Research on non cooperative target recognition technology based on Information Fusion Technology

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Abstract

In order to study non cooperative IFF to technology, this paper detailed illustrates the D-S theory in a multi-sensor data fusion principle and target recognition method, calculation method and practical model is established. By applying the theory of evidence (D-S method), we can solve the problem of data fusion in multi-sensor conditions. Aiming at the problem of multi-sensor target recognition, this paper presents and proves some conclusions of the two sensor Dempster-Shafer (D-S) fusion recognition and the conclusion of the same target. The paper also introduced the recursive formula of Hafer Demppster-S fusion for the same target, and analyzed their properties.

Keywords

multi-sensor fusion ;object recognition; Demppster-S fusion.

1. Introduction

"The field photoelectric IFF technology research "is a study of cooperative target recognition technology. It is mainly used in usually observation equipment can not be completed on the target identification friend or foe.The system uses laser wave and MM wave transmitting and receiving technology, the beam positioning technology to complete the information exchange. Combined with the GPS system, RF transmitter and other equipment information, make a judgment on the target attribute. And it also can transmit data information, and the establishment of digital information network IFF system function. For more than a decade, multi-sensor information fusion technology has received widespread attention and wide application, the integration of the word almost unlimited is cited by many application areas[1].

Information fusion can be called multi-sensor fusion (MSF).According to the research results, the precise definition of information fusion can be summarized as follows: using computer technology to analyze and process the information of several sensors in a certain standard to complete the process of information processing in order to accomplish the task of decision-making and estimation. There are some defects in the identification of single technology. By using the comprehensive recognition approach, can foster strengths and circumvent weaknesses and attack sensitive quite strong. Its application can be divided into two categories: military application and civil application. Military application is a multi-sensor data. The source of the birth of the touch technology is mainly used in the detection, localization, tracking and recognition of military target. Data fusion is not a single technology, but a comprehensive theory and method of cross discipline, and it is still a new research direction which is not very mature. It is still in the process of continuous change and development.

2. Function model and Working characteristic

According to the three levels of data abstraction, touch can be divided into three levels, namely, pixel level fusion, feature level fusion and decision level fusion.The model is divided into two steps: the first step is the low level processing, which corresponds to the pixel level fusion and feature level fusion, the output is the state, features and attributes;the second step is high-level processing (behavior estimation), which is the decision level fusion, the output is abstract results, such as threat, attempt and purpose. From a military point of view, sensors can be classified as defensive (threat

alert), offensive (fire control) or the combination of the two (surveillance), but their measurements can be combined in the fusion system to provide complementary information.The military sensor has three important characteristics: 1) sensor emission characteristics,2) goal of synergy,3)spatial measurement features.Another basis for distinguishing various tactical sensors is the ability to measure the space provided by the sensor, especially the spatial dimension of the target data[2].

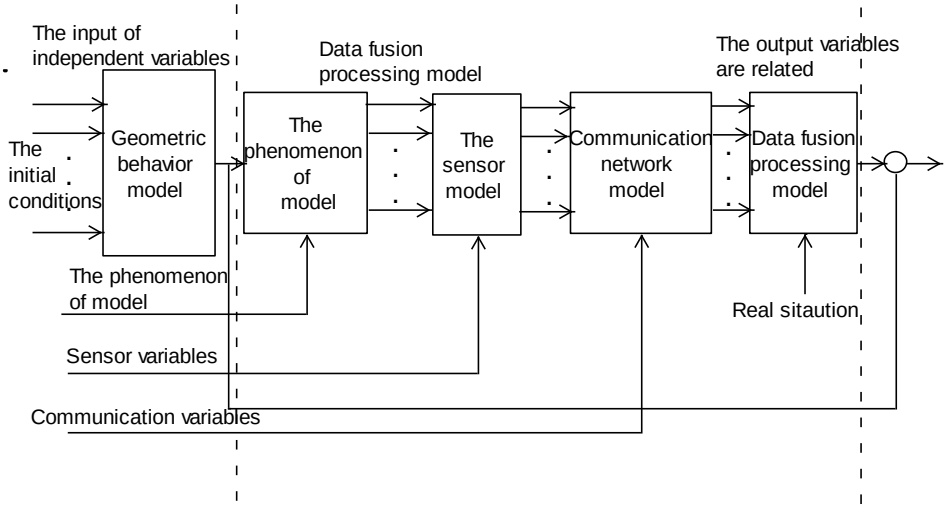

Figure 2.1,The function of the data fusion system is mainly related to calibration, correlation, identification and estimation.Among the calibration and correlation are for the identification and estimation, the actual fusion in the identification and the litter.

3. Method of multi-sensor data fusion

Due to the sensor is not accurate and due to environmental noise ,human interference and other factors in multi-sensor data fusion system, the data are not determined by fusion. First, the reasons for uncertainty—1)uncertainty in image editing;2)Uncertainty in the situation assessment: situation assessment is to combine the physical characteristics of the situation with the knowledge obtained from the previous experience;3)uncertainty in response When the decision process is chosen to be implemented, the operator must consider the following factors: the ability of image editing and situation assessment, the decision cost, the existing constraints and the full priority; the influence of the selected scheme to the situation. Second to determine whether the multi-sensor data fusion algorithm is reasonable four criteria sensor modeling—1)Each sensor may provide information on its specific abstract level: the fusion algorithm must be able to provide accurate modeling of the information provided by each sensor;2)fusion and display:fusion algorithm must be able to fuse the information provided by multiple sensors, calculate the target identity obtained by the statistical measure and display it to the user;3)conflict handling capacity:the algorithm must be able to resolve any possible sensor conflicts;4)wide applicability:the fusion algorithm must be able to adapt to the changing situation flexibly, that is not dependent on the assumption of the application background, because these assumptions are largely unknown in advance.

In the process of multi-sensor classification, it may require several observation models or repeated experiments to characterize the sensing process, it may also require a complex calibration algorithm, or a battle command, etc. In addition, there are many ways to express the identity of the target, and each method can be operated in several different ways, which makes it more difficult to handle the identity of the fusion processing[[3]. At present, there are many methods to solve the problem of identity data fusion, which are derived from the theory of probability and statistics, artificial intelligence, neural computing, fuzzy set theory, and so on. Sometimes, multi-sensor data contact does not need to use statistical method to directly simulate the random form of observation data, but only depends on the mapping relationship between the observed parameters and the target identity to identify the target.This kind of method is called based on theory of information fusion method, such as template method, clustering analysis method, adaptive neural network, voting method and entropy

method.In addition to the template method, the other methods are described below:1)Application of clustering analysis theory in multi-sensor data fusion;2)artificial neural network (AN) in the application of multi-sensor data fusion;3)voting method in multi-sensor data fusion application. Each sensor provides an input description of the identity of the observer, and then searches for these instructions by the voting algorithm to find a description of the "consent" of more than half of the sensor and declare a joint. Of course, sometimes it is possible to introduce the weighted method, the threshold technique and other methods. Thereby to a certain extent, the complexity of the voting method is increased. But when there is no accurate a priori statistical data available, the voting method is very useful, especially for real-time fusion of attractive[4].It is not a formal process, which is obviously shortcoming. Fuzzy is a matching concept, a pre determined model and observation data to match, determine whether the conditions are satisfied, so as to carry out reasoning.

Intelligent data fusion can be seen as a multi-sensor data fusion of three levels.The first layer is used to deal with the numerical data. It is used in the estimation of the optimal estimation techniques. The identification is based on the parameters matching technology. Second (situation assessment) and third (threat estimation) to deal with a large amount of data that reflect the relationship between the numerical data and the meaning of abstract data.So it is to use inference or reasoning technology[5]. And the symbolic processing function of this technique can be used to obtain these inference or reasoning ability.

4. D-S method for multi-sensor fusion

As a Bayesian inference technique (D-S), it has been widely used in multi-sensor data fusion.Formal theory of D-S metric belief. The main points of the theory are:1)the basic probability assigned to a set of power set of the member;2)the application of the Dempste: rule for the combination of two trust functions.First,there are some basic concepts:1)identification framework;2)basic probability assignment;3)proposition of function;4) function plausibility;5)the extension of the basic probability assignment of "and" proposition or "intersection" proposition. Two, Dempster synthesis is a law that reflects the combination of evidence[6]. Fusion principle can be classified as single sensor multi measurement cycle reliability distribution fusion multi-sensor and multi cycle reliability distribution fusion.

5. Computer simulation of multi-sensor fusion

Various classical system analysis methods can be used to analyze the performance of data fusion system, in order to compare or estimate the relevant indexes of the candidate system.The followings are:1)the reasoning structure of D-S method: the structure can be divided into three stages: (1)stage is the synthesis. (2)second stage is deduced. 3)stage is updated. A set of continuous reports from the same sensor at the time of full independence will be more reliable than any single report;2)The basic application of D-S evidential reasoning in multi-sensor data fusion:the basic process of applying D-S inference in multi-sensor data fusion: (1) computes the basic probability assignment function M, the trust function Bel and the likelihood function Pl,(2)computes the basic probability distribution function, the trust function and the likelihood function under the combined effect of all the evidence by D-S. (3)according to a certain decision rule, the maximum of the joint support is selected;3)The software framework of D-S reasoning algorithm based on object recognition(1) assume that the target of each sensor is a radio communication network[7]. It is closely related to the target and the target.(2) D-S theory of the algorithm process.

6. Conclusion

On the basis of cooperative IFF technology, this paper studies the multi-sensor information fusion technology.In the case of a possible subset of the target identification of each sensor, the conclusion of the two sensor D-S fusion recognition of the target is given.This theory proves that D-S can achieve the performance of fusion, and this is also the theoretical basis for choosing different sensors and how to fuse them effectively.

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