B Target recognition based on fuzzy mathematics

RCS and polarization single characteristic can be recognized by applying fuzzy mathematics method. Parameter values used in the fuzzy mathematics method listed in Chart 5. RCS and spread $\sigma(k)$ of the polarization characteristic are decided by characteristic bank. The value of the spread is fixed when the characteristic bank is determined. There are only 3 kinds of targets. To get the every spread $\sigma(k)$, the following method can be used:

$$\sigma^2(k)=\frac{[X_i(k)-c(k)]^2}{-\log 0.5}$$

Among that, $c(k)=\frac{\sum_{i=1}^{s} X_i(k)}{2}$

Chart 3 Illustration of the Parameter

parameter	value	content
$\tau_{RCS}(k)$	0.1	RCS adjust degree，k is the number of the characteristic parameter
τ_J	0.01	adjust degree of the polarization characteristic
R	（0.2,0.2,0.2,0.2,0.2）	RCS is the right parameter

The characteristic of the target RCS can be recognized by method 3(choosing membership functions of the normal distribution). The polarization characteristic can be recognized by method 3(choosing membership functions of the normal distribution).

Chart 4 recognition frequency of the single characteristic（method 3）

target and characteristic	70% inaccuracy	50% inaccuracy
heavy-duty truck（RCS）	90%	95%
light truck（RCS）	90%	95%
care（RCS）	80%	90%
heavy-duty truck（polarization characteristic）	90%	95%
light truck（polarization characteristic）	60%	85%
care（polarization characteristic）	80%	90%

C Target recognition based on template matching

The RCS and polarization characteristic of the heavy-duty truck, light truck and care can be recognized by method 4.The parameters are listed in chart 1.

Chart 5 recognition frequency of the single characteristic (method 4)

target and characteristic	70% inaccuracy	50% inaccuracy
heavy-duty truck（RCS）	95%	95%
light truck（RCS）	100%	100%
care（RCS）	80%	85%
heavy-duty truck（polarization characteristic）	80%	90%
light truck（polarization characteristic）	70%	85%
care（polarization characteristic）	80%	90%

V. Analysis of simulation result

（1）When the single characteristic is used to recognize the mobile targets in the artillery battlefield, it is very important to chose a proper method because it has a strong impact on the target recognition frequency. Recognition method should be determined according to the specific characteristic of the target.

（2）Mobile target can be recognized basing on gray relevance, fuzzy mathematics and template matching. Judging from the simulation result, the highest recognition frequency can be get by using the fuzzy mathematics method. Regarding to gray relevance method, a higher recognition frequency to the limited data can be got by using method 1 than using method 2.

Due to the multiformity and complexity of the recognition targets as well as the variability and uncertainty of the recognition environments, there isn't one universal method that can be used to recognize every typical of target and can be got a good recognition result. To increase the probability of the target recognition frequency, many methods are included in the article. When the specific target to be recognized, multiple methods should be tried to get a better result.

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