COVID-19 Detection using SVM Classifier

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Abstract—Viral lung disorders are increasing day by day throughout the globe.Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 is the main cause for Coronavirus Disease (COVID-19) pandemic. The disease is contagious during close contact and via respiratory droplets produced when people cough or sneeze. In this paper a method is proposed to detect the COVID-19 using chest X-Ray images. In order to classify the normal and COVID-19 cases, a CAD system is developed using Support Vector Machine (SVM) Classifier with a Graphical User Interface. An accuracy of 57.1% is achieved with the dataset of 15 COVID-19 and 15 normal X-Ray images.

Keywords— *CAD, COVID-19, Support Vector Machine, SARS-CoV-2.*

I. INTRODUCTION

Viral lung disorders are increasing day by day throughout the world. Respiratory diseases like Interstitial Lung Disease (ILD), tuberculosis (TB), chronic obstructive pulmonary disease (COPD), pneumonia are most emerging health problem around the world. In which, COVID-19 is the recent pandemic (2019-20) all over the globe. Dated to 28th March 2020, around 5, 97,458 coronavirus cases and 27,370 deaths are accounted. The outbreak was first identified in Wuhan, China 2019 recognized as a pandemic by World Health Organization (WHO). The virus can spread with close contact and via respiratory droplets produced when people cough or sneeze. People may also get affected by COVID-19 by touching any contaminated surface and then their face, eyes, nose and mouth. Common symptoms such as fever, cough and shortness of breath are seen first. Complications include pneumonia and acute respiratory distress syndrome. Currently there is no vaccine or antiviral treatment against COVID-19. A large study has been started in the field of imaging which can be used to detect the COVID-19 by radiographs and computed tomography. Due to overlap with other infection such as adenovirus, imaging without confirmation by PCR is of limited specificity in identifying COVID-19 [1].

MucahidBarstugan et.al [2] developed and classified Coronavirus (COVID-19) using CT images by Machine Learning Methods. GLCM, LDP, GLRLM, GLSZM were used as feature extraction and support vector machine for classification.

In this study, we have used 30 chest X-Ray images for COVID-19 classification. The datasets weredivided into two as COVID-19 and normal (non-infected). GLCM features were extracted and the results were used to train the model. SVM classifier is used to classify the COVID-19 images. The obtained results showed that the proposed method is feasible for diagnosis of COVID-19 as a CAD system.

II. METHODOLOGY

In the proposed method, a dataset of 15 normal and COVID-19 X-ray chest images are taken for experimentation. The X-ray images initially undergo pre-processing operations such as image filtering by median filter and image enhancement by histogram equalisation. The pre-processed images are ROI selected of 25x25 pixel size window and GLCM features are extracted.

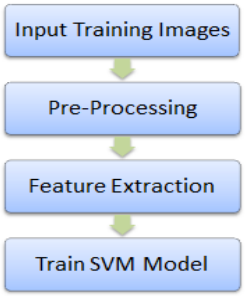

Fig1.Training SVM Model

The extracted contrast, correlation, energy and homogeneity features from 30 images are used to train the SVM model and the best curve fit with 5-fold cross validation is found to classify the COVID-19 against normal images.

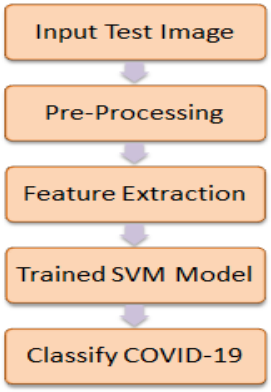

Fig2. Classification Flow Diagram

III. RESULTS

The following figures are the images taken for experimentation. COVID-19 refers to a blurred area with increased attenuation in the lung due to pneumonia than that of healthy lung. So it becomes very easy to classify from chest X-ray images by extracting GLCM features.

Table1: shows the GLCM features extracted from 15 chest X-ray images of COVID-19 cases.

Sl No.	Contrast	Correln.	Energy	Homog.
1	123.693	-0.1632	0.0023	0.0168
2	121.084	-0.0396	0.0015	0.1849
3	121.118	-0.0226	0.0015	0.188
4	112.858	0.0395	0.0016	0.1941
5	108.897	0.0152	0.0015	0.1985
6	142.454	-0.2472	0.0027	0.1628
7	130.193	-0.1769	0.0025	0.1804
8	103.057	-0.1501	0.0019	0.1911
9	103.710	0.0803	0.0019	0.2084
10	111.213	-0.0446	0.0017	0.1907
11	101.739	0.0473	0.0015	0.2009
12	122.323	-0.069	0.0018	0.1823
13	114.802	0.0327	0.0021	0.1984
14	142.613	-0.2918	0.002	0.1669
15	99.8898	0.0477	0.0017	0.1986

Table2: shows the GLCM features extracted from 15 chest X-ray images of normal cases.

Sl No.	Contrast	Correln.	Energy	Homog.
1	118.582	-0.0438	0.0016	0.1881
2	113.954	0.0392	0.0016	0.191
3	118.268	-0.0941	0.0017	0.1839
4	125.244	-0.065	0.0015	0.1869
5	113.045	0.0576	0.0016	0.1932
6	113.794	0.0099	0.0015	0.1944
7	124.162	-0.0165	0.0016	0.1863
8	112.098	0.05	0.0017	0.2007
9	100.961	0.0353	0.0016	0.196
10	116.398	-0.0438	0.0016	0.1903
11	108.578	0.1168	0.0016	0.2026
12	119.241	0.0004	0.0015	0.1894
13	112.839	-0.025	0.0016	0.1905
14	127.526	-0.1200	0.0017	0.1791
15	118.506	-0.1044	0.0017	0.1893

The support vector plot of the trained SVM model is displayed below. Red dots represent COVID-19 and blue dots for normal.

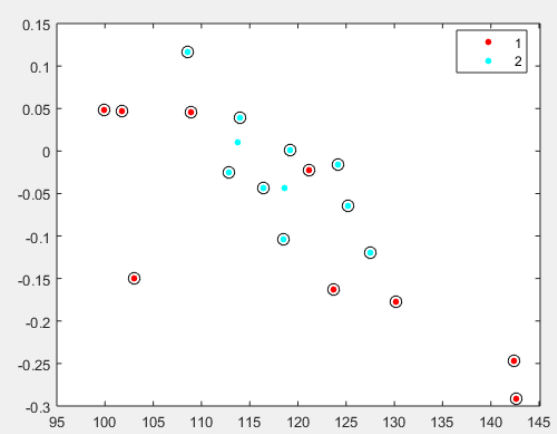

Fig3. Support Vector Model Plot

GUI Images –

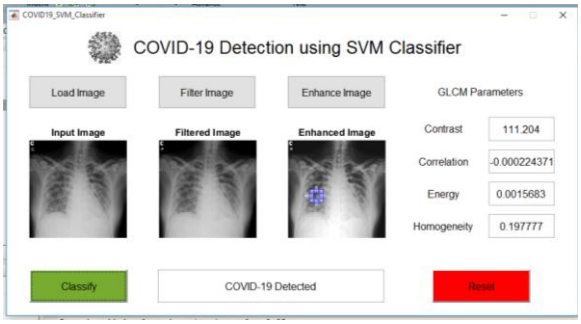

Fig4. Input Classified as COVID-19 Detected

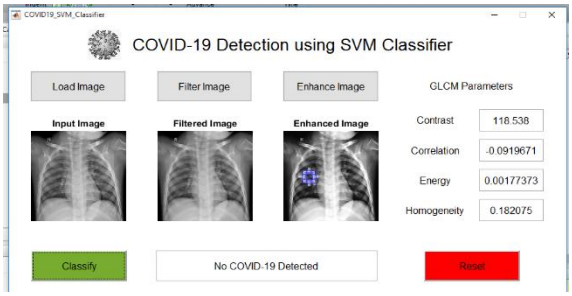

Fig5. Input Classified as No COVID-19 Detected

IV. DISCUSSION

A set of 30 chest X-ray images are taken among which fifteen of each category are normal and COVID-19 cases. In order to classify the chest images are pre-processed first, image filtering and image enhancement. Later the GLCM features are extracted from all the 30 images and these extracted Contrast, Correlation, Energy and Homogeneity parameters are used to train the SVM model and find the best hyperplane for detection of COVID-19. Once the SVM model is trained, the GLCM features of the test input X-ray image is extracted and passed through the classifier to identify whether the input image is COVID-19 or not.

V. CONCLUSION

The proposed system is trained and tested for 30 image dataset of COVID-19 cases. The results obtained shows as accuracy of 57.1% in classifying the COVID-19 images. However, more images of COVID-19 and normal images are to be tested for developing an expert system with 100% accuracy. Future the work is to continue to increase the accuracy of the system and differentiate the COVID-19 images with viral pneumonia cases.

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REFERENCES

[1] https://en.wikipedia.org/wiki/2019%E2%80%9320_coronavirus_pandemic.

[2] https://arxiv.org/ftp/arxiv/papers/2003/2003.09424.pdf.

[3] Oussema Zayane1, Besma Jouini1 and Mohamed Ali Mahjoub21, "Automatic lung segmentation method in CT images" published in Canadian Journal on Image Processing & Computer Vision Vol. 2, No. 8, December 2011.

[4] Daniel Y. Chong, "Robustness-driven feature selection in classification of fibrotic interstitial lung disease patterns in computed tomography using 3D texture features", 0278-0062 (c) 2015 IEEE.

[5] Gehad Ismail Sayed; Mona Abdelbaset Ali; Tarek Gaber; Aboul Ella Hassanien;VaclavSnasel 2015 11th International Computer Engineering Conference (ICENCO) Year: 2015 Pages: 144 -149, DOI: 10.1109/ICENCO.2015.7416339.

[6] Mark R Dension: Coronavirus Research: Keys to diagnosis, Treatment and Prevention of SARS.

[31]Akbarzhon Madaminov, “Recommendation Systems”, Engpaper Journal

[32]Aathi oli.S , “REVIEW PAPER ON PHISHING ATTACKS”, Engpaper Journal

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[34]K. SAI BHARGAV, V. RAJENDRA, “Study on Data Structures for Machine Learning”, Engpaper Journal

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[59]Abhishek Pawshekar, Deepti More, Akash Khade, Pratiksha Wagh, Ganesh Ubale, “Augmented Reality: to converting and placing object into 3D model”, Engpaper Journal

[61]Prof.Ubale.G.S, Pranjal Adhav,Pooja Gaikwad, Sushama Nadavade ,Pooja Kale , “Iot based Bridge Monitoring System”, Engpaper Journal

[62]Divya Deewan, Priyanka Maheshwari, Sanjay Jain, “A REVIEW OF BATTERY-SUPERCAPACITOR HYBRID ENERGY STORAGE SYSTEM SCHEMES FOR POWER SYSTEM APPLICATION”, Engpaper Journal

[63]Prof.Ansari.M.B, Pranjal Adhav,Pooja Gaikwad,Sushama Nadavade,Pooja Kale, “Survey on MyHelper IOT based Bridge Monitoring System”, Engpaper Journal

[64]Shreyas.S.J, Saddam hussain, Chaithra E, “COMPARATIVE STUDY ON SEISMIC RESPONSE OF MASONRY INFILLED RC FRAME BUILDINGS AND MIVAN BUILDINGS WITH DIFFERENT PERCENTAGE OF WALL OPENINGS”, Engpaper Journal

[65]Yusuf Ali Hassan, “Somali Power-Grid Significant Challenges”, Engpaper Journal

[66]Ahmed N. Elhefnawy, “Refractive IR Objective Optical Design Operating in LWIR band For Military Observation Applications”, Engpaper Journal

[67]S MANJULA, D SELVATHI and SUCHITAV KHADANGA, “Design of low-power CMOS transceiver front end for 2.4-GHz WPAN applications”, Engpaper Journal

[68]Suchitav Khadanga, “Fabrication of MEMS Pressure Sensor on thin film membrane”, Engpaper Journal

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[70]Suchitav Khadanga and S. Ahmad, “DESIGN AND FABRICATION OF LOW COST MICROWAVE OSCILLATOR”, Engpaper Journal

[71]Ameen Ahmed, Noushad S, Suchitav Khadanga, K.R.Suresh Nair, P.K.Radhakrishnan, “DEVELOPMENT OF LOW PHASE NOISE SMALL FOOT PRINT SURFACE MOUNT VOLTAGE CONTROLLED OSCILLATOR”, Engpaper Journal

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[73]Kavya.G.R, Shivaraju.G.D, Dr. T V Mallesh, S R Ramesh, “PROGRESSIVE COLLAPSE RESISTANCE OF FLAT SLAB BUILDING”, Engpaper Journal