

On the Statistics of Wide-Sense Markov Random Fields and its Application to Texture Interpolation

Shira Nemirovsky and Moshe Porat
Department of Electrical Engineering
Technion – Israel Institute of Technology
Haifa 32000, Israel

Abstract

Random field models are one of the most common classes of image models. Such models, as suggested in the literature, attempt to characterize the correlation among neighboring pixels in the image. Since images are defined on 2D grids, it is more appropriate to model them as realizations of 2D time series or random field models. By assuming a separable correlation function for a 2D autoregressive (AR) model, a straightforward generalization of the 1D time series AR model to 2D is obtained. This simple model and its extensions have found many applications in image restoration, image compression, and texture classification and segmentation. In this work we explore the statistical properties of wide-sense Markov random fields with a separable correlation function. We analyze the effect of interpolation on the statistics of such images, and develop corresponding mathematical relations. Motivated by these results and relations, we propose a new method for texture interpolation, based on an orthogonal decomposition model for textures. Experiments with natural texture images and comparison with presently available interpolation methods demonstrate the advantages of the proposed method.