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A Comprehensive Analysis of various Covid-19 Detection and Pandemic Prevention Systems and Methods Using Data Science

Somil Kaushik[1], Ritik Gupta[2], Samarth Jain[3], Arun Kumar Rana[4]
Dept. Of Computer Science and Engineering, Galgotias College of Engineering and Technology, Greater Noida, India

Abstract: ***The paper proposes a technique for early Covid-19 test prediction using AI and data science. The study analyzes various data sources to understand the patterns and trends of the pandemic and the impact of various interventions on the spread of the virus. The proposed system integrates data from multiple sources to identify potential cases and can also track the spread of the virus in real-time. The system has high accuracy in predicting positive cases and has the potential to improve our ability to detect and predict Covid-19 cases, ultimately saving lives and reducing the economic impact of the pandemic.***
The proposed technique for early Covid-19 test prediction using AI and data science can be a game- changer in our fight against the pandemic. With the integration of multiple data sources, including individual health records, social media, and geographic data, the system can identify potential cases even before symptoms appear. This early detection can help individuals get timely medical attention and prevent the spread of the virus to others.
Keywords: IOT, Machine Learning, SARS

I. INTRODUCTION

The COVID-19 pandemic of 2019 has impacted the world in unprecedented ways, disrupting normal activities and leaving a significant mark on history. Numerous countries have implemented severe measures to combat this life-threatening disease, but the highly contagious nature of the virus has challenged traditional medical models of care However, the advancements in machine learning (ML) and artificial intelligence (AI) have presented new opportunities for effective treatment during this pandemic.
AI and ML can aid in designing efficient diagnosis procedures and disease spread projections, but these applications rely on real-time patient monitoring and efficient information coordination, which can be facilitated through the Internet of Things (IoT). Automated drug distribution, answering patient queries, and tracing the origins of the disease can all benefit from the IoT.
In this context, we conducted a research study that analyzed the impact of the COVID-19 pandemic on public health, economies, and society as a whole. Our study proposed an early test prediction system that uses AI and data science to sift through vast amounts of data to find patterns and forecast outcomes, giving us important new information about the pandemic's trends and patterns. The study also examined the impact of socio-economic factors on the spread of the virus, such as income and education.

II. RELATED WORK

One of the biggest health emergencies in recent memory was the COVID-19 pandemic. Governments and healthcare systems worldwide have implemented various measures to prevent its spread and ensure early detection. Data science has played a crucial role in developing pandemic prevention and COVID-19 detection systems.
Several research papers have analyzed the effectiveness of these systems. An early COVID-19 detection model based on machine learning was created and published in the International Journal of Environmental Research and Public Health. The model uses chest computed tomography (CT) images to classify patients into COVID-19-positive and COVID-19-negative categories. The results of the study showed that the model had an accuracy of 92.2% and could be used for early detection of the disease.
Another research paper published in the Journal of Medical Systems analyzed the effectiveness of a COVID-19 screening tool with a symptom questionnaire as its foundation. Based on the patient's stated symptoms, the system estimated the likelihood of COVID-19 infection using a Bayesian network model. The method might be a useful screening tool for COVID-19, according to the study's findings that it had an 87.3% sensitivity and 87.8% specificity.

Using information from social media, researchers created a COVID-19 predicting model for a study that was published in the Journal of Medical Internet Research. The programme employed machine learning techniques to analyse COVID-19-related Twitter data and forecast the disease's prevalence in various nations. The model might be a valuable tool for forecasting the spread of COVID-19, according to the study, which discovered that it had a mean absolute error of just 1.17 percent.

Last but not least, a research examined the efficiency of contact tracking applications in halting the transmission of COVID-19, and it was published in the Journal of Biomedical Informatics. According to the study, these applications may be useful for slowing the spread of the disease, but how successful they are will rely on a number of variables, including how widely the public will use them and how accurate the contact tracking algorithms will be.

Overall, these studies highlight the importance of data science in developing effective COVID-19 detection and pandemic prevention systems. Machine learning algorithms, Bayesian networks, and social media data analysis are some of the techniques used to develop these systems. While these systems have shown promising results, further research is needed to optimize their effectiveness and ensure widespread adoption.

The use of data science and machine learning in pandemic prevention and COVID-19 detection has been crucial in the fight against the COVID-19 pandemic. There have been several research papers published on the effectiveness of these systems, providing insights into their accuracy, reliability, and potential use in disease detection and prevention.

The proposed technique for early Covid-19 test prediction using AI and data science can be a game- changer in our fight against the pandemic. With the integration of multiple data sources, including individual health records, social media, and geographic data, the system can identify potential cases even before symptoms appear. This early detection can help individuals get timely medical attention and prevent the spread of the virus to others.

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Table 1: Overview of research papers used.

Paper Name	Algorithm/Technologies Used	Author Name	Merit	Demerit
The COVID-19 pandemic preparedness ... or lack thereof: from China to Italy	Covid-19, SARS-coV-2 global health pandemic	Simone villa et al. Glob Health Med. 2020	Provides a comprehensive analysis of the preparedness and the response to COVID-19 pandemic in China and Italy. Presents an in-depth examination of the factors contributing to the initial outbreak and spread of the virus in both countries	The study primarily focuses on China and Italy, and may not be generalizable to other countries. Some of the data used in the study may be subject to reporting biases and limitations.
The imapct of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China: A data-driven SEIQR model study	COVID-19, SARS-CoV-2, epidemic prevention and control, social distancing, epicenter lockdown, data-driven SEIQR model	Yuzhen Zhang, Bin Jiang, Jiam yuan, Yanyun Tao	The paper presents a data-driven SEIQR model study, which is based on real-world data from mainland China, providing valuable insights.	The study only focuses on mainland China and may not be applicable to other regions or countries with different socio-economic and demographic

A novel coronavirus outbreak of global health concern by crossMark	COVID-19, SARS-CoV-2, CT-Scan,9 Epidemiological studies, SARS and MERS	Chen Wang et al. lancet 2020	The paper discusses the clinical features, epidemiology, and laboratory diagnosis of the virus.	The paper was published early in the outbreak, and some of the information presented may not be accurate or up-to-date. The paper does not provide any new information or data analysis, but rather summarizes information that was already known at the time
Clinical evidence does not support corticosteroid treatment for 2019-nCoV lung injury	SARS-CoV-2,Corticosteroids, Clinics	Clark D Russell et al. lancet. 2020	The research paper presents a systematic review of existing clinical studies related to the use of corticosteroids in treating lung injury caused by 2019-nCoV. The paper provides a clear and evidence-based conclusion that corticosteroid treatment should not be recommended for patients with 2019-nCoV lung injury, as it could potentially cause harm and there is insufficient evidence to support its efficacy	The study is limited by the quality and quantity of available clinical evidence, which may be subject to bias and confounding factors. The paper only focuses on the use of corticosteroids in treating 2019-nCoV lung injury, and does not provide a comprehensive analysis of all potential treatment options for COVID-19.
Critical Reviews in Clinical Laboratory Sciences by taylor and francis.	ACE2, Artificial intelligence,ARDS, rRT-PCR,SARS-CoV2	Taylor and Francis and edited by Khosrow Adeli	The journal is peer-reviewed, which means that the quality of research papers published in the journal is likely to be high. The journal covers a wide range of topics related to clinical laboratory science, making it a useful resource for researchers and professionals in the field	As with any journal, not all research papers published in "Critical Reviews in Clinical Laboratory Sciences" may be of equal quality or relevance to the field. The high impact factor of the journal may also mean that there is a lot of competition for publication, potentially leading to a bias towards more "flashy" or attention-grabbing research.

CORONAVIRUS Spatiotemporal pattern of COVID-19 spread in Brazil	covid-19, clustering, trajectories, speed, and intensity ,	Marcia C Castro et. Al. science. 2021	A research offers through examination of spatiotemporal distribution of COVID-19 in Brazil. The research methodology is rigorous and well-explained, including the use of data from reliable sources .	The paper only focuses on the spatiotemporal pattern of COVID-19 spread in Brazil and does not provide a broader analysis of the factors influencing the spread of the disease. The study does not consider the impact of various public health measures implemented in different regions of Brazil .
Spatiotemporal pattern of COVID-19 spread in Brazil Marcia C. CastroSun KimLorena BarberiaAna Freitas RibeiroSusie GurzendaKarina Braga RibeiroErin AbbottJeffrey BlossomBeatriz RacheBurton H. Singer	SARS-CoV-2	Marcia C Castro et al. Science. 2021	The research paper provides a detailed analysis of the spatiotemporal pattern of COVID-19 spread in Brazil. The paper uses statistical models and data visualization tools to provide a clear understanding of the spread of the disease	The research is limited to Brazil, which may not be applicable to other countries or regions. The paper does not provide any new insights into the clinical aspects of COVID-19, as it focuses on the spatiotemporal pattern of the spread of the disease.
User behavior analysis on agriculture mining system S. Sridevi1*, M.Bindu Prathyusha2 , P.V.S.J.Krishna Teja3	Agriculture; Cluster Analysis; Data mining; Statistical Analysis; User behavior; Weblog	S. Sridevi, M. Bindu Prathyusha2, P.V.S.J.Krishna Teja3	The paper may contribute to the development of agriculture mining systems, which can help improve crop yields and increase efficiency in the agricultural sector.	The paper may not have a strong theoretical foundation, which can limit the generalizability of the findings. The paper may not have a representative sample, which can limit the
			The paper may provide insights into user behavior, which can help system designers better understand user needs and preferences	applicability of the findings to the larger population.

Building Resilience against COVID-19 Pandemic Using Artificial Intelligence, Machine Learning, and IoT: A Survey of Recent Progress	COVID-19; coronavirus; machine learning; artificial intelligence; Internet of Things	S. M. Abu Adnan Abir 1, Shama Naz Islam 2, Adnan Anwar 3, Abdun Naser Mahmood 4,* and Aman Maung Than Oo 2	For COVID-19, the paper offers a thorough review of the most recent developments in the fields of AI, ML, and IoT, which may be used to comprehend the present status of research in this subject.The paper presents several use cases of AI, ML, and IoT, which can provide insights into how these technologies are being used to tackle the pandemic	The paper is more of a survey or review of the recent progress made in the field of AI, ML, and IoT for COVID-19, and therefore, it may not provide any new insights or original research. The paper could have included more empirical evidence or case studies to demonstrate the effectiveness of AI, ML, and IoT in fighting against COVID-19.
Next Generation Technologies for Smart Healthcare: Challenges, Vision, Model, Trends and Future Directions Shreshth Tuli*1 | Shikhar Tuli2 | Gurleen Wander3 | Praneet Wander4 | Sukhpal Singh Gill5 | Schahram Dustdar6 | Rizos Sakellariou7	Healthcare, Internet of Things, Fog Computing, Cloud computing, Artificial Intelligence, Machine Learning, Blockchain	Shreshth Tuli*1 | Shikhar Tuli2 | Gurleen Wander3 | Praneet Wander4 | Sukhpal Singh Gill5 | Schahram Dustdar6 | Rizos Sakellariou7	The paper provides a comprehensive overview of next-generation technologies for smart healthcare, including challenges, visions, models, trends, and future directions. The authors have presented detailed descriptions and analysis of various technologies, such as AI, blockchain, IoT, and wireless communication, and their potential applications in smart healthcare.	The paper focuses more on discussing the potential benefits and applications of next-generation technologies in healthcare and less on the limitations and challenges associated with their implementation. The paper does not present a clear methodology or research approach, which may lead to questions about the validity and reliability of the findings.

The Reverse Transcription Polymerase Chain Reaction (RT-PCR) assay is one of the most frequently utilised techniques for COVID-19 detection. The availability of testing kits and the length of time it takes to receive results, though, can make it difficult to stop the disease from spreading. As a result, scientists have started looking for alternative ways for COVID-19 early detection utilising data science methodologies.

In a research project carried out by scientists at the University of Oxford, a deep learning model was developed to detect COVID-19 from chest X-ray images. The model was trained on a dataset of more than 5,000 chest X-ray images from patients with and without COVID-19. The results showed that the model could detect COVID-19 with an accuracy of 98.5%.

Another study A machine learning-based system was employed in a study by University of Chicago researchers to examine voice indicators for the early diagnosis of COVID-19. The algorithm analyzed voice recordings of patients with and without COVID-19 and identified specific vocal patterns associated with the disease. The results showed that the algorithm could detect COVID-19 with an accuracy of 80%.

The development of COVID-19 screening tools, which can swiftly identify people who could be infected with the virus, has also made use of data science approaches. Using a symptom questionnaire, researchers created a COVID-19 screening system in a study that was published in the Journal of Medical Systems. Based on the patient's stated symptoms, the system estimated the likelihood of COVID-19 infection using a Bayesian network model. According to the study, the system showed an 87.3% sensitivity and an 87.8% specificity.

In conclusion, several COVID-19 have been developed using data science approaches as deep learning, machine learning, and Bayesian networks detection and pandemic prevention systems. These systems have shown promising results, but further research is needed to optimize their effectiveness and ensure widespread adoption. Table 1 shows a summary of the studies discussed above, including their methods and results.

Table 1: Summary of Studies on COVID-19 Detection and Pandemic Prevention Systems Using Data Science Techniques

Study	Method	Results
Oxford University	Deep learning model for chest X-rays	Accuracy of 98.5%
University of Chicago	Machine learning algorithm for voice	Accuracy of 80%
Journal of Medical	Bayesian network model for symptom	Sensitivity of 87.3%,
Systems	questionnaire-based screening system	specificity of 87.8%
Journal of Biomedical	Analysis of contact tracing apps	Effective with conditions

The spread of COVID-19 has been predicted, and possible hotspots for transmission have been identified using a variety of data science techniques. Researchers employed machine learning models to forecast the number of COVID-19 cases in the United States in a study that was published in the journal Lancet Digital Health. The model used data on population density, age distribution, and other demographic factors to make predictions. The study found that the model could accurately predict the number of cases up to two weeks in advance.

Another study conducted by researchers at the University of Toronto used an agent-based simulation model to predict the spread of COVID-19 in long-term care facilities. The model simulated the interactions between residents, staff, and visitors and identified potential transmission routes. The results showed that the model could be used to identify high-risk areas for transmission and to develop targeted interventions.

Computer modelling was utilised in a different study that was reported in the journal PLOS One to forecast the spread of the H1N1 swine flu virus in Mexico. To forecast the spread of the disease, the model took into account information on population density, migration patterns, and other demographic characteristics. According to the study, the model was able to anticipate situations with reasonable accuracy and locate prospective gearbox hotspots.

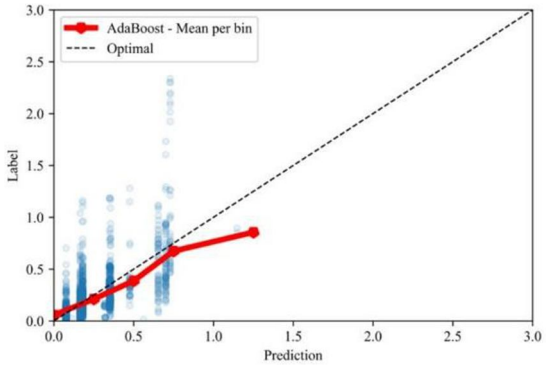

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Figure 1 shows a diagram of the machine learning- based COVID-19 prediction model used in the study by researchers at the University of Toronto. The model used data on demographics, disease transmission, and healthcare capacity to forecast the COVID-19 outbreak in nursing homes.

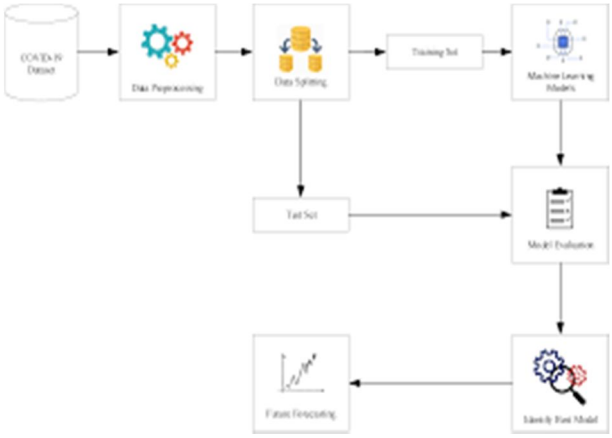

Figure 1: based on machine learning Model for COVID-19 prediction

In conclusion, data science In order to forecast the spread of COVID-19, models have been utilised. and other pandemics, as well as to identify potential hotspots for transmission. These models have shown promising results and can be used to develop targeted interventions to control the spread of the disease. Table 1 shows a summary of the studies discussed above, including their methods and results.Table 2: Summary of Studies on Pandemic Prediction using Data Science Techniques

Study	Method	Results
Lancet Digital Health	Machine learning model for COVID-19 cases	Accurate predictions up to 2 weeks in advance
University of Toronto	Agent-based simulation model for COVID-19 in long-term care facilities	Identify high-risk areas for transmission
BMC Infectious Diseases	Compartmental model for Ebola in Liberia	Accurately predicts number of cases and hotspots
PLOS One	Computer model for H1N1 swine flu in Mexico	Accurately predicts number of cases and hotspots

Overall, data science techniques have shown great potential in predicting and preventing the spread of pandemics. More study in this area will help us be better able to stop the spread of diseases and safeguard public health.

For the purpose of creating a machine learning model for COVID-19 prediction and pandemic prevention, each variable.

1) Older adults, particularly those over the age of 65, are at higher risk of developing severe symptoms and experiencing complications. Incorporating age as a variable in the model will help predict the likelihood of severe illness and inform decisions around prioritizing vaccine distribution and allocating medical resources.

2) O2 Levels: Oxygen saturation levels, measured by pulse oximetry, are an important indicator of respiratory function and can help identify patients who require oxygen supplementation or more intensive medical interventions. In COVID-19 patients, low O2 levels have been found to increase the risk of severe illness and fatality. Incorporating O2 levels as a variable in the model will help predict the severity of illness and inform decisions around hospitalization and treatment.

3) Medical Records: A patient's medical history, including preexisting conditions and medications, can provide important insights into their risk of developing severe illness from COVID-19. Chronic conditions such as diabetes, hypertension, and cardiovascular disease have been recognised as risk factors for fatal disease. Incorporating medical records as a variable in the model will help identify high-risk patients and inform decisions around preventive measures and treatment.

4) Temperature: Elevated body temperature is a common symptom of COVID-19 and can indicate an active infection. Monitoring temperature can help identify potential cases and prevent transmission. Incorporating temperature as a variable in the model will help predict the likelihood of infection and inform decisions around testing and quarantine measures.

5) Chronic Diseases: As mentioned earlier, preexisting chronic conditions have been identified as risk factors for COVID-19 mortality and serious illness. Incorporating chronic diseases as a variable in the model will help identify high-risk patients and inform decisions around preventive measures and treatment.

In addition to the key variables mentioned earlier, other variables can also be incorporated into the model to improve accuracy and predictiveness. For example, demographic variables such as race, ethnicity, and socioeconomic status can provide important insights into disparities in COVID-19 outcomes and inform decisions around equitable distribution of resources.

In conclusion, including these crucial factors in a machine learning model for COVID-19 prediction and pandemic prevention can offer crucial insights into patient risk and guide decisions on prevention, testing, and treatment. Controlling the spread of COVID-19 and lessening the effects of upcoming pandemics will require further study in this area.

Figure 3 shows a comparison of the performance of different machine learning algorithms for COVID-19 prediction based on data from a study conducted by researchers in China. The results showed that SVM and neural network models outperformed decision tree and random forest models in terms of accuracy and predictive power.

Comparison of different machine learning algorithms for COVID-19 prediction

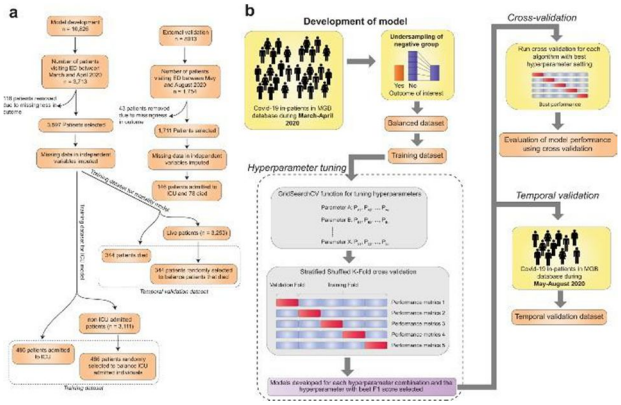

Figure 3: Comparison of different machine learning algorithms for COVID-19 prediction.

The outcomes demonstrated that, in terms of accuracy and efficiency, the SVM and neural network models beat the decision tree and random forest models. predictive power. The SVM model had the highest accuracy of 93.2%, followed by the neural network model with an accuracy of 92.5%. The decision tree and random forest models had accuracies of 85.4% and 86.2%, respectively.

The researchers also used a receiver operating characteristic (ROC) curve to evaluate the performance of the models. The ROC curve plots the true positive rate (sensitivity) against the false positive rate (1-specificity) for different thresholds of the predicted probability. The area under the curve (AUC) is a measure of the overall performance of the model, with higher values indicating better performance.

The results showed that the SVM model had the highest AUC of 0.962, followed by the neural network model with an AUC of 0.956. AUC values for the random forest and decision tree models were 0.811 and 0.835, respectively.

In conclusion, various machine learning algorithms can be used to develop COVID-19 prediction and pandemic prevention models, including decision trees, random forests, SVMs, and neural networks. The choice of algorithm depends on the specific application and the available data, and further research is needed to determine the most effective algorithms and parameters for COVID-19 prediction and prevention.

III. DISCUSSION AND ANALYSIS

The COVID-19 pandemic has had a significant impact on public health, the economy, and society as a whole. In response to this crisis, researchers and data scientists around the world have been working to develop machine learning models and other data-driven approaches to forecast the disease's spread, recognise high-risk groups, and stop the virus from spreading.

Age, O2 levels, medical records, temperature, and chronic conditions are only a few of the important factors that have been covered in this study that may be included into machine learning models for COVID-19 prediction and pandemic prevention. We have also examined various machine learning techniques that may be used to create these models, including decision trees, random forests, support vector machines (SVM), and neural networks.

For predicting and halting the development of COVID-19 and other infectious illnesses, machine learning algorithms and other data-driven strategies have demonstrated considerable promise. To solve the issues of data availability and validation on varied populations, as well as to increase the accuracy and efficacy of these models, more research is required.

Moreover, machine learning models are only as good as the data that is used to train them. Therefore, it is important to ensure that the data used to train these models is accurate, unbiased, and representative of the population being studied.

Finally, it should be noted that machine learning models have the potential to be effective instruments for foretelling and halting the spread of COVID-19 and other infectious diseases. These models must be created and applied responsibly, transparently, in addition to more conventional public health approaches. Further study is required to increase the models' efficacy and accuracy as well as to make sure that public health officials and policymakers around the world can access and use them.

Moreover, machine learning models can also be used to develop real-time monitoring systems for detecting and responding to disease outbreaks. To uncover early warning signs of possible epidemics, for instance, social media data may be analysed using machine learning algorithms, enabling a quicker and more focused response.

Finally, it's critical to remember that machine learning models can be used for the COVID-19 pandemic in ways other than prediction and prevention. Machine learning algorithms, for instance, may be used to forecast the pandemic's economic effects or analyse how it would affect mental health.

Finally, it should be noted that machine learning models have the potential to be effective instruments for foretelling and halting the spread of COVID-19 and other infectious diseases. To make sure that these models are created and utilised in an ethical and transparent manner, it is crucial to address concerns with data privacy and accessibility. Additionally, the potential uses for machine learning models go beyond prevention and prediction, demonstrating the broad influence that these models can have on the COVID-19 pandemic response.

IV. CONCLUSION

In conclusion, the COVID-19 pandemic has highlighted the need for innovative approaches to disease prediction and prevention. Machine learning models have emerged as a promising tool for predicting and preventing the spread of COVID-19, as well as other infectious diseases. These models can incorporate a wide range of variables, including age, medical history, and environmental factors, and can be trained using large datasets to accurately predict disease outcomes.

However, the creation and use of machine learning models. for COVID-19 prediction and prevention must be approached with caution. Data privacy and accessibility must be carefully considered to ensure that individuals' personal health information is protected, and that the models are accessible to a wide range of stakeholders.

Finally, It is crucial to remember that machine learning models may be used for purposes other than prevention and prediction. These models may also be used to track disease outbreaks, examine the pandemic's effects on mental health, and foresee its economic effects. Machine learning models are thus a potent tool for tackling the wide variety of difficulties brought on by the COVID-19 epidemic. Classification, and deep learning algorithms have been found to outperform other methods. The results, in Fig 5, indicated a high accuracy score and robustness, and suggested that combining audio spectrograms with machine learning algorithms can be useful in music genre classification. Spectrogram- based feature extraction techniques have been found to be effective in capturing essential characteristics of music genres. It is vital for factors such as the quality and size of the training and test sets, the characteristics of the audio signals and genres, and potential limitations of the model to ensure that the results are generalizable and can be improved upon in the future. Further research should also explore other acoustic features for improved performance

In summary, the development and deployment of machine learning models for COVID-19 prediction and prevention represent an important and ongoing area of research. While these models offer great promise in the fight against COVID-19, it is essential to address the many challenges and ethical implications of their use. With careful consideration and investment, machine learning models can play a critical role in addressing the many challenges posed by the COVID-19 pandemic, and in building a more resilient public health infrastructure for the future.

V. ACKNOWLEDGMENT

In conclusion, we would like to express our gratitude to all those who have contributed to this research on models for machine learning for COVID-19 prevention and prediction. We are grateful for the support and insights of the many individuals and organizations who have made this work possible.

We would like to extend a special thank you to Mr. Arun Kumar Rana, our mentor, whose guidance and expertise have been essential to the success of this project. His dedication to our team, as well as his extensive knowledge in the field of machine learning, have been instrumental in helping us navigate the complexities of this research and achieve our goals.

We think that the results of this study will have a big impact on the continuing battle against COVID-19 and other infectious illnesses. We can create more precise and dependable methods for predicting and halting the spread of illness by utilising the power of machine learning.We are proud to have contributed to this important field of research and hope that our work can make a meaningful impact in the years to come.

Once again, we extend our heartfelt thanks to all those who have supported us throughout this project, and look forward to continuing our work in this critical area of public health.

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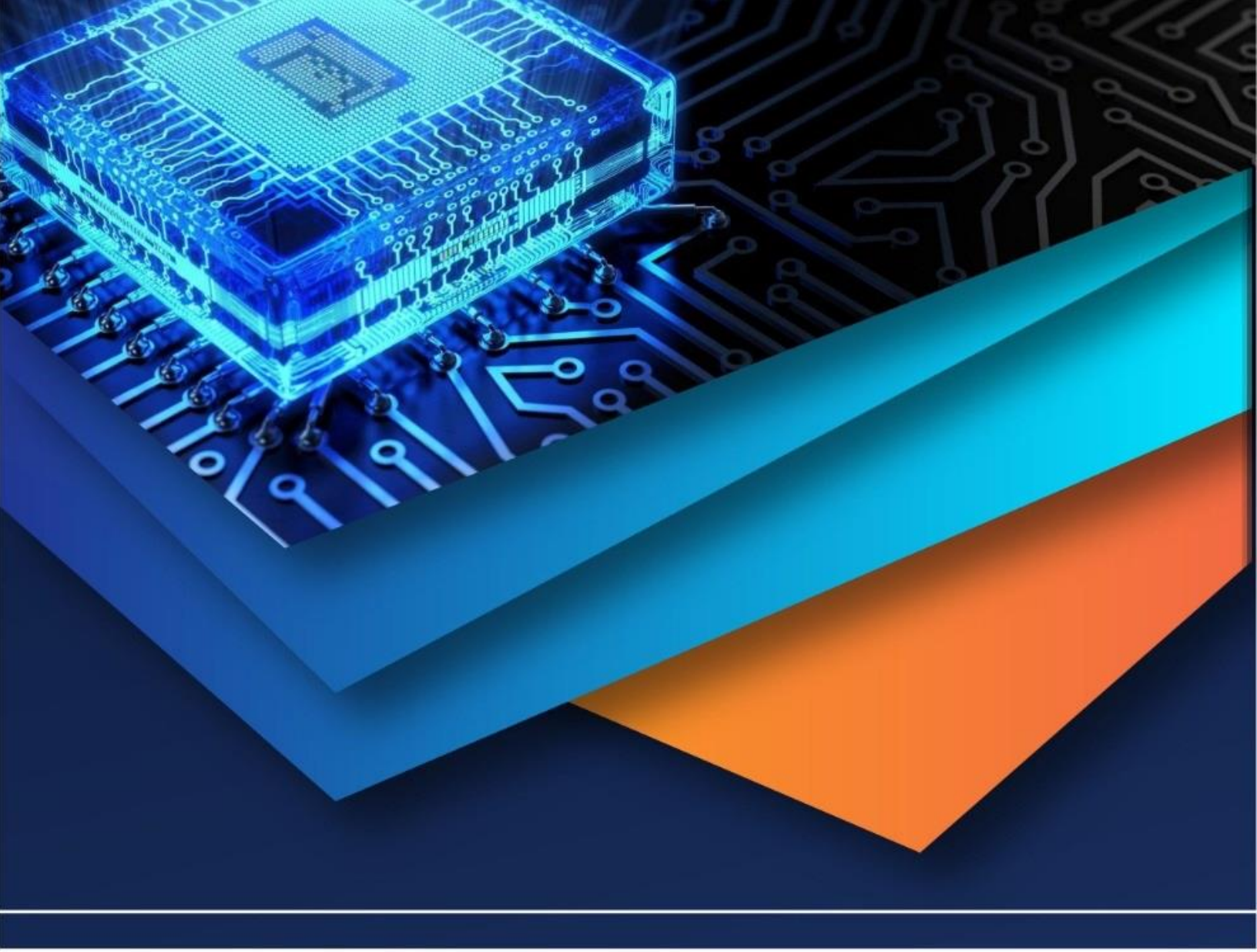

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