International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 08 | Aug -2017 www.irjet.net p-ISSN: 2395-0072

A Classical Hierarchy method for Bone X-Ray Image Classification using SVM

K. Sri Praveena[1]

[1]M.Tech Scholar (ECE) Dept. of Electronics and Communication Engineering V.R Siddhartha Engineering College, Andhra Pradesh, India

---

ABSTRACT: *The medical image classification is often very less ventured research area which needs solutions that are based on machine learning practices and problems of Content Based Image Retrieval (CBIR) systems. The aim of this work is to classify the bone X-Ray image database into healthy, fractured, and various cancer types. The image database consists of 10 different image classes. The methods like GLCM (Gray level co-occurrence matrix), Local Binary Pattern (LBP), and Gradient Binary Pattern (GBP) are used to extract the texture features from the images. The texture features are applied to the Support Vector Machine (SVM) classifier and classified the images into individual classes. The classifier gave best results for the GBP texture features with 0.84 Kappa value and 87.8% classification accuracy.*

Keywords: Medical x-ray image, GLCM, GBP, LBP, SVM.

1. INTRODUCTION

Medical images simulate a central part in the surgical arrangement, medical training and patient recognition. In medical field for large medical image database CBIR eliminates the difficulties that present in the text based query. The CBIR needs to deal the whole x-ray images and their applications are based on retrieving images anatomically [1]. The detailed list of images is a pertinent step of CBIR. The CBIR allows removal of difficulties in those traditional citations. The purpose of the CBIR system is the most effective and efficient way to recover similar images in the query image. In this paper we have divided the images into ten number of classes for which we specify the image type and its number of such as healthy- 38, fractured – 77, miscellaneous – 67, breast – 343, osteosarcoma – 98, giant cell tumour – 46, osetoblastoma – 9, Ewing sarcoma – 39, chondrosarcoma–62, enchondrosarcoma – 26. In this osteosarcoma mainly occurs in not fully developed bones. Osteoblastoma mainly occurs in lower long bones. Giant cell tumour mainly occurs due to bone disorder. Ewing sarcoma mostly occurs in femur bone. Chondrosarcoma is understood when there is pain at rest. Enchondrosarcoma mostly occurs in side cartilage or bone marrow. This paper derives a set of unique feature vector to support easy and fast medical x-ay image classification using global and local texture features applies on GBP, GLCM and LBP [3]. A fraction of the low level features are utilized for the characterization of restorative x-ray images [1]. Grouping of restorative x-ray images is a period depleting process. X-rays have gray level images and do not have any colour information. On a large dataset various feature extraction methods are been used on comparing and choosing the best one for best outcome [2]. The surviving methods like LBP, GLCM, and GBP are used for feature extraction. After the extraction of these features, we use an SVM classifier to classify these images. The main aim is to aid the person in the medical domain to develop the excellence and efficiently use this process. In future diagnosis image database has a dominant role. In this exploration we are utilizing SVM. In SVM we have two stages viz binary SVM and multi class SVM. The experimental results is that in feature extraction techniques GBP gives the best results compared with other features like GLCM, LBP. To extract the features of an x-ray image for its classification it uses GBP, LBP and GLCM which gives the most important data.

2. RELATED WORK

S.K.Mahendran Et al proposed a method on classification on various methods used for classification of images. Selection procedure for classifier requires deliberation of many aspects such as classification accuracy, algorithm performance and computational resources. The experimented research papers utilize SVM and Bayes classifier. The presented works use a set of feature vectors on multiple classifiers to identify fractures. Fusion of feature vectors has not been considered. The usage of multiple classifiers for extracting fractured bones in X-ray images is to be experimented with [5].

Vineta Lai Fun Lum et al [7] proposed a technique by using classifiers for detection of fractured bone. In this paper, for the identification and detection of fractured bone x-ray images the probabilistic combination methods are considered. Test grades showed that the effectiveness of the method is in improving both accuracy and sensitivity depends on the method as well as the quantity of the positive samples.

N.Umadevi et al [8] used multi class sorting method used for fracture recognition for X-Ray images. This paper mechanically recognizes cracks in long bones,

leg bone, and from plain demonstrative X-Rays utilizing a different order framework. The features like texture and shape features are used with three classification techniques are Back Propagation Neutral Network, K-Nearest Neighbour, and Support Vector Machine. Two types of features, namely, texture features and shape features were extracted from X-Ray images forming an entire of 12 features. Three binary classifiers, SVM, BPNN and KNN were used to construct ensemble classification models and during training, boosting method.

3. METHODOLOGY

In the region of pattern identification a dynamic research in taxonomy of x-ray images was carried out. The classification can be done in two phases are training and testing phase [2]. This process can be done all the images after when features are extracted [1]. Over the past decade research that is done in arrangement of medical x-ray images is considered.

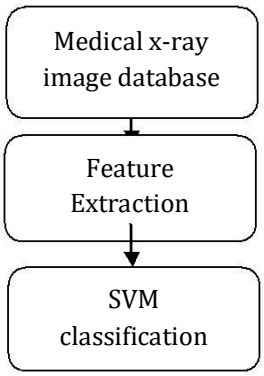


Figure1: Block Diagram for classification process.

Here, Figure1 shows the block diagrams for classification of images. For describing the texture features we use statistical techniques [1]. Texture feature gives the sufficient information for classification tasks. Cancer detection of x-ray is a complex operation for which limited algorithms have been proposed. Moreover, although many classification approaches have been developed, respective approach that suits an application area is not fully understood. Selection of best classifier requires the consideration of factors such as classification accuracy, algorithm performance, and computational resources.

4. FEATURE EXTRACTION

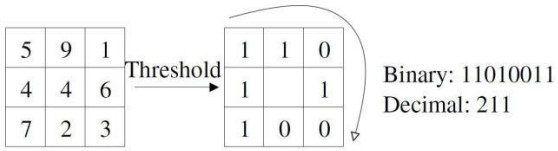
In feature extraction sorting of medical x-ray images plays an important role because it would have better outcomes in classification [1]. Medical x-ray images which are used in this domain are gray level images in which it does not extract any colour feature.

4.1 GLCM: GLCM holds the specific particulars about location of gray level comprising of resembling gray levels [2]. GLCM extracts the texture properties from an images and also is one of the statistical tool is used for an image. GLCM is a second order moment, Gauss-Markov arbitrary field and nearby straight change which is Controlled by spatial relations between neighbouring pixels in an image [3]. Given that Image I and size N×N and the matrix P can be defined by

$$p(i,j) = \sum_{x=1}^{N}\sum_{y=1}^{N}\begin{cases}1, if\ I(x,y)=i\ and\ I(x+\Delta x, y+\Delta y)=j\\ 0, \quad otherwise\end{cases}$$

The offset$(\Delta x, \Delta y)$ is the distance between main pixel and neighbour.

4.2 LBP: LBP is a local texture descriptor design with less computational complexity and it's against monotonically illumination changes. LBP can be utilized as a visual descriptor for applications in PC vision field



[2].

Figure: Example of an LBP

A local binary pattern is called uniform if the binary pattern contains at most two bitwise transitions from 0 to 1 or vice versa when the bit pattern is traversed circularly.

4.3 GBP: The Gradient Binary Pattern (GBP) is a texture operative generally useful in different computer vision issues such as texture classification, face acknowledgement, and background subtraction [6]. GBP depicts every pixel by the relative dim estimations of its neighbouring pixels. The GBP operator describes each pixel by the relative gradient on different directions of the pixel

For calculation two simple1-D [-1 0 1] and [-1 0 1]$_T$ masks be used to calculate the gradients in the horizontal and vertical directions i.e., G2 and G4. Gradients on the other diagonal directions (i.e., G1 and G3) are calculated with two 2-D [0 0 1 ; 0 0 0 ; -1 0 0]and[-1 0 0 ; 0 0 0 ; 0 0 1]. The GBP value of a pixel at position (i, j) is

$$\begin{aligned}GBP\ (i,j) = {} & s(\| G_1(i,j) \| - \| G_4(i,j) \|) \\ & + s(\| G_3(i,j) \| - \| G_4(i,j) \|)2^1 \\ & + s(\| G_1(i,j) \| - \| G_2(i,j) \|)2^2 \\ & + \sum_{k=1}^{4} s(G_k(i,j))2^{7-k}\end{aligned}$$

$$s(x) = \begin{cases} 1, & x \geq 0 \\ 0, & otherwise \end{cases}$$

The GBP value is an integer among 0 and 2^7-1.The measurement of the histogram is 2^7 and the histogram of GBP values are calculated for organization and texture descriptor.

4.4 SVM classifier: The algorithms for linear discriminant functions are requested to the original variables or in a transformed feature space defined by nonlinear transformation of the unique variables. SVM performing better results in various domains compare to another classifications method [1]. SVM is very efficient for classification of images as target is towards to find the better hyperplane portioning the appropriate and inappropriate vectors maximize the amount of scope. SVM can execute better classification techniques when compared with other classification techniques [2]. In SVM it's possible to achieve the operation of multiple classes in same time while in binary classification it can perform only in two classes [2].

5. EXPERIMENTAL RESULTS:

The Gray Level Co-occurrence Matrix (GLCM), Local Binary Patterns (LBP) and Gradient Binary Patterns (GBP) are applied with multiclass Support Vector Machine (SVM) classifier for ten classes dataset: Healthy-38, Fractured-77, osteosarcoma-98, osteoblastoma-9, giant cell tumour-46, Ewing sarcoma-39, breast-343, chondrosarcoma-62 and enchondrosarcoma-26 and various cancer types of bones -67. Our experimental results showed that Gradient Binary Patterns (GBP) gives the high results with 87.8% corrected medical images for all classes and with kappa value 0.84. At the same level came GLCM nearly the 79.5% corrected results and with kappa value 0.73. LBP came with accuracy of 66.6% corrected results and with kappa value 0.57.

Methods	Confusion Matrix
GLCM	19 7 12 0 0 0 0 0 0 0 10 50 17 0 0 0 0 0 0 0 14 16 37 0 0 0 0 0 0 0 0 0 0 318 0 25 0 0 0 0 0 0 0 0 58 4 0 0 0 0 0 0 0 5 4 2 0 0 0 15 0 0 0 0 5 0 34 0 0 0 0 0 0 0 4 1 8 33 0 0 0 0 0 0 2 1 0 0 6 0 0 0 0 0 6 9 0 0 0 84
LBP	8 19 11 0 0 0 0 0 0 0 3 48 26 0 0 0 0 0 0 0 0 24 43 0 0 0 0 0 0 0 0 0 0 309 0 34 0 0 0 0 0 0 0 0 54 4 0 3 0 1 0 0 0 0 12 6 5 3 0 0 0 0 0 1 14 10 12 2 0 0 0 0 0 2 24 10 1 9 0 0 0 0 0 0 3 3 0 0 3 0 0 0 0 2 24 11 7 10 0 45
GBP	38 0 0 0 0 0 0 0 0 0 0 76 1 0 0 0 0 0 0 0 0 0 67 0 0 0 0 0 0 0 0 0 0 317 0 26 0 0 0 0 0 0 0 0 60 2 0 0 0 0 0 0 0 4 4 2 0 0 0 16 0 0 0 0 3 4 32 0 0 0 0 0 0 0 4 8 7 27 0 0 0 0 0 0 2 2 0 0 5 0 0 0 0 0 6 8 1 0 0 84

Figure: final confusion matrix

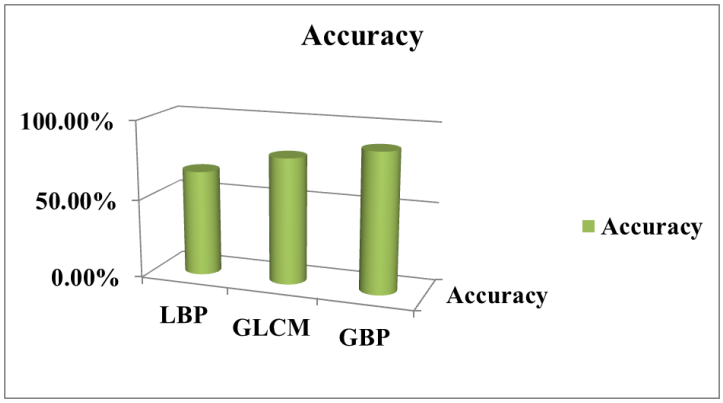


Figure : Final classification accuracy

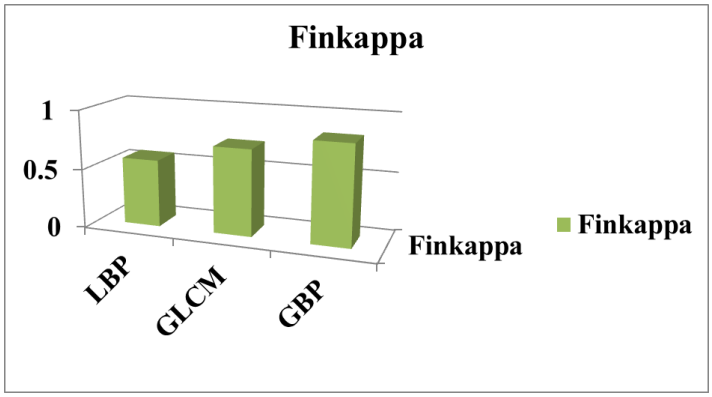


Figure: Final kappa value

6. CONCLUSION

The use of image categorization is demonstrated to useful in improving the precision of image retrieval systems. This presents a method of automatic classification of x-ray images. The experimented method performed well with Gradient Binary Patterns (GBP), Local Binary Patterns (LBP), and Gray-Level Co-occurrence Matrix (GLCM) techniques for which useful results with gradient binary patterns technique are observed. The Gradient Binary Patterns (GBP) is applied with multiclass support vector machine (SVM) in support of ten classes datasets viz Healthy-38, Fractured-77, osteosarcoma-98, osteoblastoma-9, giant cell tumour-46, Ewing sarcoma-39, breast-343, chondrosarcoma-62 and enchondrosarcoma-26 and various cancer bones -67. Support Vector Machine is used for classification purpose. Our experimental gave the best result for GBP texture feature with 87.8% accuracy for ten classes. In future more feature extractions can be considered which is helpful for x-ray image analysis and classification can be studied.

REFERENCES:

[1] Mohammad Reza Zare, Ahmed Mueen, Woo Chaw Seng, Mohammad Hamza Awedh. "Combined Feature Extraction on Medical X-Ray images", Third International Conference on Computational Intelligence, 2011 IEEE.

[2] Randa Hassan Ziedan, Mohamed A. Mead, Ghada S Eltawel, "Selecting the appropriate feature extraction techniques for automatic Medical Image classifications", International journal of Emerging Engineering Research and Technology, Volume 4, May 2016, PP 1-9.

[3] Prachi.G.Bhende, Dr.A.N.Cheeran, "A Novel Feature Extraction Scheme for Medical X-Ray Images." Int. Journal of Engineering Research and Applications, Vol.6, issue 2, February 2016, pp.53-60.

[4] S.K.Mahendran and S.Santhosh Baboo, "Automatic Fracture Detection Using Classifiers - A Review", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 6, No 1, pp. 340-345, November 2011.

[5] S.K.Mahendran, S.Santhosh Baboo, "An Enhanced Tibia Fracture Detection Tool Using Image Processing and classification Fusion Techniques in X-Ray Images", Global Journal of Computer Science and Technology, Volume 11, Issue 14, Version 1.0, August 2011.

[6] Li Zhou, Zongtan Zhou, Dewen Hu, "Scene classification using multi-resolution low-level feature combination", Elsevier, pp. 284-297, 2013.

[7] Vineta Lai Fun Lum, Wee KhengLeow, Ying Chen, TetSen Howe and Meng Ai Png, "combing classifiers for bone fracture detection in X-Ray images", IEEE transactions on image processing, vol. 3, pp. 112-115, 2005.

[8] N.Umadevi and S.N.Geetha Lakshmi, "multiple classification system for fracture detection in human bone X-Ray image", IEEE transactions on image processing", pp. 200-207, 2012.

[9] www.cancer.com

[10] https://radiopaedia.org/articles/

[11] A.mueen, M.sapiyan Baba and R.Zainuddin," Multilevel feature extraction for x-ray image classification," progress in journal of applied sciences, 7(8):1224-1229, 2007.