International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 1088-1092 www.ijaem.net ISSN: 2395-5252

# Artifical Intelligence Enabled COVID-19 Screening using Thermal Images

Jesuraj Pravin T, Dr.K.Sumathi
*Department of ECE , Sri Sairam Engineering College, Chennai-44*
*Associate Professor, Department of ECE, Sri Sairam Engineering College Chennai-44*

---

Submitted: 01-06-2022 Revised: 10-06-2022 Accepted: 15-06-2022

---

**ABSTRACT**—According to WHO (World Health Organization) it has been reported that 4.3 million confirmed cases and 0.5 million deaths reported due to Corona virus. COVID-19 is a serious disease caused by severe respiratory syndrome called Corona virus. It was identified in December 2019 in Wuhan, China. Coronavirus is primarily spread between people during close contact. Motivating to this notion, it is proposed an artificial intelligence system for social distancing classification of persons using thermal images. A novel machine learning detection technique is developed for detecting and tracking people in indoor and outdoor scenarios. KNN algorithm is implemented for detection of human and measuring temperature of an individual. Using the SVM obtained temperature is classified to identify the individual. Hence, this work aims at minimize the spread of the COVID-19 virus by evaluating the temperature. The Proposed approach is applied to images acquired through thermal cameras and establishes a complete AI system for body temperature monitoring and identification. The training phase is done with two datasets captured from different thermal cameras. MATLAB is used for labeling the persons in the images. The proposed technique has been deployed in a low-cost embedded system which is composed of a fixed camera. The proposed system could be implemented in distributed surveillance video system to visualize people from several cameras in one centralized monitoring system. The results show that the proposed method is suitable to set up a surveillance system in smart cities for people detection in, social distancing classification, and body temperature analysis.

## I. INTRODUCTION

Influenza is defined as a clinically defined respiratory illness accompanied by systemic symptoms as well as the name for the orthomyxoviruses which cause this illness. The symptoms associated with influenza are fever, cough (usually dry), headache, muscle and joint pain, severe malaise (feeling unwell), sore throat, and a runny nose. Among the previously stated symptoms of influenza, there are some which won't be possible to detect using a camera. These symptoms are headache, severe malaise, and muscle and joint pain. However, the other symptoms are possible to detect with cameras. Fever is the symptom best used in this type of project due to the hardware used in the project. According to science, a fever is defined as an a.m. temperature of >37.2°C (>98.9°F) or a p.m. temperature of >37.7°C (>99.9°F)‖ .When detecting fever with a thermal camera the temperature is typically measured on the temple and forehead .From the temperature detected ,its compared with the nominal temperature and if the temperature exceeds the nominal ,a warning is sent to that individual ,this is possible by the process of Facial Recognition ,when using face recognition, there is a multitude of tools to use. Among these are; Face++, IBM Bluemix Visual Recognition, AWS Recognition, and Microsoft Azure Face API. Due to requirements from the collaborator, this project will be using Azure Face API to identify whose temperature has been measured.

A variety of literature and documentation has been taken into consideration during this project. Most of it concerns medical literature for identifying what symptoms for influenza are easiest identifiable for this project. As well as studies regarding facial recognition. Other than that sources for the project have been documentation for Python, C#, and Azure

## II. PROBLEM STATEMENT

*A.* Existing Method

According to World Health Organization (WHO) as on Feb 2022 around 8,899,578 people lost their life, whereas about 426,624,859 people are infected , how to overcome this pandemic is

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 1088-1092 www.ijaem.net ISSN: 2395-5252

that detecting the infection at an early stage , and strengthen our immune system , in order to detect the infection at an early stage various process are adopted such as Snapshots of Chest X-rays, By analyzing the CT Scans using AI, and many other contact form of screening was done. Zhang, J., Xie, Y., Li, Y., Shen, C. and Xia, Y., 2020. Covid-19 screening on chest x-ray images using deep learning based anomaly detection. arXiv preprint arXiv:2003.12338, 27.

During pandemic last three year was very much difficult for most of the people in the world, many daily wages and unskilled persons were suffering from unemployment. Hunger, Food crisis and other issues, all these problems are due to the Global pandemic COVID-19. Not only the poor people are suffering, the rich get richer the poor get poorer.

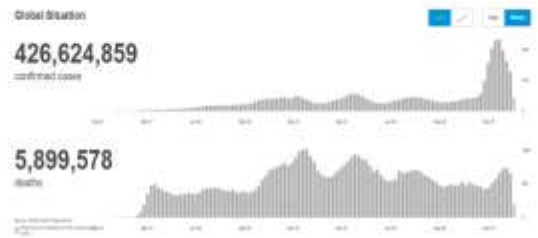



Fig 1: Image courtesy: COVI-19 Data derived from WHO

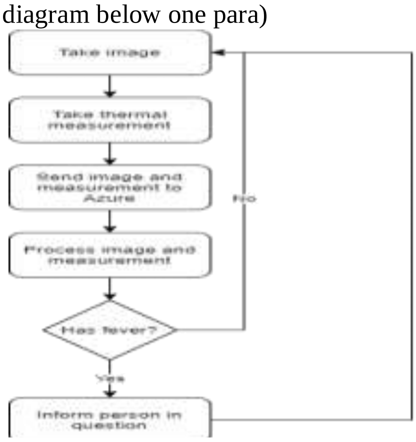
In Reference to this project, deep learning techniques was deployed to detect the covid-19 patient from their Chest X-ray images Visualization of four patients chest X-ray images (a) and the corresponding Grad-CAMs obtained by our model. (b) is the Grad-CAMs obtained by the classification head and (c) is the Grad-CAMs obtained by the anomaly detection head.

The aim of this paper is to classify COVID-19 patients from the chest X-ray and carry out further analysis of their health. The main contribution of this research work is to design a novel machine learning model by using Multi-objective Adaptive Differential Evolution (MADE) and convolutional neural networks (CNNs) for the classification of human beings based upon whether they are affected from COVID-19virus or not. The main contributions are as follows: A multi-objective function is proposed to classify COVID-19 virus-affected people by considering the accuracy and F-measure. The hyper-parameters of CNN are tuned by utilizing MADE.

The proposed model is trained by using the benchmark COVID-19 dataset. The comparisons between the proposed MADE-based CNNs and the competitive machine learning models such as CNN, genetic algorithm (GA)-based CNN (GA-CNN), and particle swarm optimization (PSO)-based CNN (PSO-CNN) are also drawn by considering the well-known classification metrics. AI-assisted CT imaging analysis for COVID-19 screening: Building and deploying a medical AI system in four weeks. Authors: Shuo Jin, Bo Wang, Haibo Xu, Chuan Luo, Lai Wei :It is the Process of detecting the COVID-19 using CT Scan Images enabled by deep learning techniques. All the Above Mentioned is very efficient in their own perspective, but they are time consuming process, a statics states that for every one minute 1345 people are being infected with COVID-19 virus, above mentioned techniques requires at least 3 to 4 hours ,which won't be a efficient way in screening a pandemic, and also analyzing a x-ray or CT Scan images requires skilled person , which limit the resources to limited person

*B.* Proposed Method

In this Proposed Method, a thermal imager is used, which capture the images of the individual to be screened, this image is sent to the Mat Lab for processing, through which the temperature of the individual is obtained, and then its compared with the nominal temperature, if the temperature exceeds the normal temperature then an warning message is triggered by identifying the person using facial recognition.(Write few lines about block diagram below one para)




**(Draw above block convert to image and paste for more clarity)**

## III. DESIGN AND MODELLING

*A.* Calibration of Thermal Camera

When conducting the tests of the prototype itwas discovered that the thermal camera was unable to register the correct temperature if a person was standing at a distance. To fix the problem multiple persons were tested with the different lengths from the prototype and saw what the temperature showed from the camera and compared that to the person's real temperature which was the tympanic (ear) temperature. From this test, it was decided together with the collaborator to add 6.5°C and that the persons being tested should stand 50cm from the prototype.

*B.* Evaluation of Prototype

When performing the final testing of the prototype, the person whose temperature was to be measured was placed 50 cm away from the prototype. The prototype was held by another person at the eye level of the test person. After that, the process of measuring began and the person had to stay put until a message on the screen showed up and said that the measurement was done. Following that the command prompt on Azure was monitored to ensure that the flow of the solution had been correct. If the person‘s temperature exceeded the limit, the test person had to check his or her email to ensure that an email had been sent.

This process was repeated multiple times to ensure the solution working properly. There is a multitude of advantages and some disadvantages of using cameras as it has been done in this project to detect human flu-like symptoms. One of the more prominent advantages is that it is easy to use cameras for this way of detecting symptoms. This means that it is not complicated for a user to measure his or her temperature as it can be using more traditional ways of detecting symptoms, more specifically fever as it was the one symptom used in this project. The solution can also be further developed to include a more automatic method by having the camera constantly checking the persons passing by it and measuring their temperature. Apart from those advantages, this prototype is built in a way that makes it easy for it to be improved with better hardware, such as cameras and the computer. As well as adding hardware to the solution for additional ways of detecting symptoms, meaning the solution built in this project is scalable. By adding a slow-scan CCD camera to MATLAB, a particle measuring makes it possible to detect which particles are in the air, and through that detect if there are any influenza virus in the air. In the same manner, as with the slow-scan CCD camera, adding a microphone to the MATLAB and using the model developed by the university in South Korea another dimension of measurements can be used to further develop this prototype. The difference between this prototype and the South Korean prototype is the fact that the South Koreans have built the model used in their prototype by themselves and this prototype has relied on already built APIs and cloud services for the completion of the project.

As for the disadvantages to this prototype, it showed a rather big inaccuracy of the temperature. This is due to the poor performance of the hardware used for this prototype. However, with better hardware that has better accuracy in their measurement, the probability of this being a problem is rather small. Another disadvantage to this current solution is the fact that the current solution can be slow at times due to limitations in the database. This is because the chosen database in Azure is a Basic-tier‖, which is the cheapest one and the one with the most limited performance. In this tier the performance is not dedicated to the specific service, resulting in the database competing with other services in the subscription. This can cause the database to get fewer resources assigned. The problem with a slow database can easily be fixed by increasing the level of the tier, which means that the speed and stability of the database will improve to a higher monetary cost.

As for this project's contribution to the scientific community and the collaborator, CGI, the project has made some notable contributions. CGI has stated that they have not worked with cameras to any extent. In that regard, this project could be significant for their understanding of how they might adopt cameras in their regular work and how they might use this project for a future customer. Would the collaborator use the code in the project for further development, the code is structured in a manner that makes it easy to switch out hardware and still have a functional prototype, given the fact that the code is replaced with a working code for the new hardware. As for the contribution to the scientific community, the project shows the possibility of making a prototype with a data flow that could be used in future work for prototypes used to detect flu-like symptoms, which was something that could not be found when conducting the literature review.

| Measurement | Mean [°C] | Standard Deviation [°C] | RMS Error [°C] |
|---|---|---|---|
| 36°C | 36.016 | 0.095 | 0.095 |
| 34°C | 34.003 | 0.090 | 0.090 |
| 38°C | 38.018 | 0.093 | 0.094 |

Table 1: Summary Statistics for Laboratory Accuracy Tests

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 1088-1092 www.ijaem.net ISSN: 2395-5252

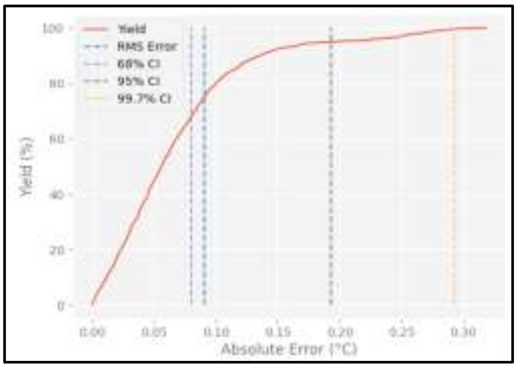



Figure 2: Blackbody Laboratory Accuracy Test at 36°C Yield Analysis

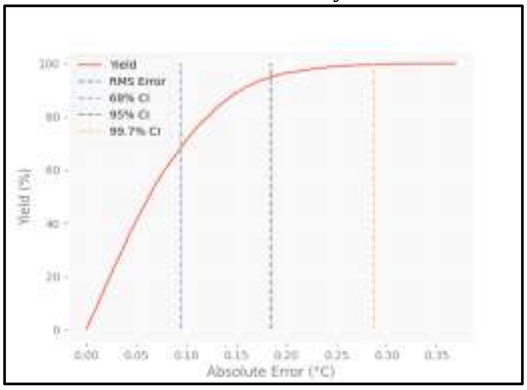



Figure 3: HTD Blackbody Laboratory Accuracy Test at 34°C Yield Analysis

**(Try to put output image with more clarity)**

## IV. RESULTS AND DISCUSSION

The prototype which was built is proof of the possibility of building a system to detect some human flu-like symptoms. The application shows an implementation of the hardware and the usage of services provided by Azure is capable of taking an image and the temperature of a human to then process this data to detect if a person has some human flu-like symptoms. The prototype was also capable of informing the person in question. As for future work, the image captured were undergone a facial recognition process , and the captured temperature is compared to the nominal temperature and if the temperature exceeds the nominal value then the individual are informed via digital communication.

Fig 4 : Proposed System Graphical Interface

Thus the screening of the COVID-19 can be done using the thermal imager enabled by an artificial intelligence at much faster way avoiding the much more time consumption by other methods and also this system is easily operational by any non-technical persons Above shown are some of the proposed model and real time model.

The above image , demonstrated the GUI of our proposed system, likewise it can be made available at all public gathering palace , closed Institutions, organisation, hospitals and so on ,this process of screening the people is very easier, it won't consume more time, and doesn't require any special skill set, while operating in a closed loop system such as educational institute, MNC companies, the face image of every persons are available , it is easy for the system to recognise the facial , and intimate them in case of an abnormal temperature is observed , the abnormal temperature are feed the system in the prior.

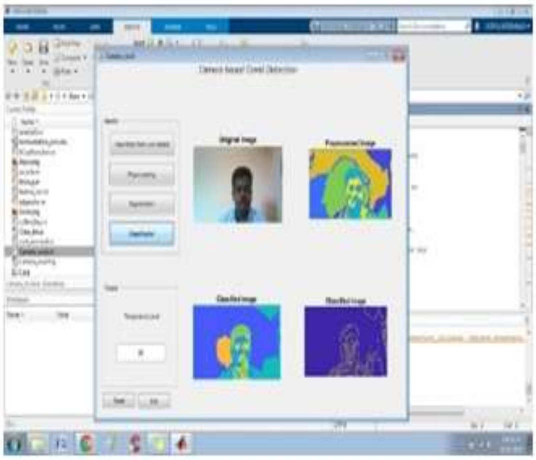


Fig 5 : Real Time Output of the Proposed Project in MAT Lab

The above image is the Real Time Output of the Proposed Project, on executing the written code the above pop up arises, where the image to be identified for temperature, is either uploaded or directly captured from the camera, it was then further pre-processed, segmented and classified and the resultant output temperature is displayed in the output panel.

## REFERENCES

[1] S. Gazzah, O. Bencharef, A survey on how computer vision can response to urgent need to contribute in COVID-19 pandemics, in:
[2] 2020 International Conference on Intelligent Systems and Computer Vision (ISCV), IEEE, 2020, pp. 1–5.
[3] M. Poongodi, A. Sharma, V. Vijayakumar, V. Bhardwaj, A.P. Sharma, R. Iqbal, R. Kumar, Prediction of the price of Ethereum blockchain cryptocurrency in an industrial finance system, Comput. Electr. Eng. 81 (2020) 106527.
[4] G. Rathee, A. Sharma, R. Kumar, F. Ahmad, R. Iqbal, A trust management scheme to secure mobile information centric networks, Comput. Commun. 151 (2020) 66–75.
[5] A. Geitgey, Proclamation on declaring a national emergency concerning the novel coronavirus disease (COVID-19) outbreak, 2020.
[6] A. Sharma, R. Kumar, A constrained framework for context-aware remote E-healthcare (CARE) services, Trans. Emerg. Telecommun. Technol. (2019) e3649
[7] P. Bhavana, Role of technology in the era of COVID-19 pandemic, 2020.
[8] R. Alizadeh, J.K. Allen, F. Mistree, Managing computational complexity using surrogate models: a critical review, Res. Eng. Des. 31 (3) (2020) 275–298.
[9] A. Sharma, R. Kumar, Computation of the reliable and quickest data path for healthcare services by using service-level agreements and energy constraints, Arab. J. Sci. Eng. 44 (11) (2019) 9087–9104.
[10] L. Jia, R. Alizadeh, J. Hao, G. Wang, J.K. Allen, F. Mistree, A rule-based method for automated surrogate model selection, Adv. Eng. Inform. 45 (2020) 101123.
[11] A. Kimball, K.M. Hatfield, M. Arons, A. James, J. Taylor, K. Spicer, A.C. Bardossy, L.P. Oakley, S. Tanwar, Z. Chisty, et al., Asymptomatic and presymptomatic SARS-CoV-2 infections in residents of a long-term care skilled nursing facility—King county, washington, march 2020, Morb. Mortal. Wkly. Rep. 69 (13) (2020) 377.
[12] C.H. Yan, F. Faraji, D.P. Prajapati, C.E. Boone, A.S. DeConde, Association of chemosensory dysfunction and Covid-19 in patients presenting with influenza-like symptoms, in: International Forum of Allergy & Rhinology, Vol. 10, Wiley Online Library, 2020, pp. 806–813, no. 7.
[13] J.D. Hasday, N. Shah, P.A. Mackowiak, M. Tulapurkar, A. Nagarsekar, I. Singh, Fever, hyperthermia, and the lung: It‘s all about context and timing, Trans. Amer. Clin. Climatol. Assoc. 122 (2011) 34.
[14] D. Ogoina, Fever, fever patterns and diseases called ‗fever‘–a review, J. Infect. Public Health 4 (3) (2011) 108–124.
[15] E.F.J. Ring, A. Jung, B. Kalicki, J. Żuber, A. Rustecka, R. Vardasca, New standards for fever screening with thermal imaging systems*, in: Infrared Imaging, in: 2053-2563, IOP Publishing, 2015, pp. 5–1–5–11.