Maritime Safety Early Warning Method Based on CBR

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Abstract: Aiming at the special and general characteristics of the decision-making of the emergency dangerous ship, this paper introduces the principle and method design of case-based reasoning (CBR) with the characteristics of complete matching. The construction of the case database of the decision-making of the emergency dangerous ship, so the algorithm performance of the case library is based on the automatic search of the driving and characteristic decision of the biochemical radiation ship, so the simulation experiment is carried out with the help of the intelligent control simulation test platform of the generating mechanism ship, which verifies the possibility of its realization. It is an integral part of the decision support system of ship's intelligent avoidance, which has theoretical research and practical value for ship's navigation safety, navigation simulator training and guidance.

1. Introduction

In the case of a collision, the process is ultimately an urgent danger. However, researchers at home and abroad have not studied how to avoid or reduce the collision loss in the emergency and dangerous situation. According to the assessment requirements of Manila International Convention and Exhibition Center and National Resource Security Administration for bridge resource management, emergency training must be carried out for the master and the director. Therefore, it is necessary to study the decision-making of ships in emergency and dangerous situations. The geometric analysis of collision avoidance research shows that the ship's emergency and dangerous decision-making plan has special and general characteristics. As for the so-called "particularity", the meeting features of the same two ships have different meeting situations[1]. Therefore, the ship's handling method means "meeting situations". The EC of the two ships is determined by the basic situation of the meeting, and the relative position of the target ship is called embryo research, which means that it is divided. The so-called "generality" refers to that the rotation angle (P) of ship operation decision-making scheme follows certain regularity under different encounter conditions, which can be represented by its solution model. If the emergency danger can not be avoided by the other party's coordination, that is to say, when the unavoidable situation occurs, the conflict is called the inevitable conflict. The same EC and different RBS constitute two diagrams of the Inc operation decision plan. Although the steering direction is the same, in order to minimize the collision loss, it is necessary to adopt different redirection angles[2]. Therefore, the details and universality of the decision-making plan considering the urgency and danger of the ship are considered. If we can provide decision-making plans for ships that minimize collision loss under automatic generation of various Inc situations, and provide decision support for pilots or trainees, so as to implement correct Inc operation measures in emergency. It improves the importance and practical value of theoretical research in reducing the loss of navigation and marine pollution, as well as the training and guidance quality of navigation simulator.

2. CBR principle and Method Design

Case-based reasoning (CBR) is a reasoning method simulating human analogy. Resesbeck and Schank believe that CBR can solve current problems by accessing similar case libraries. Inference technique

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2.1. Implementation Principle and Characteristics of CBR Based on Feature Complete Matching

CBR process model is a 4R cycle proposed by American scholars. The traditional CBR retrieval process relies on experience cases as a whole. The quantity and quality of experience cases have a great influence on the system. Because there are many encounter situations in the function of each intersection, it is difficult to effectively solve the emergency and dangerous problems of various encounter situations under the same intersection characteristics. It is clear that the decision of urgent and dangerous vessel activities is complex. For this reason, according to the production rule description based on the case, through the performance based on the algorithm, based on the CBR matching features, retrieval, in order to solve the current problem, the model of determining the emergency dangerous ship in the source shell is obtained. According to the existing CBR method, it is improved[3]. The characteristics of the improved CBR method are as follows. The case base is described with algorithm. It is necessary to build an algorithm case base based on feature recognition model and ship decision-making solution model. The case base of the algorithm has the characteristics of generalization and adaptability, which can ensure the legitimacy of the decision of the emergency dangerous ship[4]. Without the conclusion that the process characteristics are completely consistent, the solution model of case source can be directly used to solve the current problem.

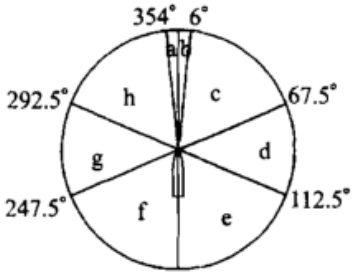

Figure 1 No intention of Rb division of target ship

2.2. System Structure Design

The automatic generation system of emergency and dangerous maneuvering decision of two ships is one of the important modules of the intelligent decision-making system. Among them, there are two decision-making methods of emergency avoidance, assisting in avoidance (monitoring). This decision-making avoidance method has been studied in depth. It is impossible to get the collocation of the other party. Depending on the operation of the company, conflicts as far as possible will reduce the need for loss.

2.3. System Workflow Design

The design of case base and the characteristics of case retrieval algorithm are the important contents of the design of decision system of emergency dangerous ship based on CBR. The former is the basis of system establishment, and the latter is the core of system inference. The urgent danger of graph is represented by ID (IMI next danger). In order to determine the construction of the case base of ship driving, based on the characteristics of multiple encounters of the ship under a certain convergence characteristic, according to the description of the case, the algorithm performance of the above algorithm case base, Inc application decision case base, is proposed.

2.4. Description of the Case

The information contained in the Inc case is divided into two parts: the problem awareness department and the decision-making department. The former is the index structure of the case, and the latter is the solution of the case. Therefore, in the case of Inc operation, it is expressed as Inc operation condition indicator information + Inc judgment information. The situation is as follows. The if - then rule is used to describe the situation[5]. Take the case as the rule, the problem is the

condition, and the decision is the conclusion.

Table 1 Weight of loss corresponding to collision angle and collision position

Ship collision loss weight		Hit part of target ship					
		Bow segment		Midship		Stern section	
		Nose of nose	Other parts	Middle of ship	Other parts	End of ship	Other parts
Collision angle of bow section of the ship	0		0	0	0		0
	30	2	1	22	4	21	3
	60	8	7	22	10	21	6

The establishment of case evaluation model provides a scientific basis for the decision-making of Inc. Therefore, it is necessary to determine the factors that have a significant impact on ship collision loss. Scholars in the field of ship collision damage research have mathematically determined the functional relationship between the influencing factors and collision damage. In addition, the literature of E4 and E53 shows that under some impact conditions, the impact loss is much greater than the impact angle and impact position before impact velocity. Moreover, the influence of the influence angle is very important to the energy loss. Therefore, two main parameters affecting the energy loss of conflict are established. The parameters of the conflict process are very uncertain and there are many possible combinations. Different combinations of collision parameters can correspond to completely different results of collision energy loss. From the point of view of conflict, the opportunity to reduce energy loss can be considered in the conflict, that is, the important components of both sides (engine room and stern, etc.) and the avoided conflict. It is also necessary to consider that the damage of both sides' hull structure (conflict) is minimized[6]. Therefore, the ship's maneuvering results are evaluated by investigating the collision parameters of the collision position and collision angle. The two-dimensional parameter evaluation model is included in the Inc decision-making system, which is used to achieve the appropriate and optimized objectives of the system to achieve the plan.

3. Automatic Retrieval and Generation Mechanism of Urgent Dangerous Ship Handling Decision Based on CBR Characteristics

3.1. Organizational Structure of Case Base

The design method of case-based reasoning is to find the cases matching the current problems from the case base. Therefore, the method to improve the efficiency of the process will have an important impact on the system reasoning process. The case-based reasoning mechanism represented by the algorithm adopts hierarchical retrieval and forward inference based on production rules. By designing retrieval mechanism and feature matching algorithm, the reasoning efficiency of the system is improved.

3.2. Automatic Search for Decision Making of Emergency Dangerous Ship

So it's the case that the automatic retrieval organization of "completely consistent" feature term index + algorithm proposes Inc's ship driving case database, focusing on figure 62, and the hierarchical structure is the feature that constitutes the response meeting situation. Feature algorithm is used in retrieval. In the inference process, the pre stored features and relative direction features of the intersections of the two ships are extracted from the functional values of the intersections in turn. Situations are represented in the form of classes. The system analyzed 62 CAC cases, focusing on 80 cases in Inc case bank. Through the research of 18 kinds of meeting conditions, according to the internal code of each category to complete the specific automatic generation work[7]. The process of reasoning retrieval is completed by class Creason. The first function is to establish the rule basis of lattice inference. The second function describes the case library. The third function is to call the corresponding dialog box according to the inference results of the first two functions.

3.3. Simulation Example and Result Analysis

The design idea of simulation experiment plan is as follows. Based on the unification of the "ship intelligent control simulation platform" of the 6-DOF model ship developed by the Danish Institute of navigation, the existing research results use the code of the decision-making module code of the emergency dangerous ship, and use the code written in C + in Japan. The user algorithm of infiltration platform is merged as PID VCA algorithm. In all kinds of new situations, Inc cases are set, and the autopilot used in PID - VCA algorithm platform is upgraded. In the case of conflict danger, the ship decision module of emergency danger will be inevitable, in order to confirm the implementation of simulation test[8]. The system automatically searches whether the guidance device generated by the solution model can achieve the effect of reducing collision loss.

The example of Figure 1 (b) is set as "ship intelligent control simulation test platform". Self ship and target ship are represented by OS and TS respectively. Please select chart No. 12100; OS select model 3178, automatically generated relevant information, decision parameters and simulation result display interface; ts select 310l ship model[9]. The result is that the case solution obtained through system retrieval and matching is an executable operation plan, which is basically consistent with the basic empirical operation decision plan, and verifies the possibility of the implementation of Inc's decision-making method. The help section provides a text description of the case installation results.

4. Conclusion

The research on the automatic generation method of ship Inc decision is one of the effective methods to reduce collision loss and improve ship safety. The CBR method based on feature matching provides a theoretical basis for the realization of the system. In this study, the algorithm is used to represent the Inc grid library. Firstly, the automatic Inc generation method based on feature matching CBR is generated.

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