Faculty of Engineering and Technology

Seminar Report

on

Cloud-based image data model optimization approach.

By

Gaurav Bhutada

1032191448

PE 51

Under the guidance of

Vitthal Gutte

MIT-World Peace University (MIT-WPU)

Faculty of Engineering & Technology
School of Computer Engineering & Technology
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MIT-World Peace University (MIT-WPU)

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School of Computer Engineering & Technology

CERTIFICATE

This is to certify that Mr. Gaurav Bhutada of B.Tech., School of Computer Engineering & Technology, Trimester – IX, PRN. No. 1032191448, has successfully completed seminar on

Cloud-based image data model optimization approach.

To my satisfaction and submitted the same during the academic year 2021 - 2022 towards the partial fulfillment of degree of Bachelor of Technology in School of Computer Engineering & Technology under Dr. Vishwanath Karad MIT-World Peace University, Pune.

Prof. Vitthal Gutte

Seminar Guide

Prof. Dr. Vrushali Kulkarni

Head
School of Computer Engineering & Technology

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Abbreviations

IT	Information Technology
Iaas	Infrastructure as a service
Paas	Platform as a service
Saas	Software as a service
ECS	Elastic compute service
DTS	Data Transformation service
IMS	Integrated management system
DBTG	Database Task Group

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Gaurav Bhutada
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S1032191448

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Abstract:

The amount of data has grown to extraordinary dimensions in this age of data explosion. The majority of these data are digital image data. The desire for networked work and living continues to rise as research and technology advance. Cloud computing is becoming more prevalent in both personal and professional lives. The optimization strategies for cloud computing image data recognition models are investigated in this work. A cloud computing platform is used to investigate the parallelization and work scheduling of the remote-sensing image classification model SCSRC, which is based on spatial correlation regularization and sparse representation. First, cloud detection technology is used in cloud computing mode, together with the dynamic aspects of the edge overlap region. The SCSRC method is developed on a single machine for picture edge overlap region detection, and the method's time performance is empirically evaluated, providing a foundation for parallelization research on the cloud computing platform. 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 algorithm under scheduling

Objectives:

- To gain a better understanding of how image data model can be optimized using cloud computing techniques.
- To know various image processing approaches for a better optimization of image.

Keywords:

Cloud Computing, Data model, Image processing, Optimization method.

CHAPTER 1

1.1 Introduction:

The process of proposing a new notion is generally slow, and cloud computing is no different. Various sectors create a considerable quantity of multimedia data every day as a result of the rapid growth of information technology and the quick development of picture data gathering technology, the majority of which comes from digital image data. Traditional stand-alone image processing, faced with the increasing rise of digital picture data, has a number of issues, including slow processing rates and inadequate concurrency.

As a result, the traditional image processing method will not grow to satisfy the expectations of consumers, and a new effective image processing mode will be required. From accountability to data sources, identity, and risk management, Aminsoofi developed a generic reference to address a wide variety of concerns linked to data security in cloud computing[1]. Later, A. F. Barsoum predicted that a growing number of businesses will desire to move data to third-party cloud computing service providers[2].

Cloud computing is a widely used Internet-based computing model in which computer resources (computing, storage, and interaction) are provided as dynamic, scalable, and virtualized services. Cloud computing is a type of distributed computing that entails breaking down large data-processing programmes into countless little programmes over a network "cloud" and then processing and analysing these small programmes using several servers. The user receives the outcome.[3,4]

In brief, simple distributed computing was conducted in the early days of cloud computing, the distribution problem was overcome, and the calculation results were integrated, which is why cloud computing is also known as grid computing. Thousands of data points may be analysed in a short amount of time (a few seconds) using this technology to deliver strong network services [8].

1.2 Significance:

Cloud services now encompass hybrid computing and computing technologies such as distributed computing, service computing, load balancing, parallel computing, network storage, hot backup, and virtualization, in addition to distributed computing. Private online data storage and offline data storage appear to be inextricably linked, and many application service providers are projected to send software to businesses over the Internet. On a cloud computing platform, the parallelization and job scheduling of the remote-sensing image classification model SCSRC based on spatial correlation regularisation and sparse representation is investigated. In cloud computing mode, first, cloud detection technology is merged with the dynamic properties of the edge overlap region. The detection of image edge overlap regions is done.

1.3 Motivation:

In this age of data explosion, the amount of data has increased to incredible proportions. The majority of this information is in the form of digital images. As science and technology advance, the desire for networked work and living grows.
Cloud computing is a type of distributed computing that entails breaking down large data-processing programmes into countless little programmes over a network "cloud" and then processing and analysing these small programmes using several servers. The user receives the outcome.
The key benefit of cloud computing is its consistency; it is highly scalable, and it is required to provide consumers with a whole new experience. The coordination of many computer resources is at the heart of cloud computing.

CHAPTER 2

2.1 Literature Review

Index	Paper Name	Year of Publication	Author	Highlights of Paper
1	Image data model optimatization method based on Cloud Computing	2020	Jingyu Liu, Jing Wu, Hailong Zhu	The algorithm used is subspace classification algorithm based on MapReduce, a parallel programming framework. The method used had high accuracy in detecting the overlapping area of images based on cloud computing.
2	Image Processing Design and Algorithm Research based on Cloud Computing	2021	Defa He, Si Xiong	Graphics processing method based on cloud computing. Image Processing System design experiment. The hardware implementation scheme of the image processing algorithm is proposed.
3	A cloud-based Framework to Secure Medical Image Processing.	2018	Mbarek Marwan, Ali Kartit, Hassan Ouahmane	Calculating the entropy of a discrete random distribution with different colour components of an image. Approach to built a distributed data processing system with an efficient method for reducing disclosure risks.

4	A review on Cloud based Image Processing services.	2020	Neeraj Kumar Pandey, Manoj Diwakar	Popular image processing tools which are working in the cloud environment. Satellite image processing in cloud environment. Image securities in cloud environment.
5	Current and future applications of statistical machine learning algorithms for agricultural machine vision systems	2018	Tanzeel U. Rehmana, Md. Sultan Mahmudb, Young K. Changb, Jian Jina, Jaemyung Shin	This paper surveyed the current use of statistical machine learning techniques in machine vision systems, examined each technique's potential for specific applications, and provided an overview of instructive examples from various agricultural fields. Specific statistical machine learning techniques for specific purposes are suggested, as well as the drawbacks of each technique. The use of statistical machine learning technology in the future is addressed.

2.1.1 Image data model optimization method based on Cloud Computing.

This research presents an algorithm used in subspace classification which is based on MapReduce, a parallel programming framework. It had method addressing the shortcomings of Hadoop's existing scheduler and can be integrated into remote-sensing cloud computing systems in future.

The method used had high accuracy in detecting the overlapping area of images based on cloud computing. In this paper research was carried out on the parallelization of the hyperspectral remote-sensing image classification algorithm under the cloud computing platform.

2.1.2 Image Processing Design and Algorithm Research based on Cloud Computing [Defa He, Si Xiong]

The goal of this research was graphics processing method based on cloud computing. The structure of the cloud computing-based on-chip programmable system is constructed by comparing the PC implementation of the image processing system with the dedicated digital signal processor (DSP) implementation, and the various parts of image acquisition, storage, and real-time display of each part of image processing are carried out, and the overall structure design is improved. The design of the structure has been enhanced.

Because picture data comprises a huge quantity of information, implementing image processing algorithms places greater demands on hardware components. The functionalities of embedded microprocessors are getting increasingly powerful as embedded system technology advances. A complicated system project will emerge from the marriage of style and picture processing.

2.1.3 A cloud-based Framework to Secure Medical Image Processing. [Mbarek Marwan, Ali Kartit, Hassan Ouahmane]

This research developed to calculate the entropy of a discrete random distribution with different colour components of an image. It proposed an entropy-based segmentation method to assign all pixels to a region. And the entropy-based segmentation problem is formulated as an optimization problem.

It also approached to built a distributed data processing systems with an efficient method for reducing disclosure risks.

2.1.4 A review on Cloud based Image Processing services. [Neeraj Kumar Pandey, Manoj Diwakar]

In this paper, a study of image processing services in cloud computing is summarized. Some recent methodologies of image processing have been studied such deep learning based applications in cloud environment. In this paper we have analyzed that image processing based applications in cloud environment can be a new domain of research where the processing of image type big data can be accessed and processed in different cloud environment.

The security in cloud environment is a big issue. However, securities as well as quality of images both are effectively required.

2.1.5 Cloud Computing: the next Frontier for vision software. [Andy Wilson]

For system designers, image processing and machine vision applications for cell research, dimensional measurements of automobile parts, and evaluating multispectral satellite pictures face a variety of obstacles. While they're all computationally and data-intensive, the rate at which such photos must be acquired and processed differs significantly from one application to the next.

While scientific and medical applications make use of cloud computing's processing and storage capabilities, several machine vision and image processing providers are now offering cloud-based solutions as a partial or whole solution to their clients' applications.

CHAPTER 3

3.1 Proposed Method

3.1.1 Cloud Computing image data model:

3.1.1.1 Cloud Computing:

Cloud computing gets its name from the technique of constructing Internet maps, which are called clouds. The "public cloud" paradigm for remotely running workloads in a commercial provider's data centre over the Internet is a methodology for adding, consuming, and delivering Internet services that often entails supplying dynamic and scalable information on the server. The Internet is often a virtualized resource in terms of content. Cloud computing is an information technology (IT) approach that allows users to have rapid access to shared, configurable system resource pools and more advanced services that are often available through the Internet with little effort. Cloud computing, like business computing, uses pooled resources to promote consistency and economies of scale.

3.1.1.2 Cloud Computing Classification:

Cloud computing is classified into three categories based on the kind of service: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) (SaaS). The private cloud may be described as a tiny public IaaS cloud that allows customers to deploy and execute applications 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 multiple people, rapid redeployment, and services that can be monitored and measured, just like a public cloud.

3.1.1.3 The status quo of cloud computing:

The Alibaba Cloud's Elastic Compute Service (ECS) is an IaaS-class cloud computing service. It boasts exceptional performance, stability, and dependability, as well as the capacity to expand in a variety of ways.[7] Cloud Server ECS eliminates the requirement for IT equipment pre-production, allowing the server to supply off-the-shelf computing resources as simply and efficiently as public resources such as water, electricity, and gas. Alibaba Cloud ECS continues to offer cutting-edge servers to fulfil a wide range of business demands and assist users in expanding their operations. The Alibaba Cloud applies stronger IDC requirements, server access rules, and operating and maintenance standards than traditional IDC rooms and server providers to guarantee that cloud servers are operated in a way that promotes cloud computing's high availability and data dependability. Users can get three types of support from the Alibaba Cloud: products and services that increase availability, such as cloud servers, load balancing, multi-backup database services, and DTS data migration services; industry partners and environmental partners can help users create more stable architectures; and users can get high availability across the entire communication channel from the e-commerce platform.

3.1.1.4 The positive impact of Cloud Computing:

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 very efficient method of delivering IT services. Cloud computing may make new services run quicker 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, operational 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 supplied are unsuccessful. 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. They can establish virtual servers ahead of time and have them launch a hot backup site at any moment to respond more swiftly to crashes. Cloud computing is considerably superior to any other option, especially for small and medium-sized businesses with limited IT budgets, and it reduces the expense and operational complexity associated with traditional backup systems that require redundant hardware and software infrastructure. Cloud computing streamlines operations and lowers capital expenditures greatly [5,6].

3.1.2 Image data model optimization method:

3.1.2.1 Image data model:

A data model is a representation of data functions; data is a symbolic representation of a thing, and a model is a representation of reality. It abstracts the system's static characteristics—its dynamic behaviour and limitations—and offers an abstract foundation for describing information and the database system's functioning. Data structure, data manipulation, and data restrictions are the three components of the data model. China has developed a set of data models to estimate mineral resource potential. Hierarchical data models, grid data models, and relational data models are the three types of data models that have been employed. The layered model was the first to be developed: its basic structure is a tree structure, and the IMS model is a good example.

3.1.2.2 Data model content classification:

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, substance, nature, and connection of data. Target kinds, also known as record types, data elements, relationships, and domains, are database components that may be divided into two categories: relationships between data types and data types themselves. Some of the relationships in the database task group (DBTG) grid model are also employed in the relational model. The data structure is the foundation of the data model, and it is largely responsible for the data's operations and limits. Different operations and constraints apply to different data structures.

The state of the database and state modifications that adhere to the data model are determined by a set of integrity rules. According to various concepts, the constraints can be split into data value constraints and data connection constraints: static and dynamic constraints, entity constraints, and reference constraints between entities.

3.1.2.3 Image data model optimization method for cloud computing:

An example algorithm is given below from the literature review (1).

Definition one: uncertain reasoning in the cloud.

In practical applications, a set of single-conditional rules can be formally expressed as:

IfA,thenB,·i=1,2,3,⋯,mIfA,thenB,·i=1,2,3,⋯,m (1)

Similarly, multiple rules and multiple conditions can be formally expressed as:

IfA1A2,⋯,An,thenB1IfA1A2,⋯,An,thenB1 (2)

Definition two: principles of cloud computing

1) Calculation logic

If F is a calculation and × 1, × 2, …, xn are the n calculated parameter variables, then F is called an n-ary calculation, and S is the result of the calculation. This can be written as:

S=F(χ1,χ2,⋯,χN)S=F(χ1,χ2,⋯,χN) (3)

If a_1, a_2, …, a_n are the values of the n parameter variables x_1, x_2, …, x_n, then:

S=F(a1,a2,⋯,an)S=F(a1,a2,⋯,an) (4)

If A_1, A_2, …, A_n are n conditions and B is the conclusion, then a rule called an n rule, denoted as R, can be expressed as:

IfA1A2,,⋯,An,thenBIfA1A2,,⋯,An,thenB (5)

2) Computational logic transformation

Given a calculation F and an eq. $S=F(a_1,a_2,\ldots,a_n)$, an n rule R can be generated, which is expressed as:

IfA1A2,⋯,An,thenB1,B2,⋯,BnIfA1A2,⋯,An,thenB1,B2,⋯,Bn (6)

Definition three: computing clouding process.

1) For the n calculation F, if its domain is:

Ω=(U1×U2×⋯×Un)Ω=(U1×U2×⋯×Un) (7)

then m parameter values can be extracted as Ω sample parameter values, and the calculation of F can be performed. The result is Si, where:

Si=F(a1i,a2i,⋯,ani)i=1,2,3,⋯,mSi=F(a1i,a2i,⋯,ani)i=1,2,3,⋯,m (8)

By the conversion theorem:

Ifa1i,a2i,⋯,ani,thenSii=1,2,3,⋯,mIfa1i,a2i,⋯,ani,thenSii=1,2,3,⋯,m (9)

3) Clouding

Once a numerical variable has been clouded by a clouding process P, it is assumed that process A constructs a set A of qualitative concepts corresponding to U, which contains K qualitative concepts, namely:

A={A1,A2,⋯,AK}A={A1,A2,⋯,AK} (10)

CHAPTER 4

4.1 Algorithm:

The technique employed is a three-part regular subspace classification approach based on MapReduce, a parallel computing framework:

4.1.1 Split:

The input test data set is split into many serialised splits in the Hadoop architecture. The getSplit method is used to do this operation. Splits can be processed in parallel to speed up the processing of large data sets. Each split is parsed into key-value pairs by the RecordReader function. A split shard can be broken down into numerous key-value pairs and provided to the Map function to be processed. When the amount of input data to be processed is modest, the data should be separated into as many shards as feasible to balance the machine load of the entire platform and optimise cluster utilisation.

4.1.2 Map:

The Map function takes two arguments: a key and a value. The value is a piece of test data, whereas the key indicates 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 Map step, the last classification procedure, contains a number of matrix operations such as matrix inversion, matrix multiplication, and matrices diagonalization. Functions are created to correspond to these operations. This is a time-consuming procedure since it involves a big matrix.

4.1.3 Reduce:

The input key-value pairs in the Reduce phase are the output key-value pairs from the Map phase, and they have the form. The serial numbers of the test data may be determined based on 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).

CHAPTER 5

5.1 Results

5.1.1 Image edge detection performance comparison using cloud computing

A literature review (1) offered analytical work and tested the application performance of this method in the detection of image edge overlap areas, they carried out a simulation experiment and the matching coefficient of image frame feature point is 1.25. This approach, which is based on cloud computing, can successfully identify picture edge overlap areas; the detection output's information enhancement performance is high, and the accuracy of image detection by different ways is examined. The findings of the comparison are displayed in Fig. 1, and the analysis is completed. Based on cloud computing, the approach presented in this work has a high accuracy in recognising the overlapping region of picture edges.

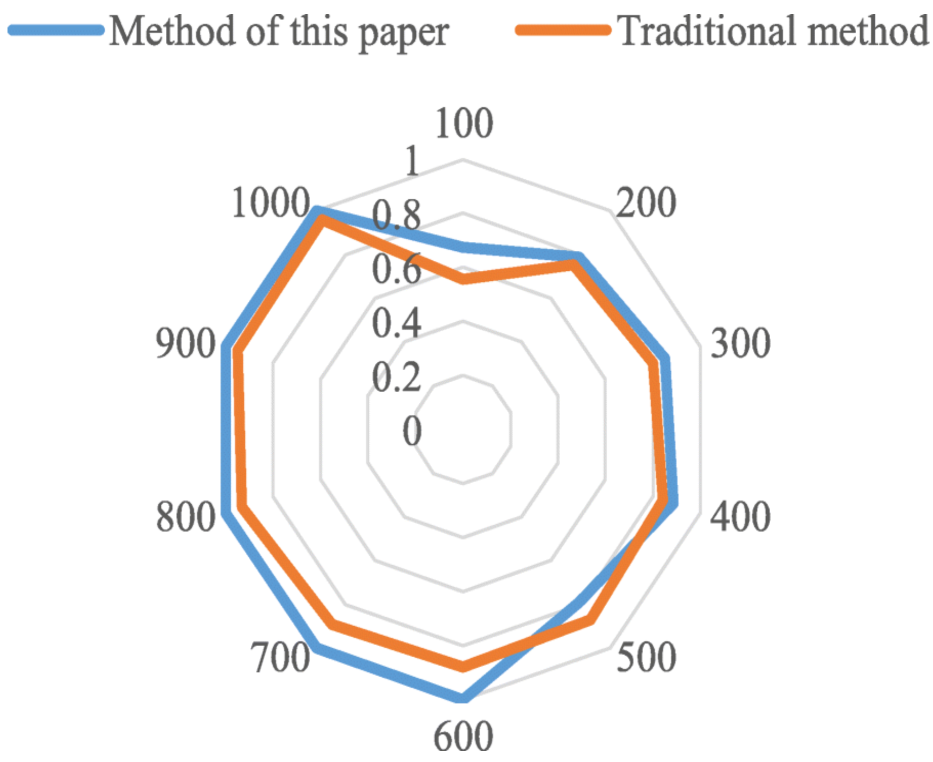

Fig.1. Test performance comparison

5.1.2 Different data sets were subjected to a speed ratio performance test.

Because Hadoop creates a thread for each partition to analyse the partition's data, there is a gap between the actual acceleration ratio and the ideal acceleration ratio. Because the amount of data in each 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 portion of the partition's calculation time, there is a gap between the actual and ideal acceleration ratios. To assess the acceleration performance, the previous tests are performed using datasets Data 2, Data 3, and Data 4. The table being given and the speedup performance test has been done in literature review (1). Fig.2. shows speedup ratio after parallel processing in Table.1.

No. of Partition	**OA**	**AA**	**Kappa**	**Total time**	**Speedup ratio**
1	0.9756	0.9490	0.9737	6461s	1.1
3	0.9756	0.9490	0.9737	4544 s	1.45
6	0.9756	0.9490	0.9737	2562s	2.67
9	0.9756	0.9490	0.9737	1715s	3.56
12	0.9756	0.9490	0.9737	1329s	4.35

Table.1. Data set processing with different number of partition.

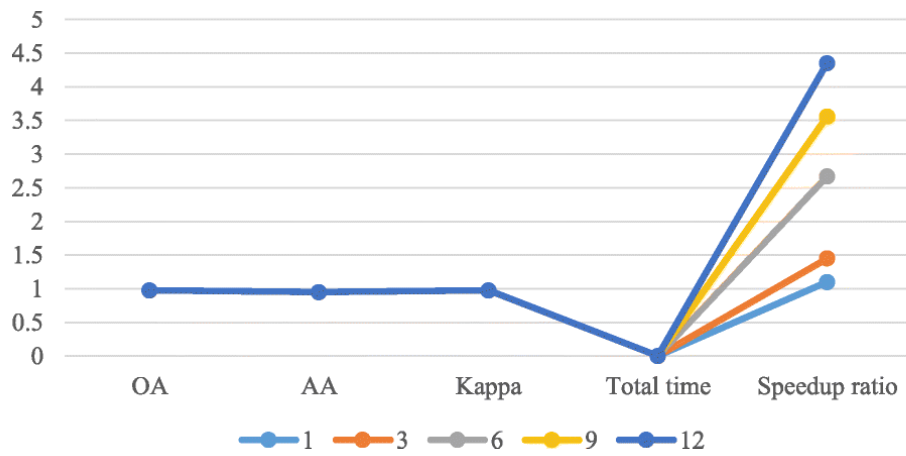

Fig.2. Acceleration ratio performance test

The acceleration impact becomes more noticeable as the volume of data grows. The real acceleration ratio approaches the ideal acceleration ratio as the amount of data increases, and the number of divisions increases, the greater the acceleration impact. When the number of divisions 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 partitions grows, because the overhead of network transmission will rapidly increase after this point.

Conclusion

Since its inception, the notion of cloud computing has evolved quickly and dramatically. Cloud computing, in today's extremely competitive industry market, is not only a wonderful chance for innovation, but also for faster, more cost-effective corporate operations than ever before. As a result, cloud computing may help new services get up and running faster than traditional infrastructures. Because the cost of cloud computing operations is based on real consumption, operational expenses, particularly capital expenditures, are decreased, making the adoption of cloud computing in companies much easier. Even if the services supplied are unsuccessful, the financial risk of adopting new services is substantially smaller. Cloud computing provides several benefits 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 geographical limits while increasing computational capability. Adding cloud computing capabilities based on a source server speeds up computations, allowing the virtualization layer to dynamically expand to meet an application's goals. Cloud computing may also instantly deliver processing power and resources based on user demands. 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 computations.

The parallelization of the hyperspectral remote-sensing image classification method is investigated using the cloud computing platform, and the current state of study is reviewed. The Hadoop cloud computing platform, as well as the HDFS component, are investigated. The programming model is used to reduce the size of the map. The HDFS generation background is investigated. Map reduction is investigated, with an emphasis on the map reduction task implementation mechanism and map comparison.

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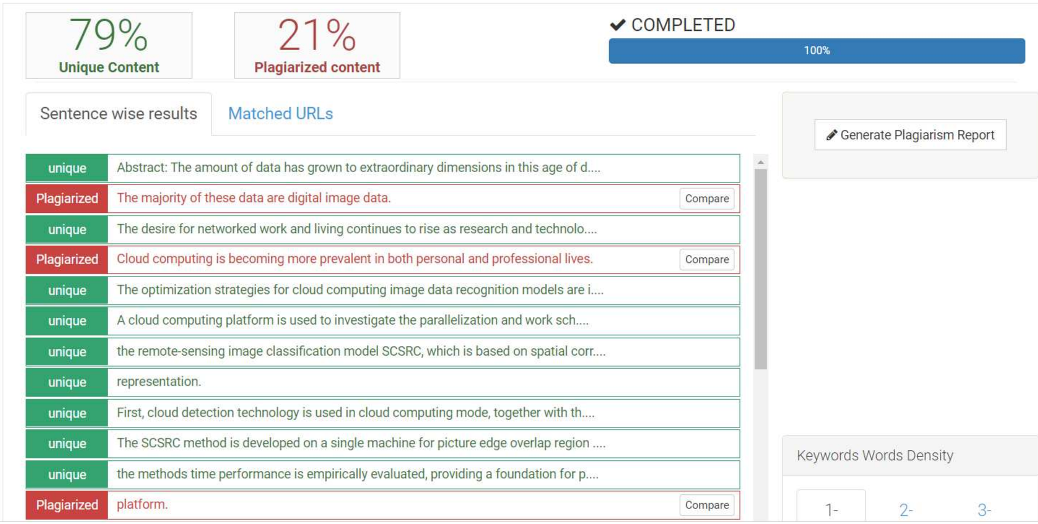
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