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Research on Task Scenario-oriented Information User Concern Mining Technology

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Abstract—With the rapid evolution of war forms and the profound reform of combat forms, battlefield intelligence information will present complex and diverse characteristics. Faced with a large number of complex intelligence information, it is difficult for users to obtain the key information in the battlefield to make real-time decision aid by using traditional methods. Based on the analysis of user interaction behavior rules of intelligence users of different levels, different identities and different specialties facing different task scenarios and different battle stages, the information that users pay attention to, the way that users want to display information and the way that users want to input information can be obtained. Firstly, the task scene is modeled, and the current task scene can be sensed in real time. Secondly, the user behavior under the current scenario is collected and stored in the user behavior analysis sample database. Finally, the user behavior analysis model is constructed, and the model outputs the content that the current user pays attention to, the desired presentation way and the desired information input way. The mission-scenario-oriented information user concern mining technology is an important component of the mission-scenario-oriented information product adaptive service technology, which can support the collection of operational user behavior and the analysis of behavior rules in the interactive process of operational information. This technology mainly studied user interaction behavior preferences facing different task scenarios, and provides basis for information recommendation and information adaptive presentation.

1. INTRODUCTION

With the accelerated evolution of war forms and profound reform of combat forms, information-based joint operations are characterized by three-dimensional and multi-dimensional combat space, integrated combat force system, real-time and efficient combat command, rapid linkage of combat operations, and precise and efficient combat support. Based on the new command system of “the CMC is in charge of the general command, the services are in charge of the construction, and the combat zones are in charge” and the expansion of missions and tasks. Based on the new environment, new capabilities and new equipment, how to improve the adaptive service ability of intelligence products from the aspects of the demand, collection, processing and distribution of intelligence products in the context of joint operations so as to realize the accurate perception of battlefield situation, parallel linkage of combat units and dynamic and real-time auxiliary decision-making has become the key to improve the combat ability of the military systems[1]. The transformation of the current war form mainly includes the following aspects.

(1) The diversified characteristics of combat styles put forward new demands for multi-task and multi-scene intelligence products. Therefore, it is necessary to change the mismatched service mode of intelligence products. First, analyze the user interaction rules oriented to specific tasks and scenarios. Next, apply intelligent technology to identify and focus on users' concerns, track, understand and lead users' real-time demand for intelligence products. Finally, create an “on-demand supply” intelligent intelligence product service mode to solve the problem that intelligence products cannot converge on demand, improve the intelligence and accuracy of the information system to control the flow and flow direction of information products, and avoid the blocking of information products and eliminate the interference and harm of useless information products at the same time[2].

(2) The characteristics of diversification of combat forces are obvious, which puts forward new demands for combination and interaction of intelligence products. With the acceleration of the pace of information technology, the combat capability of the PLA system has been significantly improved. The combat capabilities of the armed forces of all services have been continuously improved, the new combat capabilities have been continuously developed, and the cohesion and outreach capabilities have been continuously enhanced. Therefore, it is necessary to combine intelligent technology with the extraction, understanding, presentation and operation of intelligence products to improve the interaction ability of

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intelligence products among users of different levels and categories, so that cross-level and cross-category combat users can have timely and intuitive intelligence interaction. Through the extraction, combination and presentation of intelligence, intelligent interaction environment of intelligence products can be built and improve its interactive utilization efficiency [3].

(3) The characteristic of combat command precision is obvious, which puts forward new demand for the distribution and push of intelligence products. In this regard, it is an important way to improve the commander's command and decision efficiency to study the autonomous push and distribution technology of information and improve the quality of information service. From the perspective of the complexity of battlefield intelligence, battlefield intelligence can be presented as multi-modal data such as image, video, audio, text and formatted message. The processed useful intelligence can be quickly integrated into complete, consistent and accurate high-quality intelligence, and a set of unified data attribute and correlation description system can be established to classify useful intelligence associated with combat missions. It is the key to transform the advantages of intelligence products into the advantages of command decision-making and combat operations by delivering the information to the commanders in need at the right time and in the right way and providing them with auxiliary decision-making suggestions with sufficient response time [4].

Modern battlefield is changing rapidly and battlefield intelligence information is complex and diverse. In the course of combat, when the multi-level commanders and staff members use the information system to carry out various command tasks, they need to interact with the information system quickly, efficiently and accurately. In order to meet the interaction requirements of multi-level commanders and staff and intelligence information system, this paper proposes a task scenario-oriented intelligence user concern mining technology, which mainly studies user interaction behavior preferences in different task scenarios, and provides a basis for information recommendation and self-adaptive presentation.

2. TECHNICAL OVERVIEW

2.1 Research objective

The mission-scenario-oriented information user concern mining technology is an important component of the mission-scenario-oriented information product adaptive service technology, which can support the collection of operational user behavior and the analysis of behavior rules in the interactive process of operational information. This technology mainly studies user interaction behavior preferences facing different task scenarios, and provides basis for information recommendation and information adaptive presentation.

It is necessary to analyze the task scenarios faced by the operational users in different stages of the operational process when studying the technology of intelligence user concern mining. The interactive behavior model of combat users is established according to the task scenarios, and the personalized interactive behavior of combat users at different levels, different identities and different specialties is analyzed when facing different task scenarios. By mining interactive preferences such as personalized interaction mode, interaction content, interaction object and interaction frequency of combat users, it provides support for the research of intelligence adaptive interaction technology for different mission scenarios.

2.2 Research content

This research mainly analyzed the interactive behavior rules of intelligence users at different levels, different identities and different specialties when facing different task scenarios and different battle stages, the analysis results include three aspects: the information users are concerned about, the way users want to display information and the way users want to input information. Firstly, the task scene is modeled and the current task scene is sensed in real time. Secondly, the user behavior under the current scenario is collected and stored in the user behavior analysis sample database. Finally, the user behavior analysis model is constructed, and the model outputs the content that the current user pays attention to, the desired presentation way and the desired information input way. The logical framework is shown in Fig.1.

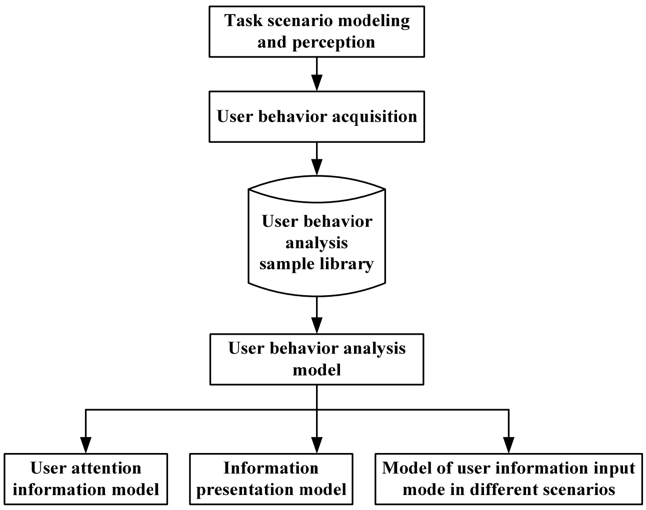

Figure 1. Logic frame diagram

2.3 Research idea

The research ideas of information user concern mining technology is shown in Fig. 2. The specific research ideas are as follows:

According to the five specific aspects of the task scene, the task scene is modeled and classified. According to different personnel in different task scenarios, determine the user information to be collected, such as interaction channel information and interaction scenario information.

Collect raw data (such as a voice) through sensors or VR devices according to the type of information to be collected. In the specific experiment, in the training stage, the sample generation tool is used to generate.

The collected data are cleaned and preprocessed to obtain the user's specific interactive behavior data (such as the voice command text content or the voice fragments in a voice) and scene data and store them in the user behavior sample database.

According to the data in the sample library, modeling analysis is carried out on the information types that users are concerned about, the presentation ways that users are interested in and the information input ways that users want, and output the information types that users are concerned about, the presentation ways that users want and the input ways that users want.

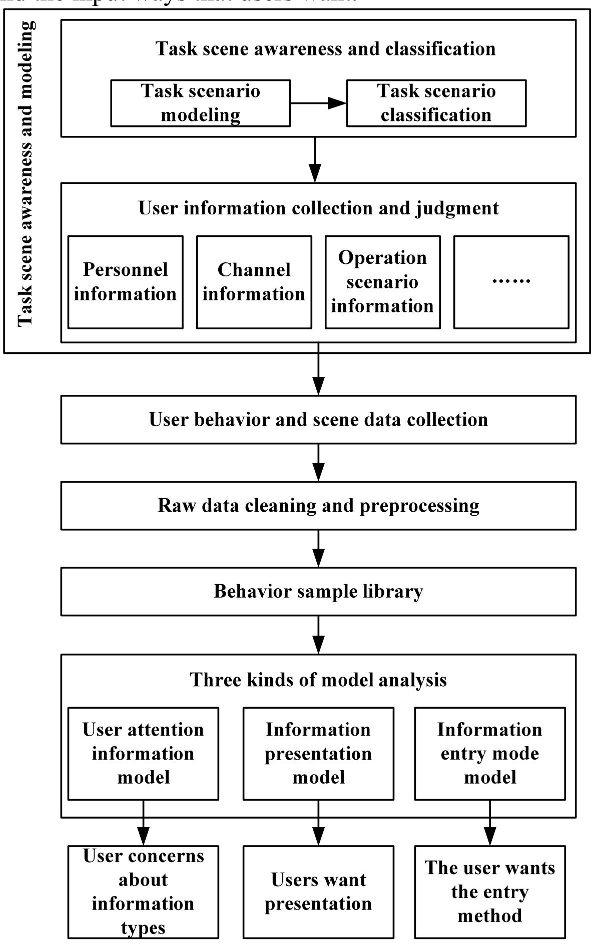

Figure 2. Analysis of the law of user interaction behavior

3. MAIN TECHNICAL COMPOSITION

3.1Task scenario modeling and awareness module

Analyze and model the elements related to the task scenario based on expert advice or other valid information. In an actual application scenario, we can collect or perceive the attribute information of the current task scenario. In the task scene awareness module, the relevant attribute information can be given by the system or obtained by the sensor, or the current attribute information can be judged according to the data obtained by the sensor. For example, for the attributes of the user task environment in a task scenario, we can determine the current user task environment by obtaining the picture information of the current environment and using the classification algorithm. After determining the current task scenario, it is needed to further determine user interaction requirements in the current scenario. The demand for intelligent human-computer interaction mode mainly refers to the demand for information collaborative interaction by intelligent interaction means under different combat mission environments. For example, in the collaborative interaction between the individual soldier and the vehicle, the interaction content is mainly composed of speech recognition and speech broadcasting. The individual soldier checks the damage degree of the target and reports to the vehicle by voice[5].

3.2User behavior and scene data acquisition module

User behavior data includes voice control, eye tracking, gesture recognition and augmented reality related data, such as part of the user behavior recorded by the upper application (what kind of information to focus on, preferred presentation way, etc.). User behaviors output by HoloLens, such as what kind of software users prefer to control by voice and gesture [6].

Analyzing the user interaction process and behavior rules by means of data collection, behavior experiment and questionnaire survey, sort out some user behavior analysis samples (sample content is user behavior and behavior labeling), and then use sample generation tools to automatically generate some samples to build an initial sample library, which can support training of tensorflow in user behavior analysis module. In the process of subsequent debugging and using, sample generation tools are used to extract some user behavior data from AR equipment and upper-layer application software to optimize the sample library [7].

3.3Build a sample library of user behavior

After collecting user behavior and scene data, it is necessary to clean and preprocess the original data, segment scene pictures, extract interest areas and other operations, and then store the user behavior sample database. Some samples are generated using the sample generation tool. The samples generated by the sample generation tool are virtual samples, which means that in the case of unknown sample probability distribution function, the prior knowledge of the studied domain and the existing training samples are used to generate some reasonable samples in the sample space of the problem to be studied. The purpose of adding the generated samples is to expand the training sample set, effectively improve the generalization ability of the classifier and the classification accuracy of small sample classification problems.

3.4User behavior analysis module

According to the content in the user behavior sample library, the deep learning engine based on TensorFlow is adopted to conduct behavior analysis model training, and the following contents are output:

Information type of user concern: the information type of user concern and the information content of user preference in different scenarios. The user concern information model generated by the user behavior analysis module can analyze the specific user concern information according to different mission scenarios and the role of combat commanders. It is necessary to go deep into specific information types and generate targeted user concern information analysis model clusters. Specific information types include the situation information of a specific area, the status information of the main attack combat unit (ammunition, oil, personnel health, etc.), and the real-time message information of the assist combat unit [8].

User's expected presentation mode: according to different information types and current task scenarios, different presentation modes are adopted (including AR presentation, voice broadcasting, text, graphic images, tables, etc.). According to the user information presentation mode module generated by the user behavior analysis module, it can deeply analyze the presentation mode preference of specific users and analyze the presentation mode of specific information types based on different mission scenarios and the role of combat commanders. For example, in a certain type of intelligence information in a maneuver scenario, the commander will display the preferred voice broadcasting mode, and generate specific user information presentation mode analysis model cluster.

Information input method desired by users: different information input methods are adopted according to different information input contents and current task scenarios. The user information input mode model is generated according to the user behavior analysis module, which can deeply analyze the information input mode preferences of specific roles in specific scenarios based on different mission scenarios and roles of combat commanders. For example, in maneuver scenario, combat and training personnel are accustomed to using the nine-grid input method for information input and generate specific user information input mode analysis model cluster [9].

4. Conclusions

In the course of combat, the multi-level commanders and staff need to interact with the information system quickly, efficiently and accurately when they use the information system to carry out various command tasks. The adaptive system of information products adaptively presents the information users may need in a timely and intuitive manner, which can improve the efficiency of information acquisition and reduce the cognitive burden of information users. In the process of interaction with information users, the system will actively record the historical operation information of users, model the information requirements of users, and form the focus model of users. The core of adaptive recommendation is to establish dynamic correlation between the multi-source, heterogeneous and large amount of information received by the information system and the intelligence requirements of the combat users, and to mine the concerns of different intelligence users in the group when facing different task scenarios. The adaptability and accuracy of information users' concerns mining directly determine and influence the effect of personalized and multi-level information visualization.

In order to provide personalized and task-adapting intelligence service requirements for different intelligence users, a method of intelligence user concern mining based on dynamic concept clustering was proposed. A user concern model is established based on user interaction behavior data, and task scenarios are introduced to conduct concept clustering on the concerns of intelligence users, forming concept clusters with different granularity oriented to task scenarios. Hierarchical concept trees are created according to the relationships between the clusters. By calculating the similarity between the concept and the user's concerns in the concept tree, the concerns of intelligence users are mined. Based on the migration of intelligence users to task-oriented concerns, the model of intelligence users' concerns is optimized. In the future, we will further study the visual attention allocation strategy based on fuzzy kernel clustering to describe the attention of intelligence users to intelligence information.

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