Contribution ID: **66** Type: **Oral**

Denoising for Reconstructed Image of Spectral X-ray CT Using Weighted Linear Local Regression

Saturday, 26 November 2022 07:45 (15 minutes)

X-ray CT is a technique to visualize the distribution of the X-ray attenuation coefficient inside an object and has a wide range of applications, such as nondestructive testing, medical examination, and intraoperative assessment. In general, the attenuation of X-rays depends on the energy of the X-ray photon and the material they penetrate; the X-ray spectrum will be different when it penetrates different materials.
However, Energy-integrating detectors used in conventional X-ray CT cannot obtain the spectral information of X-rays because they measure X-rays as intensity integrated with respect to energy. As a result, it can be difficult to distinguish between different materials with similar integrated values of X-rays after transmission.
In contrast, spectral X-ray CT, which has recently been studied and developed, uses a photon-counting detector (PCD) that can obtain discrete information on the X-ray spectrum, and thus spectral X-ray CT is a promising technique for the discrimination of multiple materials.
Nevertheless, in spectral X-ray CT, the tube current during measurement is limited to prevent pile-ups, and the measured data is divided for each energy threshold, which causes an increase in Poisson noise in each energy image.
In this study, we propose a method for denoising spectral X-ray CT reconstructed images by applying weighted linear local regression. In this method, the pixel value of each energy region is calculated by linear regression using the pixel values from other energy regions.
By reference to the structural features of the object common to the images, image-specific Poisson noise is expected to be reduced.

Topics

Session C. Applied optics and engineering

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Session Classification: Optoelectronics and detection technologies II