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A Comprehensive Study of CRM through Data Mining Techniques

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Abstract: Over the past years, Customer Relationship Management became a matter of considerable importance due to the competitive era. CRM is very important for any organization as with the help of this the organization can know the relationship between customer and their organization. For the success the organization needs to identify the problems and needs of customers and hence enhancing the interconnection between the customer and the organization. This paper focuses on study of CRM. It contains a general overview of CRM, providing a definition of the concept, enumerating dimensions, models and mentioning the scope and benefits of CRM. This paper also discusses the Data Mining Application Domains and Data Mining Techniques for CRM.

Keywords: Data Mining, Customer Relationship Management, CRM, Customer Retention, Relationship Marketing

I. INTRODUCTION

In today's culture, information shatters through the customer's database. After collecting and storing information of customers, the useful information found hidden in the database and Corporate cannot convert these data into knowledge and thus cannot achieve the ultimate goal of at the right time providing appropriate services to the right customers. Retaining the customers again is the crucial task for the organization. The emergence of Information Technology and use of computer in every field of activities has thus created a new tinkle in the field of marketing and that is the concept of Customer Relationship Management (CRM). CRM is defined as "the process of acquiring, retaining and growing profitable customer which requires a clear focus on service attributes that represent value to the customer and creates loyalty".

A. CRM Meaning

The organization can optimize profitability, revenue and customer satisfaction by organizing around customer segments, fostering customer-satisfying behaviors and implementing customer-centric processes. CRM technologies can enable greater customer insight, increased customer access, more effective customer interactions, and integration throughout all customer channels and back-office enterprise functions (Gartner, Inc., 2013)[1].

B. CRM Framework

According to Buttle [2], there are four major types of CRM: strategic, operational, analytical and collaborative CRM. Payne (2009) classifies CRM into three types: operational, analytical and collaborative CRM; From the architecture point of view, the CRM framework can be classified into operational, analytical and Collaborative CRM [3]

1) Strategic CRM is a customer-centric business culture and strategy that aims at winning and keeping profitable customers
2) Operational CRM refers to the automation of business processes
3) Analytical CRM refers to the analysis of customer characteristics and behaviors so as to support the organization's customer management strategies
4) Collaborative CRM: this approach focuses on relationship integration with customers using the appropriate communication channels (multi-channel management).

C. Dimensions of the CRM

CRM helps in allocating resources to the most profitable group of customers through the cycle of customer identification, customer attraction, customer retention and customer development. In order to obtain a deeper understanding of each customer's behaviors, characteristics and needs , detailed knowledge must be built up systematically. The four dimensions of the CRM cycle are [4]
Customer identification: CRM begins with customer identification, which is referred to as customer acquisition. This phase involves targeting the population who are most likely to become customers or most profitable to the company. Moreover, it involves

analyzing customers who are being lost to the competition and how they can be won back [5] Customer attraction: This is the phase following customer identification. After identifying the segments of potential customers, organizations can direct effort and resources into attracting the target customer segments [6] Customer retention: This is the central concern for CRM. Customer satisfaction, which refers to the comparison of customers' expectations with his or her perception of being satisfied, is the essential condition for retaining customers [7] Customer development: This involves consistent expansion of transaction intensity, transaction value and individual customer profitability. Elements of customer development include customer lifetime value analysis, up/cross selling and market basket analysis.[8].

D. Model of CRM

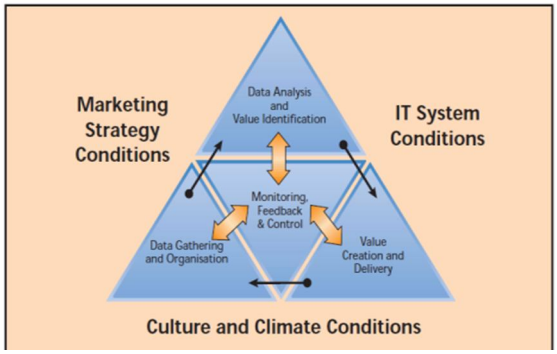

Fig 1: The Generic Model of Effective CRM [9]

1) *Data gathering and organization:* Individual customer data is gathered and organised for analysis. Data that considers customer motivations, like purchasing patterns and complaints is especially important.
2) *Data analysis and value identification:* The data is analysed to create better insights into customer needs and identify possible value from satisfying them.
3) *Value creation and delivery:* The new suggestions for targets and propositions, which come out of the data-analysis are translated into actionable changes in the activity of the organisation.
4) *Monitoring, feedback and control:* This is the centre of the other three processes and ensures that the CRM process is consistent with the objectives of the organisation.

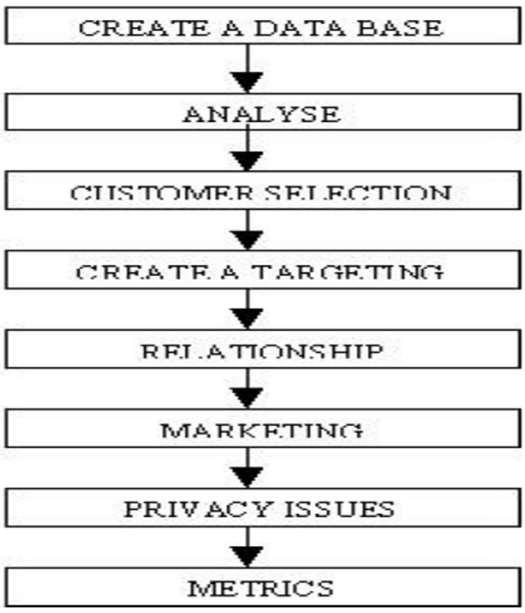

Fig 2 :Improving Customer Relationship Management [10]

E. Creating a Customer Database

A necessary first step to a complete CRM solution is the construction of a customer database, this should be a relatively straight forward task as the customer transactions and contact information are accumulated as a natural part of the interaction with customers. Ideally, the database should contain information about the following:

1) *Transactions:* This should include a complete purchase history
2) *Customer contacts:* Today, there are an increasing number of customer contact points from multiple channels and contexts.
3) *Descriptive information:* This is for segmentation and other data analysis purposes.
4) *Response to marketing stimuli:* This part of the information file should contain whether or not the customer responded to a direct marketing initiative, a sales contact, or any other direct contact.

F. Analyzing the Data

Customer databases have been analyzed with the intent to define customer segments. A variety of multivariate statistical methods ranging such as cluster and discriminate analysis have been used to group together customers with similar behavioral patterns and descriptive data which are then used to develop different product offerings or direct marketing campaigns

G. Customer Selection

After the database has been created and analyzed, the next step is to consider which customers to target? The customers in the most desired segments are with highest purchasing rates and greatest brand loyalty.

H. Targeting the Customers

More conventional approaches for targeting selected customers include a portfolio of direct marketing methods such as telemarketing, direct mail, and, when the nature of the product is suitable, direct sales. The Internet to facilitate individual relationship building with customers may be used.

I. Relationship

help businesses to manage customer relationships in an organized way and the most important aim is to retain the existing customers.

Fig 3: Customer Retention Program [10]

Because customers have more choices today and the targeted customers are most valuable to the company, customer service must receive a high priority within the Company. There are two types of customers services i.e. Reactive service is where the customer has a problem (product failure, question about a bill, product return) and contacts the company to solve it and Proactive service is a situation where the manager has decided not to wait for customers to contact and to establish a dialogue prior to complaining. Loyalty/Frequency programs should be arranged in order to provide rewards to customers for repeat purchasing. A number of Web-based companies providing incentives for repeat visits to Web sites. Ultimately the manager can build an environment that makes it more difficult for the customer to leave the “family” of other people who also purchase from the company.

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J. Marketing

The notion of mass customization goes beyond 1-to-1 marketing as it implies the creation of products and services for individual customers, not simply communicating to them.

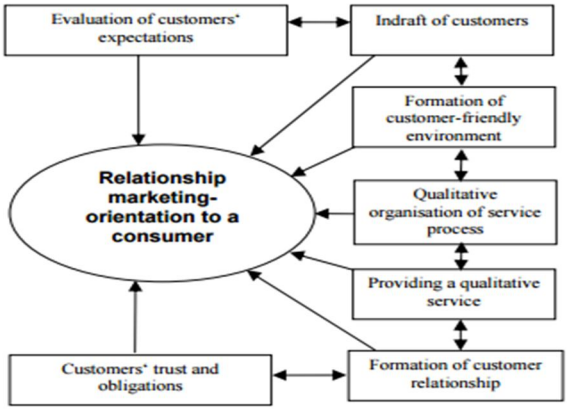

Fig 4: Coherence of relationship marketing and CRM elements [11]

K. Privacy issues

The CRM system described here depends upon a database of customer information and analysis of the data for more effective targeting of marketing communications and relationship-building activities. With the popularity of the Internet, many consumers and advocacy groups are concerned about the amount of personal information that is contained in databases and how it is being used.

L. Metrics

The increased attention paid to CRM means that the traditional metrics used by managers to measure the success of their products and services in the marketplace have to be updated. Financial and market-based indicators like profitability, market share, and profit margins have been and will continue to be important. However, in a CRM world, increased emphasis is being placed on developing measures that are customer-centric.

M. Scope of CRM

The scope of customer relationship management in terms of
point is as follows: Implementing appropriate systems to support customer knowledge acquisition, sharing and measuring CRM effectiveness. Integrating the activities of marketing, sales and service to achieve a common goal. Applying customer knowledge to continuously improve performance through a process of learning from successes and failures.
Acquiring and continuously updating knowledge about customer needs, motivations and behavior over the lifetime of the relationship. Measuring both inputs across all functions including marketing, sales and service costs and outputs in terms of customer revenue, profit and value.
Constantly flexing the balance between marketing, sales and service inputs against changing customer needs to maximize profit.

N. Benefits of CRM

The main advantages of CRM can be stated as below: [12]
Improve capabilities in targeting profitable customers.

1) Virtual integration of communication with customers
2) Improve sale forces efficiency and effectiveness
3) Personalized marketing message
4) Make products and services Proportional (especially storage)
5) Improve efficiency and effectiveness in customer services
6) Improve pricing capabilities
7) CRM permits to achieve customer retention and to cross sell new products

8) better relationships with their customers achieve loyal customers
9) CRM focus upon profitable clien
10) CRM results both in higher revenue and lower cost making companies more effective and efficient.

II. DATA MINING

Data Mining is the process of exploring and analysis of large amount of data with a specific target of discovering Significantly important patterns and rules. Data Mining helps finding knowledge from raw unprocessed data. Using this Mining Techniques allows extracting knowledge.
Data mining is defined as a business process for exploring large amounts of data to discover meaningful patterns and rules. [13]

A. Data Mining Application Domains

From the CRM point of view, the data mining applications include following applications: Customer Retention: Sophisticated customer-retention programs begin with modeling those customers who have defected to identify patterns that led to their defection. These models are then applied to the current customers to identify likely defectors so that preventive actions can be initiated. Sales and Customer Services: In today's highly competitive environment, superior customer service creates the sales leaders. When information is properly aggregated and delivered to front-line sales and service professionals, customer service is greatly enhanced. If customer information is available, rule based software can be employed to automatically recommend products. The programs like market-basket analysis have already shown phenomenal gains in cross-selling ratios, floor and shelf layout and product placement improvements and better layout of catalog and web pages.
Marketing: Marketing depends heavily on accurate information to execute retention campaigns, lifetime value analysis, trending targeted promotions, etc. Only by having a complete customer profile can promotions be targeted and targeting dramatically increase response rates and thus decreases campaign cost.
Risk Assessment & Fraud Detection: An accessible customer base significantly reduces the risk of entering into undo risk. For example, a bank can identify fiscally related companies that may be in financial jeopardy before extending a loan to them. The most important business areas that successfully apply data mining, presented below:

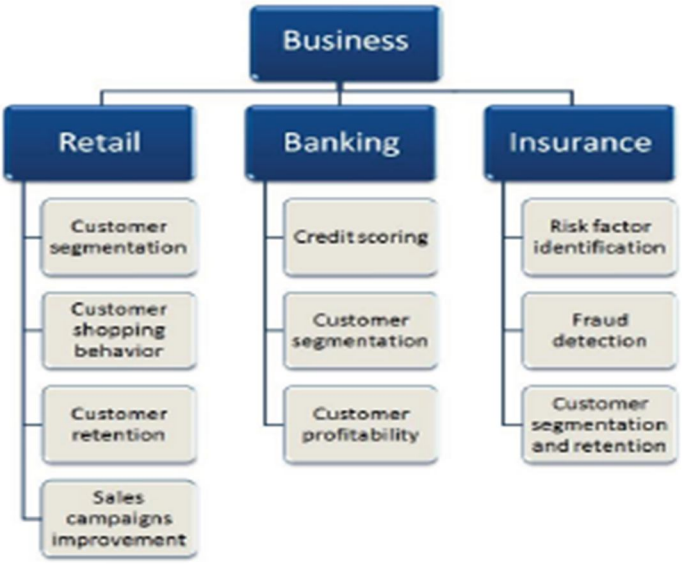

Fig 5 : Business areas that successfully apply Data Mining [14]

B. Data Mining Techniques for CRM

Data mining provides the technology to analyze mass volume of data and/or detect hidden patterns in data to convert raw data into valuable information. S. Govindu, B.Yugandhar [15].Data mining techniques deal with discovery and learning. Data mining techniques may be helpful to accomplish the goal of CRM by extracting or detecting hidden customer characteristics and behaviors from large databases. Belete Biazen Bezabeh [16] applied Data Mining Techniques to support customer relationship management. Following are the some of the popular data mining techniques:

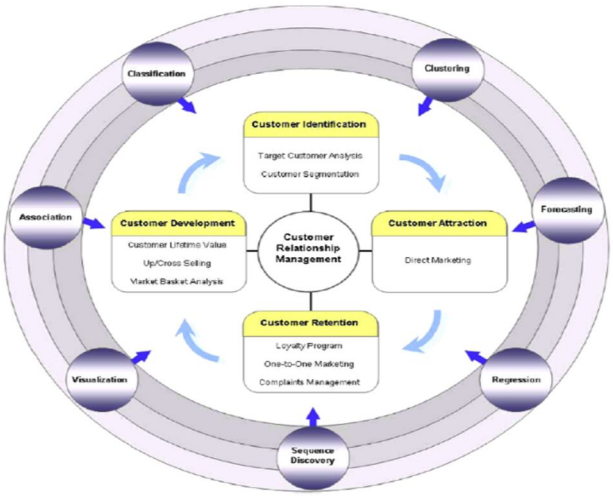

Fig 6: Classification Framework for Data Mining techniques in CRM [17]

C. Association Rule Learning

Association Rule Learning is a popular method for discovering interesting relations between variables in large databases. Agrawal et al. [18]

D. Classification & Prediction

Classification and prediction are two forms of data analysis that can be used to extract models describing important data classes or to predict future data trends. [19].

E. Clustering

Clustering is the method by which similar type of records are
grouped together. Usually, clustering is done to give the end user a high-level view of what is going on in the database. [19].

F. Regression Analysis

Regression analysis helps us understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent

III. DATA MINING CHALLENGES & OPPORTUNITIES IN CRM

Jingjing Wu [22] explored the existing practical problems when implementing Customer Relationship Management Following are the key data mining challenges and opportunities for better Customer Relationship Management:

A. Non-trivial results almost always need a combination of DM techniques

Chaining/composition of DM, and more generally data analysis, operations is important. In order to analyze CRM data, one needs to explore the data from different angles and look at its different aspects. This should require application of different types of DM techniques and their application to different "slices" of data in an interactive and iterative fashion. Hence, the need to use various DM operators and combine (chain) them into a single "exploration plan".

B. There is a strong requirement for data integration before

1) *Data Mining:* In both cases, data comes from multiple sources. For example in CRM, data needed may come from different departments of an organization. Since many interesting patterns span multiple data sources, there is a need to integrate these data before an actual data mining exploration can start.
2) *Diverse data types are often encountered, which requires the integrated mining of diverse and heterogeneous data:* In CRM, while dealing with this issue is not critical, it is nonetheless important. Customer data comes in the form of structured records of different data types (e.g., demographic data), temporal data (e.g., weblogs), text (e.g., emails, consumer reviews, blogs and chat-room data), (sometimes) audio (e.g., recorded phone conversations of service reps with customers)

3) *Highly and unavoidably noisy data must be dealt with:* In CRM, weblog data has a lot of "noise" (due to crawlers, missed hits because of the caching p
4) *Problem,* etc.). Other data pertaining to customer "touch-points" has the usual cleaning problems seen in any business-related
5) *datReal-world validation of results is essential for acceptance:* In CRM, as in many DM applications, discovered patterns are often treated as hypotheses that need to be tested on new data using rigorous statistical tests for the actual acceptance of the results. This is even more so for taking or recommending actions, especially in such high-risk applications as in the financial and medical domains. Example: recommending investments to customers (it is actually illegal in the US to let software give investment advice)
6) *Developing deeper models of customer behavior:* One of the key issues in CRM is how to understand customers. Current models of customers mainly built based on their purchase patterns and click patterns at web sites Such models are very shallow and do not have a deep understanding of customers and their individual circumstances. Thus, many predictions and actions about customers are wrong. It is suggested that information from all customer touch-points be considered in building customer models. Marketing and psychology researchers should also be involved in this effort. Two specific issues need to be considered here. First, what level should the customer model be built at, namely at the aggregate level, the segment level, or at the individual level? The deciding factor is how personalized the CRM effort needs to be. Second is the issue of the dimensions to be considered in the customer profile. These include demographic, psychographic, macro-behavior (buying, etc.), and micro behavior (detailed actions in a store, e.g. individual clicks in an online store) features.
7) *Acquiring data for deeper understanding in a nonintrusive,: low-cost, high accuracy manner:* In many industrial settings, collecting data for CRM is still a problem. Some methods are intrusive and costly. Datasets collected are very noisy and in different formats and reside in different departments of an organization. Solving these pre-requisite problems is essential for data mining applications.
8) *Managing the "old start/bootstrap" problem:* At the beginning of the customer life cycle little is known, but the list of customers and the amount of information known for each customer increases over time. In most cases, a minimum amount of information is required for achieving acceptable results (for instance, product recommendations computed through collaborative filtering require a purchasing history of the customer).Being able to deal with cases where less than this required minimum is known is a therefore a major challenge.

IV. APPLYING DATA MINING TO CRM

In order to build good model of CRM system, there are a number of steps that need to be followed. Following are the basic steps of data mining for effective CRM: -

A. Define the Business Problem

Each CRM application will have one or more business objectives for which there are a need to build an appropriate model. Depending upon the goals, build a very different model.

B. Build a Marketing Database

Next step is to build a marketing database because of operational databases and corporate data warehouse. This will often not contain the data in the form it is needed. Also CRM applications may interfere with the speedy and effective execution of these systems. After this there is a need to clean and integrate the data.

C. Explore the Data

Before building a good predictive model, it is important to understand your data. Graphing and visualization tools are a vital aid in data preparation and their importance to effective data analysis cannot be overemphasized.

D. Prepare Data for Modeling

This is the final data preparation step before building models. There are four main parts of this step:

1) Select the variables on which to build the model.
2) Construct new predictors derive from the raw data
3) Decide to select a subset or sample of your data on which to build models
4) Transform variables in accordance with the requirements of the algorithm you choose for building your model.

E. Data Mining Model Building

The most important phase in this is an iterative process. There is a need to explore alternative models to find the one that is most useful in solving your business problem. Most CRM applications are based on a protocol called supervised learning.

F. Evaluate Your Results

Perhaps the most overrated metric for evaluating your results is accuracy. Another measure that is frequently used is lift.

G. Deploy Model and Results

In building a CRM application, data mining is often a small but critical part of the final product. The way data mining is actually built into the application is determined by the nature of the customer interaction. There are two ways you interact with your customers: they contact you (inbound) or you contact them (outbound). The deployment requirements are quite different.

V. CONCLUSION

In today's global economy, the tide of integration, CRM has become an essential business survival strategy, It can help companies achieve profit maximization, and improve enterprise competitive Data mining technology in the field, throughout the customer life cycle, the various stages of mining enterprise customers the greatest value. It can be utilize proper allocation of existing resource for businesses support and plays a central role. We use appropriate data mining tools for analysis of customer information in order to find the actual needs of the customer and do the customer classification, find out how to make better product sales to increase product sales. customer's expectations are for all time growing, and business services must grow along these expectations. CRM is the technique throughout businesses which can attach with their customer and so serve them better.

By paying a smaller price increase related to customer satisfaction factor scores, which greatly increase customer satisfaction, strengthen customer relationships and will reach highest enlargement and great success.

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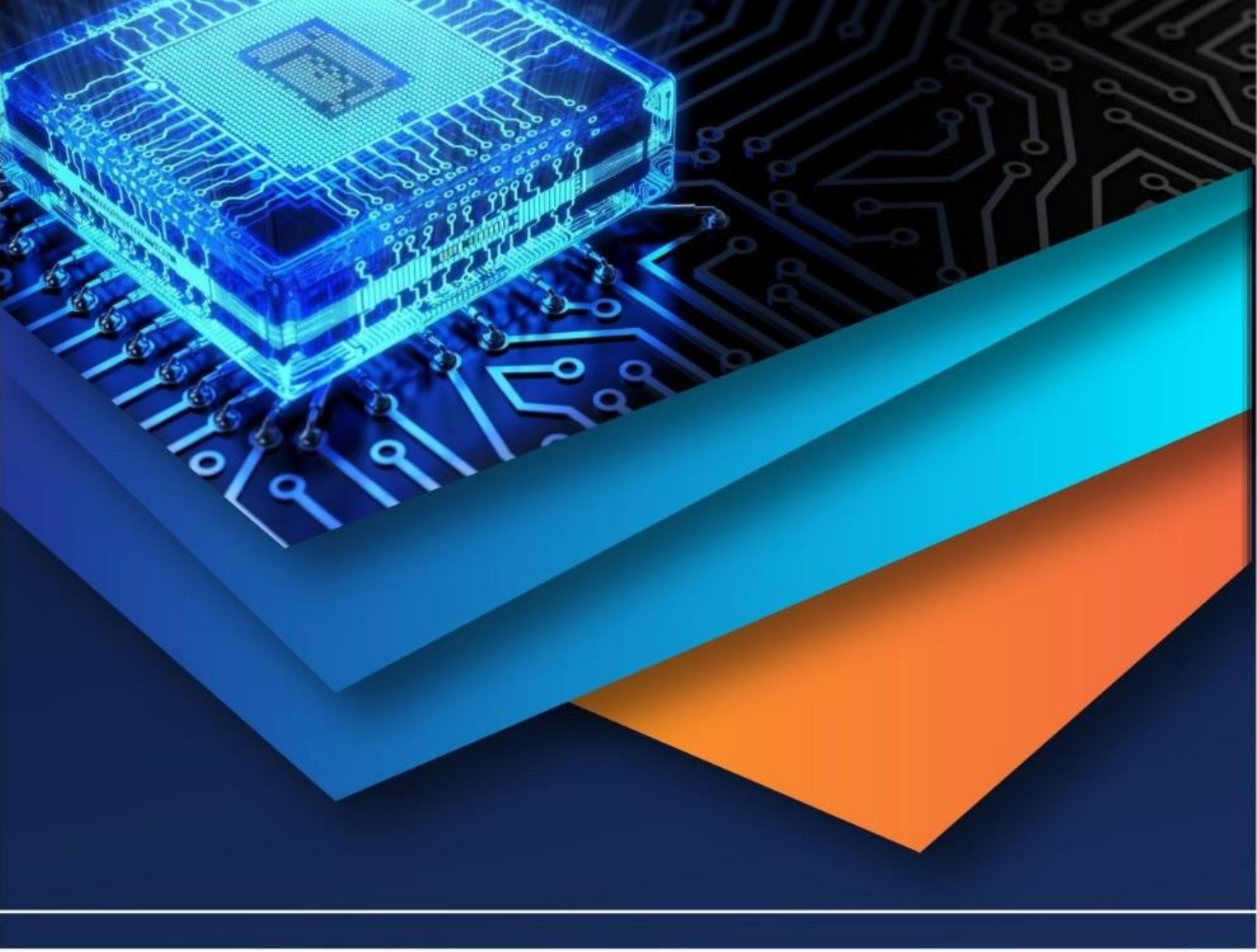

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