Advance Approach for Brain Tumor Detection and Classification using Segmentation

Ladali M.Barot[1], Damini J.Patel[2]
[1]Student LCIT, Bhandu, India, [2] Prof. LCIT, Bhandu
[1]Computer Engineering Department
[1] LCIT, Bhandu, India,

Abstract: *Brain tumor is an abnormal and excessive growth in the brain. It can be categorized as benign and malignant. Benign tumor stays localized and does not spread elsewhere in the body and can be cured by surgical removal. The malignant tumors spread to other organs and tissues. Both the benign and malignant tumors are hazardous to the patients and may lead to death. Image creation of the human body (or parts thereof) for clinical application is referred as medical imaging. A medical imaging technique used primarily in radiology to image the anatomy and functioning of the body is known as MRI (Magnetic Resonance Imaging). Hence an efficient method for tumor segmentation should clearly use a reliable tool where the MRI scan can be used as an accurate technique for detecting tumor from human brain. Main objective of these dissertation is design efficient architecture for base on segmentation and classification base concept.using segmentation base on color shape and texture identify*

Keywords: *Brain MRI,Segmentation,Classification,Tumor*

I. INTRODUCTION

In medical image processing, segmentation of MR images of brain is a complicated and challenging task because the MR images are associated with the artifacts. Appropriate and accurate segmentation technique is necessary in prior to tumor detection and classification of abnormalities. Segmentation in image processing is referred to the technique of isolating an image into mutually exclusive regions. It is applied in order to identify objects of interest and also edges or boundaries in images. The presence of artifacts, obscure or simulate the pathology. Image segmentation algorithms are based on one of the two basic properties of image intensity values, namely discontinuity and similarity. The former approach is based on the changes in the pixel intensity values (at the edges and corners) and the latter is based on subdividing an image into different regions that are similar based on a set of predefined criteria.

In the literature review, there are many techniques and algorithms which were developed and implemented for image segmentation that are histogram based, edge-based, artificial neural network based methods, region-based methods (region growing, splitting and merging), physical model based approaches, and clustering methods (Kmeans clustering, Fuzzy C-means clustering, , Mean Shift and Expectation Maximization) [1]-[5],but still there is a necessity to identify and develop an efficient and fast technique for medical image segmentation, because, all these techniques have their own advantages and limitations with reference to their suitability, applicability, performance and computational time.

The difficulty in segmentation process is the selection of proper method for a particular kind of image dataset. There is no generally accepted technique for brain MRI image segmentation. In this paper, image segmentation by Edge based (Morphological operations) technique is implemented and its performance is evaluated.The performance of these approaches can be judged in terms of PSNR Value, SSIM Value, MSE Value, Mean value.

II. RELATED WORK

In [1]this paper, They have presented an improved FCM algorithm for brain MRI image segmentation. The proposed method takes intensity in homogeneity into consideration and makes full use of the local neighbour influence with bias field constraints to form regularization terms. Applying the proposed algorithm to brain MRI images and comparing it with the EM and conventional FCM

methods, results indicate that the improved FCM method produces more accurate and reasonable segmentation of WM, GM and CSF from MRI data..

In [2]this paper The proposed system is better method to discover and classify brain tumor in MRI images. The hybrid technique consisting of SVM and two clustering methodise-mean and FCM provides more accurate results compare to other algorithms. With this proposed system it is easier to classify the tumor and also to grade the location of the tumor so that the visualization becomes easier with GUI interface. The system has more accuracy rate and less error rate.

In [3] The proposed method classifies the MR brain images using bilateral symmetry property with respect to interhemispheric fissure. MRI brain has structural symmetry between right and left cerebral hemispheres. Fifteen histogram similarity measures (HSM) are used to measure the similarity between cerebral hemispheres. The proposed method is able to classify the brain images into normal and abnormal classes with high accuracy and less error rate.

In [4] The proposed machine learning algorithm for brain tumor classification uses texture based features. These features were extracted by using GLCM technique. 22 features were extracted from an MRI. For the classification purpose, Ad boost classifier is used and maximum accuracy achieved by proposed system is 89.90%.

In [5]Automatic segmentation of brain MR images is implemented using MATLAB tool for morphological and compared with EM and FCM segmentation methods. The difficulty in segmentation process is the selection of proper method for a particular kind of image dataset. Therefore, there is no generally accepted technique for brain MR image segmentation. Performance of the Morphology, EM and FCM techniques are summarized in tables. Values of performance parameters suggest that the segmentation by Morphological operations is fast and effective for the selected image dataset.

III. METHODOLOGY

Brain MR Image database is created by collecting T1 weighted, T2 weighted and FLAIR images of patients acquired using 1.5 Tesla MRI scanner from the radiologists of medical colleges and research centers as well as from internet. Preprocessing is done to remove noise or artifact. Segmentation algorithms are implemented as given in below steps.

(A) Median Filter :

Median filtering is a nonlinear method used to remove noise from images. It is widely used as it is very effective at removing noise while preserving edges. It is particularly effective at removing ‘salt and pepper’ type noise. The median filter works by moving through the image pixel by pixel, replacing each value with the median value of neighboring pixels. The pattern of neighbors is called the "window", which slides, pixel by pixel over the entire image 2 pixel, over the entire image. The median is calculated by first sorting all the pixel values from the window into numerical order, and then replacing the pixel being considered with the middle (median) pixel value.[6].

(B) Texture Operation Using Scale-invariant feature transform (or SIFT)

Step1: Constructing Scale space :

- ✓ In scale Space we take the image and generate progressively blurred out images, then resize the original image to half and generate blurred images.
- ✓ Mathematically blurring is defined as convolution of Gaussian operator and image.

$$L(x,y,\sigma)=G(x,y,\sigma)*I(x,y),$$

Where G= Gaussian Blur operator

1/) / 2

- L is a blurred image .

- G is the Gaussian Blur operator .
- I is an image .
- x, y are the location coordinates .
- σ is the "scale" parameter. The amount of blur. Greater the value, greater the blur.
- The * is the convolution operation in x and y. It applies Gaussian blur G onto the image I.

Step2: Difference of Gaussian(DoG):

✓ LoG are obtained by taking second order derivative.

✓ DoG images are equivalent to Laplacian of Gaussian image. Moreover DoG are scale invariant.

✓ In other word when we do difference of Gaussian images, it is multiplied with σ 2 which is present in Gaussian blur operator G.

Step3: Finding Key point :

✓ Finding key point is a two-step process:

1. Locate maxima/minima in DoG images .

2. Find subpixel maxima/minima

Step4: Eliminating bad keypoints :

1. Removing Low Contrast features
2. Removing edges.

Step5: Assigning Orientation:

✓ Gradient direction and magnitude around key points are collected, and prominent orientations are assigned to key points.

Step6: Generating SIFT Features

✓ Creating fingerprint for each key point, so that we can distinguish between different key points[7].

(C) Edge Detection Using Canny Edge Detector

Process of Canny edge detection algorithm:

The Process of Canny edge detection algorithm can be broken down to 5 different steps:

➢ Apply Gaussian filter to smooth the image in order to remove the noise

➢ Find the intensity gradients of the image

➢ Apply non-maximum suppression to get rid of spurious response to edge detection

➢ Apply double threshold to determine potential edges

➢ Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges[8].

(D) Morphological Operation

Steps for Morphological segmentation are as follows.

1. Read MR brain image as input from database

2. Binary conversion of the input image is obtained by applying the threshold T [9] [10], such that

$$b(r,c) = \begin{cases} 1 & g(r,c) \geq T \\ 0 & otherwise \end{cases}$$

Where g(r,c) bintensity or gray scale image & b(r,c) is the binary image.

3. Apply Erosion on the binary image with suitable structuring element and resulted image is called eroded image.

$$A \ominus B = \{z|(B)_z \subseteq A\}$$

Where, A represents the binary image and B is the structuring element.

4. Apply Dilation on the previous resulted image with same suitable structuring element and resulted image is called dilated image $A \oplus B = \{z|(\bar{B})_z \cap A \neq \phi\}$ Where ,ϕ empty set.

5. Create mask of brain tumor region. This extracts only tumor region which has more number of pixels than surrounding tissues.

6. Subtract the created tumor mask region in the dilated image to detect tumor region.

IV. PROPOSED WORK

According to Literature survey Still Found Certain Limitation is Medical Image Processing like type of Tumor Detection Rate, Early Stage Detection Etc. So Using proposed Flow Work an early Stage Detection with high accuracy and also classify different type of tumor on early stage.

(A) Proposed System

We have made a survey on different techniques for Detect Tumor on early stage and which approach suits the best. From that, we have realized that we will design efficient architecture for base on segmentation and classification and improve quality of image. Using segmentation base on shape and texture identify max feature and then use classification approach for identify tumor on early stage.

In propose system image taken as input from databasethan we perform pre-processing on image by applying Median filter. After apply Median filter than we perform feature extraction on image by applying Texture feature.Here as described in proposed flow chart after apply feature extraction than we perform Segmentation on image by applying Canny Edge Detection. we perform Morphological Operationon image by applying Erosion and dilation Morphological Operation. According to proposed flow chart after Perform above all operation in last step finally we detect tumor.

Flow Diagram of proposed system

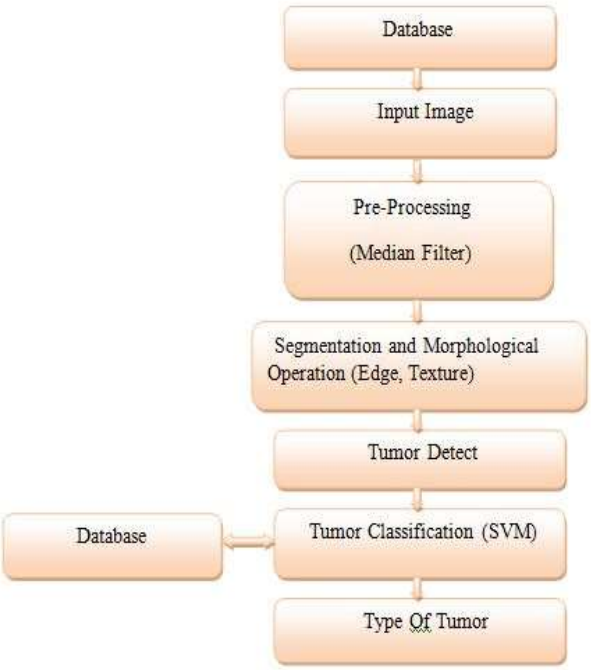

Fig 1. Flow Diagram of Proposed System

V. EXPERIMENTAL RESULTS

The experimental results are discussed for sample original input image as shown in figure 1. Images are collected from radiologist of various medical colleges and research centers as well as open source.

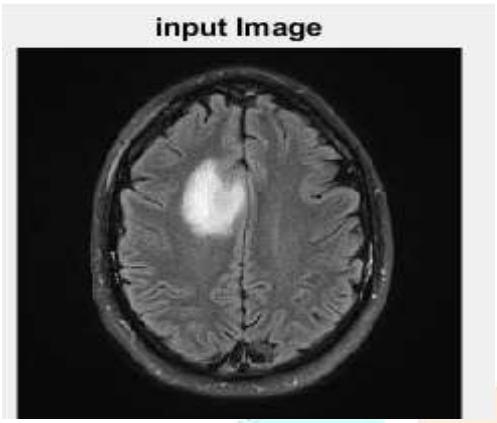

Fig 2. Original input MR image of brain.

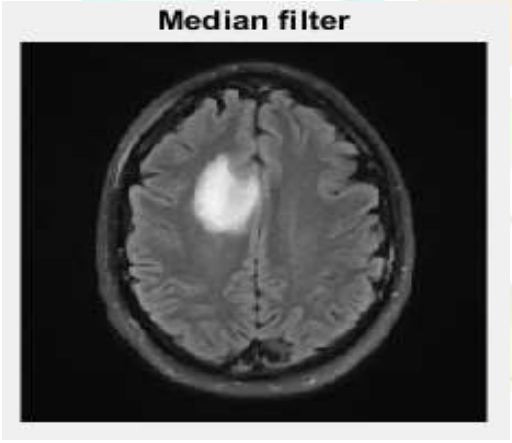

Fig 3. Image after applying Median Filter.

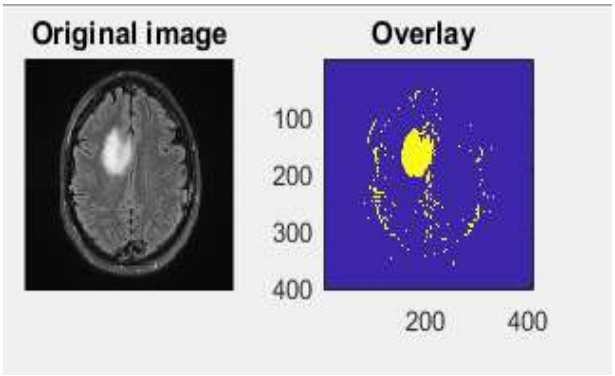

Fig4. Brain image after applying Feature Extraction

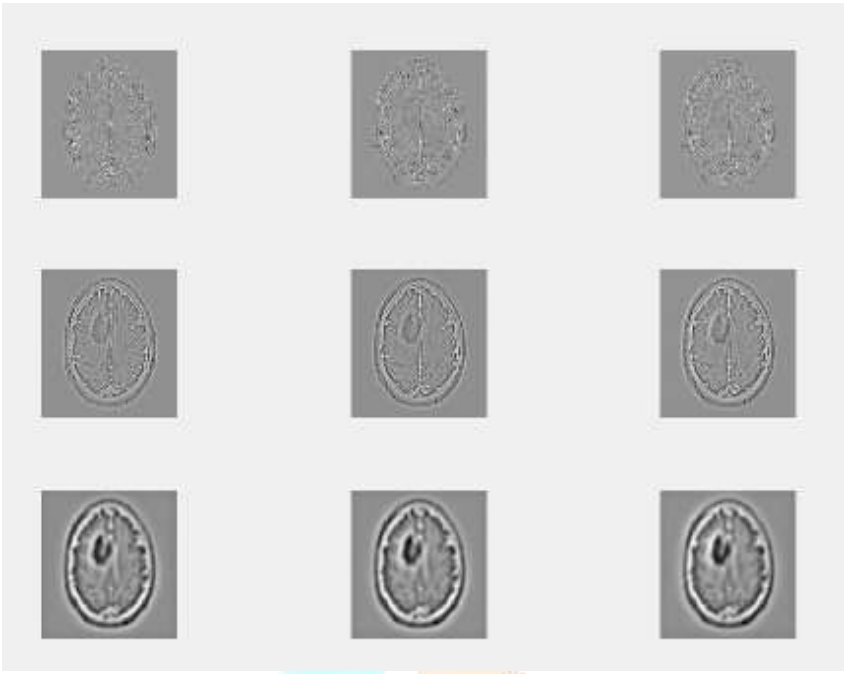

Fig 5. Image after perform Texture Feature

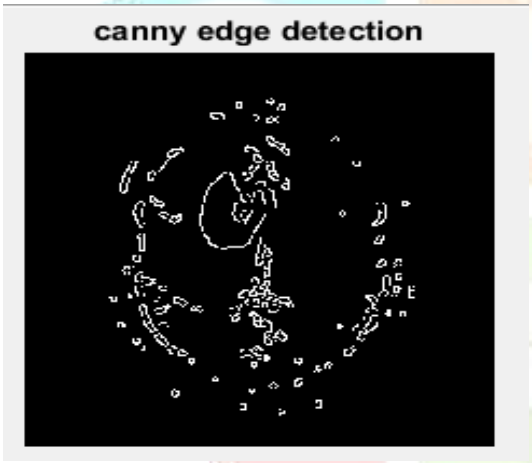

Fig 5. Segmentation brain tumor by Canny Edge Detection

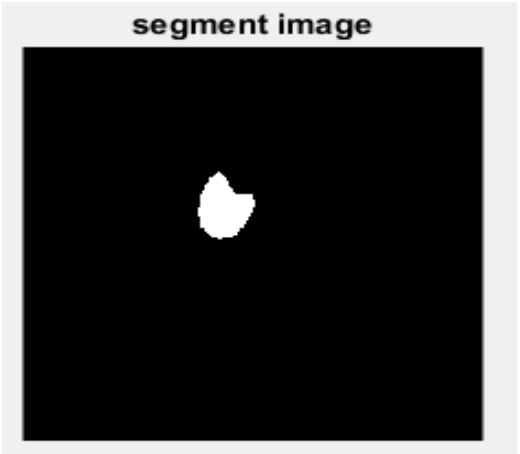

Fig 7. Segmented brain tumor by Morphology.

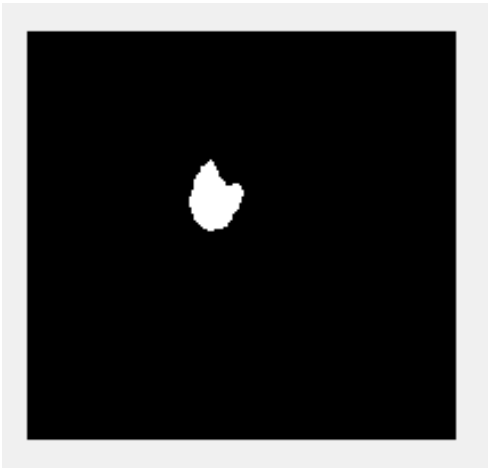

Fig 8. Segmented brain tumor by Morphology.

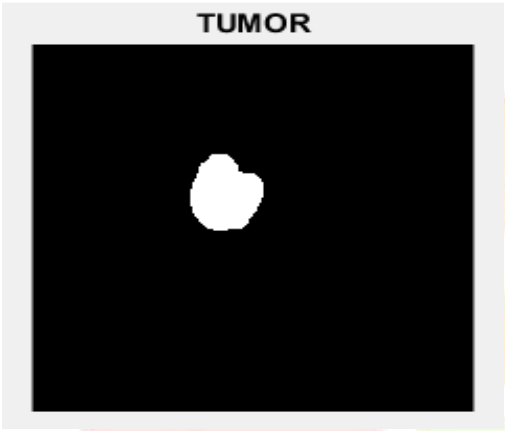

Fig 9. Detect Brain Tumor

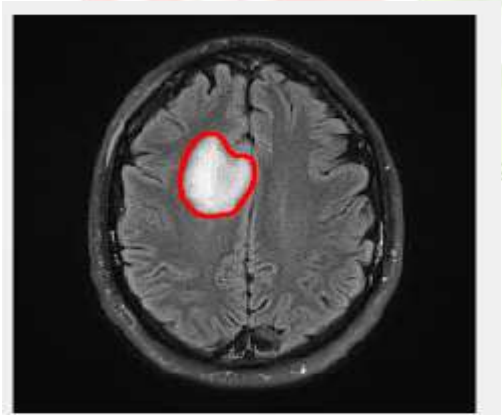

Fig 10. Brain Image after Detect Tumor.

VI. EXPERIMENTAL EVALUATION

Experiment of proposed method is executed on computer having Intel (R) Core (TM) i3-5200U CPU@2.20GHz with 4GB RAM having Windows 10 (64 bit) operating system and MATLAB 2017R .Simulation.The experimental parameters used in simulation of the system are listed below:

Table 1: Performance parameters of Propose System

. Input	PSNR Value	SSIM Value	MSE Value	Accuracy (%)	Mean value	sensitivity
Dataset1	20.1459	0.6986	0.0097	0.9083	0.0648	0.5937
Dataset2	27.8537	0.9634	0.0016	0.9891	0.0131	0.957
Dataset3	27.8302	0.8964	0.0016	0.9669	0.0255	0.761
Dataset4	23.0596	0.79	0.0049	0.7234	0.1085	0.6017
Dataset5	25.308	0.8794	0.0029	0.9246	0.7089	0.0475

(A)Comparison chart of different datasets

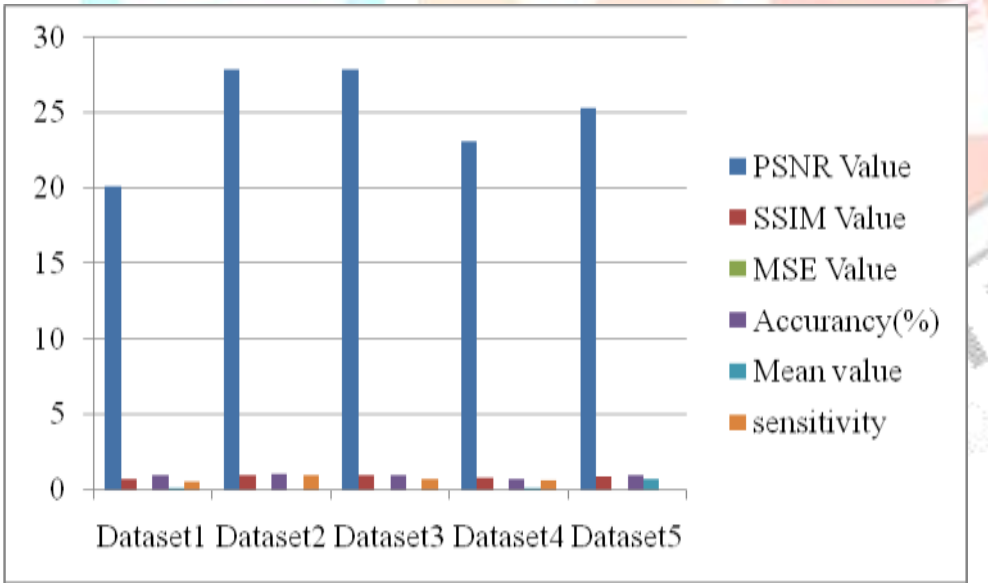

Fig 11. Chart of propose system parameters

After implementing the System the result derived is been shown in below figures. The simulation result shown below gives the comparison of parameter with previously proposed algorithm which shows significant improvement in Accuracy Compare to existing system.

Table 2: Comparison of Propose system and Existing System parameter

Input	PSNR Value of Propose system	PSNR Value Of existing System	SSIM Value Of Propose system	SSIM Value Of existing System	Accuracy (%)Of Propose system	Accuracy (%) Of existing System
Dataset1	20.1459	14.7302	0.6986	0.6017	0.9083	0.5097
Dataset2	27.8537	19.5895	0.9634	0.7295	0.9891	0.6242
Dataset3	27.8302	19.0115	0.8964	0.7526	0.9669	0.6452
Dataset4	23.0596	19.807	0.79	0.7014	0.7234	0.5776
Dataset5	25.308	20.1093	0.8794	0.6967	0.9246	0.5862

(B)Comparison Chart of Propose system and Existing System

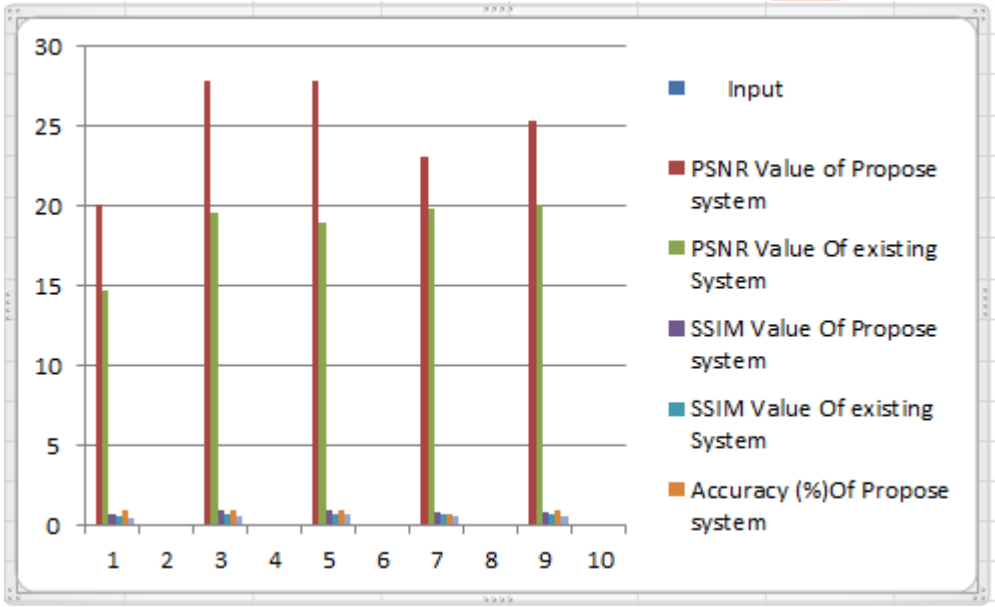

Fig.12 Existing System v/s Propose System

VII. CONCLUSION

According to analysis we successfully completed Implementation of Segmentation and Pre-Processing using Edge Detection and Filtering method and also apply Morphological operator for find particular Region . Than we finally can detect tumor on early stage.Values of performance parameters suggest that the segmentation by Morphological operations and Edge Detection is fast and effective for the selected image dataset.

VIII. REFERENCES

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