

行政院原子能委員會

委託研究計畫研究報告

動物實驗用 PET/CT 之影像重建定量分析研究
(Quantitative Analysis for Small Animal PET/CT)

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中文摘要

正子標誌分子影像藥物，可在標定目標器官上累積，並藉由小動物正子斷層掃描儀成像，為現代藥物開發研究的利器。小動物 PET/CT 具備同時提供，功能性正子斷層掃描（Positron Emission Tomography, PET）與結構性 X 光斷層掃描（X-Ray Computed Tomography, CT）等，兩種類型影像的能力。而其所產生的 PET 與 CT 的影像，也由於硬體設備之系統整合，幾何上兩種影像可以直接相互融合，藉由影像疊合的輔助，可提高判讀診斷的正確性。PET/CT 除了可以提供結構性 CT 影像輔助 PET 影像的診斷外；亦可提供衰減係數修正的功能，取代傳統 PET 所需的穿透式掃描，減少掃描時間，並提供相對定量分析。我們將使用微型電腦斷層掃描所得影像，針對不同組織結構，進行自動影像分割；再依據分割組織對 511KeV 光子的衰減係數，重新組合出一衰減影像圖譜。最後根據衰減影像圖譜，搭配微型正子掃描儀之幾何結構，計算正子掃描儀中，每一條由成對偵檢對所形成的反應路徑（LOR）之衰減校正係數。所發展的衰減校正方法，也將與現有微型正子掃描儀系統結合，達成一整合型正子影像定量分析系統。

英文摘要

Functional PET imaging using targeted molecular probes has become very important in many drug development using small animal models. However, probe uptakes limited to specific targeted areas greatly increase diagnostic difficulty. However, small animal PET/CT scanners have now been recognized as a powerful diagnostic modality. PET/CT scanner provides “hardware” image fusion capabilities which will make interpretation of PET images much easier due to the anatomical landmarks offered by CT scans.

In addition, the CT data can be used to correct PET scans for photon attenuation. The thesis of two-year project is the development of a quantitative imaging system that provides accurate bio-distribution measurement of positron-labeled molecular images for combined 3D PET/CT scanners. The imaging system consists of two major research tasks: (1) automatic CT image segmentation, and (2) accurate estimation of attenuation correction factors for PET imaging.

An automatic segmentation algorithm based of fuzzy clustering will be developed for whole-body CT image. After image segmentation, each region of the partitioned CT image, representing one type of material, is then assigned a unique attenuation coefficient of 512 keV photons. The corresponding ACF can be computed via accurately forward projection the 512keV attenuation image. It is anticipated that the newly developed system can provide some quantitative PET image using the co-registered CT image for small animals.