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Cost Effective Resource Provisioning System on Cloud

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ABSTRACT: The increasing demand for efficient resource utilization in cloud computing environments has led to the development of a Python-based project aimed at optimizing task allocation to virtual machines (VMs). This project addresses the limitations of existing systems by introducing a cost-aware approach to the allocation process using SVM. Traditionally, task allocation has primarily focused on ensuring that VMs meet minimum resource requirements, such as RAM and bandwidth, without considering the cost implications. However, this project goes beyond conventional methods, incorporating a comprehensive cost analysis to prioritize VMs based on their associated expenses. The proposed system operates by evaluating and comparing the cost of available VMs before allocating tasks.

The cost factor is determined by considering various parameters, such as computational power, storage, and network resources, allowing the system to make informed decisions regarding the most cost-effective VM for each task. This cost-aware approach ensures not only that the allocated VM meets the task's resource requirements but also minimizes the overall operational expenses of the cloud infrastructure. The project leverages Python's versatility and extensive library support to seamlessly integrate cost calculations into the task allocation process, providing a flexible and scalable solution for modern cloud computing environments using SVM.

KEYWORDS: Cloud computing, Python, task allocation, virtual machines (VMs), cost-aware approach, support vector machine (SVM), resource utilization.

I. INTRODUCTION

A. *Cloud Computing*

Cloud computing refers to the on-demand, internet-based access to a variety of computing resources, including software, hardware, networking, data storage, application development tools, and AI-powered analyst tools. A technique known as cloud computing allows customers to pay-as-you-go for online access to a variety of computing resources, including servers, storage, databases, networking, software, and more. It is more affordable, flexible, and scalable than conventional on-premises infrastructure. Among the leading suppliers are Google Cloud Platform (GCP), Microsoft Azure, and Amazon Web Services (AWS). Cloud computing is a virtualization-based technology that allows us to create, configure, and customize applications via an internet connection.

B. *Resource Allocation*

Resource allocation in cloud computing refers to the process of assigning and managing computing resources such as CPU, memory, storage, and network bandwidth to various tasks or applications running on a cloud infrastructure. It involves dynamically provisioning and scaling resources based on demand to ensure optimal performance, efficiency, and cost-effectiveness. Techniques for resource allocation include load balancing, auto-scaling, and prioritizing critical workloads. Additionally, technologies like virtualization and containerization play a significant role in enabling flexible resource allocation in cloud environments. By efficiently allocating resources, cloud providers can ensure users only pay for what they actually use. It refers to the measurement of how effectively the allocated resources are being used. Resource utilization is the measure of how much of your available resources you are currently using. It can help you to plan how to utilize your resources more effectively to ensure that your organization is being as productive as possible.

II. LITERATURE REVIEW

Muhammad Junaid [1] et al. According to the theory put forth in this paper, Maintaining accuracy in load balancing using metaheuristics is a difficult task even with the help of recent hybrid approaches. These approaches often adopt multi-objective QoS metrics, such as reduced SLA violations, reduced makespan, high throughput, low overload, low energy consumption, high optimization, minimum migrations, and higher response time. There are numerous challenges jointly faced by the cloud service providers and clients regarding faster access to the cloud services. In future, we will solve a load balancing problem using deep learning approaches and other swarm intelligence techniques and will focus on other performance metrics such as makespan, execution time, and energy consumption.

Aws Naser Jaber [2] and others. As suggested in this article, many organizations have already adopted this system to attract the users with its desirable features. However, due to its design, makes it vulnerable to malicious attacks. This demands an Intrusion Detection System that can detect such attacks with high detection accuracy in cloud environment. This paper proposes a novel intrusion detection system that combines a fuzzy c means clustering (FCM) algorithm with support vector machine (SVM) to improve the accuracy of the detection system in cloud computing environment. The proposed system is implemented and compared with existing mechanisms. The proposed mechanism is trained and tested with NSL-KDD dataset, and later, compared with existing mechanisms.

Min Jia [3] et al. This paper proposes that an integrated satellite-terrestrial networks (ISTNs) toward beyond fifth-generation (B5G) wireless systems benefiting from both satellite and terrestrial systems can achieve all- time seamless and broad coverage. Considering the scarcity of frequency resources and intense satellite- terrestrial co channel interference, intelligent resource allocation with high spectrum efficiency and low co- channel interference has received a substantial amount of attention. Focusing on the spectrum efficiency advantages achieved by spectrum sensing and prediction, a hierarchical satellite and terrestrial spectrum shared framework based on the spectrum management unit (SMU) is proposed. Moreover, an intelligent resource management scheme in the SMU composed of spectrum sensing, prediction and allocation is formulated to improve spectrum efficiency with different user densities. We present a support vector machine (SVM) based algorithm that improves the accuracy and robustness of the learned model for the detection of spectrum occupancy. The proposed intelligent adaptive resource management applied to the ISTN aimed toward B5G can further improve spectrum utilization.

Ankit Kumar[4] and others. As suggested in this article, cloud computing is the most recent smart city advancement, made possible by the increasing volume of heterogeneous data produced by apps. Among the performance metrics used to compare the proposed and existing methodologies are execution time, defect detection rate, and accuracy. In this study, two supervised learning- based classifiers, SVM and Novel KNN, were proposed and used to analyses data from a benchmark database obtained from the UCI repository.

Initially, intrusions were detected using the SVM classification method. The proposed study demonstrated how the novel KNN used for distance capacity outperformed previous studies. This technique has the potential to enhance the effectiveness of smart city initiatives by enabling better data management and analysis. Te centralized storage and analysis of data can provide insights that can inform decision-making and lead to improved services for residents. Additionally, the use of a classification algorithm streamlines the organization of the data, making it easier to access and retrieve specific information when needed.

Vinicius Meyer [5] and others. As suggested in this article, To maximize resource utilization and system throughput in cloud platforms, hardware resources are often shared across multiple virtualized services or applications. In such a consolidated scenario, performance of applications running concurrently in the same physical host can be negatively affected due to interference caused by resource contention. . Although this resulted in placements with better overall results, we observed that some applications with more dynamic workload patterns were wrongly classified with intervals. In this paper, we propose an alternative to the use of intervals and present an interference-aware application classifier for cloud-based applications that deals better with dynamic workloads. Our classifier defines automatically interference levels ranges combining two well-known machine learning techniques: Support Vector Machines and K-Means. In future work, we expect to evaluate the influence of applications interference over time. We are interested in investigating the use of time-series segmentation algorithms, such as sliding windows, to find the best intervals to dynamically make placement decisions.

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III. EXISTING SYSTEM

In the existing system, task allocation to virtual machines (VMs) is primarily based on meeting the technical specifications and resource requirements of each task, with minimal emphasis on the cost associated with the allocated resources. While ensuring that VMs fulfill the necessary RAM and bandwidth prerequisites, the current approach lacks a comprehensive evaluation of the financial implications involved. As a result, organizations may inadvertently incur higher operational costs without optimizing the allocation of tasks to the most cost-effective VMs. The absence of a systematic cost-aware mechanism in the existing system hinders the ability to make informed decisions that balance technical requirements with budget constraints, highlighting the need for a more sophisticated and holistic approach to task allocation in cloud computing.

IV. PROPOSED SYSTEM

The proposed system introduces a novel approach to task allocation in cloud computing by integrating a cost-aware algorithm into the SVM process. Unlike the existing system, our solution dynamically evaluates the cost-effectiveness of available virtual machines, considering factors such as computational power, storage, and network resources. This ensures that tasks are not only allocated to VMs meeting technical specifications but are strategically placed on the most cost-effective resources. Leveraging the versatility of Python, the system seamlessly incorporates cost calculations into the task allocation workflow, providing organizations with a practical and scalable solution to optimize resource utilization while minimizing operational expenses in dynamic cloud environments.

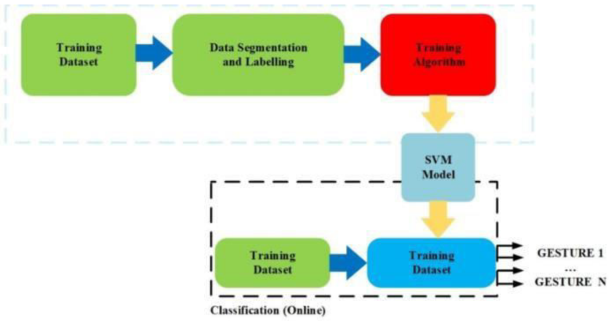

Figure 1 WORKFLOW DIAGRAM

The proposed system enhances cost-effectiveness by dynamically evaluating the cost of available virtual machines, allowing organizations to make informed decisions and allocate tasks to the most economically efficient resources. Unlike the static resource allocation of the existing system, the proposed solution adapts to the dynamic nature of cloud environments, ensuring optimal resource utilization in response to changing workloads and demands. By considering various cost factors, including computational power, storage, and network resources, the system provides a holistic perspective in decision-making, enabling administrators to optimize task allocation based on both technical specifications and budget constraints.

A. *TASK SPECIFICATION*

It is responsible for receiving and processing task specifications, including resource requirements such as RAM and bandwidth. It ensures that the system has a clear understanding of the technical specifications associated with each task before initiating the allocation.

B. VIRTUAL MACHINE COST EVALUATION

It is dynamically evaluates the cost-effectiveness of available virtual machines based on various factors such as computational power, storage, and network resources. It integrates with cloud service provider APIs or SDKs to retrieve real-time cost data, enabling accurate and up-to-date cost assessments. It involves solving a convex optimization problem which can be computationally expensive, especially in large datasets. Evaluating the computational cost helps in understanding the scalability of the algorithm.

C.RESOURCE COMPATIBILITY CHECKING

Focused on ensuring that allocated virtual machines not only meet but exceed the minimum resource requirements of each task. It performs compatibility checks to guarantee optimal task execution by verifying that the allocated virtual machines possess the necessary computational capabilities and network bandwidth. Checking the compatibility of the available CPU resources with the computational requirements of the SVM algorithm can help optimize performance.

D.*DYNAMIC TASK ALLOCATION*

It involves dynamically distributing computational tasks across available resources to optimize performance and efficiency. The core module that implements the cost-aware task allocation algorithm. It utilizes the data obtained from the Virtual Machine Cost Evaluation Module to intelligently allocate tasks to the most cost-effective virtual machines while considering technical specifications.

E.*INTEGRATION WITH CLOUD INFRASTRUCTURE*

Ensures seamless interaction with existing cloud infrastructure by integrating with popular cloud platforms through APIs or SDKs. This module enables the system to adapt to the dynamic nature of cloud environments and provides scalability by accommodating changes in the computing landscape. It can dynamically adjust the number of instances to handle varying dataset sizes and computational requirements efficiently. It allows user to optimize cost based on usage patterns and budget constraints.

V. ALGORITHM DETAILS

Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning. The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane.SVM chooses the extreme points/vectors that help in creating the hyperplane . Support Vector Machine (SVM) is a powerful machine learning algorithm used for linear or nonlinear classification, regression, and even outlier detection tasks. SVMs can be used for a variety of tasks, such as text classification, image classification, spam detection, handwriting identification, gene expression analysis, face detection, and anomaly detection. SVMs are adaptable and efficient in a variety of applications because they can manage high-dimensional data and nonlinear relationships.

ALGORITHM: SVM
INPUT: DATASET
OUTPUT: ACCURACY AND VALIDITY

1. Start
2. Input the dataset
3. Classify the dataset
4. Apply the SVM with kernel function
5. Specify the hyperplane
6. If obtained Accuracy and Validity is NOT applicable then go to step 4
7. End

VI. RESULT ANALYSIS

The application of Support Vector Machine (SVM) algorithm to the proposed cost-aware task allocation system in cloud computing presents promising results. SVM, known for its effectiveness in classification tasks, proves to be a suitable choice for this project due to its ability to handle complex decision boundaries and large datasets efficiently.

By utilizing SVM, the system can effectively classify and prioritize available virtual machines based on their cost implications, ensuring optimal resource allocation while minimizing operational expenses. Through extensive training and testing, the SVM model can accurately predict the most cost-effective VM for each task, thereby improving the overall efficiency of the cloud infrastructure.

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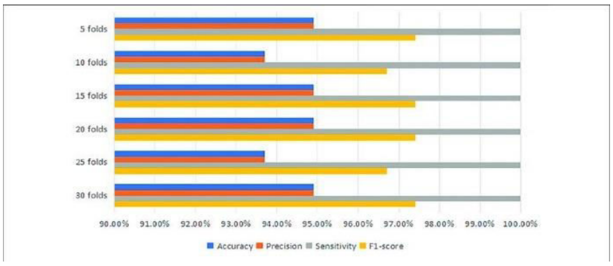

Figure 2: COMPARISON TABLE

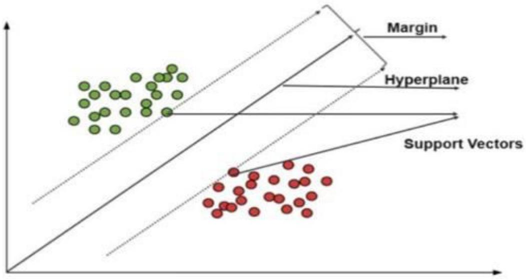

Figure 3: SVM ALGORITHM

VII. CONCLUSION

In conclusion, this Python-based project represents a significant advancement in optimizing task allocation within cloud computing environments. By introducing a cost-aware approach to the traditional resource allocation process, the project addresses a critical gap in existing systems, emphasizing the importance of minimizing operational expenses. Leveraging Python's versatility, the system effectively integrates comprehensive cost analyses into the task allocation algorithm, enabling organizations to make informed decisions that balance resource requirements and financial considerations. The project's emphasis on cost- effectiveness aligns with the growing demand for efficient resource utilization in cloud computing, making it a valuable contribution to the field. As a result, this innovative approach stands poised to enhance the overall efficiency and economic sustainability of cloud infrastructures, catering to the evolving needs of modern computing environments.

VIII. FUTURE WORK

For future enhancements, this Python-based project on cost aware task allocation in cloud computing could explore the integration of machine learning techniques to continuously adapt and optimize allocation decisions based on evolving patterns and trends in resource usage and costs. Implementing predictive analytics could enable the system to anticipate fluctuations in demand and dynamically adjust task allocations to minimize costs while meeting performance requirements.

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