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Survey on Skin Disease Detection using Convolutional Neural Network

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Abstract: Skin diseases are very common in people's daily life. Each year, millions of people are affected by all kinds of skin disorders. Diagnosis of skin diseases sometimes requires a high-level of expertise due to the variety of their visual aspects. As human judgment are often subjective and hardly reproducible, to achieve a more objective and reliable diagnosis, a computer aided diagnostic system should be considered. In this project , we investigate the feasibility of constructing a universal skin disease diagnosis system using deep convolutional neural network (CNN). The key part of architecture is a Convolution Neural Network that is trained on a skin disease image database. The dataset is obtained from skin disease database available openly HAM10000 dataset. Seven classes of diseases are predicted. It uses softmax layer of CNN for disease prediction. Our project can achieve as high as 90% accuracy. The accuracy can be further improved if more training images are used.
Keywords: Convolutional neural networks, Skin Disease, softmax layer, machine learning

I. INTRODUCTION

Skin diseases are one of the most commonly seen infections among people. Due to the disfigurement and associated hardships, skin disorders cause lots of trouble to the sufferers. Speaking of skin cancer, the facts and figures become more serious. In United States, skin cancer is the most common form of cancer. According to a 2012 statistics study, over 5.4 million cases of nonmelanoma skin cancer, including basal cell carcinoma and squamous cell carcinoma, are treated among more than 3.3 million people in America. In each year, the number of new cases of skin cancer is more than the number of the new incidence of cancers of the breast, prostate, lung and colon in combined. Research also shows that in the course of a lifetime one-fifth of Americans will develop a skin cancer.Skin diseases intend to be prevalent due to climatic as well as the living situation of the vast majority of people. Skin disease doesn't just affect the skin. It can have a huge impact on a person's day-to-day life, crush self confidence, restrict their movement, and lead to depression and even ruin relationships. So it is needed to take skin disease seriously. In the field of medical science there is a great demand for computer-aided tools to facilitate many tasks. Many things that were done manually using traditional equipment have been replaced with automated systems. Modern medical science is looking for solution which could assist the doctors with any aspect of work using the new technology. One of the common approaches used in this areas are digital Image processing and Data mining. Our proposed system enables user to recognize skin diseases and provide user advises or treatments in a shorter time period. We build our skin disease dataset from skin disease dataset HAM10000 dataset which is one of the largest photo dermatology source that is available publicly. At first we Pretrain CNN with VGG16/VGG19 models then extract features with CNN for the whole train set Each feature vector is of 4096. Classifies each skin into one of n classes: Specific skin disease sets and trains fully connected layers with skin images 7 classes of diseases are predicted.It uses softmax layer of CNN for prediction.

II. LITERATURE SURVEY

[1-52]

Sl No.	Title of the Paper	Authors	Month & Year	Observations
1	Dermatological Disease Detection using Image Processing and Neural Networks	Mrs S.Kalaiarasi,Harsh Kumar,Sourav Patra	April 2018	Dermatology,image Processing,Machine Learning.
2	Skin disease detection using artificial neural network	D.s Zingade,Manali Joshi,Viraj Spare,Rohan Giri	December 2017	Neural Network, image preprocessing,Back propogation,ANN algorithm.
3	Skin disease detection models	Nisha Yadav	March 2016	Image processing,

	using image processing	Virendra Kumar Narang Utpal shrivastava		segmentation and feature extraction. Classification model and skin disease prediction.
4	Skin disease classification using convolutional neural network	Simon Schafer , Christian LUudwigs	2018	Skin Disease Classification, Neural Networks.
5	An Intelligent System to diagnosis the skin disease	Manish Kumar and Rajiv Kumar	October 2016	Dermatology,KNN,active contour,ROI,contrast,mean value.
6	Texture based feature extraction for skin disease detection	-	November 2016	Skin disease, texture based feature extraction.
7	Detecting skin disease by accurate skin segmentation using various color spaces	Megha D. Tijare, Dr V.t Gaikwad	December 2018	Color spaces, feature extraction, image preprocessing, KNN,segmentation
8	Skin Disease Diagnosis System using Image processing and Data Mining	R.s gound,Priyank S.gadre,Jyoti B. Gaikwad,Priyanka K.Wagh	January 2018	Processing,Segmentation,Feature Extraction,Feature Classification
9	Digital Dermatology-Skin Disease Detection model Using Image Processing	Shashi Rekha G,Prof.H.Srinivasa Murthy,Dr.sudarson Jena	July 2018	Dermatology,Multivariate Statistical Analysis, Psoriasis, Acne,Melasma,Urticaria
10	Vitiligo detection techniques	Desai Bijal Pareshbhai,Prof. Bhatt Bhumika	December 2017	Re-pigmentation,digital preprocessing,Melanin,Vitiligo
11	Automating Skin Disease Diagnosis Using Image Classification	Damilola A.Okuboyejo, Oludayo O.lugbara,Solomon A. Odunaike	October 2019 October 2013	Automated diagnosis, computational intelligence,medical imaging,remote health diagnosis, skin disease
12	An Innovative Approach For Skin Disease Detection Using Image Processing and Data Mining	Er.Shrinidhi Gindhi,Ansari Nausheen,Ansari Zoya,Shaikh Ruhin	April 2017	Image processing,Histogram,Vitiligo,Psoriasis
13	Classification Of Human Skin Diseases using Data Mining	Qusay Kanaan Kadhim	January 2017	Image Processing ,decision Tree
14	Machine Learning Approaches to Multi-Class nHuman Skin Disease Detection	Ms Seema Kolkar,Dr. D.r. Kalbande,dr. Vidya Kharkar		Machine Learning,Classification,Neural Network
15	Skin disease detection system for financially unstable people in developing countries	Rahat Yasir,Md Shariful Islam Nibir,Nova Ahmed	March 2015	Skin disease,Off the record,medical image processing,neural network, mobile computing,telemedicine
16	A Survey on Melanoma diagnosis using image processing and soft computing techniques	J.Premaladha,S.Sujitha ,M.Lakshmi Priya, K.S Ravichandran	2014	Image acquisition, preprocessing,segmentation, feature extraction, post processing, classification
17	A Survey of feature extraction in dermoscopy image analysis of skin cancer	Catarina Barata, M.Emre Celebi, and Jorge S. Marques	August 2015	Dermoscopy, CAD systems, skin cancer,melanoma ,feature extraction
18	Detection of malignant skin disease based on lesion segmentation	Kailas Tambe, G.Krishna Mohan	December 2018	Dermoscopy,skin lesion segmentation algorithm,texture distinctiveness
19	Surveys on detection of Melanoma through Image Processing techniques	Dr S.Mohan Kumar,Shwetha,Shreya Ranja,Sri Lakshmi Chundru,Vivek kumar, Prof. J.Karthiyayini	March 2018	Pre-processing ,segmentation, feature extraction ,melanoma classification, SVM network ,neural network, melanoma validation.
20	Prevalence of skin diseases in rural Kashmir:A Community	Mohammed Sarwar	August 2018	Prevalence, Community, skin disease

	based survey			
21	Epidemiology and prevalence ofdermatological diseases among schoolchildren ofMedak district.	Lakshmi Kumari Villa,Gopi Krishna	November 2015	Skin diseases, epidemiology, prevalence
22	Skin disease in Lambeth	J.N Rea, Muriel l. Newhouse, T. Halil	June 1976	Skin disease, Lambeth ,prevalence
23	Prediction of skin diseases using data mining techniques	S.Reena Parvin, O.A Mohamed Jafar	July 2017	GLCM, Gaussian Filter, Multi SVM,K-NN, Naïve Bayesian, K-Means
24	Human skin detection using RGB< HSV and YCbCr color models	S.Kolkur, D. Kalbande, P.Shimpi, C.Bapat, J.Jatakia	2017	Skin detection, color models, image processing, classifier
25	A survey of occupational skin disease in UK health care workers	K.M Campion	December 2014	Alcohol Gel, hand washing, health care workers, moisturizers, occupational skin disease, soap
26	Skin disease diagnosis system using image processing	Ms.Poonam T.Handge, Ms.Arti S.Khalkar, MS. Kajal S.Randhe, Ms Pallvi G. Patil, Mr. Deepak Y.Thorat	feb 2019	Preprocessing, segmentation, feature extraction, feature classification
27	A study on different techniques for skin cancer detection	Nikita Raut, Aayush Shah, Shail Vira, Harmit sampat	September 2018	Melanoma,skin cancer,soft computing,artificial intelligence,neural networks, accuracy
28	AN intelligent system for the diagnosis of skin cancer on digital images taken with dermoscopy	Heydy Castillejos- Fernandez, Omar Lopez- Ortega, Felix Castro Espinoza, Volodymyr Ponomaryav	2017	Segmentation: fuzzy logic, color detection, classification
29	Survey of data mining techniques used in healthcare domain	Sheenal Patel, Hardik Patel	March 2016	Data mining, health care, classification, clustering, association
30	Development of a mathematical model for skin disease prediction using response surface methodology	Sudha J, Aramudhan M, Kannan s	April 2017	Data mining, classification, regression, response surface methodology

A. Problem Statement

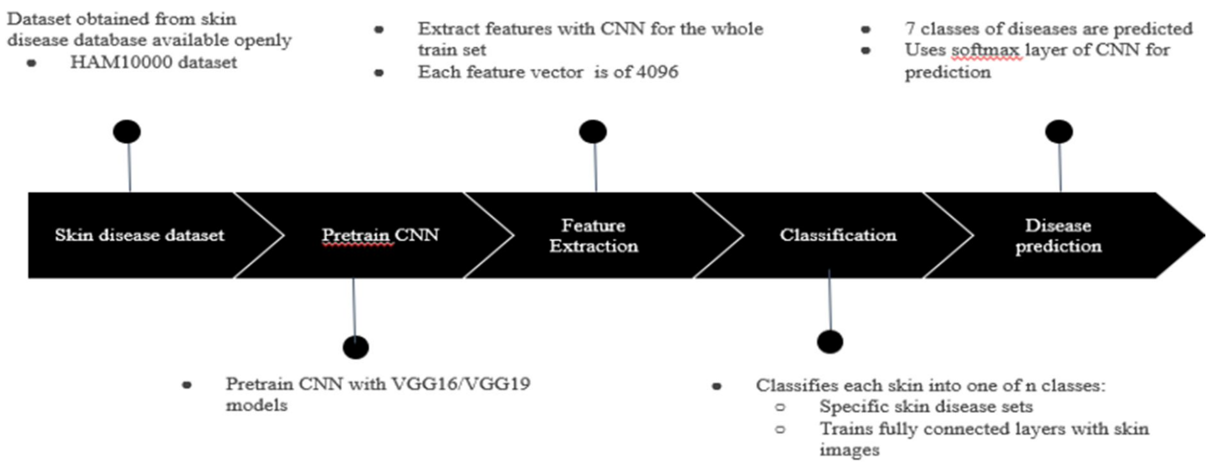
The objective of the project is to have a system that classifies skin diseases based on images with reliable accuracy with prediction, so as to use it as a computer aided diagnostic system. Have a promising accuracy that the system can be used Generating a model that is efficient in computation power and loading time. The ultimate goal is to ease the doctors role in the detection of skin cancer by providing better and more reliable results,so that more patients can be correctly diagnosed

B. Data Set

Training of neural networks for automated diagnosis of pigmented skin lesions is hampered by the small size and lack of diversity of available datasets of dermatoscopic images. We tackle this problem by releasing the HAM10000 ("Human Against Machine with 10000 training images") dataset. We collected dermatoscopic images from different populations acquired and stored by different modalities. Given this diversity we had to apply different acquisition and cleaning methods and developed semi-automatic workflows utilizing specifically trained neural networks. The final dataset consists of 10015 dermatoscopic images which are released as a training set for academic machine learning purposes and are publicly available through the ISIC archive. This benchmark dataset can be used for machine learning and for comparisons with human experts. Cases include a representative collection of all important diagnostic categories in the realm of pigmented lesions. More than 50% of lesions have been confirmed by pathology, while the ground truth for the rest of the cases was either follow-up, expert consensus, or confirmation by in-vivo confocal microscopy.

III. METHODOLOGY

We build our skin disease dataset from skin disease dataset HAM10000 dataset which is one of the largest photo dermatology source that is available publicly. At first we Pretrain CNN with VGG16/VGG19 models then extract features with CNN for the whole train set Each feature vector is of 4096. Classifies each skin into one of n classes: Specific skin disease sets and trains fully connected layers with skin images 7 classes of diseases are predicted.It uses softmax layer of CNN for prediction



A. CNN Architecture

CNNs primarily focus on the basis that the input will be comprised of images. This focuses the architecture to be set up in way to best suit the need for dealing with the specific type of data.One of the key differences is that the neurons that the layers within the CNN are comprised of neurons organised into three dimensions, the spatial dimensionality of the input (height and the width) and the depth. The depth does not refer to the total number of layers within the ANN, but the third dimension of a activation volume. Unlike standard ANNS, the neurons within any given layer will only connect to a small region of the layer preceding it.CNNs are comprised of three types of layers. These are convolutional layers, pooling layers and fully-connected layers.

1) The input layer will hold the pixel values of the image.
2) The convolutional layer will determine the output of neurons of which are connected to local regions of the input through the calculation of the scalar product between their weights and the region connected to the input volume. The **rectified linear unit** (commonly shortened to ReLu) aims to apply
3) an ’elementwise’ activation function such as sigmoid to the output of the activation produced by the previous layer.
4) The pooling layer will then simply perform downsampling along the spatial dimensionality of the given input, further reducing the number of parameters within that activation.

The fully-connected layers will then perform the same duties found in standard ANNs and attempt to produce class scores from the activations, to be used for classification. It is also suggested that ReLu may be used between these layers, as to improve performance.

B. Code & Implementation

```
import tensorflow as tf
labs = list(set(y))
alt_num_labs_train = np.asarray([labs.index(i) for i in y_train])
alt_num_labs_val = np.asarray([labs.index(i) for i in y_val])
model = tf.keras.models.Sequential([
  tf.keras.layers.Flatten(),
  tf.keras.layers.Dense(512, activation=tf.nn.relu),
  tf.keras.layers.Dropout(0.2),
  tf.keras.layers.Dense(7, activation=tf.nn.softmax
adm = tf.keras.optimizers.Adam(lr=0.001, beta_1=0.9, beta_2=0.999, epsilon=None, decay=0.9, amsgrad=False)
model.compile(optimizer=adm,
              loss='sparse_categorical_crossentropy',
```

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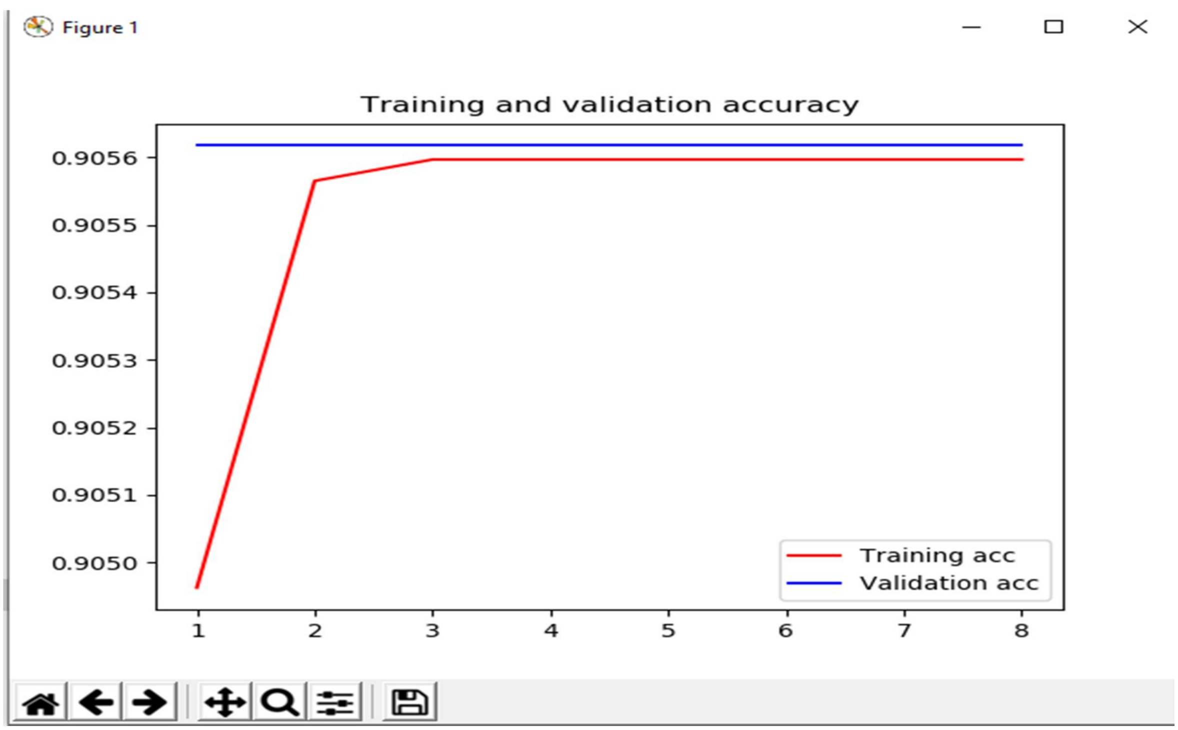
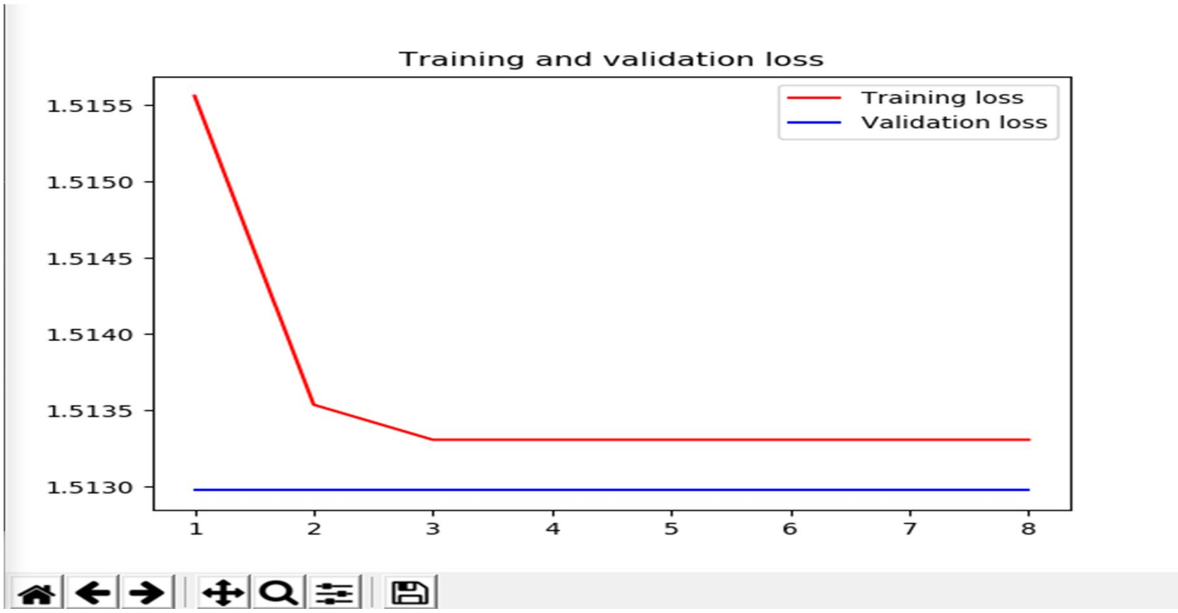
```
       metrics=['accuracy'])
model.fit(train_features, alt_num_labs_train, epochs=1)
if not (os.path.exists("model_CNN_nonopt.h5")):
    model.fit(train_features, alt_num_labs_train, epochs=15)
    model.save_weights("model_CNN_nonopt.h5")
else:
    model.load_weights("model_CNN_nonopt.h5")
    eval_score = model.evaluate(val_features, alt_num_labs_val)
    print("Evaluation score (CNN non opt):", eval_score)
import matplotlib.pyplot as plt
acc = _history['acc']val_acc = _history['val_acc']
loss = _history['loss']
val_loss = _history['val_loss']
epochs = range(1, len(acc) + 1)
plt.title('Training and validation accuracy')
plt.plot(epochs, acc, 'red', label='Training acc')
plt.plot(epochs, val_acc, 'blue', label='Validation acc')
plt.legend()
plt.figure()
plt.title('Training and validation loss')
plt.plot(epochs, loss, 'red', label='Training loss')
plt.plot(epochs, val_loss, 'blue', label='Validation loss')
plt.legend()
plt.show()
```

IV. RESULT AND CONCLUSION



Screenshot 1: Training accuracy showa how the model learned out of the training data given.Testing accuracy shows how much the model is able to cope up with unknouwn data. Variation of them over epoch shows how its happening over each epoch and improving the learning.



Screenshot 2: Loss corresponds to the amount of informantion missed by the model in training and testing. The more it absorbs, the better the learning process.

V. CONCLUSIONS

Convolutional Neural Networks differ to other forms of Artifical Neural Network in that instead of focusing on the entirety of the problem domain, knowledge about the specific type of input is exploited. This in turn allows for a much simpler network architecture to be set up.Future work may include increasing the dataset size and trying this technique on greater number of images.Different machine learning algorithm will be investigated in order to improve the accuracy.

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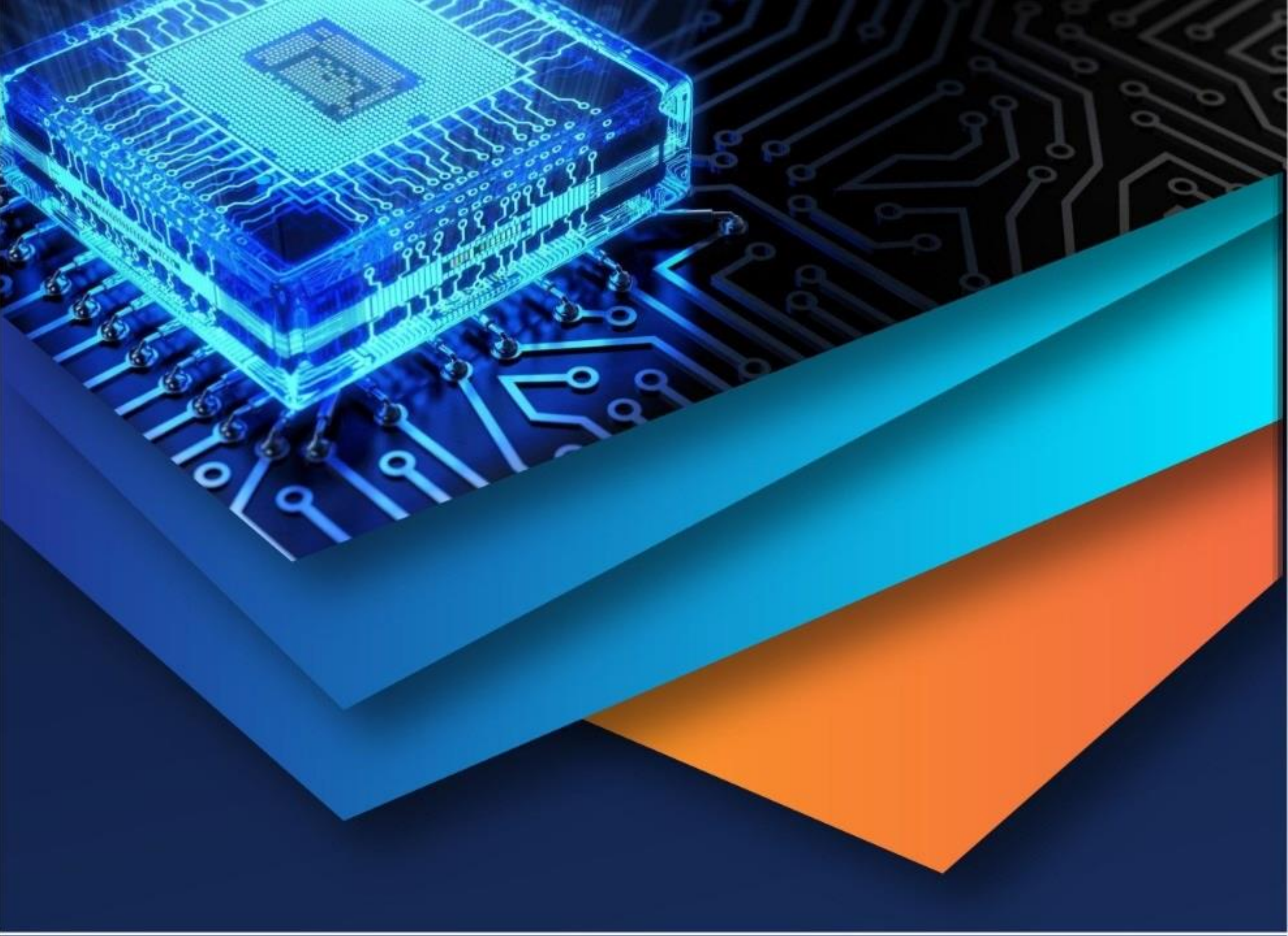

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