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RESEARCH ARTICLE

A COGNITIVE APPROACH FOR FLOWER IMAGE CLASSIFICATION BASED ON CONVOLUTION NEURAL NETWORKS.

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Manuscript Info

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Abstract

This research paper explores the application of deep learning in classification of different flower images. A Deep Neural Network based on Convolution Neural Network is proposed. The paper validates the proposed DNN model for the classification of flower images. The loss and accuracy of the model is reported here.

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Introduction:-

Image classification is one of the common procedure in image processing which is routinely done in mobile and web applications[1]. Conventional methods involve extraction of features from input images and uses feature classifier to detect the nature of the images[2]. Methods based on feature extraction requires user defined features which can be textural or some properties of the image. A feature classifier is selected for identification of images. Some of the commonly used classifiers are Linear Discriminant Analysis (LDA), Decision Tree, Bayes classifier, and Support vector machine[3]. Literature survey on applications of Machine Learning (ML) for image classification reports high classification accuracy when the dataset size is less. There is always a problem of data over fitting with conventional ML methods. Moreover, when the image datasets is large, ML does not provide good generalization capability. These problems are overcome by the recent introduction of Deep Neural Network (DNN) and Deep Learning (DL)[4]. Deep Learning is a new way of performing image classification and has gained recent popularity due to its ease of development and deployment. This research paper validates a custom Deep Neural Network (DNN) and uses deep learning methodologies for training and validation.

Methodology:-

Image classification using DNN is attempted in this research paper. Flower image classification is commonly used in web applications such as style transfer and semantic recognition. Here, a custom network based on Convolutional Neural Network (CNN) is proposed here.

Dataset: For training and validating the proposed Deep Neural Network, the flower image dataset is obtained from Kaggle given in the link: <https://www.kaggle.com/olgabelitskaya/the-dataset-of-flower-images/notebook>. The images are resized to a uniform dimension of 128x128. The images are color images of ten classes of flowers.

DNN Model: The custom model consists of three convolutional neural networks and two max-pooling layers. On the output block it consists of three dense layer and a final SOFTMAX classification layer with 10 neurons signifying the 10 classes of flower images.

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Layer (type)	Output Shape	Param #
conv2d_10 (Conv2D)	(None, 126, 126, 32)	320
max_pooling2d_5 (MaxPooling2)	(None, 63, 63, 32)	0
conv2d_11 (Conv2D)	(None, 61, 61, 64)	18496
max_pooling2d_6 (MaxPooling2)	(None, 30, 30, 64)	0
conv2d_12 (Conv2D)	(None, 28, 28, 64)	36928
dropout_7 (Dropout)	(None, 28, 28, 64)	0
flatten_4 (Flatten)	(None, 50176)	0
dense_10 (Dense)	(None, 128)	6422656
dense_11 (Dense)	(None, 10)	1290
dropout_8 (Dropout)	(None, 10)	0
dense_12 (Dense)	(None, 10)	110
=====		
Total params: 6,479,800		
Trainable params: 6,479,800		
Non-trainable params: 0		
=====		

Fig.1:-The representation of Deep Neural Network proposed for classification of flowers

Results:-

The evaluation of proposed deep neural network in image classification is done using the Kaggle flower image dataset. KERAS, a well-known deep learning library is used in this application. It uses TensorFlow supported by Google for the backend[5]. In this experimental work, a training epoch of 30 was set and Stochastic Gradient Descent (SGD) was used as the optimizer. Fig. 2.shows the training process of the DNN architecture. Fig.2 (A) shows the loss function with the epochs and Fig. 2(B) shows the training accuracy. The weights are stored when the network reaches the highest accuracy of 83%. The obtained weights are used for testing the accuracy of the proposed DNN with the flower images apart from the images used for training. Table 1 shows the prediction of different flower input images with their prediction probability. For the total of 10 test images, 8 flower images are correctly classified thus leading to the test accuracy of 80% for the proposed DNN model.

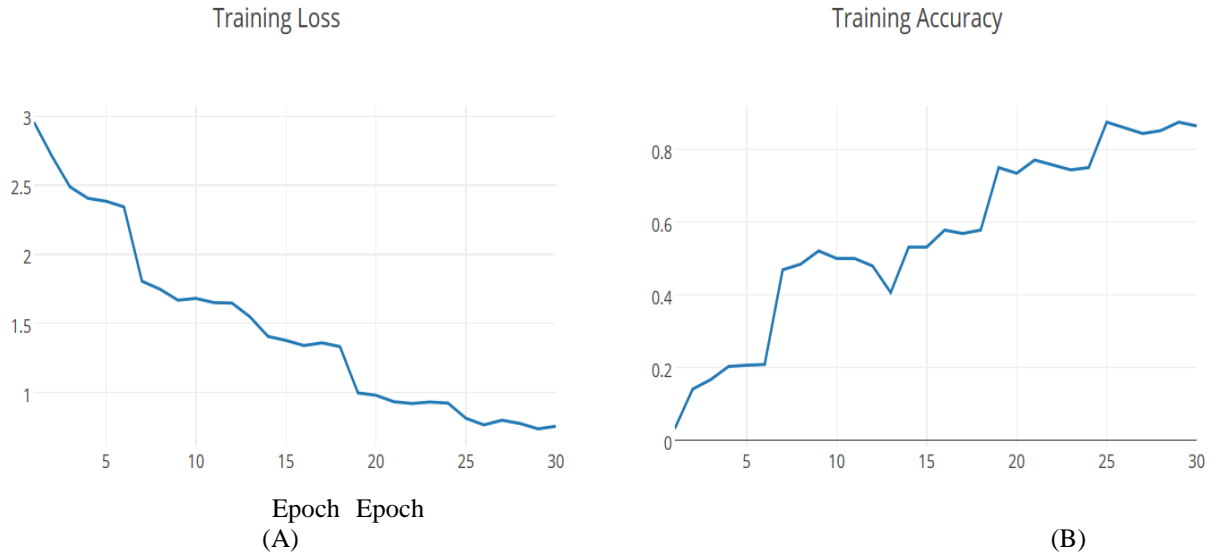


Fig.2:-Training Performance curves (A) Loss Function (B) Accuracy

Table 1:-Classification outcome for test flower images

Test Image	Label	Prediction	Classification Result	Probabilities
0190.png	GOLDQUELLE	GOLDQUELLE	Correct	0.382
0191.png	LEUCANTHEMUM	LEUCANTHEMUM	Correct	0.6217
0192.png	GOLDQUELLE	CALENDULA	Wrong	0.3988
0193.png	ROSE	ROSE	Correct	0.3327
0194.png	AQUILEGIA	AQUILEGIA	Correct	0.3205
0195.png	PEONY	PEONY	Correct	0.5411
0196.png	IRIS	CALENDULA	Wrong	0.3863
0197.png	VIOLA	VIOLA	Correct	0.3116
0198.png	BELLFLOWER	BELLFLOWER	Correct	0.2993
0199.png	VIOLA	VIOLA	Correct	0.3314

Conclusion:-

This research paper proposes a deep neural network based on convolution neural network for classification of flower images. The network attains a maximum training accuracy of 83% and 80% for the test images.

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