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A SURVEY ON CATEGORIZATION OF BREAST CANCER IN HISTOPATHOLOGICAL IMAGES

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Abstract - Cancer is a baneful disease across the world . It mainly affect both public and private health system. Particularly in females, breast cancer is the second most type of cancer affecting largely and particularly mass dangerous types when not properly observed and treated. Many trending imaging technologies are there for verdict, biopsy is the most common way to detect cancer when it is present. . Histopathological images are mainly used in diagnosis purpose. Accurate detection of these characteristics are essential to obtain morphological characteristics for diagnosis of diseases. Advances in machine learning algorithm and also image processing techniques are very much useful in pathological image classification. Advances in image processing and machine learning modes ,in which CAD(Computer-Aided Diagnosis) systems are built, which helps pathologists to be more, objective and consistent in the diagnosis process. One of the obstacle facing is the deficiency of large publically available datasets. Due to the different shapes and size of tissues image classification is difficult. Different methods are used to get better accuracy in images. A comprehensive survey on classification of breast carcinoma in histopathological images is done in this paper.

***Key Words*:** breast cancer, histopathological image, image processing, machine learning, computer-aided diagnosis.

1. INTRODUCTION

Cancer is one of the major health issues. According to the word cancer research fund there was an increase of 20% of disease in recent days. Unhealthy diet is one of the major factor causing cancer. When compared to other type of cancer BC have high mortality rate. Among all types of cancer BC is the second most type of cancer occur commonly in females .Early detection of cancer is one of the major challenging task. Biopsy is the nearly common way to detect cancer when it is present. In biopsy first samples of cells are collected .These samples are placed across a glass microscope slide for microscopic examination. Detection of cancer from a histopathology image persist the "gold standard" especially in BC.

One of the chief goal in classification of histopathological images is the categorization of images as cancerous and non-cancerous. Thus, the main challenge of work is to create a reliable classification with large available datasets. Nowadays CNN become an important area in classification purpose. High percentage of accuracy can be obtained. Advances in machine learning algorithm and also image processing techniques are very much useful in pa image classification. Computer based system and many other analysis system plays an important role in quantitative analysis. In histological images the detection and segmentation of object of interests is a challenging undertaking due to the large variance in appearance.

2. CLASSIFICATION METHODS

Mitko Veta et.al [14] analyses all the methods for breast cancer detection in histopathological images. Structural differentiation of tissue is one of the main factor in detection. Many quantitative techniques are used as an explanation to the problem of observer variability. Bloom –Richardson grading system is used for the automatic detection of mitosis. CAD system is also used in order to reduce the overall workload of the pathologist. IHC methods are used in analysis of breast cancer. CAP methods are used to detect the survival of patients. These methods are cost effective. One of the drawback of these systems is the scarcity of large datasets.

Fatema Tuz Johra et.al[7] proposed fuzzy logic based method in detection of histopathological images .Fuzzy logic is a method which create human thinking as a basic mathematic rule in problem solving and decision making. Fuzzy based system mainly consist of 3 steps. Fuzzification,Inference and Defuzzification. In fuzzification all input and output variables are defined. Fuzzy inference step gives a fuzzy output.The last step is defuzzification which predict the final output.

LeiHe et.al [16] exposed a method for the study of microscopic dissection of cells and tissues in organisms. Level set methods are used to detect topological changes in an image .Level set methods use level sets as an apparatus for analysis of shapes. The main advantage is it can perform numerical computations

D Bardou et.al [20 Proposed a process for the classification of breast cancer .Biopsy is used for breast cancer identification which gives a clear picture of the abnormal cells in the images. Pattern recognition based systems are used to improve the overall quality of images.2 machine learning techniques are used. First method used a bag of word model for the feature extraction .The second main approach is CNN which solve challenging classification task.

Vibha Gupta et.al [3] they proposed an approach which uses texture features and ensemble method for classifying histopathological images .The main goal of the act is to classify images based on different magnification levels. Large variability in tissue advent is used to get different magnification levels.

Smrithi H Bhandari et.al [13] proposed a process to solve the problem in detection of malignant tissues in breast histopathological images .Bag of feature method is used to represent the content of dataset .SIFT technique is used for feature extraction. By using Euclidean distance further classification is carried out.2 main stages are used in classification .first stage classified image as normal or else cancerous .Second stage represent cancerous tissues as invasive or in situ.

S Doyle et.al [1] proposed a novel method for impulsive detection of breast cancer histopathological images and distinguish as high and low grades .They exposed a dataset of 3400 images which include textural and nuclear based features. Spectral clustering is used to abate the dimension of images. SVM classifier is used to classify images as cancerous and non-cancerous image and to distinguish low and grades of cancer.

FA Spanhol et.al [18] proposed a method which represents a brief description of all available dataset for breast carcinoma histopathological image classification. Dataset mainly consist of 7909 breast cancer images from 82 patients. The main goal of this paper is automatic classification of images into 2 classes. The classification accuracy ranges with 80-85%.

AE Tutac et.al [6] proposed a medical knowledge guided paradigm for indexing of histopathological images. A rule based decision method is used to narrow the semantic gap which is one of the major confronts in medical image analysis and indexing. This method is a robustic tool for the visual positioning and semantic retrieval.

FA Spanhol et.al [2] proposed a method which uses DECAF features for breast cancer detection .These features gives high accuracy in breast cancer recognition system .This is an automatic malignant breast cancer recognition system .DeCaF is a scalable method and less apt to error. CNN can achieve high recognition rate. Increase in cost is one of the cons. In order to reduce the cost more feature based method is introduced.

Peikari et.al [8] proposed a work based on the sophisticated analysis of the tissue structures. Whole tissue area were divided into smaller tiles and Gaussian-like texture filters were applied to them. Texture filter responses from each tile were combined together and statistical measures were derived from their histograms of responses. B. A support vector machine classifier is mainly used for classification. In this method the whole tissue area is mainly divided into smaller regions. Texture filter is used to combine all the smaller regions. Classification accuracy is 87%.

Belsaree A D et.al [11] proposes a system based on the histopathological image classification using textural features. Spatio-color-texture graph segmentation method is used. In this method first images are segmented as epithelial lining and then features such as gray level co-occurrence matrix, graph run length matrix features , euler numbers are then extracted A linear discriminant analyzer is used for the classification purpose. This classification method mainly help the pathologists for the carcinoma image analysis. Future work mainly focus to extent the classification of malignancy grades of breast histology images and also enhance the diagnosis process.

Qu,Hirokazu Nosato et.al [12] proposes a system on pathological image classification by using higher order local auto association feature. Here a novel image preprocessing and area scalable evaluation method is used. In the novel preprocessing technique a result with no false negative and with 3%false positive rate is shown. In the scalable evaluation method pathological images are segmented into smaller regions and local area is evaluated without any additional computational cost .Anomaly detection performances is enhanced and the location of anomaly is estimated.

Loay E George et.al [15] proposed a method for the classification of breast tumors. Fractal geometry texture analysis is one of the main advantage. The approach mainly consist of 2 steps. The extraction of fractal dimension and a classifier which automatically identifies the breast tumor tissue. A k means clustering innovation is used to define sets of centroids. This method is applied is applied on 24 histopathological breast tumor images.

Pin Wang et.al [19] proposed an method known as curvature scale space corner detection method for nuclei detection in breast histopathological images. This method mainly splits the surrounding cells to get better accuracy. Here for finding the region of interest wavelet disintegration and multi scale region growing are combined together. Chain –like agent genetic algorithm is proposed for the classification.

Hossam M Moftah et.al [5] proposed a k mean clustering method for classification and segmentation. This method is more efficient than the old k means clustering algorithm. This method is mainly useful for interpretation of medical images.

Kursad Ucar et.al [10] proposed a classifier known as Wavelet Neural Network. Wavelet Neural Network is a type of artificial neural network. This current method is based on wavelet transform and neural network .The proposed model reveals how WNN classifies by using certain formulas.

Xing F et.al [17] proposed a work based on tissue structure. Computer aided methods are commonly used. This method mainly improves the reproducibility and also objectivity. Cell observation and subdivision plays a very important role in the molecular complex information. Major challenge is to overlap nuclei cells. Cell subdivision is very much important in the complex computations which determines the category of cells. One of the major challenge is pixel wise classification

AB Tosun et.al [4] proposed a method for unsupervised subdivision of histopathological images. Here a texture descriptor is introduced to specify the background knowledge. It almost quantifies the spatial allocation of tissue components with the help of graph based method. The graph based algorithm mainly enables to select a very common parameter which leads to good segmentation results. Future work proposed a texture descriptor for supervised classification. These descriptors are mainly used for cancer diagnosis and grading.

Zhang X et.al [9] proposed a system for the automatic analysis of the histopathological images. Here computer aided diagnosis method and content based image retrieval methods are mainly used. To develop a scalable image retrieval technique with the histopathological images is the main aim. A supervised kernel hashing technique is also used. Here binary codes are indexed in a hash table for the real time retrieval of images. This methods achieves an accuracy of 88%.Main advantage is that it is a time efficient process. Applications mainly include image guided diagnosis, decision support, education and efficient data management. Future work mainly examine more features gathering from segmentation and architectures.

3. CONCLUSION

In this article, we carried out a study of different classification techniques for histopathological images. Several machine-driven breast cancer detection were reviewed in this article. One of the future work is multi class classification. Breast Cancer detection in histopathological images with large dataset is a confront task in classification. There is a future scope in the improvement of the present methodology as no method guarantee cent percent accuracy.

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