Fuzzy Shape of Objects in Images with Similarity Measure for Image Retrieval Applications

P. Sumathy, Department of Computer Science, Bharathidasan University, Tiruchirappalli, India

P. Shanmugavadivu, Department of Computer Science and Applications, Gandhigram Rural Institute, Dindigul, India

A. Vadivel, Department of Computer Applications, National Institute of Technology, Tiruchirappalli, India

ABSTRACT

The object present in an image is an important content and can be used in CBIR applications. Identifying and representing the shape of the object is highly complex because there are uncertainties in the boundary of the object of interest. In this paper, the authors have proposed Fuzzy-Object-Shape to capture the shape of the object of interest along with the degree of impreciseness in the boundary information. The Fuzzy-Object-Shape information is extracted from each object in an image. This information provides a measure of closeness of the object of interest with well-known shapes. For each object, the fuzzy membership values are calculated and considered as feature vector. A similarity measure is proposed for measuring the degree of closeness of objects present in both query and database images. The performance of the proposed approach is compared with some of the recently proposed similar approaches. Benchmark dataset and uncontrolled dataset are used for the experiments and found that the performance of the proposed approach is encouraging.

Keywords: Approximate Shapes, Fuzzy-Shape, Geometric Features, Image Retrieval

1. INTRODUCTION

The Content-Based Image Retrieval (CBIR) is a fast growing research area and research is carried for retrieving relevant images from a high volume of digital image repositories. It uses image content for automatically retrieving images from databases satisfying user queries (Ma and Manjunath, 1997). Well-known features extracted from images are color, texture and shape. Though, the color and texture are prominent in visual appearance, shape is considered as one of the important low-level features in various image retrieval systems. This is due to the fact

DOI: 10.4018/IJCVIP.2015070104
that shape features can capture the most attractive visual information, which is based on human perception (Ardizzoni, et al, 1999). Human perceive scenes of the images as composition of individual objects and is suitably identified by their shapes. Once the images are visualized in terms of individual objects, they can be effectively used for image retrieval applications. In shape based retrieval, representing shape, similarity measure and indexing are considered as the most important issues and among them the shape representation is a challenging task. Various techniques have been proposed for representing the shapes and they are broadly classified as contour-based and region-based. While the contour based approach extracts the border information of the object shape, the region-based approach considers the internal details of the shape of the object. Compared to color and texture, the contour based shape is playing important role in image retrieval systems (Belongie, et al, 2002). The region based methods, in general, use moment descriptors to describe shape. Contour based shape representation only exploits shape boundary information and they are classified as global shape descriptors, shape signatures and spectral descriptors. Various methods such as curvature scale space (Abbasi et al, 1999) and (Mokhtar and Mackworth, 1992) and Fourier descriptors (El-ghazal, et al, 2007) have been proposed for shape similarity assessment and shape retrieval. The shape geometry features, such as circularity, eccentricity and mementos have been extracted for representing the shape (Flickner, et al, 1995, Shanmugavadivu, et al, 2012). Structural methods (Latecki and Lakamper, 2000) represent shapes as various disjoint parts with their relationships by and making use of data structures such as trees, graphs and strings.

All the above mentioned shape based features describe the shape properties and it ignores the impreciseness and vagueness presents in the shape of the object. The impreciseness may be captured by using fuzzy logic approach (Colombo et al, 1999) and have advocated a syntactic construction of a compositional semantics to build the semantic representation of images. A Linguistic Expression Based Image Description (LEBID), which is a fuzzy semantics description framework, has been proposed to validate its feasibility in texture image retrieval (Li et al, 2009). It is noticed that prior knowledge is required to describe the image and fuzzy rules. Based on the above discussion, it is observed that none of the methods capture the vagueness and impreciseness presents in the shape of an object. In this paper, we propose Fuzzy-Object-Shape (FOS) and derived fuzzy membership function of the objects. Membership functions are derived for circle, ellipse, square, rectangle, rhombus, cone and cylinder. Given an object, the membership function calculates the closeness of the object with well-known primitive shapes. A suitable similarity measure is proposed by considering the degree of overlap of the object for ranking the retrieval set. The rest of the paper is organized as follows: Section 2 provides related works and the proposed approach is discussed in Section 3. Experimental result is presented in Section 4 and we conclude the paper in the last section.

2. RELATED WORK

Various techniques for extracting shape features have been introduced in (Yang, et al, 2008) and comparative study has been made (Zhang and Lu, 2001). Edge point detection is an important step before extracting shape and various edge detection methods have been proposed in the literature (Mahmoudi, et al, 2003, Hou and Koh, 2003). A neural network-based shape retrieval system is proposed for extracting the shape (Xing and Ahmad, 2009). The moment invariants and Zernike moments are used to construct feature vector, which describe the shape of an object (Joaquim, et al, 2005). The similar images are grouped using fuzzy K-means clustering algorithm, which groups similar images and neural network has been used for retrieving similar images. One of the
3D Scanner, State of the Art
www.igi-global.com/chapter/scanner-state-art/60280?camid=4v1a

Support Vector Machine for Recognition of White Blood Cells of Leukaemia
www.igi-global.com/chapter/support-vector-machine-recognition-white/24820?camid=4v1a