MONUMENT IMAGE SEGMENTATION AND CLASSIFICATION USING AMS MEM ALGORITHM

I. Arockia Mary[#1], E. Stephena[#2], M. Alice Christy [#3]

*#1 Assistant Professor-ECE,LIT,*janijanu2007@gmail.com,9444390711
*#2 P.G student,*steffysimon13@gmail.com,9841985122
*#3 Assistant Professor-ECE,LIT,*achristy6008@gmail.com,9176053607

Abstract: **Monuments have vast significance in cultural heritage area. The fundamental importance of the work is to segment and classify the monuments, in order to find their degradation. The paper uses images acquired from photo and digital TV cameras under various lighting conditions. Initially, the paper deals with the segmentation of the monument image from the background using AMS MEM algorithm. Then the segmented monument image is classified based on SVM, the classification was detected in terms of accuracies and the result confirmed that the proposed method has potential in detecting the anomalies.**

Keywords: **Monument, AMS MEM, SVM classifier, degradation.**

1. INTRODUCTION

A community thrives through its cultural heritage, it dies without it. Monuments have a large role in cultural heritage; preservation of these monuments is an important task. Not only preservation but also restoration of this monument is important. When analyzed with human involvement could lead to further damage. So the paper works on the non invasive methods of finding the degradation.

2. RELATED WORK

There are various techniques used by the experts to study about the decay that is present in the monument. The classical method used is 'naked eye' analysis and experts view each and every element he is observing. This type of investigation could lead to acquisition of a number of images. The paper uses the image acquired by digital TV and photo that are chromatically and geometrically correct.

The paper by Dian Palupi Rini [1] uses the PSO based approach that uses the images that depend on the intensity and not on the shape and texture. The main drawback is that the sensitivity and accuracy is low. Segmentation of the image from the background is important to know more details of the image. The Fuzzy C-means [2] and K-means [3] are the well known algorithms for segmentation. It uses histogram of the image intensities and k-distance, but it fails in measuring the desired similarity in the image. The feature extraction [4] is used to extract the features in the image in order to assess the amount of decay in the monument. The Support Vector Machine [5], [6] classifier is used to classify the monument and find the percentage of degradation.

3. PROPOSED METHODOLOGIES

I. ANISOTROPIC DIFFUSION FILTER

The first step in the proposed system is the acquisition of the images. The paper uses the images that are acquired at various lightning conditions that are geometrically and chromatically correct using the digital TV cameras and photos. The noise that is present in the acquired image is removed by Anisotropic Diffusion filter [7]. The process of the filter is, it initially calculates the center pixels and creates a mask. Then each of the resulting images is given as a convolution between the image and 2D isotropic Gaussian Filter [9]. The output of the system is a combination of the input image and a filter, the work produces a family of 8 blurred images.

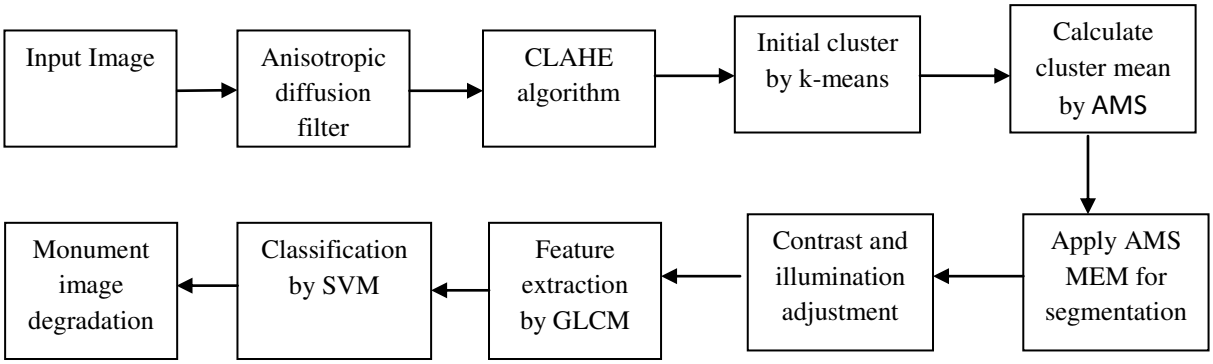

Fig 1: Block Diagram

The filter is effective in reducing the noises like salt and pepper noise, Gaussian noise and random noise. Also the effectiveness of the filter is given by the PSNR and MSE ratio. The expression for the PSNR is given by

$$PSNR=10 \log_{10} 255/MSE \quad \ldots\ldots\ldots\ldots 1$$

When the value of PSNR is large, it means less noise. The expression for the MSE is given by

$$MSE=1/MN\sum_{j-1}^{M}\sum_{k-1}^{N}(x_{j,k}-x_{j,k}')^2 \quad \ldots\ldots\ldots\ldots 2$$

The MSE should be less, which means that the pixel intensity of input and output are as close as possible.

In this paper, the Adaptive Median Filter [10] is used in order to show the efficiency of the Anisotropic Diffusion Filter and there PSNR and MSE are compared.

II. CLAHE ALGORITHM

Image enhancement is done to make an object distinguishable from other object and the background. The work uses the Contrast Limited Adaptive Histogram Equalization (CLAHE) algorithm [11], [12]. In this algorithm, the thresholding values are assigned as 0.992 (upper threshold), 0.5 (medium threshold), 0.008 (lower threshold) where the limits are 1, 0, 0.5 respectively. It does the operation of enhancement for multispectral and panchromatic images separately by setting threshold

III. AMS MEM ALGORITHM

The segmentation process is to simplify the image and make it easier. In this paper, the proposed algorithm is the Adaptive Mean Shift Modified Expectation Maximization algorithm that is used to segment the monument image from the background. The fig (1) shows the various steps that is been carried out in the proposed system. The AMS MEM algorithm initially does the shifting operation [14] calculating the mean. It is useful in finding the clusters. Then a MEM [15] is carried out it calculates the maximum likelihood parameter. The two steps of Expectation (E) and Maximization (M) [16] maximize the expected pixels and minimize the unexpected pixels. Based on the values of the matrix that is loaded into the algorithm the algorithm segments the monument from the background automatically. The paper also does a comparison of the K-means and the Fuzzy C-means algorithm [2]. The proposed segmentation algorithm result shows that the

algorithm is efficient than the K-means and Fuzzy C-means algorithm.

IV. FEATURE EXTRACTION

The process of feature extraction [4], [17] is done by a combination of three algorithms to extract the features in the monument image so that most relevant data from the original image is obtained. The algorithms used are the GLCM [18] (Gray Level Co-occurrence Matrix), PCA [19] (Principal Component Analysis) and Gabor filter. The GLCM extracts the second order statistical texture features. The GLCM computes the matrix by calculating how often the pixel value occurs. The PCA calculates the Principal Component of the feature and linear filtered by the Gabor filter [20] so that the edge is detected correctly.

The following features were extracted in the work:

Autocorrelation, Sum of average, Sum of variance, Difference variance, Difference entropy, Sum of squares, Information measures of correlation, Maximum probability, Inverse Differential Normalization, Inverse Differential Moment Normalization

V. SVM

The classification of the image is the final step of the proposed system which is done by the SVM (support Vector Machine) [21].The SVM uses the neural networks [22] for the classification, the values of TP, TN, FP, FN are calculated by the confusion matrix and the performance of the classifier is evaluated in terms of Zernike moment classification the proposed algorithm was able to classify with an efficiency of 97%.

4. EXPERIMENTAL RESULTS

The input to the algorithm is shown below:

Fig 2: Input Image

The output of the proposed Anisotropic Diffusion Filter and Adaptive Median filter are shown below, the PSNR and MSE values of the filters shows that the proposed filter is efficient.

Fig 3: Anisotropic Diffusion Filter output

Fig 4: Adaptive Median Filter output

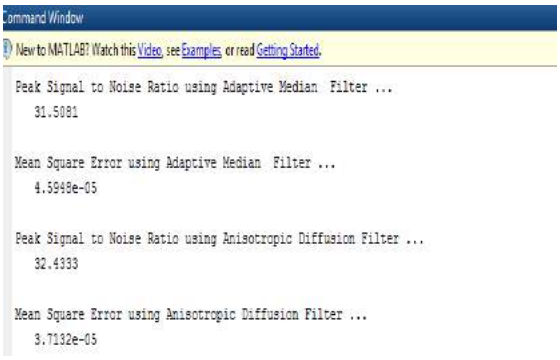

Fig 5: PSNR and MSE values

The enhanced monument image using the CLAHE algorithm is shown below:

Fig 6: CLAHE output

The output of the K-means and Fuzzy C-means is given below:

Fig 7: K-means output

Fig 8: Fuzzy C-means output

The proposed algorithm AMS MEM output, which segments the monument image automatically from the background, is shown below:

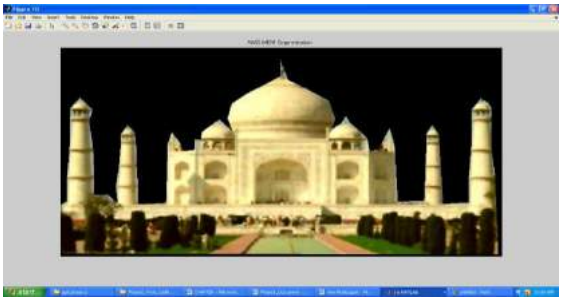

Fig 9: AMS MEM output

The features that are extracted by the GLCM for the monument image are given below:

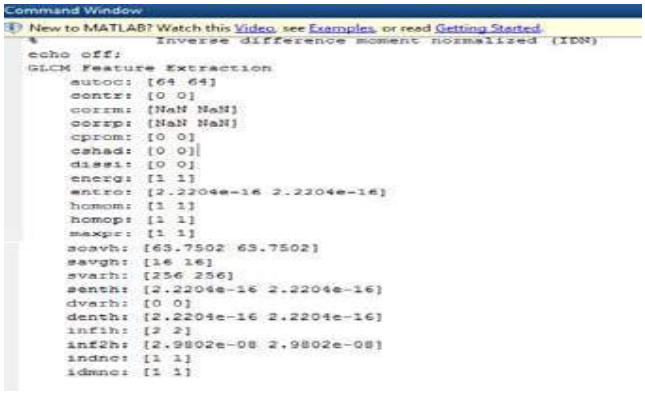

Fig 10: Extracted features

The values of TP, TN, FP, and FN are as follows:

TP=0.8, TN=0.2, FP=0.01, FN=0.03.

Accuracy in % is: 96.154

Sensitivity in % is: 96.386

Specificity in % is: 95.238

The percentage of degradation of the monument is: **11.538%**

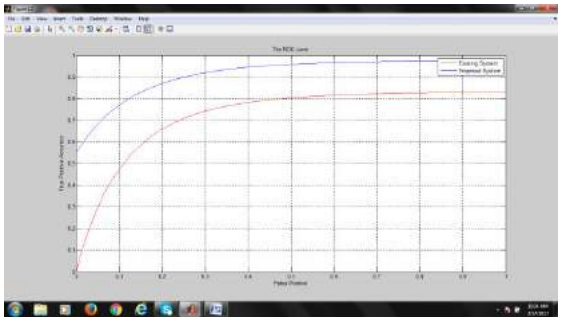

Fig 11: Existing vs. Proposed system

5. CONCLUSION

Thus the monument image acquired using photos and digital TV cameras were segmented by AMS MEM and the SVM classifier classified the monument image with an efficiency of 97% and the percentage of degradation was detected.

6. REFERRENCES

[1] Dian Palipi Rini, Mariyam Shamusuddin, "Particle swarm optimization: technique, system and challenges", International journal of computer applications, Vol 14, Jan 2011.

[2] Navin Prakash, " Fuzzy C-means technique with histogram based centroid initialization for brain tissue segmentation in MRI of head scans", Vol 131, 2015.

[3] Pankaj K.Agarwal, Nabil H. Mustafa, "K-Means Projective clustering", Dept of computer science, June 2004.

[4] Muhammad Arif, Haswadi Hassan, " A review Feature extraction and Feature selection", Int journal of advanced comp science and apps, Vol 6, no 2,2015.

[5] Valery Grishkin, Alexzander Kovshov, " A system for the recognition of biofouling on the surface of the monument", 2015.

[6] Gauri Borkhade, Ranjana Raut, "SVM Neural network based optimal binary classifier for diabetic retinopathy" , Int journal of innovative research in comp and comm. Engg, Vol 3, issue 1, Jan 2015.

[7] Shen Liu, Jianguo Wei, Bo Feng, "An anisotropic diffusion filter for reducing speckle noise of ultrasound images based on seperability", Japan advanced institute of science and technology, May 2009.

[8] Joachim Weickert, "A review of nonlinear diffusion filtering", Springer, Vol 1252, 1997.

[9] Elhanan Elboher, Micheal Werman, "Efficient and accurate Gaussian image filtering" School of computer science, 2006.

[10] Chun –mei Wang and Tian-yi li, "An improved AMF for image denoising", 3rd Int conf on comp and electrical engg, vol 53,2010.

[11] Youlian Zhu, cheng Huang, " An AHE algorithm on the image gray level mapping", Physics Procedia, Vol 25, 2012.

[12] Jharna Majumdar and Santhosh Kumar, "Modified CLAHE: an adaptive algorithm for contrast enhancement of aerial, medical and underwater images", Int. journal of comp engg and tech,Vol 5, Issue 11, Nov 2014.

[13] Pieter Vuylsteke, Emile Schoeters, "Multiscale image contrast amplification", June 2005.

[14] Qaiser Mohammed, Artur Chodorowski, "A novel Baysian approach to AMS segmentation of brain images", Dept of signals and systems, Vol 17, June 2009.

[15] Yifeng Zhou and J.P.Y. Lee, "Modified expectation maximization algorithm for maximum likelihood direction of arrival estimation", Signals, systems and computers, Oct 2000.

[16] Mohamed Ali and Karim Katli, "Image segmentation by adaptive distance based on EM algorithm", Int journal of adv. Comp science and apps, May 2011.

[17] Gaurav Kumar, " A detailed review of feature extraction in image processing", IEEE fourth Int, Conf. on adv computing and comm Technology, Feb 2014.

[18] Shilpa Yaligae and Sanjeev Samakki, "Identification and retrieval of archeological monuments using visual features", Conf. on emerging research in comp and app, ERCICA 2013.

[19] Sasah Karamizadeh, " An overview of PCA", advanced informatics school, Journal of signal and image processing,2013.

[20] Debmalya Bhattacharya, Jibanpriya, " Brain image segmentation technique using gabor filter parameter", AJER,Vol 2,Issue 09,2013

[21] Dmitriy Fradkin and Ilya Muchnik, "Support Vector Machines for classification",DIMACS, 2000.

[22] Lin W.E Tsao and C.Chen, "Constraint satisfaction neural networks for image segmentation", Jan 1991.