MAMMOGRAM MASS CLASSIFICATION BASED ON DISCRETE WAVELET TRANSFORM TEXTURAL FEATURES

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1. OBJECTIVE

- To develop a Computer Aided Diagnostic (CAD) system based on discrete wavelet transform textural features using K- Nearest Neighbor classifiers (K- NN), Radial Basis Function Neural Network (RBFNN) & Support Vector Machine (SVM) classifying breast nodules as either benign or malignant on mammographic images.

2. METHODOLOGY

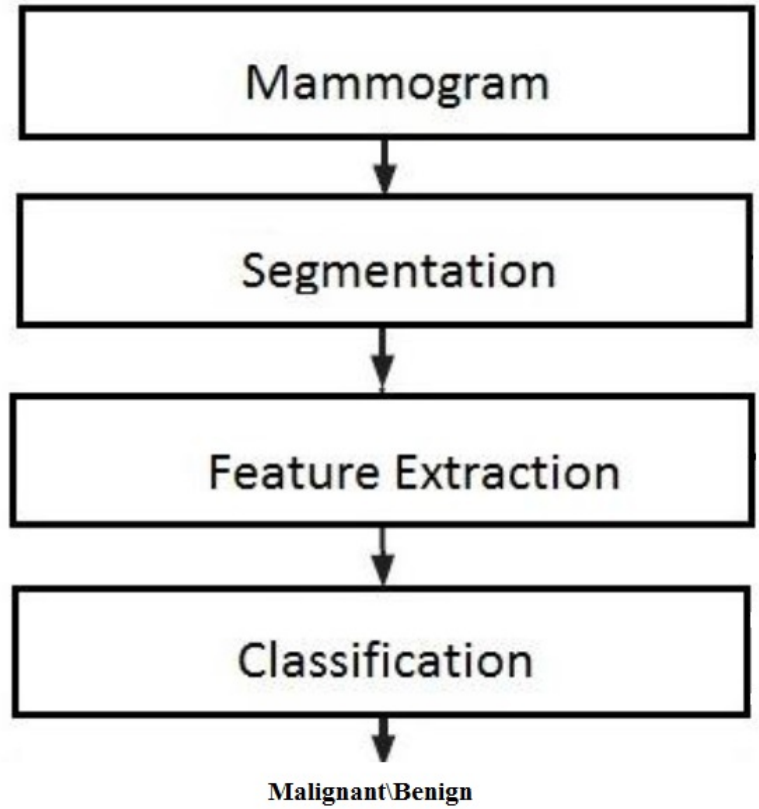

Figure 1: Methodology of the developed CAD system

3. IMAGE DATABASE

- Mammogram is a low dose x- ray exam of the breasts to look for any abnormalities.
- The results are recorded on x- ray film (Screen Film Mammograms) or directly into a computer (Digital Mammograms).
- Images used are Digitized Screening Mammograms.
- Mammograms in the Mini Mammographic Image Analysis Society (MIAS) database is used here.
- The size of all the images is 1024 pixels x 1024 pixels.
- Image Database with 148 images: 56 Malignant and 92 Benign images.

4. SEGMENTATION

4.1. Manual Segmentation

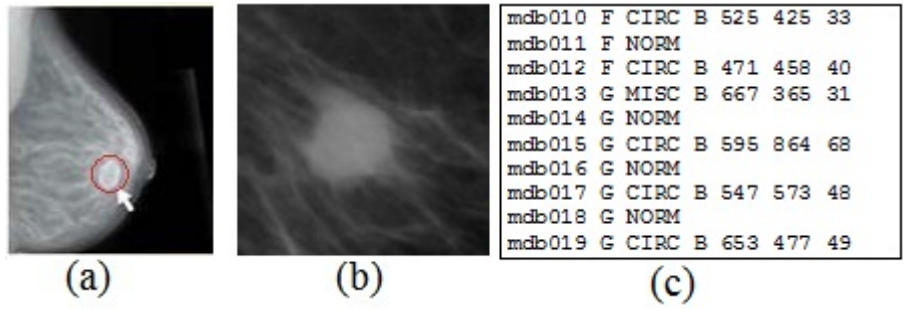

Figure 2: (a) Mammogram with circular ROI. (b) Manually segmented ROI. (c) Database Details

- Mini MIAS database provides the ground truth information with each mammogram.
- Suspicious region is specified in terms of x, y co ordinates with r radius by the radiologist: circular ROI.
- Region of Interest (ROI) is manually segmented as rectangular region of interest.

$$I_{AD} = [x - r, 1000 - y] \tag{1}$$

$$I_{NonAD} = [x + 50 - r, 900 - y] \tag{2}$$

5. FEATURE EXTRACTION

5.1. Discrete Wavelet Transform

- Energy measures textural uniformity.

$$Energy = \sum_{x,y} (d_{x,y}^{subband})^2 \tag{3}$$

- Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution.

$$\beta = \frac{E[(g - \overline{g})^4]}{(E[(g - \overline{g})^2])^2} \tag{4}$$

- Standard deviation is a measure of contrast in an image.

$$\sigma = \sqrt{\sum_{g=0}^{L-1} (g - \overline{g})^2 P(g)} \tag{5}$$

6. CLASSIFIERS

6.1. K Nearest Neighbor classifier

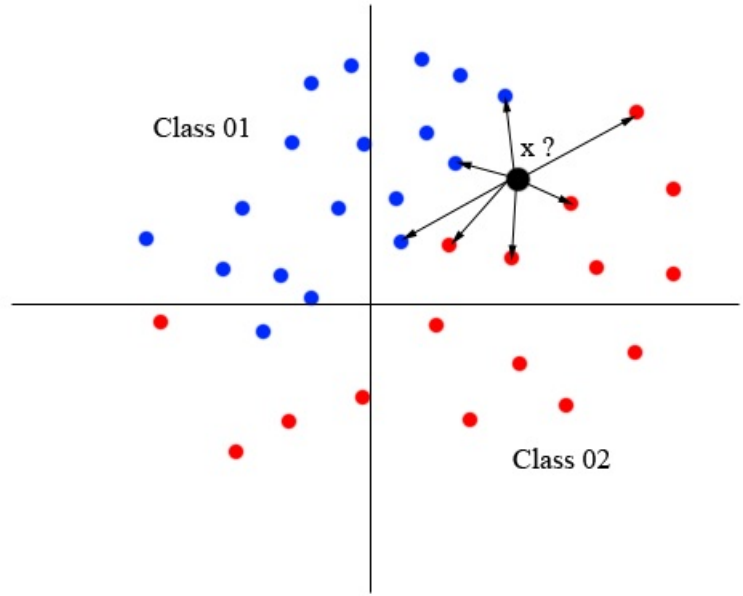

Figure 3: k–Nearest Neighbor algorithm representation

- Distance can be calculated using:

$$d(x_i, x_j) = \sqrt{\sum_{r=1}^{n} (x_{ir} - x_{jr})^2} \tag{6}$$

6.2. Support Vector Machine (SVM)

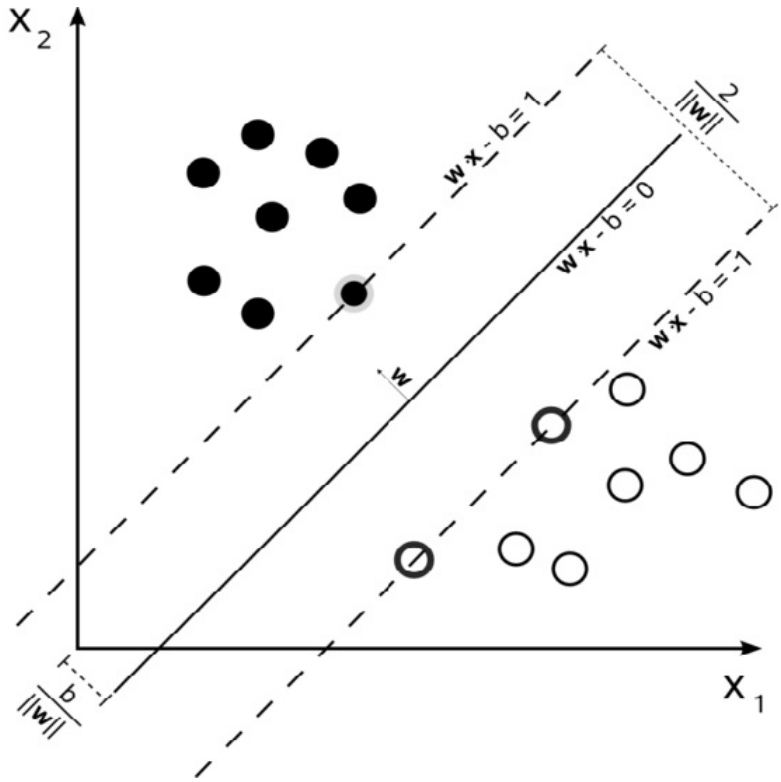

Figure 4: SVM classification general representation

6.3. Radial Basis Function Neural Network(RBFNN)

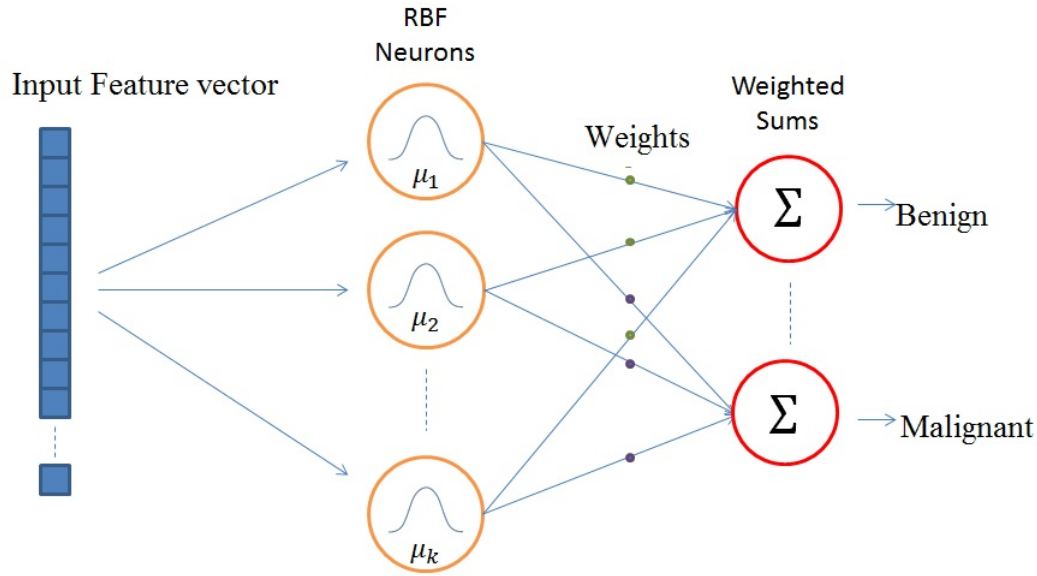

Figure 5: RBFNN architecture

- Input feature vector, Hidden layer with 32 RBF neurons & output layer with 2 neurons.

7. Performance Comparison

K-NN	P'	N'
P	37	9
N	1	27

SVM	P'	N'
P	42	4
N	3	25

RBFNN	P'	N'
P	43	3
N	5	23

Figure 6: Performance Analysis

8. CONCLUSION

- Segmentation of mammograms were done with manual segmentation and feature extraction is done by DWT.
- The accuracy of K–NN classifier can be varied from 80% to 85% by changing the value for k.
- SVM Classifier has given an average accuracy of 85% for DWT features.
- RBFNN with DWT features outperforms all other classifiers with an accuracy of 93.24%.

9. REFERENCES

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THANK YOU