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# *Environmental Technologies for Nature Conservation Incorporating Artificial Intelligence*

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***Abstract:*** Nature reserve management requires the processing and analysis of large amounts of information and map data, so artificial intelligence meets the practical needs of nature reserve management. The aim of this paper is to study artificial intelligence-based technologies for nature conservation environments. In order to solve the outstanding problems in the environmental management of the M Mountain Nature Reserve, an environmental management information system for the M Mountain Nature Reserve was designed through feasibility and requirement analysis. Based on the large amount of images and measurements collected, the visualstudio 2008 development tool was used to classify the wetland system of M Mountain Nature Reserve using the arcGIS mechanism as the development platform and making full use of the functions of GIS components. The results show that the M Mountain Nature Reserve is extremely rich in wetland types, with marshes being the main wetland type in the area, accounting for 95% of the total wetland area. Based on the full consideration of the natural environment of M Mountain Nature Reserve, it provides a basis for the development of wetland environmental protection in M Mountain Nature Reserve.

## 1. Introduction

So far, the construction of nature reserves has attracted the full attention of countries and reached a certain level of development, but the overall level of information is not high. With the development of new technologies such as computer technology, network technology and artificial intelligence, the benefits of new technologies have gradually emerged on the other hand, and economic development and the environment require the application of these new technologies to the construction of nature reserves [1, 2]. The establishment of an intelligent nature reserve management information system provides scientific management and decision support methods for the conservation of biodiversity in nature reserves, the protection of environmental resources and the creation of social benefits [3, 4].

In order to improve environmental protection monitoring capabilities, Laura Amo proposed a large-scale data mining method based on the characteristics of intelligent monitoring and diagnostic techniques related to environmental protection. Constrained parameter models are established for raw statistics on environmental monitoring, soil monitoring data, spatial pollution emissions and water resources monitoring data. The association rule-based resource extraction method is useful information for environmental protection data mining. Classification analysis, environmental monitoring and intelligent diagnosis of environmental data based on the classification results. Simulation results show that the higher the accuracy of mining environmental data using this method, the higher the accuracy of pollution information classification, the higher the efficiency of environmental monitoring and the higher the real-time performance [5]. Yuta Yaguchi proposed an intelligent video analysis system, briefly summarised its functions and proposed the design of intelligent analysis for video monitoring in environmental systems. It is concluded that video monitoring and intelligent analysis can be used in environmental systems. Remote monitoring of water quality, remote monitoring of water levels, monitoring of wastewater treatment systems in chemical enterprises and overhead video monitoring are carried out [6]. ali Akbari Through various online sensors, process instruments, video monitoring systems and animated displays, the intelligent environmental monitoring system for pollution sources provides information on pollution generation, access to the working status of pollutant control equipment, management of various stages of the acquisition of key water quality parameters, real-time display of working scenes and three-dimensional simulation of the entire production model. The programme is mainly aimed at the acquisition of various monitoring parameters at the field end and the construction of the field system [7]. Therefore, according to the requirements of environmental resources research and protection in the development, protection and management of environmental resources, as well as the current trend of GIS application, it is an important and urgent task to design and develop an environmental management information system for GIS of natural reserves [8, 9].

This paper uses ArcGIS software as the basic platform, and based on the powerful spatial analysis function of ArcGIS software, the statistical analysis of wetland distribution in the key research area is carried out at different levels and levels. Taking the wetlands of M Mountain Nature Reserve as the research object, a wetland classification system is established to classify the main types of wetlands in M Mountain Nature Reserve and explore their distribution characteristics. It provides a reference for the in-depth study and effective protection of wetland ecosystems in M Mountain Nature Reserve.

## 2. A Study of Nature Conservation Environmental Technologies Incorporating Artificial Intelligence

### 2.1. Artificial Intelligence

With the continuous progress of computer technology, artificial intelligence technology has become more and more mature, but the definition of artificial intelligence, the industry and academia have not yet formed a unified understanding, more widely accepted definitions are mainly the following:

(1) Artificial intelligence is a computer program that makes people feel incredible, a machine that can do things that people do not think a machine can do. This definition comes from the perspective of the general public on AI, which is very vivid, but highly subjective, and is an empirical definition that is obviously not scientific and reasonable [10, 11].

(2) Artificial intelligence is the study of computer programs. This definition is in line with human

cognition and is the view of many people on artificial intelligence. But machine learning is only an important means of achieving AI at this stage, and it is likely to break through to powerful levels of AI in the future. This definition has a temporal character, but a narrow scope.

(3) Artificial intelligence is a type of software based on environmental awareness that is used to take rational measures and maximise benefits [12, 13]. This definition emphasises not only that AI responds positively to environmental perception, but also that the AI response must achieve its purpose; it does not emphasise AI that mimics the human mindset or the ultimate human rules of thought, which is most explicit.

## 2.2. System Design Principles

The overall system design can be based on the design ideas of system engineering, using intelligent systems to make the environmental management of nature reserves more scientific, rational and efficient. The overall principle of system construction is to achieve integrated planning, unified standards, unified management, rational use of funds and a sustainable development path from a macro, global and long-term perspective [14, 15]. The following basic principles should generally be followed:

(1) Principle of practicality

The environmental management of the M Mountain Nature Reserve is still somewhat chaotic and disorganised, but the situation is changing to one of good management with laws to follow and rules to follow. For example: gradually improve the relevant laws and regulations, and further improve the business quality of the management personnel; in addition, the office software for basic data also needs to be upgraded, and the financial investment needs to be strengthened. Therefore, the system should be convenient and practical in terms of function, effective and feasible in terms of technology, and also needs to have certain innovation [16].

(2) Standardization principle

According to the convenience and superiority of GIS information management system development, a set of adjustable environmental information management processes for M Mountain Nature Reserve should be developed, so as to achieve a standardised and standardised transformation of the existing work related to natural environment management operations. In addition, system development, database construction and function design are all standardized requirements [17, 18].

## 2.3. Supervised Classification of Remote Sensing Data

In this paper, we use supervised classification to classify the landscape categories of M Mountain Nature Reserve. Supervised classification is also called training classification method, that is, the set of image elements or a single image element is selected as the area of interest in the training area, that is, the training sample, and then the feature parameters are selected and derived as the decision rules, which are divided according to certain rules to form the final supervised classification map. Supervised classification is a method of pattern recognition. In this study, we choose the maximum likelihood method to classify images for pattern recognition. The flow of supervised classification is shown in Figure 1 below:

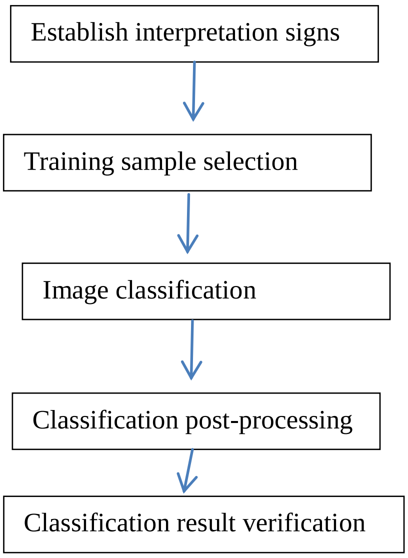


*Figure 1. Flow chart of supervision classification*

## 3. Investigation and Study of Environmental Technologies for Nature Conservation Incorporating Artificial Intelligence

### 3.1. Overview of the Study Area

The landscape of Mount M Nature Reserve is a typical volcanic landscape with gradually decreasing slopes.Mount M has a temperate continental mountain climate influenced by monsoons. Winters are long and cold, summers are short and cold, and springs are dry. Due to its high topography and complex terrain, Mount M exhibits a spectrum of visible vertical climate change in addition to the influence of solar radiation, geography and atmospheric circulation. From mountain to mountain, the three climates can be classified as temperate, boreal and subtropical.

### 3.2. Overall System Design

The system is built on a C/S architecture based on a local area network, so that the advantages of the hardware environment on both the client and server sides can be fully utilised and tasks can be reasonably allocated to the client and server sides to achieve resource sharing. The system's spatial database is stored on the server side, which is managed and maintained by the system maintenance staff. When a request is received from the client, data for different purposes is sent as required, so that the client can provide users with functions such as data loading, editing, map browsing, spatial analysis and system management as long as ArcGISEngineRuntime is installed.

### 3.3. Image Classification

This paper uses MaximumLikelihood, a non-linear classification method based on Bayesian criteria with a low error rate, which is more common in supervised classification. Currently, Maximum Likelihood is a widely used supervised classification method.

Assuming that there are N types of features in the study area, let gi(n) be the discriminant function, and the conditional probability density function p(MiIn) for the nth type of feature is given by:

$$gi(n) = p(Mi|n) \tag{1}$$

where p(MiIn) is also known as the posterior probability, and according to the Bayesian formula, there is :

$$gi(n) = p(Mi|n) = \frac{p(n|Mi)}{p(n)} p(Mi) \tag{2}$$

where p(MiIn) is the conditional probability of observing the nth image element in the Mi study area; p(Mi) is the prior probability of the Mi category; and p(n) is the probability of occurrence if n is independent of the category. When there are multiple categories of features, multiple values of p(MiIn) are calculated, and the category with the highest probability of occurrence is the category to which the image element belongs, based on Bayesian principles.

## 4. Analysis and Research of Environmental Technologies for Nature Conservation Incorporating Artificial Intelligence

### 4.1. System Function Design

In the collection, management and application of geospatial data, the Environmental Management Information System of M Mountain Nature Reserve needs to handle a large amount of graphical data. According to the objectives and principles of system design, and according to the analysis method and design idea of system structure, the Environmental Management Information System of M Mountain Nature Reserve can be mainly divided into six modules: file operation module, map browsing module, data retrieval module, spatial analysis module, physical resources display module and environmental health evaluation module. The functional design of the environmental management information system of M Mountain Nature Reserve is shown in Figure 2:

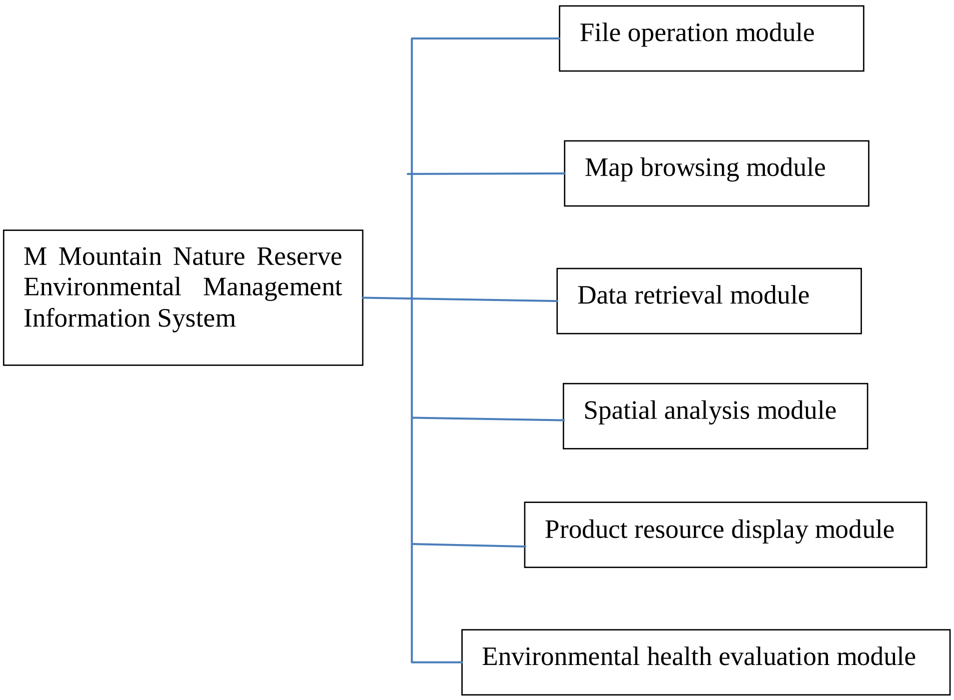


*Figure 2. Design diagram of system function*

## 4.2. Wetland Information Extraction Based on Soil Characteristics

The classification analysis of wetland distribution characteristics is the premise and foundation of wetland management, utilization and protection. From the system spatial analysis module, wetlands in M Mountain Nature Reserve are mainly distributed in poorly drained and easily stagnant soils.

The swamp area of M Mountain Nature Reserve is relatively small, mainly distributed in the south, mainly in an island-like distribution, mainly in terraces and low-lying areas, as shown in Table 1. Based on the results of the system, there is a 95% probability that the swampy soil sample points are wetlands, as shown in Figure 3.

*Table 1. Distribution of plots in different soil wetlands*

| Main soil types | Number of quadrats belonging to wetlands | Wetland probability (%) |
|---|---|---|
| swamp land | 12 | 95 |
| baijiang soil | 17 | 86 |
| Meadow albic soil | 10 | 90 |
| River beach forest soil | 16 | 87 |
| Montane white-pulped dark brown soil | 12 | 74 |
| Brown coniferous forest soil | 3 | 36 |
| Mountain dark brown soil | 6 | 41 |
| other | 8 | 58 |

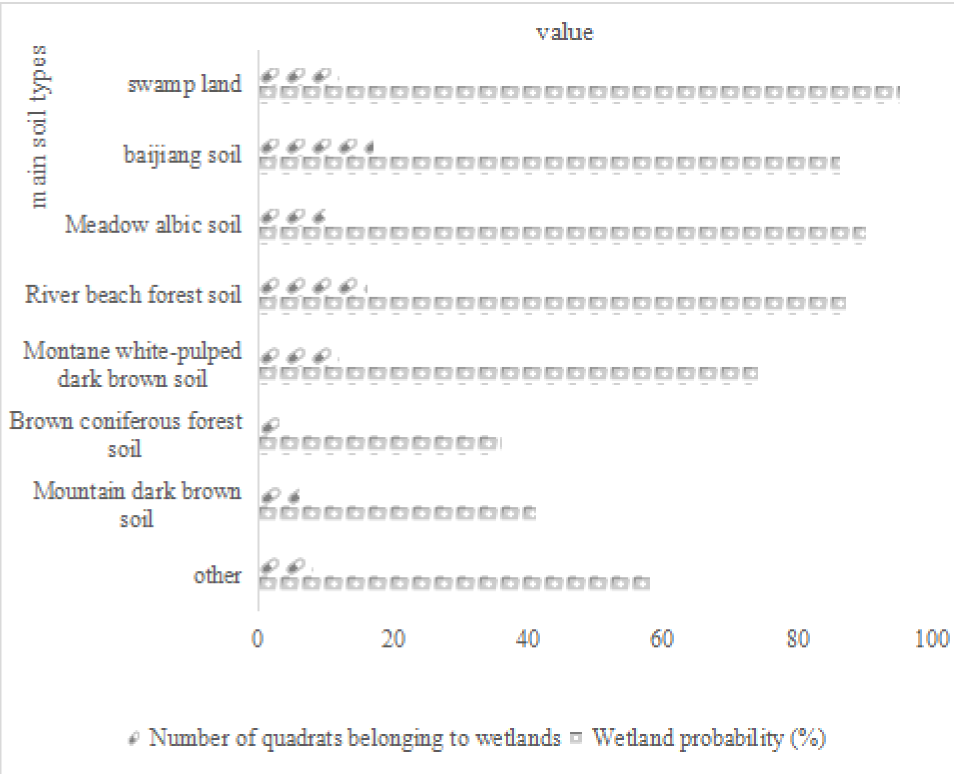


*Figure 3. Wetland information extraction*

### 4.3. Horizontal Distribution Characteristics of Wetlands

Topographically, due to the volcanic cone like mountain structure of Mount M, low-lying and uneven terrain is formed after long-term river impact. Long term ponding is easy to form in the process of water infiltration, or seasonal ponding is formed in the rainy season, resulting in water saturated soil with marsh or hygrophytes, thus forming various wetlands. The north slope of Mount M Nature Reserve is relatively gentle, followed by the west slope, and the south slope is relatively steep with complex and diverse terrain. The north slope has rich wetland types, the south slope has the largest wetland area, and the west slope has relatively few wetlands, as shown in Table 2.

*Table 2. Percentage of wetlands of different slope orientations to total wetland area in M Mountain Nature Reserve*

| Wetland types | north slope (%) | South Slope (%) | Western Slope (%) |
|---|---|---|---|
| Seasonal river wetland | 12 | 26 | 12 |
| Permanent river wetland | 6 | 14 | 0 |
| Permanent lake | 8 | 0 | 0 |
| Forest swamp wetland | 26 | 55 | 36 |
| Shrub swamp wetland | 25 | 5 | 15 |
| Other swamp wetlands | 18 | 0 | 28 |
| Artificial wetland | 5 | 0 | 9 |

## 5. Conclusion

In modern society, people's awareness of environmental protection is gradually enhanced. Based on ArcGIS software platform, this paper completed the classification results map of the study area, and carried out statistical analysis on the distribution of different types of wetlands. Due to time, funds and many other reasons, this system still has some shortcomings, which need to be improved and perfected according to the actual situation in the future. There are two specific points as follows: to study the mechanism of wetlands affecting the natural ecological environment, and how to study the relationship between wetlands and the natural environment from the micro level, which is worthy of further discussion. Whether the landscape index can reflect the relationship between landscape pattern and ecological process as expected, it is necessary to analyze the relationship between landscape index and ecological process and select more appropriate analysis and research methods to better study the impact of wetlands on the natural environment.

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## Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

## Conflict of Interest

The author states that this article has no conflict of interest.

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