SKY CLOUD: A COMPARATIVE SURVEY ON EMERGING CLOUD COMPUTING TECHNIQUES WITH AI AND ML

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ABSTRACT

Beginning with an overview of cloud computing, this paper explains its fundamental ideas and discuss some of its most important characteristics, including scalability, flexibility, and demand. It describes the advantages and uses of cloud computing's resources, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), comparison of cloud -based AI and ML framework their many responsibilities. The advantages and drawbacks of cloud computing are also covered in this study. Benefits including reduced investment costs, increased production, and improved teamwork are evident. Additionally, it discusses risk-mitigation strategies such data encryption, authentication procedures, and compliance standards as well as security and privacy concerns related to cloud computing. It demonstrates how cloud computing may assist innovation and enhance performance by examining the effects of these firms on efficiency, effectiveness, and cost effectiveness. Finally, the study paper discusses upcoming technologies including serverless computing, edge computing, and packaging to show future trends and advancements in cloud computing. In a nutshell, by using AI and ML this research study offers a thorough analysis by looking at the cloud computing structure, deployment approach, benefits, difficulties, and real-world applications. It gives enterprises, decision-makers, and researchers insight on how to fully utilize cloud computing in an increasingly digital world.

KEYWORDS: *Cloud computing, AI/ML, cloud security, cloud storage*.

1. INTRODUCTION

The term cloud computing has emerged recently but has not been widely used. Among the many definitions available, the simplest is "a network solution that provides affordable, reliable, simple and easy access to IT resources. Cloud computing is considered service-oriented, not application oriented. The service-oriented nature of cloud computing not only reduces equipment overhead and cost of ownership, but also offers flexibility and improved performance to end users. A central concern of the cloud technology revolution is security and privacy. Ensuring data integrity, confidentiality and security is critical for cloud services. For this purpose, some service providers use different strategies and methods depending on the nature, type, and size of the data. One advantage of cloud computing is that data can be shared between different organizations. However, this advantage brings risks to the data. To avoid data risk, it is necessary to protect stored data. One of the most important questions when using clouds to store data is whether to use third-party cloud services or create a cloud organization. Sometimes information, such as national security information or confidential information for future products, is too important to store in the cloud. Such data can be very sensitive and the consequences of exposing such data in the cloud can be huge. In this case, it is recommended to use a company in the cloud to save the data. This approach helps protect data from local data management through policies

[1]. It has become a cloud computing bug. Data storage is considered one of the main factors in terms of security, accessibility, reliability, and cost. As technology advances, Internet use becomes more common, and hardware and software costs increase accordingly. The cloud service concept has been successful and profitable in the short term to reduce hardware and software costs by providing services tailored to the needs of users over the Internet. Cloud services have recently become a solution because one of the main reasons why management turns to IT is not a new idea, but the fact that there are small fees to pay. But as we grow and develop, we see computer electronics expand and serve the same purpose in the homes and offices of people across the country as electronics and telephones do today. Now we see that his predictions were correct, and he talks about the use of electricity today. In the 1990s, when grid computing was born and offered services on demand. Resources depend only on how much they are used [2].

Productivity challenges and recording of financial information were observed e.g., a major problem for businesses until the adoption of cloud storage. The cloud was not immediately seen as a serious solution to this problem. However, the cloud has striven to become one of the most important and fundamental technologies that other technologies rely on. In addition to backup, a high level of organization was essential for large databases. Artificial intelligence was first applied to organizational issues cloud and then became essential to it[3]. Currently, the most advanced cloud platforms are those merged with artificial intelligence (art intelligence) provides. Artificial intelligence is also important for big data analytics and aimed at the development of cloud and artificial intelligence [4].

Cloud service providers combine large amounts of computing, storage, and networking resources and make those resources available to users through virtualization and other technologies. These funds are allocated as needed and paid based on volume. With the continuous development of cloud computing technology, its application area is expanding and expanding. In the early days of cloud computing, the problems of dividing tasks and combining results were simply solved by distributed computing. Therefore, cloud computing is also called network computing. This technology can process tens of thousands of data in a very short time (seconds), enabling high performance web services [5].

Big data is important because people exchange countless units of data in real time, not to mention the amount of data produced historically. This knowledge is priceless if addressed correctly [6]. The cloud and artificial intelligence give society a better price-quality ratio compared to previous traditional technologies, better organization, access to information not available before and data storage is even more secure for modern column technologies Amazon offers an advanced analytics service as one of its core services [6].

1.1 Overview of cloud computing AI/ML

The main goal of the rapid development of artificial intelligence is to better serve other industries. AI-as-a-Service products based on cloud computing also best represent this development goal.

In order to maintain a leading position in the market competition, more and more AI companies are trying to integrate AI technology with other related applications, products, services and various methods of big data analysis. Modern companies hope to use artificial intelligence technology to create one of the easiest and most popular ways to use artificial intelligence products as services based on cloud computing [32].

Artificial intelligence has already become an integral part of our lives. GPS tracking services, high-speed voice recognition, digital assistants, chatbots and automated repair services are common examples of AI.

But the range of apps goes far beyond Siri and Amazon Alexa. Artificial intelligence and cloud computing offer analytics solutions, data mining and processing applications, cloud security automation, overall savings and better decision making with AI-based solutions.

As the speed of big data increases, so does the need for integrated systems of flexibility, security and efficiency. Artificial intelligence will play an important role in companies in the near future in improving big data management, customer experience and security. This white paper explores how artificial intelligence is shaping the future of small and large organizations through AI technologies and the scale of those technologies [33].

1.2 Cloud based AI/ML Frameworks

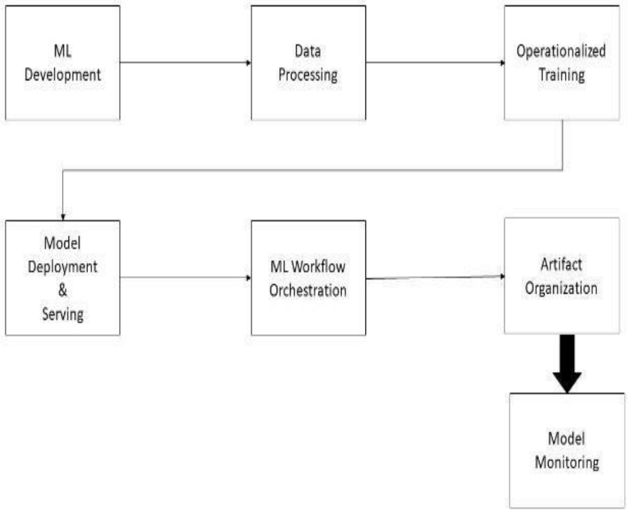

Figure 1 Cloud Implementation using ML

1.2.1 Amazon Sage-Maker

A fully managed service for building, training, and deploying machine learning models. It offers a suite of user algorithms, distributed training capabilities and integration with AWS infrastructure.
AWS Deep Lens: a video camera with deep learning capabilities that integrates with AWS services to build and deploy models for computer vision [34].

1.2.2 AWS Recognition

A deep learning-based image and video analysis service that can recognize objects, people, text and scenes from images and videos [35].

1.2.3 Google Cloud AI Platform

A comprehensive platform for training, deploying and managing ML models. It offers a wide range of tools to automate machine learning tasks, including Auto-ML [36].

1.2.4 Google Auto-ML

An automated machine learning service that allows users to build custom ML models without extensive knowledge [37].

1.2.5 Google Vision API

An image analysis service that can identify and understand the content of images, such as objects, faces, and text [38].

1.2.6 Azure Machine Learning

A cloud-based service that enables end-to-end machine learning workflows, including model development, training, deployment, and monitoring [39].

1.2.7 Azure Cognitive Services

A suite of artificial intelligence services, including computer vision, natural language processing and speech recognition, that can be easily integrated into applications [40].

1.2.8 Azure Custom Vision

A service that allows users to build custom image classification models using their own identified datasets [41].

1.2.9 Watson Studio

An integrated environment for building, training, and deploying artificial intelligence models. It supports multiple programming languages and offers collaborative features [42].

1.2.10 Watson Assistant

A service for creating AI chatbots and virtual assistants that understand and respond to user questions [43].

1.2.11 Watson Visual Recognition

Service for training custom image classifiers and visual analysis of images and videos [44].

1.3 Comparison of cloud-based AI and ML frameworks

1.3.1 Watson Visual Recognition

1.3.1.1 Features

Sage Maker provides a comprehensive platform for building, training, and deploying machine learning models. It supports many frameworks such as TensorFlow, Py-Torch and MX Net. It also provides automatic model updates, built-in algorithms, and integration with other AWS services.

1.3.1.2 Scalability

Sage Maker is designed to scale seamlessly, allowing you to train models on large datasets spread across multiple instances.

1.3.1.3 Easy to use

It provides a user-friendly interface and simplifies machine learning workflows with off-the-shelf notebooks and simple model options. However, some jobs may require training.

1.3.2 Google Cloud AI Platform

1.3.2.1 Features

AI Platform provides the foundation for building and implementing AI/ML models. Among other things, it supports Tensor Flow, scikit-learn, and XGBoost. Provides access to predefined models, hyper parameter editing and Auto ML features.

1.3.2.2 Scalability

Google Cloud AI Platform can handle training at scale and distributed across multiple instances to improve efficiency.

1.3.2.3 Ease of use

It integrates well with other Google cloud services and makes it easy to set up and manage your machine learning pipeline. The platform features a user-friendly web interface and scripting tools for easy interaction.

1.3.3 Microsoft Azure Machine Learning

1.3.3.1 Capabilities

Azure Machine Learning provides a variety of tools for building, training, and deploying models. It supports many frameworks such as TensorFlow, Py-Torch and scikit-learn. It provides automated machine learning, model interpretation, and integration with Azure services.

1.3.3.2 Scalability

Azure Machine Learning enables you to distribute workloads across multiple nodes by providing scalable training and inference by leveraging Azure infrastructure.

1.3.3.3 Easy to use

It has a user-friendly interface with drag and drop functionality, Jupiter notebook integration, and comprehensive SDKs for various programming languages.

1.3.4 IBM Watson Machine Learning

1.3.4.1 Features

Watson Machine Learning provides tools for building and implementing models. Support for popular frameworks such as Tensor Flow, PyTorch, and Keras. It offers machine learning capabilities, a simple deployment model, and integration with Watson Studio.

1.3.4.2 Scalability

Watson Machine Learning leverages the IBM Cloud infrastructure to provide scalable training and inference across distributed resources.

1.3.4.3 Easy to use

It has a user-friendly web interface and integrates with other IBM cloud services. However, some advanced features may require experience in the IBM Cloud ecosystem.

2. LITERATURE SURVEY

Alvaro López García et. al [7], suggests that, the DEEPHybrid-Data Cloud framework is suggested in this study with the goal of offering machine learning practitioners a complete collection of tools and cloud services encompassing the whole machine learning development cycle. Model development, training, validation, testing, serving, sharing, and publication are tasks that fall under this category.

In order to efficiently use distributed resources for compute-intensive tasks in machine learning research, the framework enables transparent access to already-existing e-Infrastructures. Through cloud-based services, a serverless architecture, and a DevOps methodology, it enables scientists to make their models accessible to the general public. This makes it easier to share, publish, and use developed models.

The community-driven DEEP project intends to assist user groups in creating machine learning services and applications without having to worry about technical concerns. The project focuses on biological research communities.

Ala'a Al-Shaikh et. al [8], Suggests that, in order to address the issue of resource usage in cloud computing, this In order to address the issue of resource usage in cloud computing, this study provides an algorithm based on the greedy method. The issue is predicated on a privately held cloud that connects to the Internet and provides worldwide service to numerous consumers. The goal is to determine the most profitable usage schedule for a given resource in terms of the number of time slices it will be used. Its computational difficulty is demonstrated by the fact that the problem is NP-Complete. To create an effective solution, the suggested algorithm combines the 0/1 Knapsack issue and the activity-selection problem. The algorithm is implemented in Java, and its runtime complexity is determined to be O((FS)nLogn), where F is the highest possible profit and S is the number of time slices.

Chandresh Kumar Chhatlani et. al [9], Suggests that, Security worries, particularly those related to possible data breaches, have slowed the rise of cloud computing. To combat this, businesses are shifting to private clouds and putting in place a range of security measures to enhance public perception of cloud computing. To protect data and set guidelines between Cloud Service Providers and end users, government regulations are anticipated to be passed. New tools with enhanced user interfaces, speed, economic efficiency, accuracy, and security will be created in the future. According to studies, cloud computing will grow in acceptance by 2020, with private clouds seeing a higher rate of adoption because of their organizational control and focused operation.

Efficiency and collaboration will be improved by the idea of domain linkages and shared services among cloud domains.

Access to computing resources on a worldwide scale will be made simpler by a proposed domain relationship model via an intermediary platform.

With better flexibility and application generalization, cloud computing presents interesting potential. Data analysts and programmers will have more chances since cloud providers will keep their data updated more frequently than cloud users.

The adoption of private clouds and the implementation of strict security measures can assist to clear up the cloud computing industry's murky reputation, even though security concerns have generally slowed down the expansion of the cloud computing industry. Government restrictions, better tools and interfaces, domain cooperation, more customization options, and better data management capabilities are all aspects of the cloud computing future.

Aleksandar Petrović et. al [10], Suggests that, the integration of artificial intelligence (AI) and cloud-based storage options is examined in this research in light of the expanding popularity and uptake of cloud computing. It starts by giving a quick overview of each technology before going into detail about the advantages that can be obtained by integrating them. The analysis emphasizes social and economic benefits.

The study demonstrates how AI may improve cloud storage by enabling sophisticated data analysis and classification techniques. The corporate world has adopted the habit of storing massive volumes of data in the cloud, and AI offers the means to uncover insightful information from this data. However, the authors also issue a warning about the possible dangers and difficulties connected with the fusion of cloud and AI technology. The report highlights the necessity of ongoing research and development to enhance current solutions and maybe open the door for the advent of universal AI. It also emphasizes the significance of adopting legal guidelines to address the potential dangers and effects of AI. Although the authors admit that the marriage of AI with cloud computing fosters creativity and has the potential to benefit society, it should be used with prudence. In conclusion, This paper examines the benefits and advancements brought about by the combination of AI and cloud storage technologies. It analyzes the advantages, difficulties, and hazards connected with this combination and highlights the requirement for additional study, development, and regulatory concerns.

Ashawa Et Al [11], Suggests that, the main topic of this study is resource distribution in large-scale distributed computing, particularly in the light of cloud computing. The goal is to maximize throughput, or overall computer efficiency. In the paper, cloud computing is distinguished from grid computing, and the difficulty of distributing different virtualized resources in cloud environments due to a variety of application workloads is acknowledged.

The LSTM (Long-Short Term Memory) method is suggested for use in the research's construction of a dynamic resource allocation system. The best additional resource to allot is determined by this system's analysis of application resource use. Virtually real-time simulations show how well the trained LSTM model allocates resources. Additionally, the study investigates the advantages of incorporating dynamic routing methods, particularly for cloud data center traffic.

The advantages of MCTS when traffic patterns are stable are highlighted by comparisons between LSTM and Monte Carlo Tree Search (MCTS).

In comparison to alternative load balancing methods, the suggested model for resource allocation exhibits improved accuracy rates and decreased error percentages in traffic load average request blocking likelihood. The study recommends further investigation into the implementation of cloud data centers employing various machine learning and heuristic methodologies for load balancing.

The research does, however, admit some constraints. It did not consider power minimization or energy usage in wired and wireless networks. Without testing on more network data, the experimental results, which are based on a small number of networks, may not be generalizable.

In summary, this study uses the LSTM algorithm to examine dynamic resource allocation in cloud computing. It investigates the incorporation of dynamic routing algorithms and contrasts MCTS with LSTM. In comparison to alternative load balancing strategies, the suggested model shows higher accuracy and lower error rates. Future research will focus on network device energy consumption and power minimization as well as additional algorithm creation and implementation in cloud data centers.

Sachin Shankar Bhosale et. al [12], Suggests that, Since Amazon's cloud services were launched in 2006, cloud computing has grown significantly in prominence. The number of local businesses using cloud services is anticipated to increase as a result of Hong Kong's extensive data processing needs across numerous industries. The study of cloud computing has grown significantly in importance in computer science, especially when it comes to large data, where cloud computing is crucial.

Further demonstrating the importance of cloud computing is Lenovo's opening of a sizable cloud R&D facility in Hong Kong. It has the potential to drastically change a substantial segment of the IT sector by increasing the availability of software as a service and influencing the creation and acquisition of IT hardware. With cloud computing, developers are no longer required to make significant hardware investments or pay for ongoing expenses. They can scale their services in accordance with demand, preventing resource waste or losing out on potential clients and income.

Utilizing cloud computing enables businesses with big batch-oriented operations to scale their programs across several servers without incurring additional fees, resulting in speedier outcomes. This level of resource flexibility without the requirement for substantial investments is unheard of in the history of IT. The advent of cloud computing heralds the start of a new age in data and communication technologies that has the potential to transform conventional computing methods.

Although customers are still getting used to this technology, cloud computing is gradually replacing traditional computers. This change makes it possible for programmers with creative ideas for internet services to create their tools and applications without incurring major up-front fees.

As a result of its scalability, affordability, and flexibility, cloud computing has revolutionized the IT sector. Significant interest and acceptance are being driven by its influence on computing methods and the potential to alter numerous industries in Hong Kong and throughout the world.

Peter Kairouz Et. al [13], Suggests that, Federated learning (FL) is a machine learning strategy where numerous clients work together to train a model while maintaining decentralized data under the supervision of a central server. The challenges and unresolved issues surrounding FL are examined in this paper along with current developments in the field.

FL addresses the costs and privacy hazards associated with centralized machine learning and data science methodologies by concentrating on data acquisition and minimization. The research underlines the requirement for diverse privacy approaches to be tailored to FL deployments in the real world. This entails using several independent actors, training different machine learning models over overlapping populations with time-evolving data, and considering non-deterministic elements like client availability while preserving privacy and utility without exhausting the privacy budget.

Several approaches are put forth to deal with these difficulties, including trusted execution environments (TEEs), homomorphic encryption (HE), and secure multiparty computation (MPC). Although some MPC techniques have been effectively scaled up for critical FL operations, many vital functionalities still call for a significant amount of communication and compute resources. Creating a trustworthy and impervious to exploit TEE platform, as well as setting up supporting infrastructure and procedures to guarantee particular privacy features, remain open challenges.

The paper emphasizes the development and importance of FL in machine learning research in its conclusion. It highlights the necessity of modifying differential privacy strategies for FL deployments in the real world and explores the difficulties in obtaining privacy, security, and value in federated learning systems.

Waleed Al Shehri et. al [14], suggests that, this report explores the concept of Database as a Service (DBaaS) and its functioning within the context of cloud computing. It highlights the shift of databases to the cloud and the benefits it offers in terms of availability and cost savings compared to traditional data centers. DBaaS allows organizations to leverage the resources provided by service providers without the need for investing in and maintaining hardware and software.

The report discusses the working of DBaaS, including data storage, management, and access mechanisms. It also addresses the challenges faced by DBaaS, such as scalability, security, data integration, and vendor lock-in. The structure of databases in cloud computing and their collaboration with nodes are examined, emphasizing enhanced reliability and fault tolerance.

Furthermore, the report emphasizes the importance of considering key factors before adopting a DBaaS provider. It discusses performance, availability, compliance, and cost analysis as crucial considerations for organizations.

The advantages of DBaaS are highlighted, including reduced infrastructure costs, scalability, accessibility, and improved backup and disaster recovery capabilities. However, the report also acknowledges the disadvantages, such as dependency on service providers, limited control, and potential security risks.

The report concludes by noting that DBaaS has been successfully adopted by many e-commerce companies, who have experienced significant benefits. The advantages of cloud database services outweigh the disadvantages, and organizations can choose the provider that best suits their requirements.

Overall, the adoption of DBaaS has revolutionized the way organizations manage their databases, providing efficient and cost-effective solutions while ensuring 24/7 availability of data.

Ahmed Albugmi et. al [15], Suggests that, this paper focuses on the security of data in cloud computing. It delves into various aspects related to data protection, including methods and approaches used worldwide to mitigate risks and threats. The paper examines the potential risks associated with the availability of data in the cloud, such as exposing data to applications that may have security vulnerabilities. It also highlights the security implications of virtualization in cloud computing, particularly when running a guest operating system over a hypervisor without knowledge of its reliability.

The study provides insights into data security aspects for Data-in-Transit and Data-at-Rest, covering all levels of cloud computing services: SaaS, PaaS, and IaaS. With the increasing use of cloud computing for data storage, there is a growing need to enhance data protection measures. The paper discusses the risks and security threats to data in the cloud and provides an overview of three types of security concerns.

The examination of virtualization aims to identify threats posed by hypervisors, while the discussion on public cloud and multitenancy explores the associated risks. The primary focus of the paper is data security in cloud computing, including threats and potential solutions. It addresses data security in different states and presents efficient encryption techniques such as block ciphers, stream ciphers, and hash functions for safeguarding data in the cloud, whether it is at rest or in transit.

Vijay Kumar Damera et. al [16], Suggests that, this research paper explores cloud computing as an emerging technology that provides on-demand services via the internet. The adoption of cloud computing is increasing in various industries due to its scalability, pay-per-use model, and self-service capabilities. However, the limited control over data in the cloud can lead to security issues such as data crashes, misuse, insecure APIs, insider threats, shared technology issues, account services vulnerabilities, and traffic hijacking.

The paper discusses the importance of addressing security risks and challenges in cloud computing. It highlights the need for ongoing research and technological advancements to improve cloud security and provide assurance for users. The framework presented in the paper covers the concept of cloud computing, major security risks, research challenges, industry applications, and potential future advancements in cloud security.

Additionally, the paper emphasizes the significance of cloud computing in key industries and provides insights into the increasing adoption of cloud services from 2015 to 2017. The potential impact of automation in cloud computing is also discussed, highlighting the need for further research and addressing the associated security issues.

Overall, the paper aims to enhance the understanding of design challenges in cloud computing and contribute to future research in this field, especially in terms of security.

Akherfi, K., Gerndt, M., & Harroud, H et. al [17], Suggests that, It highlights the benefits and opportunities cloud computing brings to all types of organizations, while addressing the issues and challenges that may hinder its adoption. This study uses a mixed method approach, reviewing both quantitative and qualitative studies from the past. The results of the data analysis show current and future trends in cloud computing and highlight related issues and issues. The technology is promising and is expected to continue to evolve. Cloud computing is seen as a solution to the current and future needs of businesses. The ability to store and access data at any time has led to the rapid development of cloud computing. Service providers continue to expand their offerings to include better verification services.

There are many benefits of using cloud computing and cloud storage services, where data security is important. In the future, companies will have no choice but to store information in the cloud, and competition will intensify based on information security and the ability to share and access information. The institution's success is expected to increase.

To stay competitive, organizations need a reliable cloud environment that meets their needs. ISPs need to increase speed and reduce battery life to access data in the cloud. Companies that do not receive these advances will be less competitive.

Garrison, G., Kim, S., Wakefield, R.L. et. al [18],suggests that, Cloud computing, particularly Infrastructure as a Service (IaaS), has become a popular model for delivering computing services. Resource management is an essential part of IaaS in cloud computing, providing benefits such as increased capacity, better service, reduced administrative overhead and better financial performance. Traditional resource management systems based on static principles are limited to dynamic scenarios and lead to data-driven, machine learning-based approaches. This document provides a detailed overview of the challenges of machine learning (ML)-based management in cloud computing. It discusses various machine learning methods for task estimation, task scheduling, virtual machine integration, resource utilization, energy optimization and more. This paper explores the strengths and limitations of the current approach and suggests possible future research directions based on these challenges and limitations. Research results show that machine learning models can be effectively used in cloud computing to achieve optimization goals and solve complex problems. Machine learning methods open up opportunities for intelligent management of resources and applications. Efficient strategies such as reinforcement learning and deep learning can be used to improve performance and improve resource management. This white paper presents advances in machine learning techniques for cloud management and fills research gaps in this field.

Etinosa Noma-Osaghae Et. al [19], Suggests that, Cloud computing revolutionized the IT world by providing the computing power and storage needs of the Internet. However, these technologies face challenges in the context of the Internet of Things (IoT). This paper covers emerging technologies in the cloud, their design, opportunities, and challenges. This paper examines how cloud computing can be transformed by combining the capabilities of different cloud service providers (CSPs) to increase efficiency, reduce latency, and increase bandwidth. The use of these models in health services is introduced, and their contributions and problems are examined in detail. The architecture and enhancements to these technologies are also described. Future research directions discussed in this paper include review of machine learning algorithms to identify vulnerabilities in United Healthcare cloud environments to improve quality of service (QoS). A comparative study of cloud computing and cyber-physical systems is also presented. Overall, this paper provides a comprehensive overview of cloud computing technologies, their impact on ecosystem health, and potential research recommendations. It highlights the importance of these standards for the processing, storage, and transmission of information around the world.

Martin Abadi et. al [20], Suggests that, TensorFlow is a powerful machine learning system developed by Google that is designed to work at scale and in diverse computing environments. It uses data flow diagrams to represent calculations, shared space, and operations that change state. TensorFlow can distribute these graphs across multiple machines in a cluster and across multiple computing devices (e.g., CPUs, GPUs) and dedicated hardware (e.g., Tensor Processing Units (TPU)) within a single machine. One of the main advantages of TensorFlow is its flexibility, which allows developers to experiment with different optimization techniques and training algorithms. Unlike previous systems that had built-in shared space management, TensorFlow offers a more open and extensible programming model. It supports a wide range of applications with a strong emphasis on deep neural networks for training and inference. Many Google services use TensorFlow in production, and it has gained considerable popularity as an open-source project with thousands of forks and many machine learning models built on top of it. The article highlights the TensorFlow dataflow model and demonstrates its superiority over existing parameter server systems. It shows how TensorFlow enables large-scale heterogeneous computing for both production tasks and experimental purposes. The paper also provides examples of how TensorFlow supports experimentation and demonstrates that its applications are both functional and scalable.

While TensorFlow has shown promising results, the paper acknowledges that it is still a work in progress. Default policies that work well for most users have yet to be established, and further research into automatic optimization is needed. The system-level development of TensorFlow includes algorithms for automatic placement, core fusion, memory management, and scheduling. The document acknowledges the need to strengthen the consistency of certain TensorFlow implementations and ongoing research to address this. In addition, the dynamic nature of some algorithms, such as deep reinforcement learning, presents interesting challenges for the efficient use of distributed resources. By sharing TensorFlow implementations and collaborating with the scientific community, the authors hope to encourage further research on distributed systems and machine learning. The goal is to continue to improve TensorFlow's features, address its limitations, and advance the fields of distributed systems and machine learning as a whole.

Adam Paszke et. al [21], Suggests that, the article introduces PyTorch, a machine learning library that aims to combine usability and speed. Unlike other frameworks, PyTorch uses an imperative and Python programming style that makes it easy to write and debug code. It also integrates well with popular scientific computing libraries and supports hardware accelerators such as GPUs for powerful performance.

The article outlines the principles behind the implementation of PyTorch and how they are reflected in its architecture. One of the key aspects is that PyTorch is designed like a regular Python program, giving users complete control over its functionality. The document also emphasizes the careful and pragmatic implementation of runtime components that together achieve high performance.

Several common benchmarks illustrate the performance of individual subsystems and the overall speed of PyTorch. This demonstrates the effectiveness of PyTorch in providing both usability and performance.

PyTorch has gained popularity in the deep learning research community due to its focus on usability and efficiency. Ongoing efforts to improve the speed and scalability of PyTorch will be mentioned later in this document. Special emphasis is placed on the development of PyTorch JIT (Just-In-Time), which provides tools to run PyTorch programs outside the Python interpreter for further optimization. The article also mentions plans to improve support for distributed computing by providing efficient primitives for data parallelism and a Pythonic library model parallelism based on remote procedure challenges. These improvements will contribute to the continued growth and adoption of PyTorch in the deep learning community.

Odun-Ayo et. al [22], Suggests that, this summary discusses the evolving nature of cloud computing as the most visible IT paradigm of recent times. The cloud service allows users to use the resources, applications and infrastructure provided by the cloud service providers for a fee. Access can be in the form of pre-installed applications or the ability to develop and deploy user applications using cloud services. The cloud also provides a comprehensive storage infrastructure for user databases and data.

The presentation focuses on analyzing current trends and developments in cloud computing architecture by analyzing articles published in journals, conferences, and white papers. The main architectures covered are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS), which can be deployed in private, public, community, or hybrid clouds.

However, the analysis reveals that only a few articles discussed "As a Service" models, and a limited number of articles discussed the main players of cloud services. This highlights the need for further research in these areas.

The benefits of cloud computing are that it provides businesses, SMEs, and individuals with scalable, on demand resources from anywhere, anytime, without the need to invest in internal application development infrastructure. According to the report, companies allocate the most budgets to SaaS service, and the use of public clouds is growing even more compared to private clouds. Together, this summary highlights the importance of cloud services and the need for further research in certain areas. This suggests that the findings are useful for cloud service providers, users, and researchers.

Jain, k., and Bhatnagar, et. al [23], Suggests that, Since the 1990s, the development of knowledge has always been driven by changes. Researchers have developed many ideas and combinations to improve database resources and solve new problems. Introduced in the 1970s, the relational model revolutionized data management by allowing data to be tables with relationships. Relational databases dominated the field for many years, but as data volumes and needs grew, their limitations emerged. In the late 2000s, NoSQL databases emerged as an alternative, providing flexibility and data flexibility to deal with heterogeneous data. NoSQL databases do not replace relational databases, but provide additional options for specific applications. The evolution of databases continues as new technologies such as NewSQL and multilingual persistence add additional capabilities and expand resources according to the ever-changing needs of databases.

Caiyun xu, et. al [24], Suggests that, This paper describes the problems caused by the growth of knowledge in the context of increasing user numbers and distributed technologies. Traditional systems can struggle to handle large amounts of data in a cloud environment. To improve storage performance, This paper focuses on data partitioning algorithm to reduce response time of data backup. Data printing techniques are also being explored to improve storage performance. In the context of virtualization, scalability, and cloud computing, optimizing the performance of distributed storage systems while maintaining high reliability has become a major research challenge. This paper specifically examines data distribution systems based on deduplication. Compared with the long-distance block algorithm and the variable length block algorithm, the slider algorithm is designed to optimize storage space utilization in the cloud environment, reduce data backup time, and improve distributed data storage performance

Liu Kun et. al [25], Suggests that, the popularity and significance of cloud computing and cloud storage are highlighted in This paper's overview. The author examines the architecture of cloud storage and two proprietary, real world business model-based technologies, GFS (Google File System) and HDFS (Hadoop Distributed File System). This paper discusses the difficulties of data storage in a cloud environment and emphasizes the significance of cloud data storage in the context of cloud computing. The cloud storage architecture built on the eye OS Web operating system is also introduced by the author, along with other related concepts.

This paper's final section focuses on how dispersed data and informal management via Hadoop's HDFS technology might improve the data storage process. The authors describe how the eyeOS online operating system incorporates these advances.

This presentation serves as an overall illustration of the rapid development of cloud computing and the significance of accurate and relevant information in cloud environments. The design and development principles offer a lot of useful information about how to use cloud storage services. Tests have shown the system's efficacy and ease of use.

Nan Wu and Yuan Xie. 2021 et.al [26], Suggests that, this publication highlights the need to rethink the relationship between machine learning (ML) and computer architecture/system design. It highlights the potential of machine learning to transform the way computer architectures and systems are designed, leading to increased productivity and a productive success cycle. This paper aims to provide a comprehensive review of machine learning applications for computer architecture and design. Classifies machine learning methods according to their role in design, distinguishing between rapid modelling and the use of machine learning as a design model. It also identifies common problems that can be solved using machine learning in computer architecture/system design and discusses specific learning techniques applied to each problem. While focusing on computer architecture, the article also considers the concept of the data center as a warehouse-scale computer and briefly talks about adjacent areas such as code generators and aggregators. Demonstrates how machine learning techniques can help and change design automation. In addition, This paper provides a vision of future opportunities and possible directions for using machine learning in computer architecture and design. It envisions a successful society where machine learning techniques can be used efficiently on powerful computers to create the next generation of computers, and highlights the social implications of machine learning and the machine. Overall, This paper promotes the use of machine learning to advance computer architecture and systems, emphasizing that machine learning evolves in powerful machines and designs, and recognizing the potential of machine learning techniques to transform these functions.

Daniel Pop [27], Suggests that, this post discusses the challenges machine learning practitioners face when working with big data and the need for new approaches. Traditional machine learning libraries are not efficient when dealing with very large datasets, leading to the popularity of computational methods such as MapReduce, CUDA, and Dryad. New machine learning libraries such as Apache Mahout-TM, Graph-Lab, and Jubatus build on these standards. also explores the impact of cloud computing on machine learning. This includes using statistical tools and libraries in the cloud, creating Hadoop clusters in the cloud, and building distributed machine learning algorithms. The article also talks about machine learning as software as a service, where companies provide machine learning solutions in the cloud. The findings highlight the importance of existing programming techniques such as MapReduce for implementing machine learning algorithms in a distributed environment. He also noted the need for user-friendly machine learning solutions in the context of cloud computing, targeting users with little programming or statistical knowledge. Overall, this post highlights the challenges of dealing with big data in machine learning and the adoption of clustering techniques and climate comparisons to solve them. It also demonstrates the need for user-friendly distributed machine learning solutions.

Marios Avgeris [28], Suggests that, This paper discusses the problems arising from the use of resources used in continuous communication. As a solution, work offload is proposed, which is the process of offloading computationally intensive work to more powerful remote devices. Although cloud computing has traditionally been used for offload tasks, its centralized location slows down communication and is not suitable for latency sensitive applications. To solve this problem, the concept of edge negotiation was introduced, where cloud computing operates close to terminal equipment at the edge of the network. This publication clearly demonstrates that edge computing and cloud computing can be combined to reduce workload. It focuses on optimization through mathematical, cognitive and control logic to achieve the goals, constraints and adverse conditions of end-to-end applications. In end-to-end communication, a survey was conducted using equipment, including the end of the network, to identify key components in end-to-end communication and calculate connections, starting from the end device and before reaching the cloud. This study aims to better understand the task offloading problem and to provide the integration of edge computing and cloud computing to solve it.

Joe Fiala, [29], The literature reviewed in This paper investigates the application of machine learning (ML) to regulatory, utility, and security issues in cloud computing. This paper discusses recent research and contrasts several machine learning techniques for bettering security, resource efficiency, and resource management. Support vector machines (SVM) and artificial neural networks (ANN) beat linear regression (LR) in determining the necessary virtual machine (VM) size for dynamic resource management. The decision between SVM and ANN is dependent on the circumstances. Resource- and energy efficient machine learning techniques like auto-lock and collaboration are advised. The best approach to use will depend on the circumstances, though. This paper offers a generic framework for high-level decision making about cloud computing security that can act as the basis for cutting-edge solutions. Although a method employing Naive Bayes Trees (NBT) and Random Forests (RF) works well, it is impossible to compare it to other approaches. Other approaches are meant to serve as a foundation for future research areas. In summary, this paper demonstrates the potential of machine learning applications to improve cloud management, utilities, and security. This highlights the need for specific assessments and additional research to refine and refine the plan.

This paper focuses on the role of cloud computing in managing big data using storage, database, and network resources. He distinguished cloud computing from network computing, noting that cloud computing involves servers that host applications across multiple companies. Data stored in the cloud can be accessed from anywhere as long as there is a constant internet connection. Big companies like Amazon, Google and Microsoft are known as cloud service providers.

Ali Bou Nassif [30], Suggests that, This paper describes data analysis using machine learning (ML) techniques for cloud security. The review looked at 63 related studies and combined findings across three main research areas: climate change, machine learning methods and outcomes. The review identified 11 aviation security categories, including covert detection, intrusion, self-defense, security, vulnerability detection, confidential documents, personal data, DDoS (Distributed Denial of Service), DoS (Denial of Service). - service) and search connection (ID). Among them, the most detected were DDoS at 16% and data protection at 14%. Regarding machine learning methods, the analysis identified 30 different methods, all for mixed models and individual methods. Support vectors (SVM) have become the most popular machine learning techniques used in both hybrid and singular models. In addition, 60% of the papers compare their models with other machine learning models to evaluate and improve accuracy. 13 metrics were found, true positive rate (TPR), true rate, false positive rate (FPR), high, negative rate (TNR), false positive rate (FAR), detection, F-measure, non-negative rate (FNR) and training time. The most used metric is TPR and the least used is training time. During the audit, 20 documents were also identified for the evaluation of performance standards; the most used were KDD and KDD CUP '99. In summary, the qualitative literature review provides insights into the intersection of machine learning and cloud security. It offers cloud security, popular machine learning techniques such as SVM, machine learning model benchmarking, and commonly used metrics and data.

N. Dhivya [31], Suggests that, This paper explains the science behind cloud computing, starting with the history and definition of cloud computing.

It discusses cloud computing models, including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). They also talk about the introduction of aerial work, its advantages, and disadvantages.

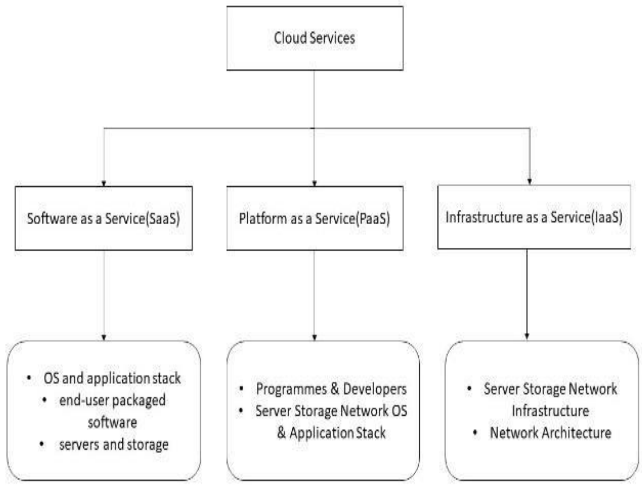

Figure 2 . Cloud Based Services

This paper clearly shows that cloud computing is a rapidly changing trend that has been rapidly adopted since the early 2000s. This refers to various cloud applications such as Google Sheets, Calendar, and Presentations, which work similarly to Microsoft tools when connected to the Internet. The purpose of This paper is to provide an overview of cloud services, the service models offered by companies providing cloud services, and the advantages and disadvantages of cloud services.

3. FUTURE SCOPE

After analyzing, different papers certain short comings found can be addressed in future. Some of the key points that to be noticed are:

3.1 Advanced data analytics

Cloud computing can provide the computing power and storage needed to process big data. AI/ML algorithms can use these techniques to perform advanced analytics, including predictive analytics, anomaly detection, and realtime decision making [30].

3.2 Intelligent Automation

Cloud-based AI/ML services enable intelligent automation of various tasks and processes. This includes restructuring, optimizing resource allocation and improving overall performance. By leveraging cloud resources, organizations can scale AI/ML capabilities as needed [20].

3.3 Natural Language Processing (NLP) and Speech-based AI

Cloud-based AI services can help improve NLP processes and speech-based AI. These apps understand and respond to human speech, enabling voice assistants, chatbots, and virtual agents to provide better customer support and a more personalized experience [4].

3.4 Image and Video Processing

Cloud computing along with AI/ML can transform images and video into applications. For example, cloud services can be used to train deep learning models on big data, perform powerful image visualization, object detection, and video analytics [6].

3.5 Predictive maintenance and the Internet of Things

Cloud computing can support predictive maintenance by using artificial intelligence/machine learning algorithms to analyze sensor data from IoT devices. By anticipating maintenance needs and identifying critical gaps, organizations can reduce equipment downtime and optimize maintenance time [10].

3.6 Personalized Medicine

Cloud-based AI/ML solutions can facilitate personalized medicine by analyzing large volumes of genomic data, patient data, and clinical trial testing. This can help identify diseases, predict treatment outcomes, and identify individualized treatment options [15].

3.7 Improving cybersecurity

Cloud-based AI/ML can play an important role in improving cybersecurity measures. It analyzes network traffic patterns, identifies potential threats in real time, and automatically responds to security events. Additionally, AI-driven authentication mechanisms can strengthen control and protection of sensitive data [13].

3.8 Edge computing and intelligence

The combination of cloud computing and artificial intelligence / machine learning with edge computing (processing data close to the source) opens up new possibilities. AI models can be implemented and run on edge devices, reducing latency and enabling real-time decision making in applications such as driverless cars, smart cities, and business automation [9].

4. CONCLUSION

This research paper offers a thorough analysis of cloud computing, illustrating its development and the impact it has had on numerous facets of technology and society. It is evident that cloud computing has evolved into the cornerstone of contemporary technology after considering its benefits, difficulties, and potential developments.

These results that we get from numerous papers emphasize the numerous advantages of cloud computing, such as cost savings, greater capacity, simplicity of use, and collaboration capabilities. Organizations can use cloud platforms to promote productivity, efficiency, and resource use. The way that people and businesses use technology has evolved as a result of having access to data and apps at any time and from any location. The paper does, however, highlight the problems and worries related to cloud computing. Strong steps are necessary in order to address security and privacy concerns.

Finally, with intense survey of about 40-45 papers we came to conclude that the researches examine some anticipated advancements and trends in cloud computing. The effectiveness and capacity of cloud platforms will be improved via edge computing, serverless computing, and intelligent integration. There is no denying that cloud computing has transformed industries, facilitated digital transformation, and encouraged creativity. It enables companies of all sizes to better utilize their available resources, streamline processes, and seize new chances. However, it is crucial for businesses and decision-makers to address these issues and offer a safe, dependable, and interoperable cloud solution. While using AI and ML frameworks we have integrated various services from cloud platforms like AWS and as mentioned in the paper. We are finally concluding this paper thoroughly that the cloud computing is a technological revolution that has immense promise for business, individuals, and society at large. Its continuing advancement and uptake will influence.

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