iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VI **Month of publication:** June 2019

DOI: http://doi.org/10.22214/ijraset.2019.6286

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

A Review on Privacy Issues in Content Based Image Retrieval

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Abstract: ***Content Based Image Retrieval is most dominant process image query. Past researches are mainly focused on improving the efficiency of CBIR, with little attention paid to privacy and security issues related to CBIR. This paper reviews existing techniques for maintain privacy in CBIR and suggest possible research directions.***
Index Terms: Content Based Image Retrieval, AES, encryption, decryption.

I. INTRODUCTION

As of late, huge accumulations of pictures and recordings have developed quickly. In parallel with this development, content-based recovery and questioning the filed accumulations are required to get to visual data. As an intense system, content-based recovery frameworks need to give simple to-file information structures as well as quicker question execution offices. With a specific end goal to record and answer the inquiries that the client's stance to look for visual data, the substance of the pictures and recordings must be separated.

Presently days, CBIR (Content based picture recovery) is a hotspot of advanced picture preparing systems. CBIR explore begun in mid-1990 and is probably going to keep amid the initial too many years of 21st century [1].

The developing requests for picture recovery in sight and sound field, for example, wrongdoing avoidance, Fashion and visual communication and biometrics has driven application engineers to seek approaches to oversee and recover pictures all the more productively. Manual perusing the database to look for indistinguishable pictures would be illogical since it requires a great deal of investment and requires human mediation.

A.Anandhet. Al[2] pointed out three feature techniques viz. color auto-correlogram, gabor wavelet and wavelet transform that extracts the features on the basis of color, texture and shape respectively. In this process manhattan distance algorithm is used to retrieve similarity features to find similar image.

The model used to find similar image is represented in figure 1.1S.M.Singhand et.al[3]. describes a model of Content based image retrieval by combining feature extraction based on HSV, color moments, autocorrelogram and gabor wavelet. This model also used SVM (support vector machine) algorithm of machine learning for better classification based on features.

M. D. Malkauthekar[4] represents the analysis of two algorithms for face recognition. For finding similarity between facial images manhattan and eulidean distance metric of content based retrieval is used. This model represents that manhattan distance performs better than Euclidean distance metric.

H.Lachehebet. al[5] proposed a CBIR (content based image retrieval) system which uses density clustering technique and t-SNE (t-Distributed Stochastic Neighbor Embedding) data reduction method. This model has advantage over previous CBIR systems as the storage space required is less due to dimension reduction, good precision and also no need of clustering. Also the similar images grouped into same cluster.

FaiqBajiet.al[6] proposed a new model to solve the ROI (region of interest) based image retrieval. In this model histogram and texture features vectors are generated by connected components and interesting of images techniques to retrieve images from large database of images.

The HSV histogram and GLCM (Gray Level Co-occurrence matrix) are used to extract the color and texture features from images. Histogram intersection is used to match the features. This model shows better efficiency over traditional ROI based CBIR system.

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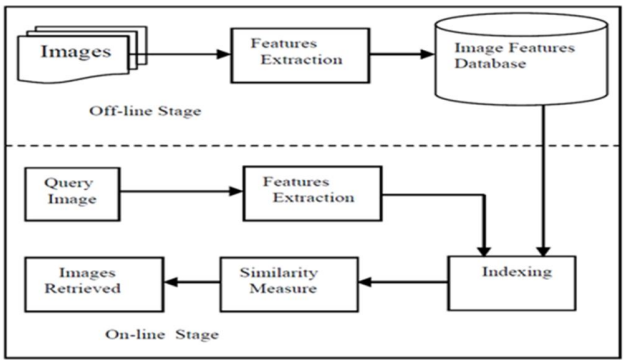


Fig 1.1 Content Based Image Retrieval System.

However, security and privacy issues associated with image query in CBIR cannot be neglected. CBIR providers or hackers may analyze the user's image query and feedback and use it for malicious purposes. For instance, if a user continuously searches for images related to eye tumor and marks some search result images as relevant, then it is quite relevant that the user or someone near him is suffering from eye tumor. This is sensitive information and can be used for malicious purposes. Thus, privacy aspects in CBIR must also be enhanced

Privacy protection in Content Based Image Retrieval (CBIR) is a new research topic in cyber security and privacy. The state-of-art CBIR systems usually adopt interactive mechanism, namely relevance feedback, to enhance the retrieval precision. Three types of attacks as shown in Fig 1.4 are possible in a Content Based Image Retrieval System with Relevance Feedback .In query attack the attacker may directly find out user's search intention. If the query is performed cryptographically attack on result may occur. In feedback attack the malicious person can easily find the most relevant images for user can easily compromise his privacy. Therefore Protecting the user's privacy in Relevance Feedback based CBIR (RF-CBIR) is a challenging problem. In May, 2016, a lawsuit alleged that the photo-tagging system of Facebook violates user privacy[9]. In fact, Facebook stopped the automatic application of facial recognition technology in Europe4 three years ago, facing similar privacy concerns. To address serious privacy concerns, Google has also forbidden apps to use the face recognition feature on Google Glasses5[10].

II. LITERATURE SURVEY

Celik, M.U.,and van der Veen, M.,(2008)[7] proposed a protected watermark inserting plan in light of query tables for spread-range watermarks. Our quick discovery calculation enhances recognition speed of existing strategies by six requests of size in a common framework with a large number of customers. They have demonstrated that the watermark recognition process can be accelerated by six requests of size for a run of the mill framework various customers have gotten the watermark lookup table for various customers from a constrained arrangement of lookup table references and connection performed straightforwardly on lookup tables.

Shashank, J., Kowshik, P., Srinathan, K. and Jawahar, C.V., (2008))[8] A security saving calculation named 'Private CBIR' is proposed in te paper. Database is listed utilizing hash ordering plan ..

Wang, M. and Hua, X.S.,(2009))[9] proposed a strategy named upgraded multigraph-based semi-administered learning (OMG-SSL), plans to handle these troubles at the same time in a brought together plan. In light of this calculation, they gave a novel effective video comment plot, in which large scale unlabeled information, different modalities, various separation capacities, and video fleeting consistency could be all the while handled in a bound together way

Khelifi, F. and Jiang, J., (2010))[10] another perceptual picture hashing method has been proposed. The proposed hashing procedure has been appeared to convey better execution as far as power at a lower computational cost when contrasted with related strategies.

Piva, A., and De Rosa, A., (2010),)[11] Watermarking in Client-Side implanting frameworks have proposed as conceivable answer for copyright insurance in substantial content of the scale dispersion conditions. The proposed approach licenses to effectively consolidate the security of customer side install ding with the strength of educated implanting techniques. Since this approach licenses to effectively consolidate the safe implanting of fingerprints at the customer agree with the predominant heartiness of educated installing systems, giving another intense apparatus to the protected dispersion of brilliant interactive media sub-stance. Be that as it may, the security isn't upgraded and when the server appropriates encoded image it cannot be ideally com-squeezed. Open issues in the proposed structure to be tended to later on inquire about concern the requirement for higher security and the pressure

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overhead. Rial, A.,andPreneel, B., (2010))[12],proposed security definitions for visually impaired and intelligible watermarking plans and for unknown BSW conventions. Recent BSW conventions are not furnished with the formal investigation of their security of properties. In this paper, they just focus on security properties. They didn't stretch out to different properties. So the future work should be directed to adjust or stretch out definitions to conventions that offers extra properties. For instance, attractive property for on-line business conventions is exchange decency and hence characterizing and outlining protection safeguarding reasonable BSW conventions is an intriguing objective.

Wang, M. and Yang, K.,(2010))[13] proposed an assorted significance positioning plan that can consider the importance and decent variety by investigating the substance of pictures and their related labels. The positioning rundown is created by an avaricious requesting calculation which enhances normal various exactness in view of the importance scores and the likenesses, a novel measure that is reached out from the ordinary normal accuracy.

Duan, L. and Li, W.(2011))[14] proposed another pack based reranking system for expansive scale CBIR. They first bunch pertinent pictures by utilizing both literary and visual highlights. The favorable position is that utilizing the programmed pack comment technique can accomplish the best execution, as contrasted and other conventional picture reranking strategies. Later on, they will examine more successful grouping strategies to additionally enhance the execution of their system

Zhang, J. and Xiang, Y.(2011))[15] three valuable highlights are displayed: security against fractional watermark evacuation, security in watermark check and non-repudiation. The test comes about demonstrate that watermarking question pictures don't influence the recovery execution; so the power of computerized watermark can be enhanced by expanding its quality. There is no change in the strength of advanced watermarks. As a future work, growing new watermarking and recovery calculations to improve the strength of computerized watermark at the cost of low quality watermarked question picture without impacting the recovery execution

Su, J.H. and Huang, W.J.(2011))[16] proposed a novel strategy, Navigation-Pattern-based Relevance Feedback (NPRF), to accomplish the high proficiency and adequacy of CBIR in adapting to the extensive scale picture information. Inside a here and now of significance criticism, the route examples can help the clients in acquiring the worldwide ideal outcomes. Future work will be in perspective of substantial informational collections, scale their proposed strategy by using parallel and dispersed processing procedures.

Lai, C.C. and Chen, Y.C.(2011)[17] a client situated instrument for CBIR technique in view of an intuitive hereditary calculation (IGA) is proposed. The aftereffects of the proposed approach have demonstrated the critical change in recovery execution. Additionally, work considering all the more low-level picture descriptors or abnormal state semantics in the proposed approach is in advance.

Zhang, L. and Wang, L.(2012)[18]proposed a novel calculation called summed up BDA (GBDA) for CBIR. To keep away from the Gaussian presumption for the positive specimens, the GBDA characterizes the between-class scramble by turning to interclass closest neighborhood tests, subsequently separating the most discriminative data.

Yu, J. and Tao, D(2012)[19]For transductive picture grouping, a versatile hypergraph learning technique is proposed. In our technique, we produce hyperedges by connecting pictures and their closest neighbors. This strategy all the while takes in the names of unlabeled pictures and the weights of hyperedges. The approach explores a strong hyperedge development technique as well as presents a synchronous learning of the names of unlabeled pictures and the weights of hyperedges. Later on, they will exactly think about the methodologies and grow new systems to make the versatile hypergraph learning effective for expansive scale databases.

Hsu, C.Y., and Pei, S.C., (2012) [20] proposed a approach utilized is this, protection safeguarding highlight ex-traction and representation address the issue of extricating and speaking to media includes in the encoded area while permitting display of intrinsic properties in the plain-text/unscrambled space. The weakness of this plan accomplishes better outcomes however the computational many-sided quality should be expanded. In Future work, they demonstrate that the proposed Paillier cryptosystem-based Privacy Preserving scale-invariant element change Privacy Preserving scaleinvariant feature transform (PPSIFT) plot accomplishes provable security in light of Data Loss Prevention Data Loss Prevention (DLP) and Rivest Shamir AdlemanRivest Shamir Adleman(RSA), however the computational intricacy should be additionally diminished.

Wang, C., and Lou, W., (2012) [21]proposed a scheme used for encryption is ranked searchable encryption scheme. This scheme over-comes the disadvantages in another scheme that cloud server needs to directly navigate the entire file of the considerable number of reports for each inquiry ask for, while this is effective as SSE plans which is existing one with just consistent hunt money on the server. The disadvantage of this is the current implementation of secure ranked keyword search is not fully optimized. The Future work is an extension of experimental results will make this work more efficient

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Zhang, L. and Wang, L.(2012) [22] proposed a novel calculation called summed up BDA (GBDA) for CBIR. To keep away from the Gaussian presumption for the positive specimens, the GBDA characterizes the between-class scramble by turning to interclass closest neighborhood tests, subsequently separating the most discriminative data.

Tiakas, E. and Rafailidis, D.(2013) [23] a novel estimated ordering plan for productive substance based picture pursuit and recovery is introduced, called Multi-Sort Indexing (MSIDX). The proposed plot underpins the coveted functionalities of present-day applications since it is equipped for performing exact substance based recovery in low inquiry time and handles the dynamic operations of inclusions and cancellations continuously

Cao, N., and Lou, W., (2014), [24] Multi-keyword rank search encryption (MRSE) technique is utilized. They proposed conspire presents about steady overhead while expanding the quantity of inquiry keywords. Future work in this paper investigates supporting other multi keyword meaning over encoded information and checking the trustworthiness of the grade request in the query output.

Cheng, B and Zhuo, L.,(2014) [25],proposed the reversed file is produced utilizing visual expressions of pictures and after that scrambled dually by randomized twofold encoding and a key-based Gaussian arbitrary grid separately, creating a protected file. The proposed strategy can give secure, successful and precise recovery execution for clients without decoding, and accomplish practically identical recovery execution to the traditional huge scale picture recovery without uncovering data about picture substance and clients' protection.

Hong, R. and Wang, M.,(2014) [26] proposed a MIL strategy with discriminative component mapping and highlight choice. The impediment of our proposed technique, i.e., the comment depended on a solitary choice and not founded on different conceivable outcomes choice. Future work will concentrate on vast scale picture ordering by misusing visual examination and logical data.

W. Lu, A. L. Varna, and M. Wu (2014) [27] The authors reviewed and compared two techniques for preserving confidentiality in CBIR namely, holomorphic encryption and index randomizations. The holomorphic based technique is more secure but too heavy-weight in terms of computational complexity, communication load, and user involvement for practical applications, while the feature/index randomization techniques offer very high efficiency using deterministic distance-preserving randomization at the cost of revealing some information about the distance distribution among randomized feature

Z. Xia, Y. Zhu, X. Sun, Z. Qin, and K. Ren (2015) [28] The authors proposed a novel approach for privacy protection and copy prevention approach in CBIR. The proposed threat model considers query users as dishonest therefore a watermark is embedded in the image. KNN algorithm is used for encrypting features of images.

Guo, J.M. and Prasetyo, H., (2015) [29] proposed two picture highlights are proposed to list a picture, to be specific, shading co-event include (CCF) and bit design highlights (BPF), which are created straightforwardly from the ODBTC encoded information streams without playing out the interpreting procedure. The upside of the proposed plan can give the best normal accuracy rate contrasted with different previous plans. Future heading can be the proposed picture recovery plan can be connected to video recovery. The video can be dealt with as grouping of the picture in which the proposed ODBTC ordering can be con

Weng, L. and Amsaleg, L.,(2015) [30] two unique developments of hearty hash calculations are utilized. One depends on arbitrary projections; the other depends on the discrete wavelet change. The two calculations show acceptable execution in correlation with best in class recovery plans. A breaking point of their proposition is that it requires both the server and the customer to actualize a similar engineering, i.e, a similar component extraction, hash calculations, ordering, and so on. Albeit irregular projection can be connected to any element, it isn't generally practical for existing frameworks. Future work can be once hash-based ordering and pursuit turn out to be broadly utilized, their proposition requires less push to actualize.

J. Yuan, S. Yu, and L. Guo (2015) [31] In this paper, a lightweight secure image search scheme over encrypted data, namely SEISA.is proposed. Compared with image search techniques over plaintexts, SEISA only increases about 9% search cost and sacrifices about 3% on search accuracy. SEISA also efficiently supports search access control by employing a novel polynomial based design, which enables data owners to define who can search a specific image. Furthermore, a secure k-means outsourcing algorithm that significantly saves the data owner's cost is demonstrated.

L. Zhang, T. Jung, P. Feng, K. Liu, X. Y. Li, and Y. Liu (2015) [32] In this paper a novel system PIC: a Privacy-preserving Image search system on Cloud. The provide secure content-based large-scale image search with fine-grained access control. Users can search on others' images if they are authorized by the image owners..

L. Weng, L. Amsaleg, A. Morton, and S. Marchand-Maillet (2015) [33] The paper proffers a privacy protection framework for large-scale content-based information retrieval. It offers two layers of protection. First, robust hash values are used as queries to prevent revealing original content or features. Second, the client can choose to omit certain bits in a hash value to further increase the ambiguity for the server.

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B. Ferreira, J. Rodrigues, J. Leitao, and H. Domingos (2015) [34] in this paper a secure framework for outsourced privacy-preserving storage and retrieval in large image repositories is proposed based on IES-CBIR, a novel Image Encryption Scheme that displays Content-Based Image Retrieval properties.

Zhu, X. and Li, X., (2016) [35]paper all the while conducts a progressive element choice and a multiviewmultilabel (MVML) learning for multiview picture characterization, by means of inserting a proposed another square column regularizer into the MVML system. The proposed strategy successfully led picture arrangement by staying away from the antagonistic effect of both the repetitive perspectives and the uproarious highlights. Later on, they will expand the proposed strategy into its portion version for the use of video suggestions.

Fu, Z., and Huang, F., (2016), [36]personalizedmultikeyword ranked search over encrypted data is employed. They built a model that analyzes an user interest for a single user by search history of users, and with the help of semantic ontology WordNet adopted a mechanism of scoring to express interest of the user smartly. This scheme overcomes the limitation of the one size fits model in the existing searchable encryption scheme.

Xia, Z., and Wang, Q., (2016) [37] , unencrypted dynamic multi-keyword ranked search scheme is employed and they built a tree-based index structure and they proposed a Depth-first Greedy algorithm to enhance multi-keyword search rank efficiently. Because of the tree-based index structure, the proposed method achieved sub-linear search time and deal with the deleting and inserting the flexible documents. The main disadvantage is that searchable encryption used here is not sufficient.

Xia, Z., and Ren, K., (2016) [38] proposed a watermarking plan that backings Content Based Image Retrieval (CBIR) over encoded pictures without releasing the data which is sensitive to cloud. This secures the protection of information in CBIR deployment applications beyond an inquisitive server and the unscrupulous inquiry clients. The proposed watermarking technique cannot be viewed as an exceptionally hearty one. Later on, more endeavors expected to plan watermarking calculation with better strength and implanting limit. Zhu, L. and Shen, J.,(2017) [39]proposed a novel unsupervised visual hashing approach called semantichelped visual hashing (SAVH).SAVH has a vital favorable position that its disconnected learning can successfully use semantics associated with the content, while its web-based hashing requires just visual picture as input. Future work is to additionally approve the adequacy of SAVH when more related modalities are included. For instance, the land area of the picture, social relationship of pictures, and so on. Besides, it would be likewise intriguing to examine the viability of visual picture on helping to hash for content recovery. Wangming, X.U. and Er, M.J.,(2017) [40]another nonnegative scanty component learning way to deal with creating an all-encompassing picture portrayal in light of low-level neighborhood highlights is displayed. The upside of the proposed system over the aggregate pooling or max pooling procedure happens in the way that the kMaxSum pooling jelly more discriminative data and can be seen as a speculation of these two pooling techniques. Enlivened by late advances and triumphs of profound learning methods for picture recovery, they will incorporate the proposed approach into a progressive profound element learning structure to additionally limit the semantic hole for CBIR assignments in future work.

Y.Huang, J. Zhang, L. Pan, and Y.Xiang,(2018) [41]The paper proposes a privacy protection scheme for Relevance Feedback CBIR systems. Concept of ‘Private Query’ and ‘Private Feedback’ is introduced to enhance the performance of CBIR system with Relevance Feedback, without compromising with user’s privacy. Private Query is developed using Percentage Of Variance. In private query certain features of images are sent to the server instead of the image. In Private Feedback some bluff images are introduced in the user’s feedback , by K Anonymity principle to confuse the malicious persons.

III. RESULTS AND CONCLUSION

From the literature surveyed it is incurred that Privacy protection in content based image retrieval systems especially in Relevance Feedback based CBIR is very crucial. From the literature surveyed it can be concluded that adequate research is not performed on following factors.

1) *Reducing Latency:* Most of the research is concentrated towards developing advanced image encryption techniques such as holomorphic encryption, Double encryption, KNN based encryption. Such complicated encryption strategies can be very efficient in privacy protection but on the cost of increased latency.
2) *Developing Lightweight Algorithms:* The proposed algorithms demand high computational power which may not be possible is user end devices such as smartphones, Personal Computers etc.
3) Reducing Bandwidth usage: The concept of introducing confusing images is demonstrated in[22]. The algorithm can prevent feedback and result attack but by increased bandwidth usage.
4) Result hiding: Most of the proposed privacy protection algorithms hide the query image’s features but directly expose the query result to attackers.

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IV. FUTURE SCOPE

In future the author plan to implement lightweight image encryption techniques to enhance privacy in CBIR.

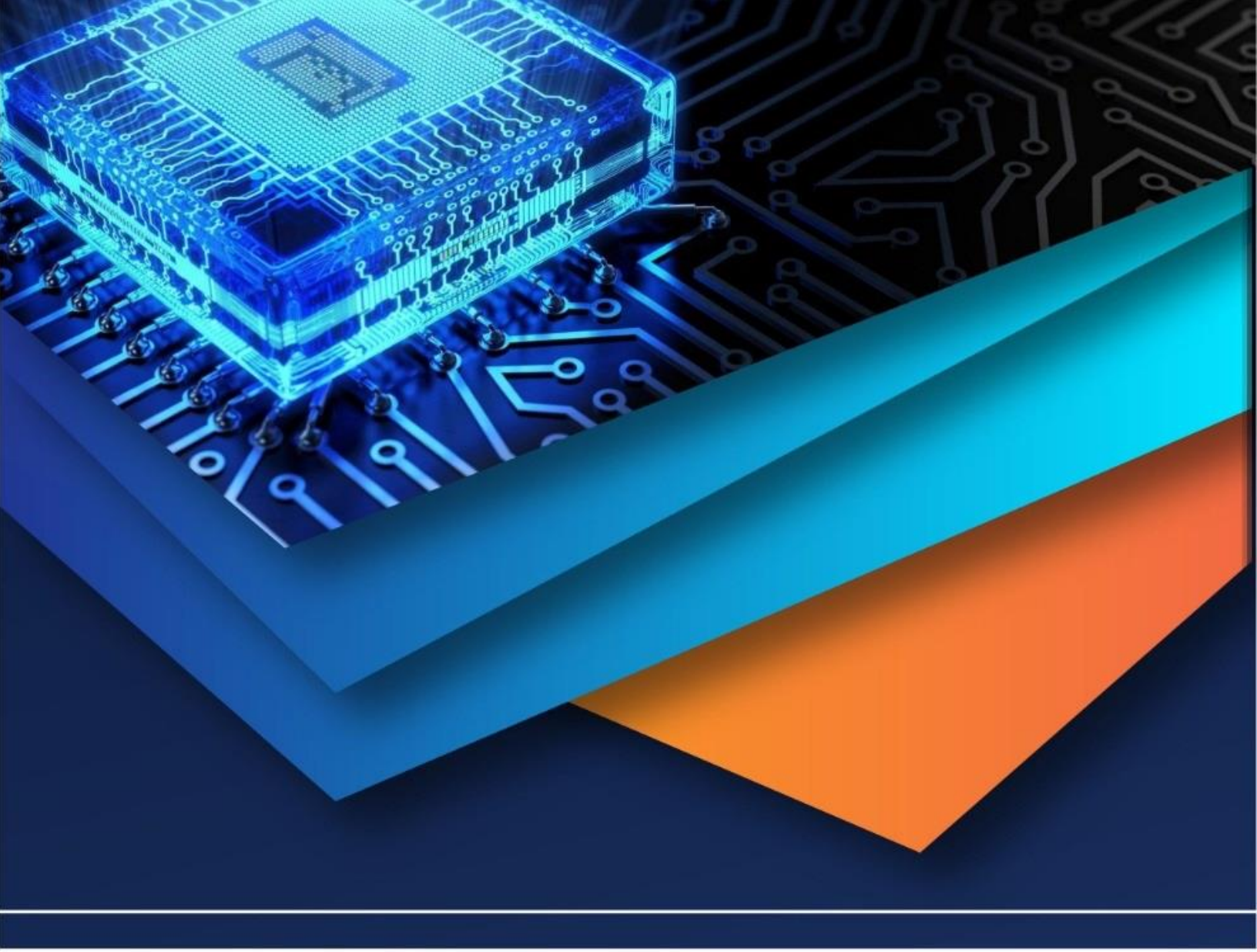
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