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EFFECTIVE DETECTION OF BREAST CANCER AT EARLY STAGE USING VARIOUS CLASSIFIERS

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Abstract: This study has been undertaken to investigate the determinants of stock returns in Karachi Stock Exchange (KSE) using two assets pricing models the classical Capital Asset Pricing Model and Arbitrage Pricing Theory model. To test the CAPM market return is used and macroeconomic variables are used to test the APT. The macroeconomic variables include inflation, oil prices, interest rate and exchange rate. For the very purpose monthly time series data has been arranged from Jan 2010 to Dec 2014. The analytical framework contains**.** Cancer is one among the most frightful diseases known to man. Most people feel that getting cancer means that their life span has shorten whatever they do to treat themselves. Advancements in the recent treatment have drastically improved the survival rate of patients compared to last 2–3 decades. For the early detection of breast cancer mammography is the effective method that is used. Breast cancer is more effectively detected using the digital mammograms. This paper proposes a method for the detection and classification of mass abnormalities in digital mammogram images using multi SVM classifier, Radial Basis Function Neural Network (RBFNN), and Long Short-Term Memory (LSTM). The objective of this project is to escalate the diagnostic accuracy of image processing and for a more precise classification between malignant and benign abnormalities in mass region which reduces the misclassification of breast images. Normal and abnormal abnormalities are detected from the segmented images using K-means, which correspond to the Regions of Interest (ROIs) or abnormal regions. Gray Level Co-Occurrence Matrices (GLCMs) method is used to extract texture-based features from the ROI samples. Using these feature extractions as base, the image will be classified using classification techniques like Support Vector Machine (SVM) and Radial Bases Function Neural Network (RBFNN), and Long Short-Term Memory (LSTM. These classification techniques will be evaluated based on their resulting accuracy.

Index Terms **- Digital Mammogram, SVM, GLCM, Malignant, Benign, Region of Interest (ROI), Radial Basis Function Neural Network, Long Short-Term Memory.**

I. INTRODUCTION

Cancer is often termed to be one of the scariest diseases in mankind. Most people feel that getting cancer means that their life span has and that whatever they do to treat themselves, there is no hope of survival. By the recent advancements in medical treatment in the last 2-3 decades the survival of patients has drastically improved. Due the mutations in genes which regulate cell growth leads to occurrence of cancer. The mutated cells divide and multiply in an uncontrolled way. Breast cancer forms in either the lobules or the ducts of the breast, often the uncontrolled cancer cells invade other healthy breast tissue and can also travel to the lymph nodes under the arms. For a cancer cell to travel to other healthy tissue lymph nodes act as the primary pathway.

As per the report breast cancer has a rate of 25.8 women per 100000 women in India 2017 Studies show that with all age combined almost 350000 women living with breast cancer in India and is 2017 Studies show that with all age combined almost 350000 women living with breast cancer in India and is projected to increase to a shocking level of 1800000 by early 2020 as per predictions. For the early detection of cancer MRI and Digital Mammogram techniques are used, which show 1 out of 12 women are affected by breast cancer. The screening process in digital mammogram was causing the major drawback leading to 15% misclassification. It is possible to detect the stage of abnormality in breast tissue. The breast abnormality is generally classified as either normal or abnormal. Micro calcification clusters (MCCs) and Mass lesions (or masses) are the two most important radiographic indications related to breast cancer. Benign tumors are not harmful to human tissue and it has defined borders, but there is no significant border found in malignant tumors and they grow rapidly on the breast tissues.

The Poor image quality, physician eye fatigue, the nature of radiographic, can affect the quality of image and due to this reasons the mammographic images may be wrongly identified and classified. To avoid these wrong identification Magnetic

Resonance Imagining technique (MRI) are used with help of computer aided diagnostic model is used. Mammogram and MRI image classification was carried out by using GLCM feature extraction method with SVM, RBFNN classifiers, and LSTM classifier.

II. METHODOLOGY

2.1 Image Acquisition:

The digital mammogram images containing both benign and malignant state as well as normal images are collected from the Hospitals. The patient images are collected from Rajiv Gandhi Government General Hospital and Bharathiraja Speciality Hospital & Research Centre, for classification between benign and malignant in mass regions between benign and malignant in mass regions.

2.2 Image Processing:

The preprocessing is removal of noise and the background (black pixels) is concealed from the mammogram images. This is mainly performed to remove the noise and background from the image and it is done by Median Filter which is a non linear filter, which is very much effective at removing of impulse noise like salt and pepper in an image. This filter doesn't affect the edge or boundaries of the image. The filtering process is accomplished by sliding a window over the image.

2.3 Image segmentation:

To find the region of interest (ROI), segmentation is done on the enhanced image. Firstly, The image is converted to gray scale image. Then, Segmentation is done using region based segmentation and K- means. This algorithm tries to partition the dataset into K pre-defined distinct non-overlapping subgroups (clusters) in which each data point belongs to only one group. The lesser the variations occurring within the clusters, the more homogeneous the data points are in the same cluster.

2.4 Feature Extraction:

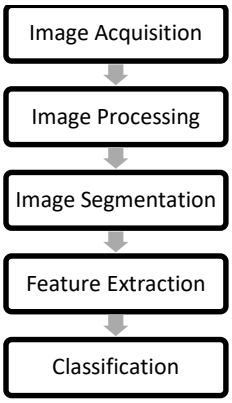
This process involves reducing the number of resources required to mark out large set of data. For texture features analysis Gray-Level Co- occurrence Matrices (GLCMs) technique is the efficient method. The GLCM characterize the texture of an image by calculating the occurrence of specified spatial relationship. The extraction of features is done by using four spatial position, horizontal, vertical, left and diagonal corresponding to 00, 450, 900, 1350 and four pixel distance d= 1,3,6 and. The statistics gives information about the textures of an image like: Mean, Standard deviation, Entropy, Variance, Contrast, Correlation, Energy, Homogeneity and Auto Correlation.

2.5 Classification:

For classification of data Support Vector Machines (SVM), Radial Basis Function Neural Network (RBFNN), and Long Short-Term Memory (LSTM) are used. SVM algorithm analyzes data used for regression analysis. To classify the tumor the nine features are extracted. SVM use Kernel Trick to efficiently perform a non-linear classification.. To classify benign and malignant images the multi-SVM classifier is used. The extracted GLCM features are feed as input to the classifiers and are classified.

The RBFNN is an artificial neural network where, radial basis functions are used as activation functions. The Basic architecture of RBF has a 3-layers network. The input layer is a fan-out layer and no processing occurs in it. The second or hidden layer performs a non-linear mapping from the input space and converts into a higher dimensional space in which the patterns become linearly separable. The last layer performs a simple weighted sum with a linear output. The activation of hidden units in this network depends on the distance between the input vector and a prototype vector.

The (LSTM) is an another type of artificial recurrent neural network (RNN) architecture which is used in the field of deep learning. LSTM has feedback connections, unlike standard feed forward neural networks. This neural network not only process single data points (like images), but it can also process an entire sequence of data (like speech or video). For example, LSTM is applicable to tasks such as unsegmented, connected handwriting recognition, speech recognition and anomaly detection in network traffic or IDS's (intrusion detection systems). A common LSTM unit is composed of a cell, an input gate, an output gate and a forget gate. The cell remembers values over arbitrary time intervals and the three gates regulate the flow of information into and out of the cell.



III. ALGORITHM

- Let I be the input image
- Image is segmented using Region Based Segmentation with K-means technique.
- For feature extraction GLCM is used.
- Multi SVM, LSTM, and RBFNN classifier compares the feature extraction output and classified MAT file.

- Output is the classified type of tumor.

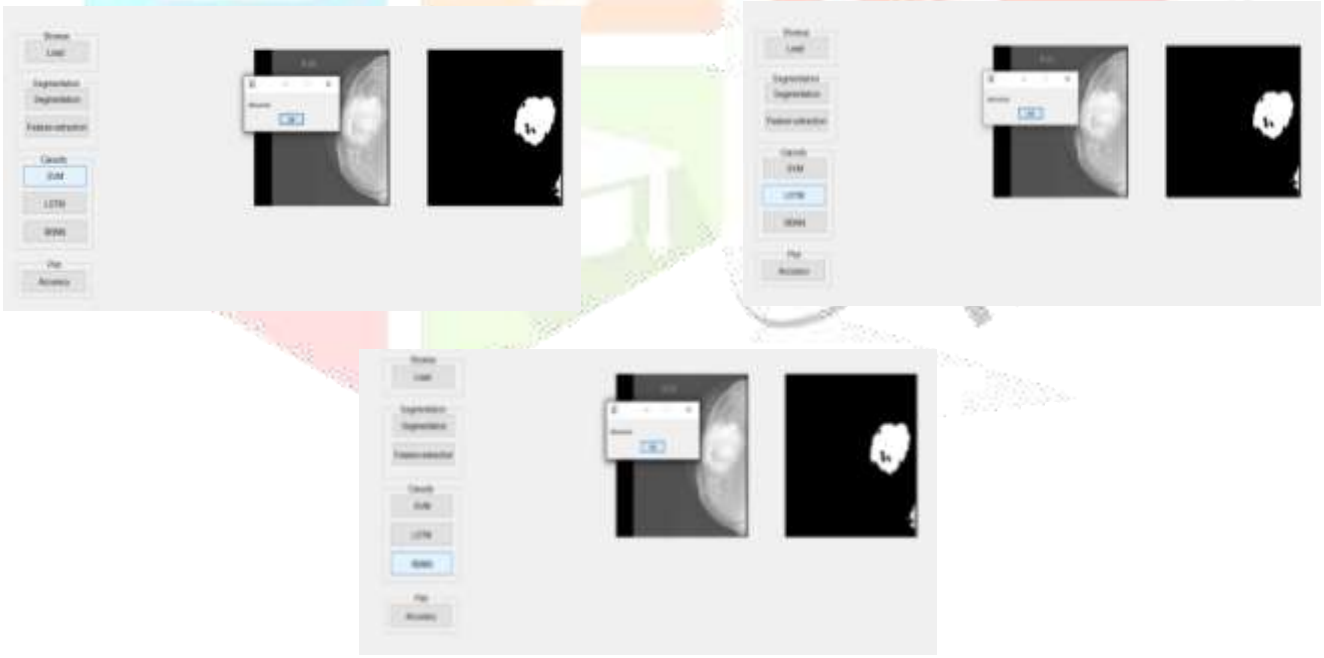
IV. RESULTS AND DISCUSSION

In this proposed work, a set of mammogram images are acquired from hospitals. The image are segmented using Region based segmentation with K-means algorithm, the features are extracted using GLCM feature extraction, Multi-SVM, LSTM and RBFNN classifier are used for classifying the mammogram images into normal and abnormal classification.

Table 4.1: Feature Extracted Values For Abnormal Images

FEATURES	Image 1	Image 2	Image 3	Image 4	Image 5
Mean	93.8744	102.6935	94.2717	79.4702	97.2568
Standard Deviation	66.7574	65.1256	58.8553	61.1174	57.1446
Entropy	0.1964	0.2121	0.0830	0.0630	0.0675
Variance	3.7245	3.7266	3.8405	3.8783	3.8703
Contrast	0.0044	0.0040	0.0016	0.0005	0.0007
Correlation	0.9451	0.9551	0.9426	0.9731	0.9681
Autocorrelation	1.1220	1.3890	1.0411	1.0318	1.0341
Energy	0.9163	0.9065	0.9709	0.9731	0.0766
Homogeneity	0.9978	0.9980	0.992	0.9997	0.9996

FIGURE 1 SEGMENTED OUTPUTS OF ABNORMAL IMAGES



IV. CONCLUSION

In this algorithm the input image, is segmented using region k-means and classified using SVM, RBFNN, and LSTM classifier. The classifier classifies the image features with the significant dataset. It trains the feature extracted with respect to the significant data set. The input images contain 25 normal and 25 abnormal images. The accuracy of the classifiers is:

Classifier	Accuracy
SVM	90%
LSTM	92%
RBFNN	95%

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