IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Special Issue-11, May 2019 E-ISSN: 2347-2693

Object Recognition Based Smart Digital Processing Using Fuzzy Logic

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Available online at: www.ijcseonline.org

Abstract- Object recognition can be viewed as a part of a computer vision system in which the image patterns will be converted into a feature space and in turn this will be transformed into the classification of various objects to be identified. Object recognition requires a prior knowledge of the object description. Typically these descriptions include shape, texture, color, and size of the occurrence of such objects in an image. For identifying image different approaches are followed such as similarity based approach and discontinuity approach. Since these approaches does not give better results hence we have applied Fuzzy logic-K means for identifying different objects in an image. The model accuracy is tested on MATLAB.

***Keywords*:** Object recognition, Fuzzy Logic, K means, Digital Image, Cluster.

I. INTRODUCTION

The problem of object recognition can be viewed as a part of a computer vision system. In which the image patterns will be converted into a feature space and in turn this will be transformed into the classification or decision space comprising the prototypical definition of the various objects to be identified. Context finding and image understanding is the following stage. The object recognition problem can be divided into two basic blocks: low level and high level vision. The low level vision task can be seen as to isolate objects and regions from the given image and similarly extracting other characteristic features from an image. The high level vision means the interpretation of these objects or features in the frame of a reference scene. In other words the task of object recognition is to find and label various parts of the two dimensional image of the scene. To accomplish the object recognition task one must first establish the models description of the object which has to be recognized. This implies that the object recognition requires a *prior* knowledge of the object description. Typically these descriptions include shape, texture, color, and size and context knowledge of the occurrence of such objects in a scene. A digital image may contain several distinct kinds of information which can be interpreted in entirely distinct ways. The most elementary information comes from the measured pixel values without its meaning. The conventional approaches to object recognition rely entirely on local operators that analyze the measured light intensities of the image. The real objects are defined by their geometric and semantic characteristics as well as by their statistical properties. Thus the conventional methods may fail to recognize the objects properly. For example, depending on the arbitrary threshold settings, edge detector methods will either produce so many edges that the relevant information will be very difficult to be interpreted or sometimes extract very few from the all relevant boundaries. In related work we will present some techniques of image segmentation and boundary detection.

II. METHODOLOGY OF THE PROPOSED WORK

2.1. Feature Vectors

i. Signature: It is used for representation of boundary. It is a boundary distance vector from the centroid of each component.
ii. Shape number: It is used to represent a boundary by a connected sequence of straight line and segments of specified length and direction.
iii. Histogram of each component.
iv. Statistical properties: In this we have find the Mean and Variance of the objects for the physical interpretation of the objects or components.
v. General properties: General properties are Area, Perimeter and compactness.

2.2. Working

i. Resize the image in an appropriate size of (255X256).
ii. Segment image by K-means.
iii. Merging the segment having the same color.
iv. Find out region and eliminating very small regions.
v. Calculation of features vectors.

III. RELATED WORK

3.1. Image Segmentation and Edge Detection

In computer vision, segmentation refers to the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation

is typically used to locate objects and boundaries (lines, curves, etc.) in images [1]. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Edge detection is a major step for recognizing objects from a given scene. The classification stage of the object recognition depends on the quality of edge characterization stage. A variety of edge detection algorithms exist [2] & [3], e.g. dynamic programming, piecewise linear polygonal approximation of a connected edge list, Hough transform [2]. A number of clustering techniques have been used for edge detection. Amongst these the fuzzy Clustering techniques are proved to be highly successful [4][5], not only for edge detection but for region segmentation as well. These techniques are mostly based on the minimization of objective functional [4], where the objective functional is the weighted sum of square (WGSS) of the distances (Euclidean for linear clusters) from a measured pixel to the calculated prototype or centroid of the particular class. Hence the type of detection is dependent on the type of prototype. If the prototype is chosen to be a straight line, then the algorithms tend to detect the lines in the data. The type of distances can also be varied to fit into the shape of clusters. A variety of distances as well as linear prototypes have been proposed. An extended form of this algorithm can also be utilized to recognize planes.

3.2. Fuzzy K-Means

The clusters produced by the k-means procedure are sometimes called "hard" or "crisp" clusters, since any feature vector **x** either is or is not a member of a particular cluster. This is in contrast to "soft" or "fuzzy" clusters, in which a feature vector **x** can have a degree of membership in each cluster.

3.3. Algorithm

The *k*-means algorithm assigns each point to the cluster whose center (also called centroid) is nearest. The center is the average of all the points in the cluster — that is, its coordinates are the arithmetic mean for each dimension separately over all the points in the cluster.

Example: The data set has three dimensions and the cluster has two points: $X = (x_1, x2, x3)$ and $Y = (y_1, y2, y3)$. Then the centroid Z becomes $Z = (z_1, z2, z3)$, where

$$z_1 = \frac{x_1 + y_1}{2},$$

$$z_2 = \frac{x_2 + y_2}{2} \text{ and } z_3 = \frac{x_3 + y_3}{2}.$$

The algorithm steps are:

- Choose the number of clusters, *k*.
- Randomly generate *k* clusters and determine the cluster centers, or directly generate *k* random points as cluster centers.
- Assign each point to the nearest cluster center, where "nearest" is defined with respect to one of the distance measures discussed above.
- Recomputed the new cluster centers.
- Repeat the two previous steps until some convergence criterion is met (usually that the assignment hasn't changed).

IV. RESULT AND DISCUSSION

Figure 5(a): This is Original Image on which we applied the object recognition techniques.

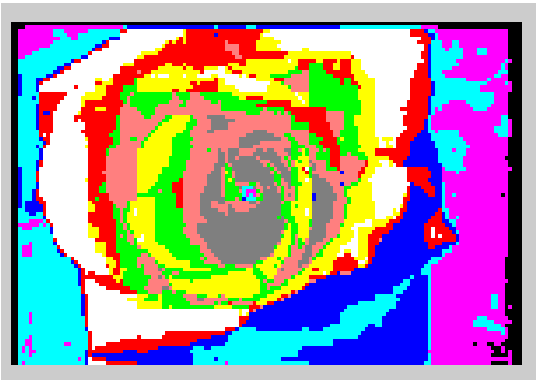

Figure 5(b): This is K-Means Segmented image.

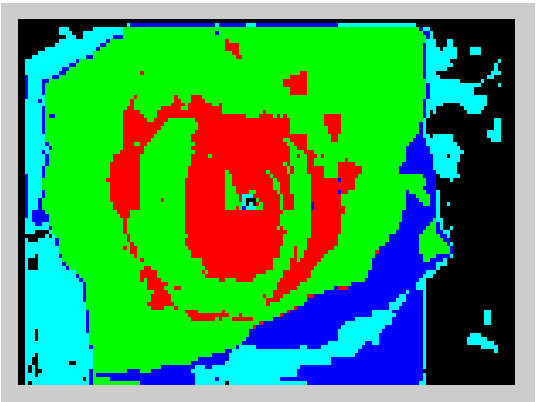

Figure5(c): Merging the segment having the same color.

Figure 5(d): This is Final image which shows the objects in different color.

V. CONCLUSION

In this paper we have presented techniques for object recognition in an image using fuzzy logic which follow K-means. These object recognition techniques can be applied to any kind of objects in an image. The advantage of this technique retrieves or recognizes number of objects in an image. This technique can be further implemented in advance projects like "Content Based Image Retrieval" (CBIR) etc.

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