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RECENT TRENDS ON CANCER IDENTIFICATION USING DIGITAL IMAGE PROCESSING TECHNIQUES

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Abstract: This paper is focused on a study of various biomedical scanning techniques of various tumors like brain, skin, cervix, ovarian, ovary, thyroid. This study also carry on various biomedical image types of X-ray, Ultrasound, CT, CAT, CAD, MRI, FTIR spectroscopy, Pap smear cytology and PET. The latest trends in biomedical image processing techniques, detection methods, and tumor area calculations of various cancers are also involved in this study. The accuracy, efficiency, processing time and quality performance parameters of SNR, PSNR, MSE and also the tumor identification using image processing techniques of noise removal, binary imaging, histogram, edge detection and segmentation are efficiently discussed. This study is helpful in analyzing the biomedical images and identification of challenges in this field.

Index Terms **- Scanning Techniques, Cervical Cancer, ZSI, Feature Extraction**

I. INTRODUCTION

Cancer is a disease in which abnormal or damaged cells are grow uncontrollably and spread to other parts of the body and this may forms tumors is shown in Figure 1. Tumors can be identified into cancerous or non cancerous. There are more than 100 types of cancers. The cancers are based on specific types of cell are Carcinoma is in the most common types of solid tumors, Sarcoma is a cancer largely in bone and soft tissues and Leukemia is non solid tumors forms in the blood tissues and bone marrow, Lymphoma, Multiple Myeloma, Melanoma, Brain and Spinal Cord Tumors and etc [1]. The world health organization (WHO) alert the death count of cancer caused patients are 10 millions in 2020. It also emphasis the most common cancer diseases are from breast to stomach cancers. This list also extended to cervical cancer is the most common in 23 countries [2]. The early detection of cancer is better to cure and this leads to better life. This proposed study deals with biomedical imaging techniques and its deals with various types of cancers with effectives tools and methods.

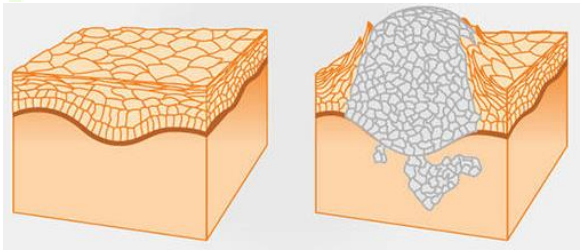

Figure 1: Normal cell and Cancer Cell

Brain Tumor detection (Vipin Y. Borole and Seema S. Kawathekar, 2016) using MRI Scanning involved the DIP tools of preprocessing, segmentation is shown in the Figure 2, morphological operation and also it deals with color (intensity), edge, texture for tumor area calculation and image quality parameters [3].

I. LITERATURE REVIEW

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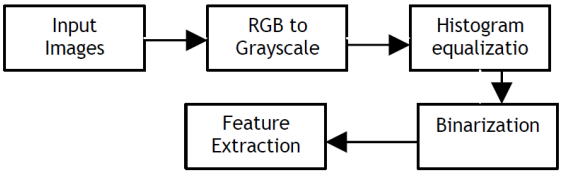


Figure 2: Pre-Processing techniques

Breast Cancer detection (Xiaochen Tang ,Yunbo An,and Congshan, 2021) method deals with data processing system, model system and image segmentation and recognition system. It involved texture feature, morphological characteristics, spatial features and slice identification of document management system. This system improved the accuracy of digital mammography involved in preprocessing technology Pathological image and medical image recognition technology[4]. Automatic Segmentation system (Ammar Akram Abdulrazzaq et al., 2022) used the random forest, Neural Networks and Detection of contours of the regions for diagnosing breast abnormalities of mammography images. The basic schematic of the neural Network is shown in Figure 3.

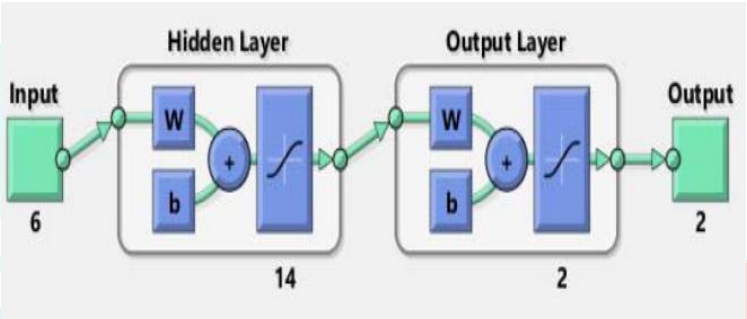


Figure 3: basic schematic of the neural Network

This system methodology involves the Digital Image, Monochrome Image, Thresholding, Neural Networks and Random Forest classifier [5]. Segmentation-Based Machine Learning Techniques deals with contrast restricted adaptive histogram equalization (CLAHE), fuzzy SVM, Bayesian classifier, and random forest for Diagnosis of Breast Cancer effectively. This system focused on histogram equalization technique to improved the efficiency of the system [6] Breast Cancer Calcifications (Sushovan Chaudhury et al., 2021) methods involved in Morphology of calcifications of Benign and Suspicious calcifications. It also deals with Machine Learning Algorithms of Supervised learning, unsupervised learning and Reinforcement learning. Preprocessing phase, region based segmentation, textual feature analysis algorithm and classification algorithms are applied for efficient diagnosis of breast cancer [7]. Breast Cancer Detection method (T.C. Cahoon and et al, 2020) involved in supervised and unsupervised methods of segmentation. The k-nn and fuzzy c-means algorithms and adding window means and standard deviations are involved to improve the segmentation of digital mammograms for significantly reduce the number of mislabeled pixels[8]. Clusters of fine, granular micro calcifications (tumor) and individual grains appearance of uterus are used to early detection of uterine cancer (Snehal N. Patil, K.V.Kulhalli and Smita S. Patil, 2014). This cancer is a serious threat to women health. This method contains three modules. Module 1 contains the digital image processing tools of Image Acquisition and preprocessing. Module 2 contains Region of Interest (ROI) and segmentation. Finally Module 3 contains Feature Extraction and Analysis for tumor classification. The preprocessing deals with noise removal algorithms of Average and Median filter for Salt Pepper Noise and Gaussian Noise. Radius, Area (A), Compactness (C), Roundness (R) and Irregularity Index of Features Extracted parameters of Benign Uterine are confined to precise detection of the tumor [9]. Neural Network Classifier, morphology and Histogram techniques (Elayaraja and Suganthi, 2018) are used for detecting the Cervical cancer. The enhancement of edges and multi resolution of images are achieved with the help of Oriented Local Histogram Technique (OLHT) and Dual Tree Complex Wavelet Transform (DT-CWT)[10]. The morphological and wavelet are applied to segment the abnormal cell. This system is effectively classify the normal and abnormal cells. This proposed system was achieved the performance metric of 97.42% of sensitivity, 99.36% of specificity, 98.29% of accuracy, Positive Predictive Value (PPV) of 97.28%, Negative Predictive Value (NPV) of 92.17%, Likelihood Ratio Positive (LRP) of 141.71, Likelihood Ratio Negative (LRN) of 0.0936, 97.38 % precision, 96.72% False Positive Rate (FPR) and 91.36% False Negative Rate (FNR)[10]. Cervical cancer detection from colposcopy images (Venkatesan Chandran et al, 2021) using ensemble deep learning network. This system contains two deep learning CNN architectures. The outcome of the proposed system of performance metrics are high sensitivity of 92.4%, specificity of 96.2% and kappa scores of 88%. The CYENET system achieved the higher accuracy of 92.3% compared to VGG19 (TL) model[11]. Segmentation of cancer cells from Pap smear images (Mithlesh Arya and et al, 2018) using morphological functions and Feature Extraction. This system focus on shape, size, and texture of nucleus of the cancer cells using effective support vector machine (SVM) classifier. The proposed system achieved the accuracy rate of 96% ,specificity 100% and sensitivity of 95.6%[12] RGVF segmentation and SVM Classification for automatic identification of cervical cancer cell. Radiating Gradient Vector Flow (RGVF) algorithm is effectively classified the cytoplasm and nucleus of the cell. Support Vector Machine (SVM) and artificial neural networks (ANN) are also included in this system. The performance of metric of Zijdenbos similarity index (ZSI) and of segmentation and classifier performance analysis are compared with Fuzzy C Means (FCM) and

RGV. This automatic detection is achieved the accuracy of 93.78 % and sensitivity of 98.96 % and specificity of 96.69 % compared the existing systems [13]. Mathematically ZSI can be expressed as:

$$ZSI = \frac{2TP_s}{2TP_s + FP_s + FN_s}$$

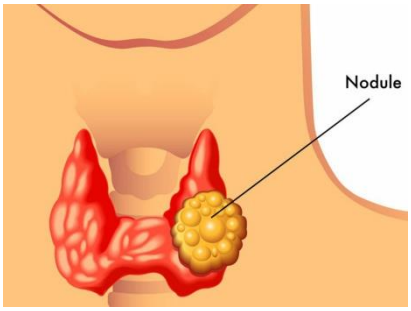


Figure 4: Thyroid Nodule

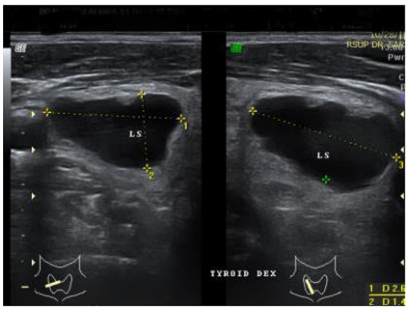


Figure 5: Thyroid ultrasound imaging

Hanung Adi Nugroho and et al, 2021 proposed the Computer aided diagnosis for thyroid cancer system[14]. This system can be classified into two characteristics are Internal and External. Thyroid diagnosis methods find the malignancy of nodules in Thyroid gland of ultrasound images to assist radiologists Figure 4 & 5. The thyroid cancer diagnosis involved in various steps are followed as shown in Table 1.

Step 1: Preprocessing	Applying speckle noise removal algorithm of adaptive median filter followed by bilateral filter
Step 2	Nodule Segmented by morphological and active counters operations
Step 3: Final step	➢ Internal characteristics was done by SVM ➢ External characteristics was done by multilayer perceptron. Geometric and texture features are also involved

Table 1: Computer aided diagnosis for thyroid cancer system using DIP

Xuesi Ma and Lina Zhang, 2022[15] was proposed the Diagnosis of Thyroid Nodules used the method of automatic thyroid nodule classification in ultrasound images. This system involved in an image enhancement and deep neural networks for diagnosis of thyroid cancer at early stages. Histogram equalization and the neural Networks algorithms are used for an image enhancement and Image segmentation of thyroid cancer ultrasound images.

Diagnosis of Malignant Thyroid Nodule using Artificial Intelligence system [16] was proposed to reduce errors in traditional diagnosis methods of thyroid nodule. It analysis the spatial and frequency domains of artificial intelligence and also involved in weighted binary cross-entropy loss function. Shokofeh Anari and et al, 2022 [17] was proposed to eliminate the time consuming process of existing systems. This system involved the deep learning method and analyses the practical problems and clinical workflow of ultrasound and CAD imaging system.

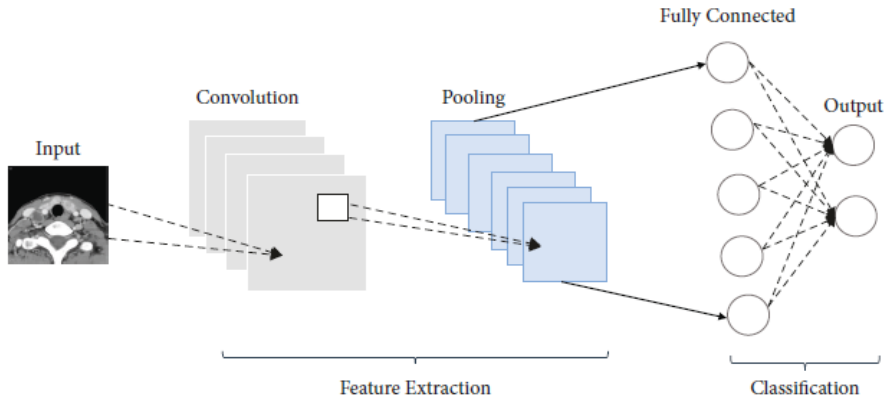
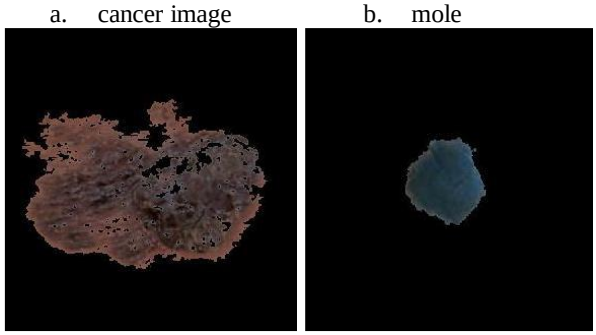


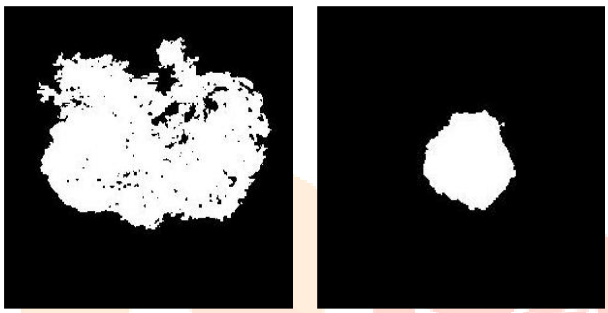
Figure 6: Simple structure of CNN

Melanoma skin cancer detection [18] was proposed to early diagnosis of using Melanoma skin cancer using computer aided techniques. The main cause of the melanoma is prolonged and extensive exposure of ultraviolet light. This system involved the Segmentation and feature stages of texture, size and shape analysis.

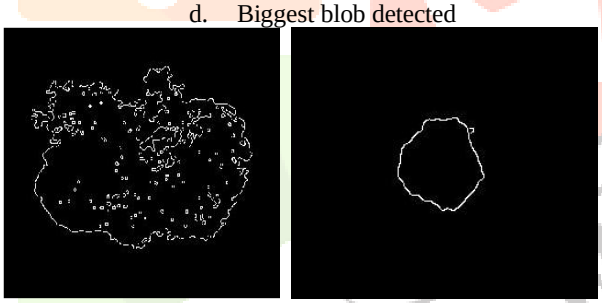
a. cancer image b. mole



c. Mask is created



d. Biggest blob detected



e. Edge detection

Figure 7: Melanoma Cancer Image and segmentation

This system is also classified and detects the skin into Normal skin and Melanoma cancer lesion is shown in Figure 7. Sara Medhat and et al, 2022[19] was proposed the Skin cancer diagnosis using convolutional neural networks. This system involved the skin cancer images acquisition from smart mobile phone. This system involved various binary classification and CNN architectures. Multiclass skin cancer classification method[20] was proposed to remove the fine-grained variability and remove the hair from the images. Precision, Recall, Accuracy, F1 Score, and Confusion Matrices are used to determine the performance of the system. It produced the highest quality performance and characteristics like resolution scaling, data enhancement, noise removal, successful transfer learning of ImageNet weights, and fine-tuning.

Kamil Dimililer, Yoney Kirsal Ever and Haithm Ratemi, 2016 [21] system was proposed the diagnosed the eye tumor in PET-CT images to extract the tumor is shown in Figure 8. This system involved smoothing of image for median filter and to increase the brighter area of tumor by subtracts the background of the image and added it to original image. Eye Tumour Detection System and Intelligent Eye Tumour Detection System are involved in two phases of the proposed system.

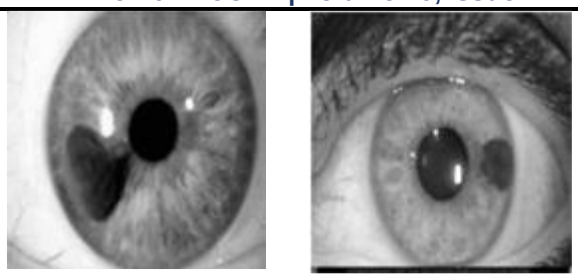


Figure 8: Eye tumour images.

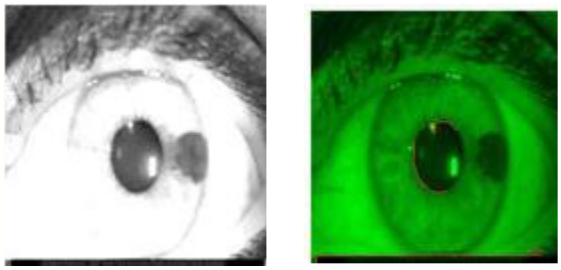


Figure 9: Adjusted and Fused images

Deep Learning techniques [22] was used to detect the eye tumour. The eye tambour is also known as Iris melanocytic tumours and its detection method involves expensive and early detection is very difficult. PET - CT, eye ultrasound, angiogram, optical coherence tomography, etc. are bio imaging of eye. The Deep network model and Hough circle transformation are used to extract the eye ball and iris region. This system qualitative performance of accuracy of 95% was achieved. The iris camera and setup is shown in Figure 10.

Figure 10: Iris camera and setup

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