**Study of Quantum-Inspired R**[**emote Sensing Image**](http://dict.cnki.net/dict_result.aspx?searchword=%e9%81%a5%e6%84%9f%e5%9b%be%e5%83%8f&tjType=sentence&style=&t=remote+sensing+image) **Denoising with Double Density Dual-Tree Complex Wavelet Transform**

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**KEY WORDS:** Double density dual-tree complex wavelet transform, [Quantum-inspired](http://dict.cnki.net/dict_result.aspx?searchword=%e9%87%8f%e5%ad%90%e8%a1%8d%e7%94%9f&tjType=sentence&style=&t=quantum+inspired), Bayesian estimation theory, Image noise reduction

**ABSTRACT:** This paper proposed a new quantum-inspired noise reduction method, in which Double density dual tree (DD-DT) complex wavelet transform was combined with quantum-inspired parameter estimation. Remote sensing images, especially the SAR images, are the main targets for the proposed noise reduction method. DD-DT complex wavelets has the advantage of translation invariance, anti-aliasing and spatial compactness, thus this proposed method conduct DD-DT complex wavelets decomposition and composition before and after noise reduction to minimize influences of other factors. The main idea of the proposed method is to estimate the variance of noise and signal in the form of DD-DT complex wavelets parameters by using altered Bayesian estimation method inspired by quantum-superposition theory. Concretely speaking, this paper take the inter-scale correlation of wavelet coefficient into consideration, express the DD-DT complex wavelets parameters of noise and signal in parental frequency with superposition of that in its children frequency and differ the noise and signal by its variance estimated by Bayesian . The general process is addressed as below: Firstly, conduct a logarithmic transformation for the SAR images, convert the multiplicative speckle noises to additive noises; Secondly, decompose the DD-DT complex wavelets for each image, thus to get the wavelet coefficient for each layer in all detailed directions; Thirdly, utilize the Bayesian estimation theory along with the quantum mechanics principle of superposition, calculate the estimated wavelet coefficient; Fourthly, proceed the data layer by layer, restructure the SAR images using the processed coefficients. Finally conduct an anti-logarithmic transformation to get the noise reduction result. In this paper, the proposed method was compared with some other methods, such as Lee filter and traditional wavelet denoising algorithms. The results have shown that the images denoised by proposed method have a significant improvement in different evaluation functions such as the Peak Signal Noise Ratio, Edge Preserve Index etc. The results have also testified better noise reduction quality in the images.

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