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Semantic Image Segmentation by Deep Convolution Nets and Watershed Transformation

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ABSTRACT: In recent years, substantial research has been carried out in the field of image processing to evaluate different structures and information from images. Image processing techniques have played a pivotal role in a wide range of applications. Convolution Neural Networks (CNNs) are an alternative type of neural network that can be used to reduce spectral variations and model spectral correlations which exist in image. After the image is filtered with DCNN technique the image is segmented. Image segmentation is the process of partitioning an image into multiple segments, so as to change the representation of an image into something that is more meaningful and easier to analyze. Segmentation technique, basically convert the complex image into the simple image. For the image segmentation process the Watershed technique is used and by this the high accuracy of segmented image can be obtained.

KEYWORDS: Convolution Neural Networks (CNNs), Watershed Transform, Deep Convolution Neural Network.

I. INTRODUCTION

In this paper, substantial research has been carried out in the field of image processing to evaluate different CNN architectures and information from images. In image processing field the high resolution images which are present n the Image Net LSVR-2010, these images are divided by using the Deep Convolutional neural networks.

Watershed transform consist of an interesting properties which is useful for many different image segmentation applications in image processing field. The Deep Convolutional neural network to computer-aided detection networks determines the three important factors. We first determine the architectures of different CNN networks. These CNN networks are alternative of neural networks. We then calculate the evaluation rate of dataset scale and spatial image. Finally we examine the use of transfer learning from trained ImageNet. Computer aided detection consist of two type of problems. First problem is troraco-abdominal lymph node detection problem. Second one is interstitial lung disease classification. The main purpose of CNN neural network is model analysis and the design of high performance CAD system for medical imaging tasks.

In Image processing field by using segmentation technique the complex image is converted in to the simple image. Segmentation technique is nothing but basically convert the complex image into the simple image. Image is become more meaningful and easier to analyze by using image segmentation process, in this process image is divided into multiple segments. Images are used as one of the most important medium of conveying information in various fields like computer vision, navigation of robots, medical field and identification of an airport from remote sensing data. Substantial research has been carried out in the field of image processing to evaluate different CNN architectures and information from images. In image analysis field image segmentation is the first step. In image segmentation field image denoising is the first step to avoid the false contour selection for segmentation to segment the picture without loss of information for different fields; one of the important fields is medical field. In image segmentation process divides the digital image into number of segments that is of pixels, in homogeneity criteria pixels contain same quality means color, intensity or texture, to locate and identify objects and boundaries in an image. Image processing field the

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Watershed Transform is a unique technique for segmenting the digital images. The Watershed Transform there is mainly three methods viz. First one is the Distance Transform Approach and second one is the Gradient method, finally the Marker Controlled Approach.

The watershed transformation technique the main drawback is there is chance of loss of data. It is not able to detect the interfaces between homogeneously textured image means which consist of same color, intensity or texture image regions. To detect the texture boundaries a Texture Gradient is detected. This is means that the gradient image highlights the variations within the textures rather than showing the changes among the textured regions. The advantages of image segmentation process are time for execution is less and it is easy as well as advanced method for segmenting the various applications.

II. LITERATURE SURVEY

There are several research work is conducted still continued to meet the efficient level in image segmentation process designing. In this section we summarized referred research papers which are worked on different techniques for image segmentation process.

Tara N. Sainath et.al [01], they have explored applying CNNs to large vocabulary speech tasks. First, we determine the appropriate architecture to make CNNs effective compared to DNNs for LVCSR tasks. Specifically, they focus on how many convolution layers are needed, what is the optimal number of hidden units, what is the best pooling strategy and the best input feature type for CNNs. Then they explore the behavior of neural network features extracted from CNNs on a variety of LVCSR tasks, comparing CNNs to DNNs and GMMs. They find that CNNs offer between a 13-30% relative improvement over GMMs, and a 4-12% relative improvement over DNNs, on a 400-hr Broadcast News and 300-hr Switchboard task.

Hoo-Chang Shin et.al [02], they have exploit three important factors of deep Convolutional neural network. The Deep Convolutional neural network to computer-aided detection networks determines the tree important factors. We first determine the architectures of different CNN networks. These CNN networks are alternative of neural networks. We then calculate the evaluation rate of dataset scale and spatial image. Finally we examine the use of transfer learning from trained ImageNet. Computer aided detection consist of two type of problems. First problem is troraco-abdominal lymph node detection problem. Second one is interstitial lung disease classification. The main purpose of CNN neural network is model analysis and the design of high performance CAD system for medical imaging tasks. Our aim and the expected result suggest that various CNN architecture with dataset resampling protocols are critical for the lymph node detection. The lymph nodes with respect resampling and reformatting then the LN images are more flexible than IDL images. The IDL dataset contain fewer amounts of training and testing data augmentation compared to the LN dataset. The LN dataset is less comprehensive than neural image datasets like as Image Net.

Emmanuel Maggiori et.al [03], they propose an end-to-end framework for pixel wise classification. This frame work for pixel wise classification of satellite imagery with convolution neural network. The classification of large scale satellite image introduces certain challenges and that challenges we must address in the way to turn CNNs neural network into relevant classification tool. In this framework the CNNs neural networks are directly trained to produces classification maps of the input images. The dense classification problem is solved by using this frame work, in this framework first divides a fully convolution architecture and then illustrates the dense problem by using this end-to-end framework. By using the two step training approach they address the problem of incomplete training data. The CNNs neural networks are first named by using the huge amount of reference data and then defined by a small amount of labelled data. In end-to-end framework we designed a multi-scale neuron module and this module illustrates the similar trade-off between precise and recognition localization. The fine-grained classification maps are obtained by using this frame work, it also shows the network which takes large amount of context to provide fine-grained classification maps.

Rekha Shukla et.al [04], This paper involves the information on WST in this Image segmentation means that assigning a label to each pixel in the image and that image of pixels with same labels, and some similar visual

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characteristics. In image processing field the image segmentation process makes an image easier to analyse the image processing tasks. Segmentation process means that which converts the complex image into the simple image. Image processing field various types of technique are available to perform the image segmentation. Recently substantial research has been carried out in the field of image processing to evaluate different structures and information from images. Images are considered as one of the very important medium of getting information. Image segmentation process is the first step in image analysis. We could segment the digital image on the basis of some features, like color, texture, patterns, shapes, etc.By using these defined features, there are many image segmentation techniques which provides the segmented results. The digital image is divided into multiple segments this process is called as image segmentation technique.

III. METHODOLOGY

In the proposed methodology the DCNN technique for the image convolution and Watershed technique for the image segmentation are used. The image is taken as input and it is first convoluted with up-sampled filter and the resolution of the image is also controlled. LANEZOS interpolation method is used for the conversion of image from down-sampling to up-sampling.

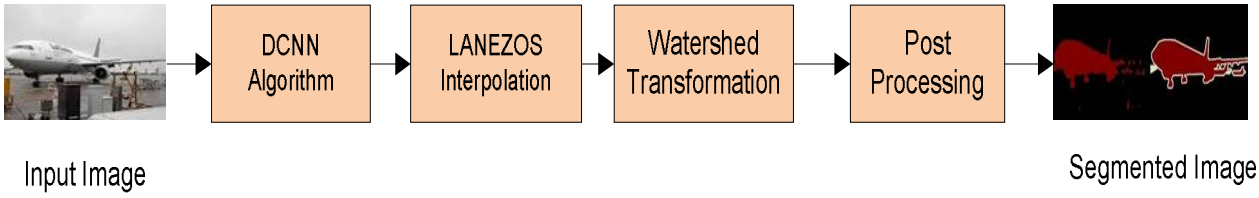

Figure.3: Block Diagram of the Image segmentation

The up-sampled image is taken for the segmentation and for that the image is given as input for the Watershed transformation and by using this algorithm the object is identified on the pixel concentration rate and the image is segmented. The segmented image is post processed to get the high resolution of image. By using this technique the segmentation of image can be done with high accuracy and with high efficiency.

3.1 CNN Algorithm

Convolution neural networks are n alternative type of neural network. A neural network is a process of interconnected artificial “neurons” which interchanges the massages between each other. A neural network is a system which connects the artificial neurons, and these connections have numeric values that are tuned during the process of training. In image or pattern recognize process the trained network will respond correctly. CNNs network consists of multiple layers of feature-detecting “neurons”. Each layer of networks has many neurons are present and that layers responds the various combination of input from the previous layer. Previous layers. Network consists of many layers and the first layer is used to detect the input primitive pattern. The patterns of pattern are detected by using second layer. Third layer detects pattern of those patterns. CNNs have 5 to 25 different layers of pattern recognition. Training process at block level is performed by with the help of “labeled” dataset. The intermediate and feature neurons weights are determined by using general purpose methods of training. Neural networks are inspired with the help of biological neural system. The brain have basic computation unit that is neuron and these neuron are connected with synapses. In a animal neural system, a neuron takes the input signal from its dendrites and it gives the output signals along with its axon. The axon branches are connected with the help of synapses to dendrites of other neurons. When the input signal combination reaches threshold point between its input dendrites, the neuron is triggered and its activation is communicated to successor neuron.

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3.2 Feature Extraction

Feature extraction means that transforming the input data in to set of features is known as feature extraction. If the input data is very large to process then the data is converted in to set of feature using this feature extraction. Image analysis process involves the investigation of image data for specific applications. In image the set of raw data is analyzed to get the benefit of what is happening with the images and how they can be utilized to extract desired information. In the process of image processing and pattern recognition, the feature extraction is plays very important role, which is special form of dimensionality reduction. Feature extraction contains the image feature like color, shape, context or texture etc.

3.3 Gabor Feature Construction

The Gabor wavelet has Gabor features and these features are based on Gabor filter reactions for input image. The reactions over the input image determine the set of filters, different orientations and frequencies. In the following rules are briefly visited and the important methods for selecting the parameters of filter.

a. Gabor Filter in 1 – d

The Gabor filter 1-d description result includes the generalized 2-d filter. The time domain which is present in the normalized Gabor filter is represented by using following equations

$$\Psi(t) = \frac{|f_o|}{\gamma\sqrt{\pi}} e^{-\frac{|f_0|^2}{\gamma} t^2} e^{j2\pi f_o t} \qquad (1)$$

Where f_o represents the filter frequency and γ represents the filter bandwidth is also called as filter sharpness. The effective time duration is inversely proportional to the effective bandwidth via the uncertainty relation. The equation for Gabor filter in Fourier domain is

$$\psi(u) \equiv e^{-\frac{\gamma\pi^2}{f_o}(u-f_0)^2} \qquad (2)$$

Where u Represents the frequency. The Gabor filter frequency range is $f_0 = 120 = 0.05$.The time domain wavelength is $20\ units$.The filter become sharper at the level of frequency domain.

b. Gabor filter in 2-d

The Gabor filter sharpness is controlled by using the major and minor axis of γ and η.The filter reaction can be normalized by using the following equation.

$$\psi(x, y; f_{0,}\theta) = \frac{{f_0}^2}{\pi\gamma\eta} e^{-\frac{{f_0}^2}{\gamma^2}x'^2 + \frac{{f_0}^2}{n^2}y'^2} e^{j2} \qquad (3)$$

$$x' = x\cos\theta + y\sin\theta$$

$$y' = -x\sin\theta + y\cos\theta$$

Where f_0 parameter represents central frequency of the filter, θ parameter represents the rotation angle of both the Gaussian major axis and the plane wave. γ Parameter represents the sharpness along the major axis. The η parameter represents the sharpness along the minor axis. The Gaussian aspect ratio is $\lambda = \eta/\gamma$. The Gabor filter normalized frequency domain is representing with the help of following equations.

$$\psi(u, v; f_{o,}\theta) = e^{-\pi^2\frac{u'-f_0}{\sigma^2}+\frac{v'}{\beta^2}} \qquad (4)$$

$$u' = u\cos\theta + v\sin\theta$$

$$v' = -u\sin\theta + v\cos\theta.$$

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$$f_{m=k^{-m}f_{max,m=\{0\ldots\ldots M-1\}}} \quad (5)$$

Where f_m represents the m^{th} frequency, $f_0 = f_{max}$ is the parameter represents the highest frequency desired, and $k > 1$ represents the frequency scaling factor. The filter orientations mathematical representation is shown bellow.

$$\theta_n = \frac{n2\pi}{N}, n = \{0 \ldots, N-1\} \quad (6)$$

Where θ_n represents the n^{th} orientation and N parameter represents the total number of orientations

3.4 Watershed Transform

In image segmentation process watershed transformer is used the main aim of water transformer is to find out the regions of high intensity gradients or watersheds that divide neighbored local basins or local minima. By using watershed algorithm zero marker values of watershed line pixels was obtained and the marker image involves marker values of zero marker values of watershed line pixels. The watershed transform method is a unique method for segmenting digital images. The watershed transform concept is based on three dimensions. First one is calculated gradient image values. Middle one is the using watershed algorithm step. Finally it consist merging steps. Advantages of Watershed Transform in this transformer by using discontinuity and similarity based method the Watershed Transform effectively combine elements. Using watershed algorithm step, the watershed transformer in this the water model is nothing but it is mathematical morphological approach and derives its analog from a real life food situation. Watershed model, Since its original development is grey-scale images.

a. Watershed Implementation Methods

Watershed transform technique mainly consists of three important implementation methods namely listed below.

- Distance Transform Approach
- Gradient method
- Marker Controlled Approach

In digital image segmentation process Watershed transforms is a unique technique for segmenting the image. The Watershed Transform is a unique technique for segmenting digital images that uses a type of region growing method based on an image gradient. The watershed transformation process is performed on a gradient image and which extract the feature of input image. The methods are like discontinuity and similarity in these methods by using watershed transform method combines the elements of both the methods. The main advantage of Watershed Transform effectively combines the elements. The problem with this technique is the conventional intensity gradient is it is not able to detect the interfaces between homogeneously textured image regions.

IV. RESULT

The experimental result of image segmentation process is represented by using the following images. Image segmentation process main aim is, the improvement and increase the quality of output image by segmentation process using DCNN convolution technique and Watershed transformation technique for the image.

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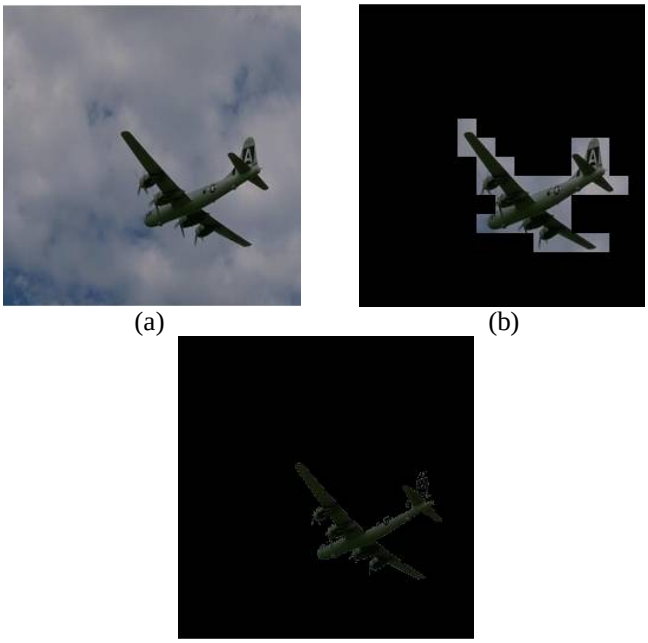

(a) (b)

(c)

Figure.5.1: (a) Input Image; (b) CNN Segmented Output for Input Image ; (c) Watershed Segmented Image of Input Image.

V. CONCLUSION

In this paper we have presented a novel approach for image segmentation technique to provide better segmented image. This technique involves the DCNN, LANEZOS interpolation and Watershed transformation. The DCNN technique is used to get the image in the proper resolution and once the image is got it is further processed for the interpolation to get the up-sample image, then by using the Watershed transformation the concentration of the pixel and the identification of the image is done, the image obtained is the segmented image and by using the post processing the high resolution segmented image is obtained. The proposed method is efficient compared to existing system.

REFERENCES

[1] Tara N. Sainath, Abdel-rahman Mohamed, Brian Kingsbury and Bhuvana Ramabhadran, “Deep Convolutional Neural Networks for LVCSR”, IEEE, 2013.

[2] Hoo-Chang Shin, Holger R. Roth, Mingchen Gao, Le Lu and Jianhua Yao, Daniel Mollura, “Deep Convolutional Neural Networks for Computer-Aided Detection: CNN Architectures, Dataset Characteristics and Transfer Learning”, IEEE, Vol. 1, 2016.

[3] Emmanuel Maggiori,, Yuliya Tarabalka and Guillaume Charpiat, and Pierre Alliez, “An 'H2 error expression for the Lanczos procedure”, IEEE, 2016.

[4] Rekha Shukla and Rajesh Kumar Rai, “Implementation of Image Segmentation using Watershed Transformation”, International Journal of Scientific Research in Science, Engineering and Technology, Vol. 1, No. 5, 2015.

[5] Nurul Ain Mohd Zaki, Zulkiflee Abd Latif, Mohd Zainee Zainal and Khairulazhar Zainuddin, “Individual Tree Crown (ITC) Delineation Using Watershed Transformation Algorithm For Tropical Lowland Dipterocarp”, IEEE, 2015.

[6] Olaf Pichler,Andreas Teuner,Bedrich J and Hosticka, “A comparison of texture feature extraction using adaptive Gabor filtering, pyramidal and tree structured wavelet transforms”, Pattern Recognition, Vol. 29,Issue. 5, pp. 733-742.

[7] Yehuda Dar, Alfred M. Bruckstein, Michael Elad, and Raja Giryes, “Postprocessing of Compressed Images via Sequential Denoising”, IEEE, Vol. 2, 2016.

[8] Nurul Ain Mohd Zaki, Zulkiflee Abd Latif, Mohd Zainee Zainal and Khairulazhar Zainuddin, “Individual Tree Crown (ITC) Delineation Using Watershed Transformation Algorithm For Tropical Lowland Dipterocarp”, IEEE, 2015.