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Recommendation System on Cloud Environment: A Descriptive Study on This Marketing Strategy

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Abstract: ***Anything that is popular and, on the trend, would be automatically recommended to the customers and non-customers in order to make them buy the product or service and make a purchase. Today's recommendation systems follow the concept that users with comparable browsing and purchase histories would make similar purchases in the future. Either a huge number of historical transactions or comprehensive information on the users' online activity are required for such a system to function. This article provides a descriptive study on how recommendation system on various Cloud Applications is carried out as a marketing strategy. Sample cloud applications of different genres are taken for the primary research. The genres include the Ott platforms, Online Music and E-commerce.***

A sample size of 150 is taken for the survey as primary research. These platforms differ based on diverse criteria and how the usage of the users vary based on those criteria is taken into consideration. The evaluation method or analysis is done using regression method of various applications based on the criteria provided. Through this we analyse that which application provide better recommendations, which criteria users prefer, which application perform well in recommending a product or service and which application needs to improve their recommendation system.

Keywords: Recommendation system, Regression, Cloud applications, Users, Marketing strategy, diverse criteria*.*

I. INTRODUCTION

The recommendation system analyses the user's interests and offers suggestions for things that will capture their interest. These are very efficient machine learning techniques that have boosted revenue for enterprises.

Through filtering a user's prior behaviour, recommendation systems build a structure for the user that is appropriate in perspective of historical data. The best-case scenario for a suggestion is that the user chooses it, and in the hardest scenario, the machine learning algorithms estimate the items a user could enjoy based on the prior behaviour and helps produce suggestions that would have a higher possibility of the user going for it.

The usage of recommendation system has been found to be advantageous for both users and product sellers since they cut down on the extra expenses associated with locating the goods that are most likely to sell. Users' decision-making is aided by the recommendations because they are based on their preferences and interests. The system is entirely dependent on data, which is collected from all websites and applications and includes user information such as age, history, likes, reviews, and much more. This data is used to create recommendations that are relevant to the user's persona. These fall under the categories of "User-Item Interaction" and "Characteristic Information."

Businesses utilise recommendation systems to increase sales, simplify market analyses, improve user experiences, and improve customer retention.

The emergence of cloud storage systems, which allow its users to store files in the cloud, coincided with the development of cloud computing. As the use of these technologies increased, it became impractical for humans to process the massive amounts of data stored in the cloud.

This barrier suggests the concealing of pertinent information from the users, who are prevented from discovering new contents because they lacked effective tools for data filtering during the search for pertinent knowledge and that met their expectations. Prior to this scenario, users had the option of using recommendation algorithms to aid in file selection and to filter pertinent facts from a vast amount of data. Having an enormous amount of publicly viewable data stored in the cloud, it is essential that the user is capable of locating products with ease.

As a result, the major goal of this research is to provide a method for recommending files based on the cloud, using the content-based recommendation strategy. The suggested approach will help users with the challenging chore of finding fresh content, as well as filter out pertinent information from a vast amount of data stored in the cloud.

II. LITERATURE REVIEW

A. G Shani (2010)

According to G Shani and the team's research study, recommender systems are now widely employed in both the business and academic communities and there are a variety of methods for creating recommendations. A system designer must choose from a range of feasible tactics if they want to frequently use a recommendation system. The first step in the process is to decide which application properties to focus on while selecting a suitable algorithm. The user experience may be impacted by a number of features of recommendation systems, including as accuracy, robustness, scalability, and others. In this study, we compare recommenders based on a set of application-relevant features. We place more focus on comparative studies, where a few algorithms are assessed using several assessment metrics, as opposed to absolute benchmarking of algorithms. We provide acceptable experimental setups for choosing between algorithms. We look at three different kinds of experiments: user studies, where a small number of test subjects use the system and give feedback, large-scale online experiments, where actual user populations interact with the system. In offline settings, different recommendation approaches are contrasted without user interaction. We describe the kind of inquiries that can be addressed in each of these circumstances and provide experimental approaches. We also go through reliable methods for interpreting experimental results. After that, we go over a variety of attributes and explain how to evaluate systems in relation to relevant properties. We also look at a wide variety of performance metrics in relation to the factor that each one takes into account.

B. Paritosh Nagarnaik (2015)

According to Paritosh Nagarnaik and his team, recommendation systems have recently altered how people and websites communicate. Huge amounts of data are sorted through by a recommender to determine user preferences and speed up information search. To do that, numerous strategies have been employed. Collaborative filtering (CF) is a method for predicting users' interests automatically by combining data from a variety of different users. This method makes use of several collaborative basis algorithms. Contrary to all prior association mining techniques, which did not support massive datasets, the “CHARM algorithm” is one of the most commonly used algorithms for pattern recognition. In addition to exploring various recommendation system methodologies, this study also suggests a brand-new system for effective collaborative filtering based on a collaborative approach and the "CHARM algorithm" connected to algorithms for pattern discovery including clustering and association rule mining.

C. Ricardo Batista Rodrigues (2013)

In their study report, Ricardo Batista Rodrigues and the group claimed that the capacity of users for in-depth data analysis has been overtaken by the enormous growth in data volume brought on by the rise of computing power. This paper describes the development of a file recommendation engine for a cloud storage environment using content-based method filtering along with cloud features. As a result, it recommends a cloud-based recommendation technique. The main contribution of this work is the use of cloud factors, which, when used in the generation of recommendations, can lead to significant gains in terms of the accessibility of recommended files and the user's capacity to reduce search time while looking for new contents, in addition to the ability to filter pertinent contents from a vast amount of data stored in the cloud.

D. Debashis Das (2017)

In their research paper, Debashis Das and the team suggested a new system for efficient web page recommendation based on hybrid collaborative filtering, that is, using collaborative technique and CHARM algorithm coupled with pattern discovery algorithms like clustering and association rule mining. The team also discussed various recommendation system techniques in their paper.

E. Robin Burke (2011)

In their study paper, Robin Burke and the colleagues claimed that recommender systems are useful tools for interacting with huge and complex information environments. They provide a personalised view of these regions, prioritising content based on the user's anticipated interests. The field, which was founded in 1995, has rapidly expanded in terms of the variety of challenges it examines, the techniques it uses, and the potential applications. Research on recommender systems has utilised a variety of artificial intelligence techniques, such as machine learning, data mining, user modelling, case-based reasoning, and constraint fulfilment. Personalized recommendations are a key component of many online e-commerce systems, such as Amazon.com, Netflix, and Pandora. Academics have been inspired to extend the use of recommender systems into new and challenging disciplines by the wealth of real-world application experience.

The articles in this special issue seek to evaluate the present state of recommender systems research and identify the prevailing trends. This article lists all of the several articles in the special edition and provides a summary of the current situation in the region.

F. Hyeyoung Ko (2022)

According to Hyeyoung Ko and the team's study paper, the paper reviews the technical sophistication of recommendation systems used in a number of service fields as well as the financial elements of these services. First, for a reliable analysis of recommendation models for recommendation systems, data mining technologies, and related research by application service, more than 135 high-calibre articles and conferences published in Google Scholar between 2010 and 2021 were gathered and reviewed. This serves as the basis for systematising research on the technological underpinnings of recommendation system models and for assessing research patterns over time. The application service fields that employed recommendation systems were further classified, and each field's research on the model and technique of recommendation systems was evaluated. Without taking journal rankings into consideration, massive amounts of data on applied services—which are employed by recommendation systems—were also collected between 2010 and 2021 and reviewed with data from the applied services sector industry and various studies on recommendation systems. The flow and quantitative growth of several in-depth research of recommendation systems and the commercial development of the actual applied service sector were found to interact in this study. Through an analysis of the many technologies and trends in the service industry, where recommendation systems are utilised, this study, which provides a full overview of recommendation systems, also enlightens several scholars who are interested in recommendation systems.

G. F.O. Isinkaye (2015)

Filtering, prioritising, and effectively distributing essential information on the Internet, where the number of options is overwhelming, are necessary to reduce the problem of information overload, which has potentially caused a problem for many Internet users, according to F.O. Isinkaye and the team in their research paper. Recommender systems, which sift through a huge amount of dynamically generated data to offer clients personalised content and services, overcome this problem. This paper covers the various qualities and potentials of various prediction techniques in recommendation systems in order to serve as a compass for future research and practise in the field.

H. Lipi Shah (2016)

According to Lipi Shah and the team's study report, this essay provides an outline of the recommendation system. The recommendation system is a subset of the data mining subject. The era of online buying is now. Utilizing recommender systems enables the company to use one-to-one marketing strategies. Building customer loyalty, boosting the possibility of cross-selling, and satisfying consumer demands by offering products or services they might find interesting are just a few advantages of these marketing strategies. The recommendation system (RS) is crucial in many web applications. The recommendation system can be divided into three categories: content-based, collaborative-based, and hybrid systems. This study describes the various strategies in each category as well as the issues in each category. Each of the several groups has benefits and drawbacks of its own.

I. G. Adomavicius (2005)

The current generation of recommendation methods, which are typically divided into the following three primary categories: content-based, collaborative, and hybrid recommendation approaches, are described in this paper along with an overview of the subject of recommender systems, according to G. Adomavicius and the team in their research paper. This paper examines certain limitations of current recommendation strategies as well as potential enhancements that could improve recommendation capabilities and increase the applicability of recommender systems. These additions include adding contextual information to the recommendation process, supporting multi-criteria ratings, and providing more flexible and unobtrusive suggestion types. They enhance our comprehension of both users and objects.

J. Iman Avazpour (2013)

In their study article, Iman Avazpour and the team claimed that recommendation systems help users and developers of different computer and software systems with tasks like information discovery, approximation calculations, and handling information overload. Source code manipulation to business process modelling is just a few of the many application scenarios that have recently caught their attention as they have grown in prominence. Numerous techniques and criteria have been employed to rate the wide variety of application fields.

In this chapter, we cover a range of assessment metrics and measures, as well as numerous techniques for assessing recommendation systems. The sixteen criteria that make up the metrics described in this chapter include correctness, novelty, and coverage. We look at these metrics in light of the associated aspects. A description of techniques for comprehensive evaluation using groups of dimensions from recommendation systems and associated metrics is given. Additionally, we offer suggestions for critical future practise and research topics.

K. Sarah Bouraga (2014)

Knowledge-Base Recommendation (or Recommender) Systems (KBRS) give the user recommendations on what to pick or do, according to Sarah Bouraga and her team's research report. The information provided by human experts that has been encoded in the system and applied to the input data is used by KBRS to provide recommendations. In this survey, the key ideas that characterise a KBRS are summarised. The survey gives a general overview of the KBRS's components, the user issues for which recommendations are provided, the system's knowledge base, and the degree to which recommendations are automated using a classification framework.

L. Eui-Hong (Sam) Han (2005)

According to Eui-Hong (Sam) Han and the team's paper report, the emergence of e-commerce and the internet's rapid expansion have made it simpler to design recommender systems, a personalised information filtering tool used to locate a collection of N items that will be of interest to a particular user. The most effective method for creating recommendation systems to date, user- and model-based collaborative filtering, is widely applied in many commercial recommender systems. These algorithms make the fundamental assumption that there is enough historical data to determine product or user similarity. This presumption is incorrect in a number of application domains, including electronic retail, home shopping networks, and online retail, where new products are regularly offered while outmoded ones are gradually phased out of the catalogue. Another one of these application areas is the retail home improvement sector, where a variety of products (such as window treatments, bathroom, kitchen, or deck) are produced to order. There are very few duplicate products because each one is unique. There is very little probability of buying the same two products at the same time in this market. In this article, we discuss the difficulties in providing guidance in fields where it is difficult to compare two goods or groups of consumers based on past data. We offer feature-based recommendation algorithms that fix the issues with the current top-n methods. In a test project, the application of the suggested feature-based recommendation algorithms increased recommendation income by 75% in the first two months.

III. METHODOLOGY

The Project has two main Methodologies to work on,

1) The Correlation and Regression between various aspects of the Recommendation System and the Usage of the Application. The following methods were Used for the above mentioned:

a) Finding various aspects of Recommendation System through secondary research and grouping it.

b) Converting the Review and rating Data for Qualitative to Ordinal, which was fetched through the primary research.

c) Through regression finding the relationship and through Correlation finding strength between the aspects of the recommendation system and the application used.

2) Through simple Percentage Calculation Method finding the popularity of various applications in their respective fields.

IV. ANALYSIS AND INFERENCES

The following are the results of the survey. The survey consists of 150+ sample responses. The survey was taken with sample categories like Ott platforms, E-commerce platforms and Online Music platforms. Each category consists of 5 sample applications and a comparison is taken. The survey was taken using google forms based on the user’s preference. The application’s recommendations system is evaluated considering the 6 criteria.

They are the following

1) Frequency of Recommendation
2) Due Search History
3) Effect of Current Search
4) Based on Newly released/trending
5) Due to random shuffle
6) Average usage

Based on these criteria the users evaluate the recommendations made by the applications. With this data Regression is done keeping the average usage as Dependent variable and other 5 criteria as independent variables. With this weight of each category is taken to ease out the calculation and come up with the pie-chart. This is done to find the Highest and lowest apps that provide best and poor recommendation systems. 0.2 is taken and multiplied with the 5 criteria.

Table 1 Result Of Sample Ott Platforms

MULTIPLIERS		0.2	0.2	0.2	0.2	0.2	
APPLICATION	COEFFICIENT	FREQUENCY	SEARCH HISTORY	SEARCH HISTORY	TREND BASED	RANDOMNESS	WEIGHT
HOTSTAR	-0.06	0.10	0.22	0.22	0.30	0.50	0.208
NETFLIX	0.07	0.33	0.10	0.12	0.06	0.31	0.251
PRIME VIDEOS	0.07	-0.12	0.63	0.19	-0.02	0.34	0.272
ZEE	0.08	0.35	0.35	-0.27	0.18	0.30	0.261
VOOT	0.009	0.59	0.41	-0.25	-0.18	0.38	0.199

Table 2 OTT Platform Application And Their Weight

APPLICATION	WEIGHT
HOTSTAR	0.208
NETFLIX	0.251
PRIME VIDEOS	0.272
ZEE	0.261
VOOT	0.199

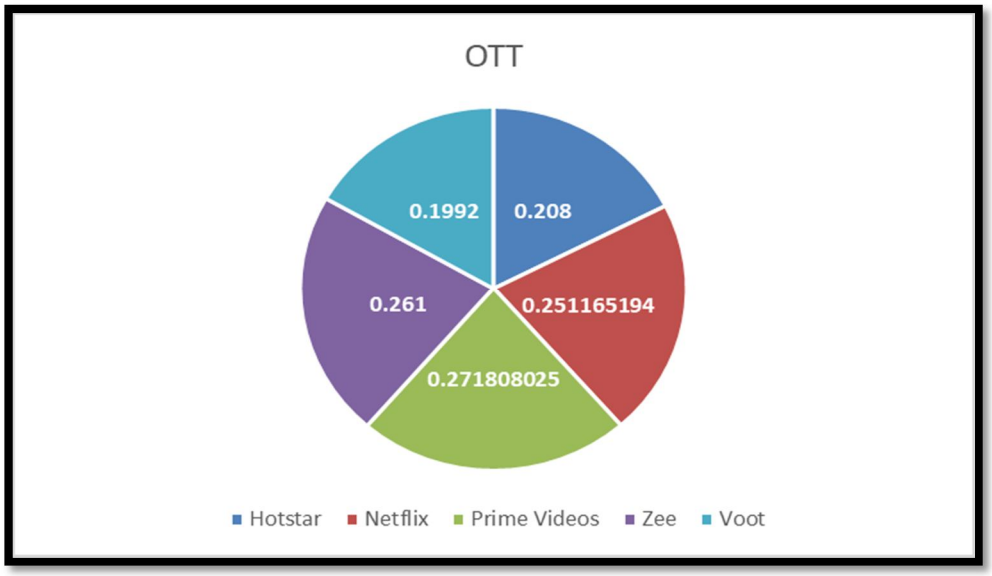

Fig. 1 Pie Chart of OTT platform

Table 3 Result Of Sample E-Commerce Platforms

MULTIPLIERS		0.2	0.2	0.2	0.2	0.2	
APPLICATION	COEFFICIENT	FREQUENCY	SEARCH HISTORY	SEARCH HISTORY	TREND BASED	RANDOMNESS	WEIGHT
AMAZON	0.2	0.07	0.46	0.53	0.10	-0.02	0.428
FLIPKART	0.05	0.28	0.17	-0.06	0.29	0.23	0.232
MYNTRA	0	-0.03	0.4	0.30	0.29	-0.15	0.162
MEESHO	0.002	0.5	0.05	0.11	0.16	0.10	0.186
AJIO	-0.005	0.06	0.35	0.20	-0.12	0.42	0.177

Table 4 E-Commerce Platform Application And Their Weight

APPLICATION	WEIGHT
AMAZON	0.428
FLIPKART	0.232
MYNTRA	0.162
MEESHO	0.186
AJIO	0.177

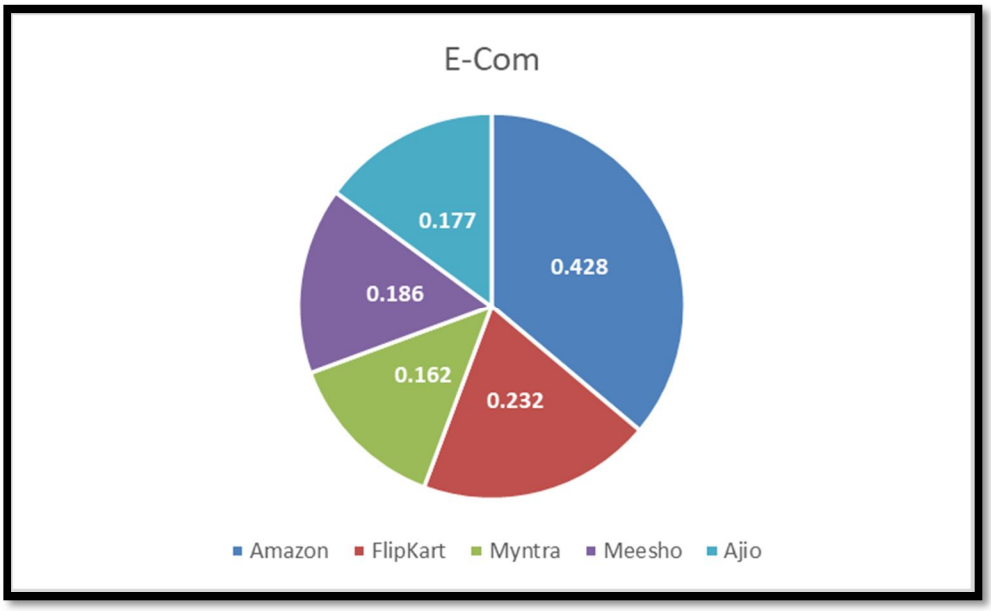

Fig.2 Pie chart of E-Commerce platforms

TABLE 5 Result of Sample Online Music Platforms

MULTIPLIERS		0.2	0.2	0.2	0.2	0.2	
APPLICATION	COEFFICIENT	FREQUENCY	SEARCH HISTORY	SEARCH HISTORY	TREND BASED	RANDOMNESS	WEIGHT
AMAZON MUSIC	0.01	0.5	0.11	0.12	0.11	0.11	0.96
WYNK	-0.004	0.03	0.46	0.04	0.20	0.15	0.876
SPOTIFY	0.02	0.33	-0.11	-0.22	0.06	0.90	0.979
SAAVN	-0.01	0.12	0.68	-0.03	0.11	0.06	0.93
YOUTUBE MUSIC	0.0005	0.8	0.2	-0.50	0.30	0.02	0.823

TABLE 6 ONLINE MUSIC PLATFORM APPLICATION AND THEIR WEIGHT

APPLICATION	WEIGHT
AMAZON MUSIC	0.96
WYNK	0.88
SPOTIFY	0.98
SAAVN	0.93
YOUTUBE MUSIC	0.82

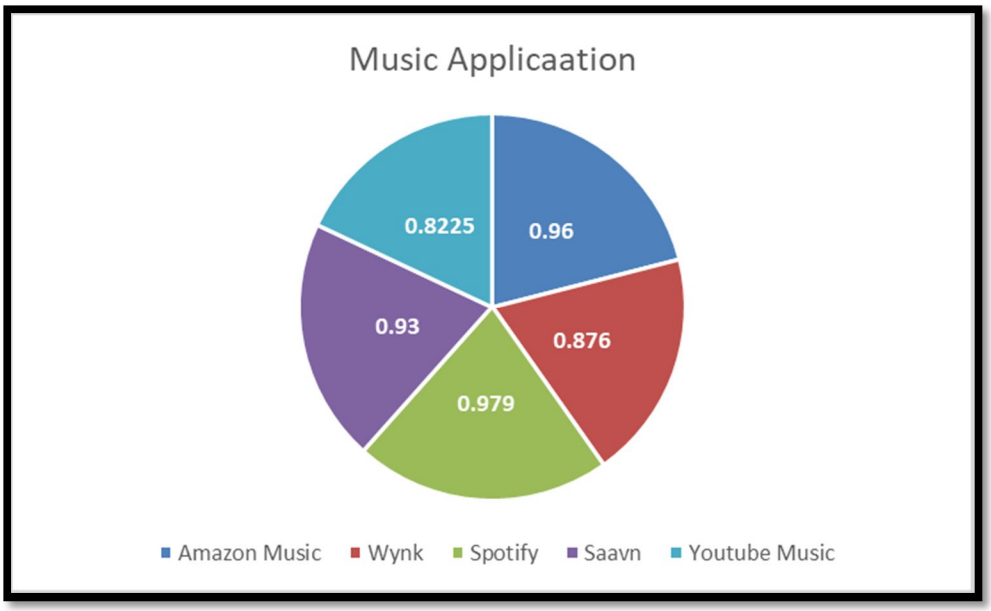

Fig.3 Pie chart of Online Music Platforms

From the above tables and figures we infer that the highest and lowest values of each segment are indicated in green and red, respectively. All of the values are the coefficients of the five parameters and the intercept value, and a common weightage of 0.2 is given to the parameters.

From table 1 we can infer that the OTT platform "Amazon Prime videos" provide the best recommendation as the values for prime video is the highest amongst the taken samples. The platform that needs to improve their recommendation system is Voot as the values for Voot is the lowest amongst the taken samples. From table 2 we can infer that the amazon prime video has the highest weight value compared to other application and Voot has the lowest weight value compared to other application. From Figure 1 we get the clear understanding through pie-chart as the highest is indicated in green and lowest is indicated in red.

From table 3 we can infer that the E-Commerce platform "Amazon" provide the best recommendation as the values for amazon is the highest amongst the taken samples. The platform that needs to improve their recommendation system is Myntra as the values for Myntra is the lowest amongst the taken samples. From table 4 we can infer that the amazon has the highest weight value compared to other application and Myntra has the lowest weight value compared to other application. From Figure 2 we get the clear understanding through pie-chart as the highest is indicated in green and lowest is indicated in red.

From table 5 we can infer that the Online Music platform "Spotify" provide the best recommendation as the values for prime video is the highest amongst the taken samples. The platform that needs to improve their recommendation system is YouTube Music as the values for YouTube Music is the lowest amongst the taken samples. From table 6 we can infer that the Spotify has the highest weight value compared to other application and YouTube Music has the lowest weight value compared to other application. From Figure 3 we get the clear understanding through pie-chart as the highest is indicated in green and lowest is indicated in red.

V. FINDINGS AND RECOMMENDATIONS

With the help the primary research we were able to find the preferences and choices of the users/customers based on the six criteria with the sample users. Through that we could find that Amazon is excelling in its own way and when we take up all the 3 categories Amazon was a part of the sample platforms be it OTT, E-Commerce or Online Music. Amazon topped 1st in both OTT and E-commerce platforms providing the best recommendations and if we see the Online Music platform Amazon Music topped 2nd amongst the other applications. When we consider the OTT platform Voot and Hotstar application differ by an average difference of 0.02 weight value amongst the other applications. They can come up with new ideas and innovation in their recommendation systems. When we consider the E-Commerce platform Myntra and Meesho should provide more recommendation so that the average usage of the customers/users might improve. Since Myntra and Meesho have slight difference of 0.02 weight value. While taking Online Music platforms, all of them differ by an average difference of 0.04 weight value. Out of which YouTube and Wynk music should come up with new innovation/strategy to improve their average usage amongst the users.

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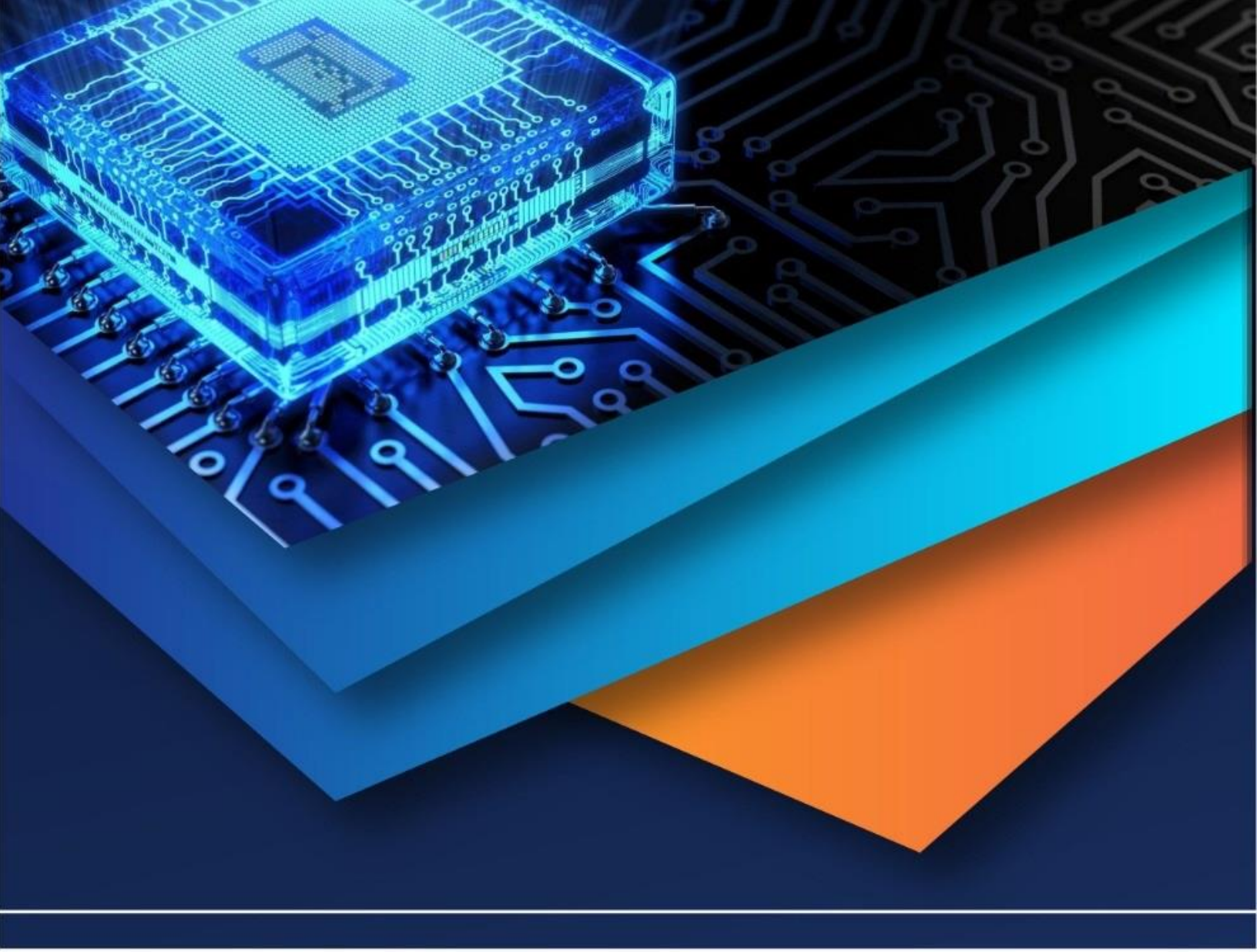

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