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Shape Based Descriptors for Image Retrieval

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Abstract:-*Image retrieval based on its content is the application of computer vision techniques to the problem of searching digital images in large databases. Images need to be described by certain features to search an image from database. During the last several years; content based image retrieval appeared as influential tool to proficiently retrieve digital images visually related to query image. The basic idea behind this approach is representation of image as feature vector and to measure the similarities between the images with distance between their corresponding feature vectors according to some metrics. The finding of correct features to represent images with, as well as the similarity metric that groups visually similar image together, are important landmark in construction of any Content Based Image Retrieval (CBIR) system. Shape is one of the most important features in CBIR. Many shape representations and a retrieval method exists. In this paper, various shape based descriptors are discussed for retrieving images.*

Keywords: *Content Based Image Retrieval (CBIR) shape based descriptor, Shape*

I. INTRODUCTION

In Content-based image retrieval, the images are indexed by their visual contents, such as color, texture, shape, structure, motion and combination of these. The use of images in human communication is common. Educators and writers use imagesfor illustrations, designers and engineers use images for recording finished projects, doctors useimages for diagnosis and monitoring, entertainers use images for making stories, newsmen useimages for enhancing text information, to name just a few.Nowadays, many image-based applications require quick and efficient research algorithms for image databases managing and access. For this purpose, many approaches have been proposed in image indexing and retrieval research field. Traditionally, the most common CBIR methods exploit global image attributes such as color, texture or shape for image characterization [1].Shape is one of the primary low level image features in content-based image retrieval. There are generally two types of shape representation methods in the literature: the region-based and contour-based methods. The classification of the varieties of shape methods is given in Fig. 1 [2].

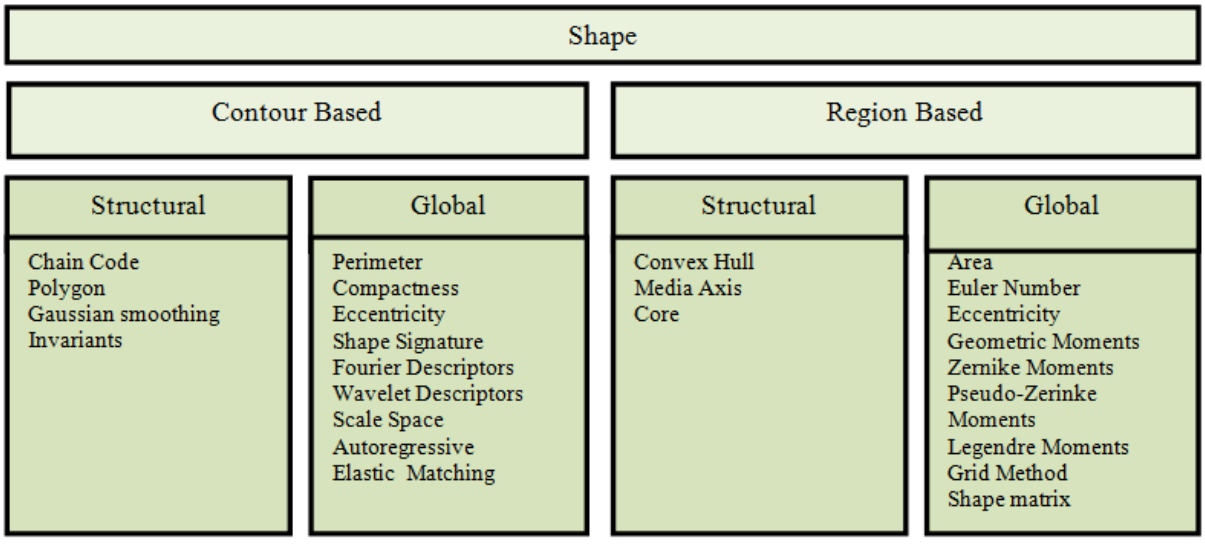

Fig 1:- Shape Descriptor Classification

Shape representation techniques are generally characterized as being boundary-based and region-based. The contour-based represents the shape by its outline, while the region-based reflects the shape as being formed of a set of two-dimensional regions. The human visual system itself focuses on edges and ignores uniform regions. This capability is hardwired into the retina. Connected directly to the rods and cones of the retina are

two layers of the neurons that perform an operation similar to the Laplacian. This operation is called lateral inhibition and helps us to extract boundaries and edges [4].

II. SHAPE DESCRIPTOR

The Shape descriptorsare numbers that are computed from atwo-dimensional shape. In some cases, the set of numbers is complete in the sense that the original shape can bereconstructed from the shape descriptors, but evenin these situations, only a subset of the shape descriptorsis typically used in practical applications [3]. Shape descriptors are classified into boundary-based (or contour-based*)* and region based methods [5]. This classification takes into account whether shape features are extracted from the contour only or from the whole shape region. These two classes, in turn, can be divided into structural (local)and globaldescriptors. This subdivision is based on whether the shape is represented as a whole or represented by segments/sections. Another possible classification categorizes shape description methods into spatialand transformdomain techniques, depending on whether direct measurements of the shape are used or a transformation is applied [6].

- **Moment Invariants:** For Moment Invariants, each object is represented by a 14-dimensional feature vector, including two sets of normalized Moment Invariants [7,8], one from the object contour and another from its solid object shape. The Euclidean distance is usually used to measure the similarity between different shapes as represented by their Moment Invariants.

- **Curvature Scale Space (CSS):** The CSS descriptor is used in the MPEG-7 standard [9] and represents a multiscale organization of the curvature zero-crossing points of a planar curve. In this sense, the dimension of its feature vectors varies for different contours, thus a special matching algorithm is necessary to compare two CSS descriptors.

- **Beam Angle Statistics (BAS):** The Beam Angle Statistics descriptor is based on the *beams* originated from a contour pixel. A beam is defined as the set of lines connecting a contour pixel to the rest of the pixels along the contour. At each contour pixel, the angle between a pair of lines is calculated, and the shape descriptor is defined by using the third-order statistics of all the beam angles in a set of neighborhoods.

- **Contour Saliences (CS):** The CS computation uses the Image Foresting Transform [11] to compute the salience values of contour pixels and to locate salience points along the contour by exploiting the relation between a contour and its internal and external skeletons. The contour salience descriptor consists of the salience values of salient pixels and their location along the contour, and on a heuristic matching algorithm as distance function.

- **Segment Saliences (SS):** The segment salience descriptor is a variation of thecontour salience descriptor which integrates two improvements: the salience valuesofcontour segments, in the place of salience values of isolated points, and another matchingalgorithm that replaces the heuristic matching by an optimum approach [11]. The salience valuesalong the contour are computed and the contour is divided into a predefined number s ofsegments of the same size. The internal and external influence areas of each segment arecomputed by summing up the influence areas of their corresponding pixels.

- **Fourier Descriptor (FD):**The set of normalized Fouriertransformed coefficients is called the Fourier descriptor ofthe shape.In overall, the FD is obtained by applying a Fourier transformon a shape signature. The shape signature is a one-dimensional function,which is derived from shape boundary coordinates. Differentshape signatures have been exploited to obtain FD. Complexcoordinates, the curvature function, cumulative angular function,and centroid distance are the commonly used shape signatures.

III. RESEARCH CHALLENGES

The execution of CBIR systems increases several research challenges, such as:

- Formalisms need to be created to describe image content descriptions. This formalism can guide the design and implementation of new applications based on image content.
- Many techniques are not available to deal with the semantic gap presented in images.
- New tools forannotating imagesneed to be developed.
- New user interfaces for annotating, browsing, and searching based on shape based content need to be investigated. Research in this area will require usability studies with practitioners.

IV. CONCLUSION

This paper has presented a brief overviewof shape based descriptor in the areaof image retrieval. This paper has described the main issues that need to be taken into account when designingthis kind of image retrieving system. This paper also describes the various shape based descriptors and research challenges for implementing such image retrieval system.

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