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Fog removal in an image using fuzzy c-means and active contour segmentation

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ABSTRACT

Edge-maintaining smoothing is a picture processing approach that smooths away textures whilst keeping sharp edges. Image de-noising is the approach to lessen noises from corrupted pics. The goal of image denoising is to enhance the evaluation of the picture or notion of records in pics for human visitors or to offer higher output for different automatic picture processing techniques. The severe risk of air pollutants to human fitness makes air first-rate awareness of public attention, and effective, well-timed air first-rate tracking is vital to pollutants manipulation and human fitness. This paper proposes a deep getting to know and picture-primarily based totally version for air first-rate estimation. The noise introduces itself into a picture by changing a number of the pixels of the unique picture through new pixels having luminance values close to or identical to the minimal or most of the allowable dynamic luminance range. Preprocessing an image is a good way to adjust the picture for similar classes and segmentation.

Keywords: *Image Processing, Adaptive Filter, Gaussian Filter, Canny Edge Filter, Active Contour, And Convolutional Neural Network.*

1. INTRODUCTION

Images are crucial records that present statistics of approximately minute things. So it's essential to have exact exceptional photographs. But today's climate situation and air pollutants make it difficult. Images with fog and haze are blurred and obscure[1]. The fog removal system overcomes the above-cited problems. It makes use of diverse filters like Adaptive filter, Dehaze filter, Gaussian filter, and Canny edge filter to dispose of noise and fog at special levels. Image segmentation is a procedure of dividing the virtual photograph into multiple photograph segments to understand it better. There are diverse photograph segmentation techniques, fog removal systems that make use of Fuzzy c, and active contour techniques. The dehaze photographs are categorized primarily based totally on CNN (critical Neural Network) which is a deep learning algorithm[3,9]. It classifies the photographs primarily based totally on the favored pattern. It helps to smooth the fog-affected image[4]. Eventually, the decision results are displayed and formulated on quality metrics.

2. EXISTING SYSTEM

In the existing system, an adaptive filter is used based on the spatial generalized AR (SGAR) model. The edge-preserving filter is used when images are polluted by several noises like Gaussian noise, Poisson noise, and impulse noise. Multiresolution analyses are used to classify the structures as borders, dots, and streaks. On the other side, LBP operators are used for classifying the variations of colors, the pigment network, etc. These features are combined at last to identify the influence of each feature in the detection process.

3. PROPOSED SYSTEM

Proposed Work Flow Diagram

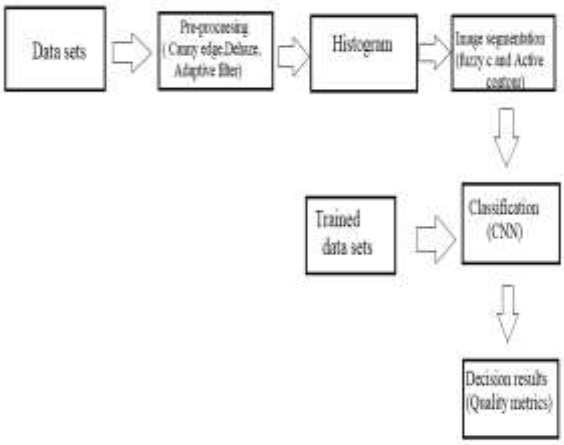

Fig 3.1

The flow diagram fig.3.1 consists of six components which are discussed below:

1. Dataset: A dataset is a collection of images with fog and haze which is to be converted to dehaze images[6].
2. Pre-processing: Pre-processing involves five different

algorithms namely converting to a grayscale image, adaptive filter, Gaussian filter, Canny edge filter, and dehaze filter.

3. Histogram: Histogram equalization is a method that uses an image's histogram for contrast adjustment in image processing.
4. Image segmentation: Image segmentation is used to divide the digital image into multiple segments.
5. Classification: Using the CNN algorithm, fog-removed images are classified.
6. Decision results: The final decision results are given based on Quality metrics.

4. DATA COLLECTION AND PREPROCESSING

Information Collection is perhaps the main errand in building an AI model. It is the social affair of errand-related data dependent on some focused factors to investigate and create some significant results. In any case, a portion of the information might be uproarious, for example, may contain mistaken qualities, inadequate qualities, or inaccurate qualities. Subsequently, it is necessary to handle the information before breaking it down and going to the outcomes. Information pre-handling should be possible by information cleaning, information change, and information determination[5]. Here we collect images of fog, mist, and haze. These digital images are converted into grayscale images. Grayscale images are easy for computational processes. Using the filters mentioned in chapter 1, fog and haze is removed. The fig.4.1 is the input image in which the fog and hazed should be removed.

Fig.4.1

4.1 Adaptive filter

An adaptive filter is used to remove noise and obscure parts of an image. The fig.4.1.1 is the filtered image of the input image. The image is gray to identify features better while using the CNN algorithm RGB images show various color contrast which is difficult to process.

Fig.4.1.1

4.2 Gaussian filter

A Gaussian filter is used for the purpose of removing Gaussian noise. Gaussian noise is introduced in an image due to low light conditions. The adaptive filtered image is then filtered to remove gaussian noises. The fig.4.2.1 is the Gaussian filtered images.

Fig.4.2.1

4.3 Canny Edge filter

Canny edge filter is one of the best edge detection techniques which preserves the edges of an image. Using this technique helps to minimize the number of images to be analyzed. Edge preservation is necessary for the reason that various objects are identified easily. The fig.4.3.1 is the Canny edge filtered image of the given input image.

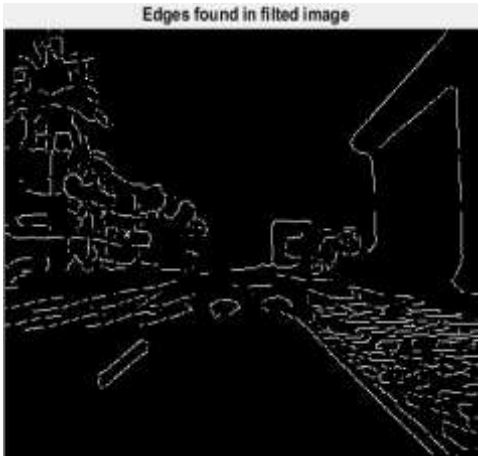

Fig.4.3.1

5. HISTOGRAM

A histogram is a graphical illustration that organizes a set of data points into user-specific levels. Fig. 5.1 shows the levels of fog in the grayscale image.

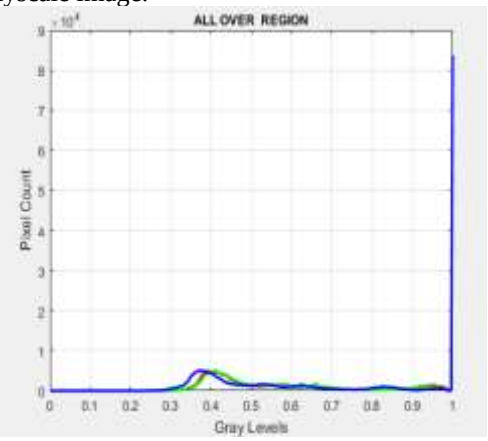

Fig.5.1

6. CLASSIFICATION

Convolutional Neural Network(CNN) algorithm is one of the most powerful deep learning algorithms. Based on the trained datasets, CNN classifies the images into high fog level, medium fog level, and poor fog level[7]. Here, the CNN classifies the given input images as high noise images, moderate noise images, and low noise images. The fig.6.1 image shows that the image has moderate noises.

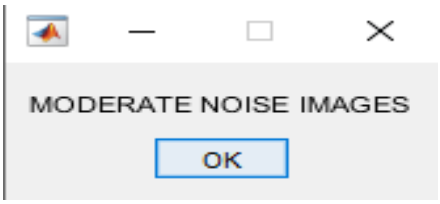

Fig.6.1

7. IMAGE SEGMENTATION

Image segmentation is done in two steps namely Active contour and fuzzy c-means techniques. The active contours technique also known as snakes is an iterative region growing image segmentation algorithm. It is used to segment the image into foreground and background regions. In the first step initial curves of an image are specified. And then an active contour function is used to evolve the curves towards object boundaries. The output of the image is segmented as black and white where black represents the background region (logical false) and white represents the foreground region(logical true). Fig. 7.1 shows active contour segmentation. In this process, areas with high fog levels are detected by using 800 iterations.

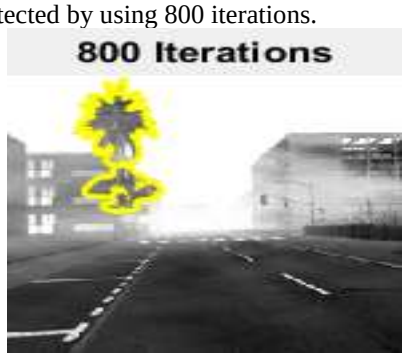

Fig.7.1

Fuzzy c-means(FCM) is a data clustering technique where data is grouped into N clusters. Each data point in the dataset belongs to every other cluster to a certain degree. Also, Fuzzy c-means is a soft clustering approach and has more tolerance for ambiguity. This method has achieved great success in many practical applications. Here each data point is assigned a likelihood or probability score to belong to the cluster. Therefore the output is based on probability. It gives better results for overlapped datasets. Fig. 7.2 shows the fuzzy-c-means segmentation of the given input image.

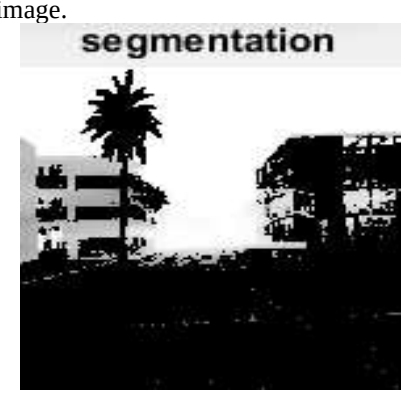

Fig 7.2

8. DECISION RESULTS

The decision results are given based on the quality metrics. Here we consider metrics like contrast, energy, correlation, standard deviation, variance, kurtosis, and skewness. The contrast shows the differences that exist between analog and digital images. Energy refers to the amount of error or deviation distance from ideal pixels. Correlation measures whether there is a relationship between two points in an image. Standard deviation measures the deviation of the gray-level intensity of an image. Variance is the measure of finding how much each pixel varies from neighboring pixels. Kurtosis is a measure to find whether the data are flat or peaked relative to normal distribution. Skewness is to find the measure of symmetry.

9. FUTURE WORK

Further, we enhance the proposed model to identify underwater species and microorganisms present on the surface that are degraded due to dust and light. Eventually, this will be more helpful for taking surveys of extinct species, endangered species, and so on.

10. CONCLUSION

In this proposed model, we enhance the images that are degraded due to fog and haze using fuzzy c-means and active contour segmentation. This helps prevent flight accidents that are occurred due to certain weather conditions. Also, it is used to detect the noise level present in an image. The main aim is to achieve a good accuracy than the existing system.

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