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# A Summary of Research and Application of Deep Learning

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## Abstract

**Deep learning is a complex machine learning algorithm that can learn the deep inner rules of a sample. In recent years, deep learning has achieved good results in the field of image processing. The essence of deep learning is to build a multi-layered machine learning architecture that trains on large-scale data. With the development of computer technology, deep learning has achieved good results in image recognition and natural language processing. Deep learning is also becoming more and more widely used in industry. This paper introduces the applications of deep learning in the industrial field, and finally discusses development and challenges of deep learning in industrial applications in the future.**

## Keywords

**Deep learning, Application, Algorithm.**

## 1. Introduction

Deep learning algorithms belong to the category of machine learning. It is one of the important branches of artificial intelligence. Machine learning algorithms implement data classification and regression by extracting data hiding features. Machine learning algorithms can be roughly divided into two phases, shallow learning and deep learning.

In 2006, Hinton et al. proposed the concept of deep learning. Deep learning can extract deeper and more abstract features of objects, and has strong generalization and self-adaptive ability. In recent years, with the improvement of computer performance, computing power has been increasing, the running speed has been accelerating, and deep learning has been rapidly developed. More and more deep neural network models are being proposed, including Convolutional Neural Networks, and Restricted Boltzmann Machines (RBM) and so on. Convolutional Neural Networks (CNN) is a supervised model architecture that is suitable for two-dimensional data structures. CNN has a wide range of applications in the fields of pedestrian detection, face recognition and signal processing. RBM has been successfully used as the structural unit of deep neural network due to its strong expressiveness and easy reasoning. In recent years, RBM learning algorithm has been widely concerned. As a practical application, RBM learning algorithm has shown excellent learning performance in some areas. The second part will introduce some typical neural networks.

## 2. Deep learning model

CNN avoids overfitting by sharing weights. CNN uses different scale convolutions and feature extraction, and obtains eigenvalues through an activation function. The activation function is commonly used by Softmax functions. The CNN training process is similar to the traditional neural network and uses the back-propagation method. Convolutional neural network results are closer to

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biological neural networks, and have achieved good results in the field of image recognition. In recent years, a number of excellent convolutional neural networks have been proposed.

The Restrict Boltzmann Machine is based on the Boltzmann machine (BM). RBM is a random neural network. It contains of two layers. The neurons in each layer are independent of each other, and the neurons in different layers are connected to each other. BM consists of binary neurons, indicates that the neuron is active, and 0 indicates that the neuron is in a suppressed state. The difference between RBM and BM is that the link structure between the same layer is removed, which greatly speeds up the learning.

The Recurrent Neural Network (RNN) takes the data of the series as input and forwards it in the direction of evolution of the sequence. RNN is a recurrent neural network that links all nodes in a chain. Cyclic neural networks have unique advantages in processing time series data and information strings. The network state of the RNN at the last moment will affect the network state at the next moment. The common cyclic neural network (Bidirectional RNN, Bi-RNN) has a bidirectional cyclic neural network and Long Short-Term Memory networks (LSTM).

## 3. Application of deep learning

With the continuous improvement of computer performance, the depth of the deep learning model is getting bigger and bigger, and the effect achieved is getting better and better. Deep learning is increasingly being applied in the industrial field. This chapter gives a brief introduction to deep learning in the fields of image recognition, fault diagnosis and data processing.

Deep learning is widely used in the fields of defect detection, remote sensing object recognition, biomedical image recognition, and license plate recognition. Lin C F et al [1]. proposed an automatic recognition model based on deep convolutional neural network for the automatic classification and identification of liquid cytopathic diagnosis. Experiments show that the experimental results show that the model has obvious advantages in the process of classification and recognition of cancer cells for cell pathology images. In the industrial inspection, Yu Y W et al [2] proposed a casting defect detection method based on deep learning feature matching, using the depth network model to propose the defect depth feature, and using the parallel parallax ranging principle to coordinate the space coordinates, providing a new Methods for defect detection.

Fault diagnosis and data processing are also hot topics in deep learning applications. Deep learning can independently mine representative diagnostic information in raw data, and can accurately diagnose fault information. Compared with previous manual feature selection, deep learning is used to solve faults. Diagnosis, the results are more reliable and accurate. Wang X L et al [3] proposed a fault diagnosis method based on deep learning, which uses the deep belief network in depth learning to extract features and establish a fault diagnosis model for extreme learning machines. The failure diagnosis method is verified by experiments, and the feasibility of fault feature extraction based on deep belief network is proved. Wang W F, et al [4] proposed a fault diagnosis method based on double-layer long-short-time memory network, and carried out performance analysis and comparison experiments on the method. The results show that the method effectively improves the accuracy of fault diagnosis.

The rapid development of the Internet has led to the explosive growth of data volume, and the development of deep learning has brought new ideas to the data processing problem. Since the introduction of deep learning, researchers around the world have conducted a lot of research. Driverless technology is a typical application case, using deep learning technology to warn of potential driving risks, making travel easier and more convenient. Li J J et al [5] proposed a method based on deep learning to identify the driving behavior of industrial vehicles. Based on the data collected by the three-axis sensor and the three-axis angular velocity sensor, the CNN and LSTM deep network models are constructed. The experimental results show that the depth model can accurately identify the state of the industrial vehicle. To lay the foundation for the subsequent study of complex driving behavior.

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Due to the ability of deep learning methods to mine deep features, in recent years, deep learning has become more and more widely used in natural language processing. Deep learning has achieved good results in part-of-speech tagging, sentiment analysis, and text categorization. In 2015, Tomas Mikolov proposed the Word2vec algorithm. The Word2vec algorithm is a new method of constructing word vectors. Use a word as input to predict the context around him. On this basis, many scholars have conducted research. Zhou H F et al. [6] uses the Word2vec model to learn the common features of similar scenes in user music records and make personalized recommendations to users. The recommended effect is significant compared to other recommended algorithms. MA X et al. [7] proposed a LSTM network combined with convolutional neural networks and conditional random fields to solve the problem of part-of-speech tagging and named entity recognition, with the best results of 97.55% and 91.21% respectively.

## 4. Conclusion

This paper gives a brief introduction to the development of deep learning. This paper introduces the structure and function of the deep neural network and the suitable application scenarios, and introduces the deep learning in defect detection, fault diagnosis and automatic driving. At present, deep learning has achieved good results in many aspects. With the development of random computer technology, more and more problems will be solved by deep learning, and the application of deep learning will become more and more diversified.

## 5. References

[1] C F Lin, Y Z Huang, D Z Chen. Pathology image recognition of peritoneal exfoliative cells based on deep learning. Journal of Qiqihar University (Natural Science Edition) ,2019,35(03):1-6.( In Chinese)

[2] Y W Yu, L Q Du, C L Zeng , H J Zhang. Automatic localization method of small casting defect based on deep learning feature[J]. Chinese Journal of Scientific Instrument, 2016,37(06):1364-1370. ( In Chinese)

[3] X LWang, C Li , C Zhang . Analog Circuit Fault Diagnosis Method Based on Deep Learning[J]. Chinese Journal of Electron Devices, 2019,42(03):674-678. ( In Chinese)

[4] W F Wang, X H Qiu,J Q Sun ,H M Zhang. Gear Fault Diagnosis Based on Binary Long Short-Term Memory Network[J]. Journal of Academy of Armored Force Engineering, 2019,13(01):26-32+38. ( In Chinese)

[5] J J Li , H Q Deng , Z Y Gao, Y Zhang. Industrial Vehicle Driving Behavior Recognition Based on Deep Learning[J]. Research & Development, 2019,13(01):26-32+38. ( In Chinese)

[6] H F Zhou, L Y Zhou. Music Session Recommendation Algorithm with Word2Vec[J]. Communications Technology, 2019,52(04):850-857. ( In Chinese)

[7] MA X, HOVY E. End-to-end sequence labeling viabi-directional lstm-cnns-crf[C]//Proceedings of ACL. Berlin, Germany: ACL Press, 2016:1064-1074.