Research on Target Detection of High Resolution Remote Sensing Image Based on Core Literacy

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***Abstract*—High-resolution remote sensing images, as a special type of image taken by satellites and other aircraft, have extremely important valuesand status in both military and civilian applications. With the continuous development of remote sensing technology and computer vision technology, remote sensing image target detection plays an important role in many fields such as military and civilian. In the existing high-resolution image change detection research methods, image registration and feature extraction are the key factors affecting the change detection results. Traditional target detection and recognition methods are difficult to adapt to massive high-resolution remote sensing image data. It is necessary to find a way to automatically learn the most effective features from massive image data, and fully re-examine the association between data. In this paper, the deep learning deconvolution neural network is used to detect the targets in remote sensing images. According to the related research of media neural cognitive computing, the development trend and research direction of target classification and recognition of remote sensing image big data are discussed.**

Keywords—High resolution; Remote sensing image; Target detection; Deep learning

I. INTRODUCTION

Remote sensing is a scientific technique that uses sensors to detect the reflection, radiation or scattering of electromagnetic waves on ground objects by non-contact and long-distance methods [1]. Remote sensing technology has received more and more attention from countries and has achieved rapid development. With the continuous development of remote sensing technology, the number of remote sensing platforms is increasing, the target observation frequency is increased, and the resolution of remote sensing images is also improved [2]. Remote sensing change detection is one of the hotspots in the field of remote sensing research. The urban change, land planning and other fields play an important role. The remote sensing image has large clutter interference, the target contour is blurred, and the features are not obvious. At the same time, with the increasing amount of remote sensing image data, the remote sensing image recognition and classification technology is proposed. Higher requirements and challenges [3]. High-resolution remote sensing images can obtain the texture of ground scene objects and rich spectral information, so the use of high-resolution remote sensing satellite data for more efficient feature extraction of data [4]. Traditional The medium and low resolution remote sensing image interpretation system cannot effectively analyze the complex features of high resolution remote sensing images [5]. High-resolution remote sensing images, as large spatial data related to emergency and disaster reduction applications of the national economy and people's livelihood, put forward higher requirements for TCR algorithm processing accuracy, intelligence level, real-time performance and processing efficiency [6].

Deep learning is an important part of artificial intelligence. With the development of artificial intelligence, it has attracted the attention of the world. Neural network is a concrete manifestation of deep learning. It is a multi-layer neural network composed of a large number of neurons [7]. Deep learning breaks through the structural constraints of traditional computer intelligent algorithms and provides a new method for image recognition and classification. It mimics the structure of neurons in the human brain, automatically acquires relevant information through the training of a large amount of data, and makes corresponding analysis and judgment [8]. Target detection is an important part of image processing, especially for target detection of remote sensing images. Target detection of remote sensing images plays an important role in both military and civilian applications. In the existing high-resolution image change detection research methods, image registration and feature extraction are the key factors affecting the change detection results [9]. With the rapid development of key technologies such as sensor platform, information processing and communication, the acquisition methods of remote sensing images are increasingly diversified, and the spatial resolution of remote sensing images spans from the initial kilometer to the centimeter level [10]. Deep learning has a wide range of applications in the field of machine vision. Target detection is an important research content of machine vision. The target detection technology based on deep learning is to use the convolutional neural network to automatically learn the characteristics of the target and identify the target.

II. PRINCIPLES OF DEEP LEARNING MODELS

Deep learning is a new field in machine learning research, the motivation is to establish and simulate the neural network for human brain analysis and learning, which mimics the mechanism of human brain to interpret data. Convolutional neural network includes two basic processes: feedforward operation, feedback Operation [11]. The feedforward operation abstracts the high-level semantic information included in the data through a series of operations such as convolution, pooling and nonlinear activation function mapping. Unlike neural networks, convolutional neural networks do not need to guarantee each layer. Each element of the input and input has a value connection, and only the convolution kernel is used to scan the input picture to obtain the output result. The position of the target appearing in the image is uncertain, and the size and shape of the target are also With uncertainty, with the improvement of the resolution of remote sensing data,

deep learning can deal with high spatial resolution data, and it can effectively identify and classify it. The degree of learning method can be used as an effective means to deal with the problem of remote sensing big data analysis and mining.

Remote sensing image filtering and noise reduction generally utilizes the characteristic difference between noise and useful information, selectively retains useful information, and improves the signal-to-noise ratio of the image. There is a certain gap in the intelligence, especially in the actual application is limited by many factors, but also need to make further improvements. Fig. 1 shows the framework of the target detection and tracking system using dense parallax variance technique.

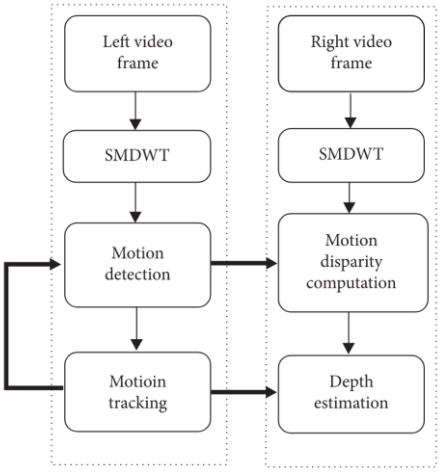

Fig. 1 Target detection and tracking system framework using dense parallax variance technique

Target characterization is the key to target detection and recognition. In recent years, deep learning has become a research feature. The essence of deep learning is to learn more useful features from massive training data by constructing a machine learning model with multiple hidden layers, which ultimately improves the accuracy of classification or prediction. For signals, due to band limiting, the signal energy is mainly distributed in the low frequency region. Therefore, for the noisy signal, the proportion of noise energy in the low frequency region is small, and the proportion of noise energy in the high frequency region is large. Therefore, the focus of denoising should be placed in the high frequency area.

III. Deep Learning Based Target Detection Method

A. Adjusting the Network with Context Information

Since the advantages of human beings in visual processing depend to a large extent on context knowledge, context-based target detection and recognition has become a research hotspot in computer vision in recent years. Since the deep learning method was introduced into the field of image processing, the target detection algorithm has made great progress. At present, the target detection algorithm based on deep learning is mainly divided into two categories based on regional nomination and end-to-end target detection algorithms. The main problem in remote sensing image target detection research is that target detection is highly targeted and lacks general and robust target detection models and algorithms. In computer vision, context information is embodied at different levels, such as the context between target components, the context between the target and the target, and the relationship between the target and the scene. The feature maps extracted from each layer are different in size and gradually reduced. The features from the bottom layer to the high-level abstract are included, and the targets of different scales are adapted to improve the accuracy.

In the neural network, the feature map of the shallow network output has a high resolution and retains more detailed information. Many traditional methods are based on local features, but high-level semantic descriptions are more stable, so the semantic description of adding context can fill the gap between low-level features and high-level semantics. The purpose of tracking is to keep the target within the field of view, as shown in Table 1, which shows the detection rate when the target is not occluded.

Table 1. Detection rate of target unoccluded condition

	Detection rate (%)	Team discrimination rate (%)
Video 1	95.8	81.5
Video 2	94.2	76.7

As the number of layers deepens, the characteristics of deep network learning are more abstract, retaining more semantic information, but the output feature map has lower resolution. The analytic hierarchy process is used to comprehensively evaluate the risk of remote sensing image perception layer. The relative importance of each factor in the same level with respect to the same factor in the previous level is compared, and a pairwise comparison matrix is constructed. The statistical data results are shown in Table 2.

Table 2. Remote sensing image perception layer risk comparison data results

	Residence time	Arrival rate	Views
Residence time	1	0.33	0.75
Arrival rate	0.89	1	0.52
Views	0.65	0.47	1

The greater the variance between classes between the background and the target, the greater the difference between the two parts that make up the image. The input image frame is divided into pixel blocks, and the local variance of the pixel block is predicted as:

$$E_{total-\min} = l(E_{elec}N + E_{DA}N + d^2{}_{toBS}\sqrt{\frac{2M_1M_2N\xi_{fs}\xi_{amp}}{\pi}}) \quad (1)$$

Through the performance state of the target body state, the target pressure before the game. Give the main effects of the various dimensions of the body state under target training:

$$M(t) = u(t)/i(t) = R_0\sqrt{1-2\eta\Delta R\Phi(t)/Q_0R_0^2} \quad (2)$$

The evaluation of the physical state of the body is divided into different stages using physiological and biochemical indicators, which are expressed as:

$$AE_i = ES_i / S_i = \sum_j (1 - \sum_q p_{iq} m_{jq}) / \sum_j \tag{3}$$

As the amplitude of the signal increases, the estimated signal can reach and exceed the true value, and it has a certain enhancement effect on the relatively large radial component, which can effectively preserve the edge and contour information of the image. The comparison of this function with other contraction functions is shown in Fig. 2.

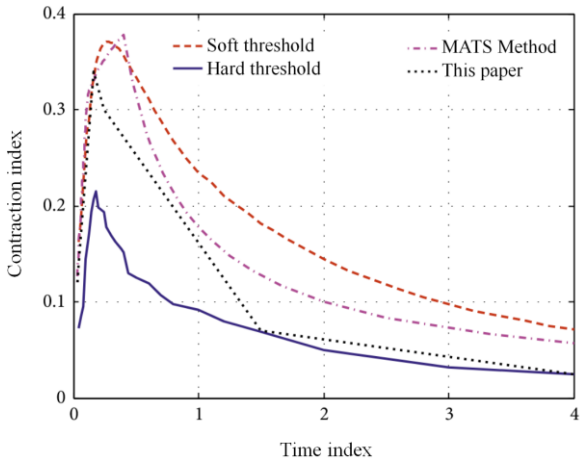

Fig. 2. Comparison with other contraction functions

The original image signal can be reconstructed by the low frequency approximation coefficient and three high frequency detail coefficients of wavelet decomposition. The reconstruction process can be expressed as:

$$i_t = (1-\rho) i_t^* + \rho i_{t-1} + \xi_t \tag{4}$$

A noisy two-dimensional signal model can be expressed in the following form:

$$\mathbf{M}_{AB}(\psi) = \{\psi_{j,\ell,k}(x) = |\det \mathbf{A}|^{j/2} \psi(\mathbf{B}^{\ell} \mathbf{A}^{j} x - k), j, \ell \in \mathbb{Z}, k \in \mathbb{Z}^2\} \tag{5}$$

The fast algorithm for digital image two-dimensional discrete wavelet decomposition can be expressed as:

$$c(j_1, k) = c(j_1, k-1) + t_{j_1 k}, k = 2, \cdots, m \tag{6}$$

The remote sensing image presented to us is not as clear as one might expect. It often results in blurred image contours and complex shapes due to the influence of the external shooting environment in which the carrier in the remote sensing device is located. The concept of deep learning stems from the study of artificial neural networks, which combines low-level features to form more abstract high-level representation attribute categories or features to discover distributed feature representations of data. In addition to setting the corresponding network environment, the parameters related to the remote sensing image system need to be set. The simulation software parameters are shown in Table 3.

TABLE 3. SETTING SIMULATION SYSTEM PARAMETERS

Simulation parameter	Parameter value
Number of sensor nodes	3500
Radio transmission range	600m
Simulation time	800s
Movement rate	15
Transfer model	Two Ray Ground

From the definition of multi-resolution analysis, the standard orthogonal vector group of remote sensing image space can be expressed as:

$$(\alpha_{MMSR}, \beta_{MMSR}) = \left(\frac{M}{k}, \frac{M}{k(d-k+1)} \right) \tag{7}$$

There must be a two-scale equation:

$$M(w) = \frac{w}{D} R_{ON} + (1 - \frac{w}{D}) R_{OFF} \tag{8}$$

Then the direct sum representation of the orthogonal complement closed subspace sequence is as follows:

$$e_j = -k \sum_{i=1}^{n} f_{ij} \ln f_{ij} \tag{9}$$

Then the wavelet corresponding to the scale function is:

$$W_j = d_j \Big/ \sum_{j=1}^{m} d_j \tag{10}$$

IV. CONCLUSIONS

As the deep learning model is continuously improved and improved, the depth detection based target detection algorithm has been greatly improved in detection accuracy, but the detection speed has always been a challenging problem. Remote sensing image classification is a basic problem in the field of remote sensing. It is an important means to extract remote sensing image information. The ground object information obtained from it provides important reference for thematic mapping, dynamic transformation monitoring, and remote sensing database construction. The deep learning method can be used as an effective means for high-resolution remote sensing data feature mining, which provides a new way for classification and change detection of high-resolution image data. When the shadow direction and the range are different under different illumination conditions, the accuracy of the change detection result is often not high, and there is no good solution at present. The deep learning algorithm has a promising application in remote sensing image target detection. The subsequent work can further optimize the network structure and parameters by combining the characteristics of remote sensing images. In order to further improve the accuracy of change detection, it is the focus and difficulty of future research to establish a universal, effective and efficient change detection

method based on deep learning to integrate sensor information, phase information and feature information.

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