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Face Mask Recognition Using Machine Learning

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Abstract: ***Face mask detection software saves time and effort by automating various processes. A camera is used to capture visual input from a specific area. Then the graphics are compared to the predefined dataset. Determine whether or not a face mask is present.***
Once we've done that, have the input in graphic form, it can be presented as an input to a deep learning model for action prediction or this is the output that should be served to the user. Then it is necessary for the model to have patterns in which it may operate.
Discern between persons who are masked and those who are not. The model will also include the actions that must be completed. When it detects the existence of a face mask, it proceeds to the next step. In addition, the most fundamental requirement for this software is for implementation, python libraries such as tensor flow, numpy, and sklearn are employed in realm of artificial intelligence. A window will appear in response to the user's command and will show the camera's graphics for identifying the face mask and the output will then be displayed based on whether the user is facing up or down.
Is there a mask on or not? Face mask detecting software has been developed. In this pandemic period, there are numerous applications.
Keywords: OpenCV, Machine Learning, MobileNetV2, Keras are all terms that can be found in the index.

I. INTRODUCTION

Coronaviruses are a kind of virus that may develop it from a flu virus to more serious infections.
In 2019, a novel coronavirus was found in Wuhan, China. This is a completely novel coronavirus that hasn't been encountered in hu mans. This course is designed for public health professionals, incident managers, and employees working for the United Nations, international organisations, and non-governmental organisations (NGOs) who want to learn more about COVID-19 and emerging respiratory viruses.
Masking is a key public health measure for limiting COVID-19 transmission, and it's vital to remember that any mask is better than none.The CDC continues to urge that you wear the most protective mask you can find that fits properly and that you will wear regularly to protect yourself and others from COVID-19. When used appropriately and regularly, masks and respirators can help prevent the spread of SARS-CoV-2, the virus that causes COVID-19.
Deep learning is a type of artificial intelligence (AI) which allows software to increase forecasting accuracy without even being expl icitly intended to do so. Machine learning algorithms utilise previous data as input to predict new output values.
Deep learning is a subset of machine learning that is highly specialised.
A neural net is used in deep learning, which is a layered structure of algorithms. Deep learning takes a lot of data but only a little human intervention to work well
Deep learning is made up of a variety of neural networks that are managed by the cores of a processor. It's a novel strategy that's becoming increasingly popular in artificial intelligence fields, including computer vision.
Deep convolution networks are a type of deep learning model that is commonly seemed to evaluate sensory information.
This machine learning-based project, "Face mask identification using machine learning," intends to provide a service that can determine whether or if a person is disguised. In this project, we take advantage of the CNN model to analyse the image.
In this study, we employed CNN, specifically MobileNetV2 and VGG16, together with various common libraries like as TensorFlow, Keras, Imutils, and OpenCV, to compare the accuracy of the two. With a small dataset and high recognition accuracy, the system has been well-balanced.
The initiative is built on real-time application automation of the public-area screening method to guarantee that individuals put on masks and help battle the infection. This method may be used to monitor public locations by deploying video surveillance cameras, drones, or other type of cameras to identify persons who aren't wearing masks.

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Figure1 shows the framework of MobileNetV2 which is used in the model discussed in this paper.

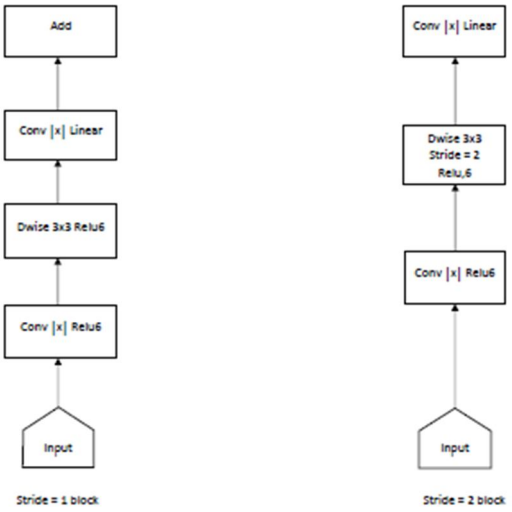


Figure: Mobile net V2

II. LITERATURE REVIEW

A paper is released by Militante and Dionisio in 2020 in which they used a dataset of 25,000 pictures with a pixel resolution of 224224 and achieved a 96 percent accuracy rate. They used an Artificial Neural Network (ANN) to simulate human brain activation. Raspberry Pi is being used in their research to warn in public areas if someone enters without a mask.

Guillermo et al. (2020) provided a research report that was used to detect face masks. They used this methodology to construct an artificial dataset on their own in their research report. They used around 600 raw photos without masks to create a fictitious set of data created via applying a mask to the face employing artificial intelligence techniques to get positions.

In 2018, Boyko, Basystiuk, and Shakhovska revealed their findings, which were based on the Dlib and OpenCV libraries.

The efficiency of these 2 most frequent machine learning packages is compared using the hog method for finding and subsequent re cognition. The coordinates of the facial border were obtained using the OpenFace package. They divided the facial characteristics into groups using 128 facial feature extraction, which will allow them to lead them with greater accuracy.

Face recognition will gain substantial importance and prospective uses in the future years, according to D. Dwivedi's "Data Science, Artificial Intelligence, Deep Learning, Computer Vision, Machine Learning, Data Visualization, and Coffee." Face detection is a critical component of the face recognition process. In the last several years study effort had done to advance face detection and improve prediction accuracy. It has a wide range of uses in a variety of industries, including law enforcement, entertainment, and safety. Pandiyan submitted this study paper in 2020, in which he devised a Text message warning system for without mask peoples being checked by Video surveillance in public places. CNN layers are utilised in this study to recognise masks and collect photographs of persons who aren't wearing them, the recorded photos are kept on-the-fly using AWS (Aws Services). Twilio messaging, which is an API for sending and receiving Text messages, has been used to issue a notification to the person whose picture has already being apprehended and saved in the Amazon Web Services system.

In 2020, Das, Ansari, and Basak published their research report, which compared the reliability and lost outcomes datasets using two sets of data. This study is based on OpenCV, TensorFlow, and Python.acquire the result, you'll need to use the Keras libraries. Das et al. have specified their field of study.With a total of 1376 people gazing forward, I created my own dataset.690 images with a white mask and 686 images without a mask; 2nd The dataset comes from Kaggle and has 853 photos.There are two types of masks: masks with masks and masks without masks. mask. They used 20 epochs to train their model.with a 90 percent training data and 10 percent testing data were used in this experiment.

Chen et al. (2020) presented their study work in which they offered a method for determining whether or not he is wearing a face mask. Deep learning and machine learning approaches are combined in this study. This model has seven steps: input face mask dataset, input face mask Restructure the collection onto disc, read the dataset from disc, then detect faces from a picture stream using Python packages., decide whether to use a mask, and report the result.

This research article was given by Kalas (2019), and the author worked on recognising a person's face from a video stream. For face detection, three technologies are employed in this study: OpenCV, adaboost, and the haar-like method is used for object recognition, as per the research., Adaboost is used for sample picture training since it does not overstretch the conceptual framework, and By evaluating the face's properties, the Haar-like Algorithm is employed to collect the boundary parameters of the face.

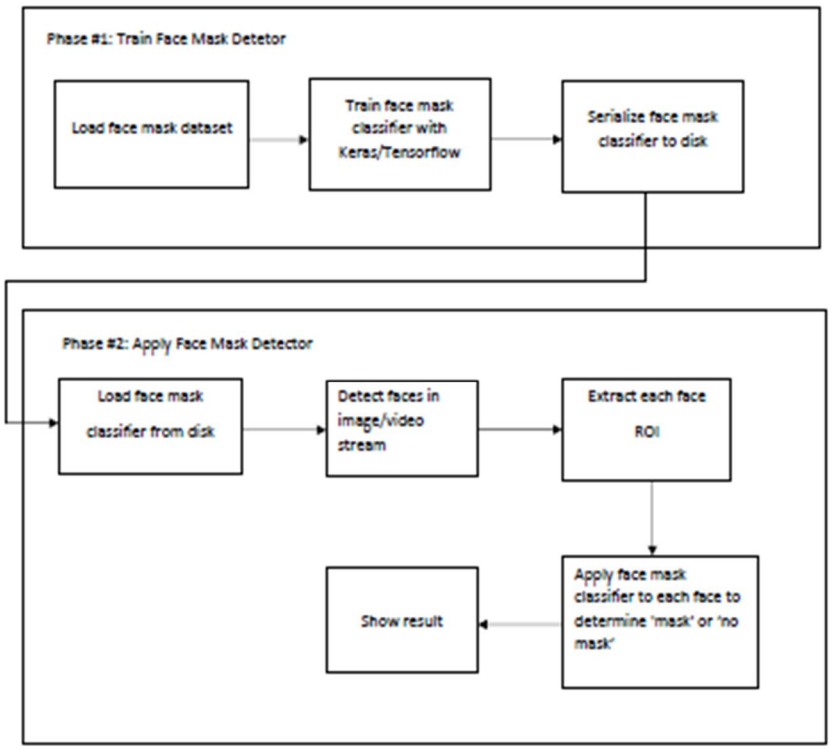
Mohan, Paul, and Chirania (2021) published a research article that uses an ARM-Cortex M7 microprocessor clocked at 480MHz with a 496kb framebuffer to identify a face mask. They demonstrated their approach for 138 kilobytes post-quantization with 30fps inference rate using data sets, two from Kaggle with 12232 photographs each. and one from the author using an OpenMV cam H7 controller camera with 1979 images. The dataset was increased to 1,31,124 photos, and after that all photos were reduced to 3232 pixels, which is the best size for the microcontroller's configured frame buffer, which is 496kb. Finally, it was the best fit model for RAM-constrained microcontrollers, with a 99.79 percent accuracy.

Salih basic & Oreho vacki in 2020 they shown their study in which they utilised Open-CV to recognise faces in images and gender from facial traits. Salihbai et al. employed the LBPH model for feature classification, which recognises features and feeds them to the three Convolutional Neural Network layers. The first layer of Convolutional Neural Network has ninety-six filters, the 2nd layer contains Two hundred fifty six filters, and the final layer contains 384 filters. However, if the person's face is lighted, the position is different, the camera's characteristics of the smartphone, and the phone's performance are all different, the accuracy of their model is reduced significantly.

Loey, Manogaran, Taha, and Khalifa (2021) presented their research work in which they offered to utilise three datasets to differentiate their correctness by running them through the same algorithms. RMFD, SMFD, and LFW are the three datasets that they utilised. They utilised ResNet50 in conjunction with traditional machine-learning Support Virtual Machine in this study, and they feel ResNet-50 performs better as a feature extractor. As a result, ResNet-50 is employed as a feature extractor, while Support Virtual Machine is used for training, validation, and testing. The study obtained 99.64 percent, 99.49 percent, and 100 percent accuracy in RMFD, SMFD, and LFW, respectively, using these technologies.

III. METHODOLOGY

Identifying the face is the initial step in determining whether or not a mask is present on the face. This splits the method in 2 components: facial identification and mask identification



A. Phase 1: Training

1) Load Dataset: As shown in Fig.3 and 4, we have the Kaggle dataset, which comprises around 4000 photos, 2000 with mask and 2000 without mask. This collection was used since it contains horizontal and vertically skewed photos.

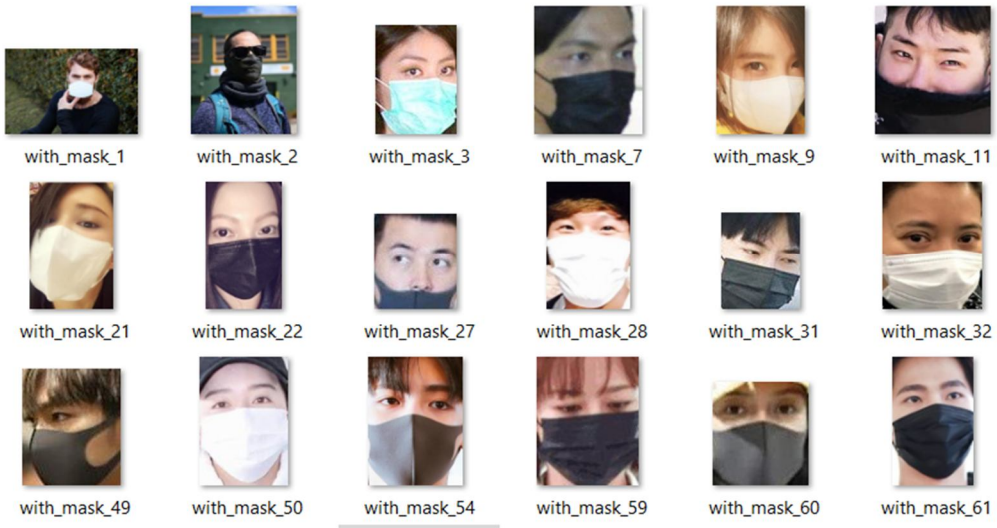


Fig 3: Collection (with mask)



Fig 4: Collection (without mask)

2) Pre-Processing: The quality of the dataset determines the accurateness. The first step in the data cleaning process is to remove any incorrect images found in the dataset. The photos are downsized to a set size of 96 × 96 pixels, reducing the strain on the machine while training and ensuring the best possible outcomes. After that, the photos are labelled as having masks or not. For faster processing, the array of photos is turned into a NumPy array. In addition, the MobileNetV2's preprocess input function is utilised.

3) Training the Model: To avoid overfitting, the number of training samples has been increased. It improves the trained model's generalisation and robustness. The full dataset is then split in train and test data in an 8:2 ratio by randomly selecting photographs from the dataset. The stratify option is used throughout the train and test set to keep the very same amount of the data as the real data set.

B. Phase 2: Detection

After a supervised learning CNN model has been trained to classify, it is classified by learning important visual patterns, the trained images to their respective classes. The suggested model's fundamental building components are TensorFlow and Keras. Eighty percent of the participants in this study the training set receives a portion of the dataset, while the testing set receives the remainder. The image to be used as an input is using the processes outlined above, the data was pre-processed and enhanced.

1) *Loading Trained Model from Disk:* After some training, a model extension file containing the trained model classifier will be generated. This training will aid in the detection of masks from faces that have been detected.
2) *Face Recognition in Streaming Content:* Whenever a person walks in front of a regular camera, a frame is collected and analysed, and thus the processing results in face recognition and extraction.
3) *Retrieval of Characteristics out of each Face:* All characteristics are extracted from a clipped photograph of a face. identified by the camera in this step. These qualities aid in increasing the mask detection accuracy rate.
4) *Outcome (Masked/Unmasked):* Last step is to compile every one of the data, including face extraction and detection, regardless of whether he or she is wearing a mask.

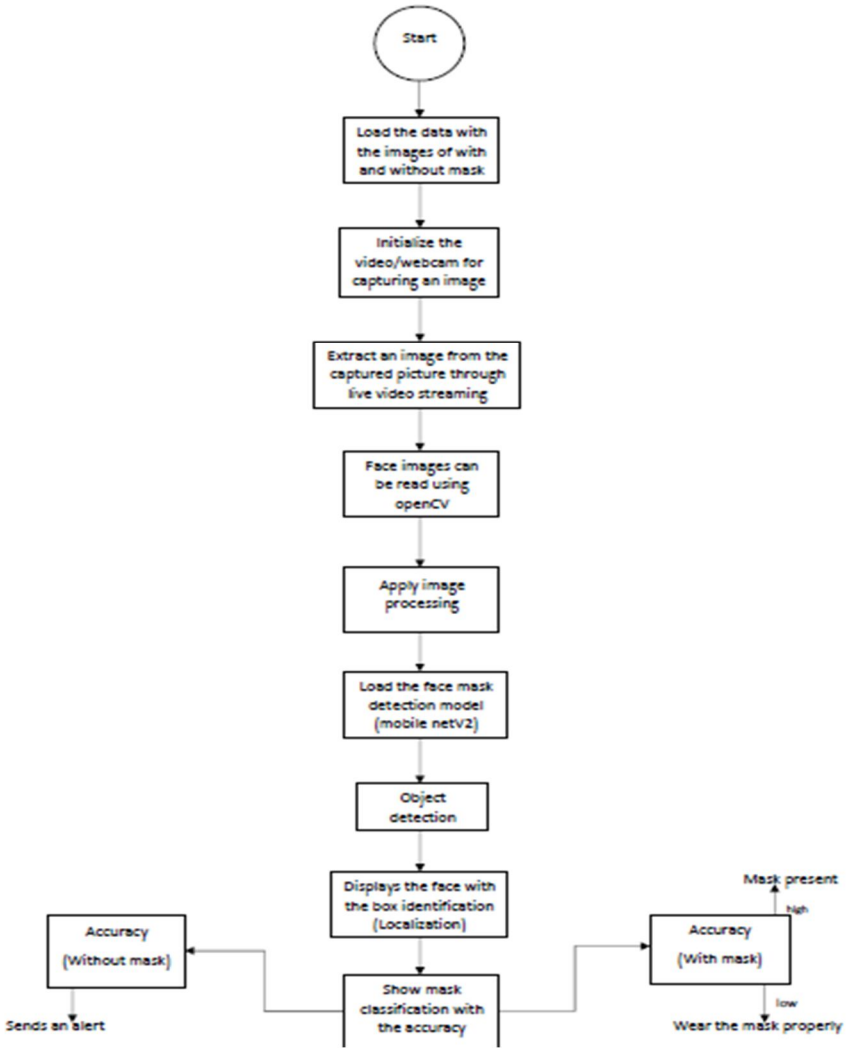


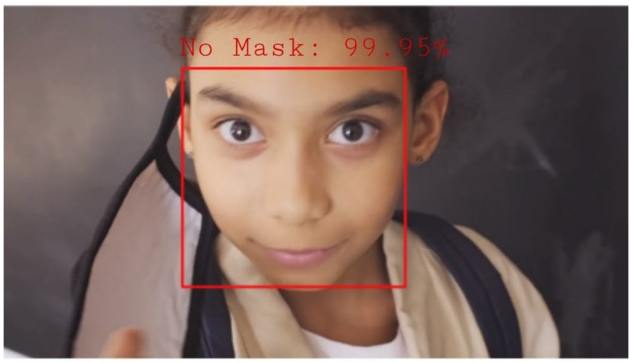
Figure5. Flow of Face Mask Detection Model

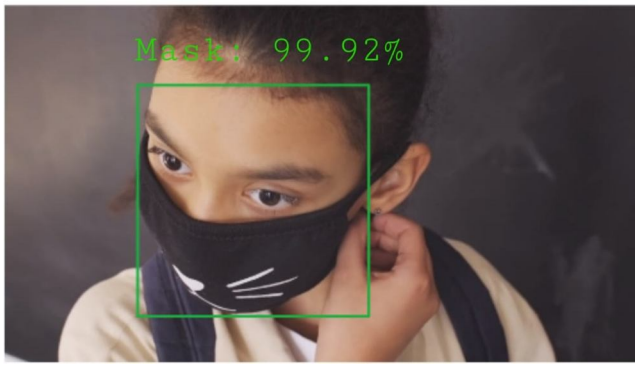
5) *Deployment:* Finally, The Convolutional Neural Network is embedded in a hosted web app so that it can be readily shared with other users, who may post a webcast or a picture to modify the structure in order for it to recognize face mask and subsequently get the expected outcome. The open source python package Streamlit was used to develop and build a simple online application that allows visitors to enter an image and receive the results.

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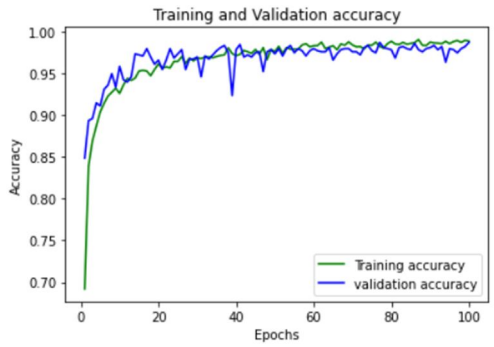
IV. ANALYSIS AND RESULTS

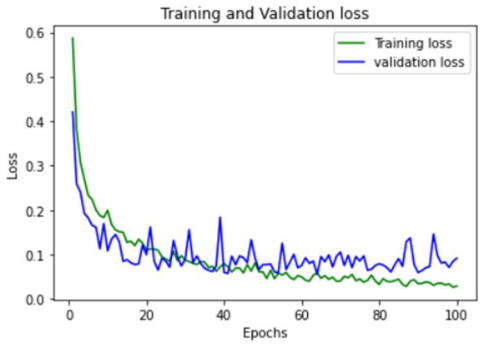
Multiple experiments were conducted utilize different hyper-parameter variables including learning rate, epoch size, and batch size to arrive at the final findings.





We got the following accuracy/loss training curve plots





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V. CONCLUSIONS

This study proposes a face mask identification system for static images and actual footage which instantly recognises if a men/women is wearing a mask, which might be a useful tool in preventing the spread of the COVID-19 disease. The suggested system can identify whether or not a face mask is worn. using Keras, OpenCV, and CNN, and the model provides exact and speedy results. The trained model achieves a 98 percent accuracy rate. Trials were carried out to compare it to other prominent models. This approach is a top choice for an actual surveillance system because of its accuracy and computational efficiency.

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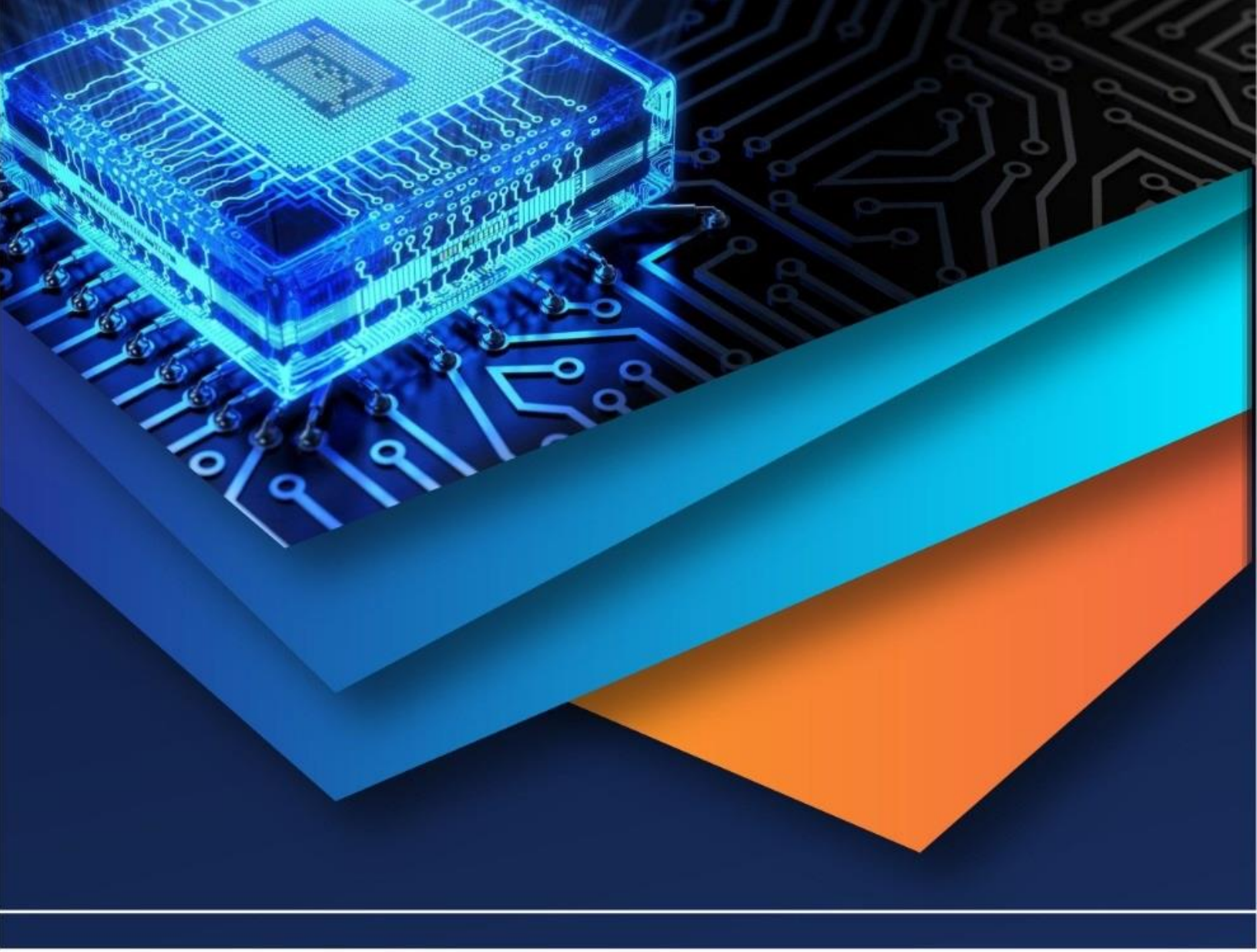
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