

# Intelligent identification technology of river and lake "four chaos" based on satellite remote sensing data

Qianru Wu, Yaduo Han, Yuxuan Chen, Xinru Li

College of Water Resources, North China University of Water Resources and Electric Power, Zhengzhou, Henan, China

**Abstract:** This study investigated and collected evidence on the "four chaos" problems of rivers and lakes through cutting-edge information technology, and promoted regulatory upgrading with technological progress to ensure that relevant departments comprehensively strengthened supervision of rivers and lakes in the region. The use of remote sensing information technology to achieve large-scale periodic macro monitoring of the "four chaos" of rivers and lakes, provide timely and reliable technical support for the supervision of the "four chaos" of rivers and lakes, and help the realization of the beautiful ecological vision of "clear water and green mountains"; With the macro and periodicity characteristics of remote sensing monitoring, problems such as incomplete supervision scope, inaccurate information acquisition, untimely acquisition and difficult problem summary and statistics can be solved. On the premise of ensuring accuracy and timeliness, human and material costs can be greatly saved and good economic benefits can be achieved.

**Keywords:** Automation, Rivers and lakes in chaos, Intelligent identification

## 1. Introduction

With the continuous promotion of the major project of the National High resolution Earth observation system, the combination of satellite remote sensing technology and water conservancy in China is an effective means to realize the transformation of river and lake supervision from supervision to periodic and regular supervision, and to establish a long-term supervision mechanism. In this paper, based on satellite remote sensing data, relevant experiments were carried out to complete intelligent extraction of river and lake dynamic supervision information, realize automatic interpretation and interpretation of river and lake supervision information, improve the speed and accuracy of river and lake supervision information extraction, and help river and lake supervision.

The phenomenon of "four disorderly rivers" is always a problem to be solved urgently. In this study, coco data sets and VOC format data sets were searched through various platforms and related algorithms, such as CNN, FCNN and RNN, were initially queried. In the process of intelligent recognition, PS, MATLAB, Labelme, EasyDL and other programs are used to process remote sensing images in the Yangtze and Yellow River basins, and the format of thousands of remote sensing images is unified. Complete the pre-annotation and collation into a standard sample set, then build an image database to realize the connection call. Project using remote sensing information technology and baidu fly blade's EasyDL access to satellite images, then an intelligent recognition, research and development of remote sensing image segmentation model algorithm and optimized unceasingly in the practical application and automatically extract the target elements information and achieve the goal on the time series of dynamic change detection, a wide range of rivers "four disorderly" real-time monitoring, It provides timely and reliable technical support for river and lake "four chaos" supervision, and solves the problems of traditional river and lake supervision scope is not comprehensive, information acquisition is not accurate, acquisition is not timely, problems summary statistics and so on.[1]

## 2. Related application cases of intelligent recognition of satellite images

### 2.1. Application of high-resolution satellite and image recognition in forest fire area estimation

At present, the developed method combining high-resolution satellite and image recognition can fully combine the characteristics of high resolution and artificial intelligence calculation speed and high precision, improve the ability of remote sensing for forest fire monitoring and ensure the accuracy of

area calculation of burned area.

## **2.2. Typhoon intelligent recognition and location method based on infrared satellite cloud image**

At present, the developed technology of typhoon positioning is proposed to extract the edge of typhoon cloud area based on wavelet and rough set fusion for satellite cloud images of dual typhoons. At the same time, Matlab software is used for simulation, and the simulation results show that the recognition efficiency and accuracy are significantly improved. Satellite intelligent identification is gradually improving the relevant mechanism in typhoon intelligent monitoring.

## **2.3. Application of intelligent identification in land and resources monitoring**

At present, Domestic landsat remote sensing has gradually been integrated into the main business of natural resource management and the workflow of major projects. Natural resource satellite data sensor correction orthotopic correction, image fusion, and change monitoring have become normal production, basically realizing the whole process monitoring and automatic transfer of results.

At present, there are few researches and related cases on information intelligent extraction of water conservancy thematic elements, which shows the necessity and urgency of the research. This paper is based on intelligent extraction technology and related experiments of river and lake dynamic monitoring information from satellite remote sensing data [2].

## **3. Analysis on the status quo of intelligent identification of river and lake chaos**

For the intelligent identification technology of remote sensing map of river and lake "four chaos", whether based on social development or national construction, a relatively good policy and market environment has been constructed. Technically, it has a stable data source basis, and mature mass data batch processing technology can also ensure that the intelligent comparison technology can provide input data continuously and stably. Intelligent comparison of water conservancy objective elements has also developed mature solutions for some elements. The recognition technology of some elements is not mature yet, but the accuracy is improving and the technology is becoming mature. Combined with the manual intervention of some interpretation work, the overall technical environment has been able to ensure that the accuracy and efficiency of river and lake supervision can be greatly improved within a certain range, and the recognition accuracy of specific target elements of the software platform is constantly "growing" in time series. At present, there are mainly FeatureStation, SenseRemote, Geoway, EasyFeature, etc., and the independent combination of UAV and satellite image to collect image data. All these methods can realize the extraction of remote sensing information [3].

The specific application of satellite intelligent identification in river and lake disturbances is still in the research stage, and there are few relevant technical references. At present, there is no complete and systematic research on intelligent identification of river and lake disturbances at home and abroad. The target identification technology is in rapid development of artificial intelligence, according to different depth of target object study sample size is with the development of technology and industry demand and gradually accumulate, establish training target object model accuracy are also gradually increase, part identification of target object has reached the extent of the actual production application, However, the recognition of some features is still in the stage of exploration and accumulation. Specific to the water conservancy industry, the intelligent recognition of multiple elements of river and lake supervision is still in the accumulative stage of quantitative change, and the intelligent comparison technology based on the intelligent recognition results is still in the active exploration stage. Its demand can be seen. In terms of intelligent water conservancy construction, we need to invest a lot of research in intelligent identification of rivers and lakes, and further realize automatic operation.

## **4. Intelligent recognition process of four chaos phenomena based on satellite images**

### **4.1. Collecting Data**

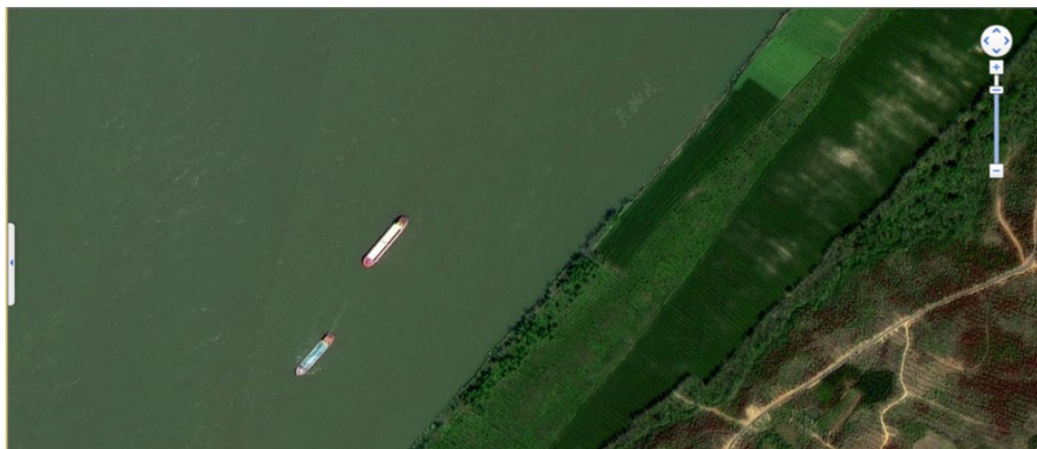
The image data required by the project had certain particularity and regionality. During the experiment, the 91-wei map assistant was used to independently intercept thousands of chaotic images of rivers and lakes in major river basins, and unified image resolution was adopted to improve the experimental accuracy. Production of coco, VOC format validation data set [4].

#### 4.2. Data Preprocessing

There is a certain format problem in the pictures taken by the assistant, so PS software is used to unify the picture format, and the picture is renamed by yousuo software to meet the relevant requirements of Baidu EasyDL for the derivative data. Using labelme and EasyDL software, aiming at the problem of "four chaos" in self-made database, four labels of "disorderly occupation", "disorderly acquisition", "disorderly heap" and "disorderly construction" are established. According to the labels, the images are marked, and the results are integrated into the standard sample library for computer intelligent learning and comparison, so as to realize image preprocessing. Among them, the label "disorderly occupation" refers to the reclamation of lakes, the reclamation of river channels without the approval of people's governments at or above the provincial level according to law, the illegal occupation of water areas and beaches, and the planting of trees and tall crops that hinder flood discharge. The label "indiscriminate mining" refers to illegal sand mining and soil extraction within the scope of river and lake management. The label "mess" refers to the phenomenon of littering garbage, dumping, landfill, storage, piling up solid waste, and dumping and piling up objects blocking flood discharge within the scope of management of rivers and lakes. The label "disorderly construction" refers to the illegal construction of river-related projects, the construction of buildings and structures obstructing flood discharge within the scope of river and lake management. The problems existing in the process of river and lake management are shown in Figure 1, Figure 2, Figure 3 and Figure 4.



*Figure 1: Phenomenon of disorderly occupation and construction*



*Figure 2: Phenomenon of disorderly mining by sand dredge*



*Figure 3: Phenomenon of disorderly construction and occupation*



*Figure 4: Phenomenon of indiscriminate mining*

#### **4.3. Creating a Database**

The relevant satellite images of river and lake "four chaos" problem were summarized to construct a complete river and lake image data set. The image data was then imported into EasyDL to construct the object detection standard database, and the next step was to complete the audit and acceptance data set operation.

#### **4.4. Review the acceptance data set**

Check and accept in EasyDL "Multi-person Label Management" module to ensure that the image label set and original satellite atlas are correct. After completing the check, model selection and data set training can be completed [5].

#### **4.5. Select models and data sets for trial training**

During the model training, CNN algorithm with high cost performance and reliability was adopted, and the trial training data set was used to deploy it in the public cloud API for a long time of trial training. The final MAP value was 31.7%, the accuracy rate was 55.6%, and the recall rate was 41.8%. Statistically speaking, the training result was relatively successful.

#### **4.6. Adjust data and model parameters**

On the basis of the successful trial training, part of the image data and training parameters were adjusted, and THE CNN algorithm was changed into a faster and more efficient FCNN algorithm, which

was then deployed on the public cloud API for formal training of satellite remote sensing images and annotation data verification. After continuous optimization, the accuracy rate of the project model has successfully reached 88%. The final MAP value is 43.5%, the accuracy is 88.0%, and the recall rate is 73.3%.

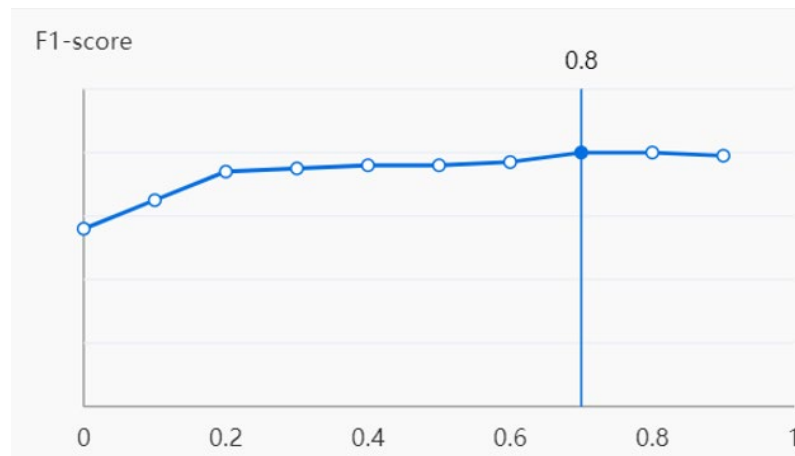


Figure 5: F1 - score

#### 4.7. Model training and optimization and interface improvement of river and lake supervision intelligent recognition technology

After the successful training of project model, higher accuracy rate and more autonomous river and lake supervision interface are still pursued. Therefore, inaccurate image data were recalled for manual correction during the experiment, and a simple intelligent recognition and feedback interface of river and lake was successfully made by using MATLAB software. The algorithm model in EASYDL was encapsulated and grafted into the interface, and a complete automatic monitoring system of river and lake was finally formed.

### 5. Research results

In this study, the relevant satellite photos of river and lake "four chaos" problems were processed and summarized uniformly, and not only a complete river and lake image data set was constructed. In addition, EasyDL software is used to mark the problem of "four chaos" in the image, and four labels of disorderly occupation, disorderly acquisition, disorderly heap and disorderly construction are established, which are integrated into a standard sample library for computer learning and comparison to achieve image preprocessing. Finally, EasyDL software was used to build an image recognition window to realize the import and export of the problem image and feedback the classification and location information. In this experiment, the intelligent recognition of the data set was completed for the satellite remote sensing data set. According to the analysis of the four chaotic problems of rivers and lakes, the results of this study show that the phenomenon of "disorderly mining" accounts for 82%, "disorderly construction" 41%, "disorderly occupation" 16%, and "disorderly pile" 13%. Therefore, the investigation watershed should focus on strengthening the control of "indiscriminate mining", "indiscriminate construction", "indiscriminate occupation" and "indiscriminate pile" problems should also be strictly prevented.

### 6. Conclusion

The intelligent recognition technology based on satellite image is a hot research direction at present, which plays an important role in the modernization of water conservancy industry. This study is committed to making new progress and achievements in the problem of river and lake chaos, striving to achieve a network of river and lake supervision, point calibration, efficient and accurate solution to the problem of river and lake chaos. In addition, this study using satellite remote sensing map of intelligent recognition technology can extract the lakes within the scope of management, mining and heap, built "information, as for the" total, mining, heap, "whether to belong to" LuanZhan, logging, heap, build, still need to combine planning and management departments to provide relevant information for comprehensive judgment. On this basis, we will continue to optimize the research results, and get in touch

with relevant departments of water conservancy, so as to provide efficient and reliable intelligent solutions for river and lake management, and boost the development of water conservancy.

Artificial intelligent target recognition technology are applied in many fields, the application in the field of remote sensing image target recognition, is now relatively mature water, roads and buildings of information extraction, specific to wade "four disorderly" elements of recognition, mainly the structure of the extract, basic accuracy can achieve 80% above, the phenomenon of sand mining to identify current research is still in exploration stage, In the case of limited sample test data set, the results of internal measurement show that the identification and finding rate of sand mining phenomenon can reach more than 90%, and there is still a certain space for improving the identification and finding rate by adding multi-spectral information.

With the continuous promotion of the major project of the National High resolution Earth observation system, the combination of satellite remote sensing technology and water conservancy in China is an effective means to realize the transformation of river and lake supervision from supervision to periodic and regular supervision, and to establish a long-term supervision mechanism.

## References

- [1] Zhang Y. *A new algorithm for object detection in remote sensing images based on deep learning [J]. North China Water Resources, (2021) 23-084-03.*
- [2] Yao Liang, Gao Lei. *Water resources development research, 2020, 20(11): 36-40.*
- [3] Chen Yuliang, Dong Shaojiang, Sun Shizheng, Yan Kaibo. *Improved YOLOv5 algorithm for low-light underwater biological target detection [J/OL]. Journal of Beijing University of Aeronautics and Astronautics: 1-13[2022-07-14]. DOI: 10.13700/j.B.1001-5965.2022.0322.*
- [4] Yang Chaochen, Chen Jiayue, Xing Ke, Liu Mengni, Gao Tao. *Research on Small Target Detection Algorithm Based on Improved DSSD [J]. Computer Technology and Development, 2021, 32(06): 63-67.*
- [5] Liu Xinchao, Yan Ying, Gan Haiyun. *Unmanned dangerous traffic scene small target detection algorithm research [J]. Science and technology, 2021, 5 (10): 38 and 43. DOI: 10.13774 /j.carol carroll nki KJTB. 2021.10.007.*