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Cloud Computing – Based Image Data Model Optimization Approach

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ABSTRACT - The amount of data has grown to incredible dimensions in our modern age of data explosion. The majority of these files are digital image files. The desire for networked work and living is growing in tandem with scientific and technological advancements. In both life and work, cloud computing is becoming increasingly vital. This research investigates visual data recognition models for cloud computing. In a cloud computing platform, the parallelization and task scheduling of the SCRC remote-sensing image classification model based on spatial correlation regularisation and sparse representation are investigated. In cloud computing mode, first, cloud detection technology is used in conjunction with the dynamic properties of the edge overlap region. The SCRC method is developed on a single machine for picture edge overlap region identification, and its time performance is experimentally evaluated, providing a foundation for parallelization research on the cloud computing platform. Finally, the SCRC-SK algorithm's speedup and expansion ratio are estimated through experiment, and SCRC-MR and SCRC-SK are compared. The simulation results show that the method of picture edge overlap detection is more accurate and image fusion is better than prior methods, which increases image recognition ability in the overlap region and illustrates the performance improvement of the SCRC-MR algorithm under scheduling. This solution corrects Hadoop's present scheduler's flaws and can be included into future remote -sensing cloud computing platforms.

KEYWORDS : Cloud computing, Data model, Image processing, Optimization method,SCRC.

I. INTRODUCTION

The process of proposing a new concept is usually gradual, and cloud computing is no exception. Various industries produce a large amount of multimedia data every day, and the majority of this data comes from digital image data, thanks to the rapid development of information technology and image data collection technology. Traditional stand-alone image processing, faced with the explosive growth of digital image data, has a number of issues, including slow processing speeds and poor concurrency. As a result, the traditional image processing mode will not evolve to meet the needs of users, and a new effective image processing mode will be required. We reveal a map-based ownership plan for multiple copies of dynamic data in this journal that has the following features: the CSP does not cheat by giving fewer copies to the client, dynamic data outsourcing is supported, and block-level operations like modifying and inserting blocks are supported[1][2].

Cloud computing is a widely adopted Internet-based computing model in which computing resources are provided as dynamic, scalable, and virtualized services. Cloud computing is a type of distributed computing that entails breaking down large data -processing programs into countless small programs over a network "cloud" and then processing and analysing such small programs using multiple servers. The user receives the outcome. in cloud computing the model technique for optimising vast image data in cloud computing can be accurate and acceptable. Cloud computing has the ability to extract useful and valuable data and make it trustworthy and convincing. The process of processing image data models in big data and cloud computing might provide new and challenging massive data picture theory and assistance tools via using intelligent optimization algorithms to solve image data model problems. The coordination of several computer resources is at the heart of cloud computing. Users can receive an unlimited number of resources over the network, and resources received at the same time are not constrained by geography or time. This makes it easier to modify image processing software code and to use different image processing methods.

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The Hadoop distributed platform's distributed storage and computing merge the benefits of high reliability and scalability with parallel processing of large images, enables users to process large images quickly and allocate them to heterogeneous clusters. The genetic algorithm-based task assignment optimization strategy shows that the optimization method is effective,reduces processing time, and improves image processing efficiency. Cloud services now include hybrid computing and computing technologies such as distributed computing, service computing, load balancing, parallel computing, network storage, and virtualization, in addition to distributed computing[3]. With the improvement of cloud computing services, anyone can now use rich software services over the Internet, access and share data from various of devices such as mobile phones and televisions. Personal computers may soon become antiques, reminding people of a time when everyone was an amateur technician.

On a cloud computing platform, the parallelization and task scheduling of the remote -sensing image classification model SCRC based on spatial correlation regularisation and sparse representation is evaluated. In cloud computing method, first, cloud detection technology is combined with the dynamic features of the edge overlap region. The detection of image edge overlap regions is done. The SCRC method is implemented on a single machine, and its time performance is experimentally evaluated, providing a foundation for parallelization research on the cloud computing platform. Finally, the SCRC-SK algorithm's speedup and expansion ratio are determined through experiment, and SCRC-MR and SCRC-SK are compared. The simulation results indicate that, when compared to other methods, the SCRC-MR method of image edge overlap detection is more accurate and the image fusion is better, demonstrating an improvement in image recognition ability in the overlap region and confirming the SCRC-MR algorithm's performance improvement under scheduling. It fixes Hadoop's current scheduler's flaws and can be integrated into remote sensing cloud computing systems in the future.

II. LITERATURE SURVEY

Williams E, Moore J, Wl LS (2017) propose 'an Image Data Resource: a bioimage data integration and publication platform 'Image processing is a widely used practical technique in the computer area, and it has significant research value in signal information processing. The goal of this essay is to investigate the design and method of image processing in the context of cloud computing. For picture data processing, this study presents cloud computing technologies and image processing techniques.

Outsourcing data to remote cloud service providers is becoming increasingly popular amongbusinesses (CSPs). Customers can hire the CSP's storage infrastructure for a monthly subscription that allows them to store and retrieve practically a limitless amount of data. Some customers may want their data replicated on several servers across multiple data centres for enhanced scalability, availability, and durability.

Aminsoofi A, Irfan Khan M, Fazaleamin FA (2017) suggests 'A review on data security in cloud computing'. Cloud computing refers to the on-demand use of computer resources over the internet. It is based mostly on the outsourcing of data and applications, which were formerly held on users' PCs, to remote servers that are owned, maintained, and managed by third parties[3]. This document provides an overview of cloud computing data security challenges. Its goal is to highlight the most important data security concerns presented by the cloud environment.

Barsoum AF, Hasan MA (2015) propose' Provable multicopy dynamic data possession in cloud computing systems' Cloud computing is transforming the way people consume and manage information technology, offering cost savings, faster time-to-market, and the flexibility to extend applications on demand[4].

III. PROPOSE METHODOLOGY

Image data model in cloud computing

Cloud computing gets its name from the technique of drawing Internet maps, which are called clouds. The "public cloud" concept for remotely running workloads in a commercial provider's data centre over the Internet is a model for adding, consuming, and delivering Internet services that often entails supplying dynamic and scalable information on the server. The Internet is generally a virtualized resource in terms of content. Cloud computing is an information technology (IT) concept that allows users to have rapid access to shared, customizable system resource pools as well as more advanced services that are often available over the Internet and

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require no administrative effort. Cloud computing, like business computing, relies on shared resources to provide consistency and economies of scale[6]. Furthermore, virtualization and centralised data centre resource management are more true descriptions of cloud computing.

Cloud computing is classified into three categories based on the type of service: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) (SaaS). The private cloud can be described as a tiny public IaaS cloud that allows customers to deploy and execute software in their own data centres. Internal clients can provide their own virtual resources to create, test, and run applications, and can charge based on resource consumption; at the same time, a cloud computing service has the following features: on -demand self-service, access to any network device at any time and from any location, a resource pool shared by several people, rapid redeployment, and services that can be monitored and measured, just like a public cloud. Rapid deployment of resources or access to services, based on virtualization technology, decreases the stress on the user's terminal and reduces the user's reliance on IT resources[5].

The Alibaba Cloud's Elastic Compute Service (ECS) is an IaaS - class cloud computing model. It provides high performance, stability, and dependability, as well as the flexibility to expand. Cloud Server ECS eliminates the requirement for IT equipment pre-production, allowing the server to be used as readily and efficiently as public resources like water, electricity, and gas to provide off -the- shelf computing. Alibaba Cloud ECS continues to offer innovative servers to fulfil a wide range of business demands and assist users in expanding their businesses. The Alibaba Cloud applies stronger IDC requirements, server access rules, and operating and maintenance standards than traditional IDC rooms and server providers to ensure that cloud servers are operated in a way that promotes cloud computing's high availability and data reliability. As a result, each Alibaba Cloud service area has many Availability Zones. [4]An Alibaba Cloud Multiple Access Zone can be used to establish primary and backup services, as well as real-time services, where higher availability is required. In the financial sector, services with improved availability can be established in numerous regions and access zones for two- and three- centre solutions. The Alibaba Cloud has a well - developed disaster recovery, backup, and other services solution. Users can obtain high availability across the entire communication channel from Alibaba Cloud, which includes cloud servers, load balancing, multi -backup database services, and DTS data migration services; industry partners and environmental partners can assist users in creating more stable architectures; and users can obtain high availability across the entire communication channel from Alibaba Cloud, which includes cloud servers, load balancing, multi-backup database services, and DTS data migration services.

Cloud computing offers a wonderful potential for not just innovation but also speedier and more cost – effective corporate operations than ever before in today's highly competitive industry sector. The cloud is a highly efficient method of delivering IT services . Cloud computing can make new services work faster than traditional architectures because users can establish new virtual servers in the cloud with unparalleled speed and consistency and can automatically assign resources such as computing power and storage to IT services. Furthermore , because cloud computing operations are paid for based on actual usage, operating expenses are lower than traditional storage costs; capital expenditures are particularly lower, lowering the risk of introducing new services into the business, even if the services provided are unsuccessful. On the other hand, if the service is used frequently, the cost will be reasonable, and the end user will pay the expected amount; revenue from external services will be greatly enhanced. Furthermore, the advantages of cloud computing are excellent for a wide range of services, and cloud computing can generate a wide range of new values. A few years ago, the concept of cloud computing was nearly difficult to implement. Cloud computing has now become normal operating procedure for many businesses. Virtual servers are established for business needs in cloud computing, which means they are used on a regular basis for internal and external services. A new virtual server can duplicate any or all production servers in the cloud in a matter of minutes. Enterprises can now replicate some or all of their data centre functionality using the cloud computing platform in at least two ways: they can create third -party cloud policies, create new virtual servers as needed, and then use the appropriate software stack and data; and they can perform recovery services[8]. They can establish virtual servers in preparation and have them launch a hot backup site at any time to respond more quickly to breakdowns. Before providing full recovery services, the site can perform all necessary basic software configuration, and the most recent data can simply be transmitted. In either instance, the effect on a business is huge. Business continuity, for example, is much improved because the organisation no longer relies on a single

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service delivery infrastructure and no longer "puts all its eggs in one basket" if the service fails; this encourages long - term planning. The firm may temporarily move to cloud backup infrastructure throughout the assessment and rectification procedure. This feature can significantly lessen the negative impact on the business; otherwise, it may persist until the data centre problem is fixed. Regardless of the situation, cloud backup offers a recovery tool that can be simply processed and prepared. Cloud computing is considerably superior to any other option, especially for small and medium -sized organizations with low IT budgets, and it reduces the expense and operational complexity associated with traditional backup systems that require duplicate hardware and software infrastructure. Cloud computing optimizes processes and minimizing capital expenditures.

Method for optimising image data models

A data model is a simplified representation of data functions; Data is a symbolic representation of an object, while a model is an abstraction of the real world. It abstracts the system's static characteristics—its dynamic behaviour and limitations —and provides an abstract foundation for describing information and the database system's operation. There are three aspects to the data model: data structure, data manipulation, and data constraints. China has developed a set of data models to assess mineral resource potential. Hierarchical data models, grid data models, and relational data models are the three types of data models that have been applied. The layered model was the first to be developed: its basic structure is a tree structure, and the IMS model is a good example. Because most practical activities do not require a true tree structure, the hierarchical data model was gradually phased out in favour of the grid data model, which expresses data relationships using a network structure. It was created earlier and offers some advantages. It is still more commonly used. The DBTG model is an excellent example[8]. Later, the relational model was established, which consists of a set of entities that express data relationships through a two - dimensional table that meets certain criteria. It has a strong mathematical and theoretical background, as well as being adaptable and simple to use. It also offers a wide range of customization options.

The data model's content is divided into three sections: a data structure, data manipulation, and data constraints. The data structure is a set of target types that represents the type, content, nature, and relationship of data. Target types, also known as record types, data elements, relationships, and domains, are database components that fall into two types: relationships between data types and data types themself. Some of the relationships in the database task group (DBTG) grid model are also applied in the relational model. The data structure is the base of the data model, and it is mainly responsible for the data's operations and constraints[10]. Different operations and constraints vary for different data structures. The type and operation mode of operations, as well as the related data structure, are the most important aspects of data processing in the data model. The structure is a set of operators that operate with a database of valid instances of the target type, containing numerous operations and inference rules. The data constraints in the data model primarily explain the syntax, word meanings, and data structure constraints and dependencies. There are also rules for dynamically modifying data to ensure that it is correct, efficient, and compatible. The state of the database and state modifications that correspond to the data model are determined by a set of integrity rules[7]. According to various principles, the constraints can be split into data value constraints and data connection constraints: static and dynamic constraints, entity constraints, and reference constraints between entities.

IV. RESULT ANALYSIS

Dataset for experimentation

Four datasets were used in this experiment. here set 1 is the Indian Pines dataset and set 2 is the University of Pavia dataset, respectively. The Indian Pines dataset was mosaiced up and down to 29,000 using ENVI software's Mosaic function. As set 3 and set 4, we chose data with a size of 144, 58000 × 144. Table 1 shows the size of each data collection.

Data set	Size of data
Set 1	126*126 (7 mb)
Set 2	630*330 (40 mb)
Set 3	40000*150 (2 gb)
Set 4	60000*150(2.5 gb)

Table 1 :data set used in this experiment

The tests were run on the Hadoop and Spark cloud platforms, using three different types of studies:

1. The parallel SCRC-SK algorithm of the Spark platform was used to perform an acceleration ratio test.
2. On the Spark platform, a parallel SCRC-SK algorithm expansion ratio test was done;

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3. The SCRC-MR method on the Hadoop platform and the SCRC-SK algorithm on the Spark platform were evaluated in terms of execution efficiency .

Environment of the experiment

The SCRC algorithm code is developed in Java to evaluate the validity of the classification method. The experiment's hardware includes an Intel Xeon E7–4807 processor with 8.0 GB of RAM and a 500 GB hard disk. The experiment's parameters, $\lambda 1 = 10^{-3}$, $\lambda = 2$, $\mu = 1$, produced classification results for the algorithm that did not change much over several experiments, preventing the algorithm's performance from deteriorating. The SCRC algorithm includes several matrix operations, and it was implemented using a matrix library.

JAMA, UJMP, and JPLAS are three popular Java matrix calculating libraries.

1) JAMA is a Java library for basic linear algebra. That contain basic matrix operations.

2) UJMP divides common Java matrix libraries into modules, allowing users to select different matrix libraries while performing matrix operations. Furthermore, it includes a matrix visualisation function.

3) JPLAS is a BLAS and LAPACK-based Java linear algebra toolkit. It has a faster operating speed because it can call native libraries using JNI.

Algorithm implementation

The algorithm is a new regular subspace classification algorithm based on MapReduce, a parallel programming framework, and it includes the following features:

1) Split : The input test data set is separated into many serialised splits in the Hadoop architecture. getSplit is used to conduct this operation. The more divides the input file has, the more splits it has. Split processing in parallel helps speed up the processing of large data files. Each split is parsed into key-value pairs by the RecordReader function. A split shard can be broken down into numerous keyvalue pairs and provided to the Map function to be processed. A map process is represented by a split shard, which is itself a shard. 64 M is the default block size. When the amount of input data to be processed is small, the data should be separated into as many shards as feasible to balance the machine load of the entire platform and improve cluster utilisation. The fragment size is determined using the formula below, which takes into account goalSize and minSize, which are both set by the configuration file and are the number of map jobs begun and the minimum fragment size, respectively. Take D be the input data set size and S the number of shards[9].

2) Map : input of map function is in the form of . The value is a piece of test data, whereas the key represents the pixel offset. The ultimate result is key', value'>, where key' is the same as key and value' is the same as value' (Euclidean distance, class number). The NRS classifier is used to calculate the Euclidean distance between each test sample data point and each type of reference data in the Map phase; the sample offset, compared category, and associated Euclidean distance are all saved so that the test data may be processed in the Reduce phase. The Map step, the last classification operation, contains a number of matrix operations such as matrix inversion, matrix multiplication, and matrices diagonalization. Functions are constructed to correspond to these operations. This is a time-consuming operation due to the enormous matrix involved.

3) Reduce : The input key-value pairs in the Reduce phase are the Map phase's result, and they have the form . The serial numbers of the test data can be determined using the data offset and length of the test data. The Euclidean distances of the values are compared for key-value pairs with the same data offset to obtain the minimal Euclidean distance. The final class label is added to the test data based on the category number corresponding to the shortest Euclidean distance, and the classification result is then stored on the distributed file system. The output value is set to empty, and the output key is of the type (test sample serial number, class number). The hyperspectral image data is then subjected to additional operations based on the classification results.

V. DICSUSSIONS

Image edge detection performance comparison using cloud computing

A simulation experiment is conducted to evaluate the application performance of this method in the detection of image edge overlap areas, and the matching coefficient of image frame feature points is 1.25. Based on cloud

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computing, this approach can successfully detect picture edge overlap areas; the detection output's information enhancement performance is good, and the accuracy of image detection by different ways is tested. comparison result shown belove as fig.1. The analysis is completed. Based on cloud computing, the method presented in this paper has a high accuracy in detecting the overlapping region of image edges.

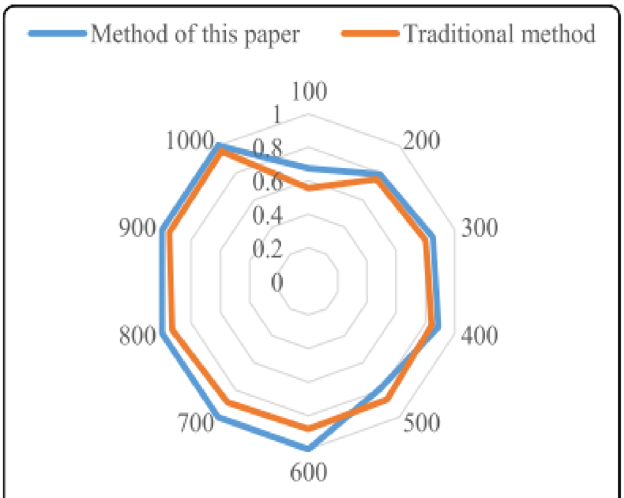

Fig. 1 Test performance comparison

SCRC algorithm parallelization on the cloud platform

1) Acceleration ratio test of SCRC-SK UU algorithm. After a serial programme is parallelized, the performance gains are referred to as speedup. It's a key metric for evaluating parallel computing performance. It can be seen in the formula.

$$sp = \frac{T_1}{T_P}.$$

eq(1)

Where ,

T1 - is the time consumed by calculating the serial program (degree of parallelization is 1), and

TP - is the time spent calculating the program after it has been parallelized (degree of parallelization is p).

First, we perform the SCRC serial program on the CPU (number of parts is 1) and the SCRC-SK parallel program on Spark under the same execution environment, using the data set Datal as input. Spark separates the input data into several partitions (the partitions here are similar to the partitions in map reduction, but they have different meanings). It creates a thread job for each partition to process the partition data, therefore the number of partitions determines the parallelization of the spark parallel process (to ensure that all tasks can be completed at the same time).

No.parts	OA	AA	kappa	Total time	Speedup ratio
1	0.9855	0.9590	0.9640	6360s	1.2
3	0.9855	0.9590	0.9640	4445.3s	1.48
6	0.9855	0.9590	0.9640	2456.46s	2.70
9	0.9855	0.9590	0.9640	1610.21s	4.45

Table 2:Partition of dataset with processing result

The operation results of the SCRC and SCRC-SK programmes are shown in Table 2. The average numbers after each program has been run 10 times are the results. The speedup ratio following parallel processing of Datal is shown in Figure 2.

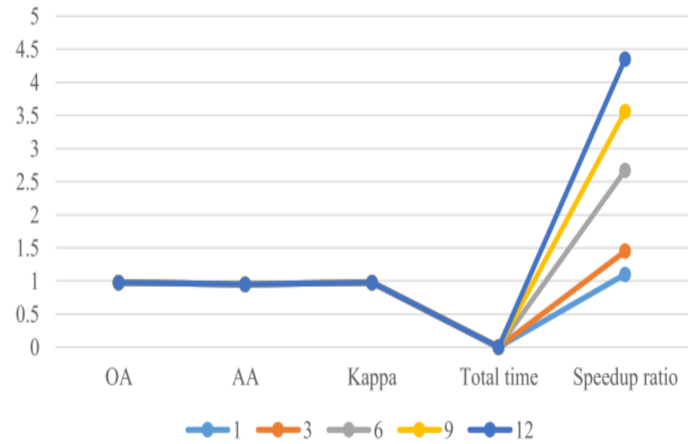

Fig.2 Set 1 performance test for several datasets

2) Speed ratio performance test on several datasets

There is a gap between the actual acceleration ratio and the ideal acceleration ratio, Because Spark initiates a thread for each partition to process the partition's data. The amount of data in every partition is small in this experiment, and the network communication cost of collecting data from each partition and the system cost of creating threads account for a certain proportion of the partition's calculation time, so there is a gap between the actual and ideal acceleration ratios. To test the acceleration performance, the previous tests are performed with datasets set 2, set 3, and set 4. Fig.3 shows the results.

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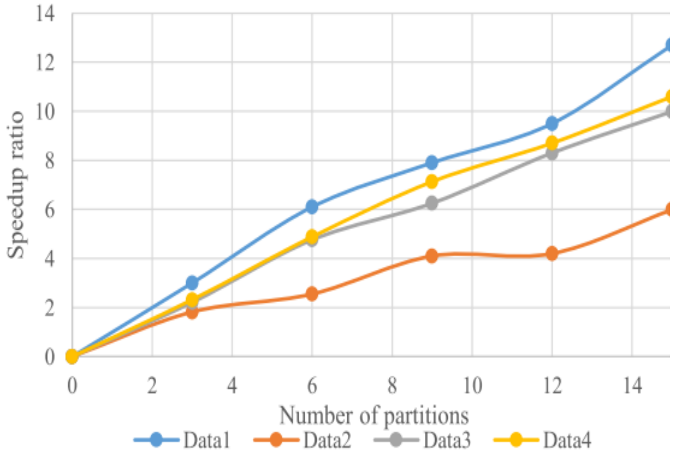

Fig.3 Speedup performance test on several datasets

The acceleration impact becomes more noticeable as the amount of data increases. The actual acceleration ratio approaches the ideal acceleration ratio as the amount of data increases, and the number of partitions increases, the better the acceleration impact. When the number of partitions reaches a certain point, however, the acceleration ratio stops increasing, resulting in a smooth curve on the graph. The acceleration ratio will decrease as the number of divisions grows since the overhead of network transmission will gradually increase after this point.

Analysis of the performance of image data model optimization using cloud computing

The SCRC-MR algorithm is run with the FIFO and StaticTaskScheduler schedulers, and set 2 is used as the algorithm input to calculate the average time of each iteration of the algorithm, as shown in Fig.4.The performance of the MR SCSRC algorithm is increased by using the StaticGATaskScheduler scheduling method, that is 40% faster than FIFO.

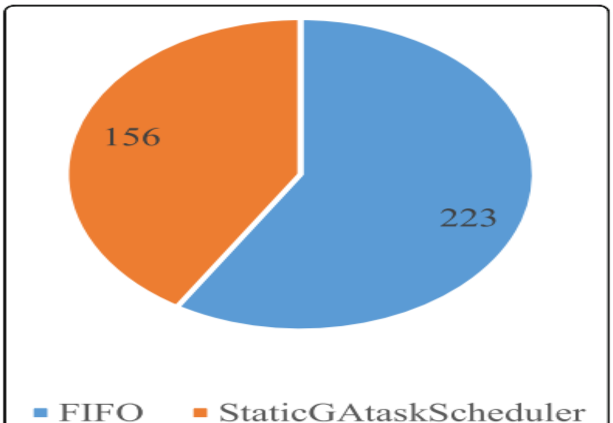

Fig. 4 Running time under two schedulers

VI. CONCLUSION

The concept of cloud computing has developed rapidly since its debut and has changed tremendously. Cloud computing, in today's extremely competitive industry market, is not only a wonderful chance for innovation, but also for faster, more cost-effective business operations than ever before. As a result, cloud computing can help new services get up and running faster than traditional architectures. Since cloud computing expenses are based on actual consumption, operating costs, especially capital costs, are lowered, making cloud computing more easy to implement in companies. Even if the services provided are unsuccessful, the financial risk of adopting new services is substantially lower. Furthermore, the advantages of cloud computing are ideally suited to a variety of services, and cloud computing has the potential to produce a variety of new types of value. Cloud computing provides many advantages over traditional web application models, including great flexibility, scalability, and popularity, as well as virtualization technologies, dynamic scalability, and high dependability. It removes temporal and spatial limits while increasing computational capability. Adding cloud computing capabilities based on a source server accelerates calculations, allowing the virtualization layer to dynamically expand to meet an application's goals, and cloud computing can instantly deliver computing power and resources based on user needs. It's compatible with a wide range of applications, and it may be used not just with low-profile machines and hardware from many manufacturers, but also with peripheral devices to enable higher-performance calculations.

There are many optimization methods for image data model. Each algorithm has its own set of application domains and requirements, as well as benefits and drawbacks. The characteristics of various algorithms, such as genetic algorithms, evolutionary algorithms, and single-purpose or multifunctional intelligent optimization algorithms such as ant colony algorithms, can be used to optimize the image data model algorithm. These intelligent optimization algorithms are used to improve the performance of the data model algorithm, expand its scope, and eliminate the faults and drawbacks. Traditional data algorithms are incapable of performing jobs efficiently and quickly when dealing with massive amounts of data. Cloud computing's

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data model optimization method boosts big data processing power. The training data is improved, and minor noise and variations are introduced. On the one hand, the training data can be supplemented in order to improve the model's generalisation capabilities. The noise data, on the other hand, can be increased, boosting the model's reliability. We can generate three-dimensional traffic and entirely solve traffic problems in urban development using the cloud computing big-data model optimization method. Medical information platforms, remote treatment diagnosis, and consultation all use Cloud Medical. To enhance the amount of data and improve model fit, the image data model optimization method employs techniques such as picture flipping, image chopping, and image whitening. Model augmentation strategies reduce the need for re-equipment and improve the model's generalisation capabilities. The optimization approach alters the learning speed in the learning process, allowing the model to better converge, strengthen model fitting ability, deepen network level and remaining network, and increase classification accuracy. The image data model optimization method may also be utilised to estimate mineralization and analyse coal, uranium, and chemical mineral potential, removing the need for existing backup systems' high cost and management complexity. Cloud computing simplifies processes and lowers capital costs by using redundant hardware and software infrastructure.The parallelization of the hyperspectral remote-sensing image classification algorithm is investigated using the cloud computing platform, and the global research status is summarized. The Hadoop and Spark cloud computing platforms, as well as the HDFS component, are analysed. On the programming model and the Spark RDD programming model, map reduction is performed. The HDFS generation background is studied. Map reduction and Spark RDD technology are analysed, with focused on map reduction task implementation mechanism and map comparison. It is analysed the differences between the reduced programming model and the Spark RDD programming model.

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