Abstract

The tremendous growth in digital imagery is driving the need for more sophisticated methods for automatic image analysis, cataloging and searching. Segmenting an image into a set of meaningful regions and extracting a set of features, representing the basic properties associated with each of these segments. The retrieval of the query image from the segmented description of a set of database image forms another important application in machine analysis of image patterns. Segmented regions and the features of the regions need not be crisp, rather, a fuzzy description has been found to be sufficient and more appropriate for image analysis. This thesis discusses the issues associated with fuzzy based segmentation, viz. thresholding, edge based and match based segmentation, and also the color based image retrieval. It aims at unveiling the problems prevailing in the field, introducing consistent notions and definitions, reviewing the current solutions and proposing novel methods to improve the scenario.

The proposed fuzzy thresholding schemes segment the images as a set of object and background regions. A new type of exponential membership function derived from Gamma distribution has been proposed and a set of measures, viz. fuzzy divergence, indices of fuzziness, fuzzy compactness and fuzzy similarity measure have been used for finding the threshold values. Algorithms based on fuzzy divergence and edge-detection based on fuzzy operators has also been proposed here for detecting the edges on various test images. The algorithm for match-based segmentation utilizes the back projection algorithm and fuzzy similarity measure and has been employed on the textured images, colored images as well as remotely sensed images.

Color based image retrieval has also been attempted using color as a feature using various fuzzy measures for retrieving the images. These measures have demonstrated the superiority of fuzzy notions for color image retrieval.

Intuitionistic fuzzy set that takes into account the membership, non-membership and the degree of hesitancy has been used for segmentation and color retrieval. An Intuitionistic fuzzy divergence (IFD) has been modeled and has been used for thresholding, edge detection and color retrieval.

Key Words: Segmentation, thresholding, edge based, match-based, color retrieval, intuitionistic fuzzy divergence, Gamma distribution, and membership function.