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Retraction

Retracted: A Deep Learning-Based Framework for Social Data Sensing and Fusion for Enterprise Management

Mathematical Problems in Engineering

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Y. Wang, "A Deep Learning-Based Framework for Social Data Sensing and Fusion for Enterprise Management," *Mathematical Problems in Engineering*, vol. 2022, Article ID 3606469, 8 pages, 2022.

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Research Article

A Deep Learning-Based Framework for Social Data Sensing and Fusion for Enterprise Management

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How to effectively realize the perception and fusion of data in the enterprise management society is the core problem that must be solved by enterprise management. On the basis of defining the resource system of enterprise management society, a semantic-oriented metadata model is proposed, combined with the classification of user needs, to build a data fusion framework for enterprise management society based on multisource data. The study designs a multilayer convolutional neural network model to process the data and proposes a recommendation path for the implementation of user data services for the enterprise management society based on the data operation center of the enterprise management society. Finally, it proposes suggestions for the development of the data fusion of the enterprise management society by improving the data fusion standard of the enterprise management society from multiple sources, actively formulating the data opening policy, and exploring the personal data collection and storage protection scheme. Experiments show that the scheme designed in this study is 5% more accurate than the state-of-the-art scheme.

1. Introduction

Enterprise management societies are developed on the basis of enterprises and are the advanced form of enterprises [1]. The guidance on promoting the Healthy Development of Enterprise Management Societies, jointly issued by eight Chinese ministries and commissions, states that, "by 2020, a number of distinctive enterprise management societies will be built" [2]. The Thirteenth Five-Year Plan for National Economic and Social Development clearly states that the construction of modern information infrastructure should be strengthened and an enterprise management society should be built [3]. The Report on the Development of New Enterprise Management Societies 2017 shows that the construction of new enterprise management societies in China is developing in clusters, and at the National Conference on Network Security and Informatization in April 2018, General Secretary Xi Jinping proposed to promote the deep development of digitalisation, big data, and artificial intelligence, and the application of big data provides a strong technical guarantee for the development of enterprise management societies [4].

Many researchers also study the use of enterprise data through the deep learning model [5]. The essence of a deep learning application is to extract and classify data features. Its research directions are mainly divided into two categories: one is to optimize the way of extracting features from data, and the quality of feature extraction directly affects the final classification results; the other is to build a good classifier based on the existing feature extraction methods [6].

The difficulty of many data processing tasks depends on the representation of information. This principle has a far-reaching impact on computer science and machine learning. For example, for tasks such as 210 divided by 6, giving the form of the problem will change the ease of calculation; if the numbers are expressed in Roman characters, the process of obtaining the results becomes less intuitive. When most modern people deal with the problem of CCX divided by VII, they first convert the numbers into Arabic numerals and then calculate them. In addition, once the

Table 1: Comparison of various models on CIFAR 10.

Model name	Training accuracy	Verification accuracy	Training time
Original network	0.8056	0.8104	—
SVM hybrid model	0.85711	0.8137	—
Enhanced network N1	0.79725	0.8195	1080.479
Enhanced network N2	0.79658	0.8127	998.404

data representation is determined, the time spent processing the data can be quantified, for example, inserting numbers into a sequential (Table 1). If the list is implemented by a chain, the time complexity is $O(n)$. If the chain is implemented by a red-black tree, the time complexity can be said to be the same as good data representation, making the next machine learning task simple. For different data processing tasks, the representation of data will change [7].

There is still no uniform definition of the concept of EMS in the industry. Sun et al. [8] argue that the connotations of the enterprise management society include the fundamental role of information and communication technology, economic development and encouragement of innovation, and the promotion of resource sharing and collaborative operations among various sectors. Although researchers have interpreted the definition of the enterprise management society from different perspectives, their core concepts are basically the same, namely, the use of a new generation of information technology tools to integrate core data on enterprise operations and provide intelligent services to the public [9, 10].

Liu et al. [11] reviewed the current status of enterprise management society research through literature and concluded that enterprise management society research is more concerned with technological progress, data integration and fusion. In 2021, the National Enterprise Management Society Standardization General Group released the standard document "Enterprise Management Society Data Fusion," which specifies the conceptual model and data coding specification for data collection, organization, interconnection, and service [12]. Based on clarifying the enterprise management social resource system, this study proposes a semantic-oriented metadata model, combines the classification of user needs, builds a framework for enterprise management social data fusion based on multisource data, enhances public participation in enterprise management, provides decision support for the government and enterprises, and innovates the enterprise management social information service model [13].

2. Related Work

In terms of the basic elements of enterprise construction, scholars have mostly focused on the basic elements of enterprise construction and have not discussed the technical issues. Zhou et al. [14] propose a preliminary framework for an enterprise-managed society from a system integration perspective, integrating government, residential communities, the economy, infrastructure, and the natural environment. Makkar and Kumar [15] argue that the fundamental elements of a business-managed society include people, technology, and organization. Blake and Michalikova [16] argue that the subjects of information resource management are government, business, and society. Rowland and Porter [17] believe that the main body of enterprise operation and management is the government department, and the service targets are the government, enterprises, and individuals.

As for the application of enterprise management in society, scholars have constructed a technical framework of enterprise management in society with data mining and analysis technology as the core, in order to provide diversified application services on this basis. For example, Muhammad and Hossain [18] proposed an enterprise management social technology framework based on trajectory data analysis and mining, which is divided into three levels: trajectory sensing, knowledge discovery, and specific application; Li et al. [19] proposed an enterprise management social technology framework with a "four-level feedback" structure, including enterprise sensing and data acquisition, enterprise management social management, enterprise management social analysis, application, and service.

In the area of enterprise management social integration, scholars have built a framework for enterprise management social data integration from different perspectives. Wu et al. [20] studied emergency information fusion and proposed an information fusion framework based on emergency information and aimed at serving emergency decision-making. Ning et al. [12] proposed a theoretical architecture for multimodal data fusion in enterprises, including service information description model, metadata model, and data interconnection model, and proposed a framework for sharing and fusion of enterprise management social data. From the technical implementation level, there are enterprise management social integration framework based on Web API information integration, enterprise management social integration framework based on metadata, and enterprise management social integration framework based on semantic aggregation: the enterprise management social integration framework based on Web API is more widely used, but the disadvantage is that the open interface is inconsistent, and specific APIs only allow access to specific data or services and cannot achieve data; metadata-based enterprise management social inclusion frameworks use a unified metadata standard to aggregate enterprise operational data, but there may be cases where the same entities from different datasets are represented, ignoring the semantic relationships between entities and the corresponding matching relationships. The framework makes use of domain-specific ontologies [13] (e.g., Km4City) to collect data from enterprise operators and aggregate data that are intrinsically semantically linked so that they are integrated in a unified, semantically interoperable multidomain ontology-based model.

3. Corporate Management Social Resource System

The enterprise management social resource system is a complex system formed by integrating geospatial data as a unified carrier and based on the intrinsic relationship of data in various fields within the enterprise's spatial and temporal scope. The government, enterprises, and public are the subjects of the enterprise management society. From the perspective of the system, the geospatial data are used as the root to build the enterprise management society data resource system based on the enterprise subjects, as shown in Figure 1:

The enterprise data in Figure 1 refer to the data related to the operation of the enterprise, including data formed in various aspects such as product development and design, manufacturing, marketing, and capital flow. The management enterprise system under big data thinking is based on massive data for information processing, so the traditional manual data statistics method is no longer applicable, and a big data system support system based on automatic docking must be built. Modern Internet enterprises have more complete management information systems. For example, the trading system of e-commerce platforms integrates customer management, order management, transaction management, and settlement management, and the management system of communication operators includes network management system, business management system, customer management system, marketing management system, and settlement management system [14–16]. These business systems can provide a large amount of management enterprise information, which is very useful for enterprise internal management and business decisions, but this information is scattered in various systems, in a fragmented state, and must be collected, collated, and modeled to turn into useful information, and this process must rely on the automatic docking of business systems to achieve the processing and handling of big data management enterprise information.

4. Semantic-Oriented Social Metadata Model for Business Management

4.1. Metadata. Metadata are structured data describing the attributes of a certain type of resource. A standardised enterprise management social metadata model is the basis for achieving interoperability between enterprise applications, resolving heterogeneous data conversion, achieving resource aggregation on the same topic, and providing data services for enterprise decision makers. The metadata service providers, mainly data producers and owners, publish metadata services to the enterprise's UDDI registry [13]. This study defines the metadata model as a six-tuple MD = {S, E, A, I, R, C}.

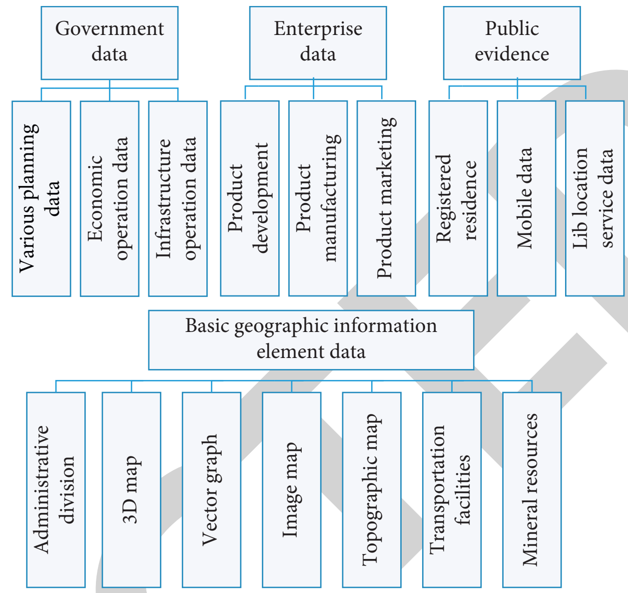

Figure 1: Corporate governance and social resource system.

(1) Data source S (Source): the data sources are data from the Education Bureau, Transport Bureau, Health Bureau, Taxation Bureau, Housing and Construction Bureau, Public Security Bureau, Civil Affairs Bureau, Meteorological Bureau, Water Bureau, and so on. The set of data sources is denoted as $= \{S_1, S_2, \ldots, S_n\}$, where S_i $(1 < i < n)$ denotes the ith data source [18–20].

(2) Entity-type collection E: a generic term for the set of entities that share the same attributes. Entity types include people, objects, and spatiotemporal entities. People (agent) is a generic term for governments, businesses, and public and refers to data holders who are capable of autonomous activities. Objects include natural geographical entities (e.g., mountains, rivers, and lakes) and man-made geographical entities (e.g., buildings, roads, bridges, and streets). Temporal spatial entity refers to objects with multidimensional characteristics in space and time. The temporal spatial entity (temporal spatial entity) is an object with spatial and temporal multidimensional characteristics, as shown in Figure 2.

(3) Entity attribute A: the set of entity attributes $A = \{a_{11}, a_{12}, \ldots, a_{mk}\}$, where $a_{ij}\,(1 < i < m,\ 1 < j < k)$ represents the jth attribute of the ith entity. For example, a sensing device is a physical device that can sense changes in external information in real time and transmit the acquired information to other devices, such as sensors, GPS positioning devices, video surveillance devices, and RFID devices.

(4) The set of instances I is the set of entity class objects. An entity is a real-world, identifiable object, and set of instance classes is denoted $I = \{I_1, I_2, \ldots, I_m\}$, where I_i $(1 < i < m)$ denotes the ith entity [21].

4.2. Deep Learning Feature Classification. The advantage of deep learning lies in the ability of deep neural networks to fit

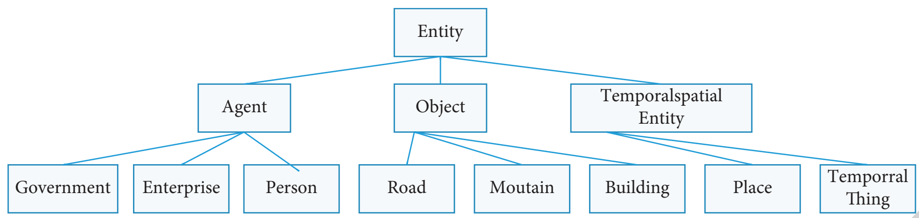

Figure 2: Example of a classification system for entities.

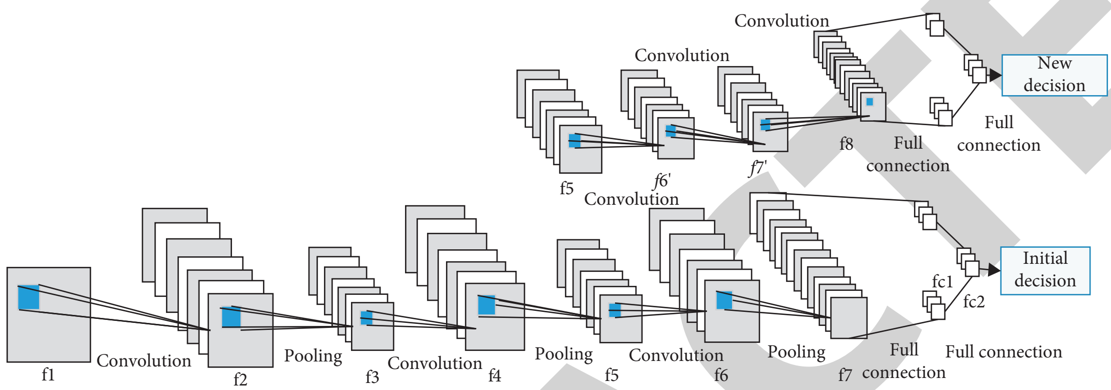

Figure 3: CNN augmentation model.

data, which not only brings high accuracy to deep learning but also has the disadvantage that deep neural networks require large amounts of data for training. The collection of labeled samples is labor intensive.

The specific mixture of CNN and SVM is divided into two parts. Firstly, a CNN is obtained by training on the original dataset or by pretraining on a large dataset. The second part of the hybrid model is an SVM, which follows the last layer of the CNN. During training and testing, the data is first extracted by the CNN, and the extracted features are then used as input to the SVM, thus enabling the training and testing of the SVM [22].

The hybrid model of CNN and SVM only uses the features of the last layer of the CNN and feeds them into the SVM, which does not make full use of the features of the lower layers.

The network framework is divided into two parts: the first part is the original network and the second part is the augmented network. The original network is a normal CNN, which can be trained in two ways: either on the target dataset or directly on the large-scale dataset using the same CNN structure. The second part of the network is an augmentation of the original network, which is modified from the second half of the original network and incorporates the last layer of feature mapping of the image with the original features. In Figure 3, the augmented network replicates the feature map of the original CNN from the feature map coincidentally and uses the same structure as the original network to regain the feature maps [23–25].

In general, the augmented network has two main functions: when the training set of the original network is the training set of the target task, the classification accuracy is improved without changing the original network; when the training set of the original network is not the target training set, the original network can only be used as a feature extractor of the data; the task of the augmented network is the main body of the task implementation.

5. Enterprise Management Social Data Integration Framework

5.1. Enterprise Management Social User Needs' Classification. The government is the operational manager of the enterprise management society, and the public is the object of the enterprise management and society management and services. Enterprise development is driven by user needs [14], user needs and feedback cannot be ignored, and meeting user needs is the key to building an enterprise management society.

The user needs are dynamic, multifaceted, and uncertain, and the enterprise management society covers specific applications in many fields, making it difficult to precisely describe their specific needs. Using the Kano model and taking into account the five stages of an individual user's lifecycle, including infancy, childhood, adolescence, adulthood, and old age, we have gradually refined the demand groups with different functional attributes (see Figure 4) and developed specific products covering different industry sectors, including smart education-related products, smart healthcare-related products, smart transport-related products, and smart community-related products [26].

5.2. Data Service Recommendation Path. Based on a multisource data fusion framework, the enterprise management social data operation center is established, responsible for

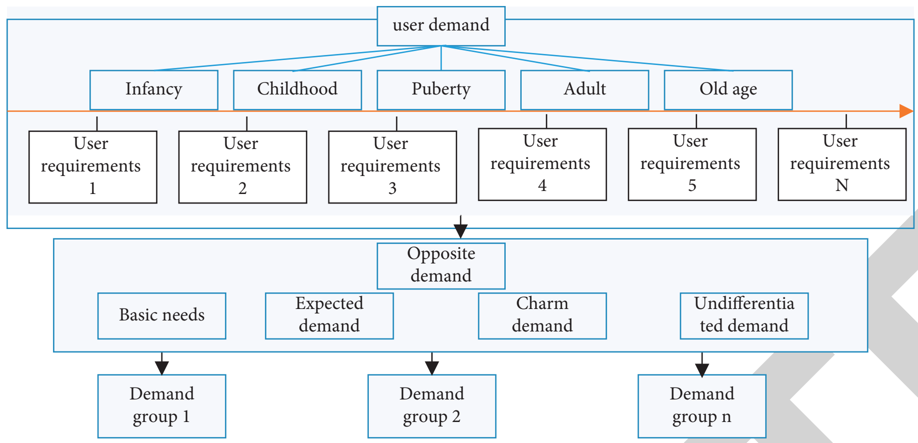

Figure 4: Classification of user requirements based on Kano.

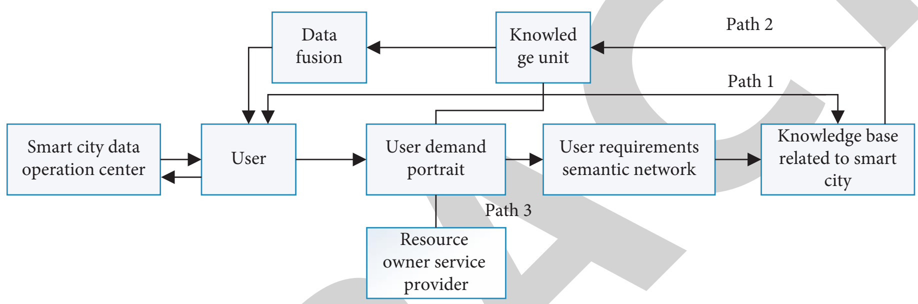

Figure 5: Implementation path for data service recommendations.

the collection, management, and sharing of big data in enterprise life, and establishing an enterprise-wide paradigm of multidepartmental cooperation, which can improve the current situation of inadequate horizontal collaboration among government departments. Based on the categorisation of the needs of EMS users, the data are combined with demographic attributes, usage preferences, and other data to build a profile of EMS users' needs and provide specific data recommendation services. Figure 5 illustrates the three paths of user data recommendation services: (i) path 1 is to match user demand information with the knowledge base related to the enterprise management society at a coarse-grained level and provide users with services related to the enterprise management society [27], (ii) path 2 is to match user demand semantic information with knowledge units extracted from the knowledge base of the enterprise management society at a fine-grained level, fuse the knowledge units with multidimensional data, and provide users with, and (iii) path 3 is to study how to open up data interfaces to resource owners and service providers and provide corresponding data services to them based on user demand profiles.

6. Simulation Experiments and Analysis of Results

6.1. Enterprise Data Effectiveness. The building of an enterprise management society requires the synergistic development of enterprise, data, and standardisation. In the

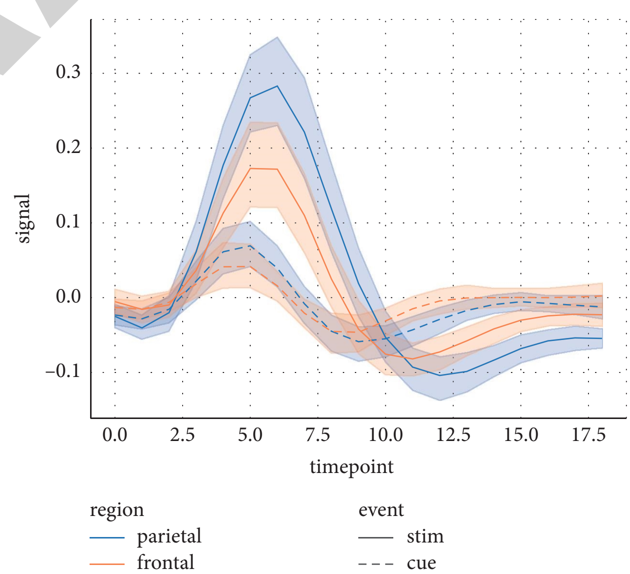

Figure 6: Comparison of enterprise data and standardisation effectiveness.

big data environment, the Internet of Things, cloud computing, and sensing technologies transform the information flowing within the enterprise into data, giving the attributes of data and thus presenting the development of an enterprise management society [28]. On the basis of the data coding specification, data collection specification, and municipal infrastructure data element specification, further

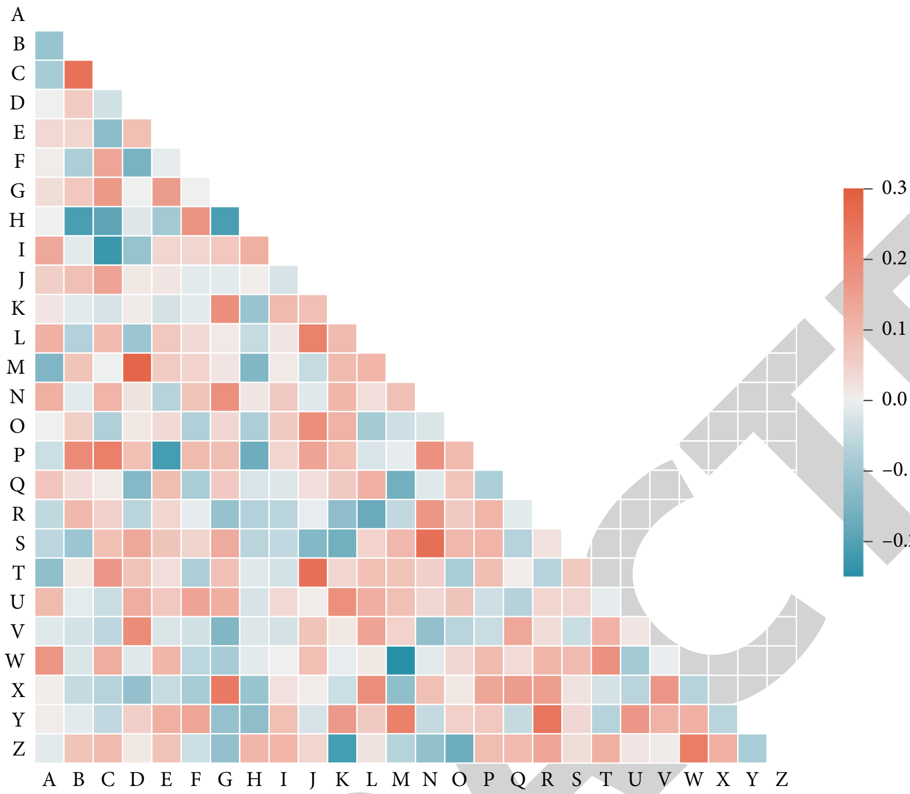

Figure 7: Level of data privacy.

improvement should be made to the enterprise management social multisource data fusion standard, including entity data standardisation, entity attribute standardisation, and application context standardisation, and data conversion standard and storage specification should be established to achieve cross-domain, cross-sector, and cross-level data fusion. See Figure 6.

The government provides decision optimization support, universities provide intellectual service support, and enterprises provide technology and product support and establish a data-sharing mechanism for stakeholder partnership. Data are a true reflection of the enterprise, and the construction of an enterprise management society should protect data extensively. The data privacy of the scheme in this study is shown in Figure 7. The government formulates a data opening policy to clarify the scope of data that can be opened. As a data provider, it should try to provide original data-sharing services and ensure the integrity of data fields under the premise of conforming to policy regulations; as a data recipient, it still has the responsibility to ensure information security under the premise of the reasonable use of data.

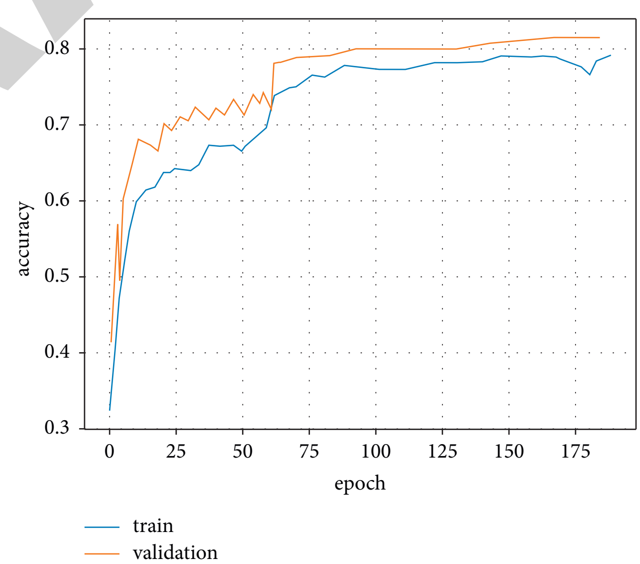

Figure 8: Original network training curve.

6.2. In-Depth Performance. The original CNN network consists of three convolutional layers, three pooling layers, and two fully connected layers. The ReLU activation function is used by default, and each convolutional operation uses a 5×5 convolutional kernel with a step size of 1, filling a blank area of 2 pixels. The pooling layer is first a maximum pooling layer of size 3×3 with a step size of 2, followed by an average pooling layer of size 3×3 with a step size of 2. The number of fully connected neural units in the penultimate layer is 512, i.e., the number of output features is 512. The training curve is shown in Figure 8.

The final training accuracy of the network at the 200th epoch was 0.8059, and the validation accuracy was 0.8107. The features extracted from the original network at the 200th epoch were used in the experiment.

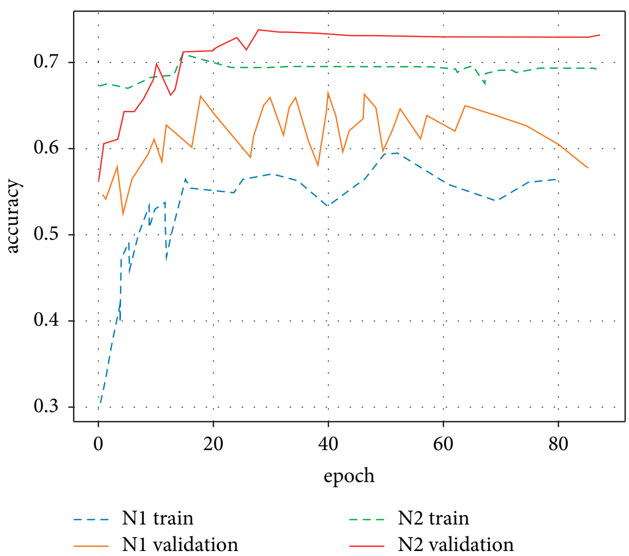

Figure 9: Plot of N1 and N2 training curves.

The enhanced network was trained using the feature map of the conv2 layer of the original network, and N1 was merged with pooB3 of the original network at the pool3 layer. n2 was spliced with fcl of the original network at the f1 layer. The training curves of N1 and N2 are shown in Figure 9. In the training of the augmented network, both N1 and N2 were trained on the 200th epoch of the original network, with an initial training step of 0001 for 100 epochs and a step size of 01 times the original at the 16th, 32nd, and 64th epochs. In Figure 9, N2 converges on the validation set at approximately epoch 16 and N1 converges at epoch 32. The training and validation accuracies of the network at the 100th epoch are shown in Table 1.

As can be seen from Table 1, the results of either training method have improved the classification results of the original network. The augmented network N1 has the best classification result because it replicates the feature maps of the convolutional layers in the original network, which is equivalent to increasing the number of convolutional layers, and N1 makes full use of the features in the intermediate layers compared to N2. The effect of the augmented network N2 is weaker than that of the SVM hybrid model because the augmented network N2 only replicates the features in the original fully connected layer, which does not make full use of the features in the intermediate layers and increases redundancy. In the augmented network model, we can see that the training accuracy is lower than that of the SVM hybrid model, but the final performance on the test set is better, which indicates that the augmented network has good generalization.

7. Conclusions

This study proposes a semantic-oriented metadata model, combined with the classification of user needs, and constructs an enterprise management social data fusion framework based on multisource data. Based on the enterprise management social data operation center, this study designs a multilayer convolution neural network model to process the data. It can be seen from the experiment that the CNN enhancement model proposed in this study is better than the hybrid model of CNN and SVM and is slightly weaker than the model that directly adds corresponding neural units to the original network, but it does not need to retrain the whole network. The CNN enhancement model proposed in this section is essentially a shallow CNN model. Compared with the original network, the enhanced network is easier to train and has faster convergence speed.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declared no conflicts of interest regarding this work.

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