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A Dynamic Multi Label Image Classification based on Recurrent Neural Networks

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Abstract: ***The traditional technique used for image recognition has complexity in the construction of algorithm and the training speed for the system to analyze algorithm is also too high so, the computation of the algorithm becomes very difficult in order to overcome this lack of computation. The proposed system is very efficient in both training as well as the computation speed required for the image recognition. Since, the proposed system uses the traditional LSTM algorithm which is one of the backbone factors of the RNN technique as it predicts the input on the basis of sequential analysis as it uses tanh function in order to remove the negative values of the matrix and it also predicts and removes the error in the input with the use of differential formulas in order to formulate the outcome desired for the image to be recognized. Because of this sequential analysis of the data increases the future scope of image recognition in the field of deep learning, and also because of its efficient use of the algorithm in comparison with the existing algorithm like ANN, CNN.***

Keywords: CNN (Convolution Neural Networks), RNN (Recurrent Neural Networks), HSI (Hyper Spectral Images).

I. INTRODUCTION

In the recent years, where technology is developing at a very rapid rate it is very necessary that we also upgrade the existing system which is CNN or ANN which analyses the input on a single basis. It is mandatory that we advance the system to predict the input on the relational or sequential analysis so current propose system focuses on the relational analysis of the input. The algorithm used is recurrent neural network which uses feed forward network in order to analyze the input on the basis of the previous process that has been completed. This feed forward technique reduces the training time since it does not repeat the process which has been previously completed. The current system uses the back propagation algorithm which is nothing but it returns to the previous step until it gets the desired output. This algorithm is applied for every time stamp which BTT (Backpropagation Through Time). This system uses the actual output that is to be achieved as one of the factors to predict the outcome is accomplished by using formula

which the square of difference of the actual output and the model output. The model output is obtained using another formula which is the addition of the weight and differential value of weight itself, the differential weight is obtained by the division of differential (e) and the differential weight. This particular algorithm is iterated again and again until there is a very negligible value which is very similar to that of the desired output to be attained(the difference in the value ie, de/dw <<<1). Since, we use RNN technique it also uses a factor known as LSTM (Long Short Term Memory) networks. This technique follows certain steps. The first step is to remove unwanted data from the cell state and this process is done with the help of sigmoid layer called the forget gate layer. Second step focuses on the sigmoid layer called as input gate layer which provides resolution for the analyzed values to be modernized. The next layer tanh gives the new entrant values which mainly focus on eliminating the negative values. The third step focuses on replacing the old or previous cell state with new ones. The fourth step focus on calculating output based on the values gained by tanh and integrates with the product of sigmoid. This kind of algorithm very much reduces the probability of error in the image recognition and increases the computation and productivity rate.

II. LITERATURE SURVEY

According to the survey conducted on image classification, it is an important process in pattern recognition. [1]This Bag of Visuals method is used for hyper spectral image recognition, this technique also extracts the texture first. The spectral and texture features are used as two factors which are named as low level feature on the basis of which the high level words are constructed. The entropy rate super-pixel segmentation to fragment the spectral into patches. The experimental data conducted on the real data shows that the proposed method is very much comparable to several state of the art methods. [2]The next method of classification uses a technique known to be Polarimetric Synthetic Aperture Radar (PolSAR) Image Classification. This technique uses watershed algorithm and edge strength calculation in order to gain over segmentation using edge strength region based affinity propagation clustering is used to achieve the initial distribution map. The wish art classifier is used to gain the final recognition results. [3]

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This technique focuses on various aspects like concepts of machine learning. Some of the key factors are statistical classification technique, quadratic discriminant, artificial neural network; they mainly support vector machines since they are capable of producing high or infinity dimensional space used for classification.

III. EXISTING SYSTEM

The existing system focuses on the same aspect that all classifiers do that is to predict the image properties. The system uses an algorithm known to be convolution neural networks. This method predicts outputs on the basis of the four factors which are backbone structure of the existing algorithm. These factors are convolution layer these layer focus on extracting the image into matrix form such that it is classified into three layer rows, columns and channels. The second factor is pooling layer, it is used to reduce the image size on the basis of calculating matrix by dividing into equal divisions of sub matrix and the calculating the average pooling. This is calculated by the use of average calculations of each sub blocks of a matrix and compiling it into a single unit by taking the max value known as max pooling. The third factor is relu layer which is used in graphical prediction of values which works on removing the negative values of the existing value. The fourth factor is fully connected is to take the average value of the values sorted out by relu layer. Using this single value, the image prediction is done which makes the system predict on relational basis. Even though, this system is very conventional but training time taken by this algorithm is very high and the output is single output oriented. For example, if we predict the output to differentiate cats and dogs they do not work on sequential basis of prediction but only the prediction of cats and dogs. So, there can be no progress in the system like finding relation of the desired output. This makes the algorithm unfit for progress to be made in future on the field of image classification using deep learning.

IV. PROPOSED SYSTEM

The proposed system analyzes the pixel on the relational basis also it uses a technique known as RNN. This technique has never been used in the image recognition field since this has been traditionally used in the relational analysis of data which are like predicting the word based on the previous word which was printed. For example this has been used in creating time tables like gym schedule, hospital databases, etc. This technique when used in image recognition it predicts the output on the basis of previous input that has been analyzed. This greatly increases the computation rate and reduces the training time. Since, we do not have to come back to train the previous data set which has been already trained. This has been a major drawback in all the previous existing systems. The current system uses the back propagation technique which predicts the output on the basis of the previous input that has been analyzed and repeats the particular operation until it gains the desired output. It uses a RNN traditional technique known as LSTM (Long Short Term Memory) networks. This uses a formula which is used to calculate the e-value which is the square of difference between actual and model input. Another formula is applied to calculate the weight which is done by addition of actual weight and the difference in weight; in this the differential weight is calculated by using a formula which is the division of differential e-value and the differential weight. This technique is used until we get a negligible differential value (de/dw <<<<1). As mentioned above the system, it uses LSTM which consist of four factors Those are, The first step is to remove unwanted data from the cell state this process is done with the help of sigmoid layer called the forget gate layer. Second step focuses on the sigmoid layer called as input gate layer which provides resolution for the analyzed values to be modernized. Next layer tanh gives the new entrant values which mainly focus on eliminating the negative values. Third step focuses on replacing the old or previous cell state with new ones. Fourth step focuses on calculating output based on the values gained by tanh and integrate with the product of sigmoid. This kind of algorithm very much reduces the probability of error in the image recognition and increases the computation rate. This technique has a promising future in the field of image recognition since it has a high computation rate and it's greatly ahead of all the system that are already present. This deals with lots of factors in an efficient manner, the factors like noise generalization capability and speed is highly better in this system. This proves that the proposed system is better than any existing system.

V. ARCHITECTURE

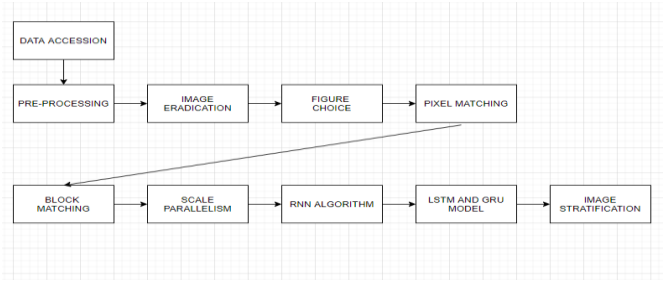

Figure 1

VI. METHOD AND IMPLEMENTATION

Image classification technique uses the proposed algorithm recurrent neural networks. This uses sequential prediction of output which provides efficiency in predicting output on the basis of time and quality. These are done with help of some formulas and techniques.

$$h(t) = f(h(t-1), X(t); Theta),$$

This is basic formula used in recurrent neural networks.
Where, h(t) - concealed state.
h(t-1) - preceding hidden state.
X(t) - current input.
Theta - is parameter of function f.
Unfolding

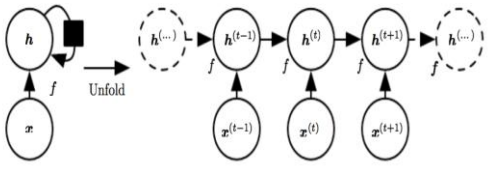

Figure 2

According to figure above the basic equations are as follows.
$a(t) = b + Wh(t-1) + Ux(t)$
$h(t) = \tanh(a(t))$
$o(t) = c + Vh(t)$
$y(t) = \text{softmax}(o(t))$
As recurrent neural network faces problem of short-term memory, it tends to use machine learning algorithm like LSTM during back propagation. RNN faces gradient problems if the vanishing gradient becomes to small also it becomes too difficult to predict the output since gradient value being very small it does not contribute much to the system.
New weight = weight - learning rate * gradient.
LSTM overcomes the problem of short term along with another algorithm of GRU.

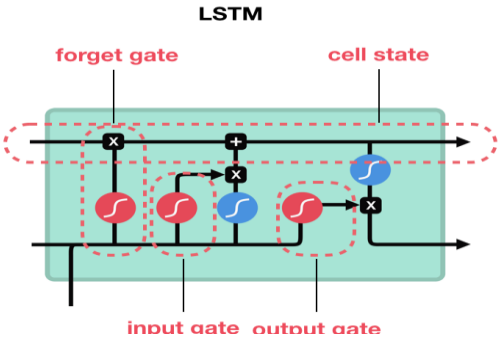

Figure 3

According to the above figure, the first step is to remove unwanted data from the cell state. This process is done with the help of sigmoid layer called the forget gate layer. Second step focuses on the sigmoid layer called as input gate layer which provides resolution for the analyzed values to be modernized. Next layer tanh gives the new entrant values which mainly focus on eliminating the negative values. Third step focuses on replacing the old or previous cell state with new ones. Fourth step focuses on calculating output based on the values gained by tanh and integrate with the product of sigmoid. This kind of algorithm very much reduces the probability of error in the image recognition and increases the computation and productivity rate.

VII. RESULTS

Image classification accuracy prediction for the provided parameters.

Accuracy	99%	98%	97%	96%	95%
Parameter	549,350	88,888	6,225	2,105	825

VIII. FUTURE SCOPE

This concept of image classification triggered some ideas that might have some great scope in future. One among this enhancement in the proposed model is to predict the cancer cell at its early stage itself. As we know that cancer is a chronic disorder that don't have any kind of cure at its mature stage but the proposed system can predict the cell with certain enhancement. At the early stage of the disorder, the cell size is very negligible or microscopic if we train our system with data-sets like the microscopic images captured from a microscope and train it into the system. Since, the proposed model analyze the data based on the pixel block it is very obvious that it could properly and efficiently predict the cancer cell present in the human body. So, there is a strong belief in the field of medicals that this technology if bought into existence would create a revolution and could stop the chronic disorder before it eventually grows into disorder which cannot be treated. Other advantage it can do is that it predicts large amount of data in very small amount of time once the data is fed into the system. This eventually reduces the time and complexity there in predicting the chronic disorder. By this, large amount of people infected or affected can be treated without any hesitation since we have its cure at early stage of the disorder. This one of the major future enhancement that our team has researched during the progress of image recognition module using recurrent neural networks.

IX. CONCLUSION

The proposed system predicts output on the basis of sequential analysis as it has the advantage of joint embedding and label co-occurrence method which since it uses the traditional technique of LSTM which improvises the image recognition to its peak. This technique is uses convolution layer to extend the effective pixel neighbourhood and it also improves factors like classifier speed, high computation rate, noise disturbance reduction and improves generalization capabilities of the system. This kind of system increases the future hope on deep learning field used in image classification and also promising technological improvisation in robotics field since it can be used for efficient recognition and sequential prediction of output desired.

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