# Abstract

This thesis is concerned with rotation and scale invariant texture features using spatial/spatial frequency methods. The rotation and scale invariant texture features are obtained utilizing the fact that rotation and scale changes in a texture image are reflected as translation along the orientation and scale channels in spatial frequency domain. Shift invariance of the energy features in spatial frequency domain along the orientation and scale channels gives the required rotation and scale invariance.

After a brief review of invariant texture analysis, rotation invariant texture features (modified average absolute deviation-MAAD) are presented using even symmetric Gabor filters. Preattentive texture discrimination is due to even symmetric micropatterns. These even symmetric micropatterns are easily captured by even symmetric Gabor filters. These features are used for practical applications such as script identification and texture segmentation. New rotation invariant texture features using Gabor wavelets have been developed. Magnitude mean features using Gabor wavelets are superior to MAAD features. The robustness of these features is shown over MAAD features by using the classifier independent Bhattacharyya distance figure of merit. All texture images in Brodatz album are classified these using these features with good accuracy. The classification rates for different categories of texture images are presented using these features.

Discrete wavelet transform gives good spatial/spatial frequency localization and is used for texture classification applications. There are few studies on invariant texture classification using discrete wavelet transform. New rotation invariant texture features are developed using discrete wavelet transform. These features are obtained for different wavelet decomposition filters and the performance is compared using quadratic Bayesian classifier. The wavelet decomposition filters chosen are Daubechies orthonormal wavelet filter with four vanishing moments, bior 3.1, bior 3.3, bior 4.4 and bior 5.5. All the texture images in Brodatz album are classified using these features.

*M*-band wavelets are direct generalization of standard 2-band wavelets. *M*-band wavelet decomposition gives a mixture of a logarithmic and linear splitting of spatial frequencies (scales) in different subbands. In addition to this, *M*-band wavelets give a better energy compaction than 2-band wavelets by zooming onto narrow band high frequency components. Novel rotation invariant texture features are developed using *M*-band wavelet decomposition of texture samples for texture classification. Performance of these features is reported for all the texture images in Brodatz album.

Most of the work on texture analysis is focused on gray level representation. Recently color texture characterization is getting increasing attention of researchers. The *RGB* color space is the most frequently used color representation because of the availability of data as produced by the camera apparatus. Its limitations imposed the development of many derived classes of color representation. Novel rotation invariant color texture features are developed using Gabor wavelets. The performance of these features is tested on 80 textures drawn from Vistex database. Perceptually uniform color spaces are compared with *RGB* color space using classifier performance and a classifier independent measure.