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Research Article

Comparison of Three Resouces Allocation Technique in Cloud Computing

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Abstract:

The shift to the cloud enables organizations of all sizes to swiftly, efficiently, and innovatively move their operations. The adoption of cloud computing has significantly transformed most organizations' work, communication, and collaboration methods, making it a crucial necessity for maintaining competitiveness in the digital age. Organizations are implementing cloud bursting to handle IT demand peaks by utilizing private cloud capacity and public cloud capacity, freeing up local resources for critical applications, and reverting data back to the private cloud. Organizations face challenges in allocating resources in cloud computing to automatically switch from private cloud to public cloud, leading to system issues, user frustration, operational failure, increased stress, and revenue loss. To address these concerns. This paper investigates traffic predictions by comparing three prediction tools, such as support vector machines, spatio-temporal, and edge-cloud collaborative schemes, and proposing conceptual solutions. Efficient cloud computing traffic management can prevent system bottlenecks, especially during peak periods, potentially leading to dissatisfied clients.

Keywords: Resource Allocation, Traffic Prediction, Cloud Computing.
Dataset link: -.

1. Introduction

Cloud computing can improve employee efficiency by improving communication, reducing downtime, and increasing company collaboration [1], [2]. The Internet of Things (IoT) is a cutting-edge technology that allows businesses to connect to on-demand IT infrastructure, such as servers, storage, and applications, over the internet. On the other hand, it is a low-cost way to manage websites and applications by spreading out the load across several servers to avoid downtime and keep things running smoothly [3].

Most organizations are now planning to invest in cloud bursting, this method allows organizations to handle Information Technology demand peaks by utilizing private cloud capacity [4]–[6], freeing up local resources for other critical applications [7]. In cloud computing, a hybrid resource allocation approach that is fault-tolerant is suggested. The results demonstrate that these approaches perform better in assuring task execution interruptions and handling dynamic compute-intensive grid system failures than classic minimal completion time (MCT) techniques [8].

In a cloud bursting model, private cloud deployment is used, with public cloud resources used during increased traffic [9]–[11]. Data is moved back to the private cloud after normal traffic levels are reached, with cloud bursts being triggered automatically or manually. Overflow traffic is directed to the public cloud without interruption. The local deployment technique application runs in a private cloud and bursts into a public cloud when demand for computing capacity increases [12]. In this regard, most organizations are struggling to predict the traffic and allocate the resources in cloud computing to identify the breaking point, which leads to system difficulty with file sharing, user frustration, operational failure, increased stress, and also loss of revenue for the organization.

The Activity Stream resource allocation was 85% accurate, but the application framework implementation is still in its early stages, and 100% accuracy in cloud computing is challenging [13], [14]. The main aim of this paper is to investigate resources allocation in cloud computing by comparing three prediction tools, such as support vector machines, spatio-temporal, and edge-cloud collaborative schemes, and proposing conceptual solutions. This article includes related work despite its introduction. The method, Recommendations, result, discussion and findings, and then the conclusion.

2. Method:

Research Design

The research design for this study will be divided into 3 steps, such as the research process, where the data collection, research questions, and search criteria are defined, followed by the research material and justification, the simulation process, validation, and evaluation, and the final steps will share recommendations from this study (see **Figure 1**):

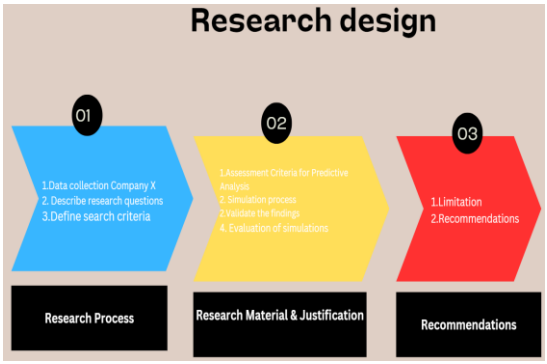

Figure 1. Federated learning using TinyML edge device

Research Process

Data Collection

The data collection strategy for this project will be based on hybrid data collection, Company X's application programming interface (open for research) will supply cloud computing data, while unsupervised data gathering, training, testing, and simulation will take place. The subsequent research inquiry is employed: Which methods are used for computer services in data science?

How can Company X address the lag and unavailability of cloud computing services using three online resouces allocation technique in cloud computing?

Research Material and Justification

In order to investigate the tools that are used to investigate data science techniques to improve cloud computing services, the process entails downloading the dataset, preparing, analyzing, and exporting the data, renaming the dataset, and simulating computing service slowness and downtime.

Predictive analysis heavily relies on the assessment metrics [15]. This study used the method of mean absolute percentage error, or MAPE, to assess the degree of agreement between the expected and actual results. The formula below is used to compute MAPE:

$$MAPE = \frac{100}{h}\sum_{t=1}^{h}\frac{p_t - k_t}{p_t} \quad (1)$$

Where p_t is the actual value and k_t is the predicted value.

Recommendations

In order to enhance the slowness and unavailability of cloud computing services, this study suggests predictive analysis. As a result, future research will concentrate on resource allocation. The study also suggests using an ensemble approach to improve overall cloud computing service management and resource allocation performance.

3. Results and Discussion

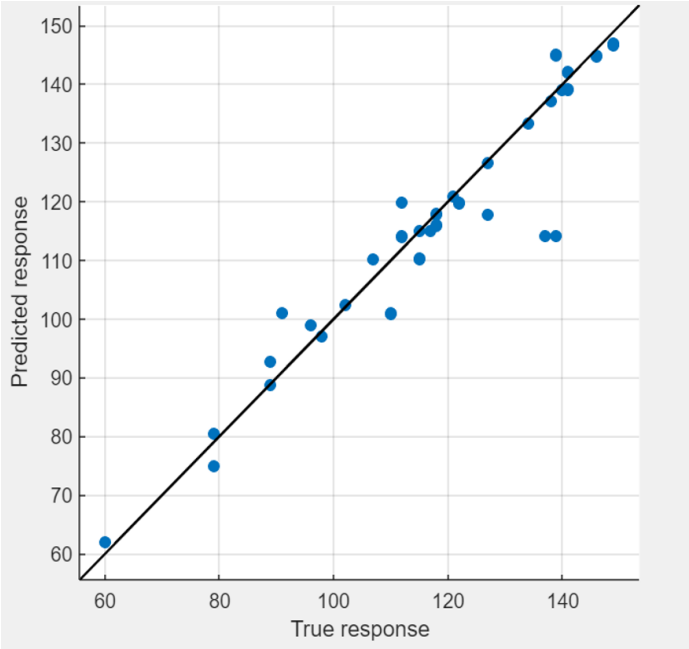

Figure 2. Support Vector Machine Results

In the results shown in **Figure 2**, traffic flow constantly increased, support vector machine traffic increased, and error evauluation increased as the results increased.

Table 1. Support Vector Machine Analysis (%)

Support Vector Machine (%)	Prediction (%)	Resources allocation	Mape (%)
62	56	51	8.93
75	64	59	7.81
80	72	61	15.28
89	81	79	25.35
92	80	75	6.25
98	92	69	25.0
119	100	52	48
127	118	51	56.78
132	121	49	59.50
139	125	48	61.60
141	132	52	60.61
147	140	60	57.14

Mape Average = 36.02

In **Table 1**, there are twelve traffic flows, predictions, and allocations of resources. Support vector machine scheme results show the unstable of the resource allocation when traffic decreases; the error is minimized, and when traffic flow increase the technique shows a high value of error with the average of 36.2 % MAPE results.

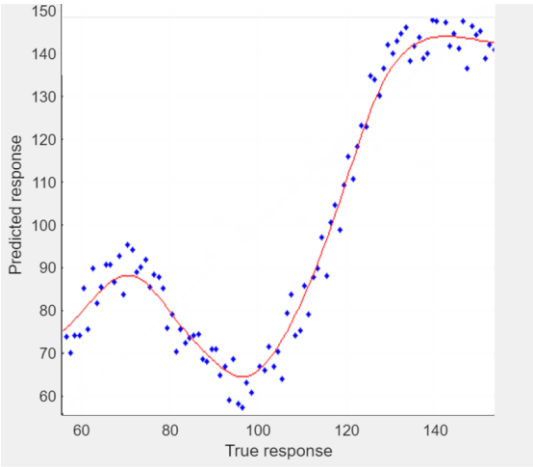

Figure 3. Spatio-temporal Results

In the results shown in **Figure 3**, traffic flow was unstable during the simulation process of Spatio-temporal technique where there is high volume of traffic there is also high volume of error.

Table 2. Spatio-temporal Analysis (%)

Spatio-temporal (%)	Prediction (%)	Resources allocation	Mape (%)
70	66	54	18.18
81	74	61	17.57
60	49	45	8.16
65	60	55	8.33
87	80	75	6.25
90	92	69	25.0
110	92	76	17.39
127	105	70	33.33
132	123	59	52.03
136	127	120	5.51
147	140	127	9.29
155	147	130	11.57

In **Table 2**, there are twelve traffic flows, predictions, and allocations of resources. Spatio-temporal scheme results show the unstable of the resource allocation when traffic increases in high volume; the error is minimized, and the avarage of the mape average is 17.75%.

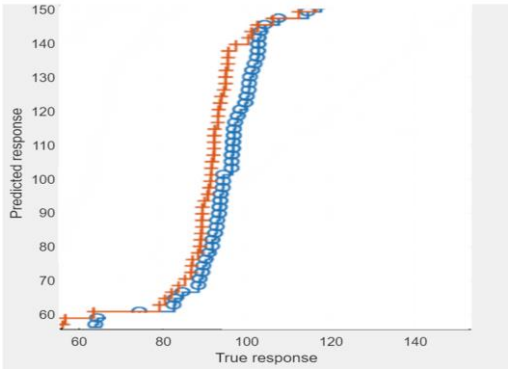

Figure 4. Edge-cloud Collaborative Scheme Results

In the results shown in **Figure 4**, the edge-cloud collaborative scheme shows promising results where allocation of resources shows stable results when traffic increases and the error is reduced.

Table 3. Assessment Criteria for Predictive Analysis (%)

Edge-cloud collaborative scheme (%)	Prediction (%)	Resources allocation	Mape (%)
60	63	61	3.17
70	69	68	1.44
80	85	83	2.35
93	91	86	5.49
100	99	87	10.3
110	107	106	0.93
120	115	116	0.87
130	125	126	0.80
140	130	139	6.92
147	144	137	4.86
145	143	141	1.39
150	157	154	8.28

In **Table 3**, there are twelve traffic flows, predictions, and allocations of resources. Edge-cloud collaborative scheme results show that when traffic decreases, there is an increase in error evaluation, and when traffic increases, the error is reduced. The average mape is 3.9%. This method can perform very well when there is a high volume of traffic.

4. Conclusion

This study performed a simulation of three online resource allocation techniques in cloud computing, which are support vector machine, spatial-temporal and edge-cloud collaborative schemes. The results show the unstable nature of resource allocation when traffic decreases; the error is minimized; and when traffic flow increases, the technique shows a high value of error with an average of 36.2%.where Spatio-temporal scheme results show the instability of the resource allocation when traffic increases in high volume; the error is minimized, and the avarage of the mape average is 17.75%, and Edge-cloud collaborative scheme results show that when traffic decreases, there is an increase in error evaluation, and when traffic increases, the error is reduced. The average map is 3.9%. This method can perform very well when there is a high volume of traffic. In this regard, only the Edge-Cloud collaborative scheme shows promising results, especially when there is a high volume of traffic. The study limitation is that when the traffic is greater than 30%, this technique is unable to allocate resources correctly and raises a risk to the company of wasting resources because a high volume of resources will be allocated and are unused. In this regard, this study proposes the Ensemble method as a future technique for building several models and combining them to get better outcomes.

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