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Content Based Image Retrieval System for Mammogram Images Using BI_RADS Standard and SVM.

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Abstract: ***The mammogram images are exposed to region of interest algorithm for extraction of infected area. The region of interest algorithm is fine-tuned using the combination of red, green and blue color matrices thresholds. The threshold limits are discussed in later section of the paper. The features including spot size, shape, brightness, contrast, density and Zernike moments are used to generate a vector set that is used to retrieve the images from the data base. The data base used for CBIR system for mammograms is MIAS data base consisting of different class of mammogram images. The data base contains images in PGM format and is converted to jpeg format using the matlab function class. The database images are categorized into different class as per the database instruction. Equal no. of images from each class are used to train a support vector machine classifier. Rests of the images are used to test the algorithm.***
Keywords: ***Image Segmentation, SVM Classifier, Texture Features, Statistical Features***

I. INTRODUCTION

Image texture, defined as a function of the spatial variation in pixel intensities (gray values), is useful in a variety of applications and has been a subject of intense study by many researchers. Texture is the most important visual cue in identifying the types of homogeneous regions. This is called texture classification. The goal of texture classification then is to produce a classification map of the input image where each uniform textured region is identified with the texture class it belongs to. We could also find the texture boundaries even if we could not classify these textured surfaces. This is then the second type of problem that texture analysis research attempts to solve texture segmentation. The goal of texture segmentation is to obtain the boundary map. Texture synthesis is often used for image compression applications. It is also important in computer graphics where the goal is to render object surfaces which are as realistic looking as possible. The goal is to extract three-dimensional shape information from various cues such as shading, stereo, and texture.

II. RELATED WORK

The author here proposed a new algorithm of segmentation named breast mass contour segmentation, He used classical seed region growing algorithm as a base for developing this algorithm to upgrade outline of a mass from interested specified mass area along with proficiency to manage threshold value adaptively. Testing is performed on a database of 260 masses whose contours are explained manually by radiologist experts.[1]

The author here compared two distinct semi automated methods named level set and marker controlled watershed methods which works to achieve accuracy and fast segmentation of tumor detected. [2]

The author presented here an adaptive contrast enhancement method for breast skin–air interface detection which is responsible for combining use of method named adaptive histogram equalization on tiny portion or interested area that are containing operators like actual edge and edge detection. [3]

The author provided an easy and simplest approach for detecting tissues containing cancers in mammogram. Detection is done through segmentation of the tumor area in a image of mammogram. [4]

The author says various algorithms and techniques have been came into existence for segmentation of image. Although in general sense, Segmentation is a problem that have no solution, so techniques often are not used individually, these are joined with knowledge from domains in order to effectively solve issue of image segmentation. [5]

The author proposed an approach for the early stage detection of tumors by performing texture segmentation on digital mammograms. The suggested algorithm was checked on set of images obtained from the DDSM database for cancer research and diagnosis. [6]

The authors have suggested an efficient Otsu's N thresholding method for segmenting ROI from the back environment of mammogram image, because a challenging obstacle in digital mammography analysis is to search for a ROI segmentation technique that provides accuracy, robustness and efficiency. [7]

The author presented a latest method to find breast cancer stem cell from an image. He uses multi thresholding concept for the detection of breast cancer stem in biomedical images and so as no cell left undetected method of over segmentation is also implemented. [8]

The author provides proposed algorithm that uses input as probability of mammographic image as for vector quantization. Kekre's Proportionate Error (KPE) algorithm is used to form regions. [9]

The author provides a latest approach for analyzing feature via detecting tumor, with respect to their size and shape by doing experiments to early detect breast tumor. The goal is to find the unusual portion in breast area using three stages: First stage is preprocessing stage in this stage, noise is removed and in second stage segmentation is applied for detecting the mass. [10]

The author combines the various denoising and enhancement techniques to identify the appropriate enhancement technique for mammography. Noise is removed from mammograms by linear and nonlinear filtering techniques and to measure efficiency. [11]

The author focuses primarily on to provide a new technique for extraction of features in order to build a CADx model to differentiate between cancers, benign, and healthy breast. They proposed a method to extract features named Square Centroid Lines Grey Level Distribution Method (SCLGM). [12]

The author's aim of the proposal is to enhance the mammogram images by doing reduction in the noise through median filter, image sharpening and image smoothing. The Fuzzy C means clustering algorithm is used to separate the required region from which various statistical, gradient and geometrical features are isolated.[13]

The features isolated from the few images of the database are used to train the neural networks for classification. The new method is checked over Mammogram (MIAS) database. [14]

The author provides an outline of novel progress in the development of CAD systems and related methodologies. They initiated with a concise elaboration to few general concepts in relation to breast cancer identification and interpretation. [15]

The author says early diagnosis from any disease can save the patient from the disease. Currently used cancer therapies leading to expensive recovery from disease and also leave some side effects behind. [16]

The author presents an approach for a tiny abnormal deposit of calcium salts in breast. detection in mammography based on the general preprocessing steps: removal of noise, partitioning image, extraction of the area of interest (ROI) and other features that illusrate the possible mismatches between the ROI of both left and right breasts. [17]

The author found that till now in cancer detection of breast region, first and second order GLCM features were mostly used, according to their best knowledge there is no evidence of using of third order features of GLCM. [18]

The author reviews the diagnosis methods and breast image enhancement approaches for detection of breast cancer in early stage. The one challenge come across current mammogram image detecting techniques is difficulty in processing dense areas. [19]

The author proposed a CAD system to carry out difference between masses and normal breast tissue. DDSM database is used, firstly which were preprocessed through image enhancement algorithm, then selection of 100 regions of interest (ROIs) containing masses and normal breast tissue took place. Then extraction of a group of 59 texture and statistical features from the ROIs is done. [20]

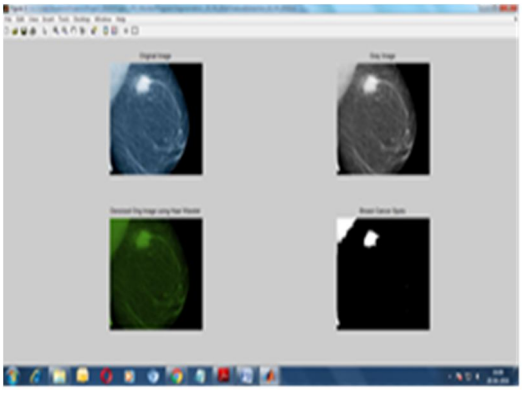

Fig. (1)

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III. REGION OF INTEREST EXTRACTION

The mammogram image is split into its R-, G- and B-component image. Following color threshold are applied over R-, G- and B-component images to segment the breast cancer spots in all color component images. Finally, the segmented color segments in R-, G- and B-component images are concatenated back to get the final breast cancer spots.

Using trail methods, following color threshold are applied:

Threshold (R) = 30;

Threshold (G) = 100;

Threshold (B) = 20;

The above algorithm is applied over number of breast mammogram images. Followings are the result snap shots of the program implemented in matlab:

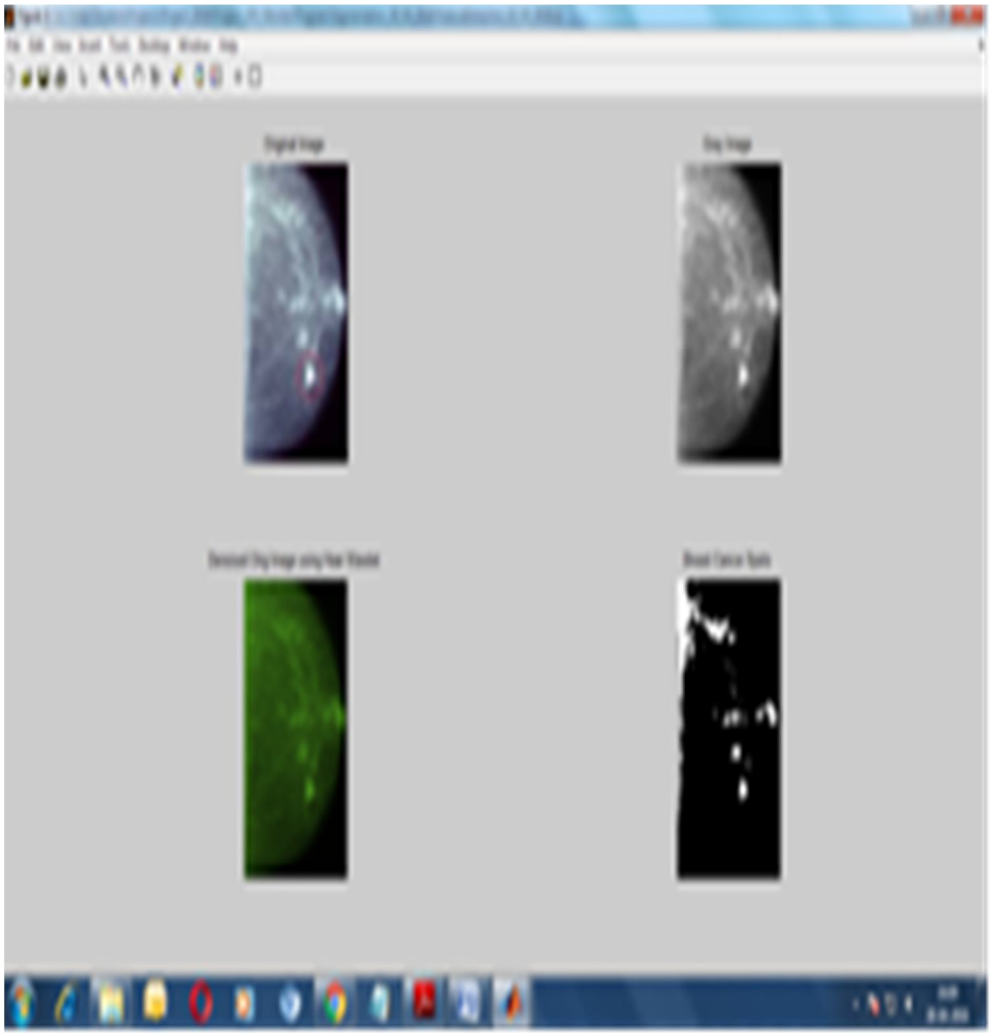

Fig.(2)

IV. REGION OF INTEREST (ROI) EXTRACTION

The region of interest is extracted by mapping the coordinates of pixels in segmented part in above step to that of the original input image. This will extract the infected part from the original image and then feature extraction algorithm is applied only on the region of interest. The ROI is extracted from the original image using the pixel mapping between segmented image and that of the original image.

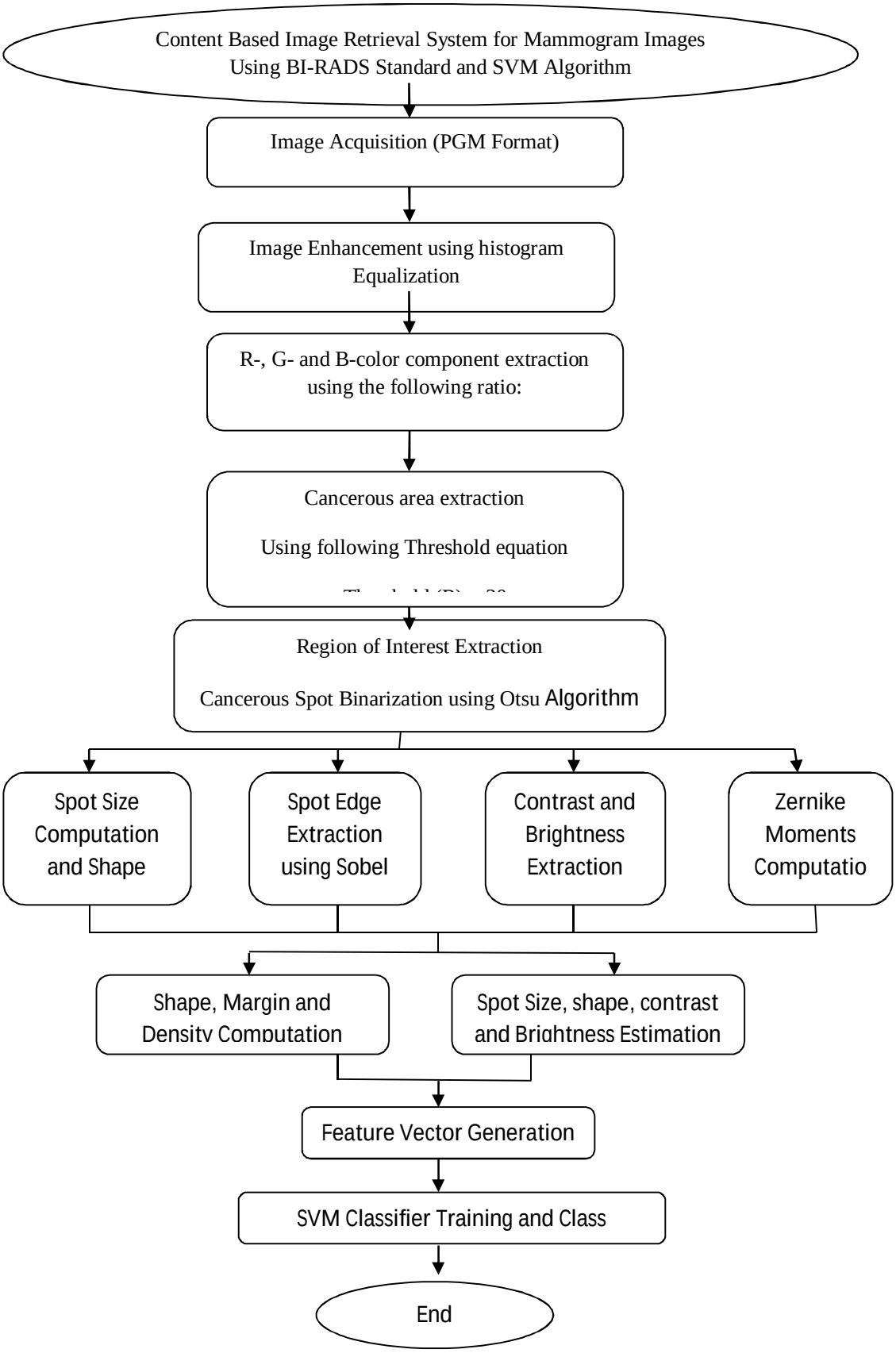

Fig. (3) Algorithm Flow Chart for Feature Vector Generation

V. RESULTS AND DISCUSSION

Data Base Used: Online available MIAS data base for mammograms in PGM format
No. of Images= 210
No. of Test Images = 50
No. of Class = 5
Class-1 → Round
Class-2 →Lobular
Class-3 → Irregular
Class-4 → Oval
Class-5 → Micro-Lobular

Table 5.1-Proposed Algorithm Results for QBE for Mass Lesions

S. No.	Recall (%)	Precision Lobular (%)	Precision Round (%)	Precision Oval (%)	Precision Irregular (%)	Precision Micro-Lobular (%)
1	15	90	95	91	95	97
2	20	91	93	94	90	95
3	25	89	94	88	88	96
4	30	89	92	85	88	96
5	35	87	90	80	87	97

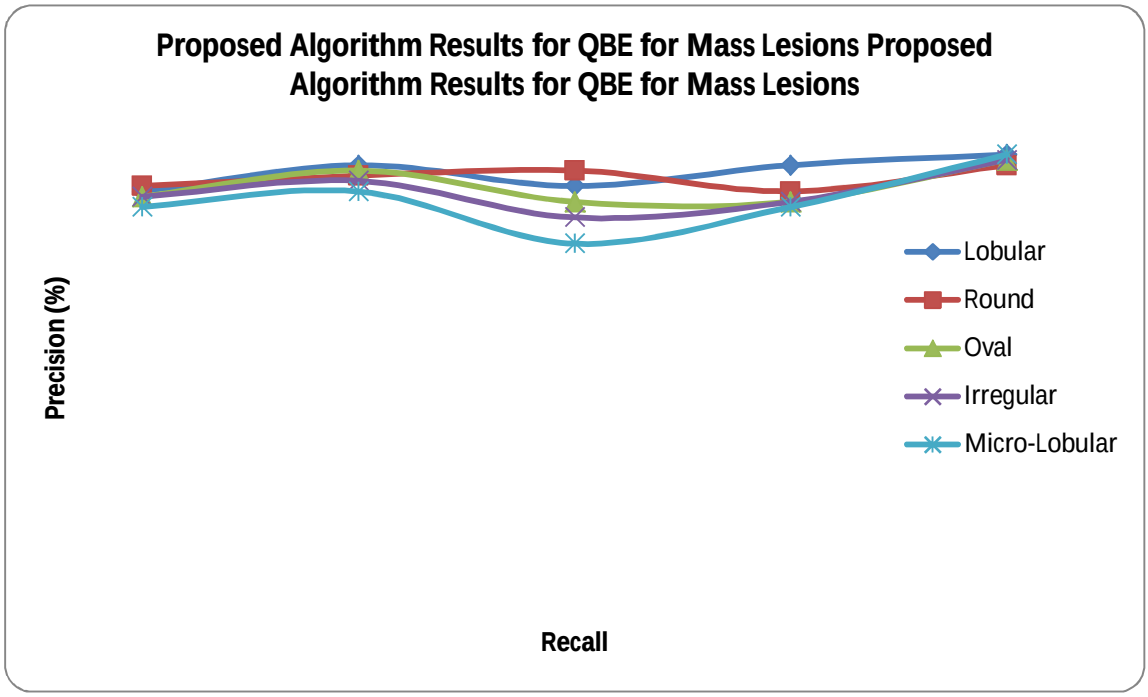

Figure (5)

VI. CONCLUSION

The proposed work is targeted to be implemented on mammogram images as obtained from the hospital as well as on online image data base. The speed of the algorithm primarily depends upon the image size and therefore is expected to vary from image to image. The accuracy of retrieved image to that of the query image depends primarily upon the quality of query and data base image. Mammograms are usually at high noises. Therefore, it is recommended to use denoising algorithm before retrieval. The precision, recall and accuracy are discussed in result table and show a fine accuracy in retrieving the mammograms based on query mammograms.

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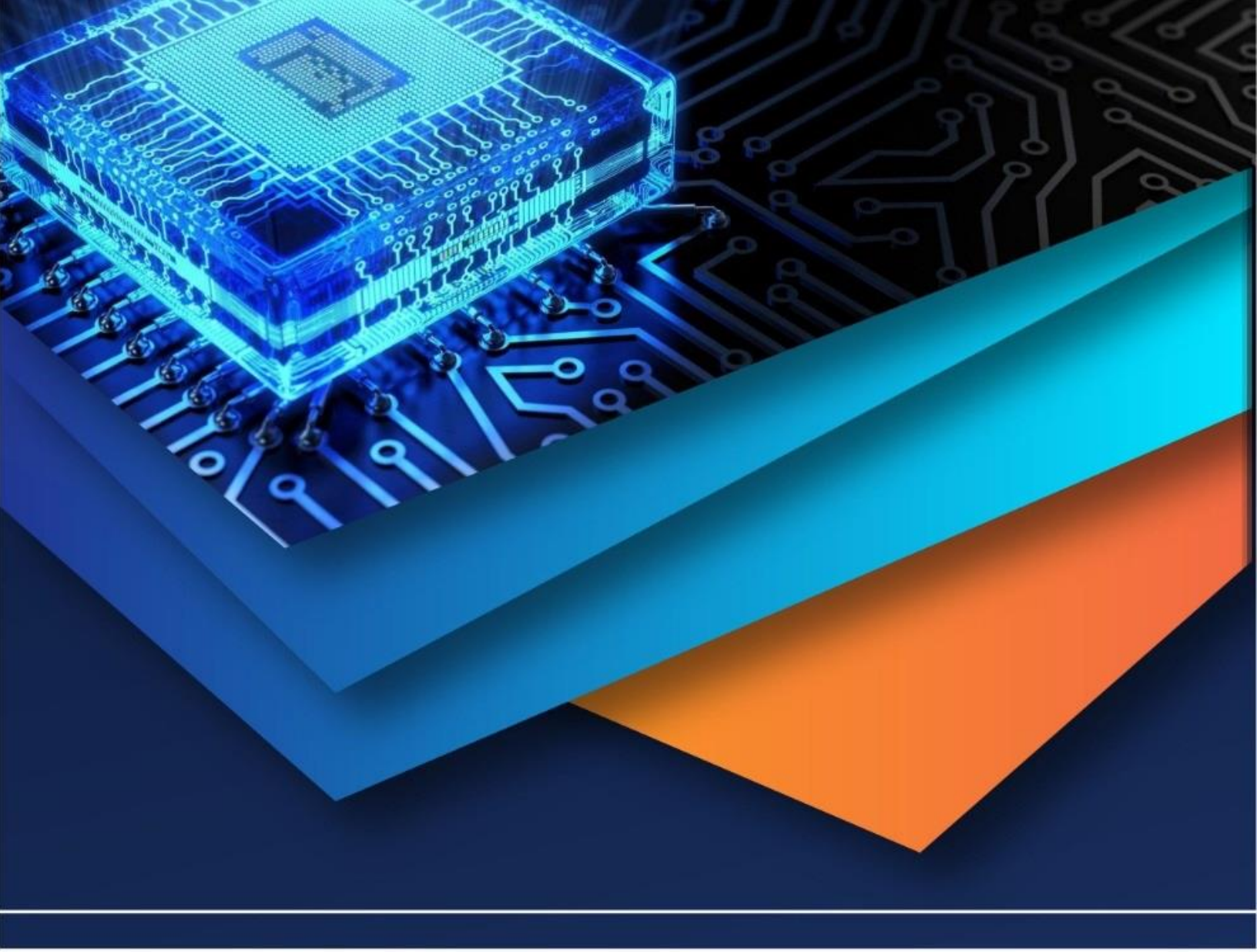

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