Research on rural land planning based on traditional farming culture

Zhuang Fei

School of Mechanics And Civil Engineering, China University of Mining and Technology, Xuzhou, People’s Republic of China; Development Research Institute, Huaiyin Normal University, Huaian, People’s Republic of China

ABSTRACT

As the electronic process of land management is accelerating, the research on the construction of land use planning system tends to be intensified. This paper combines the concept of traditional farming culture to construct a rural land planning system, and proposes a stacked combination collaborative filtering recommendation algorithm to process traditional farming cultural data and promote the integration of traditional farming cultural data and rural land planning data. Moreover, starting from the existing problems in urban land planning at this stage, this paper proposes the rationality and importance of the land use planning system, and at the same time guarantees that it can be used in a standardised and scientific way. In addition, after explaining the construction purpose of the land use planning system, this paper also explains the tasks, design and corresponding steps to be completed to construct the system. Finally, this paper verifies the performance of this system through experimental research. Through the experimental results, we can see that the method proposed in this paper has a certain effect.

Introduction

China is a big agricultural country, and land is the lifeline of agriculture and farmers. Fundamentally speaking, the three rural issues are land issues. When the land is reasonably used and managed to enable the land to truly increase the income of farmers, increase the output of agriculture and change the backward outlook of the rural, the three rural issues will be fundamentally resolved. In the first two rounds of overall land use planning implemented in my country, rural homesteads should have been reduced through reasonable consolidation and land reclamation. Land reclamation is achieved in the view of cultivating the efficiency of the soil and guaranteeing the agricultural production based on improving and continuing the land fertility. Reclamation usually results in a decrease in bio diversity, a reduction in coastal wetlands and the demise of plants and animals’ habitats. However, the actual situation is that the rural housing land has not decreased but increased. How to effectively reduce rural homesteads and achieve dynamic balance of cultivated land has become a hot topic. To this end, our country has put forward the policy of ‘linking the increase and decrease of urban and rural construction land’. Urban land construction land is situated within a remarked township. It refers to land used for residences, marketing, or industrial uses within a townsite. In meantime, the increase and decrease of the rural construction are mainly with their less population which they situated remote away from one another. Urban land construction land is situated within a remarked township. It refers to land used for residences, marketing or industrial uses within a townsite. In meantime, the increase and decrease of the rural construction are mainly with their less population which they situated remote away from one another. The major rural issues in agricultural land are manure and fertilisers, water irrigation, soil erosion, lack of machines. New rural construction provides an opportunity for the implementation of this policy and the transformation of rural land use to intensive and economical (Parry et al. 2018). In order to better serve the needs of new rural construction and strengthen the management of rural land, many places in my country have begun to require village-level land use planning in the construction of new rural (Farahbakhsh and Forghani 2019).

Land is the space carrier for human society to survive, and an important resource for the sustainable development of human economy and society. Sustainable development is elaborated as development that needs to meet the issues of the current without risking future generations’ capacity to meet their own needs. Human
resources are considered as the greatest resources since people can make the best use of available resources if they have the required knowledge, skills training and new tech. It is the carrier of all other natural resources, and at the same time, as an important natural resource, it forms the basis of the development of human society. Therefore, maintaining a certain amount and quality of cultivated land is a prerequisite for ensuring national food security (Sahitya and Prasad 2020).

In the current process of accelerating urbanisation and industrialisation in my country, the number and scale of cities continue to expand, the demand for construction land continues to expand and cultivated land resources continue to be invaded. There is a discernible acceleration of this urbanisation, with the number of city dwellers growing by a half million each week. This means that, in 2030, 60 percent of the world population will live in urban regions. Industrialisation is the process by which an economic growth turns from a primarily agricultural to an industrial production economic system. Independent manual work is commonly replaced by mechanisation mass manufacturing, and craftspeople by production lines. Traditionally, industrialisation has resulted in urban development by stimulating economic growth and employment opportunities that inspire people to cities. When a production plant or numerous factories are established within a region, a high demand for factory labour is created, and urbanisation begins. The protection of land resources, especially cultivated land resources, is becoming more and more severe, guaranteeing 1.8 billion mu of cultivated land. The pressure on the red line is increasing. Coordinating urban and rural development, under the premise of ensuring that the quantity and quality of arable land are not reduced, the problem of meeting the needs of urban development for construction land is before decision makers at all levels across the country. Rural development strategies should take into account the nature and extent as well as possibilities of remote regions and to provide aimed distinguishable approaches. A flourishing and vibrant agriculture industry is a critical habitat of regional development, trying to generate strong links to certain other economic sectors. Land consolidation planning can improve the optimal allocation of land resources and increase land production capacity through the overall arrangement of land resources in a certain area. The main function of the land consolidation is to increase the income level of the farmers and growing the gain per unit area. Among the strategies are using are growing the size distribution of farmlands into viable business units through leasehold; centralisation to decrease the separation of smallholder farmers plots; and co-operative agriculture, wherein farm owners maintain rights to the land but farm it collaborative manner. It is usually used to produce greater and much more reasonable farmland. The existing farming culture is more drawback for the small farmers, it creates risk to the environment due to deforestation and water shortage. It does not increase the yield of the crop. This method overcomes by using the stacked combination collaborative filtering recommendation algorithm to promote the traditional and rural land data. The collaborative filtering algorithm is used to promote the integration of traditional farming culture. Traditional agriculture is distinguished by the comprehensive use of indigenous and local understanding, divine and religious beliefs in farmland judgement. The weapon, hoe and stick are commonly used as ancient or reduced tools. Merits of traditional farming is much interference with crops. These crops are much healthier with fewer pesticides. Optimal allocation of land resources that helps in dividing the sample among the given source. Under the premise of ensuring the dynamic balance of the total cultivated land, the quality of cultivated land can be optimised, and the production and living land in the planned area can be optimised. Carry out zoning, improve the level of land-intensive use and increase the supply of construction land.

Land remediation is a very policy-oriented project to benefit the people, and a major measure for the country’s fiscal back-feeding of the rural areas. Land remediation deals with the elimination of contamination or pollutants from ecological mass media such as soil, groundwater, deposit or surface water. It removes all impurities. Remediation actions also include that eliminate, disintegrate, dismantle, decrease, minimise, or encompass pollutants. Remediation also involves trying to remove or minimising dangers caused by land contamination. Whether the arrangements for land improvement projects are appropriate and reasonable is related to major issues such as social stability and development. Studying the theories and methods of country land remediation planning based on the background of urban and rural overall planning, and used to guide the preparation of land remediation planning in the study area, is of great significance to the scientific and reasonable planning and layout of land remediation projects and projects, and to promote local economic development.

At present, my country has entered the second round of land use planning revision stage. The main task of this stage is to investigate and evaluate land resources using new technologies and methods such as networks and databases, thereby improving the legal and social status of planning, and building and perfecting a system of planning theories and methods. The main
motive of the manuscript is to improve the well-developed farming culture in order to overcome the traditional farming culture. Through pilot construction, gradually realise a nationwide land-use planning management information system to improve the level of technical support and application of modern technologies such as networks and databases in grassroots land use planning and management.

This paper analyzes the rural land planning data based on the collaborative filtering recommendation algorithm, builds an intelligent model of rural land planning under the traditional farming cultural concept, and analyzes it through experiments. Rural land planning effect is more significant effect of the land use including the soil erosion, desertification, salinisation and soil degradation.

Related work

Land-use planning has a long history abroad. Most of the research methods of traditional land use planning are qualitative methods. That is, the land-use zoning is carried out based on the field experience of the planners and the subjective wishes of the leaders, and then the land allocation ratio and the development direction of land use in various aspects of agriculture, forestry, animal husbandry and fishery in a certain area are determined (Dereli 2018).

With the increase in population and the deterioration of the environment, the focus of land use planning has gradually changed under the pressure of resources, environment and development. It has evolved from the original subjective wishes of a few people to public decision-making with a broad public base for the purpose of controlling changes in land types and sustainable development. Land-use strategic plan can assist in the cooperation of numerous lands used inside a river basin, disarming and making sure the quality and quantity of water for better future. The planning theory with modern cybernetics as the concept began to be accepted, and its process as the goal – continuous information – prediction and simulation of various future comparison programmes – evaluation – selection – continuous supervision (Guerreiro et al. 2018). The cybernetics is defined as the scientific knowledge of species and computer control and communication. This definition connects cybernetics to the theory of control system as well as biology, particularly the anatomy of the nervous system. In the process of land use planning, new methods such as linear programming, model analysis, remote sensing image analysis and computer application are widely introduced. Therefore, the scientifi city, work efficiency and accuracy of planning at this stage have undergone significant changes (Carpentieri and Favio 2017). The geographic information system proposed by Canada takes the analysis and processing of land data as the main content (Francemensah et al. 2017). The Federal Republic of Germany, Sweden and other countries have also successively developed their own geographic information systems, and proposed that the focus of development research is on the three aspects of spatial data processing algorithms, data structures and database management (Baba et al. 2019). Many universities began to pay attention to cultivating GIS talents and created laboratories. Therefore, the technology of geographic information system has been widely valued by government departments, commercial companies and universities, and has become a compelling field. At this time, land use planning no longer adopts static and pure qualitative methods, but has developed into a dynamic, qualitative and quantitative combination (Teixeira 2018). Khayambashi (Khayambashi 2018) uses GIS analysis tools and linear programming methods to further develop land use dynamic planning models to optimise and combine land spatial attributes. A geographic information system is a computer device that gathers, stores, tries to manipulate, analyzing, maintains and exhibits multiple kinds of geographical data. The emergence of relational spatial data structure has solved the problem of massive data processing. The development of WEBGIS technology provides conditions for the online publication of spatial information. These two technological breakthroughs have made the field of land science research continue to deepen (Lü et al. 2019). Web GIS is a promising field that incorporates web and geographic information systems (GIS). It has decided to move the authority of GIS from servers located to the cloud, trying to put interactive maps and geo-spatial intellect in the offices and fingers of millions and billions.

The different objects, scopes and tasks of land use planning make various plans that have their own unique content and focus (Alrobaee 2021). According to the nature and mission characteristics of the planning, land use planning is divided into overall planning, detailed planning and special planning. According to the planning scope and area, it is divided into national planning and local planning. Long-term planning, medium-term planning and short-term planning are divided by time period (Meenar 2017).

Land use planning involves many aspects of natural ecological system and socio-economic system, and it is a large complex system. To sort out the various
relationships inside and outside the system, the planning must be carried out in accordance with the method of systems engineering (Gieseking 2018). Determining the shape, scale, location and boundary of land is the main task of land use planning, and its content must be planned according to the environmental conditions of the land and the focus of the task (Giannopoulou et al. 2019). Township-level land use planning generally includes the following contents: land use planning for ecological environment construction, agriculture, urban and rural settlements, water conservancy projects, roads, bridges, transportation, etc. (Manogaran et al. 2021), analysis and evaluation of current utilisation and development, balance and prediction of land supply and demand, optimisation of land use structure, layout of key project land, special land use planning and land use planning zoning (Dang and Kumar 2017).

Yadav and Borana (2017) successfully applied the geographic information technology system. In the process of land suitability evaluation, after flexible processing, Chen et al. (2017) combined geographic information technology and software systems with land attributes and spatial data to greatly improve the effectiveness and accuracy of the work.

Data mining algorithm for traditional farming culture

The specific implementation process of the cascading combination collaborative filtering recommendation algorithm proposed in this paper is mainly divided into three steps. Cascading is the method of an unanticipated sequence of events which happens when actions and interactions have a serious effect on other systems. Collaborative filtering is the method which is used by the recommender system. It is also a method of creating automatic calculations about the interests of the user by collection preferences or sensitivity data from many users (Zhang et al. 2018). The first step is to predict the unrated items of the target user based on user collaborative filtering. The statistical process that underpins personalisation is known as collaborative filtering. Collaborative filtering is a technique that uses algorithms to filter data from customer reviews in order to make personalised suggestions for users with similar choices. The second step is to fill in the original scoring data. The performance of recommendation system is measured by the accuracy of recall and precision. The recommendation system can be evaluated with the help of mean average precision which is the metric of choice for estimating the performance of the recommended system. The third step is to generate recommendations to target users based on item collaborative filtering. The specific implementation steps are as follows:

**Step 1 Construct a user-item rating matrix**

First, the algorithm obtains user preference data. Normally, the user preference data includes the user’s number, the item’s number and the user’s interest preference value for the item. Data mining algorithm converts it into an initial user rating data matrix with dimension through preprocessing. To represent the mutual relationships between the elements, a user-item rating matrix is constructed. It is used in data mining to obtain the user preference data.

\[
R_{mn} = \begin{pmatrix}
R_{11} & R_{12} & \cdots & R_{1n} \\
R_{21} & R_{22} & \cdots & R_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
R_{m1} & R_{m2} & \cdots & R_{mn}
\end{pmatrix}
\] (1)

Among them, \(m\) represents the number of users in matrix \(R_{mn}\), \(n\) represents the num\(M \times N\)ber of traditional farming culture data sets, and \(R_{ij}(1 \leq i \leq m, 1 \leq j \leq n)\) represents user \(i\)'s preference value for traditional farming culture data set \(j\). Data mining algorithm helps in the construction of rural land planning in order to evaluate the implementation process by predicting the data. If user \(i\) do not rate the traditional farming culture data set \(j\), then:

\[R_{ij} = 0 \] (2)

**Step 2 Calculate the similarity between users**

We assume that the set \(U = \{u_1, u_2, \ldots, u_n\}\) represents all users in the matrix \(R_{mn}\), but the target user \(a\) is not in the set \(U\). The algorithm selects a similarity calculation method to calculate the interest similarity \(sim(a, u)\) between target user \(a\) and user \(u\). Finally, the algorithm repeats the first two steps until all users in the set \(U\) have completed the similarity calculation with the target user \(a\).

**Step 3 Find the nearest neighbours of the target user**

The algorithm sorts the similarity of the target user \(a\) calculated in Step 2, takes out the \(k\) elements in sequence, and assumes that the similarity relationship between them is:

\[sim(a, u_1) \geq sim(a, u_2) \geq \cdots \geq sim(a, u_k)\] (3)

User \(u_1, u_2, \ldots, u_k\) corresponding to these \(k\) similarities constitutes the nearest neighbour user set of
Step 4 Predict and rate the target user

For the traditional farming culture data set that the target user a has already evaluated, there is no need to make predictions. Only the traditional farming culture data set that has not been evaluated by the target user needs to be scored for its prediction. The traditional farming culture data set that has not been evaluated by the target user a is represented by a target traditional farming culture data set (Abdullahi and Pradhan 2018):

\[ U_{\text{nearest}} = \{u_1, u_2, \ldots, u_k\} \]

Step 5 Fill in the original user-item rating matrix

The algorithm adds the rating of the traditional farming culture data set in the set \( l \) to the corresponding position in the original rating matrix. For example, user 6’s rating on the traditional farming culture data set 4 is added to the sixth row and fourth column of the matrix, namely \( R_{64} \).

Step 6 Calculate the similarity between items

We assume that the set \( l = \{l_1, l_2, \ldots, l_n\} \) represents all the traditional farming culture data sets in the matrix \( R_{mn} \), but the target traditional farming culture data set \( t \) is not in the set \( l \). First, the algorithm takes out one of the traditional farming culture data sets \( l_i \) from the set \( l \), and finds the set of users who are interested in both the target traditional farming culture data set \( t \) and the traditional farming culture data set \( l_i \). Next, the algorithm selects a similarity calculation method to calculate the similarity \( sim(l_i, t) \) between the target traditional farming culture data set \( t \) and the traditional farming culture data set \( l_i \). Finally, the algorithm repeats the first two steps until all the traditional farming culture data sets in the set \( L \) have completed the similarity calculation with the target traditional farming culture data set \( t \). Similarity calculation is used to measure the distance among the two directions or statistics of pairs. It is used to measure how similar two objects being measured.

Step 7 Find the nearest neighbours of the target traditional farming culture data set

The algorithm sorts the similarity of the target traditional farming culture data set \( t \) calculated in Step 6, takes out the \( k \) elements in sequence, and assumes that the similarity relationship between them is:

\[ sim(t, i_1) \geq sim(t, i_2) \geq \cdots \geq sim(t, i_k) \]

The traditional farming culture data set \( i_1, i_2, \ldots, i_k \) corresponding to these \( k \) similarities respectively constitute the nearest neighbour traditional farming culture data set of the target traditional farming culture data set \( t \) (Alghais and Pullar 2018):

\[ l_{\text{nearest}} = \{i_1, i_2, \ldots, i_k\} \]

Step 8 Predict and rate the target user

For each traditional farming culture data set \( t_j \) in the target traditional farming culture data set \( l_{\text{nearest}} \), the algorithm takes out these \( k \) elements in sequence, and assumes that the interest preference value of the nearest neighbour user set \( U_{\text{nearest}} \) of the target user a obtained in Step 3 and the interest preference value of the nearest neighbour on other traditional farming culture data sets, the algorithm calculates the predicted rating of the target user a on the target traditional farming culture data set \( t_j \).

Step 9 Generate a list of recommended traditional farming culture data sets

The algorithm sorts the predicted scoring values \( p_{a, t_1} \) and \( p_{a, t_2} \) calculated in Step 8 in descending order, and assumes that the result of the sorting is:

\[ p_{a, t_1} \geq p_{a, t_2} \geq \cdots \]

The algorithm selects the first \( N \) highest prediction scores, and the target traditional farming culture data set \( t_1, t_2, \ldots, t_N \) corresponding to the \( N \) highest prediction scores, respectively, constitutes the traditional farming culture data set recommended for the target
user a:

\[ l_{\text{recommend}} = \{t_1, t_2, \cdots, t_N\} \] (9)

With the in-depth research of scholars in the recommendation field, there are more and more mature personalised recommendation algorithms. Therefore, how to evaluate the performance of the recommender system and what criteria are used to evaluate it is a very important issue in the research of collaborative filtering recommendation algorithm.

Generally, Mean Absolute Error (MAE) is used to express the accuracy of predicting the recommended results. The average absolute error value between the predicted interest preference and the real interest preference is calculated. The smaller the average absolute error value, the higher the accuracy of the prediction. MAE can be expressed by the following formula (Kilicoglu et al. 2021):

\[
\text{MAE} = \frac{\sum_{u, i} |P_{ui} - R_{ui}|}{N} \] (10)

Among them, \( P_{ui} \) represents the prediction of user \( u \)'s interest preference value for item \( i \), \( R_{ui} \) represents the true value of user \( u \)'s interest preference for item \( i \), and \( N \) represents the number of user \( u \)'s ratings of item \( i \) in the system.

Recall and precision can also be used to measure the accuracy of the recommendation system. The recall is expressed as the ratio of the traditional farming culture data set that the user likes in the recommendation list to all the traditional farming culture data sets that the user likes in the system. Data mining algorithm is used in traditional farming culture for the similarity calculation by the targeted user. It calculates the predicted data. The higher the recall, the more traditional farming cultural data sets that the system can recommend to users. The calculation formula is as follows:

\[
R = \frac{N_{rs}}{N_i} \] (11)

The precision rate is expressed as the ratio of the traditional farming culture data set that the user likes to all the recommended traditional farming culture data sets in the recommended list. The calculation formula is as follows:

\[
P = \frac{N_{rs}}{N_s} \] (12)

Research on rural land planning based on traditional farming culture

In the rural land planning and management business, the state manages rural land scientifically through the

![Figure 1. Boundary of rural land planning and management business.](image1)

![Figure 2. Software deployment model diagram of rural land use planning system.](image2)
rural land use planning system, and land users use the rural land use planning system to rationally and legally use land, as shown in Figure 1. The system first meets the needs of the country to manage rural land and land use units to use rural land. Regardless of the expectations of the personnel in the business system, these two most basic needs must be met, otherwise the system will lose the most basic premise.

We define a boundary for each business goal in the system, and the division of each boundary indicates the starting point for demand analysis. Moreover, each larger business goal contains many more detailed goals, and then we define their own boundaries for these more detailed goals, and the stratification of the boundaries corresponds to the level of needs. Figure 2 shows the business boundary of online review of rural land-use projects.

The software architecture of this project adopts a software architecture consisting of five levels: Web layer, business logic layer, entity layer, database logic layer and database layer. Database layer is a software interaction which unifies the interaction among a computer and database. Unattributed information will be challenged and deleted if it is not properly sourced. A database abstraction layer is an application software application that allows a software tool to communicate with datasets such as SQL, DB2, MySQL, PostgreSQL, SQLite, or Oracle. The web layer is closely related to the business logic layer and mainly deals with user requests; also individualised graphics that are shown to a particular audience on particular pages of the website to start driving engagement levels; and the entity layer and the database logic layer is mainly dealing with data, and the division of labour is obvious from the perspective of

---

**Figure 3.** Functional hierarchical structure diagram of rural land use planning system.
Therefore, consider deploying the business logic layer to the Web server, and adding an application server to deploy the entity layer and the database logic layer. The business logic layer consists of the business divisions that would provide OAGIS services for data come back or the beginning of business operations. The entities and relationships are defined by the Entity Layer, which is also an XML file. The database logic layer chooses what data they need in order to solve their assigned problems. A server that hosts applications is known as an application server. An application server model provides both the tools for creating web applications and the database server in which they run. A comprehensive support layer model will be included in an application server framework. Based on the above analysis of application programmes and operating environment, the software deployment model diagram of the rural land use planning system is shown in Figure 2.
The following system hierarchical architecture diagram can be drawn, as shown in Figure 3. The system interface layer (Web layer) in the figure is composed of web pages such as the rural land user data input interface, the rural land use project data input interface, the municipal review interface and the data query interface; the business logic layer consists of querying rural land users and automatically generating. The query interface is a kind of way of achieving secure downcasting and to aggregate interactions to an entity. It is composed of functional modules such as rural land user number, automatically generated land project number and querying rural land use project data; the entity layer is composed of entities such as rural land users, rural land-use projects, project plot graphics and system users; database logic layer It is composed of data operation functions such as connection to the database, data query, data insertion and data modification; the database layer includes the rural land user database, the rural land use project database, the land project graphic database and the system user database. Relatively independent of each layer, linear correlation, clear structure, strong maintainability.

The implementation of the system requires a current database server to store data that is currently used frequently, a historical database server to store the historical planning database and rural land planning and management historical archives, an application server to process data processing requests sent by the Web layer, and a Web server to specifically affect the Web requests of each terminal. Terminals distributed throughout the province are connected to the Web server through the government network, and mobile terminals enter the government network and connect to the Web server through the network interface of China Mobile and the dedicated secure channel of the provincial government information centre. The topological structure diagram of the system operating environment is shown in Figure 4.

The business process of rural land planning is shown in Figure 5:

The main function of the subsystem is to systematically evaluate the implementation effect of rural land use planning. Use computers to collect, calculate and analyze data such as planning data, rural land use status and economic and social impacts after the implementation of the plan, make full use of the advantages of the system, and realise the informatisation, digitalisation and scientific evaluation of the implementation of rural land use planning. The main design ideas for the evaluation of the subsystem are as follows: (1) Construct an evaluation model for the implementation of rural land use planning. Land-use planning identifies the much more effective trade-offs among land-use choices and connections economic and social development with ecologic protection and improvement, thus also designed to assist in the attainment of sustainable land management. The evaluation model corresponds to a specific index evaluation system, and its realisation method is a function or a subroutine. The Evaluation Index encourages participants to analyses search terms in order to tell their strategic plan for modifying the search. By reading the statistical data information in the database, the relevant calculation parameters in the model are determined; (2) The evaluation model in the system is called, the indicator data is modelled and analyzed, and the indicator weights and participating indicators are determined according to the calculation factors. (3) Calculate the comprehensive score of the evaluation result, and determine the evaluation level of the planning implementation evaluation result according to the final score and the pre-established evaluation criteria. The functional structure diagram of the evaluation subsystem is shown in Figure 6.

Performance test of rural land planning system based on traditional farming culture

Based on the concept of traditional farming culture, this paper constructs an intelligent rural land planning
system, which uses an improved data processing algorithm to process traditional farming culture and combines it with rural land planning data. After constructing the system structure model, the performance verification analysis of the model is carried out. When designing the experiment, this paper mainly focuses on the data processing of traditional farming culture and the effect of rural land planning. On this basis, the statistical results of the data processing effect in Table 1 and Figure 7 are obtained through simulation data research.

Through the above analysis, we can see that the rural land planning system based on traditional farming culture constructed in this paper has good data processing effects. On this basis, this paper conducts an evaluation and analysis of the rural land planning effect, and the results are shown in Table 2 and Figure 8.

Through the analysis of the above figures and tables, we can see that the rural land planning system based on traditional farming culture constructed in this paper can effectively improve the effect of rural land planning.

**Conclusion**

In the context of the revision of the third round of the country’s overall rural land use planning, and in view of the characteristics of rural land use planning implementation evaluation work, this paper establishes a rural land use planning implementation evaluation system that is compatible with social and economic development. Moreover, this paper combines data mining algorithms and traditional farming culture to construct a rural land planning system. In response to
the business needs of rural land use planning implementation evaluation, the system has been designed with rural land use status analysis, basic farm-land difference statistics, new construction land statistics and other spatial analysis functions, as well as related planning project management functions. The system realises the automation of the evaluation work of rural land use planning, and effectively solves the problems of traditional rural land use planning evaluation work methods such as cumbersome processes, heavy tasks, poor evaluation reality and evaluation results easily affected by subjective factors. Finally, this paper verifies the effectiveness of the method proposed in this paper through experimental research.

| Num | Data processing | Num | Data processing | Num | Data processing |
|-----|----------------|-----|----------------|-----|----------------|
| 1   | 89.31          | 28  | 88.18          | 55  | 90.21          |
| 2   | 91.61          | 29  | 92.76          | 56  | 88.47          |
| 3   | 88.55          | 30  | 92.92          | 57  | 88.09          |
| 4   | 88.19          | 31  | 93.29          | 58  | 89.25          |
| 5   | 90.98          | 32  | 88.72          | 59  | 89.60          |
| 6   | 89.75          | 33  | 91.43          | 60  | 89.41          |
| 7   | 89.48          | 34  | 88.50          | 61  | 93.93          |
| 8   | 92.12          | 35  | 89.85          | 62  | 91.89          |
| 9   | 91.79          | 36  | 91.97          | 63  | 90.35          |
| 10  | 89.46          | 37  | 88.81          | 64  | 89.88          |
| 11  | 89.76          | 38  | 93.73          | 65  | 92.44          |
| 12  | 93.48          | 39  | 93.16          | 66  | 92.63          |
| 13  | 91.31          | 40  | 90.51          | 67  | 89.97          |
| 14  | 93.92          | 41  | 92.44          | 68  | 91.87          |
| 15  | 92.25          | 42  | 88.70          | 69  | 88.40          |
| 16  | 90.46          | 43  | 93.41          | 70  | 89.08          |
| 17  | 93.72          | 44  | 92.03          | 71  | 93.87          |
| 18  | 93.67          | 45  | 92.56          | 72  | 89.11          |
| 19  | 89.70          | 46  | 89.40          | 73  | 91.16          |
| 20  | 93.17          | 47  | 90.84          | 74  | 88.51          |
| 21  | 92.47          | 48  | 89.33          | 75  | 88.76          |
| 22  | 93.77          | 49  | 89.03          | 76  | 88.37          |
| 23  | 92.14          | 50  | 89.46          | 77  | 91.84          |
| 24  | 91.14          | 51  | 91.99          | 78  | 89.97          |
| 25  | 90.65          | 52  | 88.34          | 79  | 92.96          |
| 26  | 92.39          | 53  | 89.24          | 80  | 89.20          |
| 27  | 91.23          | 54  | 88.10          | 81  | 91.27          |

**Table 1. Statistical table of data processing effect.**

| Num | Land planning | Num | Land planning | Num | Land planning |
|-----|---------------|-----|---------------|-----|---------------|
| 1   | 84.80         | 28  | 87.92         | 55  | 82.18         |
| 2   | 83.30         | 29  | 83.97         | 56  | 87.58         |
| 3   | 84.29         | 30  | 88.06         | 57  | 84.26         |
| 4   | 87.61         | 31  | 86.52         | 58  | 89.91         |
| 5   | 84.89         | 32  | 84.92         | 59  | 88.61         |
| 6   | 82.28         | 33  | 90.89         | 60  | 82.60         |
| 7   | 89.01         | 34  | 85.99         | 61  | 89.14         |
| 8   | 85.87         | 35  | 90.89         | 62  | 90.16         |
| 9   | 90.77         | 36  | 85.06         | 63  | 88.72         |
| 10  | 86.11         | 37  | 88.39         | 64  | 86.50         |
| 11  | 84.72         | 38  | 84.44         | 65  | 82.41         |
| 12  | 89.11         | 39  | 90.44         | 66  | 88.69         |
| 13  | 90.20         | 40  | 86.71         | 67  | 82.09         |
| 14  | 87.36         | 41  | 85.45         | 68  | 87.84         |
| 15  | 90.07         | 42  | 84.45         | 69  | 87.22         |
| 16  | 87.28         | 43  | 86.71         | 70  | 83.62         |
| 17  | 87.91         | 44  | 83.00         | 71  | 84.54         |
| 18  | 90.09         | 45  | 82.60         | 72  | 85.52         |
| 19  | 82.32         | 46  | 86.46         | 73  | 89.36         |
| 20  | 90.40         | 47  | 82.64         | 74  | 88.68         |
| 21  | 89.27         | 48  | 89.02         | 75  | 86.05         |
| 22  | 86.40         | 49  | 88.43         | 76  | 84.90         |
| 23  | 90.29         | 50  | 88.79         | 77  | 90.70         |
| 24  | 90.34         | 51  | 83.12         | 78  | 82.95         |
| 25  | 88.12         | 52  | 89.75         | 79  | 90.93         |
| 26  | 89.52         | 53  | 82.78         | 80  | 90.53         |
| 27  | 84.33         | 54  | 82.60         | 81  | 85.09         |

**Table 2. Statistical table of evaluation of the rural land planning effect.**

Figure 7. Statistical diagram of data processing effect.

Figure 8. Statistical diagram of evaluation of the rural land planning effect.
Disclosure statement
No potential conflict of interest was reported by the author(s).

Notes on contributor
Zhuang Fei is a lecturer at Huaiyin Normal University and a PhD candidate at China University of Mining and Technology. His research direction is the sustainable development of rural construction.

References
Abdullahi S, Pradhan B. 2018. Land use change modeling and the effect of compact city paradigms: integration of GIS-based cellular automata and weights-of-evidence techniques. Environ Earth Sci. 77(6):1–15.
Alghais N, Pullar D. 2018. Modelling future impacts of urban development in Kuwait with the use of ABM and GIS. Trans GIS. 22(1):20–42.
Alrobaee TR. 2021. Measuring spatial justice indices in the Traditional Islamic Cities by using GIS, an-Najaf Holy City, Iraq a case study. Int J Geospat Environ Res. 1(2):59–69.
Baba KA, Lal D, Bello A. 2019. Application of remote sensing and GIS techniques in urban planning, development and management. (A case study of Allahabad District, India). Int J Eng Res. 10(6):1127–1134.
Carpentieri G, Favo F. 2017. The end-use electric energy consumption in urban areas: a GIS-based methodology. An application in the city of Naples. TeMA-J Land Use, Mobility Environ. 10(2):139–156.
Chen W, Zhai G, Fan C, et al. 2017. A planning framework based on system theory and GIS for urban emergency shelter system: a case of Guangzhou, China. Hum Ecol Risk Assess. 23(3):441–456.
Dang ATN, Kumar L. 2017. Application of remote sensing and GIS-based hydrological modelling for flood risk analysis: a case study of District 8, Ho Chi Minh city, Vietnam. Geomatics. Nat Hazards Risk. 8(2):1792–1811.
Dereli MA. 2018. Monitoring and prediction of urban expansion using multilayer perceptron neural network by remote sensing and GIS technologies: a case study from Istanbul Metropolitan City. Fresenius Environ Bull. 27(12a):9336–9344.
Farahbakhsh A, Forghani MA. 2019. Sustainable location and route planning with GIS for waste sorting centers, case study: Kerman, Iran. Waste Manag Res. 37(3):287–300.
France-Mensah J, O’Brien WJ, Khwaja N, et al. 2017. GIS-based visualization of integrated highway maintenance and construction planning: a case study of Fort Worth, Texas. Vis Eng. 5(1):1–17.
Giannopoulou M, Roukouni A, Lykostratis K. 2019. Exploring the benefits of urban green roofs: a GIS approach applied to a Greek city. CES Working Papers. 11(1):55–72.
Gieseking JJ. 2018. Operating anew: queering GIS with good enough software. Can Geogr. 62(1):55–66.
Guerreiro TCM, Körner Providelo J, Pitombo CS, et al. 2018. Data-mining, GIS and multicriteria analysis in a comprehensive method for bicycle network planning and design. Int J Sustain Transp. 12(3):179–191.
Khayambashi E. 2018. Promoting urban spatial and social development, through strategic planning of GIS. Socio-Spatial Stud. 2(4):66–80.
Kilicoglu C, Cetin M, Aricak B, et al. 2021. Integrating multicriteria decision-making analysis for a GIS-based settlement area in the district of Atakum, Samsun, Turkey. Theor Appl Climatol. 143(1):379–388.
Lü G, Batty M, Strobl J, et al. 2019. Reflections and speculations on the progress in geographic information systems (GIS): a geographic perspective. Int J Geogr Inf Sci. 33(2):346–367.
Manogaran G, Hsu C, Rawal BS, Muthu B, et al. 2021. ISOF: information scheduling and optimization framework for improving the performance of agriculture systems aided by Industry 4.0. IEEE Internet Things J. 8(5):3120–3129.
Meenar MR. 2017. Using participatory and mixed-methods approaches in GIS to develop a place-based food insecurity and vulnerability index. Environ Plan A. 49(5):1181–1205.
Parry JA, Ganaie SA, Bhat MS. 2018. GIS based land suitability analysis using AHP model for urban services planning in Srinagar and Jammu urban centers of J&K, India. J Urban Manag. 7(2):46–56.
Sahitya KS, Prasad C. 2020. Modelling structural interdependent parameters of an urban road network using GIS. Spat Inf Res. 28(3):327–334.
Teixeira S. 2018. Qualitative geographic information systems (GIS): an untapped research approach for social work. Qual Soc Work. 17(1):9–23.
Yadav SK, Borana SL. 2017. Monitoring and temporal study of mining area of Jodhpur City using remote sensing and GIS. Int J Eng Technol. 4(10):1732–1736.
Zhang X, et al. 2018. Privacy issues in Big Data mining infrastructure, platforms, and applications. Secur Commun Netw. 2018:1–3.