Use of the NIRS On-line Computer System for Acquisition and Processing Image Data with a Conventional Scanner

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Techniques of clinical application of the NIRS on-line computer system for acquisition, processing and display data obtained with a conventional rectilinear scanner were described.

The on-line program is divided into two parts of job:

I. pulse height analyzing for gain control of the scanner.

II. data acquistion and display.

The latter consists of four procedures and is performed by command of a terminal typewriter;

1) setting of initial parameters.

2) start of the sequential data acquisition synchronized with the scanning motion.

—Each pulse from the detector consists of three informations, i.e. time(T), position on the scanning line(X) and gamma ray energy (E). The position information, X, is generated with a specially designed 'position signal generator' attached to the scanning arm and gives a number of 1 to 512, corresponding to the X-position. A program was made to distinguish each line and to eliminate noises from this generator or limit switches. The informations are stored in a word (24 bits) and transfered into a disk through two buffer memories.

3) unpack and sort.

—After the completion of scanning, the identification cords are typed on two magnetic tapes followed raw data transfer into one of them for future use. The unpacked 2-dimensional image is transfered into the other tape.

4) monitor.

—The unpacked and sorted image is displayed on a CRT in the form of 45×45 points. Four levels of brightness are used. Further procedures of data processing are done in off-line mode, including smoothing, filtering and focussing. Details of these procedures will be discussed elsewhere.

Data Acquisition and Processing for an Anger Camera by NIRS On-line Computer System

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This paper describes software for data acquisition for an Anger camera by NIRS on-line computer system.

(1) Digital data acquisition: Three kinds of programs have been developed (a) X and Y pulses from the camera are converted into digital clock pulses by means of analog-to digital converter, and then the digitized pulses are connected to the increment unit (INC) in such a way that two-dimensional counts digital image are stored in corresponding memory words of the computer. After the digital image is stored for a pre-determined period of time, the image is punched out onto a paper tape so that post-processing may be possible. (b) similar digital images are stored by means of INC unit in one of the two buffer regions of core memory. Two buffer regions are switched alternatively by an interrupt signal from the timer, and the stored

image in one of the buffer is transfered to a magnetic tape. (c) X, Y and Z pulses are transmitted to three units of ADC by which the pulses are converted into digital clock pulses. The three digitized pulses are connected to a sequence unit (SEQ) which can write these three pulses into a word and store in a buffer memory. Then, the stored information in the buffer is transfered to a magnetic disk. After all information is stored in the disk, they are unpacked by means of X and Y co-ordinates and time information so that digital images as a function of time are formed and transfered to the magnetic tape.

(2) Display of image data: The display of the image is made in two modes using CRT unit: (a) a pattern of brightness modulation and (b) a volumetric pattern. The image data acquired by means of the INC unit are converted to the display point data by a special subroutine which is called by trigger interrupt at 2 second intervals. Thus, live display is possible while the image data are being collected. The pattern on the CRT can be easily changed by typing various parameters from an I/O typewriter at the on-line experimental sites. The image data acquired by the SEQ unit are displayed in a time sequence.

Fundamental Studies on Radioisotope Image Processing with Computer

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The purpose of this paper is to describe our results in processing the data obtained with scinticamera. Scinticamera (PHO/GAMMA III, Nuclear Chicago) with 3 types of collimator (4000 holes, 1000 holes and pinhole) was used. The positioned pulses from the scinticamera were accumulated into 1600 channel pulse height analyzer through a A-D convertor and then transferred to a 7 track digitizing tape recorder (TOAMCO: TM-7). The tapes were fed into a FACOM 230–60 computer in the Data Processing Center, Kyoto University, for processing.

First, data defined by a 40×40 matrix were averaged in order to reduce the random fluctuation (smoothing). The effect of compute averaging was examined in the various configurations such as five elements cross array, block array of 9, 25 and 49 elements with and without weighing factors. It was found that nine-element averaging was appropriate in our present system.

Next, to extract true information from the averaged data, which were blurred because of the lack of resolution of the detecting system, iterative approximations were done, according to Iinuma's method. The observed image is expressed by the convolution of true radioisotope distribution with resolving power of the system. Utilizing a point or line source with ^{131}I and ^{99m}Tc, a system response function was derived in air or water for each collimator used. From the results of thyroid phantom experiments, a resolving-power matrix was chosen to be $7 \times 7 = 49$ or $9 \times 9 = 81$ elemental images at the central part of the matrix. The iteration was terminated one or two times, to eliminate the noise in further calculations.

Finally, the computer seeks the point of maximum intensity on the matrix and divides this value into 20 levels. The radioisotope image was printed out in a 120×80 array, assigned by codes, symbols and letters.

These procedures were considered to be effective in our various clinical studies. The area of an elemental image in this detector system is approximately 0.65×0.65 cm^2. This seems to be rather large to obtain all useful information. We intend to process radioisotope image from the smaller area obtained with a scintiscanner.