Image Acquisition Time Series Prediction Method Based on Deep Learning

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Abstract. At present, in-depth learning can be said to be a learning method based on neural network, and time series can be used to achieve prediction results. Therefore, a time series prediction method for image collection based on deep learning is proposed. Based on time series prediction, the image collection in deep learning is analyzed, and the DBN model is combined with GCRBM model to train the model, identify the time series category, and reconstruct the sequence in order to achieve complete time series prediction. The experimental results show that the time series prediction method works well.

1. Introduction
Artificial neural network is the basis of deep learning. The results of deep learning are usually expressed in the form of neural network. In recent years, under the background of the continuous development of Artificial Neural Networks (ANN), many practical problems have been solved in both industry and academia, such as image acquisition, simultaneous translation, robot processing, etc. [1]. The so-called Artificial Neural Network (ANN) is an adaptive information system, which is composed of a number of processing units. Based on the research results of neuroscience, the simulation of the processing of brain neural network, as well as the information processing method of reference brain, and the memory of simulated information are proposed. Using time series prediction as a tool, a series of data predictions can be made, but it is important to note that these data predictions are based on the availability of [2] in chronological order. Time series prediction can be applied in all areas of life, and time series prediction method is a basic method to simulate time series data. In this paper, based on image collection of in-depth learning, time series prediction method is studied, and its validity is demonstrated through discussion and actual verification, which promotes the wide application of time series prediction.

2. Time series prediction
With the development of economy and technology, people begin to strengthen research on risk avoidance [3]. Simply put, make predictions. Decisions based on predictions can better avoid risks in the implementation process. Among the prediction methods, time prediction method is the most applied one. In time series prediction, the historical behavior of the prediction target is portrayed by the available data. If we know that the observed values of a sequence \{Y\} are \{Y1, Y2,..., Ym-1\}, and the historical moment of this observation is \{1 to m-1\}. When predicting this series, according to the method analysis, the future value of m+t (t < 1) at this time Ym+t is predicted, and the prediction formula can be obtained:

\[
Y_{m+t} = f(Y_1, Y_2, ..., Y_m) + g(\epsilon_1, \epsilon_2, ..., \epsilon_m)
\] (1)
In the formula, the key point is to find \( f(\ldots) \) and \( g(\ldots) \), these two estimated functions are the focus of time series prediction, \( \varepsilon \) is used as the observation noise to help the analysis. Simple data is easier to analyze and internal drivers are easier to discover through \( f(\ldots) \), \( g(\ldots) \) to react. In this process, prediction mechanism can be used to mine the characteristics and rules of data based on sequence data, and phenomenal prediction mechanism can be used to study when data analysis is difficult.

3. Image Acquisition and Analysis for Deep Learning

Deep learning is a branch of machine learning. Based on the structure of multilayer neural network, an artificial neural network is constructed to model some sounds, images, etc. [4]. Once you have modeled many patterns, you can identify different categories to achieve all aspects of your work. In the development of deep learning, the structure of multilayer neural network is the core. The structure of multilayer neural network is shown in Fig. 1, which includes input layer, hidden layer and output layer.

![Structure Diagram of Multilayer Neural Network](image)

4. Sections, subsections and subsubsections

The use of sections to divide the text of the paper is optional and left as a decision for the author. Where the author wishes to divide the paper into sections the formatting shown in table 2 should be used.

At present, in-depth learning has performed well in image acquisition, and related data can be expressed in an abstract way layer by layer. In this process, the image matrix can be input, the first layer for pixel extraction, image edge coding; the second layer, composition and coding edge arrangement; the third layer, image content coding; the fourth layer for specific image recognition. Subsequently, the increase in the number of layers helps in-depth learning to be more widely used in image. Unlike traditional image acquisition methods, image acquisition based on depth learning uses large data as a resource to automatically learn features. Excellent features for image acquisition system can greatly improve the recognition function of the system. In the past commonly used recognition modes, it was difficult to advance [5] with manually designed features. Designer's experience is the main content of this technology, and the role of big data cannot be brought into play. Deep learning can be learned from large data and naturally can contain tens of thousands of parameters. In the past, a good manual feature took about ten years to be recognized, and the formation of the fast and accurate feature of in-depth learning broke the deadlock. Similarly, when using in-depth learning to identify a picture with complex elements, different analogue nerves can be used to replace different elements, and the hidden layer can then be characterized. Then the collection of pictures, including face recognition and expression recognition, will become easier because each factor has a clear division of work and no longer interferes with each other.
5. Time Series Prediction Method
The time series prediction method for image acquisition based on in-depth learning studied in this paper, which is based on GCRBM, has good stability in the original prediction method. However, the disadvantage of this method is that it can only make good predictions for one kind. Once the categories increase, the predictive effect will be reduced, and it is difficult to show the predicted results in the way of high-dimensional data. Therefore, a combination of DBN model and GCRBM model is proposed. First, the DBN model is used to reduce the dimension of image acquisition data related to in-depth learning. Then, the GCRBM model is trained by the features after dimension reduction, and finally the time series prediction is achieved, as shown in Figure 2.

![Figure 2. Time series prediction method flow](image)

5.1. Building Training Model
Based on deep learning, a time series prediction method for image collection is designed, and a corresponding model is designed to collect data for each category of time series images and train the deep network structure in comparison. The main components of deep network structure include: deep trusted network is DBN, time series model is GCRBM[6]. Before the model training step, time series image acquisition data is pre-processed in DBN phase to learn the low-dimensional features in the data. Secondly, the low-dimensional features are input into the GCRBM model to achieve the corresponding data model construction. The deep network structure accumulates learning about the characteristics of the data and ultimately determines and updates the network parameters in the time series prediction. The training algorithm used in this model is as follows:

Input: each type of time series data
Number of nodes per layer of DBN model Ze, e=1,..., o, DBN model group weight and threshold parameters initialize Ri/Ci, i=1,..., m;
Weight thresholds for GCRBM two-tier node number layer1, layer2, GCRBM model group and parameters such as direct factor initialize Xi/Vi/Ti/Pi, i=1,..., m;
Iterations of model training: q; Initialization h of RBM momentum parameter; Neural network learning rate J.

Output: Ri/Ci, Xi/Vi and Ti/Pi, i=1,..., m;

5.2. Identifying time series categories
Information about the time series that will be predicted will need to be collected to determine the known short period series, and then predicted. Based on the DBN1-DBNw in the above model, the error err1-errw is obtained, and then the maximum probability of sample rebuilding is calculated to identify the subnet corresponding to the time series in the integrated deep network model. Completes the learning of low-dimensional features of time series for DBN encoding in subnets. DBN1-DBNw is not error-free. The probability formula for rebuilding data sample X is:
From the above formulas, the higher the probability of rebuilding represented by the DBN model, the more accurate the identification of data samples will be. For the identification of data samples, we calculate the maximum probability of reconstruction, and the identification formula is expressed as:

$$C(x) = \text{arg max} \{P(x'(i) \mid x)\},$$

$$i = 1, \ldots, \omega,$$

(3)

### 5.3. Reconstruct Sequence

Based on the reconstruction probability, when the time series category of the collected picture samples is identified as \(c\), the corresponding category of DBN is used. Based on its low-dimensional feature top, the GCRBM model uses the low-dimensional feature to predict the low-dimensional feature of the later time series [7]. For future time series predicted by the model, its low-dimensional characteristics are studied, and then it is re-sent to the subnet, the time series data is re-determined by DBN decoding, and the reduced-dimensional time series data is reconstructed to the original high-dimensional spatial data. Finally, the reconstructed time series data is presented as an image sequence. At this point, a complete time prediction method is completed.

### 6. Analysis of Experimental Demonstration

In order to verify the validity of this method for time series prediction, an experimental demonstration is carried out. Using this method and traditional time series prediction method, 20 different people were selected as the experimental objects, and their walking gait images were collected. In order to ensure their accuracy, these 20 people were used in all time series prediction method experiments. Their walking gait images were collected, and each person's time series data corresponded to a category, and the number of sequences for each category was set to 120. Before the experiment starts, we will process the image to a uniform size and do model training. The 20 gait image samples were identified and compared. The experimental results are shown in Table 1.

| Method       | Identification Number | Recognition Rate (%) |
|--------------|------------------------|----------------------|
| DBN+RBF     | 7                      | 31.25                |
| SVM          | 13                     | 68.75                |
| DBN+SVM      | 17                     | 91.05                |
| Text method  | 20                     | 99.8                 |

From Table 1, we can see that in several time series prediction methods, DBN+RBF method can recognize only 7 out of 20 people, slightly more SVM, up to 13 people, DBN+SVM is better, and can recognize 17 kinds of gait sequences. The time series prediction method proposed in this paper can identify all gait sequences, and increase the correct recognition rate to 99.8%. Based on the analysis of the experimental results, the method proposed in this paper has a higher recognition rate than the traditional time series prediction method. In the time series prediction work, the high recognition rate often represents the high accuracy of prediction. After predicting the recognition sequence, it is found
that this study can make time series prediction based on deep learning picture collection, and can simulate the actual gait sequence through prediction analysis.

7. Conclusion
In this paper, the prediction method of image collection time series based on deep learning is studied. Experiments show that the practical series prediction method studied in this paper is true and effective, and can play an important role in many aspects of real life.

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