

# Harmful Algae Blooms Prediction Using Fuzzy-C Means Clustering Algorithm

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**Abstract**— A good value perceptive of the population dynamics of algal area is crucial in several ecological and pollution studies of freshwater and also in oceanic systems. This paper reviews the subsequent introduction of harmful algal communities using image processing techniques like image preprocessing, clustering, and segmentation. It provides a method to detect the harmful algae blooms in water. Mainly algal blooms are not dangerous, but assured types of algae may cause a risk to human being, flora and fauna and stream quality. In this paper an Image Processing system is developed to detect an automatic assessment of these harmful algae blooms in water.

**Key words:** Harmful Algae Blooms, Preprocessing, Clustering, Segmentation, Image Processing

## I. INTRODUCTION

In computer science, image processing is one outward appearance of signal processing for which the input is an image, such as a scanned photograph or video frame. The output of image processing may be either an image, a set of characteristics, values or parameters related to that input image. Nearly all image processing techniques treated the image as a two-dimensional signal and using some standard signal processing techniques to it. In any image processing application the important thing is an input that is an 'image'.

The word algae represent a large group of different organisms from different phylo genetic faction, representing several taxonomic divisions. In general algae can be referred to as plant-like organisms that are usually photosynthetic and aquatic, but do not have true roots, trunk, vegetation, vascular tissue and have plain reproductive composition. They are distributed worldwide in the sea, in freshwater and in wastewater. There are two types of algae,

Harmful Algae Blooms ( HAB) have been known to produce a wide array of neurotoxins, liver toxins, cell toxins and skin irritants. Consumption of large amounts of these toxins by animals or humans cans consequence in strength cramp, twitch, paralysis, cardiac difficulty, queasiness, vomiting and liver failure. Skin irritants, found in nearly all blue-green algae blooms, can turn out indication together with skin frustration, irritation and gastro intestinal distress.

In this research paper focused on the harmful algae blooms in different types of toxic algae in fresh water and oceanic water. First, this implies to commonly monitor the harmful algae blooms. The toxic images are acquired using cameras, scanners or any other digital devices. Then the acquired image has to be processed to interpret the image contents by different image processing techniques. The primary objective of this work is to detect the toxin algae in fresh water and also in oceanic water using color segmentation operation. In my proposed work collect

images of various harmful algae blooms affected in water. This imagery will be preprocessed for enrichment. Afterward segmentation will be conceded out for extraction of toxin algae in water part from foreground of image. After segmentation, various features of algae blooms including color, shape and texture will be extracted. The affected area is located by using different type of edge detection methods.

## II. METHODOLOGY

The architecture of this work is represented below figure.

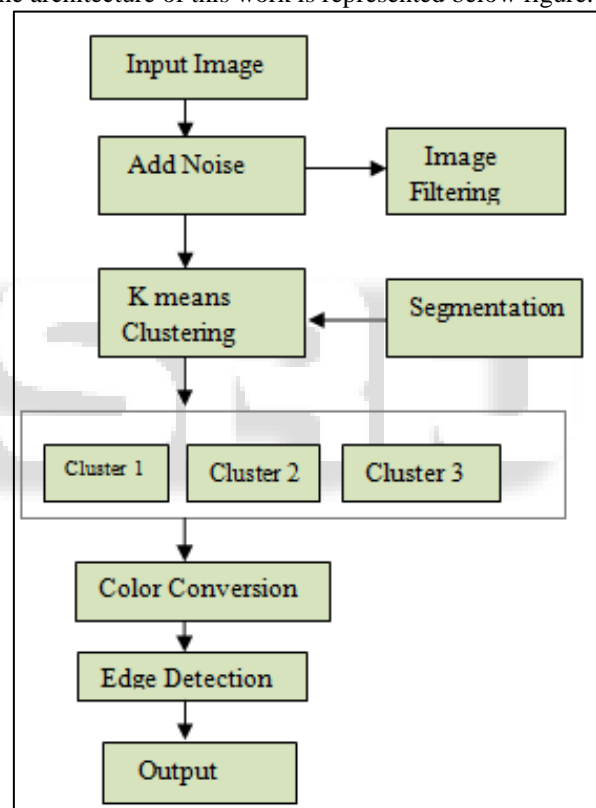


Fig. 1:

### A. Salt & Pepper noise

It represents erratically occurring white and black pixels. An effectual noise reduction method for this type of noise involves the usage of a median filter. Salt and pepper noise creep into images in situations where rapid transients, such as faulty switch, take position. In image following distortion from salt and pepper noise looks like the image attached. This type of noise contains arbitrary occurrences of both black & white passion values, and often caused by threshold of noise image. Salt & Pepper distribution noise can be expressed by

$$P(x) = \begin{cases} p1, & x = A \\ p2, & x = B \\ 0, & \text{otherwise} \end{cases}$$

Where P1, P2 are the Probabilities Density Function (PDF) p(x) is allocation salt and pepper noise in image and A, B are the array size image. In this paper salt & pepper noise in picture is at random occurred in white and black pixels of an image [6]. The challenge in removing salt & pepper noise from image is due to the fact that image data as well as the noise, allocate the similar tiny set of value, which obscure the practice of discover and eliminate the noise.

### B. Linear Filtering

Linear filter can be achieved through complication in the spatial domain. In the complication method the significance of output pixels is calculate as the weighted sum of nearest pixels from the input image.

- The medium of weighting feature is referred to as the intricacy kernel and represents the filter performance. For our purposes these matrices will be of odd dimension (e.g. 3x3, 5x5, 7x7, etc.).
- The weighting process may be expressed as:

$$R=w_1I_1+w_2I_2+\dots+w_{mn}I_{1mn}=\sum_{i=1}^{mn}w_iI_i$$

Where m, n are the indices of the kernel (often a square matrix) and I represents the input image pixel intensities. The weighting factors are given by w.

### C. Clustering

Clustering is a division of data into groups of similar objects. Representing the data by less clusters inevitably misplace assured fine fact, but accomplish simplification. Its representation of information by its clusters. Data modeling puts clustering in a historical perspective rooted in mathematics, statistics, and arithmetic investigation. From a apparatus knowledge perception cluster converse to hidden patterns, the search for clusters is unsupervised learning, and the resulting system represents a data concept. Since a machine learning standpoint group communicate to secreted pattern, the search for clusters is unsupervised learning, and the resulting system represents a records notion. From a realistic perception cluster acting an dazzling task in data mining applications such as scientific data exploration, information retrieval and text mining, spatial database appliance, Web analysis, CRM, advertising, medical diagnostics, computational science, and many others.

### III. FUZZY C-MEANS CLUSTERING ALGORITHM

Fuzzy logic deals with the ambiguity and elusiveness present in the predicament. The image in grey color has an uncertainty in brightness and darkness of a pixel value. Segmentation is carried out by firstly converting the RGB image to HIS image which has perplexity in decisive whether pixel is normal or infected. This sort of pensiveness is known as spatial ambiguity. To resolve this, image is considered as a fuzzy set. Fuzzy clustering obtained more evenhanded results for vague cluster boundaries. In a fuzzy set there is a degree of association for every member .Value of membership deceit between 0 and 1 and the sum of membership of each object is 1. Larger the membership values indicates higher assurance to the cluster. Fuzzy C-Means objective function is  $\sum_{i=1}^n \sum_{j=1}^C u_{ij}^m |x_i - c_j|^2$

Where  $m$  is any real number greater than 1,  $C$  is the number of clusters,

$u_{ij}$  is the membership degree of  $x_i$  in the cluster  $j$ ,

$|x_i - c_j|$  is euclidean distance between any data object present in the cluster and the centroid of  $j$ th cluster.

- Fuzzy C- means clustering algorithm is
- Select a number of clusters.
- Assign erratically to each point in the coefficients for being in the clusters.
- Do again until the algorithm has convergence.
- Compute the centroid for each and every cluster.
- For ever
- y point calculate its co-efficient in the cluster.

### IV. RESULT

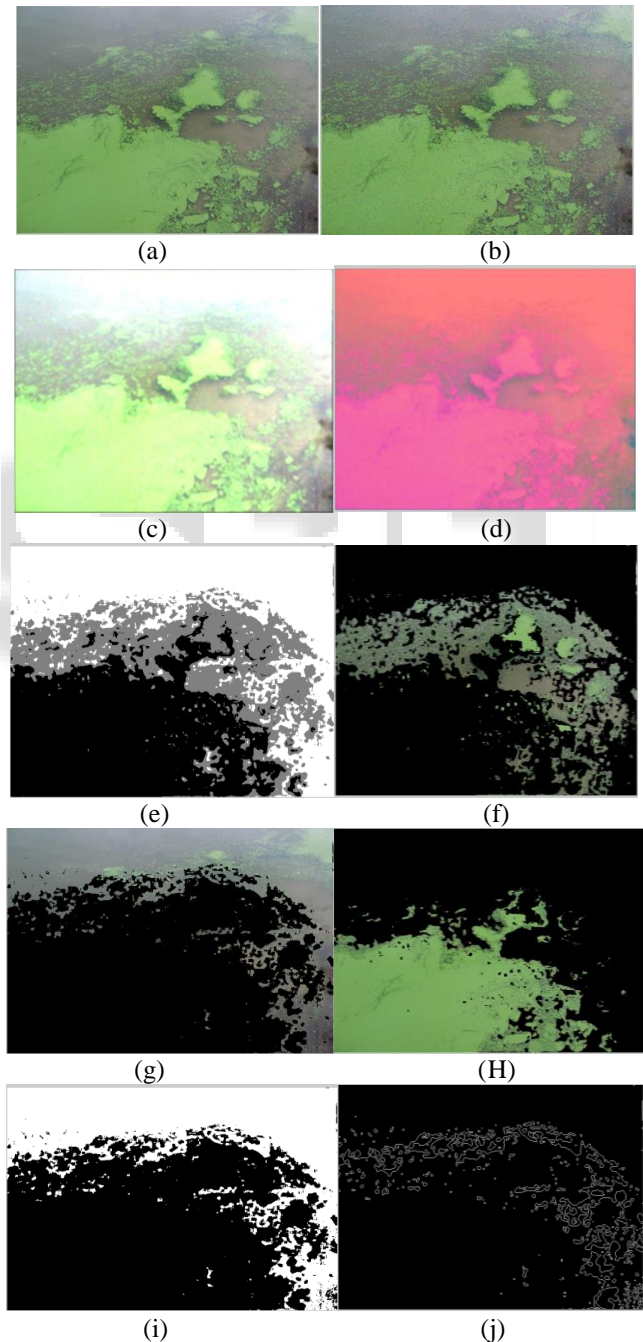


Fig. 2: (a) Typical input image present in the database. (b) Salt and pepper noise. (c) Linear filter is used to remove noise. (d) Color conversion. (e) Cluster index. (f) Objects in cluster 1. (g) Objects in cluster 2. (h) Objects in cluster3. (i).Color conversion. (j) Canny edge detection.

## V. CONCLUSION

In this research work the area of harmful algae blooms detection is introduced. The scheme developed here is for algae bloom detection, the development of good segmentation methods and precise features is very important in order to run the system in real time. One of the key concepts in image processing is segmentation in which particular homogeneous regions are grouped together based on the defined number of clusters. The performance of the novel unsupervised clustering algorithm Fuzzy-C Means Clustering (FCM) Algorithm is used to segment the algae blooms in water. The main technique used was segmentation, which is done using a method based on Fuzzy C-Means Clustering algorithm and edge detection operation; many methods exist for image segmentation that attempts to segment an image into homogenous regions. This technique gives efficient results when compared to the previous work. Experiments are applied on various images and results show a clear segmentation. Our proposed work is easy to execute thus can be managed easily and giving effectual results in segmentation of the harmful algae blooms in fresh water and oceanic water.

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