Available online at www.sciencedirect.com
SciVerse ScienceDirect
Procedia Environmental Sciences 10 (2011) 2287 – 2293
Procedia Environmental Sciences

2011 3rd International Conference on Environmental Science and Information Application Technology (ESIAT 2011)

Remote Sensing of Mangrove Wetlands Identification

SONG Xue Fei [1,a], CUI Hai Shan[*1,b] , GUO Zhi Hua[2]

[1] *School of Geographical Sciences, Guangzhou University,Guangzhou 510006,China*
[2]*Institute of Wetland Research,Chinese Academy Forest,Beijing 100091,China*
[a]*song1735@sina.com*

Abstract

Mangrove wetland has become the important and hot object for wetland research in recent years. Because remote sensing technique has applied gradually to the survey of mangrove resources, there is important realistic and theoretical significance for the remote sensing identification research of mangrove. This paper introduces the source of data of the mangrove remote sensing recognition technology processing, classification method and feature extraction.We also analyze the existings weakness, finally we put forward some related suggestions and forecast the future.

Key words: Mangrove;Remote sensing;Identification.

Introduction

Mangroves,coral reefs, upwelling and coastal wetlands are known as the world's four most productive natural ecosystem [1]. Mangrove wetland, as one of important wetlands, has become the the main object of study of the international wetland biodiversity conservation and ecological protection .The survey has important ecological and economic value [2,3]. This paper describes the mangrove data sources of the current remote sensing identification , data platform, technical processing, classification and feature extraction, analysis its shortcomings. Finally we came up with some recommendations and carried out the prospect of the future.

Components of the Remote Sensing of Mangrove Wetlands Identification

Information and Data Sources.

The main data sources include: Landsate TM, ETM, SPOT, SAR, CBERS-1CCD and MODIS satellite data and so on. In which TM and SPOT image are the most widely used data. When Li Xia etal (2006) [4] studied the remote sensing analysis of the evolution of Pearl River of the mangrove wetland, through the

doi:10.1016/j.proenv.2011.09.357

fusion of TM and SAR image in the study area of mangrove community classification and biomass estimation; In the study of the destruction of the mangrove along the coast of South China Sea and the Bay of Bengal,Blasco F etal(2001) [5] useing the TM image as the information source, putting forward a coastal mangrove forest remote sensing image and mangrove forest basic structure appearance parameters; As for the mangrove forest of West Au ckland Waitemata Harbour in New Zealand , Gao J (1999) [6],took the TM image as data sources, adopting the maximum likelihood classification method for reseaching.He divided all mangrove forest into two main types: lush type and shor type; Rasolofoharinoro M adopted SPOT1 and SPOT2 as the information resource, using the method combine the part survey of main unites in location with region-wide survey . He drew a conclusion that mapping accuracy,changes of plants have a close relation with the processing method and the season of abtaining the satellite data[7].According to Li etc (2003)who got data by CBERS (CBE RS-1 CCD) ,abtained the mangrove resource distribution and types distinction. Teng Junhua etc (1997) [8]combining DTM data with TM data madea classification study on Hainan Qinglangang mangrove.

Classification of Mangrove Wetland Remote Sensing Methods

Supervised Classification and Ansupervised Classification.

Supervised classification is based on statistical identification function , according to typical sample training methods. In other words, according to the sample that known training areas provide, by selecting he paramenters,obtained characteristic paramenters as the decision rules. Developing the discriminant function to classify images of the image classification is a method of pattern recognition. Unsupervised classification is known as the cluster analysis. A general clustering algorithm firstly selects the model number of points as the cluster center. Each center represents a category, according to some similarity measure, makes each pattern attribute to the cluster centers represented by the type.

Visual Observation.

It is also known as the experience of classification.The researchers distinguish accodong to the differences between the geometric characteristics of surface features clearly based on the growth of mangroves and the surrounding environment .It was surveyed and aerial photography combined with remote sensing image color, light, geometric feature, geographical location.Then through man-machine interactive interpretation and establish of various surface features and satellite images corresponding to the relevant characteristics of the digital image using the eye color, appearance and the interpretation of distinction.It is frequently used in the classification of remote sensing mangroves.

Artificial Neural Network.

It is referred to as neural networks or connection model , we can adjust the weights of neurons network connection. Useing the form of non-algorithm, non-structural to achieve expression and reasoning. It requires training and testing similar to the supervised classification of remote sensing data to extract useful information from the auxiliary and remote sensing data, then the algorithm is distributed and parallel information processing model.

Classification of Experts.

An expert system is an intelligent computer program system,.Its internal parts contain a lot of knowledge and experience of some expert level in a field.We can take advantage of the knowledge and problem-solving approach of human experts to deal with the problem inthis area. It is according to the knowledge and experience provided by one or more experts in a field ,to reason and judgement,then morniter the Decision-making process of human experts, in order to address complex problems that need human experts to deal with.

Band Combination Method.

Band combination method in the recognition of vegetation remote sensing is widely used, the effect is better. It is based on the physical characteristics of mangrove forests and the spectral characteristics of mangroves.Making use of the combination between the different bands to highlight the most obvious difference between spectral characteristics.It includes vegetation index, band ratio and principal component analysis and other methods. Vegetation index (Blasco et al.1986; Chaudhury 1990; Jensen etc.1991), including normalized difference vegetation index NDVI, orthogonal index (tassled cap transformation). Chaudhury [9] use the Landsat TM near-infrared bands B5, B7 of the ratio: ((B5-B7) / (B5 + B7)). Blasco, etc. from the red and infrared SPOT XS bands 2,3, calculate a normalized number of NDVI = ((B3-B2) / (B3 + B2)). Jensen etal associate [10] survey data from the field with four different vegetation indices obtained from the SPOT XSm to associate to make the ratio of image classification.

Technical Processing of Remote Sensing Image.

We should carry out processing techniques to correct the error. It willeliminate or correct image distortion caused by the errors of radiation. Using internal calibration source and calibration wedge, such as radiometric calibration of the Landsat multispectral scanner,which can calibrate the sensors radiation.In addition the correction of atmospheric effects can also be reflected by the measured radiation flux and the image density, and regression analysis of the data to be corrected.

Extraction of the information of mangrove

Interpretation Characteristics of Mangrove Image [11].

Because of the distribution speciality of the mangrove , it is generally located in coastal intertidal zone and zonal section shape with clear boundary.There is water running through them. Uniform image color is usually darker. Texture is smooth, delicate,and canopy density is very high. Through the image map we can mainly identify the broad contours of the distribution of mangroves.

Integration of Multi-Source Remote Sensing Data.

Remote sensing image fusion [12] is a technology by the advanced image processing to complex multi-source remote sensing image. The integration of commonly used methodsof integration are as follows [13]: Brovey transform fusion, principal component transform fusion, the product of fusion, wavelet transform fusion. Mangrove resolution remote sensing image can be improved through the

integration,it also can reduce or inhibit the multiple views, incomplete, uncertainty and error that may exist in Environmental Interpretation. Through that we improved the accuracy of the image feature recognition and classification.

Special Nature of the Spectrum of Mangroves.

Mangroves periodic flooding due to its growing environment, which has dfifferent spectral gharacteristics with trees,and vegetation. It has a strong absorption of the blue and red colour. According to the study reported [14], the 460nm ~ 502nm with a "trough zone ", the reflection rate of about 2 to 3% of green area in particular has a high infrared reflectivity, in 526 ~ 580nm there is a green Light reflection peak reflectivity of about 8 to 9%, between 700 ~ 745nm in the red to the infrared band of a transition band of the "red edge" characteristic, showing a sharp increase in reflectivity, reflectivity from 5% to 40% to 50%. Between 700 ~ 930nm in a reflection peak reflectivity is 40% ~ 58%. Band at 785 ~ 830nm to a reflection peak reflectivity of about 45% to 55%.We can use this feature to extract information of mangroves, as well as learned extraction techniques and methods from other green vegetation.

Mangroves Remote Sensing that Based on Leaf Area Index.

Mangrove leaf area index LAI is the quantitative analysis of energy exchange of the mangrove ecosystem is an important structural characteristic variables can be used to estimate the biomass of mangroves and pest evaluation.It also describe the important characteristics of the canopy variables. Therefore, the use of remote sensing to get leaf area index of mangrove species is an important means to the study of mangrove forests which provide a basis for ecological parameter of mangrove.

Mangroves Remote Sensing Based on Vegetation Indices.

Spectral vegetation index information the expression of plant status information can be acheved by the spectrum information. It include qualitative and quantitative evaluation of the vegetation coverage, biomass, growth and vitality and ecological parameters. It also include normalized difference vegetation index NDVI, ratio vegetation index RVI, tasseled cap transformation and so on. It is some vegetation index NDVI which is most widely used in remote sensing of mangrove forests. It often classify as a mangrove forest biomass extraction of important parameters. Mahmoud A. Saleh Isodata use non-supervised classification method to extract AbuMinqar Red Sea island of mangroves with QuikBird high-resolution satellite images information and images on QuikBird to establish a baseline database for future changes in the island's mangrove monitor, select CH3 Red band, CH4 calculated near-infrared normalized difference vegetation index NDVI = (CH3-CH4) / (CH3 + CH4).

Mangroves Remote Sensing Based on Texture.

As high-resolution satellite images mangrove monitoring is widely used in the analysis of the texture characteristics of mangroves It has been paramount.The traditional classification methods are not only lower accuracy, but also the estimated area of error. According to Fang Shenghui [15] classification survey based on Ikonos Data of the mangrove, when he extracted information from mangrove forests , the introduction of texture features to distinguish mangroves and reeds which have similar spectral characteristics. They reflectedd the difference of roughness of the surface and the film grain structure. It standard deviation and entropy texture measure to 20 × 20 window, the training of 200 × 200 were

calculated plots of mangrove and reed texture, the effect is significant.

Problems in remote sensing identify

Interpretation Methods Obsolete, less Application of Integration of the Data Source Applications.

In most application technology mainly rely on the traditional methods of visual interpretation. Although this method is simple, it requires a higher image solution translator, and it is labor-intensive, information acquisition cycle is long, The quality of solutions is also restricted by the experience and familiarity of the district of the translator. Using TM such a single data source remote sensing analysis and monitoring is not accurate and the classification results of mangrove communities are unsatisfactory.

More Errors of Monitoring and Low Accuracy.

In the actual study, we directly interprete mostly from the remote sensing image to divide the mangrove partition.We make less with the spot investigations.It causes discrepancy phenimenon to some extents. Because we can be influenced by various things ,such as GPS positioning control point selection, image the situation for the season, the protection of mangrove status. In addition, distribution and growth status of mangroves affected by many factors.Thus it is difficult to meet and obtain good classification results the requirements of accuracy.

Difficulty to Distinguish between Types of Mangrove Mommunities. Because most of the spatial resolution of remote sensing data itself is not high, and there are strong similarities in the spectrum of mangrove communities. It is difficult for them to distinguish the various communities in mangrove forests.

Less Comparison of Different Methods and Regions.

There are few comparing studies of different approaches of the current remote sensing of mangrove wetlands. and it only focuses on the comparison of a single region. It lacks of the mangrove wetland ecosystem dynamics between different methods of monitoring system, comprehensive comparative study. In addition, during a single regional comparative analysis, some only for comparative analysis of the lateral region,It also lack of longitudinal comparative analysis of region.

Recommendations and Outlook

Enhance Professional Knowledge and Skill.

We should be familiar with the reality of the study area,and combine the remote sensing and field surveys together .We should also can use GPS around the measurement position, equitable distribution of control points selected training areas. Make comprehensive use of types of data as information source . While we should take full advantage of artificial intelligence information extraction capabilities, enhangce the

ability of classification interpretation and accuracy.

Enhance the Fusion of Multiple Data, Using a Variety of Models to Estimate.

In the conventional statistical analysis model, integrate certain geological analysis, uncertainty analysis and intelligence analysis techniques to integrate analysis of mathematical statistics and systems theory, control theory, information theory, decision theory , artificial intelligence and such theory and technology.We can build a, a new Remote sensing image interpretation model, which can improve the detection accuracy remote sensing technology.We should integrate of 3S technology and data communicate technology.Multi-platform, multi-sensor, multi-angle aerospace remote sensing systems can monitor land surface changes,and the rapid changes information access could provide a rich data resource.

Combination of Various Remote Sensing Identification Methods.

Select two or more classifications to meet the characteristics of the study area and the needs of mangroves. Various methods have their own advantages, so we should make ues of each method, learning different methods could increase the contrast between different areas of study and comparison of horizontal and vertical analysis, accuracy will be more accurate of the monitoring.Which will provides fast, reliable technical support for land cover change monitoring of mangrove wetlands.

Acknowledgements

The study is supported by the Project of the National Natural Science Foundation(No. 30970482) and the Project of National Public Specific Research Foundation(No. 201104072).
*CUI Hai Shan is the author for corresponding.

References

[1] Fan Hangqing:Mangroves - coastal environmental stewardship.(Guangxi Science and Technology Press,Guangxi 2000).

[2] Zhang Qiaomin,Sui Shuzhen.The mangrove wetland resources and their conservation in China. Journal of Natural Resources , 2001,16(1):28-36.

[3] Wang Shugong.Status quo of coastal wetlands and their protection in Guangdong Province.Chongqing Environmental Science,1998,20(1):4-11.

[4] Li Xia,Wang Kai,Wang Shugong. Evolution of the Pearl River Mangrove Wetland Remote Sensing Analysis. Geography,2006,61(1):26-34.

[5] Blasco F, Aizpuru M, Gers C: Wetlands Ecology and Management. Vol.9-3(2001), p.255-266

[6] Gao J.A:Int.J.of Remote Sensing.Vol.20-14(1999),p.2823-2833.

[7] Rasolofoharinoro M,Blasco F, Bellan M F, etc. International Journal of Remote Sensing.Vol.19-10(1998),p.1873-1886.

[8] Teng Junhua,Liu Yu,Gu De Yu.Intelligent Classification of remote sensing of mangroves. Journal of Taiwan Strait,1997,(3):331-338.

[9] Chaudhury M.U,In: Proceeding of the 23rd International Symposium on Remote Sensing of the Environment,edited by Digital analysis of remote sensing data formonitoring the ecological status of the mangrove forests of Sun-derbans in Banglades.Bangkok,ICRSE (1990).

[10] Jensen J R, Ramet E, Davis B A,et al. Geocartography International.Vol. 2(1991), p.13-21.

[11] Wang Xiaojun, Feng Shi. RS, GIS in the Mangrove Protection Study of land cover . Journal of Surveying and Mapping,2010,(2):22-25.

[12] Weng Yongling,Tian Qingjiu. Remote Sensing Data Analysis and Evaluation of Fusion Review . Journal of Remote Sensing,2003,3:49-53.

[13] Yang Changbao, Jiang Qigang, Qiu Dianming, Liu Wangsong. Multi-source remote sensing data fusion of the new exploration. Jilin University (Information Science),2006,24(6):581-586.

[14] Yu Xiang, Zhao Dongzhi, Zhang Fengshou.Remote sensing in mangrove ecosystem monitoring and research of progress. Marine Environmental Science, 2005,24(1) :77-80.

[15] Fang Shenghui,Dian Yuanyong,Zhou Yuan. Based on Ikonos data on mangrove Classification, Journal of Geomatics 2005,30(4):5-6.