RI Image Processing Systems in Chiba Cancer Center

Y. Akiyama
Physics Section, Chiba Cancer Center Hospital
N. Yui, F. Kinoshita, M. Koakutsu and H. Ishigaki
Division of Nuclear Medicine, Chiba Cancer Center Hospital

In Chiba Cancer Center, we have a computer CDS-4096, which is designed for processing data from Gamma Camera, for use of nuclear medicine. We can also put into it some data from whole body scanner and renogram apparatus through interfaces.

CDS-4096 has functions of some data processing itself and of sending data to other computing system by using PT or MT. In our hospital, we can use two computer system in addition to CDS-4096. They are NEAC-M4, which is designed for calculating of dose distribution of radiation therapy, and FACOM 230–25, a medium scale computer for all purposes. For display of processed data, we have 5 inches CRT connected with CDS-4096, X-Y plotter and 11 inches CRT with NEAC-M4 and line printer with FACOM 230–25.

In this work, some processing method using these systems are reported. Smoothing or iteration has been used as a method of improvement of poor RI image, but it is difficult to decide what the most suitable weighing factor for calculating is. We made experiment with some phantoms to decide the most suitable weighing factor by comparing the image of long time counting and smoothed data of poor image of short time counting.

In conclusion, we recognized that when the counts are small, the smoothing is desired, but when the counts are large, the smoothing is injurious.

Image Processing for Coded Aperture Imaging

E. Tanaka and T. Iinuma
National Institute of Radiological Sciences, Chiba

A decoding method for an arbitrary time-modulated aperture is presented, and the characteristics of noise in the decoded images is discussed. The first step of image formation is to construct a "shadow image" by accumulating the shadow of the aperture onto the object plane from each point of detection. The shadow image is further processed by a correction function, $h(x, y)$, to yield a final image which has a point spread function, $p(x, y)$, Then, we have:

$$p(x, y)=\overline{j(x, y, t)^* j(-x, -y, t)}^* h(x, y)$$

where j (x, y, t) is the aperture function defined at the object plane, *denotes the convlution operation and —indicates the time-averaging.

The auto-covariance function of noise for a locally uniform image is given by:

$$Cov(x, y) = n_B [p(x, y) * h(x, y)]$$

where n_B is the count density. The variance of the noise is equal to Cov (0, 0).

Assuming a constant aperture area, the signal to noise ratio in detecting a small lesion in a uniform large organ is proportional to the "figure of merit" given by:

$$F = \left[A / \int\int p(x, y)\, h(x, y)\, dxdy \right]^{1/2}$$

where A is the area of the shadow of the aperture onto the object plane. An analysis shows that no coded aperture has a larger F-value than that of the optimum pinhole for a given spatial resolution, but a suitable coded aperture would provide an image having different noise characteristics which may yield a larger F-value over a certain range of resolution than a pinhole. Such a coded aperture may be expected to be suitable for observing an image with various resolution by modifying the processing function.

Spatial Frequency Filtering of Scintigram

K. Niwa, Y. Kanai, T. Iwano
Department of Dental Radiology. Josai Dental Univ.

The spatial filtering in scintigraphic reproduction can be performed by several methods. The basic feature of the spatial filtering studied is the coherence of He-Ne Laser. We used a pinhole for a low-pass filter. The small filtering diaphragm is placed at the fraunhofer spectrum corresponding to the scintigram.

The quality of the filtering image, particularly the sharpness, will be decreased; however if we want to lower the noise level of a scintigram, it is necessary to suppress some of the high spatial frequency components. This circular diaphragm behaves like a low-pass filter, and the cut-off frequency transmitted by the system is given by $\nu = \gamma / f \cdot \lambda$, where γ is the radius of the aperture, f is the focal length of the lens, and λ is the wave length of the radiation. The sample was used 35 mm size film printed the scintigram. The best image quality was recorded in a frequency band equal to 0–0.7 mm^{-1}. One could see a improvement in the contrast of the image and a decreace of the noise level. The noise level had been considerably lowered by the spatial filtering; and as a result of this action the resolving power seemed to be increased.

The Development of Color Data Processing System with Dividing Subtraction Method

F. Kinoshita, N. Yui, M. Koakutsu, H. Ishigaki, and Y. Akiyama

The color data processing system developed by us, can change the density level of scintigram to twelve colors by taking a picture of passed or reflected figure. It has a function to erase unneces-