Dyadic Curvelet Transform in Image Processing

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Background and Aim: Dyadic Curvelet transform (DClet) is to propose as a tool for image processing and computer vision. It is an improvement over wavelets in two dimensions with the major drawback of limited ability in capturing directional information or an extension over curvelets with drawbacks of redundancy and fixed scales of decomposition. It provides simplicity, dyadic scales, and absence of redundancy for analysis and synthesis objects with discontinuities along curves, i.e., edges via directional basis functions. The proposed method uses different classes of wavelet filter banks to capture the intrinsic geometrical structure that is a key in visual information. It is designed to satisfy the anisotropy scaling relation for curves, and thus offers structured wavelet-like curvelet decomposition using a discrete transform in a new type of partition for exploring geometry in images. The performance of the proposed method is evaluated by removing noise from different noisy standard images. Greater average Peak Signal to Noise Ratio (PSNR) compared to the wavelet is evidence of performance of the DClet. Moreover, the reconstructions, exhibit visually sharper images and, in particular, higher quality recovery of edges and of faint linear and curvilinear features. The proposed method is robust, which makes it suitable for biomedical applications.
Conclusions: This tool is a candidate for gray and color image enhancement and applicable for compression or efficient coding in which critical sampling might be relevant. The ability of effectively representing images based on the dyadic curvelet transform is of key importance in scene analysis, medical image analysis, remote sensing and many other applications. It is able to behave the same matter as human eyes, processing an object by filtering the input data into a number of bands and levels that can be used for understanding the topology of complex networks.