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Research Article

The Application of Wireless Network Technology in the Capacity Building of Anhui Industry Associations Based on the Characteristics of Big Data

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Recent advances of wireless networks and communication technologies, integrated into the considerable development in the field of environmental policies and public participation, have resulted in the development of wireless network-enabled big data environment in the capacity building of Anhui industry association. At the same time, effective task scheduling in the cloud server based big data environment is essential to schedule the tasks accurately and rapidly. There are thousands of jobs to be executed by the resources available on cloud data centers to achieve minimum time, high performance, and the proper utilization of CPU and resources. The necessity to fulfil user requirements is the main reason of having studies for optimizing the cloud computing of big data in terms of latency, bandwidth, execution time, and resource utilization. Therefore, this work presents a crow search optimization-based task scheduling scheme (CSO-TSS) for capacity building of Anhui industry association on wireless network-enabled big data environment. The proposed CSO-TSS technique mainly intends to schedule the tasks exist in the wireless network-enabled big data environment. Besides, the CSO-TSS technique is executed on a MapReduce environment in order to proficiently handle the big data. In addition, the CSO-TSS technique derives an objective function intending to maximize resource utilization and minimize execution time of the tasks. For examining the improved task scheduling performance of the CSO-TSS technique, a wide range of simulations were carried out and the results are investigated under several aspects. The comparative result analysis stated the better outcomes of the CSO-TSS technique over the recent approaches in terms of different measures.

1. Introduction

To achieve a truly digital economy, digital knowledge and information must be transferred efficiently through modern information networks. The use of ICT as a driving factor for efficiency improvement and structural optimization must be exploited effectively [1]. This year's China Network Security and Information Work Conference was a resounding success. In order to boost digital industrialization and develop China's digital economy, country's macroeconomic environment should be considered [2]. It is vital to assess and account for the digital economy in order to improve digital economy development management and encourage digital economy development [3]. Instead of using traditional methodologies, a new statistical index system must be developed to account for the digital economy's distinct characteristics. There is no single metric for the digital economy, both domestically and internationally [4]. The primary focus of the digital economy growth measurement study is qualitative description. A quantitative strategy to gauge the digital economy cannot be provided by researchers who just focus on the creation of the digital economy's assessment index system. There is also a lack of quantitative research that goes beyond the use of simple descriptive statistics and the structural equation model [5]. It is impossible to accurately assess the current condition of China's digital economic development due to a lack of objective, comprehensive, and systematic quantitative study results. The era of the Internet has come to an end [6]. There are three main indicators and 20 auxiliary indicators in Anhui Province's digital economy indicator system based on the China White Paper: industry digitization, information infrastructure, and digital industrialization. The efficiency coefficient approach was used to generate the indicator values for each of Anhui Province's 16 cities, depending on their relative importance [7]. Data and policy recommendations for the expansion of the digital economy are then presented in relation to the specific indicator systems in question. Here is a breakdown of what follows: This chapter covers all aspects of the weight design, construction, and analysis of every indication system. A brief overview and viewpoint on the economy of Anhui Province is also provided, as is data on several of the province's cities [8]. In this study, the organizational capacity of Anhui industry associations has been analysed using wireless technology with artificial intelligence.

2. Related Studies

As a result, the European Union has placed a high priority on the development of the digital economy and the collection of data. The European Commission (DESI) has released a report and an index on the EU's digital economy [9]. Progress in the digital economy of the EU as assessed by the DESI is a composite index. The index takes into account 31 secondary factors. Broadband accessibility, human capital, Internet applications, and the use of digital technology are all factors to consider in EU countries. Economic metrics (such as GDP and productivity level) and the growth effect of digitization across industries were recommended by the US Commerce Department's Digital Economy Advisory Committee in its inaugural report [10]. The Internet Economy Outlook, a long-term and forward-looking study, credits the OECD (Organization for Economic Cooperation and Development) with being a digital economy innovator. In light of the research conducted using the direct method, six new measurement standards should be created. The World Economic Forum (WEF) has published the network readiness index (NRI) for the first time this year, focusing on the leading countries and regions in the global information sector and their ranks, experience, and practises [11]. Throughout the world, NRI is a well-known name in information evaluation. Although the first and second-level indicators have been streamlined and are based on data, there are still 53 third-level indicators. A detailed report on the state of the information society and the ICT development index has been released by the International Telecommunication Union for the ninth time (IDI). A total of 176 economies from around the world were taken into account during the evaluation process. The examples above demonstrate both the virtues and shortcomings of both national and international index systems. In this study, researchers from the U.S. Commerce Department based their results on worldwide research into the scope and measurement of the digital economy [12]. The EU's digital index data collection is among the most comprehensive and objective in the world. There are several surveys and statistical studies conducted by the European Union that provide strong research foundations. Understanding the EU's comprehensive and long-term data collection and reporting system is critical. Testing of the WEF's Network Readiness Index and the United Nations' ICT Development Index has been done to see how well they measure and compare the global information infrastructure and industry. They did not succeed. Index systems in China are substantially different from those utilised in other countries throughout the world. The first occurs at the start of a new time period [13]. The domestic digital economy index has shown how essential the national plan and the current digital economy development trend are, as well as how rapidly different organizations, corporations, and local governments have responded to it since it was first announced in 2017. It was launched in 2017. In addition, this suggests that China has been tardy in adopting digital economic assessment methods in constructing economy. Many options are available to begin with. Organizations around the world use the same methods to evaluate their employees [14]. The focus of this research is primarily on the basis, development, and influence of the digital economy [15]. Various institutions and their roles in China's digital economy are reflected in the country's ranking. Big data innovation and application are the remaining two pillars. For the purpose of constructing the enterprise-led design index, data from a wide range of resources can be combined. Agriculture and the environment are increasingly at odds because of the rising global population and the tightening of environmental regulations. Famine, water scarcity, and pollution are only a few of the many problems that threaten agriculture's long-term viability. Approximately, 135 million people were considered food insecure by the World Food Program's 2019 Food Crisis Report. According to the Food and Agriculture Organization of the United Nations, water scarcity will affect more than 3.2 billion people in 2020. Using current technologies and service models to promote sustainable farming practises is so crucial [16]. Due to population growth, water scarcity, and climate change, it is becoming increasingly difficult for regional agriculture to maintain its long-term profitability. Relevant data must be used to accurately and fairly assess the agriculture industry's structure and competitiveness, and policy suggestions tailored to the local environment must be developed [17]. In today's volatile and dynamic world, knowledge generates significant resources and gives a competitive advantage. In the last two decades, absorptive capacity (ACAP) has emerged as a critical concept due to the availability of external knowledge resources. There has been a number of academic and empirical research into the ability of organizations to absorb knowledge in light of the work done on absorptive capacity [18]. For just a few examples, industrial organizations, organizational learning, strategic management, and innovation management can all benefit from ACAP's adaptability. Organizational decisions about how resources should be allocated are a primary concern for DL. A variety of terms have been used to describe current thinking, including "mind-sets," "interconnected choices," and "strategic frames [19]. The research is backed by absorption, which is based on the ability to absorb and the current rationale. The researcher defines dominant logic as an administrative tool for making business decisions at various stages of an organization's activities. In a transition economy, current logic can be put to the test. In environments with limited resources, the dominant logic is subjected to further tests in order to assess its intangible resource potential and significance. According to recent findings, competitive advantage is primarily derived from intangible resources. They are more difficult to replicate and more difficult to deal with in the market than tangible or physical resources, which makes dealing with these resources more complex [20]. Few empirical studies have examined the link between intangible resources and the success of businesses. This study focused on the application of wireless network technology in the capacity building of Anhui industry associations using artificial intelligence.

3. Materials and Methods

In this work, a new CSO-TSS technique has been developed for capacity building of Anhui industry association on wireless network-enabled big data environment. The proposed CSO-TSS technique mainly schedules the tasks exist in the wireless network-enabled big data environment. Moreover, the CSO-TSS technique is executed on a MapReduce environment in order to proficiently handle the big data. Furthermore, the CSO-TSS technique derives an objective function intending to maximize resource utilization and minimize execution time of the tasks.

3.1. MapReduce. It is commonly employed for processing large scale data. It is an effective distributed scheduling approach. "Map" and "reduce" are the two fundamental computing units of the MapReduce method [21, 22]. Huge data is cut into unrelated blocks through Map program and scheduled to different computers for processing, achieve distributed computing. Next, the outcomes from this computer are outputted and summarized through Reduce program [23]. The big data structure is shown in Figure 1.

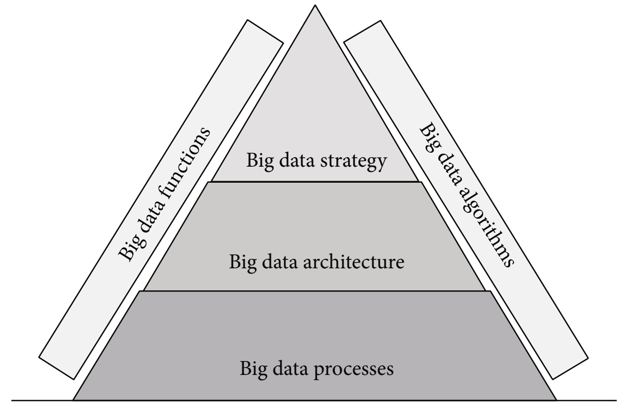

FIGURE 1: Overview of big data.

3.2. Overview of CSO Algorithm. The crow is observed as the smartest creature amongst birds. Its huge brain is compared with its body size. According to a brain-to-body relative, their brain has marginally lesser than human. The proof of the smartness of crows is several. It is demonstrated that self-awareness from mirror testing is talent for generating tools. The crow is memorizing faces and alerting one another about the threats [24]. Also, it uses tools and shares data from difficult manners and remembered their confidential food place. It can monitor and track where the birds saved their food in secret place. If the crow ensured robbery, then it alerts the hiding spot for abstaining in victim. Essentially, it uses their skill of being a thief for speculating the activity of robbers and is decided the most secured manner for defending their food in stolen. The criteria of CSA are [25]

(i) The crow exists as a group

(ii) The crow preserves in mind the place of their confidential places

(iii) The crow follows one other to do theft

(iv) The crow secured their hideouts from being stolen by probabilities

Most probably, there is N dimension environment containing many crows. Entire crows are C and the place of crows u at time (iteration) iter from the searching space (SS) has been defined as the vector,

$$V^{u,iter}(p = 1, 2, \cdots, C\,; \text{iter} = 1, 2, \cdots,)\ \text{iter}_{\max}, \tag{1}$$

Whereas $V^{u,iter} = [V_1^{u,iter}, V_2^{u,iter}, \cdots, V_c^{u,iter}]$, and $\text{iter}_{\max}$ indicates the iterations with maximal counts. All the crows memorize the confidential place where it is kept. In the iteration, confidential place of the crows u has been demonstrated as $s^{u,\text{iter}}$. During the memory of all the crows, the place of its optimum experiences has been stored. The crows begin searching for an optimum source from the environment.

Assume such iteration that the crow v requires to move their confidential location, $s^{v,iter}$. In this iteration, the crow u definite for tracing crows v to confidential place of crows v. During this phase, 2 events occur.

Event1: The crow v has no concept that crow u is tracking it. Thus, the crow u has reached to confidential place of crows v. During this phase, a novel location of crows u has developed as

$$V^{u,\text{iter}+1} = V^{u,\text{iter}} + k_j \times fll^{u,\text{iter}} \times \left(S^{v,iter} - V^{u,\text{iter}}\right), \tag{2}$$

where k_j stands for the arbitrary number with uniform distributing amongst zero and one, and $fll^{u,iter}$ refers to the flight length of crows u at iteration. The minimal value of fll outcomes from local search and maximal value leads to global searching.

Event2: the crow v identifies that crow u has been tracked. Therefore, for defending their confidential location in theft, the crow v implies the deceive crow u by moving

Table 1: MST analysis of CSO-TSS model on scenario 1.

No. of tasks	Makespan time (min) L-PSO	TBSLB-PSO	DLBA	Proposed model
10	7.60	5.60	2.88	1.60
20	13.90	9.47	6.18	3.60
30	19.60	14.32	9.60	5.75
40	27.47	20.47	13.47	10.32
50	33.18	25.18	15.60	10.88

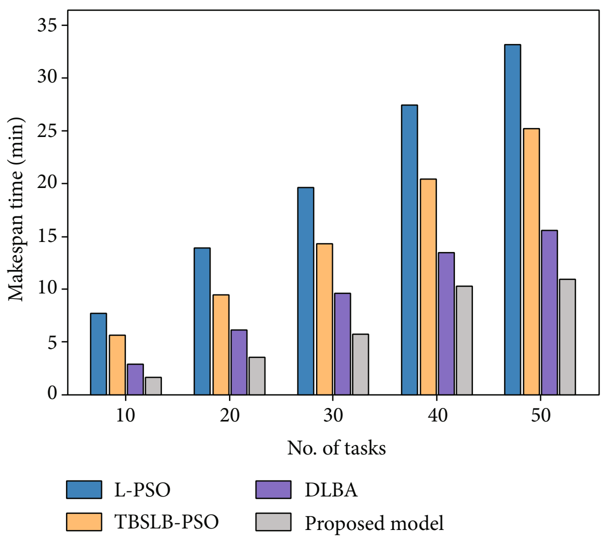

Figure 2: Comparative MST analysis of CSO-TSS model on scenario 1.

Table 2: MST analysis of CSO-TSS model on scenario 2.

No. of tasks	Makespan time (min) L-PSO	TBSLB-PSO	DLBA	Proposed model
10	3.83	2.67	1.67	0.57
20	7.75	5.17	3.42	2.17
30	11.58	8.58	5.67	3.67
40	15.75	11.75	7.50	5.58
50	19.58	14.92	9.50	8.33

to another place of SS. Therefore, events 1 and 2 are explained as

$$V^{\mathrm{u,iter}+1} = \begin{cases} V^{\mathrm{u,iter}} + k_j \times fll^{\mathrm{u,ter}} \times \left(S^{v,\mathrm{iter}} - V^{\mathrm{u,iter}}\right) k_j \geq AWP^{v,iter} \\ a\, random\, location\, otherwise \end{cases}, \quad (3)$$

where $AWP^{v,iter}$ refers the probabilities of awareness of crows v at iteration.

3.3. Process Involved in CSO-TSS Technique. The core of CSO-TSS technique is to assign n independent tasks to m heterogeneous accessible resources; thus, the overall task execution time is minimalized and resource is completely

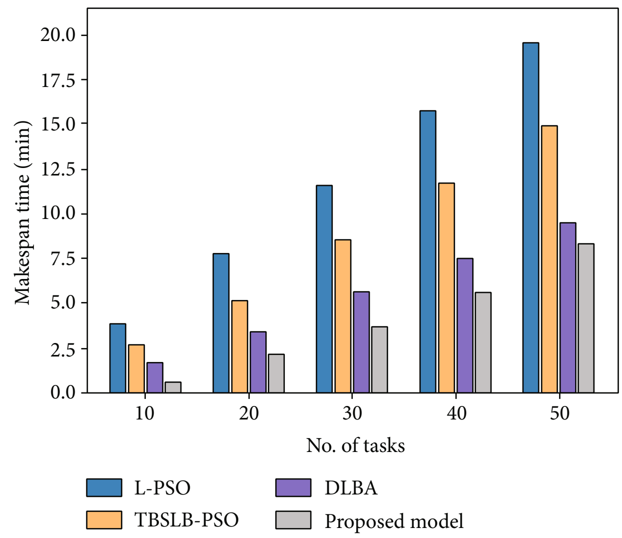

Figure 3: Comparative MST analysis of CSO-TSS model on scenario 2.

exploited. It has a heterogeneous environment, largescale, decentralized, and feature includes scalability. In a distributed scheme, n subtask $Task = \{T_1, T_2, \cdots, T_n\}$ is allocated to m processor $C = \{C_1, C_2, \cdots, C_\mathrm{m}\}.R_j$ characterizes the maximal resource quantity of the processor C_j, $R = \{R_1, R_2, \cdots, R_\mathrm{m}\}$ denotes the maximal resource quantity set of processor, and the amount of resources needed for the task implementation is $H = \{H_1, H_2, \cdots, H\}$ designates. $T_j = \sum_i X_{ij} = t_i/v_j$ characterizes the amount of execution time of each task scheduled on processor j, whereas t_i signifies the implementation time of task i on the slower processor and v_j embodies the processing speed of processor j.

$$f(X) = \min \left(A \sum_{j=1}^{m} t_j^d + B \sum_{i=1}^{m} \sum_{j=1}^{m} \sum_{p=1}^{m} \sum_{q=1}^{m} \omega_{ijpq} X_{ij} X_{pq} \right), \quad (4)$$

$$\sum_{j=1}^{\mathrm{m}} X_{ij} = 1, i = 1, 2, \cdots, n, \quad (5)$$

$$\sum_{i=1}^{m} H_i X_{ij} \leq R_j, j = 1, 2, \cdots, m. \quad (6)$$

In which A and $B(A + B = 1)$ indicate the relative significance of the overall execution time and transmission cost in the objective function, and ω_{ijpq} indicates the task i scheduled on processor j and the task p implemented on processor q. For calculating the processing time needed for all the tasks on a distinct VM, implementation time matrix can be determined by

$$T = \begin{bmatrix} time_{11} & time_{12} & \cdots & time_{1m} \\ time_{21} & time_{22} & \cdots & time_{2\mathrm{m}} \\ \vdots & \vdots & \vdots & \vdots \\ time_{n1} & time_{n1} & \cdots & time_{nm} \end{bmatrix}. \quad (7)$$

Table 3: RU analysis of CSO-TSS model on scenario 1.

	Resource utilization			
No. of tasks	L-PSO	TBSLB-PSO	DLBA	Proposed model
10	0.750	0.757	0.757	0.776
20	0.848	0.858	0.858	0.867
30	0.966	0.979	0.998	1.017
40	0.979	1.000	1.011	1.026
50	0.987	1.001	1.019	1.034

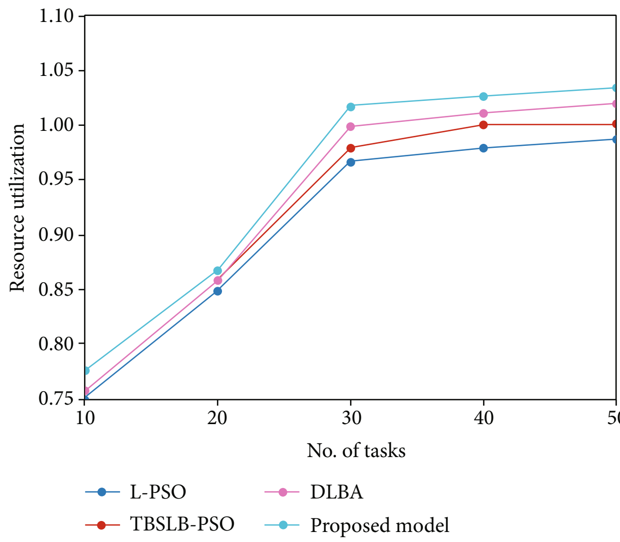

Figure 4: Comparative RU analysis of CSO-TSS model on scenario 2.

Table 4: RU analysis of CSO-TSS model on scenario 2.

	Resource utilization			
No. of tasks	L-PSO	TBSLB-PSO	DLBA	Proposed model
10	0.500	0.502	0.507	0.513
20	0.568	0.571	0.573	0.580
30	0.578	0.583	0.590	0.599
40	0.585	0.594	0.600	0.612
50	0.589	0.596	0.605	0.613

Here, $time_{ij}$ indicates the implementation time needed to the VM v_j for processing the task t_i, and $time_{ij} = MI_i/MIPS_j$. The predictable time for performing n tasks on m virtual resource is represented as E, where E indicates an $n \times m$ matrix. E_{ij} shows the time needed for T_i for running in the VM, $E_{ij} = c_{ij} + e_{ij}$. Next, the VM implements the task execution time as E_j. As the task allocated to VM resources is concurrently implemented, the implementation time needed for each task is the maximal value in the array E characterized as

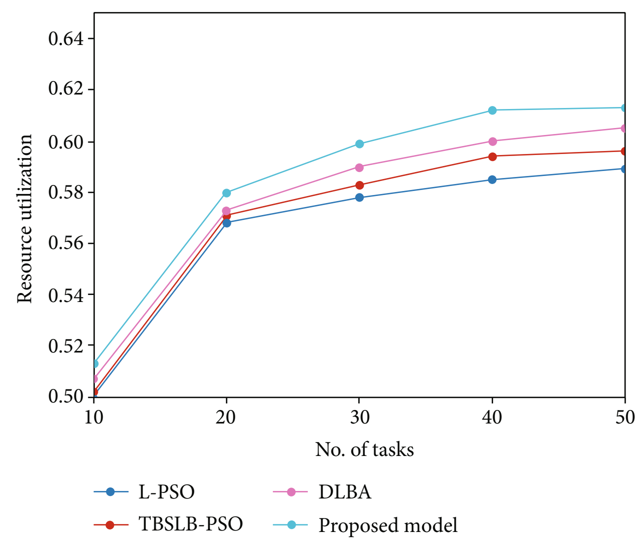

Figure 5: Comparative RU analysis of CSO-TSS model on scenario 2.

E_{total}:

$$E_j = \sum_{i \in Taskj} e_{ij} + \sum_{i \in Task_j} t_{ij}. \tag{8}$$

In which, $Task_j$ denotes the set of tasks to be implemented on the VM. The matrix $x[i][j]$ is determined based on the matching relationships among the VM and the task indicates either the task t_i is allocated to the VM v_j, as follows:

$$x[i][j] = \begin{cases} 1, & \text{is } \textit{assigned} \text{ to } V_j \\ 0, & \textit{otherwise} \end{cases}. \tag{9}$$

The implementation efficacy of the VM is estimated by evaluating the overall implementation time of the task execution.

4. Performance Validation

The performance validation of the CSO-TSS technique is carried out under distinct number of tasks. Table 1 and Figure 2 inspect the make span time (MST) examination of the CSO-TSS technique with existing methods [26] under scenario 1. The results indicated that the CSO-TSS technique has accomplished effective results with least MST under all tasks.

For instance, with 10 tasks, the CSO-TSS technique has obtained lower MST of 1.60 min whereas the Languid particle swarm optimization (L-PSO), Task-Based System Load Balancing PSO, and Dynamic Load Balancing Algorithm (DLBA) techniques have attained higher MST of 7.60 min, 5.60 min, and 2.88 min, respectively. In addition, with 50 tasks, the CSO-TSS technique has attained minimal MST of 10.88 min whereas the L-PSO, TBSLB-PSO, and DLBA techniques have obtained maximum MST of 33.18 min, 25.18 min, and 15.60 min, respectively.

Table 2 and Figure 3 review the MST examination of the CSO-TSS technique under scenario 2. The results designated that the CSO-TSS technique has accomplished operative results with minimum MST under all tasks. For instance, with 10 tasks, the CSO-TSS technique has obtained lower MST of 0.57 min whereas the L-PSO, TBSLB-PSO, and DLBA techniques have attained higher MST of 3.83 min, 2.67 min, and 1.67 min, respectively. Furthermore, with 50 tasks, the CSO-TSS technique has reached minimal MST of 8.33 min whereas the L-PSO, TBSLB-PSO, and DLBA techniques have gained maximum MST of 19.58 min, 14.92 min, and 9.50 min, respectively.

Table 3 and Figure 4 demonstrate the resource utilization (RU) examination of the CSO-TSS technique with recent methods under scenario 1. The experimental results depicted that the CSO-TSS technique has obtained improved outcome with the higher RU under all tasks. For instance, with 10 tasks, the CSO-TSS technique has resulted to increased RU of 0.776 whereas the L-PSO, TBSLB-PSO, and DLBA techniques have reached lower RU of 0.750, 0.757, and 0.757, respectively. In line with that, with 50 tasks, the CSO-TSS technique has accomplished raised RU of 1.034 whereas the L-PSO, TBSLB-PSO, and DLBA techniques have resulted to reduced RU of 0.987, 1.001, and 1.019, respectively.

Table 4 and Figure 5 validate the resource utilization (RU) examination of the CSO-TSS technique with recent methods under scenario 2. The experimental results portrayed that the CSO-TSS technique has obtained improved outcome with the higher RU under all tasks. For instance, with 10 tasks, the CSO-TSS technique has resulted to amplified RU of 0.513 whereas the L-PSO, TBSLB-PSO, and DLBA techniques have reached lesser RU of 0.500, 0.502, and 0.507, respectively. Along with that, with 50 tasks, the CSO-TSS technique has accomplished raised RU of 0.613 whereas the L-PSO, TBSLB-PSO, and DLBA techniques have resulted to reduced RU of 0.589, 0.596, and 0.605, respectively.

After examining the above result and discussion, it is evident that the CSO-TSS technique has the capability of outperforming the other methods on distinct scenarios and measures.

5. Conclusions

In this study, the Anhui industry association has developed a wireless network-enabled big data environment as a result of recent advancements in wireless networks and communication technologies, which have been combined with significant development in environmental policies and public participation. The cloud server-based big data environment necessitates effective task scheduling in order to schedule tasks accurately and quickly. To help the Anhui industry association build its capacity in a big data, wireless network-enabled environment, this study presents a task scheduling scheme based on crow search optimization (CSO-TSS). It is the primary goal of the proposed CSO-TSS technique to schedule tasks in the wireless network-enabled big data environment. CSO-TSS is also implemented in a MapReduce environment to handle large datasets effectively. With this technique, an objective function is generated that aims to maximise resource utilization while also cutting down on task execution time. The improved task scheduling performance of the CSO-TSS technique was examined in a variety of ways through a wide range of simulations. The proposed CSO-TSS method has outperformed well than the existing methods.

Data Availability

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

Conflicts of Interest

The author declares that there are no conflicts of interest.

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References

[1] B. Kim, A. Barua, and A. B. Whinston, “Virtual field experiments for a digital economy: a new research methodology for exploring an information economy,” *Decision Support Systems*, vol. 32, no. 3, pp. 215–231, 2002.

[2] B. Carlsson, “The digital economy: what is new and what is not?,” *Structural Change and Economic Dynamics*, vol. 15, no. 3, pp. 245–264, 2004.

[3] R. L. Katz, S. Vaterlaus, P. Zenhäusern, and S. Suter, “The impact of broadband on jobs and the German economy,” *Intereconomics*, vol. 45, no. 1, pp. 26–34, 2010.

[4] H. Badioze Zaman, A. H. Norsiah, A. Ahmad et al., “A visual measurement model on human capital and ICT dimensions of a knowledge society (KS) framework for Malaysia towards an innovative digital economy,” in *Proceedings of the Visual Informatics: Sustaining Research and Innovations-2nd International Visual Informatics Conference*, Selangor, Malaysia, November 2011.

[5] V. D. W. Aryanto and A. A. Chrismastuti, “Model for digital economy in Indonesia,” *International Journal of Innovation in the Digital Economy*, vol. 2, no. 2, pp. 39–55, 2011.

[6] L. Mocean and C. M. Pop, “Marketing recommender systems: a new approach in digital economy,” *Informatica Economica*, vol. 16, no. 4, pp. 142–149, 2012.

[7] B. Beham, P. Drobnič, and S. Drobnč, “Who's got the balance? A study of satisfaction with the work-family balance among part-time service sector employees in five western European countries,” *The International Journal of Human Resource Management*, vol. 23, no. 18, pp. 3725–3741, 2012.

[8] C. K. Georgiadis, E. Stiakakis, and A. R. Ravindran, “Editorial for the special issue: digital economy and E-commerce technology,” *Operational Research*, vol. 13, no. 1, pp. 1–4, 2013.

[9] V. Turcan, A. Gribincea, and I. Birca, “Digital economy–a premise for economic development in the 20th century,” *Economy & Sociology Theoretical & Scientifical Journal*, vol. 2, pp. 109–115, 2014.

[10] F. Zhao, J. Wallis, and M. Singh, “E-government development and the digital economy: a reciprocal relationship,” *Internet Research*, vol. 25, no. 5, pp. 734–766, 2015.

[11] J. B. Liu, S. Wang, C. Wang, and S. Hayat, “Further results on computation of topological indices of certain networks,” *IET Control Theory & Applications*, vol. 11, no. 13, pp. 2065–2071, 2017.

[12] J. Itkonen, “How can we measure the modern digital economy?,” *Economic Outlook*, vol. 13, no. 3, pp. 6-7, 2016.

[13] L. Haimeng, C. Fang, and S. Sun, “Digital inequality in provincial China,” *Environment & Planning A*, vol. 49, no. 10, pp. 2179–2182, 2017.

[14] E. V. Popov and K. A. Semyachkov, “Problems of economic security for digital society in the context of globalization,” *Economy of Region*, vol. 14, no. 4, pp. 1088–1101, 2018.

[15] A. V. Todoru and V. Tselentis, “Digital technologies and the modernization of public administration,” *Quality-Access to Success*, vol. 19, no. 165, pp. 73–78, 2018.

[16] N. Trusova, “Government socio-economic policy under the digital economy in the foreign countries and Russia,” *Economic Annals*, vol. 180, no. 11-12, pp. 88–96, 2019.

[17] S. Andriy, K. Ganna, and S. E. Alexandru, “The analysis of the digital economy and society index in the EU,” *Baltic Journal of European Studies*, vol. 9, no. 3, pp. 245–261, 2019.

[18] E. Brynjolfsson, A. Collis, W. E. Diewert, F. Eggers, and K. J. Fox, *GDP-B: accounting for the value of new and free goods in the digital economy*, no. article 25695, 2019NBER Working Papers, 2019.

[19] J.-B. Liu and S. N. Daoud, “Number of spanning trees in the sequence of some graphs,” *Complexity*, vol. 2019, Article ID 4271783, 22 pages, 2019.

[20] L. Mazelis, K. Lavrenyuk, and A. Krasko, “Fuzzy approach for the formation of an optimal portfolio of strategic projects to achieve regional development targets in the digital economy,” *International Journal of Technology*, vol. 11, no. 6, pp. 1136–1147, 2020.

[21] M. N. Shafique, M. M. Khurshid, H. Rahman, A. Khanna, and D. Gupta, “The role of big data predictive analytics and radio frequency identification in the pharmaceutical industry,” *IEEE Access*, vol. 7, pp. 9013–9021, 2019.

[22] M. T. Pandian and R. Sukumar, “Performance enhancement with improved security an approach for formulating RFID as an itinerary in promulgating succour for object detection,” *Wireless Personal Communications*, vol. 109, no. 2, pp. 797–811, 2019.

[23] M. T. Pandian, S. N. Prasad, and M. Sharma, “Correction to: a detailed evolutionary scrutiny of PEIS with GPS Fleet tracker and AOMDV-SAPTV based on throughput, delay, accuracy, error rate, and success rate,” *Wireless Personal Communications*, vol. 121, no. 4, pp. 2653–2653, 2021.

[24] W. Huang, “Research on the revolution of multidimensional learning space in the big data environment,” *Complexity*, vol. 2021, Article ID 6583491, 12 pages, 2021.

[25] Y. Meraihi, A. B. Gabis, A. Ramdane-Cherif, and D. Acheli, “A comprehensive survey of crow search algorithm and its applications,” *Artificial Intelligence Review*, vol. 54, no. 4, pp. 2669–2716, 2021.

[26] A. Pradhan and S. K. Bisoy, “A novel load balancing technique for cloud computing platform based on PSO,” *Journal of King Saud University-Computer and Information Sciences*, vol. 39, 2020.