Abstract

This thesis describes the research and development of content-based image retrieval system using texture features. There are two important tasks in content based image retrieval systems namely feature extraction and similarity measurement. High retrieval accuracy and less computational complexity are the two main requirements of content-based image retrieval. To address this problem, several new techniques, which are efficient both in terms of retrieval accuracy and retrieval time, are presented.

To select best feature measure and suitable similarity metrics a detailed study of the retrieval performance with wavelet based three feature measures and nine distance metrics for texture image retrieval is presented. A large texture database images derived from Brodatz album are used to check the retrieval performance. This study has clearly demonstrated that retrieval performance not only depends on a good set of features but also on the use of suitable similarity measure.

One of the main drawbacks of standard wavelets is that they are not suitable for the analysis of high- frequency signals with relatively narrow bandwidth, which limits the retrieval accuracy. To address this problem, in this research, two novel methods for texture image retrieval using M-channel wavelet, namely M-band and cosine-modulated wavelet have been presented.

In this thesis a new set of 2-D rotated wavelet filter (RWF) with Daubechies eight tap coefficients to improve the retrieval accuracy have been designed. It is demonstrated that 2-D rotated wavelet filter, which are nonseparable and oriented, improves characterization of diagonally oriented textures. 2-D rotated wavelet filter sets are 45° rotated version of the conventional 2-D wavelet filter set. Application of 2-D rotated wavelet filters

and discrete wavelet transform (DWT) jointly for texture image retrieval is presented. Experimental results indicate that the new method significantly improves retrieval performance over the traditional approach. Features obtained using combination of RWF and DWT are redundant. Method to reduce redundancy in these features for texture image retrieval is also suggested.

The concept has been extended to design a new set of two-dimensional rotated complex wavelet filter. Decomposing image with dual-tree complex wavelet transform (DT-CWT) and dual-tree rotated complex wavelet filters (DT-RCWF) jointly captures orientation information in twelve different directions. Texture image retrieval application is presented using the new two-dimensional dual-tree rotated complex wavelet filters and dual-tree complex wavelet transform jointly. The proposed texture image retrieval method has twofold advantages over the Gabor wavelet based approach. First, the retrieval accuracy is more, and secondly the computational complexity is less. Additionally the proposed method is shift invariant, which it inherits from DT-CWT.

This thesis also deals with the problem of rotation invariant texture image retrieval. A novel approach for rotation invariant texture image retrieval using the new set of two-dimensional dual-tree rotated complex wavelet filters and dual-tree complex wavelet transform jointly have been presented. The information provided by DT-RCWF complements the information generated by DT-CWT. Robust isotropic rotation invariant texture feature are obtained and tested for image retrieval application on *rotated* and *non-rotated* database of small, medium, and large size, and results obtained were consistent with the theory.