Comparison of Neural Net Classification Method with Seeded Region Growing Technique to Identify Different Classes of Wetland Using LISS-III Data

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Abstract---This paper classifies wetland of Nal Sarovar by using LISS-III remote sensing data. Taking the Nal Sarovar as study area, LISS-III data of 2013 is used as data source. Neural Net Classification method and Seeded Region Growing Technique is used to identify different classes of wetland of Nal Sarovar area. The paper describes the utilization of accuracy assessment using kappa coefficients. This paper describes that Neural Net classification is more efficient than Seeded Region Growing technique.

I. INTRODUCTION

Wetlands are valuable ecosystems that play important roles in our environment. It is human settlement and natural resources, and also one of the ecological landscapes full of biodiversity in the nature. Wetlands are defined as areas that are transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water. (Backer, 2006)

Most of the natural wetlands of India are connected with the river system of north and south. According to project report, wetlands are broadly classified in two major categories;

1. Inland wetland
2. Coastal wetland

In inland natural wetlands there are lakes, ponds waterlogged, swamps and marshes. While in manmade wetlands there are reservoirs, tanks, waterlogged, ash pond and cooling pond.

Wetlands have received considerable interest during recent years due to their ecological significance, biodiversity value, flood proofing ability and water purification. A wide variety of marshes, swamps, bogs, peats etc. can be used profitably for meeting many human requirements. Wetlands are sometimes described as "kidneys of landscapes" because they function as receiver of water and waste from both natural and human resources. Wetlands are one of the most important ecosystems in the world. It is very important to inventory and monitoring the wetland. (Bauer, 2002)

II. STUDY AREA

Nal sarovar is located in Gujarat state between $71^0 92'$E & $72^0 08'$E and $22^0 40'$N& $22^0 55'$N. It falls in two districts of Gujarat state Ahmadabad and Surendranagar. Area of 120.82 sq. Km of this wetland is being protected as bird sanctuary by the State Forest Department of Gujarat State since 1982. The natural and seasonal spread of this wetland is of irregular shape. It is shallow and in most parts muddy. Formerly a eustary, this depressed portion had come into existence by tectonic uplift, increased sedimentation.

In this study the wetlands are categorized under various classes and mapped using satellite remote sensing data from Indian Remote Sensing Satellite: IRS-P6 LISS-III sensor. The results are organized at 1:50,000 scales at district, state and topographic map. (Gandhinagar, 2008)

Fig.1: Satelite Image of Nal Sarovar [Source: Google Map]

Fig.2: Pre-monsoon image of Nal Sarovar

Fig.3: Post-monsoon image of Nal Sarovar

III. METHODOLOGY

Input Parameters And Output For Neural Net Classification And Seeded Region Technique:

1) For Neural Net classification we have to assign training signatures in terms of Polygon type Region of Interest (ROIs) and the satellite image as source data.
2) For Seeded Region Technique we have to assign training signatures in terms of point type ROIs and Satelite image as source data.

3) With this we get classified image as an output.

A. Defining ROIs (Region of Interest):

Regions of interest (ROIs) are portions of images, either selected graphically or selected by other means such as thresholding. The regions can be irregularly-shaped and are typically used to extract statistics for classification, masking, and other operations. To perform ROI definition, I use the ROI Tool dialog. Defining Regions of Interest describes how to open the ROI Tool dialog, and how to turn off ROI definition. The sections that follow describe how to define ROIs. Authors have used same ROIs of pre-monsoon and post-monsoon image for both supervised classification methods.

In the present study polygon type ROI has been used

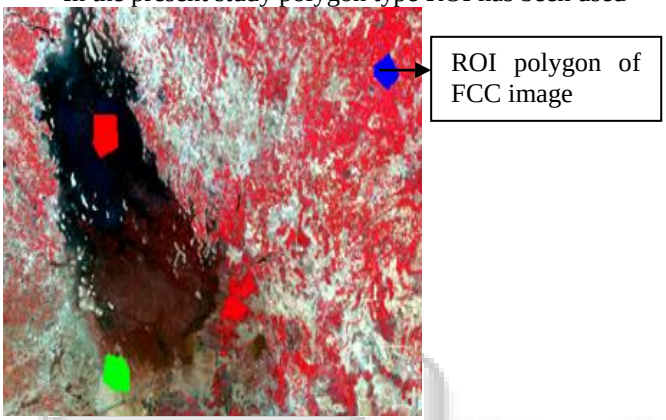

Fig.4: ROI of FCC image (Source : BISAG)

B. Neural Network Classification:

"A mathematical model to solve engineering problems is known as neural networks."It is group of highly connected neurons composite and the composition of nonlinear function.

In neural networks three types of tasks are done. The classification, discrimination and estimation are effectively done in neural networks.

1. Forward Neural Network
2. Recurrent Neural Network

ANN is an attempt to model a brain. These neural networks are based on the way neurons operate in order to solve problems that the brain is good at solving but that computers are not good at solving. Sometimes neural networks are described as "biological inspired" because their initial idea comes from the brain, but it does not matter whether or not the end product works the brain does, as long as it produces good answer to the problem. (al., 1999)

A neural network can be regarded as an attempt to make a computer based simulation of the way a human brain works. The behavior of NN is based on both weights and input-output function that is specified. This function falls into one of the three categories:

1. Linear
2. Threshold
3. Sigmoid

For linear transfer function output activity is proportional to the total weighted output. For threshold the output is set at one of the two levels depending on whether total input is greater than or less than some threshold value. The sigmoid transfer function bears a greater resemblance to the real neurons than linear and threshold function. (Mather, 2001)

F (NET) = $1/1+e^{-NET}$ [Heerman and khazenie , 1992] Where NET=sum of nod inputs

The input layer represents the raw information that is fed into the network. The activity of hidden layer is determined by activities of input layer and the weights on the connections between input and hidden layer. The behavior of output layer is depends on activity of the hidden layer and the weight between hidden layer and output layer. (Schowergerdt, 1994)

C. Feed Forward Neural Network Classification:

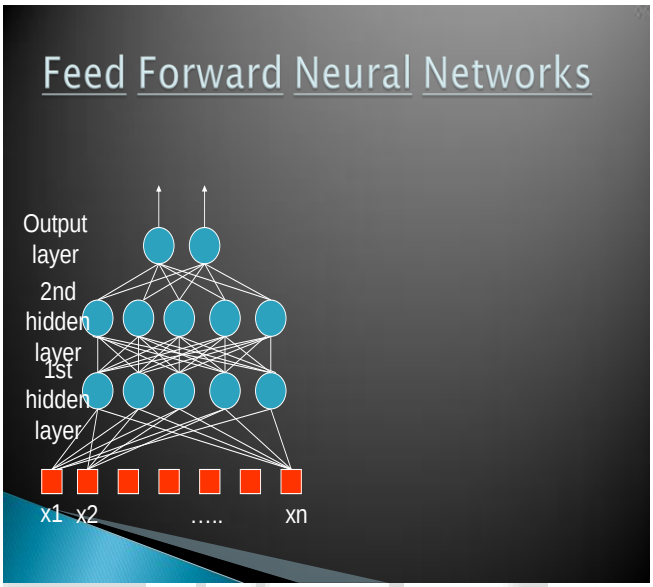

Fig.5: Feed forward neural network

The most widely used neural network is known as the feed forward neural network. This is called feed forward because the neurons on the first layer send their outputs to the neurons in second layer, but they do not receive any inputs from the neurons in the second layer. Feed forward neural networks are straightforward networks that associate input to outputs. These networks are dynamic; their state is changing continuously until they reach an equilibrium point. Feed forward neural networks have signals traveling in both directions by introducing loops in the network.

D. Seeded Region Technique:

Seeded region growing (SRG) algorithm is very attractive for semantic image segmentation by involving high-level knowledge of image components in the seed selection procedure. However, the SRG algorithm also suffers from the problems of pixel sorting orders for labeling and automatic seed selection. An obvious way to improve the SRG algorithm is to provide more effective pixel labeling technique and automate the process of seed selection. To provide such a framework, we design an automatic SRG algorithm, along with a boundary-oriented parallel pixel labeling technique and an automatic seed selection method. Moreover, a seed tracking algorithm is proposed for automatic moving object extraction. The region seeds, which are located inside the temporal change mask, are selected for generating the regions of moving objects. Experimental evaluation shows good performances

of our technique on a relatively large variety of images without the need of adjusting parameters. (Adams, 1994)

IV. KAPPA COEFFICIENT

Using Ground Truth Image:

When using a ground truth image, we can also calculate error mask images for each class showing which pixels were incorrectly classified. To Kappa coefficient the ground truth image and ROIs are to be used and from that we can find out kappa coefficient.

Generally, the kappa coefficient can be given by following equation:

$$\text{Kappa coefficient} = \frac{\text{Total pixels which are classified in that particular class}}{\text{Grand total of pixel classified by superwied classification}}$$

In present study the accuracy of each and every class which is classified by supervised classification can be find out by calculating kappa coefficient.

V. RESULTS AND DISCUSSION:

From the calculation of kappa coefficient we can say that the overall accuracy of Neural Net classifier is (85.75%) for pre-monsoon image, (80.57%) for post-monsoon image. The overall accuracy of Seeded Region Technique is (75.72%) for pre-monsoon image and overall accuracy is (70.47%) for post-monsoon image. Thus, from this study we can say that Neural Net classification is more accurate than Seeded Region Growing Technique. In this study different classes of wetlands like wetland vegetation, water body vegetation, water body, near land vegetation can be identified by Neural Net Classification and Seeded Region Growing Technique.

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