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IMPLEMENTATION OF BREAST TUMOR DETECTION USING NEAR INFRARED SENSOR AND LSVM ALGORITHM

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Abstract: *The breast cancer can be detected by the execution of automated tumor detection techniques on medical images. Some of the medical imaging techniques such as MRI, CT ,micro wave cannot detect tumor of size below 3mm.This can be detected by using Near Infrared (NIR) imaging techniques and Lagrangian Support Vector Machine (LSVM) Algorithm. This is an non-invasive method of detecting tumors. The breast is enclosed within a skull which is very rigid, so any growth inside such a restricted space can cause problems. A breast tumor is a collection of abnormal cells in the breast. Breast tumors can be cancerous (malignant) or non-cancerous (benign).Therefore, the Short Time Fourier Transform (STFT) filter is used.*

Keywords- Head phantom, Photo Detector, tumor cells, NIR sensor, LSVM, DFT,STFT filter.

1.INTRODUCTION

The optical breast cancer detection mainly focuses on spectroscopic nature of optical cancer detection and experimental results obtained using each technology. Most current clinical methodologies utilize radar technology for cancer diagnosis,. An alternate approach is to examine the Biochemical and metabolic changes induced by cancer, either globally or locally. Although NIR techniques can be used to image thick tissue, given the diffuse nature of light propagation, sub-millimeter spatial resolution is not attainable. Thus, the resolution of NIR is insufficient to expect increased sensitivity/specificity by morphological measurements over ultrasound, MRI, and mammogram. However, it is not necessary to image a cancer to detect it. The biochemical spectroscopies of MRS and PET are used in cancer detection. PET includes biochemical sensitivity principally through the uptake of radio-labeled glucose, and MRS employs the detection of cancer-specific chemicals, especially phosphoryl choline. MRI also utilizes the pharmacokinetics of gadolinium contrast agents for physiological parameters, blood flow, and permeability. NIR employs the optical intrinsic absorption signals of blood, water, and lipid concentration available in the NIR window and many extrinsic labeled organic compounds. NIR extrinsic labels are available for spectroscopic identification of cancer. Spectroscopic methods will have a high signal-to-noise ratio and a moderate response time, i.e., 1-3 milliseconds, and provide detection of small amounts of cancer-detecting biochemicals or small changes therein.

2.MODULE DESCRIPTION

2.1.NIR SENSOR

Near optical led is used as a tool for monitoring important hemodynamic parameters in tissue non invansively .NIR can typically penetrate much further into a sample than mid infrared radiation. Led offers great life time and spectral stability and reduced power requirement. NIR optical LED diode have ceased production of their 80 nm device and released new generation of high efficiency 850 nm technology. Since optical LED is used for security purpose, a LED with eye safety under IEC 60825-I standard is used.

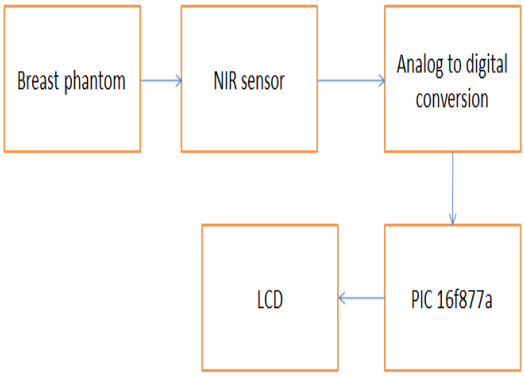


fig 2.1.1.Architecture of Breast cancer detection

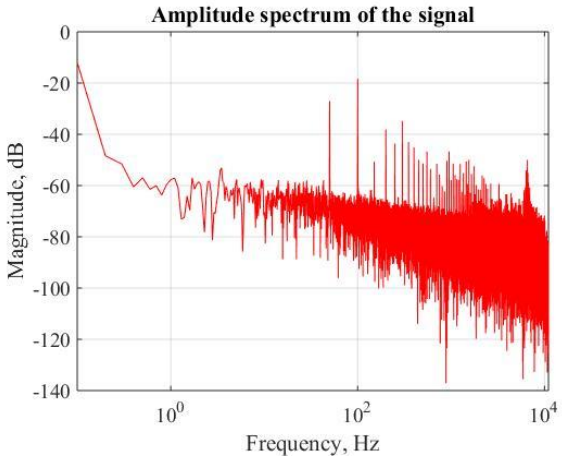


fig 2.1.2 NORMAL SIGNAL

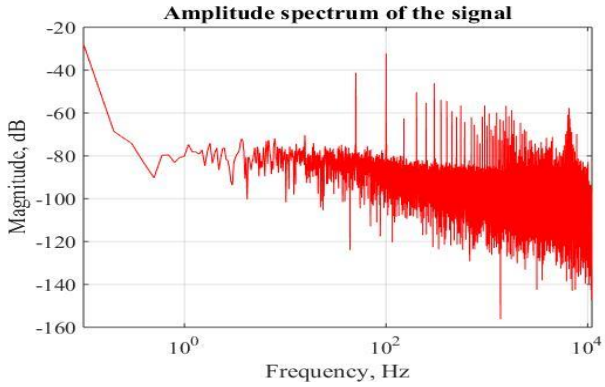


fig 2.1.3 CANCER SIGNAL

2.2.BREAST PHANTOM

The breast phantom is made up of glass which has the thickness equal to the skin. And the tissue is made up of normoxilic polyarylamide gel with the same dielectric properties. The NIR sensor is used which has the 780nm wavelength transmitter & photo detector is used. From this photo detector the signal is passed to the STFT filter.

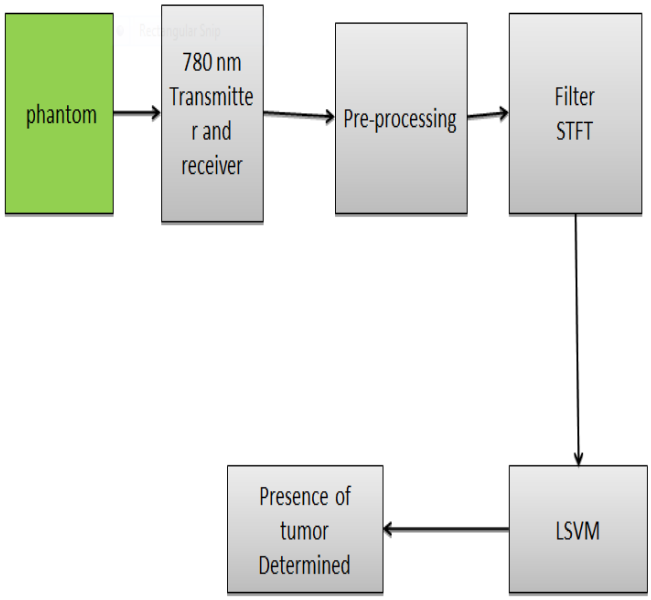


fig 2.2.1.Block diagram of breast cancer detection technique

2.3.SHORT TIME FOURIER TRANSFORM (STFT)

To apply the DFT to a real signal, either calculate one Discrete Fourier Transform (DFT) for the whole signal (impractical, especially for long signals) or split the signal into blocks and calculate a DFT for each block. The STFT uses the second possibility: The signal is split into blocks of equal length. The blocks are overlapping . Each block is windowed, i.e. multiplied with smooth function, which nearly vanishes near the edges. Segment the signal into narrow time intervals (i.e., narrow enough to be considered stationary) and take the DFT of each segment. Each DFT provides the spectral information of a separate time-slice of the

signal, providing simultaneous time and frequency information. The STFT can be computed according to the following formulas:

STFT filter is very useful for analyzing time-variant, non-stationary signals.This is appropriate for representing discontinuities or sharp corners (i.e., requires a large number of Fourier components to represent discontinuities).

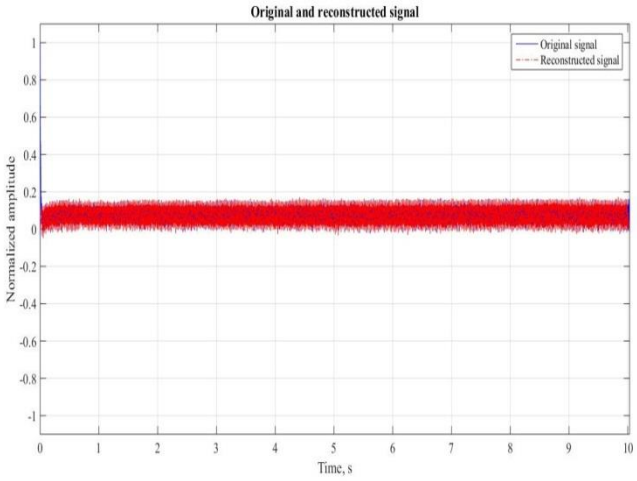
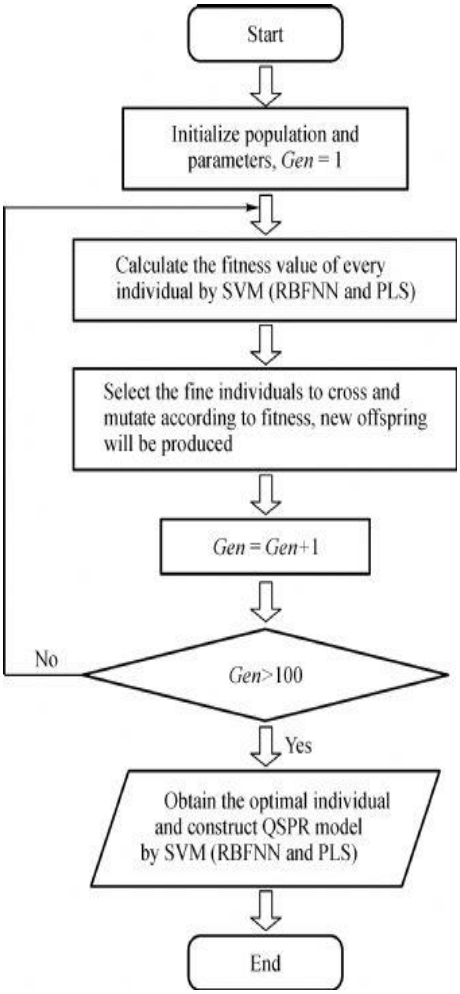


Fig 2.3.1. NORMAL STFT

2.4.LAGRANGIAN SUPPORT VECTOR MACHINE (LSVM)

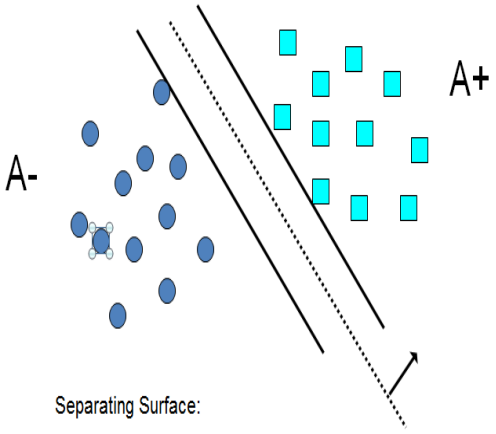
LSVM is a fast algorithm and simple iterative approach expressible in 11 lines of MATLAB code. It requires no specialized solvers or software tools, apart from a freely available equation solver.This algorithm inverts a matrix of the order of the number of features (in the linear case).



2.4.1.ER Diagram of LSVM Algorithm

The Discrimination Problem

The Fundamental 2-Category Linearly Separable Case



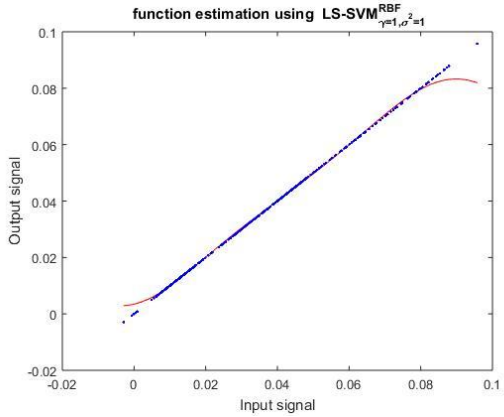


fig 2.4.2. NORMAL LSVM

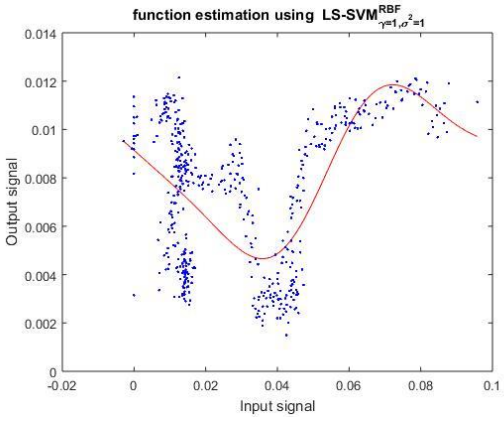
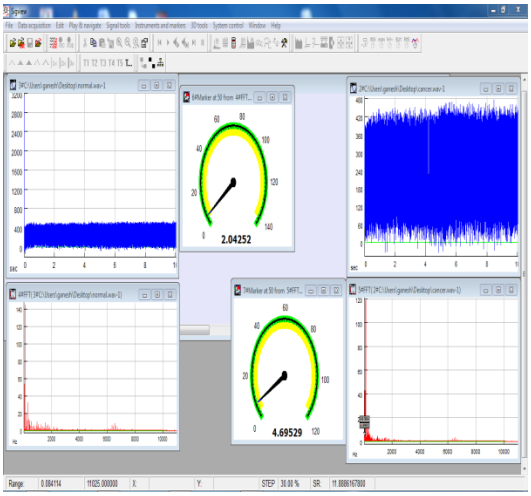


fig 2.4.3. CANCER LSVM

3.RESULT

In this section, first the breast phantom is designed then by using NIR Sensor the signals are transmitted and received. The received signals differs for normal cells and tumor cells. The STFT filter is used to distinguish these obtained signals by computing DFT for each of the signals. For accurate results, LSVM algorithm is used. So that the size and location of tumor cells can also be determined. Therefore, The tumor of siz below 3mm can be detected more accurately.

4. PERFORMANCE COMPARISION



5.CONCLUSION

The detection of breast tumor using Near Infrared sensor is a low powered, high accurate and high speed technique.Compared to other detection techiques, the results obtained in this proposed system is more accurate because of using LSVM algorithm.The breast tumor was successfully detected in an artificial head phantom. By using STFT filter, time and frequency informations of signals are determined. The location and the size of tumor can also be determined.This technique will detect the tumor of size below 3mm without damaging breast cells.

6.REFERENCES

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