layer decrease with the size of feature charts and to cut the amount of the variables. After using the various convolutions and poolings features become a more conceptual and discriminative. The complete connected layer plans learned the feature representation to the classifier.

4. Results

4.1 Experimental Works

The planned classification technique LBP +ANN and LBP +CNN technique is executed in the python program with Keras and Tensorflow library. The subset of the Kaggle dataset bird and airplane is used for the training data. 2000 images are used for training the data and 200 images are used for testing. The proposed model is trained with 50 epochs and the accuracy level of LBP with CNN is better than the LBP with ANN. The Table 1 shows the accuracy difference between the two models ANN and CNN.

Fig. 3 shown that the result of the test images. Fig. 3 shows the bird's misclassification images which mistakenly classified bird image as the airplane image, this may be due to the blurred image, motion, etc. Fig. 4 shows the airplane's misclassification images which mistakenly classified airplane image the bird image.
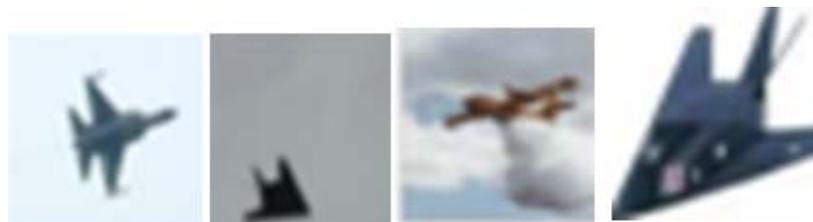
Table 1. LBP + CNN training and testing accuracy

Model	Training	Testing
LBP+CNN	92	77.50
LBP+ANN	92	62.42
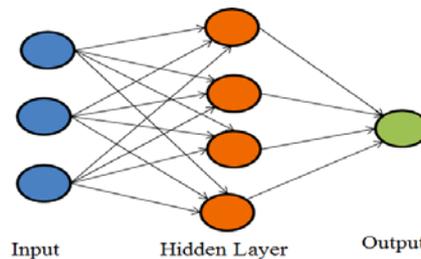
Figure 2. Shows the structure of an artificial neural network.

Figure 3. Bird Misclassification-Bird subjects mistakenly classified as the airplane.

Figure 4. Airplane Misclassification-Airplane subjects mistakenly classified as the bird.

5. Conclusion

This paper shows the classification process using neural network model artificial neural network (ANN) and convolutional neural network (CNN) with local binary pattern (LBP) feature extraction method. There are many algorithms to perform the image classification but the convolutional neural network (CNN) is considered a standard image classification technique. CNN uses GPU technology for a large number of layers. In this paper neural network classifies the images into one and the two predefined classes bird and airplane dataset from the Kaggle. By using the same classification network with different datasets can be used to improve the better accuracy level and can also compare the same dataset with different classification models or techniques.

Acknowledgement

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