iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IV **Month of publication:** April 2023

DOI: https://doi.org/10.22214/ijraset.2023.50535

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Cattle Disease Prediction Using Artificial Intelligence

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Abstract: ***In today's world identifying cattle disease and providing proper treatments is a challenging task in the current medical sector. As it is difficult to identify thecattle disease in real time, we require a method topredict cattle disease and related patterns. There are so many research works on this topic. Most of the researchworks just presented the idea of cattle disease prediction. There are many works where implementation is done and many papers predicts cattle disease using efficient data science algorithms. Research works where implementation is done uses PYTHON language or R language as programming language for cattle disease prediction. As PYTHON language and R language supports all ready libraries to process training datasets and to predict cattle disease. Many papers use training datasets from www.kaggle.com, www.dataworld.com etc. Research works uses efficient algorithms for prediction, algorithms such as Naive Bayes algorithm, KNN classifier, SVM classifier, Decision Tree classifier, Random Forest algorithm etc. Most of the papers got very good results of using these algorithms. So many works on this cattle disease and pattern prediction is done using data science techniques.***
Keywords: Data Science, Machine Learning, Cattle Disease, Treatments.

I. INTRODUCTION

Identification of symptoms, cattle diseases and providingproper treatments is difficult in the contemporary medical industry. Real-time management of the symptoms of cow illness and disease types as animals can't explain their problems or pain that they are facing. In medical sectorfinding the cattle disease symptoms, diseases are a challengingtask. Manual process of identifying the cattle disease and treatment is too complex and time consuming and also expensive. These technologies only gather information, store it in databases, and then retrieve it in the future; they do not extract any helpful data that enables medical professionals to manage the cattle disease in a better way. Existing system is a manual process where doctors diagnosis animals and identifies the diseases and gives the treatment. In foreign countries they use some advanced system such as IBM Watson, the MYCIN expert system [4], etc. These technologies merely gather information, store it in databases, and retrieves the same in the future, but no important information that aids medical professionals in handling the cattle disease in a better way.

II. LITERATURE SURVEY

1) The target of this software is to provide resources to determine whether cattle are healthy or unhealthy through machine learning. It aims to help cattle owners tokeep their livestock healthy without human intervention. It would be helpful to increase efficiency in infection diagnosis and prevent any contagious diseases from spreading amongst either cattle or from cattle to humans. This will be revolutionary as the number of cattle lost peryear will decrease and in turn reduce losses and make the cattle Industry lucrative again.

2) 9th National Conference on Role of Engineers in Nation Building - 2021 (NCRENB-2021), "Livestock Disease Prediction System". In rural households' socioeconomic development, the cattle industry is crucial. Because they lack formal education and are unskilled, a huge portion of India's population relies on agriculture to support themselves. In India, many people rely on their livestock as a secondary source of income, particularly the resource-poor families that keep fewer animals. The prevalence and outbreaks of diseases are one of the main barriers to the sector's ability to grow at the intended rates.

3) "Prediction-based illness detection in cattle 2021: "Techniques". Non-industrial countries like India, which used one of the earliest methods of occupation, Dairy farming is practiced in several countries, including Bangladesh and Nepal. The increase in productivity in the production of dairy products is largely attributed to dairy farm automation. The sustainable growth of the national economy is severely hampered by the prevalence of various diseases in cattle animals, some of which can reduce productivity, degrade the quality of dairy products, and, if not detected early, also contribute to the death of cattle. In this

research, a method is presented that illustrates how IOT and data mining can be used to diagnose cattle diseases that are uncommon in institutions that can provide affordable medical care. The system measures with a variety of sensors, including those for temperature, vibration, accelerometers, etc. The method makes use of data mining's intelligent analysis mechanism functionality to produce results from the gathered data. This programme is a first aid system that examines the symptoms in order to send you information about algorithms for identifying cattle diseases based on data computation.

4) Here, we've shown how useful it is to combine data from several dairy cattle life domains in order to forecast frequent metabolic, locomotor, and reproductive disorders in cows. To forecast the occurrence of lameness, acute and chronic mastitis, anoestrus, ovarian cysts, metritis, periparturient hypocalcemia, and ketosis, we use a random-forest based technique. Our data set includes 138 unique features from 11 distinct animal life domains and 22,923 observations from 5,828 animals over 166 different herds. Breed, age, lactation stage, physique, nutrition, milk parameters, breeding values, housing and husbandry, environmental factors, and, as a target variable, diagnosis are all included in the domains of life. We employ feature permutation importance along with multivariate logistic regression to determine the significance of individual features to disease prediction. With F1 scores between F1=0.611 and F1=0.72, we successfully predict lameness, anoestrus, periparturient hypocalcemia, ketosis, and metritis. The complex relationships and numerous contributions of several life domains are revealed through the interpretation of feature contributions. We describe connections between a variety of traits and illness risk that have never been documented before, as well as the confirmation of a significant number of associations between features and increased odds of diseases published in the literature. With this effort, we intend to demonstrate how combining data from many sources can enhance precision livestock production and how the results can be used to enhance animal welfare.

5) The information gathered from the animals in the first group was taken into consideration as the norm (the setpoint), or the parameters' standardized boundary values for the evaluation of a cow's circumstances. The information acquired for the second group was regarded as data that deviated from the parameter threshold values (deviations from the setpoint, necessitating pre-planned action). The software package "MATLAB R2019b"'s programme code was used to do the analysis. We looked at the relationships between the cows' locomotor activity, rumen temperature, and pH, as well as the environment's air temperature and relative humidity in the cowsheds. Following that, we built graphs of intercorrelating functions. The work led to the creation of algorithms for the first time that allow for the diagnosis of viral, parasitic, and neurological illnesses.

6) The algorithm first classifies the disease's symptoms using text classification technologies. Text classification is the key to implementing the auxiliary diagnosis and treatment system. The system effect is directly impacted by the caliber of the categorization findings. As a result, the main goal of this paper is to analyze the data from numerous electronic medical records and classify sentences using machine learning's SVM method [5]. Then, using the data mining association algorithm, connect the cattle disease with the symptoms of the cow[6], and provide timely recommendations for diagnosis and treatment.

7) Syndrome differentiation (SD), a crucial step in TCM medicine for treating illnesses, can be viewed as a high-dimensional complex function in which symptoms and signs serve as the input and various syndrome types as the output [24]. In computer science, ANN offers a general approach for fitting such high-dimensional complex functions. As a result, we combined the virtue of ANN with ISD of TCM in this paper and used ANN to simulate the ISD of COPD. This model could be used to study other illnesses with comparable traits to COPD.

8) According to the primary reservoirs and modes of infection, mastitis-causing bacteria in cattle have traditionally been divided into two categories: "contagious" and "environmental." During the milking process, contagious germs are frequently spread between cows by the mammary gland. Environmental bacteria are opportunistic intruders from the cow's environment and are typically not equipped to live in the host. Tests are typically obtained during milking periods and prompt an immune reaction that the immune system quickly handles, leading to a momentary rise in white blood cells in milk. The capacity to accurately determine the primary method of transmission of mastitis on farm is crucial for the effective implementation of control measures because the control techniques for contagious mastitis differ noticeably from those for environmental mastitis.

9) A complicated attribute called cow survival combines characteristics including milk output, fertility, health, and environmental elements like farm management. It is challenging to precisely forecast survival due to its intricacy. Few research has reportedly attempted to address this issue, and none have used ensemble methods; this is likely the cause. We investigated whether merging the predictions of numerous (weak) approaches in an ensemble method would enhance the prediction of cow survival to second lactation, when predicted at five different points in a cow's life. The majority voting rule, multiple logistic regression, random forest, and naive Bayes were the four ensemble approaches we examined. The performance of the ensemble model was assessed using precision, recall, balanced accuracy, area under the curve (AUC), and increases in the proportion of surviving cows in a scenario where the best 50% were chosen.

10) Based on measurements of behavior before to calving, we created models to forecast postpartum illness in multiparous and primiparous dairy cows. Postpartum deaths from metritis, HYK, and mastitis were more common in multiparous cows with higher BW and more actor behaviors. Additionally, we found interactions between feed intake, the variety of bins visited each day, and the quantity of bins visited each meal. More bins visited per meal and an interaction between feed intake and time spent feeding during the prepartum period were found to be important disease predictors for primiparous cows. When feed intake was low, an increase in time spent feeding was protective against becoming ill, while when feed intake was high, the likelihood of becoming ill increased as time spent feeding increased. The bulk of the diseased animals were successfully separated from healthy animals using predictive models. We come to the conclusion that prenatal behaviors can be utilized to identify animals at risk for transition cow illnesses, enhancing our ability to provide prevention and care.

11) The Internet of Things (IoT) is a technology application field where various technologies are included and used in daily life. IoT, in brief, helps us understand how people, animals, cars, air currents, and other comparable scenarios move around and inside themselves. IoT's ability to link physically created items and components to digitally created ones, including computers and software programs, as well as to each other, is what makes it so potent. As a result, all of these devices can implement real-time data sharing via cloud computing using the group or multi-point approach. Cattle's stomach is made up of In this work, an IoT-based system for diagnosing acidosis disease in the rumen of cattle was developed. In a lab, the system was evaluated, and the data were examined.

12) The department of Cesar (Colombia) is the area of interest in this study. This department of Colombia is situated in the Caribbean region of the country's north, bordering Venezuela (Zulia State) to the east. One of the main sectors in cattle exploitation in the nation, cattle raising is actively exploited in this area on huge farms. As a result of its proximity to the border and considerable cattle exploitation, the Cesar department is an essential region of study for FMD dynamics. In order to construct the networks of research, nodes in the network having links to regions inside the department of Cesar (Colombia) designated as a destination in the movement database were taken into consideration.

13) By observing numerous clinical indications and remedy records, Tariku JibatBeyene et al. [1] conducted a pilot study for cow diseases, evaluating disease probability of cattle. They mostly used multiple variable logistic regression analysis to show if the health conditions of the cattle had favorable or negative results. After that, they showed how to utilize a modified Delphi technique with a smartphone-based cattle diagnosis system to assess the degree of confidence in a forecast given by Vet Africa—Ethiopia and gauge the likelihood of a diagnostic match.

14) The goal of the study proposed by Giorgio Marchesini et al. [2] was to assess the level of activity and rumination in young bulls and to collect information to assess their health status using average daily weight gain (ADG), the dishomogeneity index of rumination (DR), and the daily dishomogeneity indices of activity (DDA) and rumination (DDR). In order to create a better herd management system, they used individual sensors to monitor early disease diagnosis in beef cattle

15) The factors mentioned above highlight how crucial it is to investigate these integrated impacts utilizing data mining or machine learning techniques. To research the impact of medications on various spaces, drug, target, and illness spaces may be evaluated jointly. In order to represent each medication's data as a feature vector, we took into account and evaluated a variety of drug attributes. We then used various data mining or machine learning techniques to infer connections between pharmaceuticals and side effects. The drug SE prediction is difficult from both the data science and medical science viewpoints. The major goal of this effort is to use data analytics as a lens to create a more potent strategy to improve overall prediction performance. This computational method/model can be used to analyze individual diseases using particular clinical data and information resources . Further research on the relationships between therapeutic pharmaceuticals and significant side effects for a specific disease can then be done, and special focus can then be placed on regulating and dosing of the drug in clinical trials. Individual investigations have been carried out, for instance, on psoriasis and neurological illnesses like Alzheimer's . The following subsections provide more information on the data features and the applied predictive techniques.

16) The primary goal of this suggested system is to use the Internet of Things to make the infrastructure of cattle farms smarter and to identify, inform, and address illnesses, abnormalities, emergency situations, and infections at an early stage. All livestock can now be more accurately tracked using wearable GPS technology. The inclusion of multiple sensors in wearables, such as temperature, microphone, and accelerometer sensors, enhances output reliability, consistency, and resolution. Wearables and sink nodes using the Arduino Nano and ESP-01 8266 Wi-Fi module drastically reduce in size and cost without sacrificing performance. By avoiding the environment from becoming critical, smart ventilation systems enhance cow health.

17) Early models of host-pathogen interaction used the assumption that each host had roughly the same chance of contracting an infection or spreading it to other hosts. More recently, the idea that many infectious illnesses have highly skewed population-level transmission rather than homogenous transmission has been emphasized in several research. According to what became known as the "20/80 rule," it was shown that 20% of hosts in a population contributed to 80% of the transmission potential. Numerous microbes and their interactions with their hosts, whether they be people or animals, have been described as having these heterogeneities. Escherichia coli transmission heterogeneities by cattle have been observed in several epidemiological investigations; this phenomenon has significant agricultural, medicinal, and public health ramifications.

18) The inability to attain efficient output due to the possibility of FMD even when cattle are healthy is a significant impact that is difficult to quantify. Smallholders in FMD-endemic regions frequently employ low input, low output tactics that make them more resistant to FMD, which discourages investment to boost productivity. Smallholders do not, however, adopt more productive and effective methods for a variety of reasons, including restricted access to markets and cash, various diseases, particularly endo- and ectoparasites, and a lack of technical expertise, infrastructure, and support. Although the average global impact of FMD on smallholders is unknown, this would be a rather useless statistic because the impact varies depending on the environment and comprises such a diverse group.

III. COMPARISON TABLE

AUTHOR	YEAR	METHODOLOGY	LIMITATION
Harsh J. Shah, Chirag Sharma , Chirag Joshi	2022	The system is built upon the "TensorFlow" machine learning library as well as the "Kera's" deep neural network library in Python.	Symptoms difficult to observe and Low Infection Detection Rate
Mr. Rahul Parihar, Mr. Daksh Ashar, Mr. Amit Kanojia, and Prof. Saniket Kudoo	2021	This system will forecast disease in livestock (cows, sheep, and goats) based on symptoms and will also suggest preventative measures in the event that disease is expected.	significant risk to the health of both animals and people that come into contact with them directly
Sandeep Kavalur, Sangamesha V, Sai Trinath Y, Noone Vijay Kishan, and Mr. Sumanth Reddy	2021	The system uses a variety of sensors, including vibration accelerometers, temperature sensors, and others, to detect	at this work, a method is presented for diagnosing uncommon cow diseases at farm animal hospitals, which can lead to the development of affordable treatment options.
Caspar Matzhold and Jana Lasser Birgit Fuerst-Waltl, Franz Steininger, Thomas Wittek, Christa Egger- Danner,John Klimek	2021	Machine learningapproaches such as black-box sensor systems that are employed in commercially relevant prediction algorithms.	As the black boxmainly consists of electronic circuit, there arechances of damage results in providing wrong data.
Alexei S. Dorokhov, Fedor E. Vladimirov, Igor M. Dovlatov, and Konstantin S. Lyalin are among the authors.	2021	The algorithms were developed by comparing cows housed under the same settings and divided into two groups: sick and healthy animals, with equal reproductive status and physiological parameters	confined to internal monitoring systems for cattle's physiological status
Y. Du, L. Qin, B. Li, C. Yang, L. Niu, and	2020	The focus is to divide the illness into categories in accordance with the space vector model (SVM) algorithm	The drawback of this approach is that when utilizing the system, you should choose as many symptoms as you can. Only in this manner can the disease diagnosis be made with greater accuracy.
Marina A. G. von Keyserlingk, Daniel M. Weary, Annabelle Beaver, and Mohammad W. Sahar	2020	It uses the prepartum behavior which isused to identify cows who are likely to develop metritis, HYK, or mastitis after calving	'Some cattlemay not show prepartum behavior

Chris Hudson1, Katharine A. Leach, Peter M. Down, Andrew J. Bradley, James E. Breen, Robert M. Hyde, and Martin J. Green	2020	Anonymized data from 1000 dairy farms that had taken part in the UK's national mastitis control programme, the AHDB Mastitis Control Plan, were collected for the study.	Only focused onimage recognition
The authors are E.M.M. van der Heidea, C. Kamphuisa, R.F. Veerkampa, I.N. Athanasiadisc, G. Azzopardid, M.L. van Peltb, and B.J. Ducro.	2020	Equivalent to or superior precision, AUC, balanced accuracy, and an increase in the percentage of animals surviving were obtained when using logistic multiple regression as an ensemble approach.	Regression may be the only practical approach to examine the benefits of adopting ensemble methods.
Wenjun Tang, Fei Teng, Wei Peng, Yifan Zhang, Weihong Li, Chuanbiao Wen, and Jinhong Guo are some of the other participants.	2019	In this study, the ISD of TCM for the case study of COPD was modelled using ANN.	complexity of an alternate approach is to use ensemble learning in a network.
Fatih, Kamil Aykutalp	2019	It aims to aid in the diagnosis of acidosis disease, one of the digestive issues that will affect cattle's rumen due to a relation between	Only used to monitor one disease Acidosis Disease, Sensorsused for monitoring, leadsto less accurate results.
Francisco Gomez,Jimmy Vargas, Juan Galvis, Fausto Moreno, and Jeisson Prieto	2019	cattle transportation network the description of this intricate transportation system could be useful for surveillance and management duties.	Only used to monitor the foot and mouth disease. Less accurate results generated.
Mr. V Gokul, Mr.Sitaram Tadepalli	2017	Ai is to early detection and management of anomalies, emergencies, and diseases.	Farmers might be perplexed by the high expense and utilization.
D. Mottaran, B. Contiero, G. Marchesini, E. Schiavon, et al	2018	Combining veterinary procedures with information technology enables creative Web and mobile app uses that speed up, optimize, interact with, and secure animal production processes.	This system is only used by smartphone
A. Eshetu, T. J. Beyene, A. Abdu, and others	2017	We suggest a mobile-based disease detection system for cattle in this paper, an important livestock for usage in farms and dairy products in Myanmar.	They observed early disease identification in beef cattle using individual sensors to create an enhanced herd management system.
Wei-Po Lee, Chao-Ti Lai, Jhih- Yuan Huang, Hsuan-Hao Chang, and King-Teh Lee	2017	By combining several online knowledge sources, system used a hybrid machine learning approach to build side effect classifiers utilizing a suitable collection of data attributes.	For the prediction of SEs during the drug discovery process, cost and efficiency are necessary.
Richard A. Stein1and David E. Katz	2017	Create and put into action tailored interventions with applications in food safety, animal husbandry, agriculture, and human health.	This paper will discuss super-spreading and super-shedding by cattle, analyze the primary variables that shape these transmission heterogeneities, and investigate the interface with human health using E. coli as a case study.
J. Rushton, M. McLaws, and T. J. D. Knight- Jones	2017	Costs associated with control methods include immunization, market access limitations, movement restrictions, wildlife regulations, and culling.	Smallholder systems in underdeveloped nations are expensive, difficult, and require long-term commitment due to FMD.

IV. CONCLUSION

In real time it is difficult to handle the cattle disease symptoms and disease types as animals can't explain their problems or pain that they are facing. In medical sector finding the cattle disease symptoms, diseases are a challenging task. Proposed system major objective is to find the cattle disease symptoms and then predicting the correlation between symptoms-diseases-treatments. As in current system it is difficult to identify the cattle disease and also its difficult to give the proper treatments.

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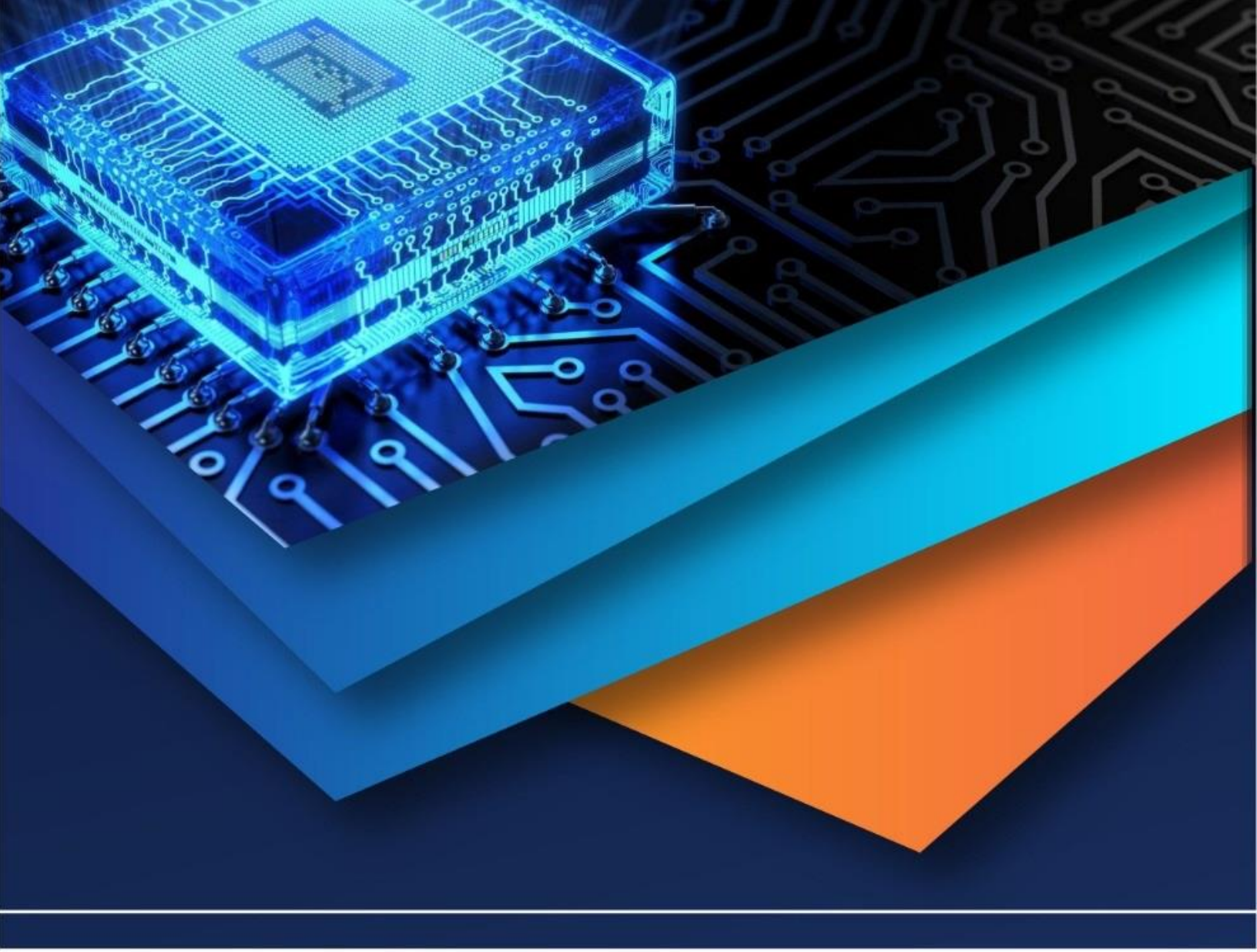

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