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COVID-19 DIAGNOSIS SYSTEM BY JOINT CLASSIFICATION AND SEGMENTATION

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Abstract

The paper demonstrates the analysis of Corona Virus Disease based on a probabilistic model. It involves a technique for classification and prediction by recognizing typical and diagnostically most important CT images features relating to Corona Virus. The main contributions of the research include predicting the probability of recurrences in no recurrence (first time detection) cases at applying our proposed approach for feature extraction. What is worse, this number continues to increase. Early diagnosis of COVID-19 and finding high-risk patients with a worse prognosis for early prevention is vital. It is essential to screen as many as suspect cases for appropriate quarantine and treatment measures to control the spread of the disease. The viral test based on samples taken from the lower respiratory tract is the critical standard of diagnosis. However, the availability and quality of laboratory tests in the infected area may cause inaccurate results, false positive the combination of the conventional statistical and machine learning tools is applied for feature extraction from CT images through four images filters in combination with proposed composite hybrid feature extraction (CHFS). The selected features were classified by the stack hybrid classification system (SHC).). Experimental study with real data demonstrates the feasibility and potential of the proposed approach for the said cause.

Index Terms: *COVID-19, Joint Diagnosis, CT Classification, CT Segmentation, COVID-19 Dataset.*

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1. Introduction

Data mining skills involved in biomedical sciences and investigated for providing prediction for help to identify the disease and classify it correctly. Screening large numbers of reported cases for successful isolation and treatment is a priorityto control the spread of Corona Virus Disease (COVID-19). Pathogenic laboratory testing is the scientific gold standard but, given significant false-negative results, it is time-consuming. There is an urgent need for quick and accurate diagnosis methods to combat the disease.

Based on COVID-19 radiographic improvements in CT scans, we tried to create a deep learning algorithm that could extract the graphical characteristics of COVID-19 to provide a pre-pathogenic clinical diagnosis and thus save critical time for disease control. Even before clinical symptoms emerge, computed tomography diagnose irregularities in patients with laboratory- confirmed coronavirus, according to a new case report. It is yet another critical piece of evidence showing the central role of the modality in stopping the lethal epidemic. Thecase, reported in Clinical Imaging on February 22, reports that of a 61-year-old asymptomatic man admitted to a Chinese hospital 1,000 miles outside Wuhan after claiming close contact with an infected person. In addition to identifying earlyabnormalities, CT showed a result that was not seen in any other COVID-19 instances. As well as those previously diagnosed with standard viral pneumonia and SARS, we obtained 250 CT photographs of pathogen-confirmed COVID- 19 events from the Kaggle database web.

Our proposed hybrid feature extraction of four filters (MPEG-7 edge histogram filter with Gabor filter- pyramid of rotation- invariant local binary pattern histograms - fuzzy 64-bin histogram), which analyzes a low-level feature of an image canextract the features and provide a statistical hypothesis. Our proposed model using composite hybrid attribute selection (CHFS) to achieve high accuracy in prediction and improve the feature extraction methods with hybrid classification techniques for combine multi-classifiers to improving an in- depth investigation. Testing is employed to see which feature vectors/elements are most informative to differentiate different image classes. Also, using (CNN) for relatively little pre- processing compared to other image classification algorithms and traditional classifiers. The article planned as follows. The next section discusses the literature review of other authors who have used data mining and its relative of machine learning algorithm to analyze coronavirus. Section 3 describes the proposed technique used for feature extraction from CT images datasets with the CHFS model and four image filters. Section 4describes the method used for the stack hybrid classification process and convolution neural network (CNN) in comparison with traditional classifiers, whereas section 5 describes the experiments and evaluation. Section 6 discusses the results. Finally, section 7 presents the paper summary and conclusions.

Image Processing

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It isa type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually, Image Processing system includes treating images as two-dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technologies today, with its applications invarious aspects of a business. Image Processing forms core research area within engineering and computer science disciplinestoo.

- Importing the image with optical scanner or by digitalphotography.
- Analyzing and manipulating the image which includesdata compression and image enhancement and spottingpatterns that are not to human eyes like satellite photographs.
- Output is the last stage in which result can be alteredimage or report that is based on image analysis.

Purpose Of Image Processing

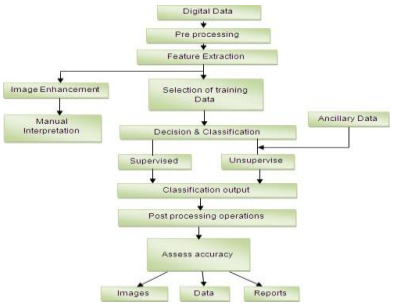
The purpose of image processing is divided into 5 groups. Theyare:

- Visualization - Observe the objects that are not visible.

- Image sharpening and restoration - To create a betterimage.
- Image retrieval - Seek for the image of interest.
- Measurement of pattern – Measures various objects inan image.
- Image Recognition – Distinguish the objects in animage.

The two types of methods used for Image Processing are Analogand Digital Image Processing. Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. The image processing is not just confined to area that has to be studied but on knowledge of analyst. Association is another important tool in image processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing.

Digital Processing techniques help in manipulation of the digital images by using computers. As raw data from imaging sensors from satellite platform contains deficiencies. To get over such flaws and to get originality of information, it has to undergo various phases of processing. The three general phases that all types of data have to undergo while using digital technique are Pre-processing, enhancement and display, information extraction.



In recent years, advances in information technology and telecommunications have acted as catalysts for significantdevelopments in the sector of health care. These technologicaladvances have had a particularly strong impact in the field of medical imaging, where film radiographic techniques are gradually being replaced by digital imaging techniques, and this has provided an impetus to the development of integrated hospital information systems and integrated teleradiology services networks which support the digital transmission, storage, retrieval, analysis, and interpretation of distributed multimedia patient records.

One of the many added-value services that can be provided over an integrated teleradiology services network is access to high-performance computing facilities in order to execute computationally intensive image analysis and visualization tasks. In general, currently available products in the field of image processing (IP) meet only specific needs of different enduser groups. They either aim to provide a comprehensive pool of ready to use software within a user-friendly and application specific interface for those users that use IP software, or aim for the specialized IP researcher and developer, offering programmer's libraries and visual language tools.

However, we currently lack the common framework that will integrate all prior efforts and developments in the field and at the same time provide added-value features that support and in essence realize what we call a 'service'. In the case of image processing, these features include: computational resource management and intelligent execution scheduling; intelligent and customizable mechanisms for the description, management, and retrieval of image processing software modules; mechanisms for the "plug-and-play" integration of already existing heterogeneous software modules; easy access and user transparency in terms of software, hardware, and network technologies; sophisticated charging mechanisms based on quality of service; and, methods for the integration with other services available within an integrated health telemetric network.

2. Related Works

In the LSM, the movement of the zero-level set is actually driven by the level set equation (LSE), which is a partial differential equation (PDE). For solving the LSE, most classical methods such as the upwind scheme are based on some finite difference, finite volume or finite element approximations and an explicit computation of the curvature. Unfortunately, these methods cost a lot of CPU time. Recently, the lattice Boltzmann method (LBM) has been used as an alternative approach for solving

LSE. It can better handle the problem of time consuming because the curvature is implicitly computed, and the algorithm is simple and highly parallelizable. The LBMis used to solve the LSE. The proposed method is based on the approach of the LBM PDE solver defined. In the proposed method, using a modified CNNobjective function, we design a new fuzzy external force (FEF). The method is fast, robust against noise, and efficient whatever the position or the shape of the initial contour and can detect efficiently objects with or without edges. It has, first, the advantage of the CNN which gives it the latitude to stop the evolving curve according tothe membership degree of the current pixel, second, the advantages of the LSM which allow it to handle complex shapes, topological changes,and different constraints on the contour smoothness, speed, size, and shape which are easily specified, and, third, the advantages of the LBM which make it very suitable for parallel programming due to its local and explicit nature.

Segmentation of Lungs from Ct Scan Images for Early Diagnosis of Lung Cancer

A patient undergoing a CT scan rest on a movable table at the center of a donut-shaped scanner, which is about 2.4 m (8 ft) tall. The CT scanner contains an X-ray source, which emits beams of X rays; an X-ray detector, which monitors the numberof X rays that strike various parts of its surface; and a computer. The source and detector face each other on the inside of the scannerring and are mounted so that they rotate around the rim of the scanner. Beams from theX-ray source pass through the patient and are recorded on the other side by the detector. As the source and detector rotate ina 360° circle around the patient, X-ray emissions are recorded from many angles. The resulting data are sent to the computer, which interprets the information and translates it into images that appear as cross-sections on a television monitor. By moving the patient within the scanner, doctors can obtain a series of parallel images, called slices. This series of slices is then analyzed to understand the three-dimensional structure of the body.

In medical imaging, segmentation is important for feature extraction, image measurements, and image display. In some applications it may be useful to classify image pixels into anatomical regions, such as bones, muscles,and blood vessels, while in others into pathological regions, such as cancer, tissue deformities and multiple sclerosis lesions. In some studies the goal is to divide the entire image into sub regions such as the white matter, gray matter, and cerebrospinal fluid spaces of the brain, while in others on specific structure has to be extracted, for example breast cancer from Magnetic Resonance images.

Segmented Morphological Approach to Detect Tumor in Lung Images

Image processing is one of most growing research area these days. In the following we are proposing an effective scheme to detect abnormal formation of cells in the lungs. Here we present an approach that detects the tumor from the lung image. In this proposed approach we have applied a series of operations, first to enhance the image and then to detect the tumor from the lung image. First of all we take an image and then enhance the contrast of an image by using contrast stretching technique to adjust its contrast. After normalizing theimage, we applied a series of steps to enhance the quality of an image and to remove the noise. In this approach enhancement of an image comes first, the aim of image enhancement is to improve the interpretability of information in images for humanviewers.

Image enhancement techniques can be divided into two broadcategories: Spatial domain methods, which operate directly on pixels, and Frequency domain methods, which operate on the Fourier transform of an image. When image enhancement techniques are used as pre-processing tools for other image processing techniques, then quantitative measures can determine which techniques are most appropriate.For enhancement first of all we applied Fast Fourier Transform. We applied Fast Fourier Transform (FFT) to enhance the imagequality. Fast Fourier Transform is a method to calculate computations which are large enough. It works on divide and conquers approach; it breaks N input values into N/2 values, so that it becomes easy to calculate. After the application of FFT, we used another enhancement method named histogram modeling technique; this is the technique that can be used to improve the visual appearance of an image.

Computer Aided Diagnosis System for Lung

Cancer Detection Using Support Vector Machine

A New CAD System for Early Diagnosis of Detected Lung Nodules is proposed. The growth rate is predictable by measuring the volumetric variation of the detected lung nodules over time, so it is important to accurately measure the volume of the nodules to quantify their growth rate over time. In this study, the author introduces a novel Computer Assisted Diagnosis (CAD) system for early diagnosis of lung cancer.

The projected CAD system involves five main steps. They are Segmentation of lung tissues from Computed Tomography (CT) images, Identification of lung nodules from segmented lung tissues, A non-rigid registration technique to align two successive LDCT scans and to correct the motion artifacts caused by breathing and patient motion, Segmentation of the detected lung nodules and Quantification of the volumetric changes. This preliminary categorization results based on the analysis of the growth rate of both benign and malignant nodules for 10 patients (6 patients diagnosed as malignant and 4 diagnosed as benign) were 100% for 95% confidence interval. The experimental results of the proposed image analysis have yielded promising results that would supplement the use of current technologies for diagnosing lung cancer.

Lung Cancer Cell Identification Based on Artificial Neural Network Ensembles

In this paper, based on the recognition of the power of artificial neural network ensemble, an automatic pathological diagnosis procedure named Neural Ensemble based Detection (NED) is proposed and realized in an early-stage Lung Cancer Diagnosis System (LCDS). NED utilizes an artificial neural network ensemble to identify cancer cells in the images of the specimens of needle biopsies obtained from the bodies of the subjects to be diagnosed. The ensemble used is built on a specific two-level ensemble architecture and a novel prediction combining method, which achieves not only a high rate of overall identification but also a low rate of false negative identification, i.e. a low rate of judging cancer cells to be normal ones we propose an automatic pathological diagnosis procedure named NED, which utilizes artificial neural network ensemble to identify lung cancer cells in the images of the specimens of needle biopsies.

The core of NED is a two-level ensemble architecture that is composed of heterogeneous ensembles that not only comprises individual networks with different number of outputunits but also employs different methods to combine individual predictions. In order to improve the accuracy of false negative identification, we also devised a novel prediction combining method named full voting that is utilized in the first-level ensemble. Through adopting those techniques, NED achieves not only high rate of overall identification but also low rate of false negative identification. NED has been realized in an earlystage lung cancer diagnosis system LCDS, which is being transferred into a routine examination following the analysis of X-ray chest films by Bayi Hospital currently.

Extraction and Segmentation of Sputum Cells for Lung Cancer Early Diagnosis

In this paper we focus on the extraction and segmentation of sputum cells from background regions. The sputum images are stained according to the standard staining method provided by the Tokyo Center for lung cancer in Japan. These images are stained with two types. Type1, blue dye images resulting in the dark-blue nucleus of all the cells present in the image and clear- blue cytoplasm. Type 2, red dye images resulting in the dark- blue nucleus of the small debris cells with their corresponding small clear-blue cytoplasm regions, and red sputum cell with dark-red nucleus and clear-red cytoplasm.

Some of the sputum nuclei cells overlap due to the dispersion of the cytoplasm in the staining process. The automatic assessment of the sputum cell state, using the sputum image, is based on the analysis of both the chromatic and geometric attribute of its nucleus and cytoplasm, therefore this process involves the extraction of their related regions in the image. This problem is viewed as a segmentationproblem whereby we want to partition the image into sputum cell regions including the nuclei and cytoplasm, plus the background that includes all the rest. Nevertheless, the sputum images are characterized by noisy and cluttered

background patterns that cause the segmentation and automatic detection of the cancerous cells highly problematic. There have already been attempts to solve this problem using heuristic rules. In thispaper, propose two methods for addressing this problem the first employed a threshold-based technique. The second method uses a Bayesian classification framework. The problem of extracting the nucleus and the cytoplasm is approached using a combination of robust mean shift segmentation and rule-based techniques.

CAD System for Lung Cancer Detection Using ANN

The Computer Aided Diagnosis (CAD) system has been developed successfully. This system was verified by the referred doctors throughout this project. The approach starts by extracting lung region. The RGA was used for extraction of thelung region. The diagnostic rules were used to eliminate false positive candidate nodules. One of the important advantages of Artificial Neural Network is their ability to learn information in data. The best

Detection of Lung Module Using Content Based Medical Image Retrieval

Computer Tomography (CT) has been considered as the most sensitive imaging technique for early detection of lung cancer. There is a requirement for automated methodology tomake use of large amount of data obtained CT images.

Computer Aided Diagnosis (CAD) can be used efficiently for early detection of Lung Cancer. The usage of existing CAD system for early detection of lung cancer with the help of CT images has been unsatisfactory because of its low sensitivity andFalse Positive Rates (FPR). This study presents a CAD system which can automatically detect the lung cancer nodules with reduction in false positive rates. In this study, different image processing techniques are applied initially in order to obtain the lung region from the CT scan chest images. Then the segmentation is carried with the help of clustering algorithm.

Finally for automatic detection of cancer nodules, SupportVector Machine (SVM) is used which helps in better classification of cancer nodules.

ANN architecture was developed and used for classification of lung cancer nodules in CT images. The CAD system helps the physician and the radiologist to identify the suspicious nodules and thus to increase the sensitivity of the diagnosis. Artificial Neural Network is developed for diagnosis and classification of candidate nodules obtained from application of diagnostic rules.

ANN work by training and testing process applied to it. The ANN network consist of three main layers input layer, hidden layer, output layer. The network is trained using Back propagation (BPA) algorithm. The idea of BPA is to reduce error produced by the difference between actual output and expected result. Initially the best optimized ANN is obtained byvarying various parameters of network like hidden nodes, training percentage for training ANN, number of epochs. After the successful network has been developed it is then ready for classification process. The performance of CAD system is measured by parameters like Accuracy, Sensitivity and Specificity.

The experimentation is conducted for the proposed technique by CT images. The database, where the images are kept is called Image database. In the preprocessing technique, the images are enhanced, segmented, and subdivided in order to make flexible work environment for further processing works. The proposed model is a combination of feature extraction methods namely texture and gray scale resolution. Then this combined form of feature set is stored as a single feature vector in the feature database. When the user submits a query image, the same process steps (such as pre-processing, feature extraction steps) are carried out as in the offline image database process in order to get the feature vector value for the query image. Then this query image feature vector value will be compared with feature vector value of the feature database.

Automated Segmentation and Hybrid Classifier for Identifying Medical

This study proposes the three stages automated pulmonary segmentation algorithm (AS algorithm) and the classification nodule method through Rough Set (RS) based on DWPT-SVD (Discrete wavelet packets transform- Singular Value Decomposition).

First, the lungs which are the region of Interest(ROI) were extracted from chest CT image with three stages automated segmentation algorithm. The performance of proposed segmentation method will be compared with a region growing method. Then, the DWPT-SVD was applied to obtain characteristic values of pulmonary images. Finally, those characteristic values were utilized as attributes for RS to classify pulmonary images. This paper proposes automated pulmonary segmentation algorithm (AS method) and the classification nodule method through Rough Set (RS) based on DWPT-SVD is proposed in this study. First, the lungs which are the regionof Interest (ROI) were extracted from chest CT image with three stages automated segmentation algorithm.

Detection And Classification of Lung Cancer Using Artificial Neural Network

In this paper the color features and texture features are extracted and the given image features are compared with given 35 sample images for classification using artificial neuralnetwork. In this three images are showing the lung cancer.

There are many techniques to diagnose lung cancer, such as Chest Radiography (x-ray), computed Tomography (CT), Magnetic Resonance Imaging (MRI scan) and Sputum Cytology. However, most of these techniques are expensive and time consuming. In other words, most of these techniques are detecting the lung cancer in its advanced stages, where the patient's chance of survival is very low. Therefore, there is a great need for a new technology to diagnose the lung cancer in its early stages. Image processing techniques provide a good quality tool for improving the manual analysis Segmentation is an extremely important operation in several applications of image processing and computer vision, since it represents the very first step of low-level processing of imagery. As mentioned above, the essential goal of segmentation is to decompose an image into parts which should be meaningful forcertain applications with color image segmentation which is becoming increasingly important in many applications. For instance, in digital libraries large collections of images and videos need to be catalogued, ordered, and stored in order to efficiently browse and retrieve visual information. Color and texture are the two most important low-level attributes used forcontent based retrieval of information in images and videos.

Because of the complexity of the problem, segmentation with respect to both color and texture is often used for indexing andmanaging the data.

3. Covid -19 Diagnosis System

To alleviate the drawbacks mentioned above, in this work, we 1) construct a large scale *COVID-CS* dataset with both patient-level and pixel-level annotations and 2) propose a *J*oint *C*lassification and *S*egmentation (*JCS*) based diagnosis system to provide explainable diagnosis results for med- ical staffs fighting with COVID-19. Specifically, we utilize the collected *COVID-CS* dataset that contains thousands of CT images from hundreds of COVID-19 cases to train our *JCS* system for better diagnosis performance. As illustrated in Figure 1, our *JCS* diagnosis system first identifies the suspected COVID-19 patients by a classification branch and provides diagnosis explanations via activation mapping tech- niques [20]. Our system is then feasible to discover the locations and areas of the COVID-19 infection in lung radiography via fine-grained image segmentation techniques. With the explainable classification results and corresponding fine-grained lesion segmentation, our *JCS* system largely sim- plifies and accelerates the diagnosis process for radiologists or other medical experts. As shown in Table II, our *JCS* system needs only 22.0 seconds for each infected case or 1 second for each uninfected case, much faster than the RT-PCR tests and CT scan analysis by experienced radiologists. With the assistance of our *JCS* system, experienced radiologists only cost 54.4 (32.4 for radiologists and 22.0 for *JCS*) seconds for each infected case or 1.0 second for each uninfected case, keeping the same high specificity and sensitivity.Hence, the speed and effectiveness of assistance have shown the superiority of our *JCS* system.

In summary, our contributions are mainly three-fold:

- **We construct a new large scale COVID-19 dataset**, called *COVID-CS*, which contains 3,855 fine grained pixel-level labeled CT images from 200 COVID-19 patients, 64,771 patient-level annotated CT images from 200 other COVID-19 patients, and

75,541 CT images of350 uninfected cases.

- **We develop a novel COVID-19 diagnosis system** to perform explainable Joint Classification and accurate lesion Segmentation (*JCS*), showing clear superiority overprevious systems.
- On our *COVID-CS* dataset, **our *JCS* system achieves 95.0% sensitivity and 93.0% specificity on COVID-19 classification, and 78.5% Dice score on segmentation**, surpassing previous state-of-the-art segmentation methods.

The remaining paper is organized as follows. In§II, we briefly summarize the related works. In §III, we intro- duce the developed diagnosis system for recognizing and analyzing the COVID-19 cases. In §IV, we present our *COVID-CS* dataset with our labeling procedures in detail. Extensive experiments are conducted in §V to evaluate the performance of our system on COVID-19 recognition, with in-depth analysis. §VI concludes this work.

Explainable Classification

In existing system, medical image segmentation algorithm was put forth by Automated segmentation of images has been considered an important intermediate processing task to extract semantic meaning from pixels. In general, the fuzzy c-means approach (CNN) is highly effective for image segmentation. But for the conventional CNN image segmentation algorithm, cluster assignment is based exclusively on the distribution of pixel attributes in the feature space, and the spatial distribution of pixels in an image is not taken into consideration. The existing CNN image segmentation scheme by utilizing local contextual information and the high inter-pixel correlation inherent. Firstly, a local spatial similarity measure model is established, and the initial clustering center and initial membership are determined adaptively based on local spatial similarity measure model. Secondly, the fuzzy membership function is modified according to the high inter- pixel correlation inherent. Finally, the image is segmented by using the modified CNN algorithm.And possibility can be viewed as absolute typicality, it measures the degree to which a point belongs to one cluster relative to all other data points, it can reduce the effect of outliers. Combining both membership and possibility can lead to worst clustering result.

Covid Dataset

The proposed feature extraction model and stack hybrid classification on covid19-Sars CT-images data in different cases pre-post feature extraction model and pre-post proposed stack hybrid classification and the result compared with CNN model on CT-images dataset. These comparisons, according toour proposed model presented in this study, were reduced a false negative rate and showed a relatively high overall accuracy with more accurate results. In the field of medical diagnosis an extensive diversity of imaging techniques is presently available, such as radiography, computed tomography (CT) and magnetic resonance imaging (MRI). Medical image segmentation is an essential step for most consequent image analysis tasks. Although the original CNN algorithm yields good results for segmenting noise free images, it fails to segment images corrupted by noise, outliers and other imaging artifact. And Image quality and accuracy is the core factors of this project, image quality assessment as well as improvement are depending on the enhancement stage where low preprocessing techniques is used based on CNN and feature extraction

Software Description

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

Typical uses include:

- Math and computation
- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including graphical user interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the

time it would take to write a program in a scalar noninteractive language such as C or Fortran.

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix softwaredeveloped by the LINPACK and EISPACK projects. Today, MATLAB uses software developed by the LAPACK and ARPACK projects, which together represent the state-of-the-artin software for matrix computation.

MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high- productivity research, development, and analysis.

Tool Boxes

MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

The MATLAB System

The MATLAB system consists of five main parts: Development Environment. This is the set of tools and facilities that help you use MATLAB functions and files. Many of these tools are graphical user interfaces. It includes the MATLAB desktop and Command Window, a command history, and browsers for viewing help, the workspace, files, and the search path.

The MATLAB Mathematical Function Library. This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

The MATLAB language: This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

This is the MATLAB graphics system. It includes high-level commands for two- dimensional and three-dimensional data visualization, image processing, animation, and presentationgraphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete graphical user interfaces on your system.

MATLAB Functions

A MATLAB "function" is a MATLAB program that performs asequence of operations specified in a text file A function accepts one or more MATLAB variables as inputs, operates on them in some way, and then returns one or more MATLAB variables as outputs and may also generate plots, etc.

Some functions are

Imread() – Reading the image from the graphics file.

A = imread(filename, fmt) reads a grayscale or color image from the file specified by the stringfilename. If the file is not in the current folder, or in a folder on the MATLAB path, specify the full pathname.

The text string fmt specifies the format of the file by its standard file extension. For example, specify'gif' for Graphics Interchange Format files. To see a list of supported formats, with their file extensions, use the imformats function. If imread cannot find a file named filename, it looks for a file named filename.fmt.

The return value A is an array containing the image data. If thefile contains a grayscale image, A is an M-by-N array. If the file contains a truecolor image, A is an M-by-N-by-3 array. For TIFF files containing color images that use the CMYK color space, A is an M-by-N-by-4 array. The class of A depends on the bits-per-sample of the image data, rounded to the next byte boundary. For example, imread returns 24-bit color data as an array of uint8

data because the sample size for each color component is 8 bits.

[X, map] = imread(...) reads the indexed image in filename into X and its associated colormap into map. Colormap values in the image file are automatically rescaled into the range [0,1].

Image- Write Image to Graphics File

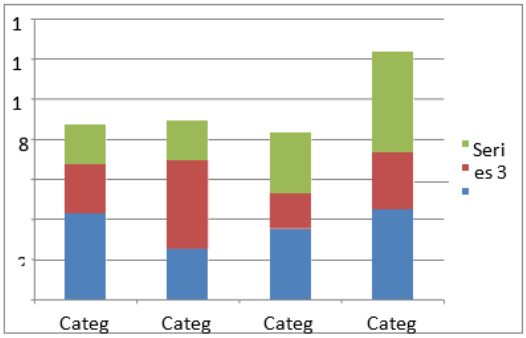
imwrite (A,filename,fmt) writes the image A to the file specified by filename in the format specified by fmt.

A can be an M-by-N (grayscale image) or M-by-N-by-3 (truecolor image) array, but it cannot be an empty array. For TIFF files, A can be an M-by-N-by-4 array containing color data that uses the CMYK color space. For GIF files, A can be an M-by-N-by-1-by-P array containing grayscale or indexed images — RGB images are not supported. For information about the class of the input array and the output image. filename is a string that specifies the name of the output file. fmt can be any of the text strings listed. This list of supported formats is determined by the MATLAB image file format registry. See imformats for more information about this registry.imwrite(X,map,filename,fmt) writes the indexed image in X and its associated colormap map tofilename in the format specified by fmt. If X is of class uint8 or uint16, imwrite writes the actual values in the array to the file. If X is of class double, imwrite offsets the values in the array before writing, using uint8(X–1). map must be a valid MATLAB colormap. Note that most image file formats do not support colormaps with more than 256 entries. When writing multiframe GIF images, X should be an 4- dimensional M- by-N-by-1-by-P array, where P is the number of frames to write. imwrite(...,filename) writes the image to filename, inferring the format to use from the filename's extension. imwrite(...,Param1,Val1,Param2,Val2...) specifies parameters that control various characteristics of the output file for HDF, JPEG, PBM, PGM, PNG, PPM, and TIFF files. For example, if you are writing a JPEG file, you can specify the quality of the output image. For the lists of parameters available for each format.

MATLAB Applications

The MATLAB Application Program Interface (API). This is a library that allows you to write C and Fortran programs that interact with MATLAB. It includes facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

What is Simulink?



4. Modules

Upload Datasets Preprocessing Image SegmentationFeature Extraction Evaluation criteria Simulink, a companion program to MATLAB, is an interactive system for simulating nonlinear dynamic systems. It is a graphical mouse-driven program that allows you to model asystem by drawing a block diagram on the screen and manipulating it dynamically. It can work with linear, nonlinear, continuous-time, discrete-time, multidate, and hybrid systems.

Block sets are add-ons to Simulink that provide additional libraries of blocks for specialized applications like communications, signal processing, and power systems.

Real-Time Workshop is a program that allows you to generate C code from your block diagrams and to run it on a variety of real-time systems.

State flow is an interactive design tool for modelling and simulating complex reactive systems. Tightly integrated with Simulink and MATLAB, State flow provides Simulink users with an elegant solution for designing embedded systems by giving them an efficient way to incorporate complex control and supervisory logic within their Simulink models. With State flow, you can quickly develop graphical models of event- driven systems using finite state machine theory, state chart formalisms, and flow diagram notation. Together, State flow and

Simulink serve as an executable specification and virtual prototype of your system design.

Modules Description Upload Datasets

The CT images dataset has two classes of images both in training as well as the testing set containing a total of around serval images each segregated into the severity of Sars and coronavirus It is aimed to diagnose COVID-19 form CT images by using CNN for which a set of CT-images of COVID19 from the Kaggle. Com benchmark web of dataset science was tested, to perform the accuracy of early-screen diagnosis.

Preprocessing

The goal of the Median filter is to filter out noise that has corrupted image. It is based on a statistical approach. Typical filters are designed for a desired

discovery of tumors. The goal of segmentation is to make simpler and/or modify the demonstration of the image into amazing that is more significant and easier to investigate. Image segmentation is classically used to situate things and borders (lines, curves, etc.) in images. The primary group is to separate the image based on unexpected modified intensity values, such as edges in an image. The second type is based on dividing the image into sections that are similar to the according predefined measure. CNN is an effective way of segmenting out objects in pictures containing both random noise and shading. This is illustrated both on mathematically created pictures and on some obtained from medical imaging. We segment the lung regions based on lung segmentation.

Feature Extraction

Image features Extraction stage is an important stage that uses algorithms and techniques to detect and isolate various desired portions or shapes (features) of a given image. To predict the probability of covid 19 presence, In fact, the proposed approach does the exact opposite; it tries to create a large number of weak features and expects the classifier to weight them according to their relevance during training. In general, many of the features may turn out to be irrelevant for a given application. However, our approach begins with a conservative feature set in order for it to be application- independent, at the expense of increased training complexity.In feature extraction, frequency response. Median filtering is a nonlinear operation often used in image processing to reduce "salt and pepper" noise. A median filter is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges.

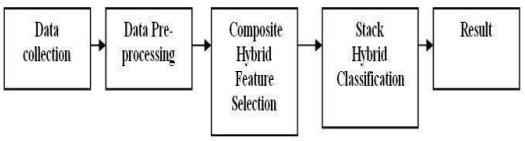
Image Segmentation

Image segmentation is an important process for the most part of image analysis consequent assignments. In particular, many of the previous methods for image report andidentification depend especially on the segmentation outcomes. Segmentation separates the picture into its ingredient sections or things. Segmentation of medical images in 2D, piece by piece has many useful functions for the medical expert such as: visualization and quantity evaluation of things of attention,

we calculate the size and shape of the tumor identified by calculating the diameter value of that tumorand provides result in millimeter (mm)

Evaluation Criteria

The proposed technique is efficient for segmentation principles to be a region of interest foundation for feature extraction obtaining. The proposed technique gives very promising results comparing with other used techniques. Relyingon general features, a normality comparison is made. The main detected features for accurate images comparison are pixels percentage and mask-labeling with high accuracy and robust operation

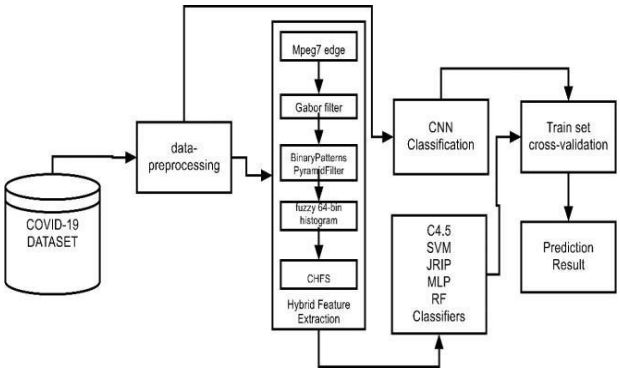


Data Processing

The CT images dataset has two classes of images both in training as well as the testing set containing a total of around serval images each segregated into the severity of Sars and coronavirus It is aimed to diagnose COVID-19 form CT imagesby using CNN for which a set of CT-images of COVID19 from the kaggle. com benchmark web of dataset science, was tested, to perform the accuracy of early-screen diagnosis.

The goal of the Median filter is to filter out noise thathas corrupted image. It is based on a statistical approach. Typical filters are designed for a desired

frequency response. Median filtering is a nonlinear operation often used in image processing to reduce "salt and pepper" noise. A median filter is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges.



Covid Dataset

Image features Extraction stage is an important stage that uses algorithms and techniques to detect and isolate various desired portions or shapes (features) of a given image. To predict the probability of covid 19 presence, In fact, the proposed approach does the exact opposite; it tries to create a large number of weak features and expects the classifier to weight them according to their relevance during training. In general, many of the features may turn out to be irrelevant for a given application. However, our approach begins with a conservative feature set in order for it to be application-independent, at the expense of increased training complexity. In feature extraction, we calculate the size and shape of the tumor identified by calculating the diameter value of that tumor and provides result in millimeter (mm)

5. Conclusions

In this system, DL architecture for early diagnosis of COVID- 19 by using a benchmark CT-Images dataset is proposed. The proposed model shows better results when two methods are taken into consideration. DL is much better than the traditional classification approaches for image classification process, and effectively reduced the false-negative rate with high accuracy, especially when using the Alex Net method. However, it is an old method that still finishes the test with 94. 74% compared to Inception-V4 with and accuracy 81. 14%, which is considerably less than the previous state-of-the-art result. The results of the proposed model have a high accuracy of COVID- 19 CT images DL method to be used to diagnose COVID-19 can efficiently and accurately calculate the infection of patients through simple and easily collected CT images, which in the near future can be applied to laboratory CT images as well. The architecture can be used to screen a large number of suspected people's CT data sets to save people's lives and to save limited medical resources Optimize the diagnosis process, and it can constantly learn, adapt, and upgrade can be improved soon as future work.

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