IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⪤ Peer-reviewed & Refereed journal ⪤ Vol. 11, Issue 3, March 2024

DOI: 10.17148/IARJSET.2024.11320

Face Mask Identification With Automated Door Entry Control Using Deep Learning

G.Venkateswari[1], B.Venkata Lakshmi[2], A.padma[3], K.Sandhya Rani[4]

M.Tech,(ph.d),Asst.professor,Computer Science & Engineering, Bapatla women's Engineering College, Bapatla, India[1]

B.Tech, Computer Science & Engineering, Bapatla women's Engineering College, Bapatla, India[2-4]

Abstract: The Face Mask Identification With Automated Door Entry Control using Deep Learning addresses the critical need for public health safety during the COVID-19 pandemic by automating the process of identifying individuals wearing face masks in public spaces. This system utilizes deep learning techniques to detect faces and classify whether the individuals are wearing masks or not, thereby allowing automated door entry based on compliance with face mask regulations. The system has undergone extensive testing and validation, proving its efficacy in correctly recognizing people who are wearing face masks and giving access in accordance with that identification. Results indicate high accuracy, speed, and reliability, with potential implications for improving public health and safety measures in various settings. Moreover, when the system detects an individual not wearing a mask, it provides a warning message through voice output, urging them to wear their mask. Conversely, when the system identifies a person wearing a mask, it delivers a message of acknowledgment, thanking them for their compliance. overall our project offering insights into its development, implementation, and potential impact on public health and safety.

Keywords: covid-19,deep learning, Mask Identification ,voice, door entry

I. INTRODUCTION

The global outbreak of the COVID-19 pandemic has necessitated the implementation of stringent measures to mitigate the spread of the virus. Among these measures, wearing face masks in public places has been widely recognized as an effective means of preventing transmission. As a result, many public institutions, businesses, and organizations have mandated the use of face masks as a prerequisite for entry into their premises. However, enforcing face mask regulations manually can be challenging and resource-intensive, particularly in high-traffic areas. Human oversight may lead to inconsistencies in enforcement and potential lapses in compliance monitoring. To address these challenges and enhance public health safety, there is a growing need for automated systems capable of identifying individuals wearing face masks and facilitating access to public spaces accordingly. The Face Mask Identification with Automated Door Entry Control using Deep Learning is designed to meet this need by leveraging advanced technology to automate the process of mask detection and access control. By integrating deep learning techniques with hardware components such as cameras, microcontrollers, and actuators, the system can accurately identify individuals wearing face masks and grant them entry into designated areas. This document presents a comprehensive overview of the Face Mask Identification System, detailing its architecture, implementation, and testing. It outlines the rationale behind the system, discusses the technical considerations involved in its development, and highlights its potential impact on public health and safety. Additionally, the document explores the integration of voice input for user interaction, enhancing the system's accessibility and usability. Overall, the Face Mask Identification System represents a significant advancement in the realm of automated access control, offering a scalable and efficient solution for enforcing face mask regulations in public spaces. As the world continues to navigate the challenges posed by the COVID-19 pandemic, innovative technologies such as this play a crucial role in safeguarding public health and mitigating the spread of infectious diseases.

II. BACKGROUND AND RELATED WORK

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, has presented unprecedented challenges to global public health and safety. Since its emergence in late 2019, the virus has rapidly spread across continents, leading to widespread illness, hospitalizations, and fatalities. In response to the pandemic, governments and health organizations worldwide have implemented various measures to mitigate transmission and reduce the burden on Healthcare systems. One of the key strategies for preventing the spread of COVID-19 is the widespread adoption of face masks in public settings. Face masks act as a physical barrier, reducing the risk of respiratory droplets containing the virus from being transmitted between individuals. Studies have shown that wearing masks can significantly reduce the transmission of respiratory viruses, including SARS-CoV-2, particularly in crowded or enclosed spaces where social distancing may be

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 3, March 2024

DOI: 10.17148/IARJSET.2024.11320

challenging. As a result, many countries and regions have implemented face mask mandates, requiring individuals to wear masks in public spaces such as stores, restaurants, public transportation, and healthcare facilities. These mandates aim to protect both individuals and the community at large by reducing the likelihood of virus transmission and preventing outbreaks. Enforcing face mask regulations in public spaces presents unique challenges, particularly in high-traffic areas where manual oversight may be impractical or insufficient. Human operators tasked with monitoring compliance may face difficulties in consistently identifying individuals who are not wearing masks, leading to potential lapses in enforcement and increased risk of virus transmission. To address these challenges, there is a growing need for automated systems capable of identifying individuals wearing face masks and facilitating access to public spaces accordingly. By leveraging advanced technologies such as computer vision and deep learning, these systems can automate the process of mask detection and access control, thereby enhancing public health safety and reducing the burden on human operators.
The Face Mask Identification with Automated Door Entry control using Deep Learning represents a significant advancement in this field, offering a scalable and efficient solution for enforcing face mask regulations in public spaces. By integrating deep learning algorithms with hardware components such as cameras, microcontrollers, and actuators, the system can accurately identify individuals wearing face masks and grant them entry into designated areas.

III. IMPLEMENTATION

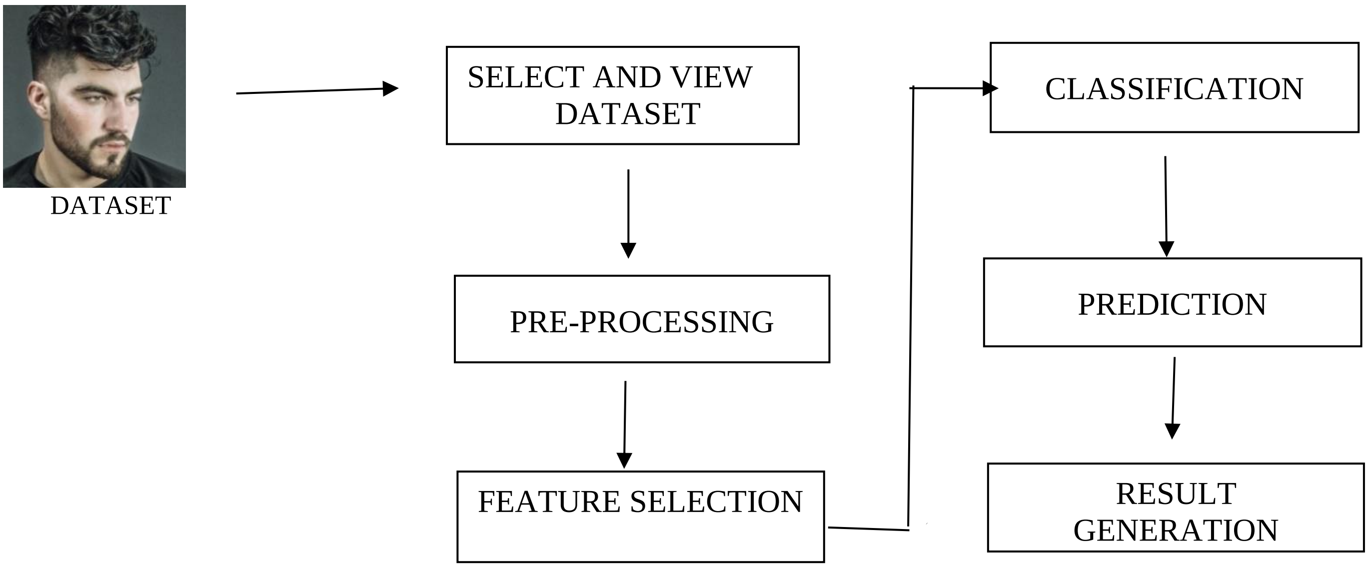

Fig. 1 System Architecture

A. **Modules Description:**

1. *data selection and loading:* The data selection is the process of selecting the data for mask and without mask face image dataset. The dataset which contains the information about the mask and without mask digital images.

2. *Data pre-processing:* Image Data pre-processing is the process of getting rescale data from the dataset.
Resize image dataset: Rescale the face image dataset
Getting data: Getting data: That categorical data is defined as variables with a finite set of rescaled values. The array input and output variables are required for the more advanced deep learning algorithms.

3. *Feature selection:* Splitting Dataset into train and test data ,Data splitting is the act of partitioning available data into two portions, usually for cross-validate purposes. For the development of the predictive model and for the evaluation of its performance, one part of the data is used. Separating image data into training and testing sets is an important part of evaluating image processing models.

4. *Classification:* CNNs are regularized versions of multilayer perceptron. Multilayer perceptron refers to networks that are fully interconnected, meaning that every neuron in one layer is connected to every neuron in the next layer.

DOI: 10.17148/IARJSET.2024.11320

These networks are highly interconnected, thus making them prone to overstuffing data. A common way of regularizing is to add some form of magnitude measurement for weights into the loss function. CNNs are taking a different approach to regularisation. they make use of the hierarchical structure of data, and develop more complex patterns using less complicated methods. Only in a restricted area of the visual field known as the receptive field does individual cortical neurons respond to stimuli. The receptive fields of individual neurons overlap in some way, so that they are all covered by the whole field of vision.

5. *Prediction:* It's a process of predicting the face mask image from the dataset. By improving the performance of overall prediction results, this project will be able to predict data from a dataset effectively.

B. **Deep Learning Model:**

The development of an accurate and robust deep learning model is at the core of the Face Mask Identification with Automated Door Entry. This section outlines the methodology and architecture of the deep learning model used for face detection and mask identification.

1. Dataset Preparation: The success of the deep learning model hinges on the quality and diversity of the training dataset. A dataset containing images of individuals both wearing and not wearing masks is collected and annotated. The dataset is balanced to ensure an equal representation of both classes, with variations in lighting conditions, facial expressions, and poses.

2. Model Architecture: The deep learning model employs a Convolutional Neural Network (CNN) architecture, which is well-suited for image classification tasks.The model consists of multiple convolutional layers followed by pooling layers for feature extraction. This is followed by one or more fully connected layers for classification. Transfer learning techniques may be employed to leverage pre-trained CNN models such as VGG, ResNet, or MobileNet, which have been trained on large-scale image datasets like ImageNet. Fine-tuning is performed to adapt the model to the specific task of face mask identification.

3. Training Procedure: The dataset is split into training, validation, and test sets. The training set is used to optimize the model parameters, while the validation set is used to tune hyperparameters and prevent overfitting.The model is trained using a suitable optimization algorithm such as Stochastic Gradient Descent (SGD) or Adam, with a predefined loss function such as categorical cross-entropy.Data augmentation techniques such as rotation, translation, scaling, and horizontal flipping are applied to increase the training data base and improve the model's generalization capabilities.

4. Evaluation Metrics: The performance of the deep learning model is evaluated using various metrics such as accuracy, precision, recall, and F1-score. The accuracy of the model's forecast is measured in terms of completeness, while precision and recall provide an indication of a model's ability to detect good and bad cases. The F1-score, which is the harmonic mean of precision and recall, offers a balanced measure of the model's performance across both classes.

5. Optimization and Fine-Tuning: Hyperparameter tuning techniques such as grid search or random search may be employed to optimize the model's performance. Fine -tuning is performed by unfreezing and retraining the last few layers of the pre-trained CNN model on the task-specific dataset. This enables the model to comprehend task specific features while taking advantage of its underlying knowledge with respect to common features acquired from a prior trained model.

6. Model Deployment: Once trained and evaluated, the deep learning model is deployed to the target hardware platform, which may include microcontrollers, embedded systems, or cloud-based servers.The model is integrated with the hardware components of the Face Mask Identification System, allowing real-time inference and decision-making based on input images captured by the system's cameras. By following this methodology, the deep learning model employed in the Face Mask Identification System can achieve high accuracy and reliability in detecting individuals wearing face masks, thereby facilitating automated access control and enhancing public health safety.

C. **Voice Input Analysis:**

Voice input analysis plays a crucial role in the interaction and functionality of the Face Mask Identification With Automated Door Entry control. This section outlines the methodology and components involved in processing voice input within the system.

1. *Voice Input Integration:* The system integrates voice input capabilities to enable user interaction and feedback .Voice input can be captured through microphones or other audio input devices connected to the system.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁙ Peer-reviewed & Refereed journal ⁙ Vol. 11, Issue 3, March 2024

DOI: 10.17148/IARJSET.2024.11320

2. *Speech recognition:* Speech recognition algorithms are employed to convert voice input into text data that can be processed by the system. Deep learning-based approaches, such as recurrent neural networks (RNNs) or convolutional neural networks (CNNs), may be utilized for accurate and robust speech recognition. Pre-trained models or custom-trained models may be employed, depending on the specific requirements and constraints of the system.

3. Voice Command Parsing: The system parses the text data obtained from speech recognition to identify relevant commands or actions. A predefined set of voice commands or keywords is defined, and the system matches the user's input to these commands to determine the intended action. Command parsing algorithms may use pattern matching, regular expressions, or machine learning classifiers to interpret the user's voice commands accurately.

4. *User Feedback and Response*: voice input, the system provides appropriate feedback or responses to the user.Voice output capabilities, such as text-to-speech (TTS) synthesis, may be employed to generate spoken responses or instructions for the user.The system communicates with the user through voice prompts, messages, or alerts, informing them of the status of the face Based on the analysis of mask identification process and any actions required on their part.

IV. RESULTS AND ANALYSIS

Our suggested approach produces two different kinds of output: one with mask and one without. When a person wears a mask, our suggested system detects that they are wearing one, opens the door, and says, "Thank you." If not, the door closes and our suggested system plays an audio alert message to the person saying, "Please wear your mask."

a) b) c)

fig.2 person with mask

In the fig.2 the persons a,b,c wearing mask and our proposed system recognized as mask then door opened and also tells to persons Thank you through the audio.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 3, March 2024
DOI: 10.17148/IARJSET.2024.11320

a) b) c)

fig.3 persons without mask

In fig.3 In the fig.2 the persons a,b,c not wearing mask and our proposed system recognized as “No mask” then door opened and also tells to persons “Please wear your mask” through the audio.

V. CONCLUSION

In this project the deep learning classifier is analyse the face mask from images. The mask and without mask data is taken as input data and applied into pre-processing method. In pre-processing method the images are resized and converted into array. Then it processed into feature selection method, in this method the dataset is split into training dataset and testing dataset. After that all the images are resized and convert into array. Finally the classification method is used to analysis and identify the face mask from images. If the person wearing mask then our proposed system is it recognized as with “mask” then door opened and also tells to the person “Thank you” otherwise If the person not wearing mask then our proposed system recognized as with “No mask” then door closed and also tells the audio alert message to the person “please wear your mask”.

VI. FUTURE WORK

The integration of face mask identification with automated door entry control using deep learning holds promise for various future applications, particularly in the context of public health, security, and convenience. Our proposed approach will be applied to the public spaces and transportation ,workplaces and educational institutions ,healthcare facilities ,retail stores and restaurants ,smart cites and high-security facilities.

REFERENCES

[1]. T. Greenhalgh, M. B. Schmid, T. Czypionka, D. Bassler, and L. Gruer, "Face masks for the public during the covid-19 crisis," BMJ, vol. 369, p. 1435, 2020. View at: Publisher Site | Google Scholar
[2]. S. Feng, C. Shen, N. Xia, W. Song, M. Fan, and B. J. Cowling, "Rational use of face masks in the COVID-19 pandemic," The Lancet Respiratory Medicine, vol. 8, no. 5, pp. 434- 436, 2020. View at: Publisher Site | Google Scholar
[3]. Z.-Q. Zhao, P. Zheng, S.-T. Xu, and X. Wu, "Object detection with deep learning: a review," IEEE Transactions on Neural Networks and Learning Systems, vol. 30, no. 11, pp. 3212-3232, 2019. View at: Publisher Site | Google Scholar
[4]. Y. Atoum, Y. Liu, A. Jourabloo, and X. Liu, “Face anti-spoofing using patch and depth-based cnns,” in IJCB, 2017, pp. 319–328.
[5]. I. Chingovska and A. R. Dos Anjos, “On the use of client identity information for face antispoofing,” TIFS, vol. 10, no. 4, pp. 787–796, 2015.
[6]. A. Sepas-Moghaddam, F. Pereira, and P. L. Correia, “Light field-based face presentation attack detection: reviewing, benchmarking and one step further,” TIFS, vol. 13, no. 7, pp. 1696–1709, 2018.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 3, March 2024

DOI: 10.17148/IARJSET.2024.11320

[7]. J. Yang, Z. Lei, D. Yi, and S. Z. Li, "Person-specific face antispoofing with subject domain adaptation," TIFS, vol. 10, no. 4, pp. 797–809, 2015.

[8]. A. Pinto, W. R. Schwartz, H. Pedrini, and A. de Rezende Rocha, "Using visual rhythms for detecting video-based facial spoof attacks," TIFS, vol. 10, no. 5, pp. 1025–1038, 2015.

[9]. P. P. Chan, W. Liu, D. Chen, D. S. Yeung, F. Zhang, X. Wang, and C.-C. Hsu, "Face liveness detection using a flash against 2d spoofing attack," TIFS, vol. 13, no. 2, pp. 521–534, 2017.

[10]. W. Kim, S. Suh, and J.-J. Han, "Face liveness detection from a single image via diffusion speed model," TIP, vol. 24, no. 8, pp. 2456–2465, 2015.

[11]. S. R. Arashloo, J. Kittler, and W. Christmas, "Face spoofing detection based on multiple descriptor fusion using multiscale dynamic binarized statistical image features," TIFS, vol. 10, no. 11, pp. 2396–2407, 2015.

[12]. D. Menotti, G. Chiachia, A. Pinto, W. R. Schwartz, H. Pedrini, A. X. Falcao, and A. Rocha, "Deep representations for iris, face, and fingerprint spoofing detection," TIFS, vol. 10, no. 4, pp. 864–879, 2015.

[13]. A. Agarwal, R. Singh, and M. Vatsa, "Face anti-spoofing using haralick features," in BTAS, 2016, pp. 1–6.

[14]. .Z. Boulkenafet, J. Komulainen, and A. Hadid, "Face spoofing detection using colour texture analysis," TIFS, vol. 11, no. 8, pp. 1818–1830, 2016.

[15]. C. Nagpal and S. R. Dubey, "A performance evaluation of convolutional neural networks for face anti spoofing," in IJCNN, 2019, pp. 1–8

[16]. X. Qu, J. Dong, and S. Niu, "shallowcnn-le: A shallow cnn with laplacian embedding for face anti-spoofing," in FG, 2019, pp. 1–8.

[17]. A. Pinto, S. Goldenstein, A. Ferreira, T. Carvalho, H. Pedrini, and A. Rocha, "Leveraging shape, reflectance and albedo from shading for face presentation attack detection," TIFS, vol. 15, pp. 3347–3358, 2020.

[18]. J. Maatta, A. Hadid, and M. Pietikainen, "Face spoofing detection from single images using micro-texture analysis," in IJCB, 2011, pp. 1–7.

BIOGRAPHY

G.Venkateswari , M.Tech, (ph.d)
Asst. Professor &H.O.D ,Dept of Computer science &Engineering, BWEC, Andhra Pradesh,India

B.Venkata Lakshmi [B.Tech],Student, Dept of Computer science &Engineering, BWEC, Andhra Pradesh,India

A.padma [B.Tech],Student, Dept of Computer science &Engineering, BWEC, Andhra Pradesh,India

K.Sandhya Rani [B.Tech],Student, Dept of Computer science &Engineering, BWEC, Andhra Pradesh,India