Smoothing and Enhancement of the Digital Scanning Image

T. Matsumoto, T. A. Iinuma, N. Fukuda and K. Fukuhisa

National Institute of Radiological Sciences, Chiba

In order to improve the digital image of scintigram, two methods of data processing, smoothing and enhancement, have been recognized to be effective. Some experiments were carried out to apply these methods to the clinical scintigraphy.

A Picker thyroid phantom, contained 1 mCi of ^{131}I, was scanned with a 3″ Picker scanner attached a fine focus collimator, 2102A.

The data were acquired in a magnetic tape of the NIRS on-line computer system as described. (No. 56 at this meeting)

The scanning was repeated 3 weeks later when the activity of ^{131}I decayed to 60 μCi.

The following methods were applied to these two image data:

1) Smoothing by averaging

—One- and two-dimensional averaging methods with or without weight were systematically tried. The number of elements used was ranged 3 to 19 in one dimension. The results were displayed on a CRT, curve plotter or line printer and compared each other to find out the optimum method. The difference on image was noticed between one and two dimensions but the increase of number of elements gave little differences on the image.

2) Matched filtering

—The point spread function (PSF) used for this study was approximated by the line spread function (LSF) which was measured in water at different depths. The normalized PSF in two dimensions was used as an array of weights. The smoothness and loss of informations (in resolution and efficiency) resulted from this method were discussed.

3) Image enhancement

—Iterative method and differential operator method were compared in term of computing time and effectiveness.

Some clinical data processed by these methods were also presented.

Two-dimensional Improvement of Radioisotope Image by the Use of Fraunhofer's Diffraction and Filtering with He-Ne Gas Laser

E. Takenaka

Department of Radiology, Faculty of Medicine, University of Tokyo, Tokyo

Present image processing through computer is routinely in radioisotope imaging systems more than other fields in radiology. Such processing is made in the following such as various smoothings, enhancement, differentiation, iso-density display and apparent three-dimensional display. But smoothing, enhancement and differentiation are simply taken the place of by the optical processings such as defocusing display, displaying with changing of gamma characteristics of displaying systems, and subtraction. Complicated computer processing of radioisotope image is simply and rapidly in the processing by the use of analog techniques. One-dimensional improvements of radioisotope image are presently made by the use of only the MTF of radioisotope imaging systems, with taking no account of noise problems. Optical Fraunhofer's diffraction with He-Ne Gas LASER

(wave length=6328 A) gives us simply and VISUALLY TWO-DIMENSIONAL SPATIAL FREQUENCY SPECTRUM (Fourier's spectrum). On the spatial spectrum plane, the components of dots and lines' scars as high frequencies components are clearly separated from the low spatial frequencies components of signals. Background level, it may be thought as a kind of direct current component, can be taken off by filtering at the center or original point of fourier spectrum plane. Selective filtering on the spatial spectrum plane displays us improved radioisotope image with enhanced contours and no lines' scar and dot. This image processing have yet some technical points to be improved. This technique will be prevailing in future.