ABSTRACT

In this thesis an endeavour is made to develop Statistical techniques using contextual information for digital image analysis problems. Specifically the concern here is on developing techniques for image segmentation, domain description and classification.

A technique has been proposed for obtaining an optimal segmentation from an initially over-segmented image using MRF model. The MRF model is defined on the region adjacency graph of an initially over-segmented image regions, in order to reduce computations. The approach is demonstrated with three illustrations.

For description of 2-D shapes of objects linear time series models are used here. In order to obtain the complete set of features to be used in the subsequent problems of recognition and classification subset AR models are used. In the technique proposed here subset AR model is selected directly and efficiently. The approach is based on partial autocorrelation function, singular value decomposition (SVD) and QR decomposition with column pivoting factorisation and some statistical tests of significance. This eliminates the exhaustive search involved in the earlier approaches.

For describing textural regions 2-D AR models are used. For selecting the best subset 2-D AR model the SVD and QRcp factorisation technique developed for one dimensional AR models has been extended. The suitability of the proposed technique is demonstrated with the help of four real textures classification problem. The performance of the algorithm is evaluated using thirty textures selected from Brodatz album.

For classification of remotely sensed images a modified contextual classification technique has been proposed. It adopts different methods of classification for high and low resolution classes. A method for characterizing the classes in the image as high or low resolution is also described based on various configuration probabilities.

Key words

Digital image analysis, Segmentation, Markov random field, Region adjacency graph, Subset AR model, 2-D AR model, Remotely sensed imagery, Contextual classification, SVD, QRcp.