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PROVINCIAL SUPERVISION EXPLORATION OF HISTORIC CITIES, TOWNS AND VILLAGES IN CHINA BASED ON DEEP LEARNING AND GIS - TAKE ZHEJIANG PROVINCE AS AN EXAMPLE

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ABSTRACT:

At present, China is building a historic heritage conservation and management system from upper to lower level. Therefore, as the middle level, provincial level is becoming increasingly important in the management of famous towns and villages. However, due to the excessive quantities of resources, the lagging management skills and other influential factors, the provincial competent authorities still face a series of difficulties in implementing the conservation and management of historic cities, towns and villages. Focusing on the regulatory issues faced by provincial competent authorities, this study combined geospatial information technology with deep learning technology to explore the intelligent auxiliary identification of traditional texture for historic settlements and the provincial planning guidance method based on GIS evaluation. This paper put forward technical optimization suggestions for the stages of declaration and identification, conservation planning, supervision and inspection in provincial conservation and management. The intervention of new technologies provides a reference for provincial competent authorities in enhance conservation and regulatory capacity, and dealing with the situation of "having laws but lacking technology, and difficult to implement".

INTRODUCTION

In 2021, the General Office of the CPC Central Committee and the General Office of the State Council issued the Opinions on Strengthening the Conservation and Inheritance of Historical Heritage in Urban-rural Construction (hereinafter referred to as the Opinions), which proposed the establishment of a "nation, province, municipal and county" management system for the historic heritage conservation and inheritance. The Opinions put forward higher requirements for provincial competent authorities to manage historic heritage, and required the province to prepare its own provincial planning for the conservation and inheritance system of historic heritage. Zhejiang is rich in urban-rural settlement heritage resources and has a good foundation for meticulous conservation and management. As early as 2019, the exploration of the special research on the conservation system planning of historic cities, towns and villages (historic cities, historic towns and historic villages, type of heritage title in China) in the province was carried out. However, due to external factors such as the large number of provincial historic cities, towns and villages resources and lacking of technology, the comprehensive implementation of conservation management at the provincial level still faces a series of difficulties.

At present, the conservation technologies of historic cities, towns and villages are mostly for municipal and county competent authorities, or conservation strategies for specific objects. The relevant research lacks technical support and practical exploration from the perspective of provincial historic cities, towns and villages management. There is also a lack of relevant research on improving conservation management of administrative management processes based on the powers of provincial competent authorities. Based on all the factors above, this study explored innovation with the introduction of intelligent means and the construction of digital management. On the basis of maintaining the fine management tradition of Zhejiang, this paper studied and formulated a series of conservation and development measures to complete the gaps in Zhejiang's historic cities, towns and villages management system and improve the management capacity on provincial level.

1. CURRENT SITUATION ANALYSIS OF PROVINCIAL HISTORIC CITIES, TOWNS AND VILLAGES MANAGEMENT BASED ON WHOLE-PROCESS MANAGEMENT

1.1 Closed-loop Analysis of Provincial Whole-process Management

The conservation and supervision system should be composed of relevant management systems and processes to form a seamless organic closed-loop management system (B. Bian and J. Wang, 2013). The historic cities, towns and villages management system in Zhejiang Province is mainly based on a series of relevant laws, regulations and policy documents issued at the national and provincial level.

On the basis of item-by-item decomposition of the Regulations on the Conservation of Historic Cities, Towns and Villages in Zhejiang Province (hereinafter referred to as the "Zhejiang Regulations") and the Regulations on the Conservation of Historic Cities, Towns and Villages (hereinafter referred to as the "Historic Cities Regulations"), the management system for the conservation of the historic cities, towns and villages in Zhejiang Province has been sorted and improved in line with the requirements of the Opinions. The Zhejiang Regulations and the Historic Cities Regulations stipulate the ascertain of responsible party, declaration and identification, conservation planning, conservation measures, supervision and inspection,

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legal responsibility and other stages of the responsible party. Among them, the three conservation management stages of "declaration and identification", "conservation planning" and "supervision and inspection" formulated for different levels and objects that were the most controllable at the main management stages in the management process. Specifically, it involving 20 management procedures to form a scientific and complete closed-loop conservation management for the whole process (Figure 1).

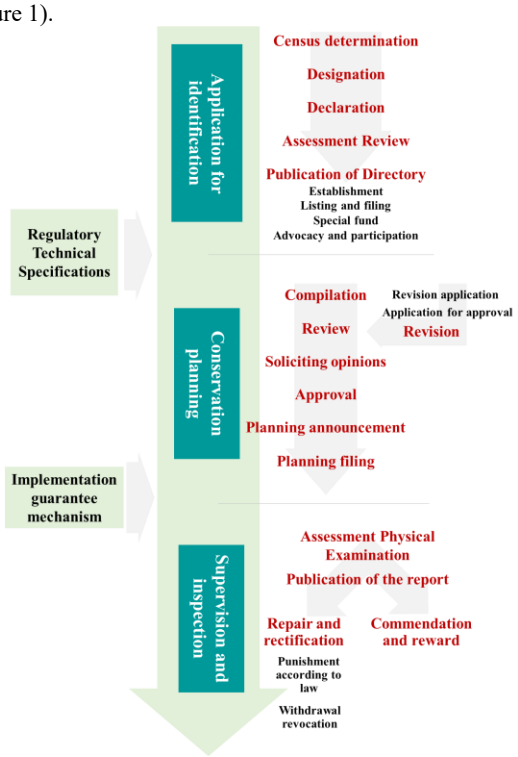


Figure 1. Schematic diagram of closed-loop analysis for the whole process management to Zhejiang historic cities, towns and villages.

1.2 Problems Faced by Provincial Management at Each Stages

1.2.1 "Declaration and identification" stage: unclear identification standard and insufficient resource identification

At the stage of "declaration and identification", due to the inability to fully grasp the current historic cities, towns and villages and potential resources, the provincial competent authorities are faced with two problems: unclear identification standards of historic towns and villages, and insufficient identification of resources.

Firstly, the conditions for the declaration and recognition of historic cities are relatively clear at present, in contrast the conditions for the declaration of provincial historic towns and villages are not clear. As historic towns and villages have not clearly defined the area and its scale where the features are centralized, some of the traditional styles and features of historic towns and villages that have been announced, especially those that have been declared in the past two years, are uneven in development. There are historic towns and villages that have retained the pattern and a small number of sites with no centralized traditional features.

Secondly, in the process of investigation, it was found that there were some traditional settlements with advantages in value and resources, but the local competent authorities did not declare. At the provincial level, the value system of urban-rural settlements in Zhejiang Province is still incomplete, and some typical settlements (such as the settlements of coastal defence posts in Zhejiang Province) are not included in the current system, which does not reflect the requirements of " conservation should full coverage of space and elements" in the Opinions. From the city and county level, some towns and villages are driven by economic interests and lack of awareness, coupled with the lack of technology, funds, enthusiasm for declaration and even the unwillingness to declare, so there are still many traditional settlements objects that need to be conserved and passed on fail in declaration. Therefore, there are still many traditional settlements objects that need to be conserved and inherited which have not been declared.

Although the "Zhejiang Regulations" and the "Historic Cities, Towns and Villages Regulations" both give the provincial competent authorities of provincial government the right to recommend and directly identify historic towns and villages, and can identify resources that meet the standards while not declared yet by the local government, it is difficult to carry out direct identification limited to the conservation and management capability at the provincial level, as well as technology and high labour research costs.

1.2.2 "Conservation planning" stage: it is difficult to comprehensively evaluate the current situation of "historic cities, towns and villages" for the province

From the sorting of the "Historic Cities, Towns and Villages Regulations" and "Zhejiang Regulations", the main responsibility of the provincial competent authorities in the "conservation planning" stage is planning review, approval, filing and other procedural work, The existing process and technical conditions are relatively mature now. The main problems include the following three aspects at present. First of all, it is not clear how to prepare the provincial historic heritage conservation and inheritance planning methods proposed in the Opinions, with no relevant standards to refer to; Secondly, due to the lack of requirements for the collection and preservation of the relevant geographical spatial data of the "historic cities, towns and villages" in the previous management process, the provincial competent authorities lack the basic spatial data for planning analysis, such as heritage sites, conservation zoning and other data resources; Thirdly, the huge quantity of historic cities, towns and villages resources makes it difficult to carry out field survey covering the whole area, and it is difficult to comprehensively evaluate the current situation of historic cities, towns and villages resources. The lack of spatial data and the difficulty of the current situation assessment make it difficult for provincial planning to propose targeted planning strategies.

1.2.3 "Supervision and inspection" stage: supervision and management responsibilities cannot be effectively implemented timely

State-level supervision for the conservation of the "historic cities, towns and villages” has not been relaxed. In 2011, 2017 and 2020, the Ministry of Housing and Urban-Rural Development and the National Cultural Heritage Administration conducted nationwide evaluation and inspection of the historic cities, towns and villages resources to implement relevant regulatory requirements. In addition, as early as 2003, the Ministry of Housing and Urban-Rural Development began to carry out dynamic monitoring on various development activities and planning implementation of municipalities directly under

the Central Government, provincial capitals and other big cities and national key scenic spots, for a trial.

In the past, the supervision and inspection of the historic cities, towns and villages were mostly regular evaluation and inspection, which were divided into local self-inspection, expert verification and third-party evaluation, feedback of evaluation results, etc. The evaluation and inspection process, and index system were complicated, which burdened provinces and localities. In addition, there was often irreversible destruction of the traditional pattern and traditional texture due to factors such as large-scale demolition and construction. It was too late to find the damage in regular assessment and inspection, so only punishment and warning could be carried out. Therefore, tracking monitoring and timely warning can prevent the historic cities, towns and villages resources from being destroyed in time. However, due to the lack of geospatial data as well as the tracking and monitoring technology, it is still a difficult problem for provincial competent authorities to carry out supervision responsibilities with the help of information management.

2. RESEARCH ON GLOBAL INTELLIGENT RECOGNITION TECHNOLOGY OF ZHEJIANG HISTORIC CITIES, TOWNS AND VILLAGES RESOURCES

2.1 The Technical Thinking of Using Deep Learning and GIS Technology to Assist the Provincial Historic cities, Towns and villages Management

Deep learning is a relatively new research direction in the field of machine learning. It simulates the neural connection structure of human brain by establishing a model. When processing signals such as images, sounds and texts, it describes the data features hierarchically through multiple transformation stages, and then gives the interpretation of data (B. Yin, W. Wang, L. Wang, 2015). In recent years, it has been a breakthrough in speech recognition, computer vision and other applications of deep learning, which has been applied in the field of remote sensing images rather than cultural heritage conservation.

The concept of texture originally refers to the visual and tactile qualities that people experience due to the different composition, arrangement, and construction of materials. In the field of heritage protection and remote sensing, traditional texture is the visual effect of surface organization structure of urban-rural settlements spatial form with traditional characteristics, as well as the result of interaction of various spatial elements in traditional settlements (T. Wang, 2011). The conservation of urban-rural texture is regarded as the key way to continue the overall form and vitality for urban-rural areas, and is an important concept in historical environment conservation for urban-rural settlements heritage (P. Liu and M. Neppl, 2020). Using deep learning to identify the traditional texture of urban-rural settlements can quickly and automatically obtain the current spatial data of historic cities, towns and villages resources, which will provide technical support for each stage of provincial historic cities, towns and villages management.

In this paper, deep learning and geospatial information technology were combined. On the basis of establishing Zhejiang historic cities, towns and villages geographic information database, deep learning technology was used to identify the traditional texture in high-resolution remote sensing images massively and dynamically, so as to evaluate the preservation status of historic cities, towns and villages resource texture. The method can refine the identification standards in the declaration process, excavate potential resource clues, realize more comprehensive status assessment, assist the government to carry out timely and effective dynamic supervision on the historic cities, towns and villages objects, and provide support for the classification and guidance of provincial historic cities, towns and villages resources by using geographic information analysis technology. (Figure 2)

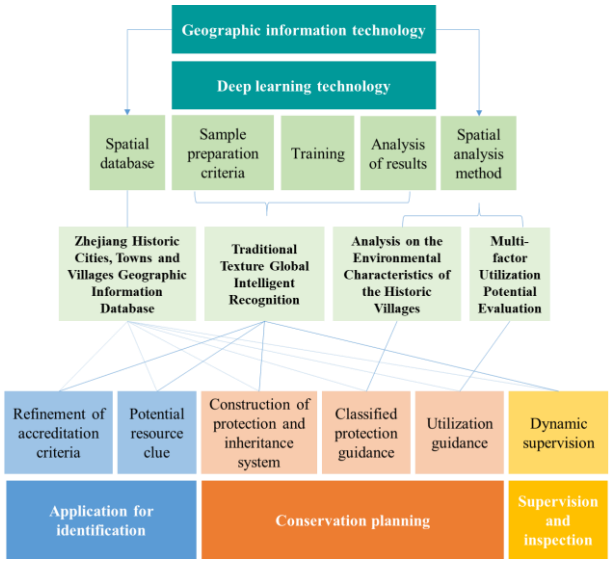


Figure 2. Technical ideas of using deep learning and GIS technology to assist the management promotion in provincial historic cities, towns and villages.

2.2 Recognition of Traditional Scenery Centralized Areas Based on Deep Learning Technology

The working principle of traditional texture recognition is to obtain the traditional texture region of a specific region by giving a certain task region. Using high resolution remote sensing images with machine learning and computer vision technology, this paper put forward the quantitative standard of traditional texture boundary demarcation based on the cognition of the traditional texture characteristics of Zhejiang historic cities, towns and villages. Meanwhile, geographical information system (arcgis, qgis and other platforms) was adopted to judge the traditional texture, visual interpretation method, while index measurement method were adopted to mark the traditional texture, image labels and training images generated in batch by data driven method on arcgis platform. Finally, the paper explored and formed the auxiliary identification method process of traditional texture in Zhejiang, including the automatic acquisition of remote sensing images, the production of geographical labels, the selection and training of models, the identification of traditional texture, the combination of graphics processing and spatial vectorization, etc.

2.2.1 Clarify the specific standards for the characteristics of Zhejiang historic cities, towns and villages features

Combining the research and analysis of traditional architectural style in Zhejiang Province, the traditional texture of settlements in Zhejiang Province is mainly aggregation type, with grey tile roof is well preserved. Therefore, in this paper, 82 resources with texture aggregation and grey tile roof are selected as

samples from historic conservation area and historic villages in Zhejiang Province, and 43 samples with the same features for representative historic cities, towns and villages in southern China are supplemented to improve the regional applicability of the model.

As some traditional texture and modern texture have certain transition, it is necessary to exclude the machine-made tile, colour steel tile, modern building and archaize building that are too different from traditional roof. Secondly, the boundary of traditional texture is fuzzy, so we should grasp the most important element in traditional texture including taking traditional courtyard as a unit, excluding wide and large river empty space, making the marked area unified as much as possible, and improving the convergence effect of the model. The reference indexes including street width, roof material, building scale, building spacing scale, etc. are constructed to unify the quantitative marking method as the discrimination standard of traditional texture, based on the analysis above.

Texture space type	Quantitative elements of texture	Quantitative standard reference	Exclusive elements
Natural space	River width	<6m	Exclude lakes, ponds and wider rivers
	Length and width of open space	<16m	Exclude large open space
Traditional streets	Lane width	<8m	Exclude modern widened streets
Courtyard	Fitness	Retain the enclosed courtyard	Include enclosed courtyard
Traditional houses	Roof form and material	Grey tile on sloping roof	Exclude mechanism tile, coloured steel tile
	House width	<16m	Exclude wider modern antique buildings
	Building floors	No more than 2 floors	Exclude modern buildings

Table 1. Traditional texture quantitative marking index.

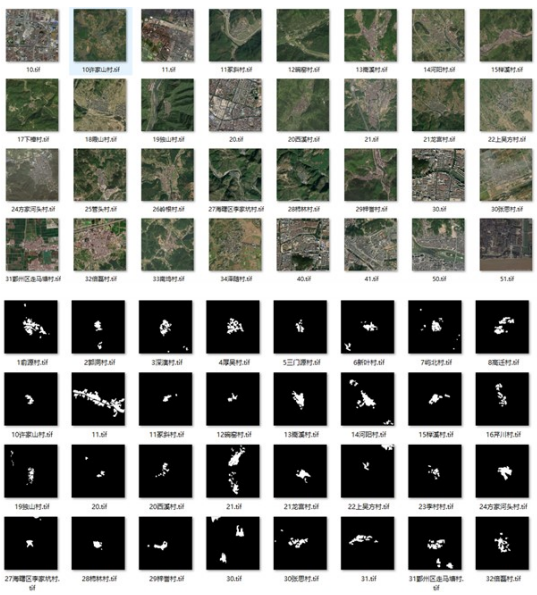


Figure 3. Part of the samples with its labels.

2.2.2 Training recognition and result processing

The first step is model selection. There are various network models in deep learning, with various application scenarios, recognition accuracy and speed for different models. Among them, U-Net model was first applied to medical image recognition, widely praised for its clear structure and excellent performance on small sample data set (H. Xu, 2018). This paper chooses this model as the recognition model, and uses python programming to construct neural network.

The second step is remote sensing image preprocessing. The accuracy of traditional texture recognition can be improved to a certain extent by acquiring remote sensing images in batches based on geographic information system, pre-processing remote sensing image data, adopting suitable colour mode and channel number, strengthening the sensitive data form of traditional texture, and weakening invalid information of traditional texture recognition.

The third step is model training and result prediction. Put the pre-treated raster image and label into the constructed model for training. Convert the pre-processed image into tiles that meet the size of the model, input the recognition model, and get the recognition result.

The last step is result correction and geographic information vectorization. There are many fragmented patches in the recognition results due to noise interference. The recognition grid results are classified according to a certain threshold. Based on graphics, open and close operations are performed on the identified texture, the aggregated but fragmented patches are integrated, and scattered and smaller interference patches are removed. The sky map building data and the identified patches are superimposed to remove the patches in the non-building area, so as to improve the accuracy of recognition. Finally, the traditional texture data in the format of raster image recognized by machine learning is vectorised with batch space using geographic information tools.

2.3 Recognition Results of Historic cities, Towns and villages Traditional Scenery Areas in Zhejiang Province

With the relatively small number of national and provincial historic cities in Zhejiang Province, the Provincial Housing and Construction Department has basically grasped the actual situation. Therefore, the focus of global technical testing is mainly on historic towns and villages at all levels. Firstly, the positions of 346 resources in the historic towns and villages directory in the whole domain are automatically geocoded, and the accurate spatial point information of the historic towns and villages resources are detected after manual inspection; then the remote sensing image data of the historic towns and villages points and the surrounding areas are obtained in batches, while the traditional texture recognition is carried out by using the pre-trained model. By comparing the model identification results with the conservation planning of some historic towns, the model identification results are closer to the core conservation scope defined in the conservation planning, indicating that the model identification effect is satisfying (Figure 4).

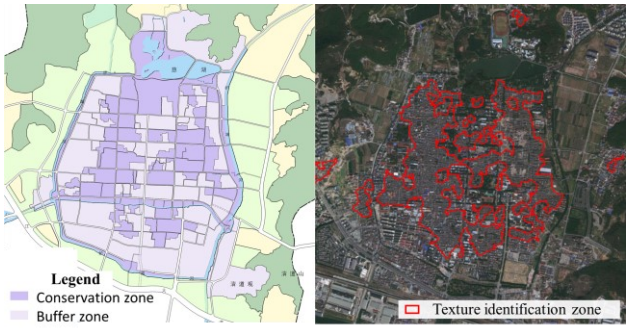


Figure 4 Comparison between conservation zone and texture identification in deep learning for historic town of Cicheng.

The recognition results are vectorized into space, and the total texture scale, median, spatial distribution, traditional texture retention ratio and others, finally realizing the "bottom investigation" of the overall historic towns and villages at all levels within Zhejiang Province.

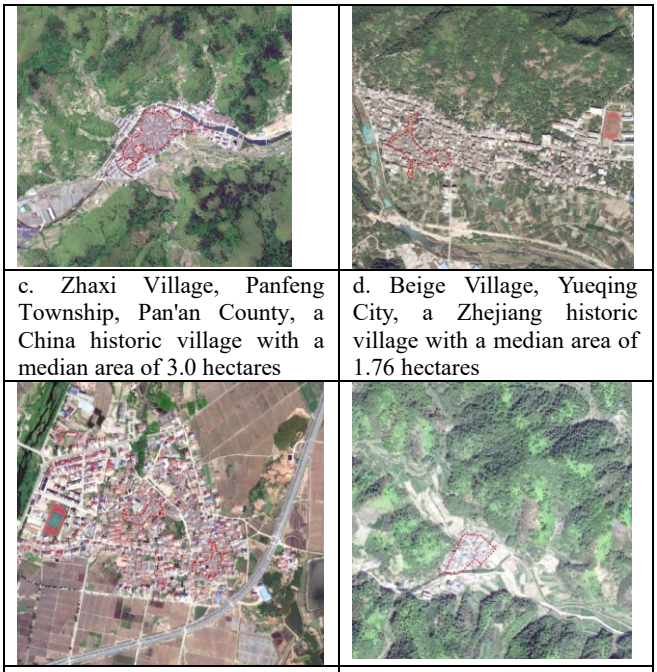
The total area of traditional texture identified by historic towns at all levels in Zhejiang Province is 1070.6 hectares, including 513.8 hectares at national level and 546.8 hectares at provincial level, among which the median area of traditional texture is 14.4 hectares at national level and 4.7 hectares at provincial level. The total area of traditional texture identified by historic villages at all levels is 820.8 hectares, including 198.9 hectares at national level and 621.9 hectares at provincial level, among which the median area of traditional texture is 4.54 hectares at national level and 2.95 hectares at provincial level.

The data comparison results indicate that, the traditional texture conservation of national related resources is better than provincial resources. In terms of spatial distribution, the traditional texture area of historic towns and villages in the hilly area of central Zhejiang basin and eastern Zhejiang is generally larger, while the traditional texture area of historic towns and villages in southern Zhejiang and Zhongshan Area Zhejiang is generally smaller. In addition, in terms of the conservation scale of traditional texture and the proportion of built-up area, the reserved area of traditional texture in most historic towns and villages of Chinese history and culture is 30%-40%, and the reserved area of traditional texture in most historic villages of provincial history and culture is 10% -20%.

a. Digang Village, Hefu Town, Nanxun District, Huzhou City, the largest China historic village, with an area of 13.7 hectares

b. Zhuge Village, Lanxi City, Jinhua City, the largest Zhejiang historic village with an area of 9.9 hectares

Figure 5. Historic villages at all levels with large area of traditional texture.



c. Zhaxi Village, Panfeng Township, Pan'an County, a China historic village with a median area of 3.0 hectares

d. Beige Village, Yueqing City, a Zhejiang historic village with a median area of 1.76 hectares

e. Siping Village, Tangxi Town, Wucheng District, Jinhua City, a small China historic village, with an area of 0.38 hectares

f. Sangling Village in Yunhe County, a Zhejiang historic village with a small area of 0.7 hectares

Figure 6. Historic villages at all levels with medium and small areas of traditional texture.

Figure 7. Distribution map of traditional texture area of historic villages.

3. AUXILIARY OPTIMIZATION OF ZHEJIANG PROVINCIAL MANAGEMENT BASED ON "INTELLIGENT IDENTIFICATION TECHNOLOGY"

3.1 "Intelligent Identification Technology" Assists "Declaration and Identification"

3.1.1 The supplement to the basis for formulating the declaration standards for historic towns and villages

In order to clarify the requirements for the preservation scale of traditional style and features recognized by historic towns and villages, we use "intelligent identification technology" to comprehensively count the preservation scale of traditional texture of existing historic towns and villages, analyse the distribution and average of their traditional texture area scale, and formulate the scale standard of traditional texture as the reference condition for recognition. For the resources that do not meet the identification standards of historic towns and villages, but with a certain pattern and style of a certain period and certain historical values, we propose to add a new resource level of "characteristic settlements" to identify them which as characteristic resources to inherit and utilize (Table 2).

Protection Classification	Identification Criteria		Standard Rationale	Remarks
Provincial historic towns	Traditional texture area	≥2 ha	Based on the settlements texture recognition technology on deep learning, the statistical analysis of 61 provincial historic towns shows that the median area is 4.7 hectares, and the average area exceeds 2 hectares	Reference recommendations
Provincial characteristics towns	traditional Pattern area	≤2 ha	Based on the deep learning settlements texture recognition technology, according to the statistical analysis of provincial historic towns, the traditional texture area is more than 2 hectares	Reference recommendations
	Remains	Retain a certain number of traditional buildings and historical environmental elements	Refer to the "Zhejiang Provincial Housing and Urban-Rural Development Department of Zhejiang Provincial Bureau of Cultural Relics on the implementation of the sixth batch of provincial historic towns and villages block declaration work notice" in the "II, declaration conditions"	**Necessary condition**
Provincial historic villages	Traditional texture area	≥1 ha	Based on the settlements texture recognition technology on deep learning, the statistical analysis of 113 provincial historic villages shows that the median area is 2.95 hectares, and the traditional texture area of 50% villages is ≥ 1 hectare	Reference recommendations
Provincial characteristics villages	Traditional pattern area	<1 ha	Based on the settlements texture recognition technology on deep learning, the statistical analysis of 113 provincial historic villages shows that the median area is 2.95 hectares, and the traditional texture area of 50% villages is ≥ 1 hectare	Reference recommendations
	Remains	Retain a certain number of traditional buildings and historical environmental elements	Refer to the "Zhejiang Provincial Housing and Urban-Rural Development Department of Zhejiang Provincial Bureau of Cultural Relics on the implementation of the sixth batch of provincial historic towns and villages block declaration work notice" in the "II, declaration conditions"	**Necessary condition**

Table 2. Standards for identification of historic towns and villages and characteristic towns and villages.

3.1.2 Provide clues for potential resource survey and direct identification

Using "intelligent recognition technology" to identify the traditional texture of the whole domain can provide clues to support the mining of potential resources. Taking Linhai City of Zhejiang Province as an example, before 2015, there were only 4 traditional villages (a type of heritage title in China) due to unclear current resources. In 2016, the potential resources of traditional villages in Linhai City were basically found out by manual investigation method, which can be compared with the results of deep learning assisted identification to verify the identification effect of deep learning method.

With 1km×1km as the grid, 2429 remote sensing image tiles were downloaded in the whole city. After identification, 159 tiles with traditional texture were found. Comparing the identified texture with the planning contents of some historic villedges, it is found that the texture identified by deep learning is closer to the scope of cultural relics, historic buildings and traditional buildings. Linhai City has published a total of 80 legal resources and other traditional settlements resources, in which 64 have been identified by deep learning, with a recognition rate of 80%.The results include scattered villages and poor quality of satellite images. The recognition rate will be higher if such adverse effects are excluded. In addition, there are still 41 villages identified by deep learning but not covered by manual survey. The overall results show that the villages results identified by deep learning have a high success rate in identifying the traditional texture of aggregation type, and can identify the clues missed in manual work, which has a good auxiliary effect in providing clues for the general survey and declaration of urban-rural settlements resources.

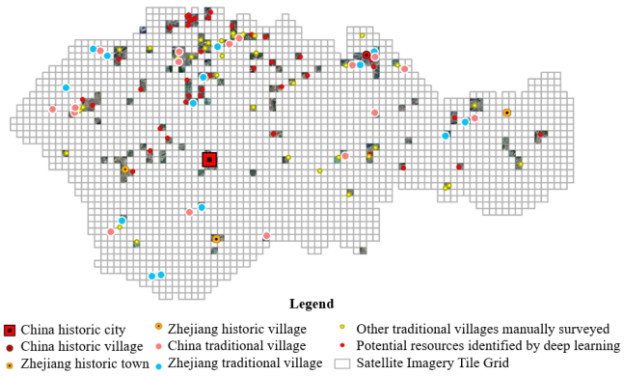


Figure 8. Potential resource identification results of linhai city.

3.2 The Guidance of Provincial Conservation and Inheritance of Hierarchical Classification Conservation and Utilization Strategy

3.2.1 The Differentiated Conservation and Inheritance Guidance of Strict Conservation and Characteristic Inheritance

As analysed in 3.1.1 of this article, there are still resources with high resource value but poor traditional style and features, which cannot reach the standard of historic towns and villages. Therefore, it is necessary to establish a different conservation and inheritance system, which is different from the original historic cities, towns and villages resources at the national and provincial levels, and attach importance to cultural excavation and re-inheritance. The characteristic historic settlements is also an important part of traditional settlements culture in Zhejiang Province and even the country, as well as an important carrier of Zhejiang historical value system. The conservation requirements of characteristic settlements cannot be strictly implemented according to provincial conservation standards, but more emphasis on cultural inheritance and development.

This contribution has been peer-reviewed. The double-blind peer-review was conducted on the basis of the full paper.
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The main task is to inherit historical and characteristic features. Urban design can be introduced to strengthen the inheritance and shaping of characteristic features of settlements heritage in combination with urban renewal and old village reconstruction.

3.2.2 Environment Analysis of Historic Villages in Zhejiang Province Based on GIS

The lack of effective analysis tools for the environmental characteristics of the whole domain historic villages leads to the lack of pertinence of the current development guidance measures. Using land cover data and GIS model builder, an automatic analysis tool of environmental characteristics of whole domain village can be constructed. This paper takes the historic villages as an example to analyse its environment: According to the statistics of the land cover area within 2km around the historic villages, the historic villages resources in different environments and with different utilization potentials are divided into ecological environment type, agricultural landscape type, construction spread type and mixed environment type according to the proportion of different land cover. Taking the historic villages of China in Zhejiang Province as an example, 41.9% of them are ecological coordination type, 34.9% are agricultural integration type, 4.7% are construction threat type and 18.6% are mixed environment type.

For villages with different environments, different guidance and integration development strategies are proposed:

Agricultural integration type: pay attention to farmland conservation, agricultural cultural heritage conservation, and promote the cultural creation and transformation of characteristic agricultural products;

Ecological coordination type: protect the surrounding landscape environment, promote the green development of villages, and encourage the integration of culture and tourism;

Construction spread type: strengthen construction control, consolidate conservation foundation and actively explore activation and utilization;

Mixed environment type: pay attention to both management and guidance, promote innovative conservation and utilization.

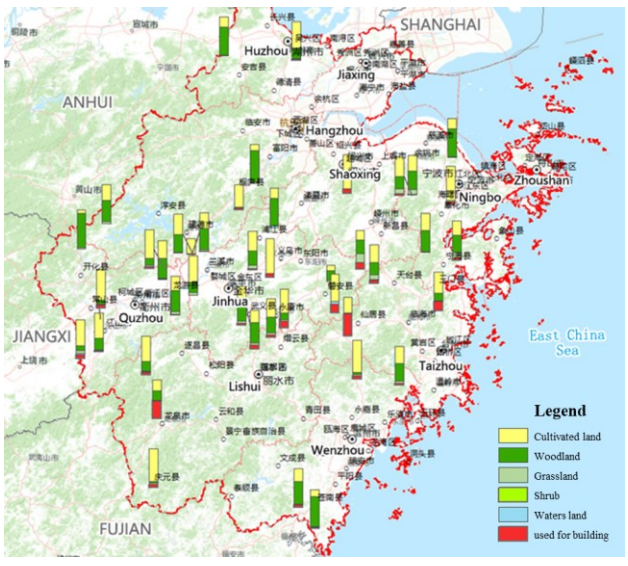

Figure 9. Analysis of the function of the surrounding environmental land of the historic villages in Zhejiang Province.

3.2.3 Utilization Potential Analysis and Utilization Guidance Based on Multi-source Data

By summarizing the factors of practical cases, relevant standards and relevant papers, combining with multi-source data, considering the availability of data, objective limitation and the criticality of indicators, 6 indicators and 12 factors are constructed from 3 aspects to form an evaluation method applicable to the utilization potential of provincial historic cities, towns and villages resources (Table 3). The results show that the north of Zhejiang and Jinqu basin are the areas with high utilization potential, while the northwest of Zhejiang, the south of the mountain area of south Zhejiang, the Zhongshan Area of Zhejiang and the coastal area of east Zhejiang are the areas with low utilization potential. Through the evaluation of the traceability factor layer, the reasons for the high and low utilization potential are analysed, and the corresponding countermeasures are proposed. For example, the mountain area in southern Zhejiang Province has low comprehensive utilizability, but it has rich historic settlements resources. Because of its location disadvantage and backward economic development, it is necessary to improve transportation convenience to explore the utilization mode that conforms to local characteristics, create a small amount of characteristic boutique resources, and pay more attention to cultural ecological and intangible cultural heritage conservation.

Target Layer	Factor Layer			Data Required	Analytical Methods
Resources Utilizability Assessment	01 Dominance of Heritage Resources				
	Resource Background				
	Rank	Aggregation degree	Storage scale	Heritage resource point level information	Nuclear density analysis
	Abundance of Relevant Heritage				
	Density of traditional villages	Cultural relic density	Heritage route distance	Relevant heritage data	Euclidean distance analysis
	Tourism Service Superiority				
	Number of surrounding scenic spots	Distance of surrounding scenic spots		Attraction data at all levels	Spatial join analysis
	02 Location Dominance				
	City Location Advantage				
	Grade of surrounding cities	Distance to surrounding cities		Traffic network data around the heritage site	Network-based isochronous analysis
	Traffic Location Advantage			City hierarchy	
	Distance to airport and high-speed railway station			Transportation facilities	
	03 Level of Economic Development				
	GDP			GDP data of each city	Spatial interpolation analysis

Table 3. Evaluation system of resource utilization potential of historic cities, towns and villages provinces.

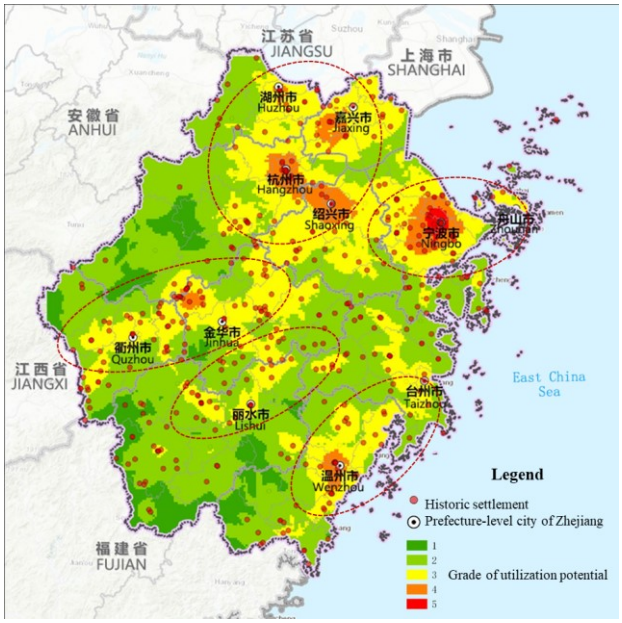

Figure 10. Distribution map of utilization potential.

3.3 Normalized Monitoring Combined with Key Indicators of New Technologies

The key core indicators need to be selected first when the regular physical examination evaluation changes to dynamic monitoring and timely early warning. The principles for setting monitoring indicators are quantification and simplification, management constraints and horizontal comparison. In the stage of "supervision and inspection", construction and development activities and the conservation of traditional patterns should be more concerned. Therefore, among the evaluation indicators issued by the national historic cities physical examination evaluation, the two indicators most relevant to the development and construction activities and the conservation of traditional pattern are selected as the indicators for dynamic monitoring and timely early warning, mainly including: Whether there are construction activities violating planning control and widening traditional streets and alleys in the historic urban area and surrounding areas; Whether there is any damage to the traditional texture in the historic conservation area.

Based on the settlements texture recognition technology of deep learning, the texture recognition is carried out on the high-resolution remote sensing image data dynamically updated in the "historic cities, towns and villages" resource area to detect the change of its traditional texture range. Once the change exceeds a certain threshold, a timely warning is required to establish a dynamic monitoring technology based on core indicators.

4. CONCLUSION

Technology exploration and progress can bring possibility for more effective conservation management at provincial level. However, the lag of conservation progress of provincial competent authorities and the lack of system and mechanism make these technologies not play a real role in provincial conservation supervision. Therefore, the implementation of technology still needs active promotion and guarantee of relevant mechanisms. On the one hand, it is necessary to establish a horizontal and vertical historic cities, towns and villages data geographic information management platform to realize the real-time reporting of lower-level zoning and monitoring data, and the cross-department sharing of remote sensing image change detection results data. On the other hand, it is necessary to strengthen the supervision responsibility of provincial competent authorities, actively promote the physical examination evaluation of historic cities, towns and villages, and increase the fund and policy support for relevant monitoring and evaluation.

There is a big gap between the traditional textures of different regions in China, which makes it difficult to identify the traditional textures of different regions by using a model.Our methodology relies entirely on analysis of vertical satellite imagery to monitor the status of cultural heritage places. And our model training samples mainly focuses on gray tile roof buildings. This weakness would be addressed by adding a significant component of ground-based verification of satellite analysis. At the same time, we hope to increase the subdivision of different textures in different regions by means of transfer learning and fine-grained identification, further identify the characteristics of internal elements of texture in the future. We hope to apply deep learning to the interpretation and inheritance of historic settlement heritage textures, in order to better understand the characteristics of traditional textures, provide a basis for planning and controlling traditional textures, and establish a traditional texture gene bank in China to play a greater role.

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