A REVIEW ON STATISTICAL TECHNIQUES COMMONLY USED IN IMAGE PROCESSING AND ANALYSIS

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ABSTRACT

An analysis has been done of statistical tools and techniques used in Image processing in recent past.The statistical tools and techniques used are PCA,DCT,FEM,SVD,BIRADS,SVM ,etc.In this review paper we observed how the various parameters changes with respect to the various changing conditions and values.Also the methods used over the traditional method in different fields.

Keywords: Support Vector Machine, Principal Component Analysis, Fuzzy Enhanced Mammogram , Image Reduction,Ultrasound Imaging.

I. INTRODUCTION

The field of image processing made significant progress in tools used over the last few years. We have tried to formulate the future scope of statistical tools and techniques in image processing. The target of statistical tools is always to simplify or change the representation of a graphic in something that is more meaningful.

II. ANALYSIS

2.1 M. A. Balafar et.al(2015)[1]

They authors presented the paper on topic 'Brain MRI segmentation methods' which covers imaging modalities, magnetic resonance imaging and methods for noise reduction, inhomogeneity correction andsegmentation.The Gaussian parameters used in this are mean,variance and covariance and can be obtained by Lloyd clustering algorithm. Gaussian MixtureModel is used to estimate the number of regions. Brain image segmentation is also useful in clinical diagnosis of neurodegenerative and psychiatric disorders, treatment evaluation, and surgical planning. There are lots of methods for automatic and semi-automatic image segmentation, though, most of them fail because of unknown noise,poor image contrast, and weak boundaries that are usual in medical images. Brain MRI segmentation is a challenging task and there is a need for future research to improve the accuracy, precision and speed of segmentation methods. Using improved atlas based methods, parallelization and combining different methods can be the way for makingimprovement in brain segmentation method.

2.2 A.Sahera Thasneem (2015)[2]

The author presented a paper on topic' Mammography Images for Breast Cancer Classification'.The American Cancer Society estimates that 215,990 women will be diagnosed with breast cancer in the U.S. in 2016.

Another 40,110 women will die of the disease.This research presents a case study between the processed images based on the statistical data. X-ray mammography is one of the most challenging areas in medical imaging. Breast lesions are described and reported according to the Breast Imaging Reporting and Data System(BI-RADS™). BI-RADS™ is a mammography lexicon developed by the American College of Radiology (ACR). In our research, we use two classes of micro calcification, benign and malignant. In order to test our method, we use MIAS (Mammographic Image Analysis Society) database that often used to conduct such experiment In this paper use Support Vector Machine (SVM) as a classifier, Some part of the mammogram that contains the micro calcification, known as region of interest (ROI), then filtered using NSCT. The output of the SVM classifier gives the result as Beningn (Normal)stage And Malignant (Cancer)stage is classified NSCT transformed over comes disadvantage of other transform and reaches the accuracy as 95% By knowing the Percentage of abnormality further treatment can be carried out for the patient Which makes ease in work for the physician.

2.3 Jonathon Leipsic, Giang Nguyen et.al (2015) [3]

The author presented a paper on topic 'A Prospective Evaluation of Dose Reduction and Image Qualityin Chest CT Using Adaptive Statistical Iterative Reconstruction'.The purpose of this study was to compare the subjective image quality, image noise, and radiation dose of chest CT images reconstructed with a 30% blend of iterative reconstruction and 70% conventional filtered back projection (FBP) with those of images generated with 100% FBP. Different reconstruction techniques were used: adaptive statistical iterative reconstruction(ASIR) blended with FBP and 100% FBP. Both acquisitions were performed with dose modulation (noise index, 25 for ASIR and 21 for FBP). Patient demographics and habitus were recorded. Compared with FBP images, ASIR images had significantly lower subjective image quality (p = 0.01), less image noise (p = 0.02), and less radiation dose (p < 0.0001). The CT dose index of the ASIR cohort (11.3 ± 51) was significantly lower than that of the 100% FBP cohort (15.4 ± 6.3) (p < 0.0001). Interobserver agreement on subjective image quality was excellent for both ASIR and FBP (Cronbach α, 0.92, p < 0.0001; Cronbach α, 0.85, p < 0.0001). In clinically indicated chest CT examinations, ASIR images had better image quality and less image noise at a lower radiation dose than images acquired with a conventional FBP reconstruction algorithm.

2.4 Michalis Mitrou, Panagiotis Agrafiotis et.al (2015) [4]

Theypresents paper on topic 'A Semi-Automatic Process for Estimating Fetus Velocity Using Ultrasound Imaging and Videos'. In this paper, the parameters and the constraints related to the study of the fetus motion done through the B-mode ultrasound videos. Here in translational method there is an approach i.e., individual point tracking calculate the velocity of the fetus which is determined by measuring the displacement of specific key points over specific time intervals but the traced points are not clearly visible in all frames throughout the measurement process. Therefore, another method comes over it named Center of Mass (centroid) Tracking. There are distinct advantages of using the centroid instead of tracking individual points. Firstly, it avoids the sensitivity problems that the other method suffers from. Secondly, by allowing the measurement of the relative displacement of the fetus centroid with respect to the uterus centroid, could alleviate or diminish the impact of the movement of the transducer probe. Finally, it allows the estimation of the rotational motion of the fetus by

tracking its principal axes of inertia over time. Here two parameter mean and standard deviation are used for different number of observed points on contours which gives the relation marking more points on the contour increases the accuracy of the velocity estimation.

2.5 T. Venkat Narayana Raoand A. Govardhan (2015)[5]

Presents journal on 'Efficient Segmentation and Classification of Mammogram Images with Fuzzy Filtering'**.** Fuzzy Enhanced Mammogram (FEM) image segmentation methods are proposed in this paper. The methods are evaluated on a set of images and the performance evaluation is carried out with segmentation efficiency metrics and also with respect to the processing time. From the experimental results it was found that the FEM1 outperforms other similar methods discussed in this paper for almost all the images. Overall Correct Detection Ration (CDR) for FEM1 is 87% while FEM2 gives 77% and consumes 6.25 times lesser processing time. The proposed work is very fast, accurate and can be more useful.

2.6 Harmanpreet Kaur (2015) [6]

Author present the research paper on topic 'Review of remote sensing image segmentation techniques'. This paper proposed a Dynamic Statistical Region Merging (DSRM) algorithm to find the automatically select scale value.Some author introduced some techniques,i.e. Jing Liu, Peijun Li , Xue Wang used Combined Spectral and morphological information, Zhijian Huang, Jinfang Zhang, Fanjiang Xu used Novel Multi-scale relative salience (MsRs) feature, Zhongwu Wang, John R. Jensen, Jungho Im used Region- based Image segmentation Algorithm (RISA) based on k-means clustering, Calderero, Marques used Unsupervised region merging technique. In most of the papers authors ignored to use fuzzy logic systemwhich is a drawback.In future an algorithm is designed using a combination of fuzzy logic and dynamic statistical region merging (DSRM) in order to automatically select scale value.

2.7 Komal S. Jaisinghani, Prof. Sini Shibu(2015)[7]

Present a research paper on the topic Digital Image Forgery Detection by Illumination Color Classification. Here they proposed a forgery detection method that find out the inconsistencies in the color of the illumination of images. physics and statistical based illuminant estimators on image areas are used.The statistical gray edge method which exploits the inverse intensity chromaticity color space is used.Here illuminant map is treated as texture maps.design techniques such as HOG descriptor and edge point called HOG edge which is defined for edge information is used.SVM classifiers for forensic detection are also used (kernel based learning) which predict whether image is original or not. The proposed method requires only a least amount of human interaction and provides a crisp statement on the authenticity of the image.

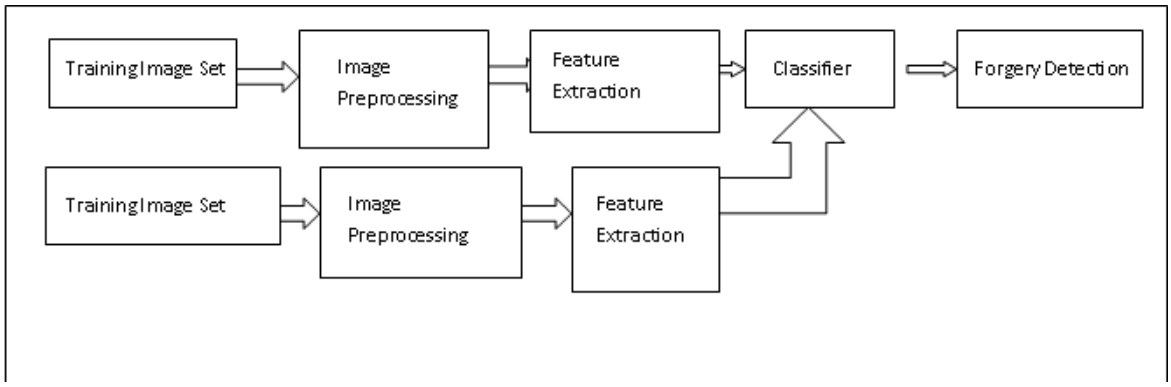

Fig 1. Framework of Forgery Detection [7].

2.8 Rashmi Chaurasiya, Surabhi Varshney, Yogesh Tayal(2014) [8]:

Present a paper on the topic Image Processing Techniques for Face Recognition Application. PCA based technique is used which reduces the analysis of data to greater extent for face recognition and then distance of pixels is used to recognize the face. The database used here is ORL database for face recognition purpose.histogram equalization and normalization are used to detect face expressions and to recognition of face. In these techniques the original images are not cropped or aligned.Image resizing and low pass filters are also used to detect an image.

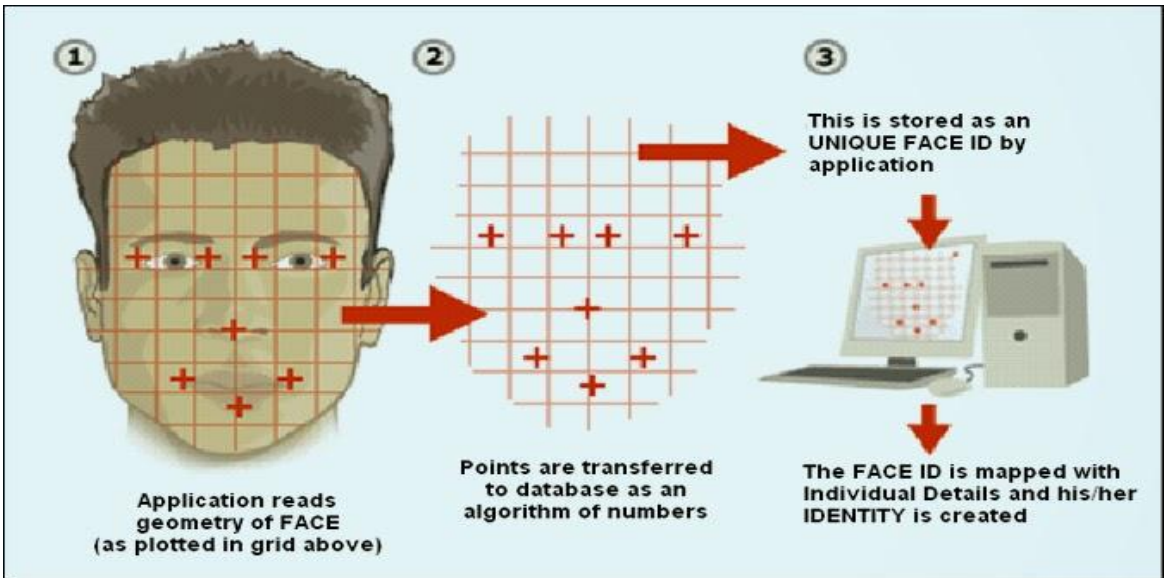

Fig. 2. Steps of face recognition [8].

2.9 Irene Amerini, Lamberto Ballan , Roberto Caldelli and Alberto Del Bimbo(2011) [9]

Presents a paper on 'A SIFT-Based Forensic Method for Copy–MoveAttack Detection and Transformation Recovery'. In this paper, the problem of detecting if an image has been forged is investigated; in particular, attention has been paid to the case in which an area of an image is copied and then pasted onto another zone to create a duplication or to cancel something that was awkward. Generally, to adapt the image patch to the new context a geometric transformation is needed. To detect such modifications, a novel methodology based on scale invariant features transform (SIFT) is proposed. Such a method allows us to both understand if a copy–move attack has occurred and, furthermore, to recover the geometric transformation used to perform cloning.

The method also deals with multiple cloning. The proposed approach has been compared to the results obtained with ourimplementations of the methods presented in based on DCT, and based on PCA . The input parameters are number of pixels per block, number of neighbourhood rows to search inthe lexicographically sorted matrix, threshold for the minimum frequency, and threshold todetermine a duplicated block, true positive rate(TPR), false positive rate(FPR), scaling and The copy–moved patch method performs better with respect to the others methods; in fact the processing time (per image) is on average about 5 s, whereas the other two take more than 1 min and almost 5 min, respectively. Furthermore,the DCT and PCA methods, though obtaining an acceptable TPR, fail when a decision about original image is required. This is basically due to the incapacity of such methods to properly deal with cases where a geometrical transformation which is not pure translation is applied to the copy–moved patch.

2.10 K.J. Worsley, C.H. Liao et.al.(2002) [10]

Authors present a paper on the topic 'A General Statistical Analysis for fMRI Data'. They propose a method for the statistical analysis for fMRI data that seeks a compromise between efficiency, generality, validity, simplicity and execution speed. FMRI have some parameters- standard deviation and variance. It usesSPM'99 method which is linear with auto-correlation structure.This method is used to remove the drifts by additive trends and choice may be made better.Emma toolbox is available for windows,linux and SGI IRIX.To overcome the problem of small number of runs/session/subjects using a regularized variance ratio to increase the degree of freedom. Future releases of SPM will remove temporal smoothing or low pass filtering as an option and replace the AR(1) model on the original data with AR(1) plus white noise estimated using the EM algorithm. The main differences between this analysis and previous ones are: a simple bias reduction and regularization for voxel-wise autoregressive model parameters; the combination of effects and their estimated standard deviations across diffrerent runs/sessions/subjects via a hierarchical random effects analysis using the EM algorithm.

2.11 Michael Unser (1999) [11]

Purposed the paper on topic 'Splines'.The purpose here is to provide arguments in favour of an alternative approach that uses splines, which is equally justifiable on a theroretical basis.Splines were first described in 1946 i.e slightly older than Shannons sampling theory.The parameters used in this are B-Splines coefficients i.e c(k) and are symmetrical and bell shaped and also were more computationally efficient than traditional sine based approach which computing a signal value at a particular non integer with an error of less than 1 % will requires of the order of 100 operation in each direction.Approximation error depends on bandwidth of signal.Spline fits are usually preferable to other forms of representation bcoz they have less tendency to oscillate. Splines have multiresolution properties that make them very suitable for constructing wavelet bases and for performing multi scale processing.The application of splines are Zooming and visualization, Image compression, Contour detection etc.The primary reason for working with B-splines represents that the B-splines are compactly supported. Splines of degree *n are (n-1)*continuouslydifferentiable.As a result splines has excellent approximation properties.

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III. CONCLUSION AND FUTURE SCOPE

This paper dealt with the various techniques that was performed with the help of various statistical tools. It can be concluded that the statistical tool performance relates closely to the scale but the scale is selected manually in majority of existing research papers. Here various tools and parameters used which makes easy to understand the practical aspects in image processing.

SN0.	AUTHORS	TECHNIQUES USED	REMARKS
1.	M.A. Balafar et.al (2015)	Gaussian parameters i.e. mean, variance and covariance and can be obtained by Lloyd clustering algorithm and image segmentation.	Improve the accuracy, precision and speed of segmentation method.
2.	A.Sahera Thasneem (2015)	Support Vector Machine, X-ray Mammography	Better Image Quality, Less Image Noise.
3.	Jonathon Leipsic, Giang Nguyen et.al (2015)	ASIR with FBP and FBP	ASIR provides better image quality and image noise
4.	Michalis Mitrou, Panagiotis Agrafiotis et.al (2015)	individual point tracking, Centres of Mass Tracking methods	Centroid method is preferred as it avoids the sensitivity problems, diminish the impact of the movement of the transducer probe.
5.	T. Venkat Narayana Raoand A. Govardhan (2015)	FEM(1), FEM(2) and SVM	Provides faster and accurate result and useful for the diagnosis.
6.	Harmanpreet Kaur (2015)	K- mean clustering, Fuzzy c- mean algorithm and Dynamic Statistical Region Merging	Use of fuzzy logic is ignored.
7.	Komal S. Jaisinghani, Prof. Sini Shibu (2015)	HOG Descriptor and Edge point combindly called HOGedge algorithm	Least amount of human interaction and provide crisp statement.

8.	Rashmi Chaurasiya, Surabhi Varshney, Yogesh Tayal (2014)	Principal Component Analysis and ORL face database.	Reduce analysis data to greater extent.
9.	Irene Amerini, Lamberto Ballan , Roberto Caldelli and Alberto Del Bimbo (2011)	SIFT, DCT and PCA	Low computational cost and robust performance.
10.	K.J. Worsley, C.H. Liao et.al. (2002)	AR(1) Model, SPM'99 Method and standard deviation and variance are the parameters used.	SPM'99 remove the drifts. SPM will remove temporal smoothing or low pass filtering and replace the AR (1) model with AR (1) plus white noise using the EM algorithm.
11.	Michael Unser (1999)	B-splines coefficient i.e. c(k)	Symmetrical and bell shaped and also were more computationally efficient than traditional sine based approach.

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