Management of offshore oil pollution and logistics transportation based on decision tree

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Abstract
Decision tree algorithm is one of the most widely used inductive thinking algorithms in data mining. Its construction does not require any domain knowledge or parameter settings, and it is widely suitable for exploratory knowledge discovery. The decision tree algorithm has clear structure, fast calculation speed, high precision, and higher flexibility and reliability. It can be used to process multidimensional data, and the acquired knowledge is intuitive and easy to understand. Decision tree algorithms are now widely used in medicine, manufacturing, financial analysis, astronomy, molecular biology, and remote sensing image classification. For example, in the field of marine oil pollution, the influence of bacterial flora has been studied through experiments with simulated bar graphs and bio-enhanced seawater oil pollution remediation, environmental parameters, and microbial metabolism have been found to affect the oil diffusion rate at the same time. In the early days, due to the high concentration of microorganisms, the established bacterial colonies that degraded petroleum had a certain degrading ability. As the abundance of microbial communities increases, the benefits of TCOB-4 and TCOB-5 gradually decrease. The oil of TCOB-5 is highly degradable, and may continue to function during the test period, and is compatible with other oil-degrading bacteria. The dominant position. With the rapid development of third-party logistics, logistics profits, the third source of profits, have become a black hole in the entire supply chain. If transportation costs can be reduced, the efficiency of the logistics system can be improved and profits can be maximized. Therefore, studying the decisions of third-party logistics transportation providers has undoubtedly become the top priority of ensuring fast transportation, reducing transportation costs, and conducting effective logistics management research.

Keywords Decision tree · Ocean · Oil pollution · Logistics and transportation

Introduction
Decision tree algorithm is a classification prediction model in data mining technology, which is part of a type of supervised learning. It outputs a decision tree view through unordered and irregular sample data sets, and is used to classify the target data set. Decision tree algorithms have been successfully applied in many fields, such as remote sensing image classification, trade, medicine, manufacturing, financial analysis, astronomy, and molecular biology (Ahmad 2003). When using remote sensing image classification, the structure of the decision tree does not need to be specific to the parameterized density distribution of spatial distribution attributes, so the overall classification accuracy is better than using traditional parameter statistical classification methods (Ahmad et al. 2004). Compared with neural network methods, when using training data for training, decision trees have faster and better flexibility and reliability (Ali 2007). At the same time, the application of decision trees in offshore oil has become more and more widespread (Bard 1983). In recent years, due to the increase in oil exploration activities on China’s shelves and the increase in oil transportation, the number of oil spills has greatly increased, and the number of accidents in China’s oceans is increasing. In the process of exploration, production, transportation, and use, and due to the complicated process and severe environmental conditions that will seriously pollute the ocean, leakage may occur (Burg et al. 2005). If poorly managed or refurbished, they will inevitably pose a serious
threat to the marine environment and public health. Conventional methods cannot collect information on oil slick coverage in various oceans in a short period of time. Only remote sensing technology can meet the technical requirements for large-scale collection and identification of oil slick information (Chamberlain and Zeitler 1996). The decision tree algorithm will be applied here. Therefore, it is necessary to systematically regulate the restoration of China’s marine ecology (Davies 1930). With the restoration of marine ecology, logistics and transportation have become indispensable and important links and third-party logistics have also developed as needed. After more than two decades of development, the global third-party logistics market has clearly demonstrated the characteristics of huge potential, gradual development, and high growth rate (Fatmi 1974). Although China’s third-party logistics has made some achievements in the first few years, there is still a certain gap between the levels of development of third-party logistics in developed countries in the world, and the overall effect is still not obvious (Fraser et al. 2001). The main reason is that most external logistics companies in China have changed from transportation or warehouse companies to their original companies. We have insufficient knowledge of modern logistics and lack of operational experience in modern logistics (Gansser 1964). There are unscientific phenomena in transportation solutions, a series of problems such as decision-making, poor service quality, and unreasonable transportation routes (Gansser 1980a). Therefore, it is of great practical significance to conduct in-depth research on transportation solutions in third-party logistics (Gansser 1980b).

Materials and methods

Data source

Since the original data of the remote sensing hyperspectral image in the study area exceeds 10 GB, and the software written in this study cannot be used to directly perform the oil film detection experiment, three test samples are selected for verification (three parts in the original hyperspectral image) (Gee 1945). In this experiment, in order to study the reliability of the method of identifying oil film proposed by the research, the method combines the composition of seawater and the spectral index of hydrocarbons (Ghauri et al. 1983). The test sample area is shown in Fig. 1.

Test part 1 (Fig. 1A) contains a very thin oil film, an intermittent base color oil film, a continuous base color oil film, and an emulsified oil film. Test part 1 is suitable for testing the ability of the oil film detection model proposed here to study the detection of oil films of various thicknesses (Grelaud et al. 2002). Area 2 (Fig. 1B) of the test piece contains an emulsified oil film collection area, which is surrounded by a very thin oil film and intermittent base colored oil film (Hamidullah and Onstot 1992). Therefore, test chart 2 is suitable for testing the ability of the oil film detection model proposed in this study to detect intermittent primary color oil film and emulsified oil film. Test part 3 (Fig. 1C) is located at the interface between the oil film on the sea surface and unpolluted seawater. The test (Fig. 3) can be used to test the ability of the oil film detection model proposed in this study to detect seawater and very thin oil films (Jan and Asif 1981). At the same time, there is a very thin oil film in the test part 1–3; therefore, all test pieces are suitable for testing the ability of the oil film detection model proposed in this study to detect very thin oil films. Since the survey area is captured in the air by a hyperspectral imager, a black border appears on the image boundary (the invalid area outside the air data boundary) (Johnson et al. 1976). Although the training area and the test area are extracted from the ROI image, they have no overlapping area (Khan 2011).

Decision tree classification method

The basic idea is to use a set of known explanatory variables (i.e., dependent variables) to predict the most likely type of matching with the relevant sample. In practical applications, it relies on the principle of the tree structure model to find the most suitable method to test the attributes in the node, and then iteratively divides the data set into subsets with the largest unified feature for all training case sets, as shown in Fig. 2.

It is assumed that the information sent by the information source corresponds to the classification of remote sensing images according to the decision tree, and the information received from the information receiver in the information sending system corresponds to the gray value of each characteristic band.

1. Information scope:

When creating a decision tree, the training data set is split into data subsets in the process. That is, the amount of information sent from the nodes of the decision tree is not the same, and the general mathematical definition of the amount of information is written as formula 1:

\[
\text{Information}(U_i) = \log_2 \frac{1}{P(U_i)} = -\log_2 P(U_i)
\]

The unit of information is bit, which is a logarithm based on 2.

Information entropy: Information entropy is the mathematical expectation of the amount of information. If the selected sample data set is divided into different categories according to requirements, the information entropy will be displayed in formula 2:
Entropy

\( U(\mathbf{\}) = \sum_{i=1}^{t} P(U) \log_2 \frac{1}{P(U)} \)

\( = - \sum_{i=1}^{t} P(U) \log_2 P(U) \) (2)

(2) Conditional entropy:

Set the candidate attribute to \( V \). If the selected attribute value is \( V_{b_j} \), the sample data can usually be called \( P(\mathbf{u}) \); otherwise, the sample data is called \( P(\mathbf{u}) \). The information entropy at this time is called conditional entropy, which is expressed as formula (3):

\[
\text{Entropy}(U) = \sum_{j=1}^{m} P(b_j) \sum_{i=1}^{k} P(U_i/b_j) \log_2 \left( \frac{1}{P(U_i/b_j)} \right) = \sum_{j=1}^{m} P(b_j) \left( - \sum_{i=1}^{k} P(U_i/b_j) \log_2 P(U_i/b_j) \right)
\]

\( = - \sum_{j=1}^{m} P(b_j) \left( \sum_{i=1}^{k} P(U_i/b_j) \log_2 P(U_i/b_j) \right) \) (3)

(3) Obtaining information

The calculation formula of information increase is as formula 4:

\[
\text{InformationGains}(U, V) = \text{Entropy}(U) - \text{Entropy}(U/V)
\]

(4) Partition entropy

When dividing the data set of sample \( S \), the characteristic attribute \( V \) is the total entropy, as shown in formula 5:

\[
\text{SplitEntropy}(V) = \sum_{j=1}^{m} P(b_j) \log_2 \left( \frac{1}{P(b_j)} \right) = - \sum_{j=1}^{m} P(b_j) \log_2 P(b_j)
\]

(5)

Information collection speed:

The information acquisition rate is the ratio of the received information to the shared information, which is mathematically defined as formula 6:
GainsRatio \( (U, V) \) = \( \frac{\text{Gains}(U, V)}{\text{SplitEntropy}(V)} \) (6)

(6) Measurement indicators based on information theory.

When using a binary decision tree for classification, the dimensional index in the classification regression tree is the reduction of the Gini coefficient. The best feature variable is the attribute that maximizes the reduction of the Gini coefficient, and then the selected training. The sample data sets are grouped to create a binary decision tree. The Gini coefficient function is used to measure the heterogeneity of the value of each sample category variable in the selected training data set. The Gini coefficient can be expressed as Eq. 7:

\[
\text{Gini}(S) = 1 - \sum_{i=1}^{c} P^2(U_i)
\] (7)

If the feature attribute \( V \) is used to divide the data set \( S \) of the selected sample into two groups \( S_1 \) and \( S_2 \), the Gini coefficient at this time point is Eq. 8:

\[
\text{Gini}(S) = \left(\frac{s_1}{s}\right) \text{Gini}(S_1) + \left(\frac{s_2}{s}\right) \text{Gini}(S_2)
\] (8)

Here, after the data set of the selected sample is divided into two groups, the reduction of the original Gini coefficient can be calculated as Eq. 9:

\[
\text{Gini}(S) = \text{Gini}(S) - \left[\left(\frac{s_1}{s}\right) \text{Gini}(S_1) + \left(\frac{s_2}{s}\right) \text{Gini}(S_2)\right]
\] (9)

### Table 1  Basic experimental tools

| Equipment name               | Model         | Manufacturer                 |
|------------------------------|---------------|------------------------------|
| Aseptic operation table      | SW-CJ-2FD     | Sujing Group                 |
| Pipette                     | TopPette      | Dalong Instruments           |
| Fume hood                    | –             | a City Diouapu Instrument Co., Ltd. |
| Electronic balance           | ME204         | Mettler Toledo               |
| UV-visible spectrophotometer | UV-1800       | b Youke Instrument Co., Ltd. |
| Refrigerator                 | BCD-118TMPA   | Haier Group                  |
| Centrifuge                   | Neojuage 18R  | c Xiangyi Centrifuge Instrument Co., Ltd. |
| Gas chromatograph            | 6890N         | Agilent                      |

### Experimental materials for petroleum degradation

Table 1 lists the main experimental tools used in this article.

The main experimental reagents used in this article include n-hexane (N-hexane), dichloromethane, methanol, NaCl, Na$_2$HPO$_4$, KH$_2$PO$_4$, NaH$_2$PO$_4$, KNO$_3$, etc. Petroleum continues to use CNOOC Environmental Services (Tianjin) Co., Ltd. to supply oil.

The composition and composition of the fermentation broth medium are shown in Table 2.

### Construction method of petroleum-degrading bacterial community

Study the generation of bacteria used in petroleum decomposition and the modeling of marine oil pollution remediation.

According to the analysis results of the decomposition rate and the calculation results of the decomposition of saturated hydrocarbons, the strains were selected based on the principle of additional advantage, and the petroleum decomposition bacteria group was established in Bohai Bay (Khan and Abbassi 1990). For comparison, other bacterial communities can be established.

The ability of a group of oil-decomposing artificial bacteria to decompose oil is analyzed. The experimental process is as follows:

1. First, a strain selected to construct a bacterial community in the LB liquid medium was added and cultured for 24 h for it to reproduce and grow. The bacterial suspension was then centrifuged at 8000 rpm for 20 min, and the supernatant was removed. Finally, the pellet was resuspended in sterile water and its concentration adjusted to OD$_{600}$ ≈ 1.

2. A bacterial suspension was prepared, and the individual bacterial suspensions prepared according to the above steps were mixed in equal proportions according to the designed flora to prepare a mixed bacterial suspension.

### Table 2  The medium formula used in the experiment

| Name                        | Ingredient          | Content |
|-----------------------------|---------------------|---------|
| Fermentation broth          | Sodium citrate      | 30 g/L  |
|                             | K$_2$HPO$_4$        | 3 g/L   |
|                             | NaH$_2$PO$_4$       | 3 g/L   |
|                             | MgSO$_4$·7H$_2$O    | 0.5 g/L |
|                             | (NH$_4$)$_2$SO$_4$  | 5 g/L   |
|                             | CaCl$_2$            | True    |

Adjust pH to 7 and autoclave at 121 °C for 20 min.
(3) A mixed bacterial suspension of 1 ml (inoculation amount of 2%) was inoculated into each conical flask, and sterile water was used as blank sample A. The blank is used to eliminate the physical loss of extraction. It is incubated for 7 days in a constant temperature shaker at 30 °C and 200 rpm to make three parallel patterns for each set of patterns.

Fig. 3 13 test results for oil film determination in area

Fig. 4 The oil film specified by USGS in area 1 of the test piece and the oil film obtained in area 1 of the test piece in this study

(A)  (B)  (C)

(E)  (D)

2 mm  0 mm

(A)  (B)  (C)

Emulsion  Code 5  Code 4  Code 1-3  The sea

Emulsion  Code 5  Code 4  Code 1-3  Sheens (Code 1-3)
After the culture is finished, it was rotated to dryness, weighed, and decomposed, calculated by formula 10:

$$H = \frac{(m_0 - m_n)}{m_0} \times 100\%$$  \hspace{1cm} (10)

Among them, $H$ is the decomposition rate of oil ($\%$), $m_0$ is the residual oil amount (g) of the control sample, and $m_n$ is the residual oil amount (g) after biodegradation, and the result is expressed as an average value.

### Results

#### Recognition results of offshore oil pollution based on decision trees

**Test results**

Figure 3 shows the slick identification method proposed in this study (combining the composition of seawater and the spectral index of hydrocarbons) in test area 1–3 (Fig. 3B, D, F) for slick identification. The gray area of the test result indicates the invalid area outside the antenna tape (the black frame in the test sample 1–3 area), the red pixel indicates the detection of the emulsified oil film, the black pixel indicates the continuous detection of the base color oil film, the yellow pixel represents the recognized intermittent base color oil film, the blue pixels represent the recognized extremely thin oil film, and the blue pixels represent the recognized seawater.

**Analysis of experimental results**

In order to better evaluate the detection accuracy of the ocean surface oil slick model, the oil slick detection results of test site 1 (Fig. 4C) were compared with the 2019USGS Gulf of Mexico oil spill results. The results of the investigation report are compared to identify the slick formed by oil on the sea surface (Fig. 4A, B).

In addition to the comparative test, this study also used the MODIS image acquired on May 17, 2020 (Fig. 5) and the ENVISAT-ASAR image acquired on May 18, 2020 (Fig. 6).
to evaluate the accuracy of the experimental results in MODIS and ASAR. There are two main reasons for the slight difference in the scale of the oil-contaminated film in the image: Although the study lacks field observation data to quantitatively evaluate the recognition accuracy of the study, it is through comparative experiments, MODIS images, and ASAR. The image also verifies the effectiveness and accuracy of the oil film identification method proposed in this study from the side.

**Recognition results of oil film under uneven seawater environment**

The black background in Fig. 7 is the marine environment, and the white area is the oil slick recovered on the surface of the ocean. The oil film in the FI and RAI recognition results (Fig. 3A, B) are not fully recognized, which indicates that FI and RAI cannot detect the oil film on the sea surface caused by natural leakage in the Landsat 8 image. However, SWIR and L8OSDI can completely remove oil film from the sea surface of test area 3.
Figures 8A–D and 9 show the best FI, RAI, SWIR, and L8OSDI results when the oil film in test area 4 is detected by the threshold.

Figure 9 shows the SWIR detection results of the oil film in the test area 4 at different thresholds.
Table 3 shows the threshold values of various spectral indices calculated from the samples during the experiment to distinguish between seawater and oil film.

Table 4 shows the best critical values for seawater and oil film processes that distinguish FI, CHL, RAI, SWIR, and CDOM.

Analysis of single-strain petroleum degradation rate

Figure 10 shows the degradation results of five high-efficiency oil-degrading bacteria TCOB-1–TCOB-5 investigated in Bohai Bay by gravimetric analysis. The oil remaining in the water sample is separated into four components by chromatography: saturated hydrocarbons, aromatic hydrocarbons, gums, and asphaltenes.

Figure 11 shows the decomposition rate of saturated hydrocarbons and aromatic hydrocarbons of five strains, TCOB-1–TCOB-5.

Figure 12 shows the gas chromatographic analysis results of n-alkanes in the remaining oil of the five strains, and the error bar is the standard deviation.

As shown in Fig. 13, the decomposition rate of normal alkanes (C13–C36) of a strain can be calculated.

Table 5 shows the degradation rates of medium-chain alkanes and long-chain alkanes by the five strains.

Bacterial community construction and oil degradation rate analysis

Figures 14 and 15 are the infrared spectra of surfactants produced by oil-producing strains TCOB-4 and TCOB-5, respectively.

Figure 15 accurately shows the infrared spectrum results of the surfactant produced by the oil-degrading bacteria TCOB-5.

In this project, TSOB-4 and TSOB-5 were selected to construct ConsortiumA of oil-producing bacteria. For comparison, TCOB-1 was also used to construct comparative flora, namely ConsortiumB and ConsortiumC. Table 6 shows the strain and degradation rate.

Table 6 shows that the oil decomposition rates of the three groups of bacteria that decompose oil in simulated seawater are 51.87%, 35.29%, and 21.39%, respectively. Figure 16 shows the weight distribution of the four components in the remaining oil in the blank control water sample and the microbiologically degraded water sample after incubation. It can be seen that Union A has the least residual oil, and compared with the blank, the amount of saturated hydrocarbons and aromatic hydrocarbons has been reduced.

Figure 17 shows the petroleum decomposition rate of the three groups of petroleum-decomposing bacteria.

Figure 18 shows the gas chromatographic analysis results of n-alkanes in the remaining oil of the three groups of oil-decomposing bacteria. Semi-volatile organic compounds (C15–C24) are the main components of the remaining n-alkanes in the samples.

Figure 19 shows the decomposition rate of n-alkanes by the bacterial colony. This figure shows that the odd carbon advantage of long-chain alkanes is not obvious compared with the results of a single strain.

Discussion

Participants and roles of logistics and transportation decision-making

In the supply chain, transportation decisions require collaboration between companies at different points in the supply chain. The supply chain can be divided into two parts: the flow of raw materials, parts, etc. between suppliers and multi-level suppliers or between suppliers and manufacturers is rising, followed by the flow of finished products and semi-finished products, and the flow of multiple manufacturers. Information flows from manufacturers to consumers.

If the company does not have its own vehicle, it must instruct the third-party logistics company to carry out the transportation, and then the third-party logistics company is the carrier.
Shipper

If we have our own transportation fleet, while respecting the interests of all participants, we will formulate appropriate transportation plans and minimize our own costs.

Recipient

The goal of the consignee is to hope that the goods will arrive safely and on time. As the receiver, the manufacturer hopes that the received materials can be delivered on time.

Carrier

If the sender does not have his own vehicle, he must hire a professional transportation company (i.e., freight forwarder) to act as an intermediary for transportation to deliver the goods (Khan et al. 1986). The goal is to complete the transportation tasks agreed in the contract at the lowest cost, and at the same time obtain the greatest benefits from the transportation (LeFort 1975). When deciding on transportation, it is necessary to formulate an appropriate transportation plan based on the relevant information of the shipper and the harvester, so as to meet the needs of various companies with the lowest transportation cost (Malinconico Jr 1986).

Consumer

Consumers are concerned about the reliability, timeliness, cost level, and actual economic benefits of company transportation, as well as environmental, social, and safety standards. Consumers create the demand for goods at reasonable prices and ultimately determine their transportation needs. Since the cost of reducing environmental risks and traffic accidents...
must be transferred to consumers, consumers will inevitably participate in decision-making about transportation safety.

**Government**

Since transportation affects the entire local economic environment, the government must maintain a balance of interests in all aspects of market operations, hoping to have a stable and efficient transportation environment to promote sustainable economic growth. The main function of transportation is to promote the efficient delivery of products to markets across the country and around the world, and to promote products with reasonable prices. The government usually takes the form of promotion or restriction, for example, by restricting the market that the airline can serve and determining the price it can charge to regulate its behavior, support research and development, and provide information such as highway management systems and aviation to promote and help profitable transportation rights for air carriers. No matter from which point of view, the state has an important and absolute influence and even control over the company’s decision-making in the field of transportation. Therefore, it is necessary to make transportation decisions for enterprises based on a deep understanding and mastery of relevant government transportation systems and regulations.

**Functions of logistics transportation management**

When making third-party logistics transportation decisions, the network resource sharing of the logistics information system is used to obtain information about transportation resources from companies, society, and other logistics companies in a timely manner, and to effectively integrate them. This method can not only improve the use of transportation resources of third-party logistics companies, but also integrate social transportation resources to ensure an efficient and fast...
supply chain. Third-party transportation solutions can help logistics companies choose suitable transportation routes in a complex transportation network, equipped with suitable vehicles to transport goods in the shortest time, which can avoid improper transportation and reduce the transportation time of goods. When third-party logistics companies carry out transportation and distribution, transportation solutions enable them to make the best choice for each transportation route and optimize transportation plans. For third-party logistics companies, the service they provide is transportation. Customers’ requirements for this type of service quality are “dynamic work and quick response.” When third-party logistics companies make transportation decisions, they usually involve customers in the entire decision-making process, taking into account all aspects. From the perspective of the supply chain, transportation decisions are made to satisfy customers.

**Strategies to strengthen logistics and transportation management**

**Third-party logistics companies should make scientific decision-making concepts**

Ideas are the harbingers of action. If a third-party logistics company wants to improve its decision-making mechanism and improve its decision-making capabilities, it must first change its decision-making concept and transition from empirical decision-making to scientific decision-making.

Decision-making strategies not only need to stand straight and look into the distance, but also need to be comprehensive and purposeful. When making transportation decisions, third-party logistics companies must not only benefit from the current situation, but must also pay attention to future developments. In view of the rapid development of China’s economy and the increasingly fierce competition between companies, third-party logistics companies must provide optimized decision-making solutions that are most suitable for the development of the entire society to adapt to the continuous changes in the relationship between supply and demand.

The decision to implement logistics transportation by a third party is the best solution provided by the logistics company during the entire transportation process. This process involves not only logistics companies, buyers and sellers, consumers, and the government. Therefore, external logistics companies should pay attention to honesty when making transportation decisions, and consider the realization of an overall original transportation decision-making method that fully considers the impact of various influencing factors, continuously improves the existing decision-making model,

| Degradation rate (%) | TCOB-1 | TCOB-2 | TCOB-3 | TCOB-4 | TCOB-5 |
|----------------------|--------|--------|--------|--------|--------|
| C15–C24              | 17.57  | 19.4   | 16.13  | 22.54  | 16.25  |
| C25–C36              | 21.3   | 35.82  | 34.38  | 29.37  | 35.74  |

**Fig. 14** The infrared spectrum of the surfactant produced by the oil-degrading bacteria TCOB-4
establishes a more comprehensive decision-making method, and does make newer, more accurate, clearer, and more feasible decisions.

**Speeding up information collection by third-party logistics companies**

Information is the basis of decision-making, and decision-making is the evaluation and application of information. Modern decision-making must be based on a large amount of information, which is based on serious research, serious analysis, scientific judgment, and ultimately rational judgment. In this way, third-party logistics companies can accelerate the development of computerization. Various departments of a logistics company can be connected to each other through the Internet to share the information resources of each department and can quickly transmit information. In this way, on the one hand, the communication channel between the upper layer and the same layer is smoothed, so that transportation decisions can be quickly communicated to various relevant departments, and on the other hand, the interruption of information flow is prevented. Through the establishment of comprehensive information management, the query system not only simplifies management connections, but also improves management efficiency. On the one hand, the logistics company can publish the company’s dynamic information and various services on the website, as well as the status of the vehicle, the status of the goods, the place of delivery, and the status of the goods received during transportation. After being processed by the internal information system, the information will be published on the website for the convenience of customers to inquire at any time. By integrating the information collected internally and externally, scientific forecasting technology can be used to scientifically predict changes in supply and demand logistics and ensure that the entire transportation process can be carried out efficiently and accurately. In the era of network economy, computerization is a prerequisite for the growth of third-party logistics companies. In foreign countries, bar code technology, electronic data exchange, control information systems, radio frequency technology, geographic information systems, and global positioning satellite systems have been fully applied in large third-party logistics companies. Among them, the geographic information system is used to determine and obtain the previous geographic location of the vehicle, and the global satellite positioning system uses r to transmit the geographic location information of the vehicle to the transportation management information system of the third-party logistics company. Therefore, the logistics company can control and plan the entire transportation process at any time. The Internet traffic management system can maximize the speed of transportation information integration, thereby effectively reducing downtime and providing important information for making transportation decisions.

**Table 6** The structure of the bacterial community

| Serial number | Strain ratio | TCOB-1 | TCOB-4 | TCOB-5 | Degradation rate (%) |
|--------------|-------------|--------|--------|--------|----------------------|
| ConsortiumA  | –           | 1/2    | 1/2    |        | 51.87                |
| ConsortiumB  | 1/3         | 1/3    | 1/3    |        | 35.29                |
| ConsortiumC  | 1/2         | –      | 1/2    |        | 21.39                |

*Fig. 15* The infrared spectrum of the surfactant produced by the oil-degrading bacteria TCOB-5
Strengthen the connection between external logistics companies and customers

Third-party logistics companies must strengthen communication with customers and receive timely feedback from customers on transportation services. On the one hand, service defects can be quickly corrected; on the other hand, transportation defects can also be resolved. There are basically the following ways to communicate with customers: third-party logistics companies can contact customers through face-to-face interviews, e-mail, and telephone surveys, so that customers can fully understand and use the services of third-party logistics companies and the assessment is still waiting for logistics. In the process of logistics transportation, third-party logistics companies must contact customers regularly and improve logistics service levels through continuous feedback. In terms of strategic partners, third-party logistics companies must pay attention to frequent contact and communication with customers, understand customer needs, and constantly provide appropriate logistics and transportation services according to customers’ changing needs to improve third-party logistics vehicle solutions.

Improve the existing management model of logistics companies

Third-party logistics companies must continue to innovate based on the original management model, and improve system flexibility by enhancing business strategies (that is, satisfying customer needs and providing service foundations). Secondly, the overall cost should be reduced and the response rate should be improved. Management innovation lies in the use of scientific and dynamic management methods to control and coordinate the rationality of the logistics system, thereby reducing the operation and management costs of third-party logistics companies. Its innovation is mainly manifested in the following: First, optimize the distribution of various resources such as talents, equipment, tools, and information in the company’s logistics; second, strengthen the logistics personnel competition mechanism, incentive mechanism, and innovation
mechanism. Ultimately, the distribution of logistics resources should be flexible in terms of organization and management to meet changing logistics needs. Third-party logistics companies must pay attention to the system design of the logistics transportation process, optimize the configuration of various departments and various transportation tools, use supply chain ideas to integrate the logistics system, and improve logistics efficiency through overall coordination.

**Strengthen the training of third-party logistics professionals**

The talents of logistics professionals play an important role in the entire transportation decision-making, because as logistics and transportation decision-makers, we must have sufficient understanding of each logistics connection and have the corresponding logistics knowledge. However, there is a serious shortage of logistics professionals with technical and management knowledge in China. Therefore, we should improve the training and professional development of experts in the logistics field. Since 2016, China has launched a logistics personnel training program. At present, China has established a special committee to train the talents of the Chinese Society of Logistics. Logistics management, logistics engineering, and logistics have been gradually opened up in nearly 100 universities, many of which are provided by logistics professional training companies. Through these channels, the training of senior logistics managers and logistics technicians are speeded up. On the one hand, theory is derived from practice; on the other hand, it guides the development of practice. Therefore, in order to be able to make more sensible decisions, it is necessary to strengthen the in-depth study of logistics theory, especially the study of specific issues and new situations in the development of modern logistics. At the same time, it is necessary to strengthen academic exchanges and cooperation with foreign logistics organizations. Explore the thoughts and theories about overseas advanced logistics management to lay a solid theoretical foundation for decision-making.
Conclusion

The decision tree system not only realizes the pixel classification of remote sensing images, but also realizes the automatic classification of segmentation results based on image segmentation. The image has many auxiliary functions, such as enhanced accuracy assessment and post-classification modification. Decision trees can help to screen and isolate local bacteria in specific marine areas from marine oil pollution, and use the principle of mutual benefit to create efficient oil-degrading bacteria colonies, and to study the functional genes of degrading enzymes in highly efficient degrading strains. By modeling the longitudinal distribution and analyzing the distribution of oil and microorganisms and the most important factors affecting microorganisms, the institute established the survival relationship between oil-decomposing bacteria and oil-decomposing bacteria on the market. On the basis of the above research, a method of combining physics and biology of degradable materials was established, and its degradation effect was analyzed. The ecological restoration of the ocean must solve the main problems of restoration through a series of laws related to goals, financial guarantees, standard setting, responsibilities and incentives, and the uninterrupted development of ecological restoration must be guaranteed. Only by clarifying the responsibility for each problem of the ecological restoration of oil pollution in the marine environment can it be possible to compensate the victims in time, better protect the marine environment, and make the environment more civilized and society more harmonious. At the same time, protecting the marine ecological environment also promotes the development of the logistics industry. For third-party logistics companies, choosing the right transportation method and continuously optimizing transportation routes are important ways to obtain profits, as well as important ways to improve their competitiveness, and it is one of the most important signs of enterprise modernization. Therefore, it is very important for Chinese logistics companies to understand the decisions of third-party logistics service providers. At the same time, by integrating the logistics resources of the whole society, a modern logistics system network can be established between enterprises and industries, thereby realizing the rationalization of social logistics. Third-party logistics transportation decision-making is an important foundation for sound logistics transportation management, and it is also the main means to achieve logistics transportation management goals. Third-party logistics companies need to fully consider various factors when choosing transportation methods, correctly assign scoring weights, and correctly quantify them to make decisions more wise.

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Declarations

Conflict of interest The author declares that he has no competing interests.

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