

# Research on the Image-target Recognition Technology

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**Abstract.** The image-target recognition technology, which can be widely used in military and civil fields, is the researching focus in the modern image-processing field. The paper detailedly introduced its current researching situation and application, discussed the problem of its classifying, analyzed and compared the advantages and disadvantages of every normal recognition algorithm, and looked forward to its developing tendency at the same time.

## Introduction

About eighty percent of the information perceived by human is visual information. With the development of computer technology, computer having part of human visual perception function has already become one of the researching focuses in the computer technology field. Image-target recognition is about the mode recognition of visual image. Processing video image by using the theory and technology of mode recognition, recognizing human beings' required target from video image, then the location and tracking are needed.

## Current Researching Situation and Application of Image-target Recognition

One of the main difficulties is how to get the rounded and distinguishing features of unknown target accurately. The result of feature extraction depends on adopting what kind of method to portray features, such as histogram feature, gradient feature, spatial distance, moment invariant feature, fourier phase spectrum and so on. Recognized accuracy varies in different portrayal methods and mathematical models. Since the complexity of video image, some related technology and other factors are not perfected enough, there is no universal and automatic algorithm to solve all kinds of image-target recognition nowadays. Most are made a concrete analysis of concrete conditions in the image field, and different solving ways and technical programs are proposed.

The image-target recognition technology has already widely used in military and civil fields. In military field: the combat mode will be mainly on information and technology in the future war. Every country is actively developing high-tech weapons, which make the force has the ability of day-night, all-weather and wide-scale monitoring and capturing target. So accurate recognition and tracking become a vital task, which are one of the main factors of winning in the war. In civil field, such as video monitoring, there is intelligent monitoring system in district, bank, parking lot and others of big city, which can detect and recognize suspicious objects effectively. The image-target recognition technology can be also widely used in intelligent transportation management, automotive vehicle detection, management of parking and others to practice the license plate recognition and the stuff, which is required to recognize and track accurately in all kinds of conditions. Consequently, the image-target recognition technology attracts much attention.

## Classifications of Image-target Recognition

As for the concrete problems of image-target recognition, different solving programs will be adopted. Therefore, according to different criteria, problems of image-target recognition can be divided into different classifications. According to sensors of acquiring image, there are visible-

light, infrared and synthetic aperture radar image-target recognition. According to the complexity degree of unknown image background, there are simple and complex background target recognitions. Simple background, such as static background, some backgrounds with less noisy and so on, in which condition the target contrasts background much obviously and can be recognized easily. Generally, simple background image-target recognition pays much attention to how recognize the smaller differences. While it is difficult to recognize the target correctly in complex background, such as dynamic background, some backgrounds with loud noise. According to the number of target, there are single and multiple target recognition. Relatively, single target recognition is much easier than multiple one. It concentrates on how to filter the background by some technologies, then extracting unknown recognized target precisely, while in multiple target recognition, it will be more complex for there are not only background disturbance, but also multi-object occlusion. According to the target type, there are rigid and non-rigid target recognitions.

### The basic algorithm of Image-target Recognition

**The algorithm of the target recognition based on the Hidden Markov model.** The Hidden Markov model (HMM for short) is a relatively successful statistical model applied in the phonetic recognition. With the low-resolution image sequence under the complex environment, the graphical transformation is very random and uncertain, and it can be described with HMM. Therefore, HMM is widely applied in the character image identification. The HMM can be divided into two parts: one is the Markov chain, the other one is the random process. It can be described by a quintuple:

$$\lambda = (N, M, \pi, A, B) \quad (1)$$

$N$  is the state number of the Markov chain in the model,  $M$  is the possible number of the observed value corresponding to every state,  $\pi$  is the probability in the original state,  $A$  is the state transition probability matrix, and  $B$  is the observation probability matrix.

Supposed that there is the  $V$  mode, whose HMM models are  $\lambda, i = 1, 2, \dots, V_i$ , and the observation sequence for some input mode sample is  $O = O_1, O_2, \dots, O_T$ .

$$P(\lambda^* / O) = \max_{\lambda} [P(\lambda_i / O)] \quad (2)$$

According to Eq2, the input mode should be the type of corresponding model  $\lambda^*$ .

The disadvantage of normal HMM method is that it uses too much parameters, so the training precision is hard to control.

**Algorithm of the target recognition based on the local feature:** In terms of biology, the human being's vision system can divide the object into many meaningful small pieces, and recognizes them based on the local information. Therefore, imitating this feature of the human being's vision system, we can also do that based on the local information of the images. This algorithm can solve some problems of target recognition under some complex environment, especially for the one when there is too much noise disturbance in the images, and some covering among the targets, and some big changes of the target attitudes. The local features are relative to the global features. We can scan the local information in the images. The extraction of local features mainly includes two parts: characteristic region detection and characteristic region description. The former one is the key, which always uses some methods such as dense selecting, random selecting and sparse selecting. The first one can get much local feature information, but the amount of the information is too little to be useful for later work. The second one requires too much samples, which may aggravate much burden for later work. The last one is widely used at present, which involves many operators. Usually they are closely related to the targets to be recognized, and the choice of operators is the key point of recognition.

**Algorithm of the target recognition based on the Image Fusion Technology:** At present the information fusion system based on multisensors has been widely used in the target recognition and tracking, the situation assessment and so on. The image fusion can be divided into three types: pixel level fusion, feature level fusion and decision level fusion. The first one is mainly used in the image fusion display and the target recognition. The second one is mainly used in the target tracking and

the joint target recognition. While the last one is mainly used in the target tracking, the joint target recognition and the situation assessment. The pixel level fusion is the low-level one, whose precision is high, and whose results are easy to analyze and process, but its cost is big and its instantaneity is poor, so it is the one of the former research orientations. The feature level fusion is the middle-level one, which uses the original information from every sensor image to extract the features to analyze and fuse synthetically. The decision level fusion is the high-level one, which fuses the local decision. It is shown in much practice that the performance of the fusion based on the feature level one is better than the other two ones in the target recognition, which can get much complex features, furthest lower the complexity, improve the adaptive ability of the algorithm, effectively eliminate the redundancies, and retain the information of target recognition for the real-time processing. However, we still lack the united theory about the feature level fusion right now, and the research is still on the way, so the image fusion techniques based on the feature level fusion is very promising and challenging.

**Algorithm of the target recognition based on the Fuzzy Set Theory:** This algorithm is based on the Fuzzy Set Theory, which is becoming the focus of research. It fuzzes the mode feature, and then respectively inputs and calculates the memberships belong to some certain samples, and then uses the principle of the maximal subordinate degree to judge. Because the membership function is the measurement of the level of similarity between the input mode and the formwork, it can express the main features of the entirety. The fuzzy mode has the significant anti-interference and the distortion resistance, so the input mode is allowed to have some interference and distortion, which is suitable for the mode recognition with much noise. However, it is always very hard to create the precise and proper membership function. Right now, some scholars are researching the combination between the neural network approach and the fuzzy recognition to create the fuzzy neural network recognition system.

**Algorithm of the target recognition based on the neural network:** The artificial neural network is a rising interdisciplinary subject, which uses the artificial neural network (ANN) to recognize the modes. Because it has the nonlinear and large-scale parallel processing ability, the self-organization and the self-learning ability are widely used in mode recognition, signal processing, knowledge engineering, expert system, optimized combination, intelligent control and so on. At present there are many neural networks applied in the image recognition, such as MLP, RBF, SCOM, PCA-NN, SVM, cognitron and so on. The neural network recognition can deal with some problems, whose situation is very complex, whose background knowledge is not clear, and whose inference rule is not certain. Its advantages are to allow the input mode to have many defects and distortions, while the disadvantage is that it is under continuous enrichment and perfection. However, the mode types, which can be recognized, are not too many.

## Conclusion

The image-target recognition technology is an interdisciplinary and frontier high technology in the IT industry. Judging from its researching method, it can use many subjects for reference, such as mathematics, physics, physiology, electronics and computer science and so on. Judging from its researching scope, it intersects with many subjects, such as the mode recognition, the computer vision and the computer image. In addition, the research progress of images is closely concerned with many theories and technologies, such as the Artificial Intelligence, the neural network, the genetic algorithm and the fuzzy logic and so on, which is closely related to many fields, such as medicine, remote sensing, communication, word processing and industrial automation and so on. At present more and more scholars throw themselves into this field, and will propose some new algorithm with stronger generality and higher robustness.

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