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Image Detection System Using Image Processing

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Abstract: The increasing popularity of Social Networks makes change the way people interact. These interactions produce a huge amount of data and it opens the door to new strategies and marketing analysis. According to Instagram and Tumblr, an average of 80 and 59 million photos respectively are published every day, and those pictures contain several implicit or explicit brand logos. Image recognition is one of the most important fields of image processing and computer vision. The CNNs are a very effective class of neural networks that is highly effective at the task of image classifying, object detection and other computer vision problems.in recent years, several scale- invariant features have been proposed in literature, this paper analyzes the usage of Speeded Up Robust Features (SURF) as local descriptors, and as we will see, they are not only scale-invariant features, but they also offer the advantage of being computed very efficiently. Furthermore, a fundamental matrix estimation method based on the RANSAC is applied.
Keywords: SURF Algorithm, CDS Extraction Matches, Computer Vision, Image Recognition

I. INTRODUCTION

Logo detection has been a well-studied subject for decades since it arises in many practical scenarios of modern marketing and advertising. Logos are mainly designed for decorative and identification purposes. A specific logo can have several different representations, and some logos can be very similar in some aspects. The automatic classification of those logos gives to the marketing industry a powerful tool to evaluate the impact of brands. Marketing campaigns and medias can benefit with this tool, detecting unauthorized distributions of copyright materials. Logos are key elements for companies and play essential role in the industry and commerce.

Different logos may have similar layout but slight difference in spatial disposition of the graphics elements, difference in orientation, size and shape. Logos of different firms exist in the database. The logo exit in text form, graphic form or in both i.e., hybrid form. Therefore, it is necessary to extract the feature logo of the logo image as well as the test image so that it can identify the text portion and graphic portion of the logo properly Logo detection process splits in two parts: the first one is the data collections preparation, a set of logos and images for training and testing, and the second one is the real application.

The last decades have seen an explosion of the amount of digitized document libraries. In order to properly index these documents, it is necessary to categorize as well as to retrieve them. It allows us to determine the source of the documents quickly and accurately, without any textual transcription and at a low cost. This brings about different interesting issues, such as logo detection, logo recognition, and logo spotting.

Its feature is also personal specific. Just like SIFT, in SURF, detectors are first employed to find the interest points in an image, and then the descriptors are used to extract the feature vectors at each interest point. However, instead of difference of Gaussians (DOG) filter used in SIFT, SURF uses Hessian-matrix approximation operating on the integral image to locate the interest points. Thus, based on the above advantages of SURF, we propose to exploit SURF features in face recognition in this paper. The performance of the proposed method will be evaluated by experimental comparisons with SIFT features. To our knowledge, the application of SURF to face recognition has not been systematically investigated yet.

II. KEY POINT MATCHING STEPS

A. Proposing Methods For Key-Point Matching

A method is proposed using key-point matching methods to find the best candidate match for each key-point from the image of the logo by identifying its nearest neighbor in the set of key- points from the document images.

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1) *Simple Key-Point Matching With Nearest Neighbor:* the best candidate match of a key-point is simply its nearest neighbor key-point using some distance function. The distance is computed in the description vector space with a suitable measure (e.g., Euclidean, Hamming).
2) *Key-Point Matching With 2-Nearest Neighbor Matching Rule:* the false matches are removed based on the ratio of the first closest neighbor and the second closest neighbor.
3) *Key-Point Matching With Post-Filter By A Second Descriptor:* the removed matches which are rejected by the 2-nearest neighbor matching rule are re-examined using a second descriptor.

B. Benchmarking Well-Known Local Feature Detectors And Descriptors

Although logo spotting has its own characteristics, the problem of locating logos in documents can be seen as a particular case of the object recognition problem from the Computer Vision field. Our objective is to test and to find the most suitable local feature detectors and descriptors for the problem of logo spotting.

C. Applying The Logo Spotting Approach On Two Applications

Document categorization and retrieval: The proposed framework with its main logo spotting method is applied to two applications: document categorization and retrieval with real document databases. A comparison is made between our proposed methods and state-of-the-art methods in the fields of the two mentioned applications.

D. Separating Text And Non-Text In Document Images

Document images are composed of text and non-text elements. Non-text can be halftones, drawings, mathematical formulas, tables, charts, logos, etc.

Separating text and non-text document images helps us to remove some superfluous elements as text in our context, and this could improve the performance of the methods. The main contribution of this part of the thesis is proposing a method to separate text and non-text in document images.

E. Optimizing The Proposed Spotting Framework

The objective point is centered on how to speed up the proposed framework. There-fore, a dimensionality reduction technique and approximate search computation are integrated into the framework. Moreover, separating text and non-text is also applied as the preprocessing step in the framework.

Creating a database of scanned magazine image for logo spotting Finally, beside testing our proposed spotting framework on a well-known database (Tobacco-800 database), we build database with complex layout. The database is collected from scanned magazine images. We also create its ground-truth as bounding boxes of logo regions.

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III. SPEEDED UP ROBUST FEATURE

SURF, Speeded-Up robust Features, is another image detector and descriptor inspired by SIFT, was first presented by Herbert Bay in the ECCV 2006 conference in Graz, Austria [7]. SURF approximates or even outperforms previously proposed schemes with respect to repeatability, distinctiveness, and robustness, yet can be computed and compared much faster.

SURF algorithm is used to extract the interest points from reference logo and test image instead of SIFT algorithm. SURF is faster than SIFT. The main difference of SURF algorithm is it mainly applied to the DOH (Determinant of Hessian), the extraction of the feature points in the image are realized through simplification and approximation, compared to the SIFT algorithm, it reduces the complexity of feature point extraction and it also has better real-time performance.

The major steps of SURF are: Fast-Hessian Detector Constructing the Scale-Space
Accurate Interest Point Localization Interest Point Descriptor Orientation assignment
Descriptor Components

1) *Find Image Interest Points:* Use determinant of Hessian matrix
2) *Find Major Interest Points In Scale Space:* Non-maximal suppression on scaled interest point maps
3) *Find Feature "Direction":* Rotationally invariant features
4) *Generate Feature Vectors:* Hessian Matrix for feature detection. a Hessian matrix in 2-dimensions consists of a 2 x 2matrix
5) *Symmetric Matrix*

a) For any square matrix, the determinant of the matrix is the product of the eigenvalues
b) For the Hessian matrix, the eigenvectors form an orthogonal basis showing the direction of curve (gradient) of the image
- If both eigen values are positive, local min
- If both eigen values are negative, local max
- If eigen values have mixed sign, saddle point

c) Therefore, if the product of the eigen values is positive, then they were either both positive or both negative and we are at a local extremum
d) Typically, we apply some kind of thresholding to the determinant value so we only detect major features.
- You can control the number of interests points this way
- Some algorithms save the trace of the hessian to remember whether a min or a max

The integral image IΣ (x, y) of an image I (x, y) represents the sum of all pixels in I (x, y) of a rectangular region formed by (0,0) and (x, y). Now calculate the Hessian matrix, as function of both space and scale. Then calculate Hessian determinant using the approximated Gaussians. The task of localizing the scale and rotation invariant interest points in the image can be divided into three steps.

- First determine threshold value for the responses such that all values below the predetermined threshold are removed.
- Then, find a set of candidate points. To do this each pixel in the scale-space is compared to its 26 neighbors, comprised of the 8 points in the native scale and the 9 in each of the scales above and below.

Once interest points have been localized both in space and scale, Key point descriptor, Orientation assignment

The SURF descriptor describes how the pixel intensities are distributed within a scale dependent neighborhood of each interest point detected by the Fast-Hessian. This approach is similar to that of SIFT but integral images used in conjunction with filters known as Haar wavelets are used in order to increase robustness and decrease computation time. In order to achieve invariance to image rotation each detected interest point is assigned a reproducible orientation. – The image is convoluted with two first-order Haar wavelets. The filter responses at certain sampling points around the Key point are represented as a vector in a two-dimensional space. –

A rotating window of 60^0 is used to sum up all vectors within its range, and the longest resulting vector determines the orientation.

Now the present worker has Interest Point descriptor vector of length 1x64 for each Interest Point. For an image the present worker has got 20-120 Interest Points. Suppose for image no. of Interest Points are 80. So, a 2D matrix D1 of size 64x80 is generated.

AB = norm (D1(x, :));

D3 (1, x) = AB; Where x=64; And a scalar value from Orientation assignment. Combining these two features the present worker has got a vector of length 1X65 for each Image sample

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(a) input image (b) output of SURF algorithm

Fig 1. Feature Extraction by SURF algorithm

IV. CONTEXT-DEPENDENT SIMILARITY(CDS)

A. CDS Logo Detection algorithm

Let SX = {x1, . . . , xn }, SY = {y1,......... ,ym} be respectively the list of interest points taken from a reference logo and a test image (the value of n, m may vary with SX, SY).

1) *Input:* {reference logo image: l_X Test image: l_y, CDS parameter: Є, α, τ, β, N_a, N_r} Processes: Extract SURF from l_X, l_y and let S_X = {x1, xn},
Sy = {y1, yn} be respectively the list of interest points taken from both images;

a) Step 1

For i=1 to n
Find context matching for x_i where it is key point of reference image. End for
For i=1 to n
Find context matching for y_i where it is key point of test image. End For

b) Step 2

Set t=1 to max=30

c) Step 3

For i=1 to n
For j=1 to m Compute CDS matrix Increment t i.e. does t++;
End for End for
Repeat step 3 until t > max or convergence.

d) Step 4

For i=1 to n do For j=1 to m do Compute $K_{yj|xi}$
Match between x_i and x_j is declared only if

$K_{yj|xi} >= \sum ms{=}j\ K_{ys|xi}$

e) Step 5

If number of matches in Sy>τ|Sx| Then logo matched i.e., detected
Otherwise Logo not detected.

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2) *Output:* A Boolean value determining whether the reference logo in l_X is detected in l_Y.

In our project, SURF algorithm will be used for extracting features and CDS for matching features as these techniques are efficient comparatively

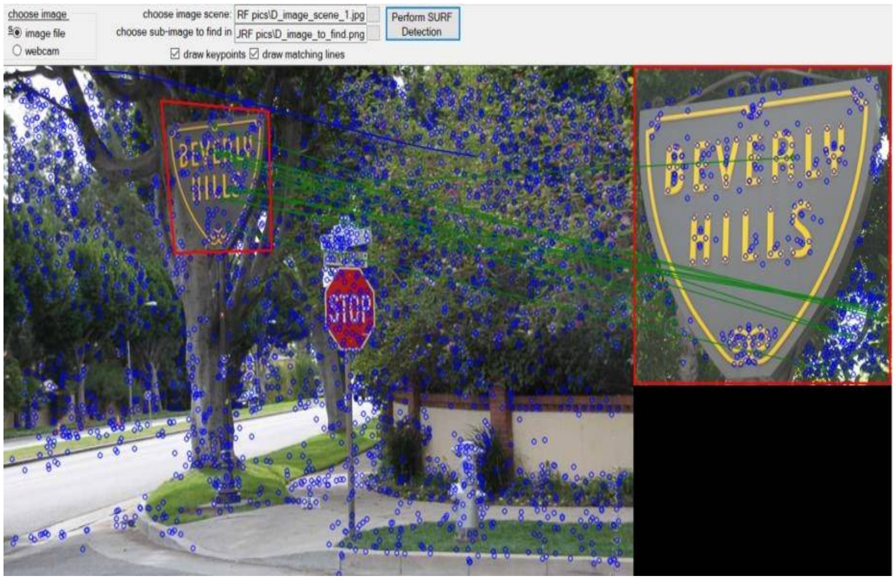

Fig 3. SURF feature matching using CDS algorithm

V. BLOCK DIAGRAM

Flow diagram for Logo detection. It consists steps: pre-processing, feature extraction, and finally logo detection

The user inputs the test image and reference logo image that is required to be converted into binary image. After binarization the current images is the images to which SURF is applied for extracting the features. Here, we are using SURF algorithm because from literature survey it is found that SURF algorithm is better than other techniques.

After extracting the features CDS (Context Dependent Similarity) is applied for matching the key points of the images. In this way, the logo will be detected in an image.

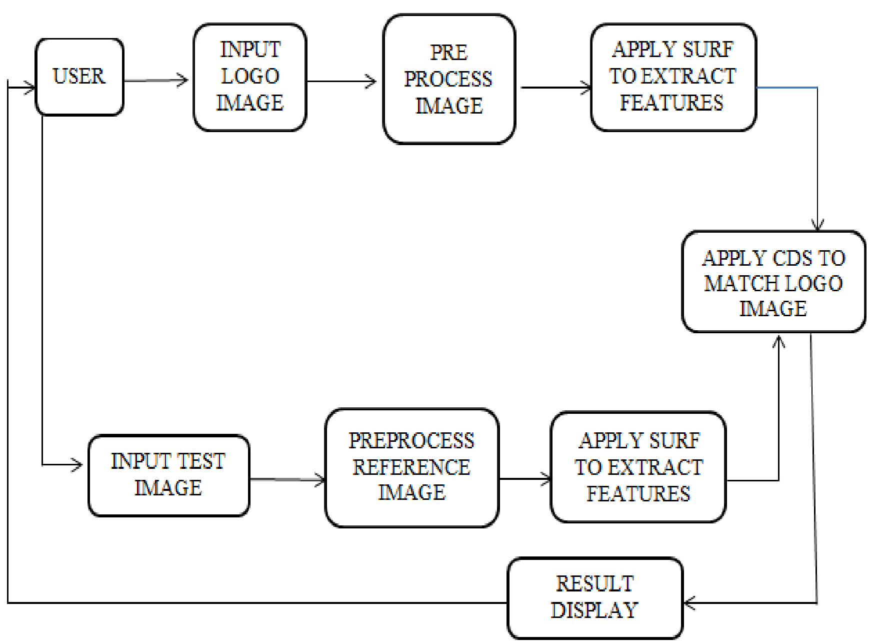

Fig 4. Block diagram of image recgnition

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In image recognition system recognize the image from user side. That is user inputted the image to the system in the image form or sometimes in the logo forms the we turn in the next steps that is preprocessing of image is an improvement of the image data that suppresses unwilling distortion or enhance some image features important for further processing although geometric transformation of images that is rotation, scaling, translation. After preprocessing process apply SURF for extract features. It is fast and robust algorithm for local similarity invariant representation and comparison of images. It can be used for tasks such as object recognition, image registration etc. after surf extraction apply CDS to match logo image CDS is (Context Dependent Similarity) is a is applied for matching the key points of the images. This all explanation is for main image which is inputted through the user.
As same we apply al the process for sub image that is user inputted image to the system then the preprocessing of reference image which is matches with the sub image like point-to-point matching lines and extract the feature of image with point to point. After preprocessing apply surf for extract feature and matches the extraction lines the again apply CDS algorithm which is applied for matching key point of image after both applying both the algorithm, we get the experimental result of matching the image.

A. Logo Detection

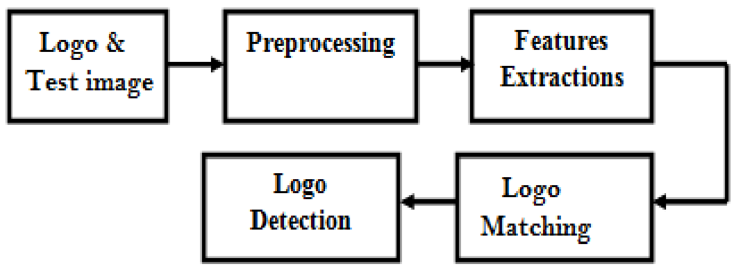

Fig 5. logo detection

1) *Pre-processing:* It includes binarization of images. Binarization is the process of converting an image from colour to black-and-white (called “binary image”). The binary image contains only two-pixel values 0 and 1. This process reduces the number of dimensions we have to work with.
2) *Feature Extraction:* This process extracts the key-points of all the logos. And extract the key-points of the input image with the same technique used to extract the key-points from the logos. Where key point is a circular image region with an orientation. It is described by a geometric frame of four parameters: the key point center coordinates x and y,

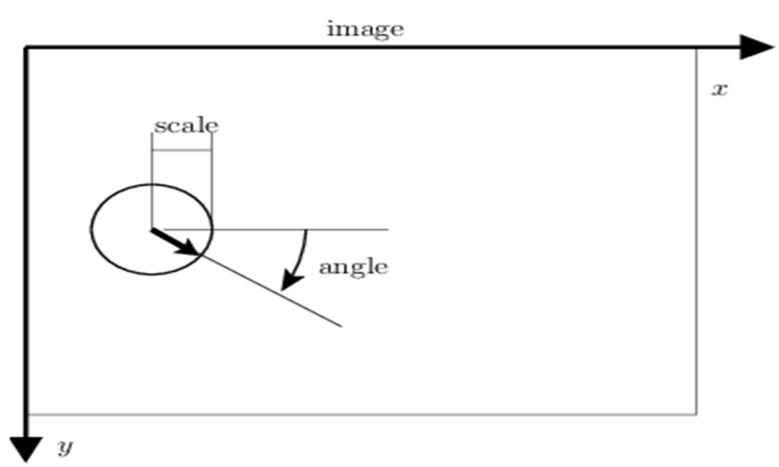

Fig 6. Key point in an image

There are many ways to extract features with reference of the goals. Some are based on the edges or on the corners, other on the curvature or on the shape. The various techniques for feature extraction are SIFT (Scale Invariant Feature Transform), SURF (Speeded Up Robust Feature), HOG (Histogram Oriented Gradient), Template Matching, etc.

3) *Feature Matching:* In this process, features of logo which are stored in database are compared with the features of an input image. The regions with maximum similar features with respect to the logo image is considered and hence the logo in the image is detected. CDS (Context Dependent Similarity) is one of the techniques used for matching the key points in the image and detecting the desired logo.

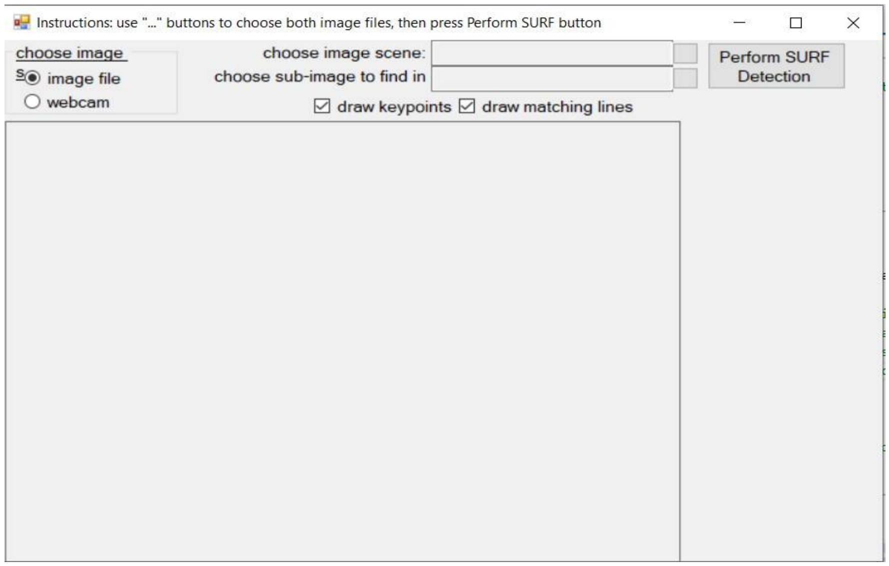

Fig 7. External architecture of bock diagram

VI. FUTURE WORK

The second phase of project will implement the process of logo detection in an image in 8^{th} Semester. The process involves binarization, feature Extraction using SURF algorithm, and finally matching of features using CDS (Context Dependent Similarity) algorithm. Execution will be performed using OpenCV in Microsoft Visual Studio 2013. Finally, the project will be able to detect the logo in an image.

VII. CONCLUSION

This paper deals with using SURF features in face recognition and gives the detailed comparisons with SIFT features. Experimental results show that the SURF features perform only slightly better in recognition rate than SIFT, but there is an obvious improvement on matching speed. Therefore, SURF features are proven to be suitable for face recognition and face object or anything in the image recognition.

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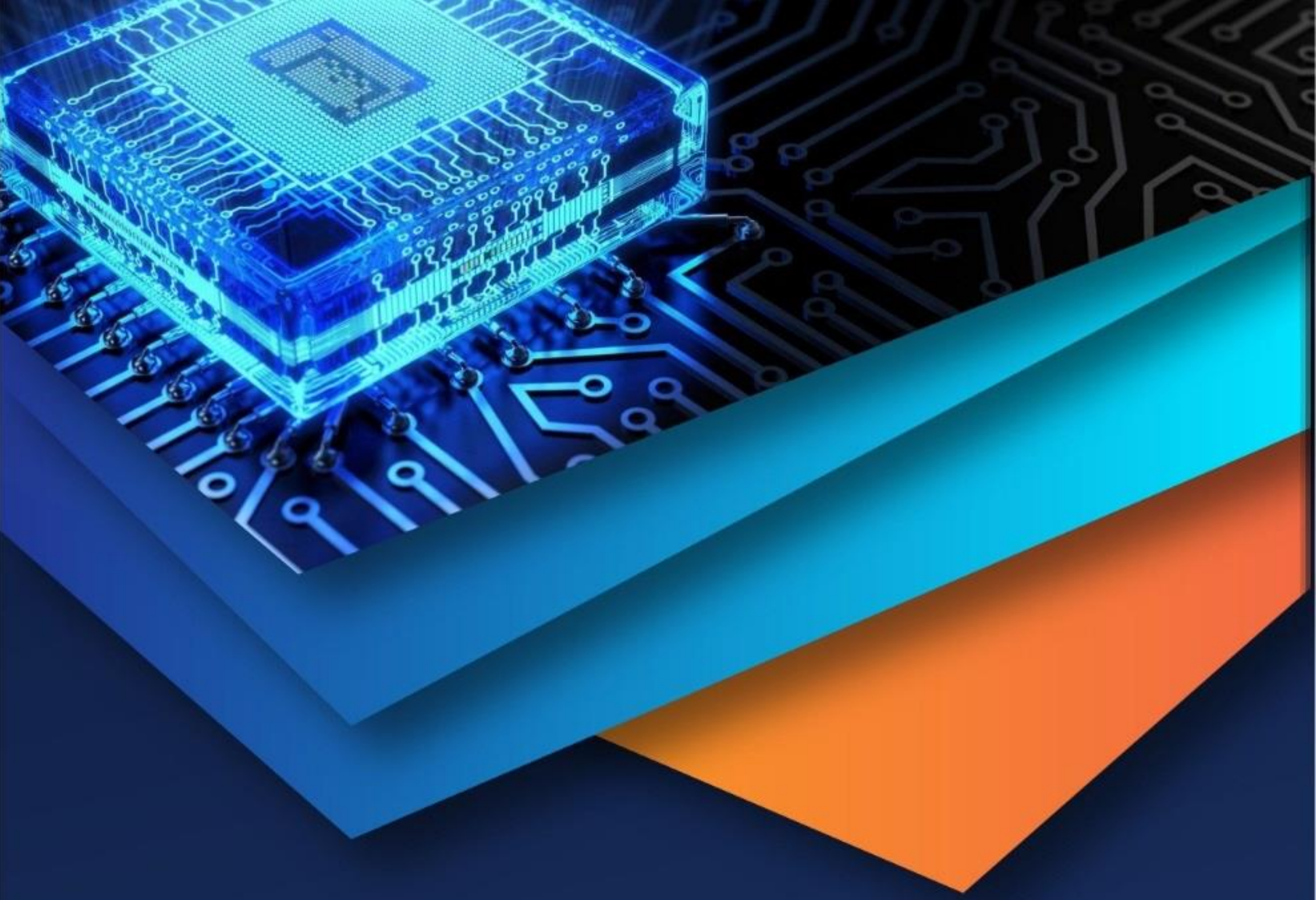

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