Research Article

Fuzzy Comprehensive Evaluation Method of Ecological Environment Damage Compensation System and Management Based on Improved Association Rule Algorithm

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In recent years, there have been frequent cases of damage to the ecological environment, and the public interests of members of society have been repeatedly violated. The safety of the ecological environment is worrying. This paper uses the association rule algorithm and fuzzy comprehensive evaluation method to improve the management of the ecological environment damage compensation system. This article has deeply studied the role of association rules in data mining and practically improved them and applied them to the management of the compensation system for environmental damage. This article also constructed a fuzzy comprehensive evaluation model, following the principles of innovation, responsibility, judicial, and openness, clarified the fuzzy comprehensive evaluation and evaluation process, established a set of comments on the evaluation object, determined the membership function, and constructed the damage factor and multiple index factors such as compensation factor and damage object. Based on the use of the improved correlation algorithm, the accuracy and complexity of the model have been improved, reaching 85.47 and 76.32 points, respectively. It is hoped that the research in this article can contribute a little to accelerating the establishment of my country's ecological environment damage compensation system, safeguarding the interests of the ecological environment, and protecting the ecological environment.

1. Introduction

Most of the damage to the ecological environment is remedied through administrative law and environmental law. The ecological environment damage compensation system is an important part of the ecological civilization system. Ecological environmental damage is damage to the ecological environment itself, including environmental pollution and ecological damage, and is a kind of environmental public welfare damage. However, as a typical external control method, the environmental law public law method mechanically and linearly stifles the enthusiasm, initiative and creativity of relevant personnel, high operating costs, and power competition between localities and departments damages public interests. Other defects are exposed in the environmental protection process. Moreover, as a means of administrative punishment, the method of

calculating the amount of fines is not proportional to the severity of the consequences, causing the government to pay for ecological damage.

Research on compensation for damage to the ecological environment can first of all maintain environmental fairness and justice and protect the public's environmental rights and interests. Studying the issue of compensation for damage to the ecological environment can implement the requirements of new damage responsibility, strengthen corporate responsibilities, and achieve environmental fairness and justice. Second, it can promote the improvement of the environmental damage compensation system and promote the academic research of environmental law theory. Third, it can enrich the theory of my country's ecological environment damage compensation system and environmental public interest civil litigation system and promote the development of environmental public welfare undertakings.

As the problem of damage to the ecological environment has become more and more serious, many studies on compensation for damage to the ecological environment have also emerged. Sun and Yan conducted research on how to establish a judicial confirmation system for ecological environmental damage compensation consultation agreements. They proposed that a large number of environmental damage compensations are prone to disputes. Due to the lack of rigidity in enforcement effectiveness, it is often difficult to implement regret afterward. Through the establishment of a judicial confirmation system, it is possible to appropriately intervene in procedures such as initiation and jurisdiction, so as to ensure the realization of the goal [1]. Yu and Hu [2] proposed marine ecological damage compensation, a compensation mechanism for the affected marine ecological environment, aiming to realize the paid use of the marine ecosystem during the development or utilization of the environment. On this basis, they discussed the research progress of ecological compensation subjects, compensation standards, compensation methods, and follow-up safeguard measures. They pointed out that previous research mainly focused on compensation for damages in marine development projects, and there was less research on compensation for damages from land-based pollution. Marine ecological damage involves complex stakeholders, and the compensation chain of the "human sea" has not yet been fully formed. The calculation of compensation standards is still a difficult point for research in this field. At present, the research on marine ecological damage assessment by domestic and foreign scholars mainly focuses on marine ecological damage assessment, but there is still a certain gap between damage assessment and compensation standards. However, his research did not actually solve the problem of ecological damage compensation [2]. The claim system and the administrative accountability system, both for the compensation for ecological damage, are two sides of the construction of ecological civilization in China. However, there are dilemmas in the choice of claims by the government, which can be attributed to three characteristics of the administrative accountability system: the grass-roots effect, the ripple effect, and the severe effect. Meanwhile, under the premise of not being able to solve the grass-roots effect, how to deal with the ripple effect and the severe effect is the main problem of breaking through the dilemma and improving the accountability mechanism. Specifically, measures should be taken as resolving the ripple effect by accountability according to the law, alleviating the severe effect in a moderate way of accountability, and improving accountability system to benefit the claim system [3]. Vulnerability assessment is becoming more and more important worldwide. The purpose of the research is to develop a method that reveals the relationship between exposure, sensitivity, and adaptive capacity based on the fuzzy comprehensive evaluation method (FCEM) and the coordinated development model (CDDM) to better assess flood vulnerability. The method is divided into three parts: the establishment of the index system; the assessment of exposure, sensitivity, and adaptability; and the assessment of multiple flood vulnerability. Hydrodynamic models and statistical data are used to establish an indicator system; the FCEM is used to assess exposure, sensitivity, and adaptability; and the CDDM is used to express the relationship between the three components of vulnerability.

The innovation of this article lies in the application of the fuzzy comprehensive evaluation method to the ecological environment damage compensation system, which is conducive to perfecting the environmental damage compensation system, strengthening environmental damage management, improving environmental protection awareness, and promoting the development of environmental protection.

2. Comprehensive Evaluation Method

2.1. Improved Association Rule Algorithm

2.1.1. Basic Concepts of Association Rules. Association rule is one of the main technologies in data mining. It was proposed by Agrawa et al. in 1993. It is usually also called market-basket analysis (MBA). It is mainly used to mine various items in large transaction databases [4, 5]. The main problems of association rules are defined as follows: let $U = \{u_1, u_2, \ldots, u_m\}$, where u is the collection of all commodity items, D be the collection of all transaction records in the database, and T be the collection of each transaction record item and also be the subcollection ($T \subseteq U$) of u. The transaction record content in T does not consider the quantity of product items purchased, and TID is the number of each transaction record [6, 7].

Association rules are represented by $X \longrightarrow Y$, which are $X \subseteq U, Y \subseteq U, X \cap Y = \varnothing$. However, what is the rule measured by an association rule and how can an association rule be established? There are two standards for measuring association rules: support and confidence. The work of mining association rules can be divided into two stages. The first stage finds all high-frequency item sets in the database, that is, finds all item groups that meet the minimum support. If the A item group contains k items, it is called k-item group; if the k-item group meets the minimum support degree, it is called k-high-frequency item set. The second stage generates association rules based on the high-frequency item set generated in the first stage [8, 9].

$$\text{Support } (A \longrightarrow B) = P(A \cup B),$$
$$\text{Confidence } (A \longrightarrow B) = P(A|B). \tag{1}$$

2.1.2. Purpose of Mining Association Rules. In a database, find out all the association rules that can satisfy the minimum confidence (Minconf) and minimum support (Minsup) defined by the user at the same time. It is conducive to quickly mining the data on environmental damage to facilitate people's analysis and application, thus providing a way to achieve a fast and effective way to protect the environment.

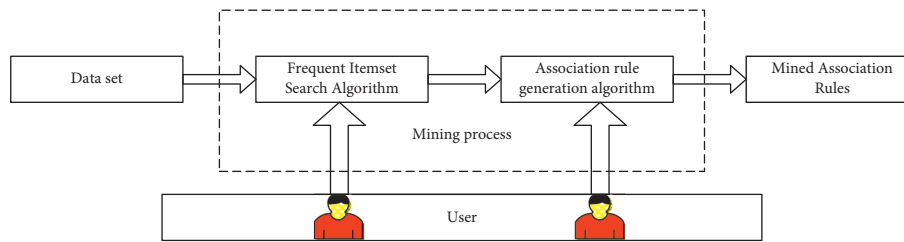Figure 1 shows the basic model of association rule mining.

Figure 1: The basic model of association rule mining.

2.2. Eco-Environmental Damage Compensation System and Management. In order to respond to the call of the country, promote green development and build a beautiful China, but also to improve my country's environmental legal system, protect the ecological environment, and maintain social public interests, starting in 2015, we began to explore how to establish an ecological environment damage compensation system in some areas of our country. In 2015, the Central Office and the State Council jointly issued the "Eco-Environmental Damage Compensation System Reform Pilot Program" (hereinafter referred to as the "Pilot Program") and selected seven provinces (cities) including Jilin, Yunnan, Jiangsu, and Shandong as demonstration sites [10, 11]. After unremitting efforts, active exploration, and continuous summary of the pilot experience in each pilot, the reform of the pilot ecological environment damage compensation system was completed at the end of 2017. On the basis of summarizing the experience of the Pilot Program, the Central Office and the State Council jointly issued the "Eco-Environmental Damage Compensation System Reform Program" (hereinafter referred to as the "Reform Program"), which was piloted nationwide on January 1, 2018. However, it is only a "program," not a detailed and comprehensive regulation of the ecological environment damage compensation system. It is still immature and needs to be refined and perfected [12, 13].

"Environmental damage" was first proposed by a French scholar, but it was not called "environmental damage" at the beginning; instead, it was called "ecological damage." With the deepening of research and frequent use, it gradually entered the public's vision. What is "environmental damage"? It refers to the damage caused by environmental pollution and ecological destruction [14, 15]. However, so far "environmental damage" has not had a unified name and definition to accurately explain this.

The term "damage" in "environmental damage" means in the civil law that the actor performs a certain act or the occurrence of a certain event that adversely affects the legitimate rights and interests of the parties. This kind of adverse impact is mainly manifested as property and non-property losses, which exist in a factual state, which is a kind of damage consequence. The meaning in environmental law refers to the adverse consequences of infringement on water, plants, soil, etc., and the relationship between these elements [16, 17]. In the 1980s and 1990s, the field of legal research in Germany began to pay attention to environmental damage. Some scholars also began to realize that the "environment" in environmental damage includes not only environmental elements but also ecological relationship elements. Therefore, "environmental damage" is the unfavorable consequence of the infringement of interests, and it focuses more on analyzing its definition from a static perspective.

The concept of "environmental damage" has roughly three categories in the development process of our country, namely, the most extensive "environmental damage," "environmental damage in a broad sense," and "environmental damage in a narrow sense." Extensive environmental damage refers to "the damage that can be perceived and quantified by society after any natural environmental system is disturbed, including damage to human health, property, natural resources, and social economy, as well as invisible damage caused to it. "The most widespread environmental damage can also be called "social damage," which is essentially damage to the overall environmental interests of mankind [18, 19]. Because the "environment" is a public good, infringement of the environment is an infringement of the public interest of human society, and in today's world, environmental issues are not only a country's national responsibility but also a responsibility that all mankind in the world should bear. However, due to the emergence of the word "country," we have to focus on the issue of environmental damage within a country to study. Environmental damage is divided into broad and narrow perspectives. Broadly speaking, environmental damage refers to the damage to human health, economy, and the environment caused by environmental pollution or interference from other human activities. This part of the damage includes damage to public welfare and damage to private interests. In a narrow sense, environmental damage in a narrow sense refers to "environmental pollution or damage to the resources and environment itself, that is, only infringement of public environmental interests, excluding damage to human health and property [20, 21]." The broad perspective is broader. Therefore, the author adopts a broad definition of "environmental damage" in this article, which includes damage to the ecological environment as well as damage to personal property and health.

2.3. Fuzzy Basic Theory

2.3.1. Blur Phenomenon. Blur is relative to clear. Many phenomena in real life are clear, but because of the existence of the human factor, more phenomena are blurred. Fuzzy mathematics is currently a hot field. The rise of fuzzy mathematics is influenced by the popularity of artificial

intelligence. The application of fuzzy mathematics in various industries is particularly important.

2.3.2. Fuzzy Set and Membership Function.

A fuzzy set, as the name implies, is an extension of explicit set compared to explicit set, that is, ordinary set. In an explicit set, the so-called certain element belongs to a certain set, either 1 or 0, or either, this is clear [22, 23]. Compared with fuzzy sets, element a does not only belong to and does not belong to but also partially belongs to and partially does not belong to explicit set. The part here only represents a degree. In other words, the fuzzy set contains all the elements of the clear set.

In a clear set, we usually use $B = \{b_1, b_2, \ldots, b_n\}$ to represent it, but for fuzzy sets, because of the inconsistency of the attribution of each element, we usually introduce a degree of membership to indicate the degree to which an element belongs to the set, and for all elements, use membership. It means that the function value $\eta_B()$ represents the membership degree $\eta_B(a_n)$ of the element a_n belonging to the set B. Then, we use the following representation method to represent the fuzzy set:

$$B = \{[b_1, \eta_B(b_1)], [b_2, \eta_B(b_2)], \ldots, [b_n, \eta_B(b_n)]\}. \tag{2}$$

This is the order couple method, and the Zadeh notation is

$$B = \frac{\eta_B(b_1)}{b_1} + \frac{\eta_B(b_2)}{b_2} + \cdots + \frac{\eta_B(b_n)}{b_n}. \tag{3}$$

2.3.3. Features and Defects of Fuzzy Comprehensive Evaluation.

The advantage of the fuzzy comprehensive evaluation method is that by transforming fuzzy qualitative problems into accurate quantitative calculation problems and making scientific and reasonable fuzzy evaluation through analysis, such results are more vivid and plump than numerical results and can more completely describe the original evaluation object. As for the shortcomings of the fuzzy comprehensive evaluation method, there are probably the following aspects:

(1) The overlap phenomenon between evaluation indicators: the refinement of the evaluation target indicators will bring about the expansion of the factor set, that is, the number of indicators will greatly increase. However, the selection of indicators is artificial. Because of human subjectivity, the selection of indicators will not be mutually exclusive. There will be overlaps and repetitions between indicators [24, 25], for example, "precipitation" and "humidity." These two indicators seem to be independent of each other, but in fact, there is an internal relationship—if the precipitation is large, the humidity will generally be relatively large; this is a partial overlap; for the "water level change" and for the two indicators of "rainfall," although the descriptions are different, they are essentially describing the same factor. This

is a complete overlap, that is, repeated indicators. Regardless of duplication or overlap, as long as the selection of indicators is still manipulated by humans, this problem is inevitable, and as the number of indicators grows, there will be more and more overlaps, and the overlap phenomenon will become more obvious.

(2) The evaluation level is not very sensitive to the evaluation objects of different scales. The evaluation level is obtained based on existing data, such as the "National Drinking Water Quality Evaluation Level." Such an evaluation level can be used anywhere in the country, but the premise is to be conducted on the scale of "National" level for the evaluation object. In a comprehensive evaluation, if the sample is only drinking water in a certain city, and the final evaluation is the water quality in different areas of the city, it is of little significance to still use the "National Drinking Water Quality Evaluation Grade." Although the "National Drinking Water Quality Evaluation Level" is used on a lower scale such as "city," it will not cause fundamental errors, but it is obvious that all "cities" are treated as average standards, because some cities are surrounded by mountains and rivers, the environment is particularly good, and the water source is not polluted. The water quality of basically all areas within the city is at the highest level in the national water quality level. It is also possible that some cities have suffered from water sources due to the development of heavy industry. Pollution and water quality are both at the lower level of the national water quality. In these two cases, the gap between the evaluation objects will be narrowed due to the size of the subject, which will bring greater errors to the evaluation results. Therefore, for different "cities" and different sizes, the evaluation level should be changed accordingly, so as to better reflect the significance of the comprehensive evaluation results and facilitate conclusions.

(3) The construction of weight vector is influenced by human subjectivity or calculation method.

This article tries to adopt an objective analysis method to reduce the error caused by human operation. The selection of weight is the core and the decisive factor that directly affects the result analysis, and this is precisely the most easily disturbed in the entire fuzzy comprehensive evaluation algorithm. Partly, it is easy to bias the evaluation results due to human subjectivity.

2.3.4. Fuzzy Comprehensive Evaluation Method.

Fuzzy comprehensive evaluation is a comprehensive evaluation method based on fuzzy mathematics and fuzzy correlation matrix, which transforms qualitative analysis into quantitative calculation process. It is mainly used to solve fuzzy and difficult to quantify problems. In a fuzzy environment, it can systematically analyze things or objects that have a variety of

factors and give a clear overall evaluation. It has a wide range of applications.

Fuzzy set: let D be the universe of discourse, and its elements are represented by x, i.e., $D = \{x\}$. The fuzzy set on D can be described by a membership function $\phi(x)_B$, which connects each element on D with a real number on the interval $[0, 1]$. The definition of the fuzzy set is as follows: the fuzzy set is usually expressed as

$$B = \left\{ x, \phi_B(x) \,|\, x \in D \right\}. \tag{4}$$

Among them, $\phi(x)_B$ is called the membership function of B, which is the degree of membership of x to B.

At that time $\phi(x)_B = 1$, x completely belongs to the fuzzy set B; at that time $\phi(x)_B = 0$, x does not belong to the fuzzy set at all; the closer the $\phi(x)_B$ to 1, the greater the degree of x belonging to B. When the membership function $\phi(x)_B = \{0, 1\}$ is the same as the characteristic function of the ordinary set $\phi(x)_B$, B degenerates into the ordinary set.

The definition of triangular fuzzy number is as follows: the fuzzy set is a positive triangular fuzzy number $B = (a, b, c)$, when its membership function is

$$\phi_B(x) = \begin{cases} \dfrac{(x-c)}{(a-c)}, & c \leq x \leq a, \\[2mm] \dfrac{(x-b)}{(a-b)}, & a \leq x \leq b, \\[2mm] 0, & \text{otherwise.} \end{cases} \tag{5}$$

3. Fuzzy Comprehensive Evaluation Model of Ecological Environment Damage Compensation System and Management Based on Improved Association Rule Algorithm

3.1. Principles of the Fuzzy Comprehensive Evaluation of the Ecological Environment Damage Compensation System and Management. The principles of the fuzzy comprehensive evaluation of the ecological environment damage compensation system and management are as follows.

3.1.1. Promote in accordance with the Law and Encourage Innovation. All damage compensation systems are in accordance with relevant laws and regulations, proceeding from reality, and provide policy and legislative suggestions.

3.1.2. The Environment Is Valuable and the Damage Is Liable. For those responsible for damage to the ecological environment, monetary compensation is required.

3.1.3. Active Consultation and Judicial Guarantee. The obligor of compensation that damages the ecological environment shall take the initiative to negotiate with the right

holder and strive to reach an agreement; if the plan is not consistent, it may initiate a lawsuit.

3.1.4. Information Sharing and Public Supervision. Information disclosure should be carried out on major matters in the process of ecological environment investigation.

3.2. Fuzzy Multiattribute Decision-Making Model. In the multiattribute decision-making problem, let $P_1, P_2, \ldots, P_m$ have m alternatives, and each object has n attributes $Y_1, Y_2, \ldots, Y_n$, and let y_{ij} denote the i-th object. The evaluation value of B_i is relative to the j-th attribute Y_j. In this way, the evaluation matrix can be used to represent the relationship between the object set and the attribute class:

$$U = \begin{matrix} P_1 \\ P_2 \\ \cdots \\ P_m \end{matrix} \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1n} \\ y_{21} & y_{22} & \cdots & y_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ y_{m1} & y_{m2} & \cdots & y_{mn} \end{bmatrix}. \tag{6}$$

Among them, $0 \leq y_{ij} \leq 1\ (i \in M; j \in N)$. Let $\tau_1, \tau_2, \ldots, \tau_n$ each represent the weight of each attribute and meet the normalization condition, i.e., $\tau_i \geq 0, \sum \tau_i = 1$.

The purpose of the decision is to get the "most satisfactory" solution among $P_1, P_2, \ldots, P_m$. There are many ways to choose the "most satisfactory plan," such as the simple weighting method that is usually used:

$$C = (\tau_1, \tau_2, \ldots, \tau_m) \cdot \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1n} \\ y_{21} & y_{22} & \cdots & y_{2n} \\ \vdots & \vdots & \vdots \\ y_{m1} & y_{m2} & \cdots & y_{mn} \end{bmatrix} = (c_1, c_2, \ldots, c_n). \tag{7}$$

In the formula, $c_j = \tau \cdot \varsigma_j$. Then, by comparing $c_1, c_2, \ldots, c_n$, we can select or sort $P_1, P_2, \ldots, P_m$.

Realistic decision-making often needs to be made in a fuzzy environment. At this time, decision-making things are often expressed as a series of fuzzy and uncertain indicators, so the choice of things ultimately comes down to the comparison and discrimination of fuzzy quantities. Among them, the attribute index and the weight can be numeric or semantic. The data structure involved can be accurate or fuzzy. Its fuzzy attribute value matrix can be written as

$$G = \begin{bmatrix} G_{11} & G_{12} & \cdots & G_{1n} \\ G_{21} & G_{22} & \cdots & G_{2n} \\ \cdots & \cdots & \cdots \\ G_{m1} & G_{m2} & \cdots & G_{mn} \end{bmatrix}. \tag{8}$$

The generalized fuzzy synthesis operator is used to transform the fuzzy weight vector and the fuzzy index value matrix G to obtain the fuzzy decision vector:

$$U = \tau \Theta G. \tag{9}$$

3.3. Judgment Process Using Fuzzy Comprehensive Evaluation.
The general steps of fuzzy comprehensive evaluation are (1) the determination of the fuzzy comprehensive evaluation object index, that is, the set of factors that determine the evaluation object; (2) the establishment of the evaluation level, that is, the determination of the comment level universe, and the final result is a vector of the m levels; (3) the membership function is determined, and the evaluation matrix is established, that is, the fuzzy relationship matrix R; (4) the construction of the weight vector; and (5) the evaluation result is obtained. Figure 2 shows the steps of fuzzy comprehensive evaluation (fuzzy sets and membership functions are the basic concepts of fuzzy mathematics. The classic set theory clearly states that, for a given set A, any element X in the universe of U belongs to A, or it does not belong to A, and the two must be one of them. This enables mathematics to describe the category and nature of things based on "yes" or "not" (0 for no and 1 for yes, denoted as {0, 1}). Fuzzy set theory converts this kind of determination of category and behavior into a quantitative analysis of the degree of category and behavior and uses the concept of "degree of membership" to describe the degree to which an element belongs to a certain category).

3.4. Creation of a Comment Set.
The number m of general reviews in the review set should be an integer in [3, 9]. If the number is too large, it will easily cause the logical confusion of the evaluator and affect the effect of the evaluation. If it is too small, it will be difficult to accurately describe the difference between the evaluation objects, which affects the quality of the evaluation. In general, there are more odd numbers, and the setting of the middle number is easy to judge the level of the evaluation object. For this reason, it is most appropriate to set the evaluation set to 5. The evaluation set is as follows:

$$B = \{B_1, B_2, B_3, B_4, B_5\} = \{\text{better, good, medium, normal, bad}\}. \tag{10}$$

3.5. Determination of Membership.
The degree of membership and the membership function are the key issues in fuzzy mathematics, and they are also a difficult point in theoretical applications. The determination of the degree of membership is mostly subjective due to the vagueness of evaluation and the complexity of objective things. And the human psychological process is the main process of the formation of membership degree, which intensifies the complexity and diversity of fuzzy membership function. This paper introduces triangular fuzzy numbers to determine the degree of membership, trying to reduce the uncertainty of evaluation within a certain range.

In the environmental management evaluation, the comment grades are "excellent," "good," "medium," "fair," and "poor." The overall value range of the industry is obtained through the investigation of related industries, and the comment level is determined by the idea of benchmark management corresponding indicator value.

$$\phi_{\overline{B}} = \begin{cases} 1, & x \geq d_1, \\[2mm] \dfrac{(x - d_2)}{(d_1 - d_2)}, & x \in [d_2, d_1], \\[2mm] 0, & \text{otherwise.} \end{cases} \tag{11}$$

For any underlying index, its membership of the evaluation set element satisfies

$$\sum_{i=1}^{d} \phi_B(x) = 1. \tag{12}$$

3.6. Processing of Fuzzy Comprehensive Evaluation Index.
The result of the comprehensive evaluation of the fuzzy comprehensive evaluation model is the membership degree of each element of the evaluated set, which constitutes a fuzzy vector, not a point value, so it can provide more information than other methods. If multiple things are compared and sorted, further processing of the fuzzy comprehensive evaluation result vector is needed. This article mainly adopts the method of maximum membership degree.

The principle of maximum degree of membership is the current general discriminant principle. For example, the comprehensive evaluation set obtained is $C = (0.4, 0.5, 0.7, 0.4, 0.3)$. Using the principle of maximum membership degree, the evaluation object is classified into the level corresponding to $\max = 0.7$. Of course, in the case of fuzzy comprehensive evaluation, the principle of maximum membership degree is not universal. For example, suppose we get the following evaluation result $C = (0.2, 0.7, 0.69, 0.2, 0.1)$. Intuitively analyze that the evaluation object is undoubtedly between the second and third levels, and according to the principle of maximum membership, it will be the evaluation object classified as the second level, which is obviously improper. Therefore, in the evaluation, it is necessary to combine quantitative analysis and qualitative analysis according to the actual situation and consider the confidence interval of the obtained results to ensure the reliability of the evaluation.

$$\begin{aligned} \text{ACC} &= \frac{\text{TP}}{\text{TP} + \text{FP}} * 100\%, \\[2mm] \text{Cov} &= \frac{\text{TP}}{\text{TP} + \text{FN}} * 100\%. \end{aligned} \tag{13}$$

The gain map is a functional image describing the sensitivity. It intuitively reflects the relationship between the sensitivity and specificity of churn prediction and the two types of error rates. The ordinate of the gain graph is defined as TPR (true-positive ratio), which we also call sensitivity (sensitivity), expressed as
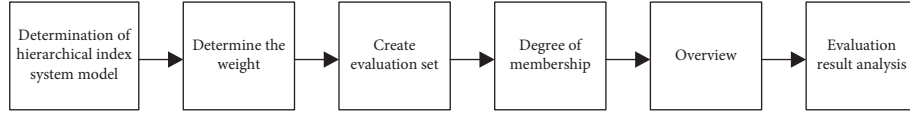
FIGURE 2: Fuzzy comprehensive evaluation steps.

$$TPR = \frac{TP}{(TP + FN)}. \tag{14}$$

The abscissa of the gain graph is defined as FPR (false-positive ratio), which has a complementary relationship with specificity (TNR), that is, FPR = 1 − TNR.

$$TNR = \frac{FP}{(TN + FP)}. \tag{15}$$

The more the gain graph is shifted to the upper left, the larger the area under the curve and the better its performance. Figure 3 shows the structural framework of this article.

4. Fuzzy Comprehensive Evaluation Experiment on Ecological Environment Damage Compensation System and Management

4.1. Determination of the Management Evaluation Index of the Ecological Environment Damage Compensation System. Table 1 shows the fuzzy evaluation factor of the ecological environment damage compensation system management set in this paper (selected through analysis of reliability analysis methods). Based on the rigor of index factor selection, it uses reliability and validity analysis methods to analyze the rationality and reliability of the indicators in the index system. The index system selected in this article has high validity and reliability compensation for damage to the ecological environment should be judicially confirmed after the negotiation agreement is reached, which can greatly improve the efficiency of damage compensation and the implementation of the negotiation agreement.

4.2. Evaluation of the Weight and Fuzzy Relationship of Each Analysis Index. We determine according to the membership function and normalize with the above formula to obtain the weight set of the ecological environment damage compensation index. As shown in Figure 4, all weights have been tested for consistency. Through the index weight, we divide the evaluation grades into five grades: "bad," "poor," "qualified," "good," and "excellent." From the figure, we can clearly show and roughly understand the degree of environmental damage, revealed by the numbers.

Figure 5 shows the index weight vector matrix, which is the result of adding the weights in the judgment matrix based on the influence factor calculated in the above figure. The ecological environment is a kind of public goods, which has a public welfare nature, but it is also the indivisibility of utility, the nonexclusive nature of benefits,

and the noncompetitive nature of consumption. Therefore, it is necessary to calculate the index weight vector matrix for the compensation of ecological environment damage, so as to obtain a more fair and just compensation result.

Figure 6 shows the fuzzy relationship matrix number of ecological damage indicators. We divide the evaluation grades into five levels: "bad," "poor," "qualified," "good," and "excellent." Seven fuzzy factors are scored separately to obtain the above results. In order to strictly protect the ecological environment, we should all be held accountable for damages to the ecological environment in accordance with the law. According to the degree of damage, we have set up a fuzzy relationship matrix.

According to the fuzzy semantic conversion table in Table 2, the obtained expert score is converted into the corresponding triangular fuzzy number, and then the obtained triangular fuzzy number is calculated according to the center of gravity method in the above formula, and the corresponding clear number is obtained (see Table 2). Under the condition of effectively reducing the subjective deviation of the expert scoring, the specific value that can be calculated by the DEMATEL matrix is obtained.

Figure 7 shows the fuzzy relationship matrix of indicators. Eco-environmental damage compensation is a monetary manifestation of the responsible person's responsibility for compensation for ecological environmental damage. For issues such as protecting the interests of the ecological environment, through compensation and other punishment methods, it can effectively improve the awareness and behavior of the protection of the ecological environment. It also has a certain preventive effect on ecological environment damage.

Table 3 shows the correlation matrix between items. We selected four aspects: the degree of damage to the ecological environment, the compensation factor, the damage object, and the amount of compensation to analyze the correlation between the projects. The damage objects here include air, surface water, groundwater, soil, forest, and other environmental elements and biological elements such as plants, animals, and microorganisms. The amount of compensation is determined according to the degree of damage.

Similar to the process of calculating the comprehensive impact matrix of the secondary indicators of the ecological environment damage index matrix in the previous article, firstly, experts are collected to summarize the scoring opinions of the degree of mutual influence between the two indicators of the primary indicators, and then the fuzzy semantic transformation in Table 2 is used. The table converts it into fuzzy evaluation, as shown in Tables 4 and 5.
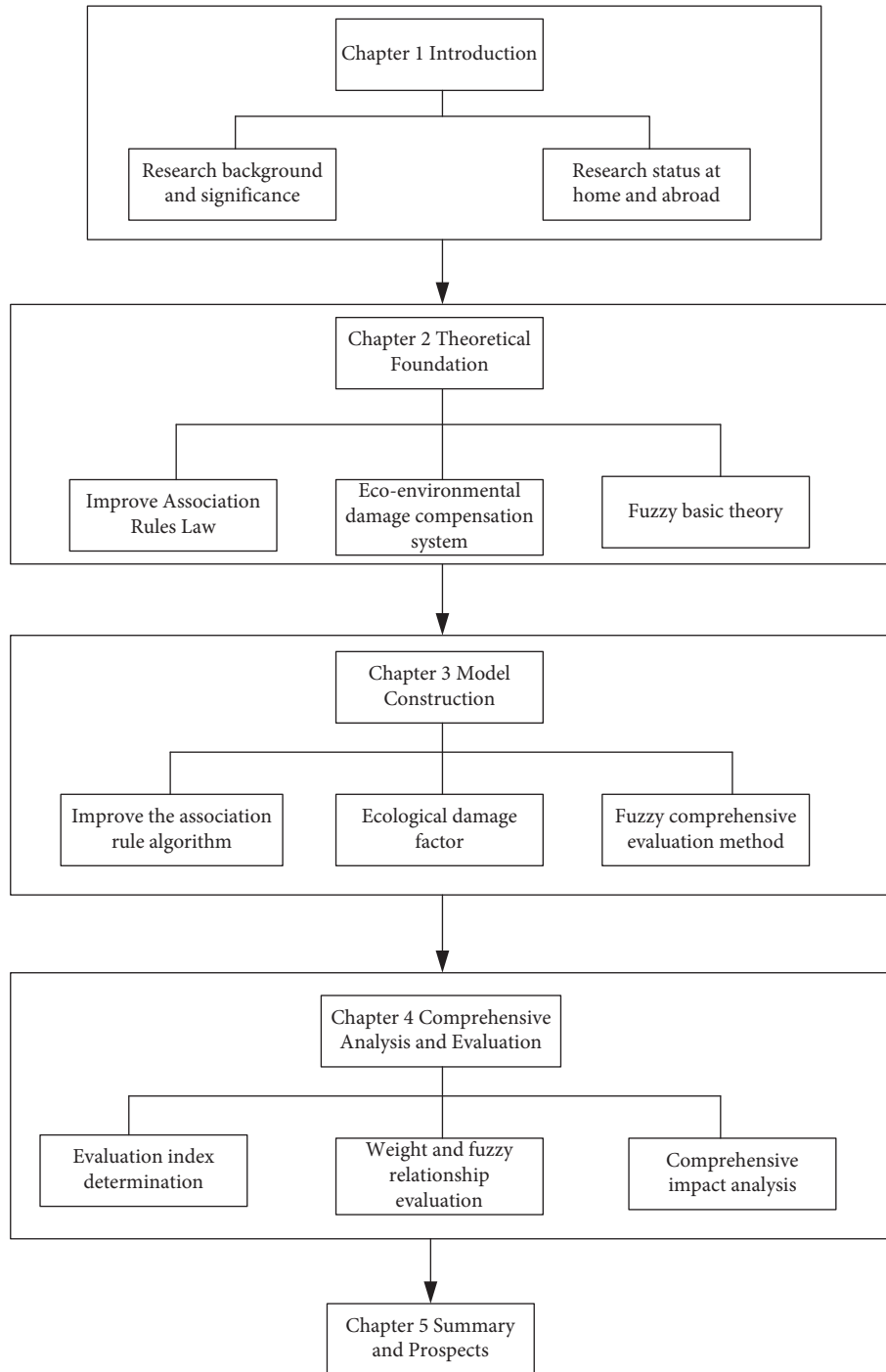
FIGURE 3: The structural framework of this article.

TABLE 1: Evaluation indexes for reliability analysis and screening.

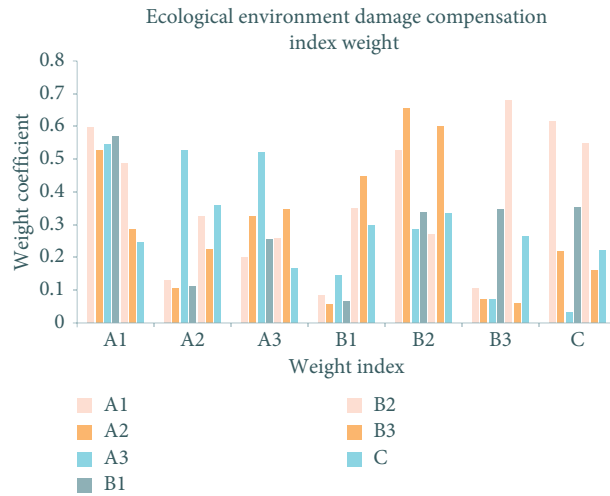| The goal	First-level index	Secondary indicators
		A1
	Damage factor A	A2
		A3
		B1
Management evaluation of ecological environment damage compensation system	Compensation factor B	B2
		B3
	Damage target C	Atmosphere, surface water, groundwater, soil, forest, plants, animals, microorganisms

FIGURE 4: Ecological environment damage compensation index weight set.
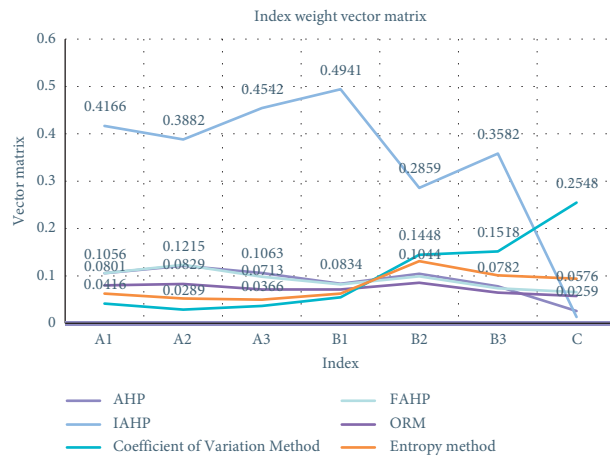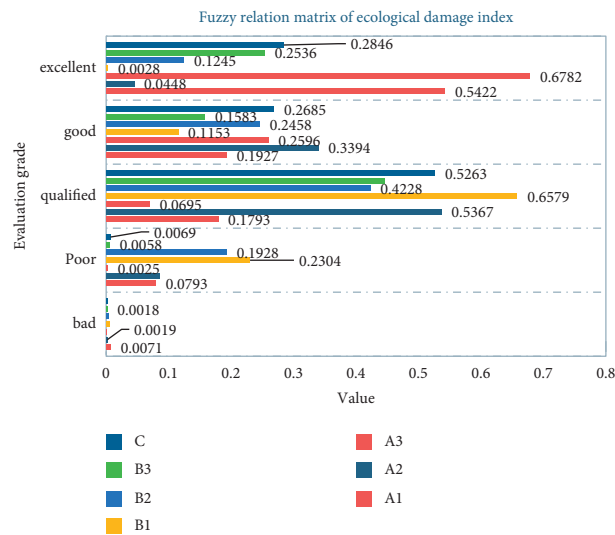

FIGURE 5: Index weight vector matrix.

FIGURE 6: Fuzzy relation matrix of ecological damage index.

TABLE 2: Fuzzy semantic conversion table.

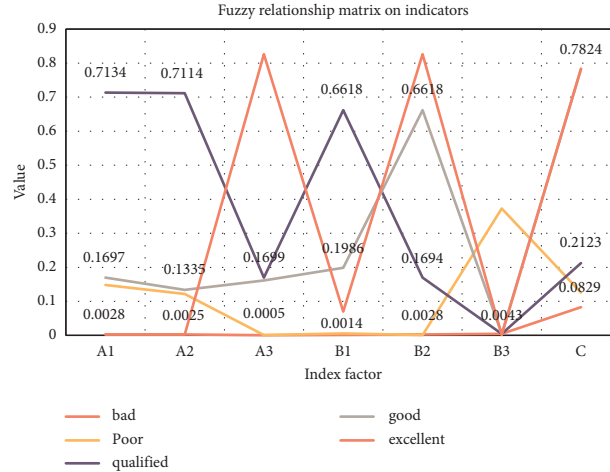| Impact level	Influence value	Triangular fuzzy number	Clear number
Great influence	4	(0.7, 0.9, 1.0)	0.8678
Big influence	3	(0.5, 0.7, 0.9)	0.7112
Small impact	2	(0.3, 0.5, 0.7)	0.5652
Little impact	1	(0.1, 0.3, 0.5)	0.3129
No effect	0	(0, 0.1, 0.3)	0.1334

FIGURE 7: Fuzzy relationship matrix on indicators.

TABLE 3: Correlation matrix between items.

Project	Level of damage	Compensation factor	Damage object	Compensation amount
Extent of damage	1.000	0.551	0.549	0.568
Compensation factor	0.552	1.000	0.388	0.629
Damage object	0.536	0.389	1.000	0.413
Compensation amount	0.577	0.627	0.412	1.000

TABLE 4: Reliability value of fuzzy evaluation index.

Variable item	Cronbach's alpha coefficient	Cronbach's alpha based on standardized terms	Number of measurement items
A1	0.976	0.996	3
A2	0.854	0.871	3
A3	0.835	0.835	3
B1	0.826	0.896	3
B2	0.723	0.689	3
B3	0.912	0.921	9
C	0.774	0.634	12

TABLE 5: Triangular fuzzy evaluation of secondary indicators.

Index	A	B	C
A	(0, 0.1, 0.3)	(0.1, 0.3, 0.5)	(0.7, 0.9, 1.0)
B	(0.3, 0.5, 0.7)	(0, 0.1, 0.3)	(0.5, 0.7, 0.9)
C	(0.1, 0.3, 0.5)	(0.1, 0.3, 0.5)	(0, 0.1, 0.3)

4.3. Comprehensive Impact Analysis of Evaluation Indicators.
Use the formula to defuzzify the triangular fuzzy number in Figure 8, get the clear number of the influence degree between each secondary index, and construct the direct influence matrix of the secondary index. And use formulas to standardize and limit the direct impact matrix, and obtain the comprehensive impact matrix of the secondary indicators of the corporate green performance influencing factors, as shown in Figure 8.

4.4. Improving the Running and Processing Time of the Association Rule Algorithm. Figure 9 shows the number of continuous value attribute division points, processing time, and relative ratio of the two algorithms under the test
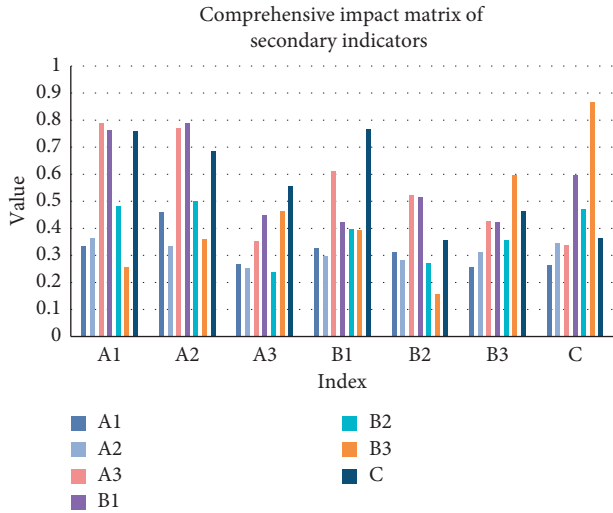
Comprehensive impact matrix of
secondary indicators

FIGURE 8: Comprehensive impact matrix of secondary indicators.

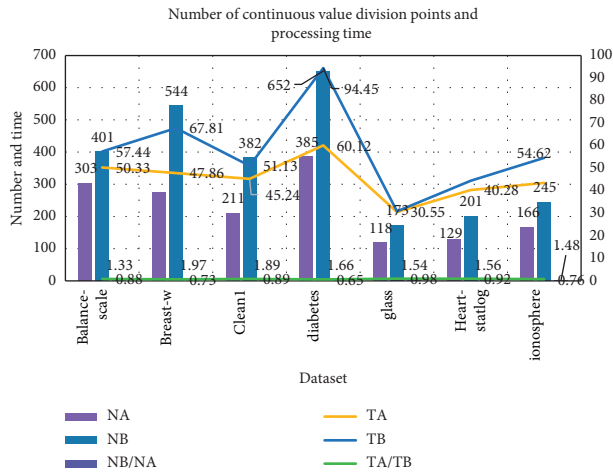Number of continuous value division points and
processing time

FIGURE 9: Number of continuous value division points and processing time.

TABLE 6: Accuracy and running time comparison table.

Algorithm	Improved algorithm	C4.5 algorithm
Average accuracy	85.47	78.54
Average complexity	76.32	99.6
Average running time	2519	2478

environment of 15 databases. Among them, A represents the improved algorithm, B represents the C4.5 algorithm, NX represents the number of division points of the algorithm X, and TX represents the running time of the algorithm X. From the above results, we can see that the number of division points of the continuous attribute of the improved algorithm is greatly reduced than that of the C4.5 algorithm, which significantly reduces the running time and improves the operating efficiency.

From the model results in Table 6, the improved algorithm has greatly improved both accuracy and model complexity, but because the improved algorithm consumes

a certain amount of time in finding high-confidence approximate association rules, the efficiency of the improved algorithm declines. Graphic indicators can be represented by gain graphs and lift graphs. Compared with the C4.5 algorithm, the number of continuous attribute division points of the improved algorithm is greatly reduced, which significantly reduces the running time and improves the running efficiency. Average accuracy, average complexity, and application time have been improved.

5. Conclusion

This article mainly studies the fuzzy comprehensive evaluation of ecological environment damage compensation system and management based on improved association rule algorithm. This paper constructs a fuzzy comprehensive evaluation model. Following the principles of innovation, responsibility, judicial, and openness, the process of fuzzy comprehensive evaluation is clarified, a set of comments on the evaluation object is established, the membership function is determined, and the damage factor and compensation are established factors, damage targets, and other indicators. The innovation of this article lies in the application of the fuzzy comprehensive evaluation method to the ecological environment damage compensation system, which is conducive to perfecting the environmental damage compensation system, strengthening environmental damage management, improving environmental protection awareness, and promoting the development of environmental protection.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

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