Chapter 13

Feature Set Reduction in Rotation Invariant CBIR Using Dual-Tree Complex Wavelet Transform

Deepak Sharma
Maharishi Markandeshwar University, India

Ekta Walia
Maharishi Markandeshwar University, India

H.P. Sinha
Maharishi Markandeshwar University, India

ABSTRACT

An accurate Content Based Image Retrieval (CBIR) system is essential for the correct retrieval of desired images from the underlying database. Rotation invariance is very important for accurate Content Based Image Retrieval (CBIR). In this chapter, rotation invariance in Content Based Image Retrieval (CBIR) system is achieved by extracting Fourier features from images on which Dual Tree Complex Wavelets Transform (DT-CWT) has been applied. Before applying DT-CWT, the Fourier feature set is reduced by exploiting the symmetry property of Fourier transform. For an N x N image, feature set has been reduced from $N^2/2$ features to $N^2/4$ features. This reduction in feature set increases the speed of the system. Hence, this chapter proposes a method which makes the Content Based Image Retrieval (CBIR) system faster without comprising accuracy and rotation invariance.

1. CONTENT BASED IMAGE RETRIEVAL (CBIR) SYSTEM: AN OVERVIEW

The term CBIR has been widely used to describe the process of retrieving desired images from a large collection of data on the basis of features that can be automatically selected from the images. CBIR uses many methods for image processing and is regarded by researchers as subset of this field.

1.1 Need of CBIR

The need of content based image retrieval (CBIR) system is increasing day by day because the interest in the digital images has increased enormously. There are various reasons which enhance the demand of CBIR system. Some of the reasons are given as follows:

- **Rapid Growth in Digital Image Database:** In today's world, the more and more image data is stored in data book. There is a need of a way to search an image quickly. The way should be fully automatic search tool to save time because the process of manual categorization of images is time consuming, expensive and tedious.
- **Professional Needs:** In many professional fields, users are getting the opportunities to access and manipulate remotely stored images in all kind of ways. The other professional need for the CBIR system is "Logo Search". The professionals are also dependent on system which gives an efficient and quick retrieval of images. In medicine, it is very useful for doctors who want to retrieve MRI, ultrasound, CT scan images matching the query image for diagnostic purposes.
- **Locating Images on the Web:** The interest in the potential of digital images has fuelled at least in part by the rapid growth

of imaging on the World Wide Web. As the collection of images in the web is increased there is a requirement of a system which has quick and efficient retrieval characteristics. The solution for these issues is "content based image retrieval" system, which provides quick and efficient retrieval of image in huge collection. The image retrieval problems are becoming widely recognized and search for solution is an increasingly active area of research and development. A number of critical areas were identified where research was needed including feature extraction and indexing, image query matching and presentation of images.

1.2 Basic Block Diagram of CBIR

In a CBIR system, the feature vectors from images stored in database are to be extracted and when a query image is given, its feature vectors are also computed. If the distance between feature vectors of the query image and image in the database is small enough, the corresponding image in the database is to be considered as a match to the query. The search is usually based on similarity rather than on exact match. The retrieval results are then compared according to the similarity index.

The basic block diagram of content based image retrieval system is given in Figure 1.

The basic blocks of the CBIR system are given as shown in the following sections.

1.2.1 Query Techniques

The implementation of CBIR in different fields makes use of different type of user queries. The various types of user queries are given as:

- **Query by Example:** It is a technique of user query that involves providing the CBIR system with an example image on which the search is based upon. The search algorithm may vary depending upon the

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