

# Speckle Reduction of SAR Images Using Independent Component Analysis

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Synthetic aperture radar (SAR) images are often degraded by multiplicative speckle noises. Appearing to be randomly granular, SAR image speckle noise is resulted from phase variations of radar waves from unit reflectors within a resolution cell. Its existence is undesirable, since it degrades image quality and affects the task of human interpretation and evaluation. SAR image speckle noise reduction has been a well studied subject for over twenty years, notably by J. S. Lee, D. T. Kuan and many others.

In this paper the neural network based independent component analysis(ICA) technique is presented that shows experimentally more significant speckle noise than those reported by other researchers. The ICA method employed makes use of fastICA algorithm for the basis images and a classification procedure to assign the basis image to signal (edge) space or the speckle (texture) space, with the assumption that the two spaces are independent. The coefficient associated with the signal space basis image is going through a nonlinear transform while the coefficient associated with the speckle space is set to zero. The image is then reconstructed from the resulting signal space.

The SAR images considered with  $250 \times 350$  pixels for the experimental comparison have nine channels with PLC bands and three polarizations. They cover the agricultural area near the village of Feltwell, UK. The comparison of ratio of standard deviation to mean clearly indicates that our method is significantly better in most image channels.

Table 1: Ratio comparison.

	Original	Our method	Wiener filter	Lee method	Kuan method
Channel 1	0.6362	0.2723	0.5597	0.3072	0.5765
Channel 2	0.6298	0.2581	0.4358	0.3154	0.5203
Channel 3	0.5842	0.2407	0.3976	0.3018	0.5276
Channel 4	0.3682	0.2196	0.3097	0.2640	0.3437
Channel 5	0.3596	0.3087	0.3164	0.2785	0.3272