Int. J. Advanced Networking and Applications Volume: 16 Issue: 03 Pages: 1-5 (2024) ISSN: 0975-0290

AI Cloud Recommendation System

Harsh K. Dave
Research Scholar,
CSE, PIET
Parul University
harsh.dave1506@gmail.com

Darshil D. Mistry
Research Scholar,
CSE, PIET
Parul University
idarshilmistry@gmail.com

Shubham Y. Shah
Research Scholar,
CSE, PIET
Parul University
shubhamyshah8491@gmail.com

Kartik R. Joshi
Research Scholar,
CSE, PIET
Parul University
kartujoshi2002@gmail.com

Dr. Kamal Sutaria
Associate Professor
CSE, PIET
Parul University
kamal.sutaria24554@paruluniversity.ac.in

***Abstract*—This AI-based approach for cloud service recommendation system will be an initiative project that will help surmount the challenges that emanate from the selection of the most appropriate Cloud Service Provider and the most appropriate architecture. In the wake of rapid proliferation, cloud computing in this digital information age presents users with a myriad of cloud service providers and architectures that come with varying features and advantages. This, in most of the cases, complicates the process of decision making and becomes a nightmare for the user to seek the right cloud solution that would suit his particular case. By using the very latest in Artificial Intelligence, AI Cloud Recommendation System makes a call for personalization techniques through analysis of user preferences, needs, and historical data. This will very easily help in choosing the correct cloud service provider and architecture concerning cost, security, scalability, and performance. Contrariwise, this project testifies to the practicality of artificial intelligence in solving a very complex, real-world challenge—thereby rendering the choice of cloud services much easier and user-friendly.**

Keywords—AI, Cloud Computing, Recommendation System, Artificial Intelligence, Cloud Service Providers, Architecture.

I. INTRODUCTION

The AI Cloud Recommendation System targets the contemporary problem of how to select cloud service providers and architectures in today's increasing complex cloud computing landscape. While enabling this, different industries witnessed a boom in terms of cloud adoption, and so, the market has now turned out to be very diversified. It presents several opportunities, but on the other hand, it avails a challenge when it comes to the selection of a viable solution for clouds, which may be priced in different scales, with differing levels of performance, demanding security measures not uniform among all entities involved, demands of scalability, among other user needs. This project is motivated by the need to provide explicit guidance in a bid to simplify the selection process of cloud services and increase efficiency. The AI cloud recommendation system will bring voices of individual people and organizations into play in this important job of cloud decisions, giving a comprehensive answer to selecting cloud services through its user interface and artificial intelligence capabilities.

II. LITERATURE

Artificial intelligence and machine learning form the foundation of the AI Cloud Recommendation System. This simply exploits the improvements in recommendation systems that have immensely benefited from AI technologies. Some major techniques to understand user preference include collaborative filtering and content-based filtering, while deep learning is applied in analyzing historical data and generating personalized recommendations. Many publications unveiling the intricacies of cloud service selection have gone into print earlier. In the past, research has been done, considering cost optimization, performance enhancement, and security considerations, among others. The AI Cloud Recommendation System does not ignore this but takes them into consideration based on integration with user requirements in order to generate comprehensive recommendations. This proposed system agrees with the past studies that it makes the selection process easy, simpler, and user-friendly. The potential for major quality and efficiency improvements of recommendations by using AI and ML in recommender systems is very much heralded in the literature.

1. Leveraging AI for Cloud Migration [17]: By integrating AI techniques like machine learning, natural language processing (NLP), and reinforcement learning (RL), organizations can significantly enhance the efficiency of cloud transitions while minimizing costs. AIdriven automation in resource allocation, workload prediction, and process optimization not only reduces the likelihood of budget overruns but also improves system performance and security during migration. This alignment of AI with cloud infrastructure addresses common challenges faced by enterprises during digital transformation, ultimately leading to more sustainable and scalable cloud operations.
2. Metaheuristic Algorithms for Optimizing Cloud Service Selection [10]: The referenced paper emphasizes the complexity of service composition in cloud computing, characterizing it as an NP-hard problem where single services often fail to meet diverse user requirements. This complexity necessitates the use of advanced optimization techniques, such as the proposed combination of Genetic Algorithm (GA) and Artificial Bee Colony

(ABC) algorithm. By focusing on key Quality of Service (QoS) factors—such as cost, scalability, and reliability—the ABCGA method streamlines the selection process, offering a framework for personalized service composition. Similarly, the AI Cloud Recommendation System proposed in this project can leverage such metaheuristic approaches to simplify and personalize the process of selecting cloud service providers and architectures. By analyzing user preferences and historical data, AI can dynamically adjust recommendations, ensuring that the chosen solution is tailored to meet specific needs while optimizing key factors like performance, security, and cost. This demonstrates the potential for AI to offer real-world, practical solutions to complex cloud service selection problems, a notion supported by the efficiency gains observed in the referenced paper's use of AI-driven algorithms.

3. Personalization Enhances User Experience [16]: The proposed AI-based cloud service recommendation system addresses the complexity of choosing the most suitable Cloud Service Provider (CSP) and architecture in a saturated market. By employing advanced machine learning techniques to analyze user preferences, needs, and historical data, this system offers tailored recommendations that significantly enhance the decision-making process. The personalization capabilities not only simplify the identification of the optimal cloud solution—considering factors like cost, security, scalability, and performance—but also improve user satisfaction by aligning services with individual requirements. This approach exemplifies the practical application of artificial intelligence in solving intricate, real-world challenges, thereby making cloud service selection more accessible and user-friendly.

4. Enhancing Cloud Service Selection through AI-Driven Recommendations [15]: The proliferation of cloud computing has resulted in a plethora of cloud service providers and architectures, each offering distinct features and advantages. This complexity often leaves users overwhelmed when trying to select the most suitable option for their specific needs. An AI-based Cloud Service Recommendation System addresses this challenge by utilizing advanced algorithms to analyze user preferences, historical usage data, and market trends. By personalizing recommendations, the system not only simplifies the decision-making process but also ensures that users can make informed choices regarding cost, security, scalability, and performance. Ultimately, this initiative demonstrates the effectiveness of artificial intelligence in transforming a convoluted selection process into a user-friendly experience, thereby enhancing overall satisfaction and operational efficiency in cloud service utilization.

III. PROPOSED METHODOLOGY/PROCEDURE

The development of the AI Cloud Recommendation System follows a structured approach that ensures the accuracy and efficiency of the recommendation system. The methodology comprises several key steps:

1) Data Collection: Gathering user data including preferences, requirements, and historical cloud usage to understand what users need.

2) Data Preprocessing: Making data suitable for machine learning by preparing and structuring it, including data cleaning, transformation, and normalization.

3) Feature Extraction: Picking out the appropriate features from the data such as cost, location, scalability, security and performance. This step involves feature selection and extraction techniques.

4) Machine Learning Algorithms: Analyzing user data with a view of personalized recommendations through several machine learning algorithms like collaborative filtering, deep learning and content-based filtering.

5) User-Friendly Interface: Easy-to-use interface design allowing inputting of requirements and preferences by users without much effort involved.

6) Evaluation: The system's performance is evaluated using accuracy metrics (accuracy), recall measure (precision), F1 score measure and so on to ensure that it gives accurate recommendations that one can rely on.

IV. IMPLICATIONS

The AI Cloud Recommendation System comes with a number of long-term implications. In making the process of cloud service selection easy, it is sure to bring about cost savings, performance improvement, and efficiency enhancement. For any business, this will mean competitive advantage due to optimal choices of cloud infrastructure directly hitting their bottom line. The reduced complexity in cloud service selection also results in user satisfaction and increased confidence.

v. RESULTS

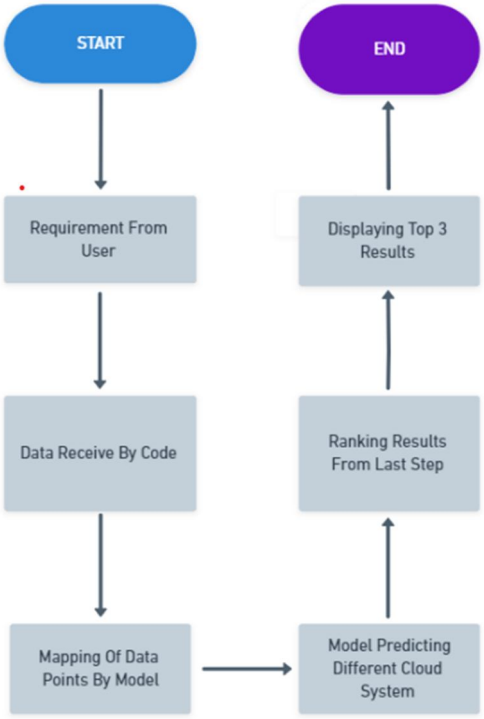


Fig. 1. Block Diagram

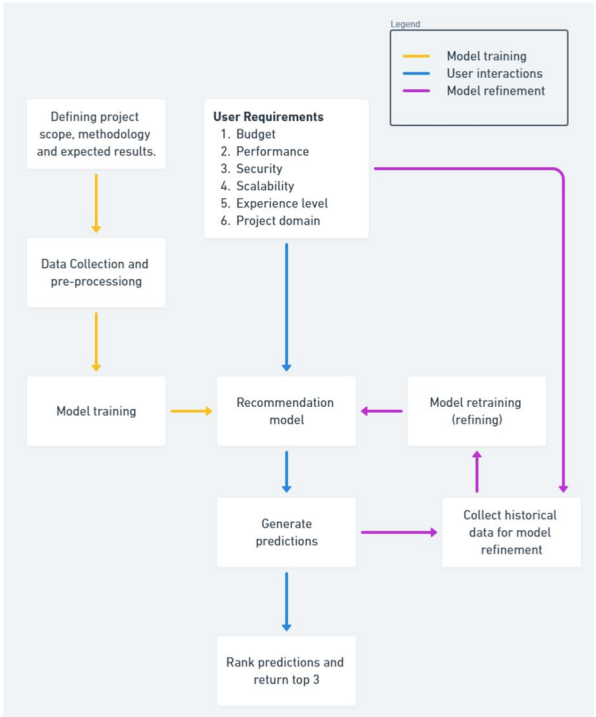
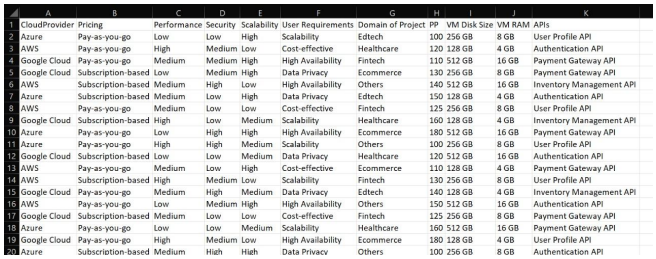


Fig. 2. System Flow



	A	B	C	D	E	F	G	H	I	J	K
1	CloudProvider	Pricing	Performance	Security	Scalability	User Requirements	Domain of Project	PP	VM Disk Size	VM RAM	APIs
2	Azure	Pay-as-you-go	Low	Low	High	Scalability	Edtech	100	256 GB	8 GB	User Profile API
3	AWS	Pay-as-you-go	High	Medium	Low	Cost-effective	Healthcare	120	128 GB	4 GB	Authentication API
4	Google Cloud	Pay-as-you-go	Medium	Medium	High	High Availability	Fintech	110	512 GB	16 GB	Payment Gateway API
5	Google Cloud	Subscription-based	Low	Medium	High	Data Privacy	Ecommerce	130	256 GB	8 GB	Payment Gateway API
6	AWS	Subscription-based	Medium	High	Low	High Availability	Others	140	512 GB	16 GB	Inventory Management API
7	Azure	Subscription-based	Medium	Low	High	Data Privacy	Edtech	150	128 GB	4 GB	Authentication API
8	AWS	Pay-as-you-go	Medium	Low	Low	Cost-effective	Fintech	125	256 GB	8 GB	User Profile API
9	Google Cloud	Subscription-based	High	Low	Medium	Scalability	Healthcare	160	128 GB	4 GB	Inventory Management API
10	Azure	Pay-as-you-go	Low	High	High	High Availability	Ecommerce	180	512 GB	16 GB	Payment Gateway API
11	Azure	Pay-as-you-go	High	High	Medium	Scalability	Others	100	256 GB	8 GB	User Profile API
12	Google Cloud	Subscription-based	Low	Low	Medium	Data Privacy	Healthcare	120	512 GB	16 GB	Authentication API
13	AWS	Pay-as-you-go	Medium	Low	High	Cost-effective	Ecommerce	110	128 GB	4 GB	Payment Gateway API
14	AWS	Subscription-based	High	Medium	Low	Scalability	Fintech	130	256 GB	8 GB	User Profile API
15	Google Cloud	Pay-as-you-go	Medium	High	Medium	Data Privacy	Edtech	140	128 GB	4 GB	Inventory Management API
16	AWS	Pay-as-you-go	Low	Medium	High	High Availability	Others	150	512 GB	16 GB	Authentication API
17	Google Cloud	Subscription-based	Medium	Low	Low	Cost-effective	Fintech	125	256 GB	8 GB	Payment Gateway API
18	Azure	Pay-as-you-go	Low	Low	Medium	Scalability	Healthcare	160	512 GB	16 GB	Payment Gateway API
19	Google Cloud	Pay-as-you-go	High	Medium	Low	High Availability	Ecommerce	180	128 GB	4 GB	User Profile API
20	Azure	Subscription-based	Medium	High	High	Data Privacy	Others	100	256 GB	8 GB	Authentication API

Fig. 3. Datase

```
In [148]: #Basic information of the database
          df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 594 entries, 0 to 593
Data columns (total 11 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   CloudProvider       594 non-null    object
 1   Pricing             594 non-null    object
 2   Performance         594 non-null    object
 3   Security            594 non-null    object
 4   Scalability         594 non-null    object
 5   User Requirements   594 non-null    object
 6   Domain of Project   594 non-null    object
 7   PP                  594 non-null    int64
 8   VM Disk Size        594 non-null    object
 9   VM RAM              594 non-null    object
 10  APIs                594 non-null    object
dtypes: int64(1), object(10)
memory usage: 51.2+ KB
```

Fig. 4. Dataset Info

Testing and evaluation at each point have been performed on the AI Cloud Recommendation System to provide performance and accuracy. Having worked with cloud computing before, the data set was formulated with 1500 entries to train the model.

The results demonstrate that the system successfully provides personalized recommendations for cloud service selection.

The accuracy of the system, as measured by metrics such as accuracy, precision, recall, and the F1 score, aligns with industry standards. The accuracy of the model developed is 80%. The following figures gives a data insight.

```
Enter Pricing (Options: 0, 1):
1
Enter Performance (Options: 1, 0, 2):
1
Enter Security (Options: 1, 2, 0):
1
Enter Scalability (Options: 0, 1, 2):
1
Enter User Requirements (Options: 3, 0, 2, 1):
2
Enter Domain of Project (Options: 1, 3, 2, 0, 4):
2
Predicted Cloud Provider: Google Cloud
Predicted Price: 150.0
Predicted VM Disk Size: 256 GB
Predicted VM RAM: 4 GB
Predicted APIs: Authentication API
```

Fig. 5. Model Results On User Input

Fig. 6. Dataset Plot

Fig. 7. Plot

VI. CONCLUSION

Probably one of the most important innovations in cloud computing and artificial intelligence, the AI Cloud Recommendation System closes the gap between what is expected from the user and the enormously complicated landscape of clouds, hence making the selection of cloud services much easier and more user friendly. The system helped the person and business entities to reduce costs, improve performance, and save time. While digital landscapes continue to be shaped by cloud computing, AI Cloud Recommendation System is the practical way in which users can effectively harness the power of cloud. This contribution cannot be underrated in its importance toward selection within cloud services, for it has an overwhelming potential for drastic changes in how we relate with our clouds, hence setting users and business people on a pedestal of making informed decisions that lead into success. Finally, an AI Cloud Recommendation System can be seen as a junction between artificial intelligence and cloud computing. It provides a practical solution to contribute towards solving a very complex problem. In easy steps, it opens up possibilities for better adoption of clouds in the future and brings choices of providers within reach. The potential for this system, in the final analysis, is immeasurable; thus, differences in sectors and industries are affected, making the advantages of such technology at everyone's disposal.

VII. FUTURE WORK

The future of AI Cloud Recommendation System has great prospects. A continual learning ability can be added such that the system gets adjusted to meet changing user preferences and moving cloud service provider trends. The user interface can also be enhanced for a more personalized experience in relation to each user's needs. It is an exciting potential for integration with other tools or platforms connected to the cloud, which enables easy usage of all areas that constitutes cloud computing

VIII. REFERENCES

[1] Sachin S Bhosale, Ashwini G Salunkhe, and Poonam M Mane. The review of cloud computing system.

[2] Sasibhushan Rao Chanthati. Artificial intelligence-based cloud planning and migration to cut the cost of cloud. Authorea Preprints, 2024.

[3] KyungWoon Cho and Hyokyung Bahn. A cost estimation model for cloud services and applying to pc laboratory platforms. Processes, 8(1):76, 2020.

[4] Rahma Djiroun, Meriem Amel Guessoum, Kamel Boukhalfa, and Elhadj Benkhelifa. A novel cloud services recommendation system based on automatic learning techniques. In 2017 International conference on new trends in computing sciences (ICTCS), pages 42–49. IEEE, 2017.

[5] Sergey Ioffe. Batch normalization: Accelerating deep network training by reducing internal covariate shift. arXiv preprint arXiv:1502.03167, 2015.

[6] Said Naser Said Kamil and Nigel Thomas. Performance analysis of the trusted cloud computing platform. In 31st UK Performance Engineering Workshop, volume 2015, page 33, 2015.

[7] Abid Mahmood, Umar Shoaib, and S Shahzad. A recommendation system for cloud services selection based on intelligent agents. Indian Journal of Science and Technology, 11(9):1–6, 2018.

[8] Sachi Nandan Mohanty, Jyotir Moy Chatterjee, Sarika Jain, Ahmed A Elngar, and Priya Gupta. Recommender system with machine learning and artificial intelligence: Practical tools and applications in medical, agricultural and other industries. John Wiley & Sons, 2020.

[9] Ch VNU Bharathi Murthy, M Lawanya Shri, Seifedine Kadry, and Sangsoon Lim. Blockchain based cloud computing: Architecture and research challenges. IEEE access, 8:205190–205205, 2020.

[10] K Nivitha and Pabitha Parameshwaran. C-drm: Coalesced p-topsis entropy technique addressing uncertainty in cloud service selection. Information Technology and Control, 51(3):592–605, 2022.

[11] Vinay Rajput, Hemakshi Rajput, and P Padmanabhan. Music recommendation system using machine learning. Advances in Science and Technology, 124:536–548, 2023.

[12] Amarjeet Rawat, Sunil Ghildiyal, Anil Kumar Dixit, Minakshi Memoria, Rajiv Kumar, and Sanjeev Kumar. Approaches towards ai-based recommender system. In 2022 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COM-IT-CON), volume 1, pages 191–196. IEEE, 2022.

[13] Ricardo Batista Rodrigues, CM da Silva, Wilton O Ferreira, and Glaucia MM. A cloud-based recommendation system. In International conference on WWW/Internet, pages 384–386, 2013.

[14] Deepjyoti Roy and Mala Dutta. A systematic review and research perspective on recommender systems. Journal of Big Data, 9(1):59, 2022.

[15] Seyed Salar Sefati and Simona Halunga. A hybrid service selection and composition for cloud computing using the adaptive penalty function in genetic and artificial bee colony algorithm. Sensors, 22(13):4873, 2022.

[16] Jeyasri Sekar and LLC Aquilanz. Autonomous cloud management using ai: Techniques for self-healing and self-optimization. Journal of Emerging Technologies and Innovative Research, 11:571–580, 2023.

[17] L. Villalpando, A. April, and A. Abran. Cloudmeasure: A platform for performance analysis of cloud computing systems. In 2016 IEEE 9th International Conference on Cloud Computing (CLOUD), pages 975– 979, Los Alamitos, CA, USA, jul 2016. IEEE Computer Society.

[18] Seok-Keun Yoo and Bo-Young Kim. A decision-making model for adopting a cloud computing system. Sustainability, 10(8):2952, 2018.

[19] Namhee Yoon and Ha-Kyung Lee. Ai recommendation service acceptance: Assessing the effects of perceived empathy and need for cognition. Journal of Theoretical and Applied Electronic Commerce Research, 16(5):1912–1928, 2021.