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# Surveys on Detection of Melanoma through Image Processing Techniques

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***Abstract:*** ***In order to achieve an effective way to identify malignant melanoma stage without performing more number of skin biopsies, digital image at an early analysis of the images is investigated. For the detection of malignant melanoma, appropriate analyses are done on the tumour images according to the clinical characteristics that early melanoma possesses. In the last stage, classification is done based on the results obtained from the above mentioned analyses. The tumours are classified as either "potential malignant melanoma" or "non-melanoma". This can reduce the time spent and pain received by the patients in detecting early malignant melanoma.***

***Keywords: pre-processing, segmentation, feature extraction, melanoma classification, SVM network, neural network, melanoma validation, test cases, machine learning***

## I. INTRODUCTION

Among all of the different forms of skin cancer, Malignant Melanoma is the leading cause of death nowadays. The incidence of melanoma has doubled during the last 20 years. Fair-skinned people, who burn easily and rarely tan, are most at risk. Major causes of this disease are 1) The depletion of ozone layer caused by pollution and 2) The excessive exposure to Sun [1]. In order to reduce the death rate due to malignant melanoma, it is necessary to diagnose it at an early stage. The less mature the malignant melanoma is, the earlier the surgical treatment, the greater the survival rate. Skin biopsies at an early stage are necessary to identify Malignant Melanoma. Due to the rise of medical costs, especially the cost of skin biopsies, some better ways to identify malignant melanoma at an early stage are needed without increasing the number of skin biopsies. The role of digital imaging corns into sight here; it was hoped that image analysis could help in identifying early malignant melanoma and aid in early diagnosis to help to reduce the death rate caused by this deadly disease.

Human skin is made up of the epidermis (the top layer) and dermis (the inner layer). In the epidermis layer, there exist melanocytes which are cells that contain melanin, which gives colour to the skin. Melanoma is often called cutaneous melanorna or malignant melanoma; it is a skin disease in which the cancer cells are found in the melanocytes of the epidermis. There are five types of malignant melanoma [2] which are classified by their histological features and are listed according to their frequency of occurrence: 0 Superficial Spreading Malignant Melanoma (SSM) is the most common type of malignant melanoma. It may occur on any part of the body and is usually greater than 0.5cm in diameter. It is a tumour which is elevated and spreads laterally. SSM usually develops as an asymmetric plague with variation in colour as pigment pattern and irregularity or notching of borders. It can be seen that this tumour has a highly irregular border with fingers stretching out on the left. It also has got variable degrees of pigmentation and a nodular amelanotic component at the lower right. Nodular Malignant Melanoma is the next frequent type, it is less common but more malignant. It is a raised papule or nodule, sometimes ulcerated. The outline of the lesion may be irregular and its colour varied. Very often, it will have a well-defined border and symmetry in contract to other melanoma. Lentigo Malignant Melanoma is represented by varying admixtures of pink, gray, blue and white. The borders are frequently highly irregular and notched. The overall size may range from 1.0 to 20.0 cm or larger. Malignant change is recognized by thickening and the development of discrete tumour modules. This is an invasive proliferation of malignant melanocytes which arise in lentigo maligna. Acral Lentiginous Malignant Melanoma is a very rare tumour. It usually arises in an acral location or on a mucous membrane and is initially flat and irregular, but soon becomes raised and subsequently nodular. Colouration is less varied than SSM, but borders may show marked irregularity and notching. The size ranges from 0.9 to 12 cm or greater. Advanced tumours exhibit raised papules or nodules that are blue, black or amelanotic and often ulcerated. Desrnoplastic Malignant Melanoma is a tumour consisting of spindle-shaped cells with an increased dermal connective tissue component. This forrn of rnalignant melanoma is almost impossible to diagnose. Al1 four of the classic forms of malignant melanoma described above can show desmoplastic changes. In order to make an early

diagnosis, the clinicians must be able to identify the melanoma tumour, so the differences in characteristics between benign pigmented lesions, rnalignant melanoma and precursor lesions that may give rise to malignant melanoma are distinguished. Characteristic clinical features of early malignant melanoma in general can be described by "ABCD", which stands for A = Asymmetry B = Border Irregularity C = Colour Variegation which means that two or more colours exist within the tumour border D = Diameter generally greater than 6 mm. Intradermal Nevus with characteristics: - Colour Flesh-coloured, pink, tan or brown - Shape Round or oval, may fade gradually into surrounding skin - Surface Smooth, sometimes papiilomatous and raised - Size < 6mm in diameter Seborrheic Keratosis often known as age spots, age warts or liver spots. Colour tan to brown, maybe flashy or pink - Shape Borders often oval or round, but maybe irregular, often sharply demarcated but will appear as gradually fading into surrounding skin in fair persons. - Surface Rough, raised surface and frequently sharp border - Size Usually 5 - 15 mm - Location Face, neck and trunk Moreover, a kind of precursor lesion that may turn into a melanoma mole [3] is 0 Dysplastic Nevus has characteristics: - Colour Mixture of tan or brown, black and red/pink - Shape Irregular borders that may include notches. May fade into surrounding skin and include a flat portion level with the skin. - Surface Smooth, slightly scaly or have a rough pebbly appearance - Size < 5 mm These descriptions indicate that melanoma and the above benign tumours differ only slightly in their physical characteristics and colours, so a collection of these features rather than a single feature is needed to obtain a satisfactory classification of the tumour image

## II. PROBLEM STATEMENT

The objective of the research is to find better and more efficient ways to automatically detect early malignant melanoma using digital image processing techniques. This project focuses on the pre-processing stage, the analysis of colour variegation, border irregularity and asymmetry of the tumour. The ultimate goal is to ease the doctor's role in the detection of early malignant melanoma by providing better and more reliable results, so that more patients can be correctly diagnosed.

## III. METHODOLOGY

The process of detection can be divided into three steps as shown in Figure 1: Pre-processing is to prepare suitable images for analysis by performing feature enhancement and noise reduction. Tumour images may contain non-tumour features like hairs, skin-mark and other noise that are acquired from taking the photograph or digitizing process which will greatly affect the result of the analysis; therefore, pre-processing is necessary. 0 Image Analysis is the stage to perform asymmetry, variegated colouring, border irregularity and textural analysis of the pre-processed tumor images. 0 Identification & Classification is to identify if the tumour image is malignant melanoma or other skin diseases. This stage is beyond the scope of this research, because this is the task of the doctor whose expertise is in this area. This research will provide better results to help the doctor to identify the tumour more easily.

Figure 1: Methodology

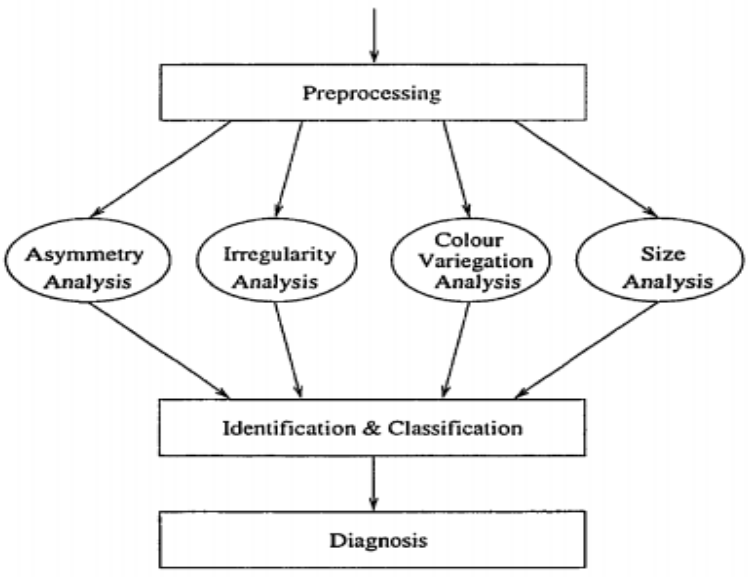



Figure 2:The detailed Existing system is proposed below: Pre-processed input

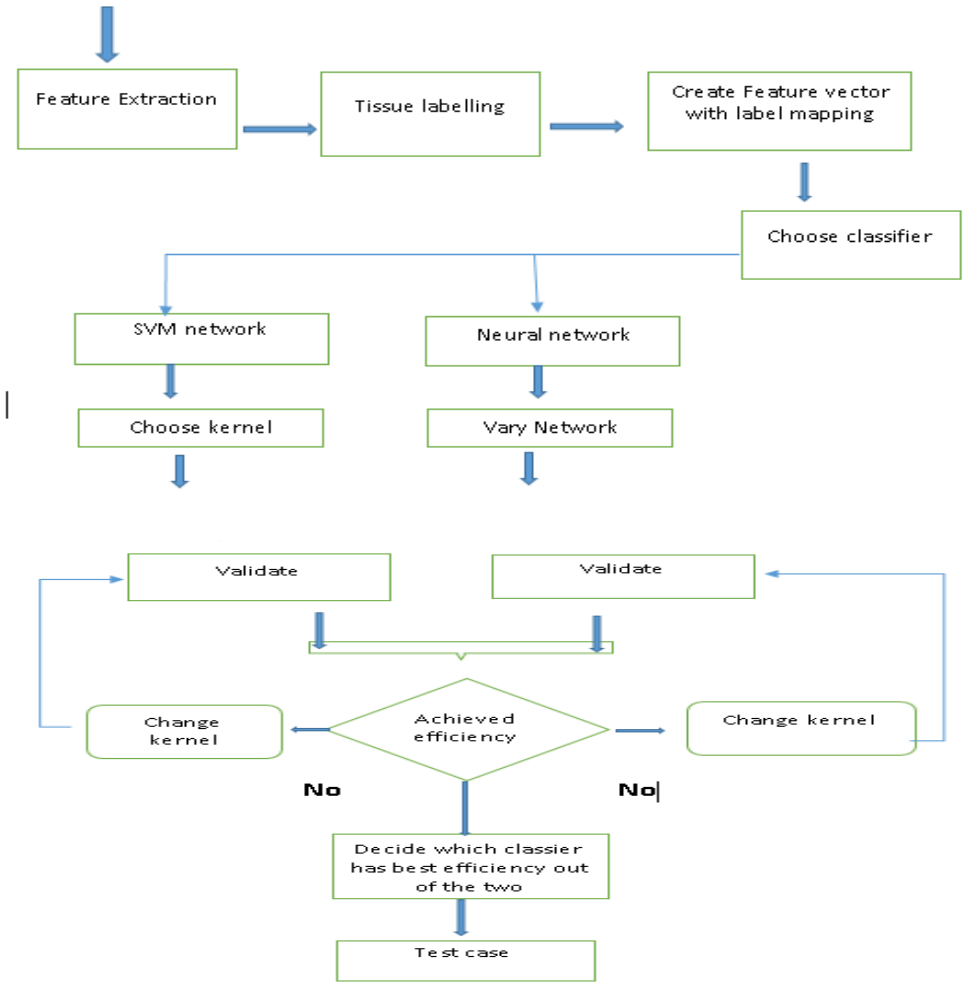
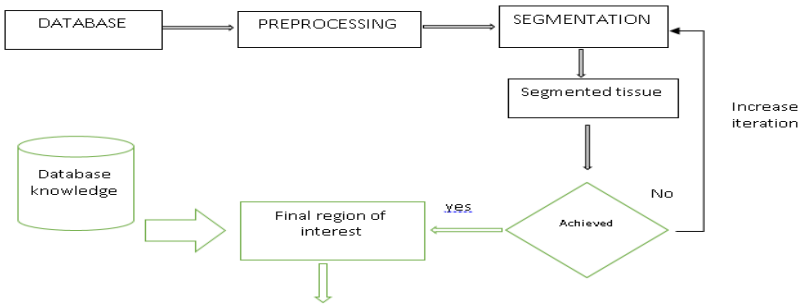



Figure 3:The test Case is presented below




## IV. LITERATURE SURVEY

*A.* Hiam Alquran *et al* [1] suggested a method for Melanoma skin cancer detection at an early stage based on pre-processing, segmentation using thresholding, statistical feature extraction using Gray Level Co-occurrence Matrix (GLCM), Asymmetry, Border, Colour, Diameter, (ABCD) etc., feature selection using Principal component analysis (PCA), calculating total Dermoscopy Score and then classification using Support Vector Machine ( SVM). 92.1% of accuracy of classification obtained from the result. .[21,22,23,24,25, 26, 27,28,29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41

*B.* Maen Takruri *et al* [2] studied on problems of automated non-invasive skin cancer detection from digital images of skin lesions. It also proposed the use of Bayesian Decision Fusion of a multiple of classifier to increase the melanoma detection rates. The relationship between confidence distribution and accuracy and resulted incomparable confidence intervals with stable recognition rate

*C.* Jessica B.Diniz *et al*[3] proposed that automatic melanoma segmentation approach based on Fuzzy Numbers. The proposed approach was compared with three state-of-art technique and was evaluated through the metrics of sensitivity, specificity, Jaccard index and balanced accuracy.[21,22,23,24,25, 26, 27,28,29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41]

*D.* Wilson F Cueva *et a*[4] showed that for the early detection of melanoma advanced Technology have allowed use. In his work, an image processing was used to obtain Asymmetry, Border, Colour, and Diameter (ABCD of melanoma).For the classification of the different kinds of moles, neural network used. As a result, this algorithm developed after an analysis of 200 images and able to obtain performance of 97.51%.

*E.* M P Pour *et al* [5] described that training entire convolutional network from scratch with random initialization is not always possible, because it is rare to find a dataset of sufficient size. Therefore Mansoureh Pezhman Pour et al investigated data augmentation. In line with this approach, fine tuning the deep network for lesion segmentation with two models that are trained on semantic images not medical images is also described. Furthermore, the last part of the methodology includes the task of lesion dermoscopic feature segmentation.

*F.* Hardin Robby firmansyah *et al* [6] Melanoma is one kind of skin cancer that attacks a pigment human cell. According to from Abramson cancer canter in 2013 there are 76.690 new cases of melanoma in United States. Currently dermoscopy method is used to detect of melanoma which included ABCD rule and STOLZ algorithm .The image is taken from the mobile camera and testing process also done in mobile. The pre-process is done using openCV. Output is in the form of TDS score and Classification result.

*G.* Muhammad Ali Farooq *et al* [7] described ALDS framework based on probabilistic approach that at starts it utilizes active contours and watershed merged mask for segmenting out the mole and later SVM and Neural Classifier are applied for the classification of the segmented mole. After lesion segmentation, the selected features are classified to ascertain that whether the case under consideration is melanoma or non-melanoma. The approach is tested for different datasets and comparative analysis is performed. Result gives the effectiveness of the proposed system..

*H.* Adheena santy *et al* [8] proposed that segmentation process is an important step in the automated system of melanoma detection where it collates the border of skin lesion in order to separate the lesion part from the background skin for further feature extraction. Statistical region merging, iterative stochastic region merging, adaptive thresholding , colour enhancement and iterative segmentation, multilevel thresholding are discussed in this paper.

*I.* Le Thu Thao *et al* [9] showed that solution using deep convolutional networks to assist dermatologists and enhance melanoma diagnosis accuracy. The result shoed that proposed method achieves promising performance. They used two methods to analyze melanoma. First one based on convolutional-deconvolutional architecture. Second method used simple convolutional neural network and VGG-16 architecture.

*J.* Reshma M *et al* [10]proposed two methodologies for detection of melanoma. Now a day's melanoma is becoming a common among one of the 200 types of cancer. First methodology explain the identification of melanoma skin lesion at different stages based on TDS (total Dermoscopic score). Second methodology explains the identification of skin cancer types. Basically the purpose is to extract more melanoma features for early detection

*K.* Alper ARIK *et a*l[11] according to him early diagnosis is important in the healing of the skin cancer. Due to limited human expertise automated systems are used. This system is capable of identifying disease in early stage and it also reduces unnecessary intervention and costs.

*L.* Supriya Joseph *et al*[12] proposesa non invasive automated skin lesion analysis system for melanoma in the early detection using mobile techniques and image processing techniques. Effective classifications are used for hair detection and removal. For hair removal a fast marching in painting algorithm is used.

*M.* Catarina Barata *et al*[13] said that there are two different systems for the detection of melanoma in dermoscopy images. First system uses global method. Second system uses local features. The main aim of this paper is to determine the best system for skin lesion classification

*N.* Lin Li [14] described that to make objective judgements based on quantitative measures it is important to develop an automated computer aided diagnosis (CAD) system for melanoma. Here it presents a CAD tool [28,29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41]with different functionalities. It provides 92% accuracy in detection of melanoma.

*O.* Qizhi Zhang *et al* [15] said that an automated system is used for early detection of melanoma which makes objective judgments based on quantitative measures. This system contains image processing, feature extraction and support vector system. This system achieved 92% classification accuracy by using SVM classifier.[21,22,23,24,25, 26, 27,28,29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41]

*P.* Aswin R.B *et al [16]* proposed a computer Aided early Skin Cancer detection. He proved that computer based methods are painless and better than traditional clinical Biopsy method. Without contacting with skin by the help of only dermoscopic image is obtained for diagnosis. He also stated that this method not required any laboratory tests and it also inexpensive and consumes less time. Also without going hospital patient can do the early detection, thus making this system very user friendly and very convenient for the patients.

*Q.* Nikhil J. Dhinagar *et al[17]* stated an optimal feature spaces for classification of skin lesion classification for suspicious ROIs. Its obtained by surface skin scanning optical techniques. . Typically either the spatial or the spectral or the frequency domain is preferred in this application for classification of skin samples which might potentially exclude valuable diagnostic information that is present in the samples of lesions. More accuracy obtained during this process.

*R.* F. Fanjul-Vélez,*et al[18]* described the use of a complex predictive model that includes a three-dimensional meshing of the considered tumour geometry and the optical propagation therein by a three-dimensional Monte Carlo method. The proposed tool is applied to three different types of skin tumours, squalors cell carcinoma, nodular and infiltrative basal cell carcinomas. He stated that for appropriate treatment planning estimated volume of treatment required for prevent undesirable tumour recurrence.

*S.* Pravda Jith Ray,*et al[19]* stated enhancement, Segmentation and Classification in histopathological images of the skin .He used CLAHE algorithm for the image enhancement followed by bilateral filtering. Fuzzy C-Means algorithm for initial segmentation and for final segmentation result, local region recursive algorithm is used. Elliptical descriptor is used to identify region ellipticity and local pattern characteristics to distinguish the melanocytes from the candidate nuclei regions.

*T.* Manasvi Kalra 1, *et al [20]* proposed the basic techniques of image enhancement by use of result of different parts of skin affected by skin cancer. The images are distinguished on the basis of different parameters by including the image size and RGB values with the enhanced form of the original image. For mobile app implementation normal digital camera has been used for input image and the enhanced output has been provided, therefore beginning techniques have been preferred. The main idea of this paper is to provide enhanced images through above mentioned techniques based on well defined parameters so that it can be useful for doctors and other medical practitioners to conclude the result and use any of the techniques as per requirement

## IV.CONCLUSIONS

From survey on melanoma detection through image processing techniques results showed that the features used where able to differentiate between normal and cancerous lesions and also we are able to compare between ostus's and modifier ostus method. Modified ostus method works the best for image segmentation purpose and takes the least amount of time.Future work may include increasing the dataset size and trying this technique on a greater number of images. Different machine learning algorithm will be investigated in order to improve the accuracy.

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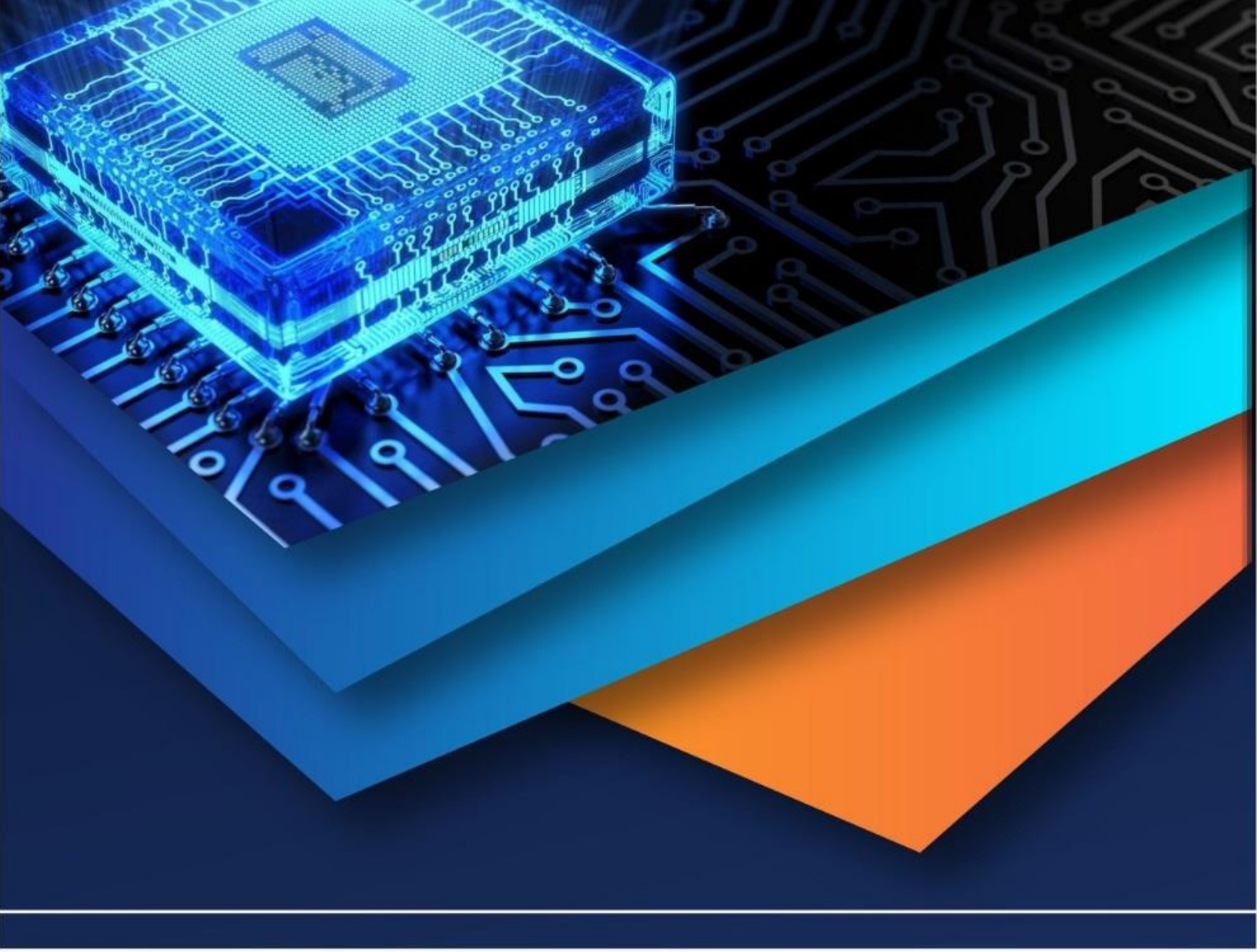

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