STM JOURNALS

Journal of Artificial Intelligence Research & Advances
ISSN: 2395-6720
Volume 7, Issue 2
www.stmjournals.com

A Covel: AI driven COVID-19 Pandemic Prediction using Personal Hand Held Smartphone

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Abstract

From the family of renowned viruses that made humans ill came in the lime light under the name coronavirus later as COVID-19. COVID-19 proved fatal in whuhan province of china that later was touted as epicenter of COVID-19. COVID-19 accelerated and expanded its footprint around the countries and is reported as a Pandemic. Currently almost whole globe is struggling to delimit the COVID-19. Not much research have been done in this, thus there arise the need to detect and point out disease COVID-19. The detection mechanism for COVID-19 involve subjection to medical examination that involve CT scan images, blood test, deep throat saliva Analysis and finally stool test. These medical Examinations make the use of MDK (Medical Detection Kits). Thus herein we have proposed a Covel approach of COVID-19 detection using Personal Hand held smartphone. As in today's era everybody is having Smartphone so we tried to incorporate same for detection purpose. Today smartphones come with extra onboard features involving high end processors, good primary and secondary storages apart from it the biometric sensors. The biometric sensors include chipset sensor, color sensor, temperature sensor and inertial sensor. Here by using the smartphone sensor we can tout out the symptoms of COVID-19 and Elementary Predict the outcome if person is suffering from COVID-19 or not. By using the proposed mechanism we can delimit the time frame and increase the efficiency of declaring the patient positive for the said disease which will ease the burden on the doctors.

Keywords:-*Corona Virus, Covid-19, medical Detection Kit, Artificial Intelligence, Epidemic, Pandemic*

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INTRODUCTION

The race of survival started in December 19 in Wuhan city, Hubei province of China. Against the deadly coronavirus infection that later became COVID19. It was firstly considered as epidemic but later World Health Origination (WHO) reported COVID19 as Pandemic after it expand beyond the geographical coverage among the masses. The coronavirus infection badly hit the human respiratory. The infection led to the involvement of throat, lungs, high body temperature, fatigue, sometimes running nose, uneasiness, and essence of vomiting fallowed by diarrhoea. Firstly detected in China now accepted and identified over globe internationally [1] [2]. The chain of transmission is between person to person involving contact less transmission upon experimentation this was declared Pandemic on 30, January 2020 by World Health Organization Energy Committee. COVID19 is mostly fatal in people with low immunity.

The first transmission of COVID19 in Wuhan was due to person to animal contact. With the grind of time it began its transmission chain between Person to Person [3]. It was announced on 11 March, 2020 that COVID19 is a global pandemic outbreak. Infected cases were 128000 and deaths 4500 and cyclic chain of infection continued [4]. Coronavirus is the family of COVID19, affecting people by incorporating MERS-Moderate cold Middle East Respiratory Syndrome or SARS- Severe Acute Respiratory Syndrome [5]. Respiratory disease viral in nature SARS was first detected

in Southern china that was reported in 2003, were as MERS found its pathway in Saudi Arabia having its virus genome from bats. MERS caused 854out of 2494 deaths of Person [6]. In [7] various technique of COVID19 detection was presented that include NAT and CT scan. NAT is Nucleic Acid Test for detection of specific nucleic acid among sequence of Virus-bacteria in blood, urine or tissue apart from Computer Tomography Scan/CT Scan, which is mostly preferred in terms of Severity and efficiency.

Radiographic presentation of Pneumonia for clinical investigation was chosen as bench mark by the National Health Commission of china in Hubei province thus increasing the importance of using CT Scan images for COVID19 diagnostics.

Clinical diagnostic procedures involve lot of time consumption for waiting to get scan leading to the overload on medical staff. Also while waiting, there are possibilities of receiving infection from other persons sitting with and around.

In Hubei province under medical treatment patients were subjected for CT scan of lung. In the initial stage the opacity was less, pointing towards less infection and with due time in infected persons opacity gradually started increasing thus patient is determined under the influence of COVID19. Performing all the imaging procedure for growing number of persons made entire procedure overloaded. That leads for the call of Quarantine [8]. The evolved pandemic envelops the chained procedure in terms of transmission and not all the COVID19 patients claim for uneasy health symptoms [10]. Various medical Diagnostic kits are offered which are costly; involve time consumption setup and require expert medical supervision.

Present day Smartphones come along with onboard sensors bearing lot of processing capacity thus making it a viable to be used in this sort of situation for seeking processed facts [11]. The important functions of current smartphones are ability to catch, get and store huge amount of processed information. Analysis of CT images for COVID19 patients can be done by performing paramount comparison on how assorted lesion has been grown up. The analysis study is vital in terms of determining and touting out the State of lung inflammation.

Herein, we put forth a Covel approach to determine the COVID19 by involving the use of Personal hand held smartphone using its hardware sensor and calibrated AI driven Machine learning algorithms. This approach shall pave the way for masses to use their smartphone for COVID19 diagnostics. Also same can be used to figure out the stage of lung inflammation. Currently our smartphones are embed with high end software and hardware chip set configurations. The proposed schemes read the signal measurement using smartphone sensors and determine viral pneumonia through CT scan Images. Proposed Scheme takes relatively less time to determine COVID19 in comparison to well-equipped radiologist. Our scheme can be used by radiologist for timely evaluation [9].

Our work is further presented under different sections as in SectionII we have explained literary work evolved for COVID19 determination using Artificial intelligence. After that we have presented the detailed view of proposed covel Scheme using smartphone mechanism with combined AI based machine learning Algorithms in SectionIII, followed by the Analysis of CT Scan Data in SectionIV, SectionV carries Conclusion and Finally SectionVI carries Future work followed by Acknowledgments in sectionVII.

BACKGROUND

In this section we have presented the crux of literary work presented recently in order to determine COVID-19. The bedrock lies in the detection of pandemic on under investigation patients.

Though not much wore is there for the deterministic approaches towards detection and identification of COVID-19 because of its novel occurrence among masses. While reviewing the literature some modern ideas and approaches are in the area. In [1] the

researchers developed AI incorporated mechanism using deep learning on CT scan images their work was delimited on high resolution CT Scan image.

In [10] the researchers used various methods for detection by incorporating combined approach and were able to acquire efficient result. Smart CT image processing system was used by Ping an Insurance Company Ltd in China, that was capable to fetch information in short range of time.

PROPOSED COVEL SCHEME

In this section we put forth our Architecture depending upon which our sound mechanism will work. The proposed Architecture contain well phased assorted connectivity among Embedded onboard Smartphone Sensors and Machine learning Algorithms.

In order to tout out preliminary outcome of COVID-19. Number of procedural approaches are there to obtain the outcome though we propose smartphone based solution that shall be adopted by the radiologists or affected people for primary diagnostics which will prove handy and efficient in the need of hour.

The working Principle involve number of predefines steps to fallow for attainment of result. Here we approach to tout out the affective level of each symptom as discussed in SectionI, by making the comprehensive use of sensors and modernity algorithms that are current state of the art algorithms for combine evaluation of symptoms.

Fever is predicted using temperature biometric finger print sensor located in front or back side of smartphone as per vendor architecture [12]. Human-Giat analysis in [13] is performed on images and clips captured with the help camera (smartphone inbuilt) to figure out fatigue in different circumstances. Fatigue level is further captured using inertial sensors onboard like accelerometer sensor as discussed in [12], [14]. By making video examination nausea assumption can be analyzed as done in [15]. Human head-ache severity is supervised using inertial sensors and camera sensors as obtained in [16]. In [17] and [18] cough stage cycle has been studied under inbuilt microphone.

In our procedural approach the hardware used could adapt further changes with change in modern devices. The complete data acquired is arranged in sophisticated single record, resulting in sound data set. That is to be fed to Machine learning Algorithms. As various modernity Algorithms are there like Neural Networks, K-means Nearest Neighbor, SVM, Decision tree that are used alongside for human features prediction. Here we have made into play the RNN and CNN for image recognition in spatial data as done in [19]. CNN-Convolution Neural Network and RNN-Recurrent Neural Network are modern techniques in deep learning. “CNN provides feed forward and in RNN output in one is input in next” [20] and [21].

A PROPOSED ARCHITECTURE

Proposed architecture is deployed in four Stages as shown in Figure 1, *Measurement Stage* and *Configuration stage* form first and second stage of our proposed mechanism here data collection from inbuilt sensors take place like video capturing, capturing CT scan lung image from filmed scan, physical data capturing of patient which involve accelerometer measurement involving 30-seconds-sit-to-stand, cough measurement using microphone, temperature measurement using touch biometric figure print sensor. The reality parameters from first and second stage are fed as an input to Algorithms for Symptom prediction that are running on smart. The third stage ie *symptom stage* gives symptom level calculation. Which are forwarded as an input to Fourth stage ie *Prediction stage.* The fourth stage accepts the input from the previous stage ie third stage and apply algorithm to determine the COVID-19. The Algorithm used in this stage are machine learning algorithms, outcome of which arbitrary change as per the recorded data nature. As this can be best understood by having an example of abnormal CT scan sub image where CNN is used first fallowed by RNN. Thus dual mechanism of CNN and RNN, have been put forth in fourth stage of our proposed architecture.

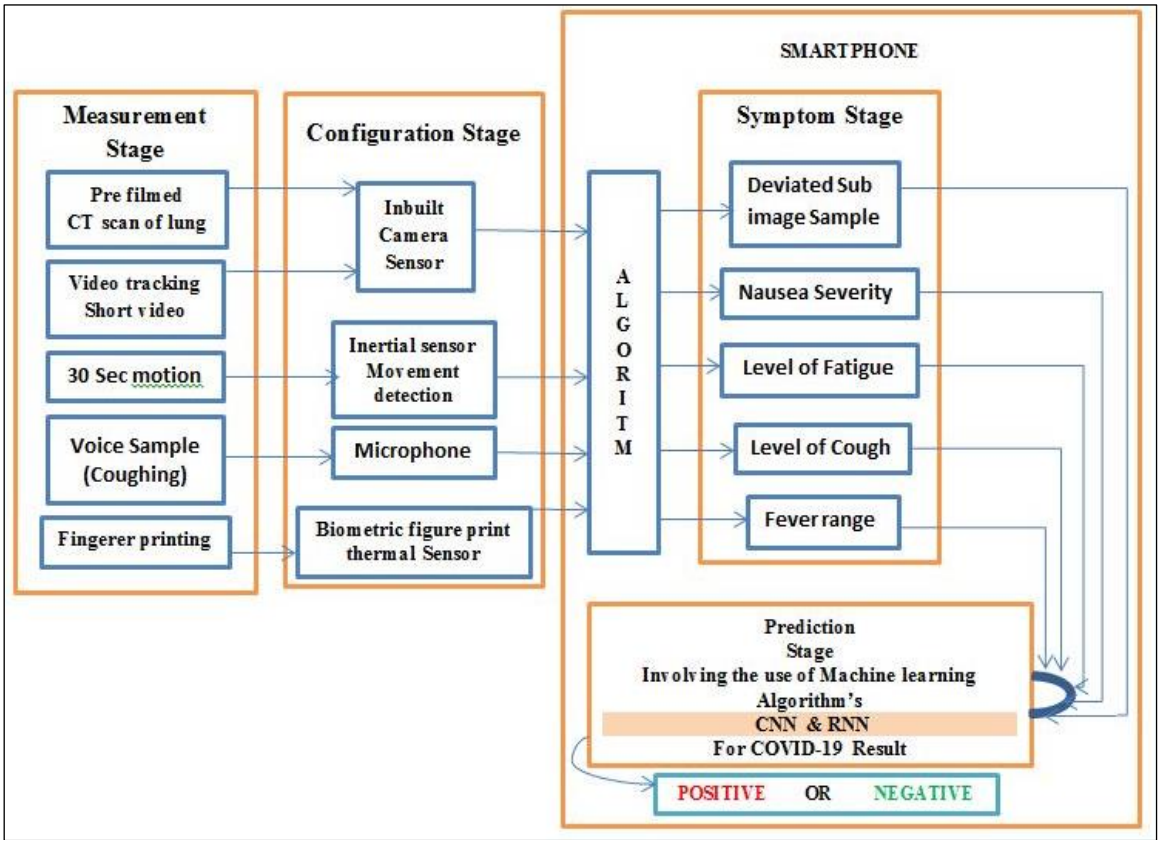

Fig. 1: *Proposed Architecture.*

Apart from the line symptoms determined our proposed system is capable of handling pre filmed CT scan image. We can fed CT scan image to our proposed system by using onboard camera and capture the image of pre filmed CT scan image. The CT scan image can be fed as input to our proposed mechanism where it will undergo processing operations using machine learning Algorithms the comparisons are made as per the parameters adjusted.

For machine learning prediction we went for feature extraction and prediction as same were compared under weighted comparison. Categorization of diseased stage can also be made by analyzing the density and size. Thus lung lesion can be compared using algorithm on multiple CT scan image films.

As manual comparison take lot of time for determination and interpretation thus automation is possible that reduce the burden from the shoulders of radiologists.

Mainly the density of lesion and volume form prime output for determination of COVID-19. Thus our introduced approach will efficiently help people having smartphones and also will make interpretation work of radiologist simple.

ANALYSIS

As in Figure 2 shows the impact of COVID-19 of a 62 year old admitted to the hospital in Kashmir, Jammu and Kashmir India on 01 April 2020 as a result of close contact with affected person during travel outside home prior 17 days after proper quarantine.

From Figure 2 it can be observed that opacities, volume quantity, density of lesion and grade are progressing from A to G. Analysis is much time consuming at the hands of radiologists. The same is scanned and fed to Machine Learning Algorithms for pneumonia stage identification by providing density of lesion, opacities and volume as outcome. As can be seen in Figure 3 and Figure 4.

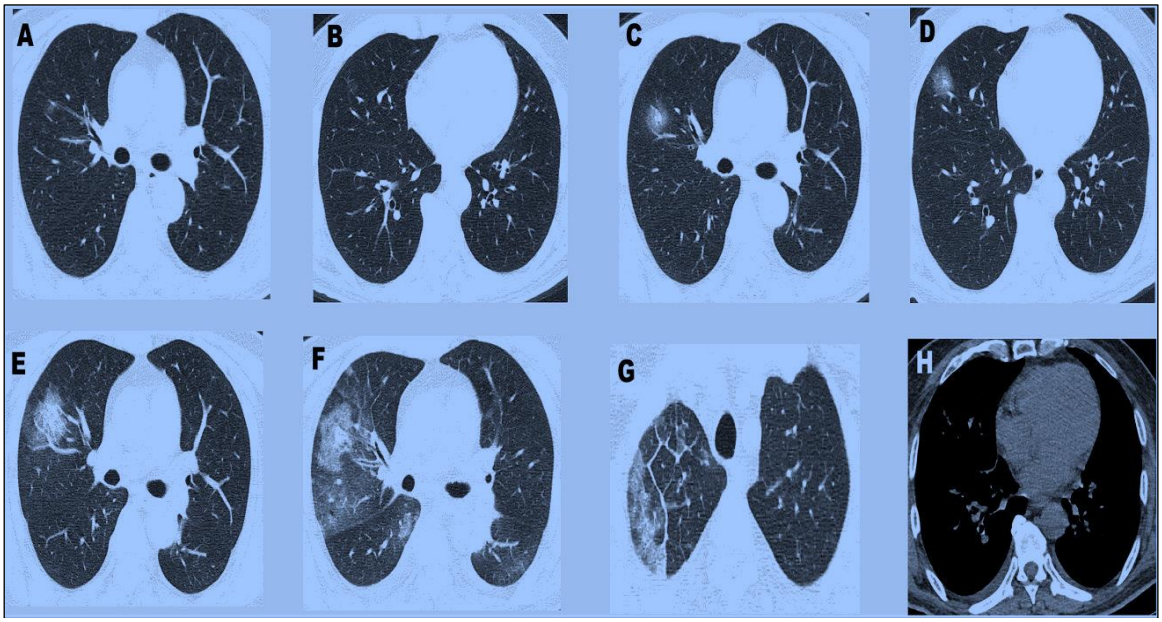

Fig. 2: *Showing the impact of COVID-19 of a 62 Year Old Admitted to the Hospital in Kashmir, Jammu and Kashmir India.*

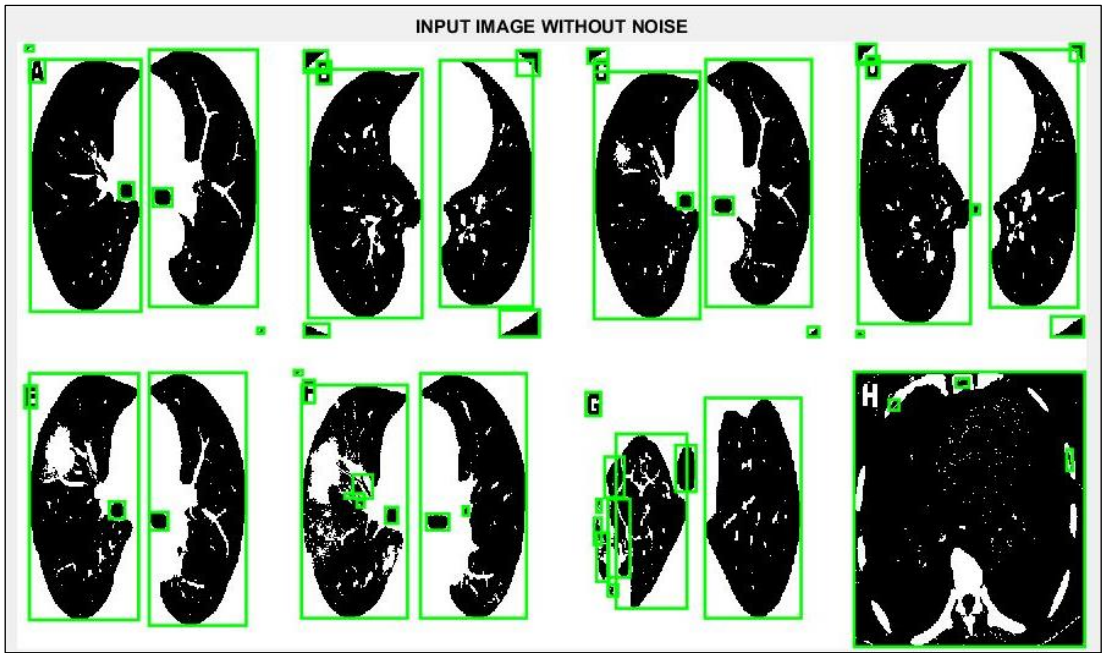

Fig. 3: *Showing Lung Detection after Region Filtering.*

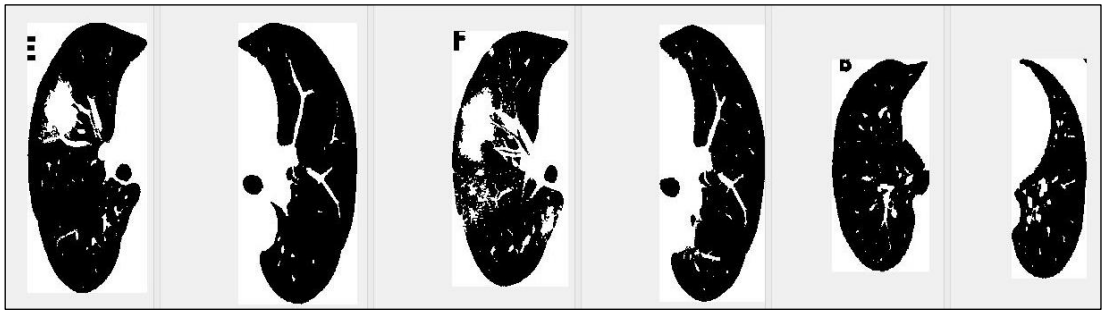

Fig. 4: *Showing Level of Damage with Infection Progression.*

As Figure 5 describes the treatment impact of COVID-19 of a 62 year old admitted to the hospital in Kashmir, Jammu and Kashmir India.

It can be observed in figure-6 the patient started to respond under prescribed medication using WHO recommended medicines. Our detection approach provided the efficient outcome so far as diseased area is concerned on performing live test on pre filmed CT Scan.

For further affectation and smooth applicability the information records and outcomes can be transferred via cloud for future sharing purpose. By incorporation cloud we can achieve diverse data throughout the globe resulting in huge dataset availability across globe. Which will further pave the way for early stage diagnostics of COVID-19 patients and may somehow, save the enormous precious souls across globe.

Fig. 5: *During Treatment Impact of COVID-19 of a 62 Year Old Admitted to the Hospital in Kashmir, Jammu and Kashmir India.*

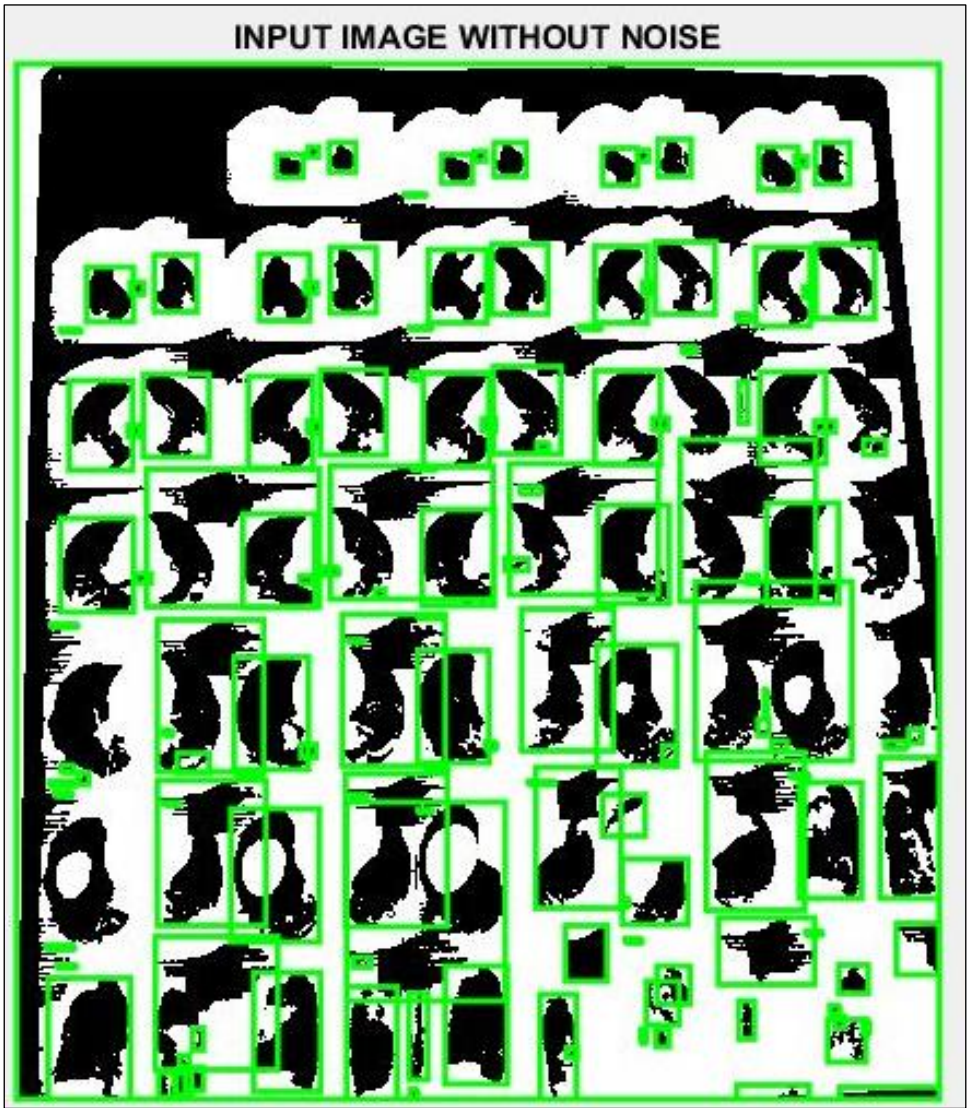

Fig. 6: *During Treatment Recovery Progression of COVID-19 of a 62 Year Old Admitted to the Hospital in Kashmir, Jammu and Kashmir India.*

CONCLUSION

In our proposed work, we provided the compressive behavior of deadly coronavirus-COVID19 pandemic detection approach. Examine and explored various procedural scientific research on the COVID19 in perspective of their outcome and methodologies implemented using the state of art methods involving MDK-Medical detection kit, Artificial intelligence tool employed and pre filmed CT scan image reading mechanism. Low girth of accuracy, less efficiency and long term time duration and huge cost is involved in state of art methods. Herein our proposed approach have reduced such limitations and evade the backbreaking procedures at the hand of radiologists.

The prime facta of our proposed approach is the use of smartphone that are readily available in today's era. The work is based on the data fed into the smartphone via already built in hardware mechanism. The proposed approach can be imbibed by concern doctors, radiologists along with other medical practioners bearing smartphone. Thus easing their work, in terms of efficiency and capability of using all the time anywhere. The same approach can be extended on various smartphone requiring none additional parameters in terms of hardware.

Our proposed approach is distributed among Four layers via coupled with interface connections that are: Measurement Stage,

Configuration Stage involving sensors, Computational Stage and Fourth Prediction Stage involving Machine learning approach.

Further refinement in results can be obtained when Lachine learning Algorithms will be made to run over diverse data acquire over cloud. The diverse data will further sharpen the efficiency criteria.

FUTURE WORK

Though our approach is quite dependable in correlation to highest development as it depend on multiple inputs from onboard sensors. The inputs obtained so are of symptomatic behavior from infected pandemic thus automated annotation for detected area need to be introduced in future. Also we will try to further extend our contribution to world by making ready-to use app for crossover platforms which shall be le on the cloud storage.

ACKNOWLEDGMENTS

Highly thankful to Mr. M Salim Parvaiz Mir and Showkar Ara Kapra for timely motivation and proof reading this work.

REFERENCES

1. J. Wu, J. Zhang, L. Zhang, D. Gong, Y. Zhao, S. Hu, Y. Wang, X. Hu, B. Zheng *et al.*, "Deep learning-based model for detecting 2019 novel coronavirus pneumonia on high-resolution computed tomography: a prospective study," *medRxiv*, 2020. [Online] Available from: https://www.medrxiv.org/content/10.1101/2020.02.25.20021568v2 [Accessed April 2020].
2. C. DeBolt, and L. S. First, "Novel coronavirus in the united states," *N Engl J Med*, vol. 2020, p. 31, 2019.
3. WHO (2020). "Novel coronavirus – china. world health organization." [Online] Available from: https://www.who.int/csr/don/12-january-2020-novel-corona virus-china/en/ [Accessed in March, 2020].
4. Jamie Gumbrecht and Jacqueline Howard (2020), WHO declares novel coronavirus outbreak a pandemic. [Online] Available from: https://edition.cnn.com/2020/03/11/health/coronavirus-pandemic-world-health-organization/index.html [Accessed in March, 2020].
5. WHO (2020), Coronavirus disease (COVID-19) Pandemic [Online] Available from: https://www.who.int/emergencies/diseases/novel-Coronavirus-2019 [Accessed in March, 2020].
6. WHO (2004). "Summary of probable SARS cases with onset of illness from 1 november 2002 to 31 july 2003. [Online] Available from: https://www.who.int/csr/sars/country/table2004_04_21/en/ [Accessed April 2020].
7. B. Hu, C. Hu, F. Zhu, X. Liu, J. Zhang, B. Wang, H. Xiang, Z. Cheng, Y. Xiong *et al.*, "Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in wuhan, china," *Jama*, 2020, 232(11), 1061-1069p.
8. National health commission of china. (March, 2020). [Online] Available: http://en.nhc.gov.cn/2020-02/16/c_76605.htm [Accessed April 2020].
9. CBC News (2020). Canadian quarantined in Italy during COVID-19 lockdown. [Online] Available: https://www.cbc.ca/player/play/1709650499517 [Accessed April 2020].
10. Bioworld. (2020, March). China uses AI in medical imaging to speed up COVID-19 diagnosis. [Online]. Available: https://www.bioworld.com/articles/433530-china-uses-ai-in-medical-imaging-to-speed-up-covid-19-diagnosis [Accessed April 2020].
11. A. P. Dicker, C. E. Champ, M. Cantor, and N. Ohri, "Big data from small devices: The future of smartphones in oncology," in *Seminars in radiation oncology*, vol. 29, no. 4. Elsevier, 2019, pp. 338–347.
12. B. Beigzadeh, "Use of a smartphone thermometer to monitor thermal conductivity changes in diabetic foot ulcers: a pilot study," *Journal of Wound Care*, vol. 29, no. 1, pp. 61–66, 2020.
13. Swapnali B. Karvekar, "Smartphone-based human fatigue detection in an industrial environment using gait analysis," 2019, Master of Science, thesis, Rochester Institute of Technology, New

York. [Online] Available from: https://scholarworks.rit.edu/cgi/viewcontent.cgi?article=11439&context=theses [Accessed April 2020].
14. Roldán Jiménez C, Bennett P, Ortiz García A, Cuesta Vargas AI (2019), "Fatigue detection during sit-to-stand test based on surface electromyography and acceleration: A case study," *Sensors*, vol. 19, no. 19, p. 4202, 2019.
15. A. Story, C. M. Smith, E. Garber, J. Hall, G. Ferenando, L. Possas, S. Hemming, F. Wurie, S. Luchenski *et al.*, "Smartphone-enabled video-observed versus directly observed treatment for tubercu-losis: a multicentre, analyst-blinded, randomised, controlled superiority trial," *The Lancet*, vol. 393, no. 10177, pp. 1216–1224, 2019.
16. M. Inoue, P. Mongkolnam, and C. Nukoolkit, "Neck posture monitoring system based on image detection and smartphone sensors using the prolonged usage classification concept," *IEEJ Transactions on Electrical and Electronic Engineering*, vol. 13, no. 10, pp. 1501–1510, 2018.
17. M. M. Rahman, V. Nathan, K. Vatanparvar, and J. Kuang (2019), "A comprehensive approach for cough type detection," 2019 IEEE/ACM International Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE), 25-27 Sept. 2019, Arlington, VA, USA, pp. 15–16.
18. T. Van Kessel, B. Ko, D. Wood, S. Wang, and T. Brun-schwiler (2019). "Nocturnal cough and snore detection in noisy environments using smartphone-microphones," 2019 IEEE International Conference on Healthcare Informatics (ICHI), 10-13 June 2019, Xi'an, China, pp. 1–7.
19. S. Naz, and A. Zaib, "Deep learning for medical image processing: Overview, challenges and the future," in *Classification in BioApps*. Springer, 2018, pp. 323–350. doi: 10.1007/978-3-319-65981-7_12.
20. S. Maghdid, "Web news mining using new features: A comparative study," *IEEE Access*, vol. 7, pp. 5626–5641, 2018.
21. H. S. Maghdid, S. M. Asaad, M. H. Ahmed, and A. T. Asaad, "Gait-based gender classification using smartphone accelerometer sensor," 2019 5th International Conference on Frontiers of Signal Processing (ICFSP), 18-20 Sept. 2019, Marseille, France, pp. 12–20.

Cite this Article
Mir Aman Sheheryar, Mir Hamza Shaheryar. A Covel: AI driven COVID-19 Pandemic Prediction using Personal Hand Held Smartphone. *Journal of Artificial Intelligence Research & Advances*. 2020; 7(2): 1–9p.