Experiments of super-resolution utilizing sub-pixel shifted overlapping images

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Superresolution is technique to increases the spatial cutoff frequency of imaging system. It is known that software techniques of superresolution can be divided into two categories. The first is based on extrapolation of higher spatial frequency spectrum for a single low resolution image. The second is based on reconstruction of a high resolution image from subpixel shifted and overlapping low resolution multiple images.Ą@In this report, experiments for superresolution image reconstruction from subpixel shifted overlapping images has been conducted for remote sensing images in order to evaluate the superresolution image reconstruction methods.

Primitive algorithms of superresolution image reconstruction based on simultaneous equation and local iteration were examined. In the examination, 1.5, 1.7, 2.0, 2.4, 3.0, 4.0, and 6.0 times higher resolution images were estimated from each low resolution image set of 144, 36, 16, 9, and 4 images. Doolittle elimination method and Gauss-Seidel relaxation(iteration) method were utilized for the reconstruction method based on simultaneous equation. Doolittle elimination method showed a smaller rms error than the Gauss-Seidel relaxation(iteration) method. But the case where the solution of the simultaneous equation was not obtained happened frequently for ill-conditioned cases compared with the Gauss-Seidel iteration method. Local iteration method showed the best performance from view point of rms error and robustness. However, rms error increased when the number of low resolution pixels per a high resolution pixel decreases. Furthermore, there is a problem in the setting of stop condition for the iteration because the behavior of the rms error(unknown for users) and the rms residual(known for user) is different.