

## ABSTRACT

Digital image inpainting is the technique of filling the missing regions of an image by using information from surrounding area. This technique has wider applications in image restoration, disocclusion and image/video compression.

The objective of this thesis is to implement novel approach of introducing Discrete Shearlet Transform (DST) in digital image inpainting models and applying them to the problem of text removal, image reconstruction and image/video coding. In this regard, this thesis addresses three significant image inpainting models with error concealment applications.

The inpainting model is proposed by introducing DST and  $p$  Laplacian operator in Total Variation model. This model with  $1 < p < 2$  can reduce the staircase effect by still keeping the sharp edges effectively. The  $p$  Laplacian operator diffuses in two directions and hence diffusion speed increases.

The second inpainting model is proposed with the idea of using Expectation Maximization (EM) algorithm in a Bayesian framework with shearlets. The EM algorithm iteratively reconstructs the missing data and then solves the equation for the new estimates. The estimates are iteratively refined

until they become convergent. The third shearlet inpainting model is based on thin plate spline Radial Basis Function Neural Networks (RBFNN) and is applied for multichannel remotely sensed images. RBFNN provides higher accuracy and faster convergence to the approximated target function when data becomes dense. The first two inpainting models are tested with images from USC-SIPI and Kodak image libraries and the later is tested with Landsat7 ETM+ and Quickbird satellite images. The experimental results show that the proposed algorithms are robust and give good results with a higher percentage of missing information.

An enhanced framework for image/video coding that uses image inpainting is proposed. In image coding, some portions of the input image are purposefully removed at the encoder. The edges are extracted from the input image and they are passed as assistant information to the decoder in compressed manner to guide inpainting at the decoder. In the video coding approach, the regions are mainly divided into two types namely, Local Motion Regions (LMR) and Global Motion Regions (GMR). In both the regions, the exemplar selection is based on the edges extracted from the input region. Texture synthesis and shearlet  $p$  Laplacian inpainting algorithms are used to recover the removed regions in LMR and GMR. Test results are compared with JPEG 2000 and H.264 intra coding algorithms and the results show that the proposed algorithms work well and give better bit rate saving.