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Remote Diagnosis Decision Support System for Breast Cancer Screen

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ABSTRACT
A decision support system is intended to allow a health professional to efficiently and accurately identify diseases by the use of information and communication technology. One of the core criteria for the design of this system is the quick retrieval of the comparison and classification sample. Rapid assessment and consistency of classification remain an issue. The accelerated dedication and regeneration are normally less effective. It proposes a hybrid picture test cum classification based on the hybrid method that facilitates fast and accurate decision making. In mammograms of medical photographs, the tool developed for early identification of cancer in various phases is evaluated. The consequence of the overall entity proof based algorithm complexity analysis indicates that the proposed scheme can be incorporated in a typical practical decision support system.
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Key words: computer-aided diagnosis (CAD), computer aided diagnosis system(CADX), Decision support system(DSS).

1. INTRODUCTION

Breast cancer among woman is the second largest cancer in the world, as per the American cancer data 2, 66,120 new cases and 40,920 Deaths in 2018.the mortality rate is to be deceased by creating awareness.screening.detectimg early[1]. The increasing diagnosis and detecting capability of a breast cancer is improve the life time of the woman. With a large number of mammograms to be handled, the analysis of mammograms relies on the expertise of the radiologist, and the tumours can are readily missed when observing the picture in early stage of breast cancer since the clinical signs differ. Repetitive screening mammogram causes fatigue and strain to the radiologist, it affects the accuracy and leads to wrong prediction. In this situation computer aided diagnosis system is proposed (CADX)[2]. This systems are highlighting the suspicious areas. In mammogram, Based on this system classifies the calcifications are in which category{Benign or Malignant}.Theses are the advantages of digital imaging ,pattern reorganization, Computer vision and Machine learning. For this classification, a number of algorithms are used to improve precision, most likely using such algorithms as structure, shape, scale, etc. The collaborative essence of these systems is therefore the logic of decision-making can not clarify such that the application of CAD systems is checked. These CAD programmes are invoked for clinically appropriate and related mammogram scans of suspect areas in the CBIR (content-based image recovery system)[3-4].
A multistage classification based computer-aided diagnosis (CAD) system for breast cancer diagnosis is reported [1]. Feature extraction is performed on the mammogram region of interest (ROI) images. System able to handle three level of a one-stage, two-stage study, and a three-stage study. A maximum of 85.47%, 88.79%, and 93.52% classification accuracies reported on the three stages.
These kind of systems are used as a visual aid for radiologists And improve their confidence and accepting CAD systems for decision making. We proposed a remote system ,from that any patient can upload their mammograms and it can be viewed and analysed by remote radiologist through this system using various algorithmic techniques and find the calcification and classifying it, send the result to patient through LED indication[2].

2. DECISION SUPPORT SYSTEM

Decision support system is designed with Graphical User Interface (GUI) facility in order to help physician\Radiologist to analysis mammogram images easily[12-13]. The developed system also facilitate the patient to upload their image samples in ubiquitous manner. These ubiquitous uploading facility is enabled through TCP/IP programming and web-scripting. Labview software is used to design the GUI Front end. The designed front end is linked with TCP/IP socketprograming&web-scripting[4-8]

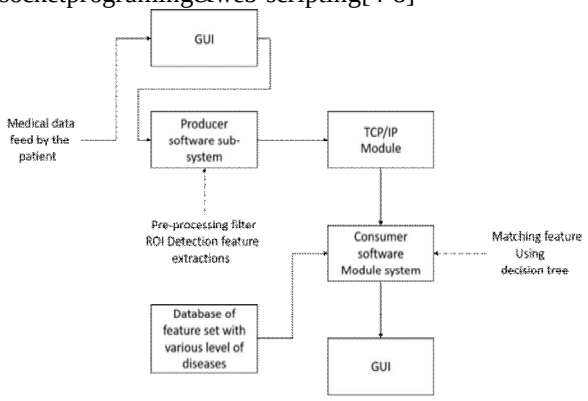

Figure 1: Block diagram of Decision support

At client side (patient side) the GUI is designed with help of HTML active page. The capability of the entire DSS system are:

2.1. Ubiquitously patient upload the mammogram image and can get initial screening result through machine learning algorithm (SVM with Bagging and boosting) which is running on the server side.

2.2. Ubiquitous initial screening result decision time is reduced with help of producer consumer software architecture, data mining algorithm and decision tree.

2.3. The accuracy of the screening is achieved (99.47 percentage) with new feature set SVM, data mining algorithm and decision tree.

2.4. The doctor side GUI system facilitates the patient information display, facility to select the machine learning algorithm, file uploading option and displays the possible level of cancer.

The entire flow of the proposed decision system is given in the figure no.1, by using web browser the user loads the front end GUI using which he will be uploading the images. Once the image is loaded the producer software subsystem is triggered. Then the producer system pre-processing the uploaded image by filtering the noises and ROI detection. The ROI detection mechanism is reported in [ROI paper]. The producer sub-system also extract the features by new feature extraction scheme which is reported in [paper]. The extracted feature sets are taken as final outcome of producer software which is given to TCP/IP module. The TCP/IP module communicates the extracted feature to the server. Once the features are received, the server system runs the consumer software module. The consumer software module matches the feature set with the data base of feature sets with the help of decision tree mechanism. The data base consist of pre-verified feature set of mammogram images with various level of diseases. There are 5 levels of diseases feature set which is named as level 0 – 4. The level of diseases data base is created with the help of expert Physician/Radiologist. The sample screen-shot of GUI system of doctor side is given in figure no. 2, from the figure 2 we can visualize the GUI facilitates loading of image, algorithm selection and displaying of various level of diseases with patient information[9-12].

3. RESULT AND DISCUSSION

The proposed ubiquitous system is tested with 100 patient in various location in order to analysis the performance of the system. The system is tested with 3 aspect:

1. Accuracy test
2. Responses time test with various location and internet speed
3. Cross validation with expert

The accuracy test is carried out with various machine learning algorithm. On the average the following accuracy levels are achieved with 100 trial test.

Table 1: Accuracy table

S.No	Algorithm	Accuracy in percentage
1	Decision tree	93
2	SVM with new feature	97.7
3	SVM with data mining, and bagging	99.47

From table no.1 it is absorbed that maximum of 99.47 percentage of accuracy is achieved by the proposed system. The accuracy of the proposed system is compared with the literature method which reported in table no.2.

From table no.2 it can be absorbed that proposed mechanism out perform in comparison with other literature methods. The decision time is evaluated on three different speed of internet connection and on different location. The results are reported on table no.3

Table 2 : Accuracy comparison table

Related Research	Result achieved by related research method	Result achieved by Proposed method
Kaur, P., Singh, G. and Kaur, P., 2019. Intellectual Detection and Validation of Automated Mammogram Breast Cancer Images by Multi-Class SVM using Deep Learning Classification. *Informatics in Medicine Unlocked*.	1. 88.7% accuracy for decision tree 2. SVM improved -96.9%	1. accuracy 93% for decision tree 2. With new feature SVM–accuracy 97.7% 3. With bagging and mining algorithm SVM-accuracy 99.47%
Li, H., Zhuang, S., Li, D.A., Zhao, J. and Ma, Y., 2019. Benign and malignant classification of mammogram images based on deep learning. *Biomedical Signal Processing and Control*, *51*, pp.347-354.	1.DenseNet-II neural network model-average accuracy 94.55%	1. With new feature SVM–accuracy 97.7% 2.With bagging and mining algorithm SVM-accuracy 99.47%
Shastri, A.A., Tamrakar, D. and Ahuja, K., 2018. Density-wise two stage mammogram classification using texture exploiting descriptors. Expert Systems with Applications, 99, pp.71-82.	1. New feature design with Histogram of Gradients (HOG) and Gabor filter combination called Histogram of Oriented Texture (HOT) *2. density wise classification-92% accuracy*	1. With new feature SVM–accuracy 97.7% 2. With bagging and mining algorithm SVM-accuracy 99.47%

Table 3: Response time measurement

SNo	Internet speed	Distance from server (in Km)	Response time (in seconds)
1	200mbps	50	10
		250	15
2	100mbps	50	20
		250	25
3	256kbps	50	45
		250	60

The table no.3 shows the measured response 3 internet speed of 200mbps, 100mbps, 256kbps at the distance of 50km and 250km.the response of 10seconds is achieved for the best case of 200mbps internet speed at distance of 50km. the worst case response time is absorbed with the value of 60seconds for 256kbps internet speed at the distance of 250km. on the doctor side(server side) the response time is reduced by means of data mining algorithm and decision tree mechanism from 1 second to 500 mille-seconds. For the comparative purpose various machine learning algorithms are applied and the results are compared [paper]. The sample result graph is given in the figure no. 3

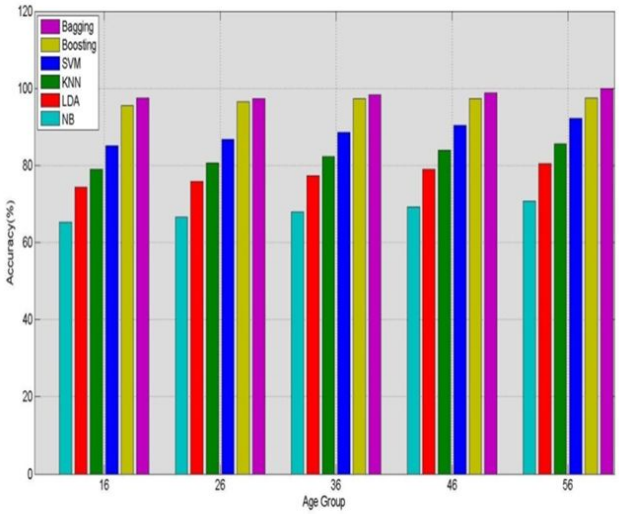

Figure 3: Accuracy comparison

In figure 3, Bagging, Boosting, SVM, KNN, LDA, NB are compared and best result showed at Bagging with 97.7 percentage.

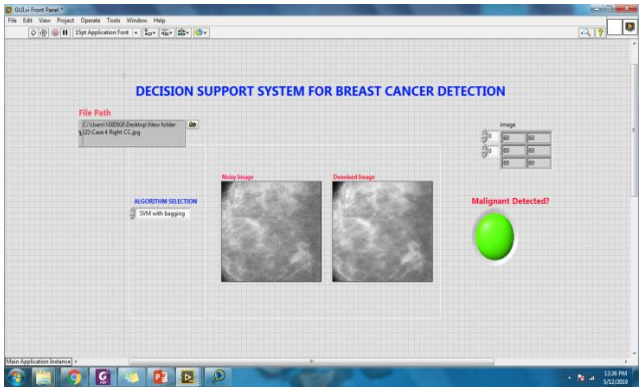

Figure 4: DSS for Breast cancer Detection

5. CONCLUSION

This work deal the CAD based decision support system which uses new feature generation. The proposed system support remote diagnosis which enable rural people who are not able to access the expert to utilize the diagnosis system . The system utilizes the SVM, LDA and decision tree mechanism. A hybrid mechanism based image retrial cum classification is proposed which will make quick decision with guaranteed level of accuracy.

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