filters in one and two dimension with various cut off frequency. The cut off frequency of FIR and IIR digital filters shows the same value as 1/29 in case of 1 cm in diameter space occupying lesion and as 2/29 in case of 2 cm in diameter, (29 cm means the diameter of the crystal of the scintillation camera), when the space occupying lesion vanishes in the processed image. This results suggest that the information of space occupying lesion may vanish when the cut off frequency is l/r (l=diameter of space occupying lesion, r= diameter of the scintillation camera).

And the space occupying lesion is clearly visualized in both FIR and IIR filters when the cut off frequency is $\frac{l}{29}\times\frac{6}{5}$, which suggests the optimum cut off frequency may be $\frac{l}{29}\times\frac{6}{5}\sim\frac{l}{29}\times\frac{7}{5}$, because the noise may be maximally removed with passing the adequate information of the space occupying lesion.

Imaging of Positron Emitting Radionuclides by a Gamma Camera and Its Image Processing

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Experimental results are presented of imaging positron emitting radionuclides by a conventional gamma camera attached with an existing parallel multi-hole collimator and of correcting images by an iteration method. When a medium-energy collimator is used for positron annihilation radiations or high energy gamma rays, it results in the point source response of a starlike pattern due to the radiations strongly penetrating septa in the directions along the minimum septal thickness in the array of holes of the collimator. The point source response, therefore, consists of mainly two components: one is the sharp component due not to the penetration and the other the broad component due to the penetration.

For instance, the fractions of the sharp and broad component are about 0.37 and 0.63, respectively, with the collimator, which has 1800 holes of 6 mm in diameter by 80 mm long with septal thickness of 2 mm, for a ^{18}F-point source located at 12 cm from the face of collimator. Relative count density in the broad component is less than 10% of the peak count density.

The point source response can be corrected to remove the broad component by an iterative method (see 23). The third iteration with a filter derived from the point source response results in the corrected point source response with the reduced broad component less than 2% of the peak count density.

Detection Limit of Lesions in Section Scintigraphy

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In the computed transverse axial emission tomography, reconstructed images are often associated with appreciable amount of noise due to limited dose of activity given to a patient and finite counting time. This paper presents an expression suitable to evaluate the amount of noise for a given activity distribution.

In the image reconstruction with the one-dimensional convolution method, the observed projections are corrected by taking a convolution with a certain correction function, $g(s)$, and these corrected projections are back-projected to a reconstruction plane. It can be shown that the variance $V(\bar{r}_1)$ of the noise associated with the reconstructed image is given by the convolution of the activity distribution $a(\bar{r})$ with a function $N(|\bar{r}-\bar{r}_1|)$, where $N(r)$ is given by

$$N(r)=\frac{1}{2\pi}\int_0^{2\pi} g^2\,(r\sin\omega)\,\mathrm{d}\,\omega$$

The function $N(|\bar{r}-\bar{r}|)$ is named here "error kernel''.

The choice of the correction function is closely related to the character of noise, and it has already been shown that, when the point spread function of the reconstructed image is Gaussian, the ratio of the one-dimensional signal power to noise power is maximized for a given r.m.s. resolution width. Such an optimized correction function has already been reported (Phy. Med. Biol. **20**, 789).

The error kernel was evaluated with the optimized correction function. The error kernel is presented as a function of r/σ where 2.35 σ is the resolution (FWHM) of the reconstructed image. Some applications of this formula are also presented. For instance, the variance at the center of a ring source having a constant activity density is nearly independent of the diameter of the ring, while that of a disc source is nearly proportional to the diameter.

Some Experimental Result Of Perception

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Since the image of the distribution of radioisotope contains statistics noise, we are not perceptible the hot region where target counts are close to background counts, even if only one hot resion exists in the uniform background.

Therefore, it is the purpose of present experiment that we are just visible the target how the differences of counts between target and backgrond are. These studies were done by computer simulation method.

First, in respect of the recognition of target with line printer, distinct display is the most available by using the threshold counts at $B+\sqrt{B}$ Second, the perception of this display is related to the formula, $T-B/\sqrt{B}$, and the value of 1.2 in this formula shows fifty percent distinguishable. (T, Target count; B, Background count)

This value is considerd to be not so different with other display systems that collecting suitable output method line printer is available for simple RI image as one target area exist in the uniform background.

The Third "Intercomparison of Computer-Assisted Scintigraphic Techniques"

Sponsored by IAEA

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This report discribes some results of the third study of IAEA co-ordinated research programme on "Intercomparison of Computer-assisted Scintigraphic Techniques" which was initiated in 1970. The first and second intercomparison which was reported on the special lecture of the 13th annual meeting of J.S.N.M. at 1973 by T. Nagai, employed mathematically simulated phantoms produced by computer, but there were some opinions that they are not suitable representation of clinical situations, since shape of the simulated phantom is too simple to simulate the clinical scans. Therefore, in the third programme, gamma-camera images of dead human liver filled with 99m-Tc solution were applied. Their images were produces in Hannover, recorded on magnetic tape in IAEA and send to 19 participating institutes including NIRS.

The specification of the scitigrams is as follows;

(1) 96 images were record on M.T., 46 of which contain cold lesions and 50 contain hot lesions.
(2) The liver-scan contains up to 6 sherical lesions.
(3) For the 128×128 matrix the sample size is 3.44×3.44 cm, but the scans normally lie between X-channels 20 and 90 and Y-channels