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Health Care Disease Prediction and Medicine, Exercise and Diet Suggestion using CNN

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Abstract: ***The Disease prediction Program is based on a prediction model predicting user disease on the basis of the following indicators the user contributes as an input to the system.. The system analyzes the symptoms provided by the user as input and gives the probability of the disease as an output Disease Prediction is done by implementing the CNN Classifier. CNN Classifier calculates the probability of the disease. Along with disease prediction system also calculates severity of disease and as per severity of disease suggests medicine. Suggesting diet and appropriate exercise is another merit of proposed system. Prediction of disease involves current as well as medical history of user.***

Keywords: CNN, disease prediction, data processing, machine learning

I. INTRODUCTION

As an important application of medical information, healthcare big data analysis has been extensively researched in the fields of intelligent consultation, disease diagnosis, intelligent question-answering doctors, and medical assistant decision support, and has made many achievements. with potential diseases that are often overlooked due to a lack of technical knowledge, so that patients can undergo medical tests aimed at preventing the health condition from getting worse. Encouraged by existing recommendations, this paper proposes a comprehensive hybrid recommendation algorithm, called a medical-based potential prediction disease algorithm.

The system evaluates user-provided signals as inputs and provides opportunities for the disease such as a disease prediction to be performed using the Decision tree Classifier. CNN Classifier calculates the probability of the disease. Along with disease prediction system also calculates severity of disease and as per severity of disease suggests medicine. Suggesting diet and appropriate exercise is another merit of proposed system.

As an important application of medical information, healthcare big data analysis has been extensively researched in the fields of intelligent consultation, disease diagnosis, intelligent question-answering doctors, and medical assistant decision support, and has made many achievements. In order to improve the completeness and integrity of medical examinations, this paper aims to use them the analysis of large-scale health care data combined with in-depth learning technology to provide patients with potential diseases that are often overlooked due to lack of technical knowledge, so that patients can perform health-based tests to prevent the state of health from detection even worse. Encouraged by available recommendations, this paper suggests a hybrid recommendation for in-depth reading an algorithm, called a medical history based on the assumption of possible algorithm diseases..

Now-a-days, people face various diseases due to the environmental condition and their living habits. Disease prediction in the first stage therefore becomes an important task. But accurate predictions on the basis of symptoms can be very difficult for a physician.. There is a need to study and make a system which will make it easy for end users to predict the chronic diseases without visiting physician or doctor for diagnosis. Diagnosing Various Diseases by Examining Patient Symptoms using different Machine Learning techniques Models

II. LITERATURE SURVEY

The prediction of disease at earlier stage becomes important task. But the accurate prediction on the basis of symptoms becomes too difficult for doctor. There is a need to study and make a system which will make it easy for end users to predict the chronic diseases without visiting physician or doctor for diagnosis. Table 1 shows literature survey about disease prediction systems proposed in different literatures.

Table 1 literature review

Sr. no.	Paper Name, Author and year	Outline	Advantages
1	A Medical-History-Based Potential Disease Prediction Algorithm, Wenxing et al, IEEE Access/2019	This paper proposed novel deep-learning-based hybrid recommendation algorithm, which predicts the patient's possible disease based on the patient's medical history and provides a reference to patients and doctors	1) It considers both, high-order relations as well as low order combination of disease among disease features, 2) Improved comprehensiveness compared to previous system.
2	Designing Disease Prediction Model Using Machine Learning Approach, Dahiwade, D., Patle, G., & Meshram, E., IEEE Xplore/2019	Proposed general disease prediction, In which the living habits of person and checkup information consider for the accurate prediction It also computes the risk associated with general disease	1) low time consumption 2) minimal cost possible 3) The accuracy of disease prediction is 84.5%
3	Explainable Learning for Disease Risk Prediction Based on Comorbidity Networks, Xu, Z., Zhang, J., Zhang, Q., & Yip, P. S. F., IEEE/2019	Proposed a comorbidity network involved end-to-end trained disease risk prediction model. The prediction performances are demonstrated by using a real case study based on three years of medical histories from the Hong Kong Hospital Authority.	1) Comfortably incorporates the comorbidity network into a Bayesian framework 2) Exhibits superior prediction performance
4	Design And Implementing Heart Disease Prediction Using Naives Bayesian, Repaka, A. N., Ravikanti, S. D., & Franklin, R. G., IEEE/2019	This paper focused on heart disease diagnosis by considering previous data and information. To achieve this SHDP (Smart Heart Disease Prediction) was built via Navies Bayesian in order to predict risk factors concerning heart disease.	1) Accuracy is 89.77% in spite of reducing the attributes. 2) The performance of AES is highly secured compared to previous encrypting algorithm (PHEC).
5	Similar Disease Prediction with Heterogeneous Disease Information Networks, Gao, J., Tian, L., Wang, J., Chen, Y., Song, B., & Hu, X., IEEE/2020	Proposed a method to predict the similarity of diseases by node representation learning.	1) As the range of predictions expands, the proposed method is better than the disease prediction of only chemical-disease data source
6	Chatbot for Disease Prediction and Treatment Recommendation using Machine Learning, Mathew, R. B., Varghese, S., Joy, S. E., & Alex, S. S., IEEE/2019	This paper explained a medical chatbot which can be used to replace the conventional method of disease diagnosis and treatment recommendation. Chatbot can act as a doctor.	1) This system help in reducing conduction of daily check-ups 2) It identifies the symptoms and gives proper diagnosis. 3) Chatbot doesn't require the help of physician 4) Cheaper 5) The chat and users relation is completely personal which helps users to be more open with their health matters
7	Chronic Kidney Disease Prediction and Recommendation of Suitable Diet Plan by using Machine Learning, Maurya, A., Wable, R., Shinde, R., John, S., Jadhav, R., & Dakshayani, R., IEEE/2019	The proposed system use machine learning algorithm and suggest suitable diet plan for CKD patient using classification algorithm on medical test records. This extracts the features which are responsible for CKD, then machine learning process can automate the classification of the chronic kidney disease in different stages according to its severity.	1) Detects and suggest diet which will be useful to the doctors as well as patients
8	Designing Disease Prediction Model Using Machine Learning Approach, Dahiwade, D., Patle, G., & Meshram, E., IEEE/2019	This system compares CNN and KNN for disease prediction Disease dataset from UCI machine learning website is extracted in the form of disease list and its symptoms. Pre-processing is performed on that dataset. After that feature extracted and selected. Then classification and prediction using KNN and CNN is performed.	1) The CNN takes less time than KNN for classifying large dataset. 2) CNN gives more accurate disease prediction than KNN.
9	Smart Health Monitoring System using IOT and Machine Learning Techniques, Pandey, H., & Prabha, S., IEEE/2020	This paper deal with IoT which helps to record the real time (patient) data using pulse rate sensor and arduino and is recorded using thing speak. Machine learning algorithms were used to make prediction of heart disease.	1) The proposed system helps patient to predict heart disease in early stages. 2) It will be helpful for mass screening system in villages where hospital facilities are not available.
10	Random Forest Algorithm for the Prediction of Diabetes, VijiyaKumar, K., Lavanya, B., Nirmala, I., & Caroline, S. S, IEEE/2019	This paper proposed a system which performs early prediction of diabetes for a patient, with higher accuracy by using Random Forest algorithm.	1) The accuracy level is greater when compared to other algorithms. 2) The system is capable of predicting the diabetes disease effectively, efficiently and instantly.

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III. SYSTEM ARCHITECTURE AND METHODOLOGY

The system evaluates user-provided signals as inputs and provides opportunities for the disease such as a disease prediction to be performed using the Decision tree Classifier. CNN Classifier calculates the probability of the disease. Along with disease prediction system also calculates severity of disease and as per severity of disease suggests medicine. Suggesting diet and appropriate exercise is another merit of proposed system.

A. Architecture

Proper forecasting of diseases is a daunting task. Overcoming this problem data mining plays an important role in predicting the disease. Medical science has a huge number of data growth per year. Due to the growing number of data growth in the medical and healthcare sector the accurate analysis of medical data has been beneficial to early patient care.. This system is used to predict disease according to symptoms. As shown in figure below, database containing symptoms of different diseases is fed as input to system along with current symptoms of user and medical history of patient (when patient observed same type of symptoms before). Python based system used CNN algorithm to predict disease patient is suffering from. After predicting disease system classified disease into mild, moderate and severe conditions.

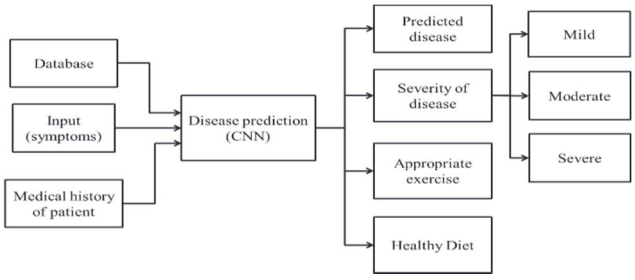

Fig 1 architecture of proposed system

If disease is mild then it suggest some medicine, in case of moderate along with medicines system suggest user to visit doctor if symptoms doesn't fade away and when its severe case system warn user to immediately visit doctor. System also suggests diet and exercise as per the disease.

B. CNN Algorithm

Over the last decade, tremendous progress has been made in the field of artificial neural networks. Deep-layered convolutional neural networks (CNN) have demonstrated state-of-the-art results on many machine learning problems, especially image recognition tasks.
CNN is one of artificial neural networks which have distinctive architectures as shown in Fig. 1; CNN input data is usually Red Green Blue images (3 channels) or gray images (1 channel).. Several convolutional or pooling layers (with or without activation functions) follows the input layer. For classification problems, one or more full connection (FC) layers are often employed. The final layer outputs prediction values (such as posterior probability or likelihood) for K kinds of objects where the input image should be classified in.

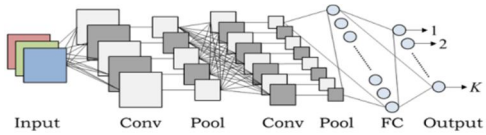

Fig 2 *CNN architecture*

Each layer of CNN can have a certain activation function which controls amount of output value to propagate its next layer. For intermediate layers, the rectified linear unit (ReLU)

$$f(a_i^l) = \max(0, a_i^l), \tag{1}$$

Note that all i∈R is a sum of signals received by the i-th unit in the l-th intermediate layer. Meanwhile, for the last layer, the soft-max function is often used to obtain probabilistic outputs.

$$f_k(\boldsymbol{z}) = \frac{\exp(z_k)}{\sum_{\kappa=1}^{K} \exp(z_\kappa)}, \tag{2}$$

Note that z is a K dimensional vector where zkis a sum of signals received by the k-th unit in the last layer. Since the function is non-negative and has the unit sum property (□kfk(z) = 1), the value of fkimplies a class posterior probability that an input data belongs to the k-th class. Therefore, by using the soft-max function in the output layer, CNN can act a role of probability estimators for the object classification problems. As one of the distinctive properties of CNN, they have consecutive multiple feature representations which are automatically organized in their each convolutional layer through the training using given labeled instances. In spite of this interesting situation, typical dimensionality reduction methods (such as PCA) will visualize each feature representation individually, without regarding the relationships between those consecutive features. These are the steps used to training the CNN (Convolutional Neural Network).

1) Upload Dataset
2) The Input layer
3) Convolutional layer
4) Pooling layer
5) Convolutional layer and Pooling Layer
6) Dense layer
7) Logit Layer

CNN uses filters on the pixels of any image to learn detailed patterns compared to global patterns with a traditional neural network. To create CNN, we have to define:

a) *A convolutional Layer:* Apply the number of filters to the feature map. After convolution, we need to use a relay activation function to add non-linearity to the network.
b) *Pooling Layer:* The next step after the Convention is to downsampling the maximum facility. The objective is to reduce the mobility of the feature map to prevent overfitting and improve the computation speed. Max pooling is a traditional technique, which splits feature maps into subfields and only holds maximum values.
c) *Fully connected Layers:* All neurons from the past layers are associated with the other next layers. The CNN has classified the label according to the features from convolutional layers and reduced with any pooling layer.

C. CNN Layers

1) *Convolutional Layer:* It applies 14 5x5 filters (extracting 5x5-pixel sub-regions),
2) *Pooling Layer:* This will perform max pooling with a 2x2 filter and stride of 2 (which specifies that pooled regions do not overlap).
3) *Convolutional Layer:* It applies 36 5x5 filters, with ReLU activation function
4) *Pooling Layer:* Again, performs max Pooling with a 2x2 filter and stride of 2.
5) *1,764 neurons*, with the dropout regularization rate of 0.4 (where the probability of 0.4 that any given element will be dropped in training)
6) *Dense Layer (Logits Layer):* There are ten neurons, one for each digit target class (0-9).

Important modules to use in creating a CNN:

a) Conv2d (). Construct a two-dimensional convolutional layer with the number of filters, filter kernel size, padding, and activation function like arguments.
b) max_pooling2d (). Construct a two-dimensional pooling layer using the max-pooling algorithm.
c) Dense (). Construct a dense layer with the hidden layers and units

IV. RESULT

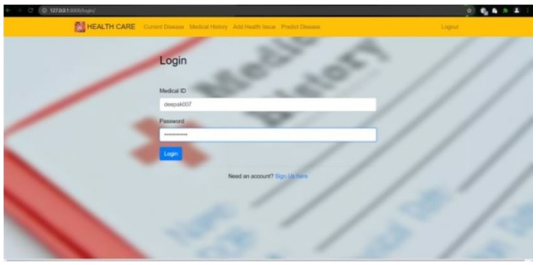

Fig 3 Login Page

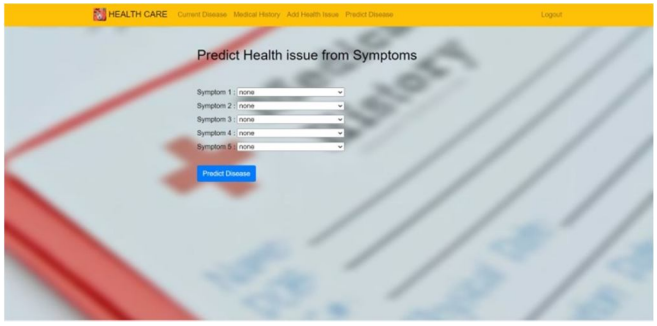

Fig 4 Input to predict disease

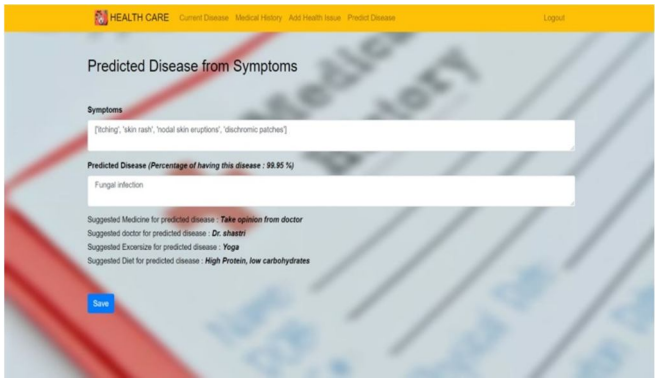

Fig 5 Predicted disease

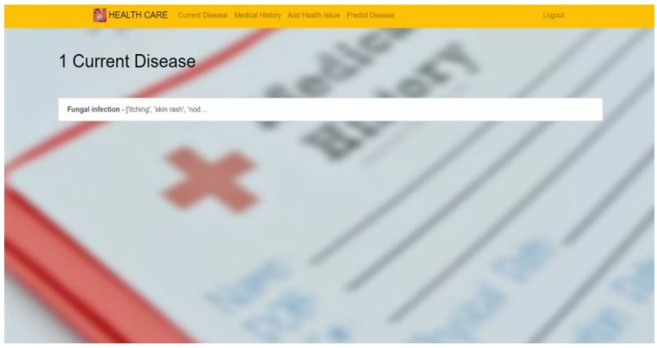

Fig 6 Current disease

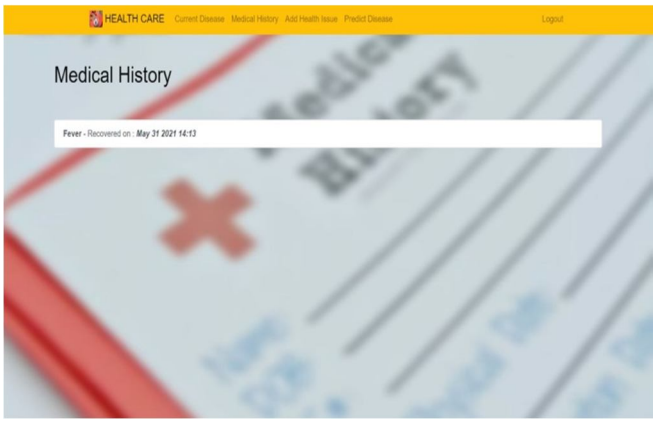

Fig 7 Medical History

Fig 8 Accuracy of algorithm

V. CONCLUSION

We proposed general disease prediction system based on machine learning algorithm. We utilized KNN and CNN algorithms to classify patient data because today medical data growing very vastly and that needs to process existed data for predicting exact disease based on symptoms. We got accurate general disease risk prediction as output, by giving the input as patients record which help us to understand the level of disease risk prediction. Because of this system may leads in low time consumption and minimal cost possible for disease prediction and risk prediction. We can say CNN is better than KNN in terms of accuracy and time.

Accuracy of general disease risk prediction of CNN is higher as compared to other algorithms like KNN [1], Naïve Bayes, SMO, Multi-layer perceptron [4] etc. We got accurate general disease risk prediction as output, by giving the input as patients record which help us to understand the level of disease risk prediction. When compared with above mention algorithms, CNN leads in low time consumption and minimal cost possible for disease prediction and risk prediction. If the system takes an image along with some noise it recognizes the image as a completely different image whereas the human visual system will identify it as the same image with the noise. User/patient has to separately book appointment with doctor if symptoms are beyond the scope.

The role played by system can sometimes be beyond the scope and user may require consulting a doctor for taking health related tests. In such situations, system can be helpful if it can be made to set up an appointment with an efficient doctor based on their schedule. Also it will be beneficial if the symptoms and disease identified by the system can be made into a report and automatically forwarded to an available doctor where he can further assist the user with more advices and future measures to maintain their health. A video call with a specialized doctor can also be made depending on the availability of the user rather than based on the availability of doctors.

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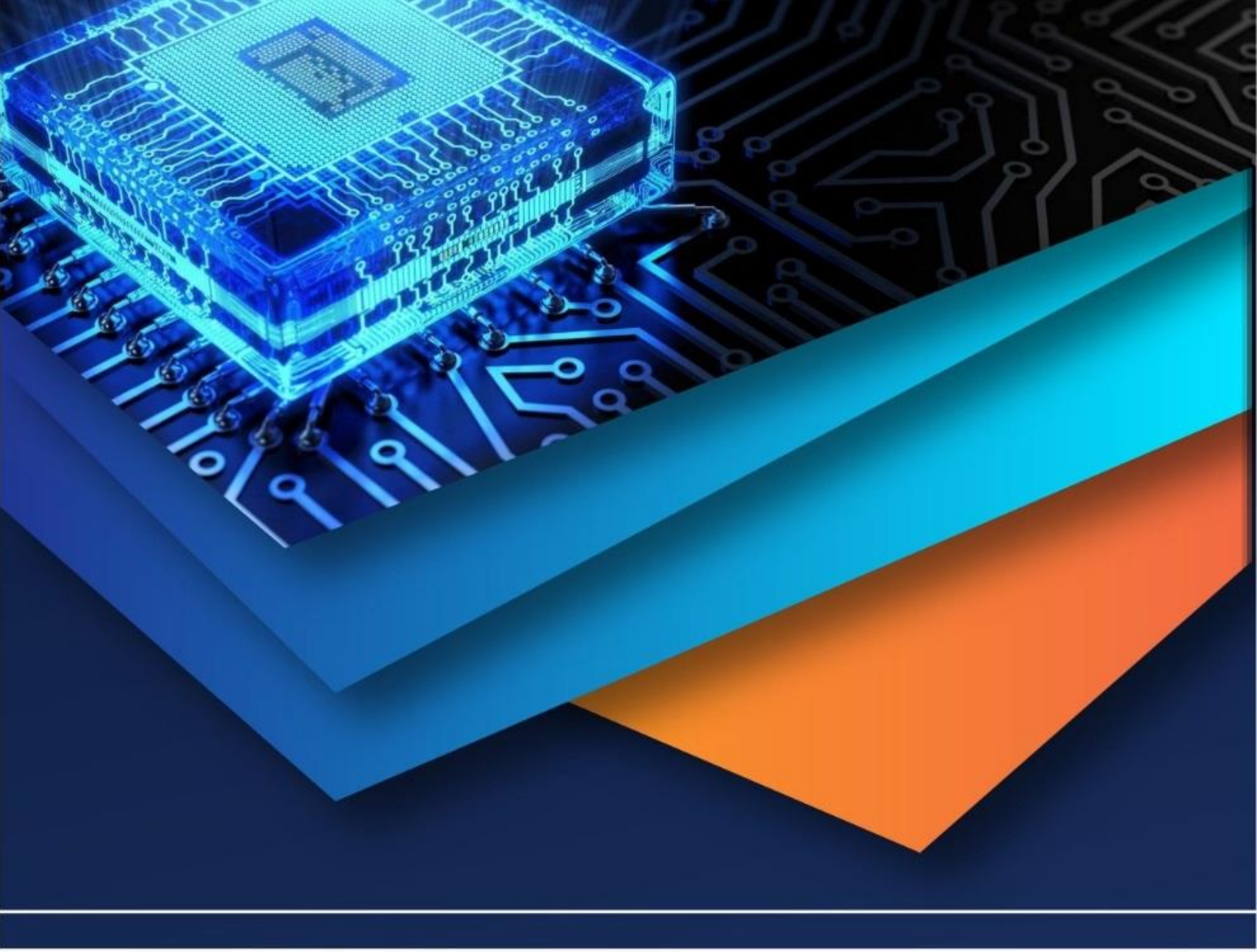

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