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Analytical Study in Knowledge Reconstruction Parameters on Diagnostic Pet Characteristics Images

Gheyath Imad Mohammed

General and Medical Physics, "International State Ecological Institute named after A. D. Sakharov" Belarusian State University

Abstract: The article presents the different types of CT imaging techniques, their analytical capabilities, advantages and disadvantages, in which the main types of CT are considered in detail: X-ray computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), and PET/CT machines. CT complexes were classified according to their purpose. Trends in the development of tomography complexes are analyzed. The results of the complex observation of computed tomography techniques are presented. Global trends in the development of medical devices have undergone significant changes in recent years. This is due to the emergence of new qualitative requirements for the level of medical diagnosis, which are dictated by the need for early detection of various diseases. At present, the state of medical technology makes it possible to visualize the structural and functional changes of the same organism using devices that have different physical principles of operation. At the present stage, tomography is one of the most informative methods (a layer-by-layer study of the structure of various objects), which provides much more information about each initial size of an object than other well-known medical diagnostic methods. At the moment, several types of tomography are being developed: x-ray tomography (CT), magnetic resonance (MRI), positron emission tomography (PET), electron beam, ultrasound, optical coherence tomography, etc. But the essence of all methods is the same: according to the aggregate information (in CT, this is the intensity of the signals on the detectors, and in MRI this is the intensity of echo signals) obtained from a particular section (layer) of the object, it is necessary to determine Local information, that is, the density of the substance at each point of the section. In various types of tomography and summary information.

Keywords: MRI, CT, F-18, PET, IQ tomography.

INTRODUCTION

PET is a diagnostic method used in nuclear medicine, which, unlike morphological/anatomical tomography techniques used in radiology (CT, MRT), obtains information at the molecular level, for example about metabolism in the body, and visualizes this in images [Itti, E. *et al*., 2013; Chung, H.H. *et al*., 2012]. The method uses weak and short-lived radioactive isotopes (eg F-18 and Ga-68), which are combined with some molecular building blocks and are metabolized by the body after intravenous injection and accumulate to varying degrees in tissues. The most common molecular building block is the glucose analog (fluorodeoxyglucose, FDG), which is largely absorbed by most malignancies, due to the high consumption of sugar. In addition, the Department of Radiochemistry at the Nuclear Medicine Clinic provides other radiopharmaceuticals [Zhang, H. *et al*., 2014; Barrington, S.F. *et al*., 2014; EANM, 2011],

With a positron emission tomography (PET) scan, a radioactively labeled substance — called a tracer — is given which is then distributed throughout the body. This distribution is used to measure the body's metabolic processes. Modern PET scans are combined with a CT or MRI scan. PET is mainly used in the diagnosis of cancer [Sunderland, J.J. *et al*., 2015; Makris, N.E. *et al*., 2013].

PET scans provide clearer images than other nuclear medicine procedures, and are used in research and in cases where other methods do not provide a clear diagnosis.

PET is primarily used in the diagnosis of cancer, heart disease (cardiology), and neuroscience (in diseases of the brain and nervous system). The areas of application are, for example, cancer of the pancreas, lungs, kidneys, breast or colon, degenerative brain diseases such as Parkinson's disease, dementia or circulatory disorders after strokes and heart attacks. In the diagnosis of cancer, PET scans are suitable for the primary diagnosis of a tumor and for the detection of secondary tumors (metastases) [R.S.N.A, 2013; Beyer, T. *et al*., 2011; Graham, M.M. *et al*., 2011].

The most commonly used radiopharmaceutical is FDG, a radiolabeled glucose whose distribution in the body can be recorded using a PET camera. Unlike mammography, ultrasound, or MRI, positron emission tomography provides information about metabolism in cells. Since the rate of glycolytic turnover and thus FDG accumulation in cancer cells is much higher than in surrounding tissues, the malignancy clearly stands out from the rest of the breast tissue. Some areas of application of PET scans are cancer

***Corresponding Author:** Gheyath Imad Mohammed

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diagnosis, inflammatory diagnosis and brain examinations [Rausch, I. *et al.*, 2014; www.fda.go].

The amounts of radioactivity required for PET are very small, so this test is practically a procedure without any side effects. Nursing mothers should breastfeed again before giving the tracer, pump, and discarding the first portion of milk after the examination [Cheebsumon, P. *et al.*, 2011; Doot, R.K. *et al.*, 2007].

METHODS

Aim of this study is to evaluate an algorithm in relation to the reconstruction on recovery ratios as moser and evidence of the effective effect of partial size predictions of Discovery IQ and Discovery 710, RC for a lesion with a diameter of 8 mm.

In order to achieve the goals discussed in the thesis, we will use data from a mock study conducted at the Republican Center for Positron Emission Tomography (PET Center). The study was performed on GE Discovery IQ positron emission tomography as shown in figure 1.

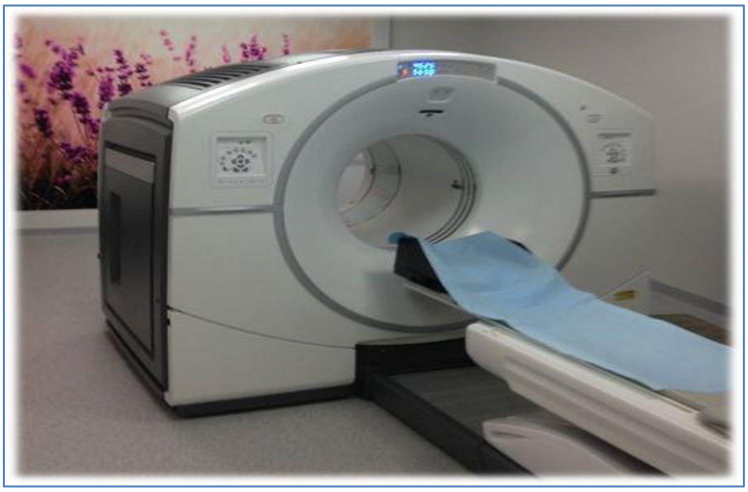

Figure 1: Technical characteristics of the Discovery IQ tomography

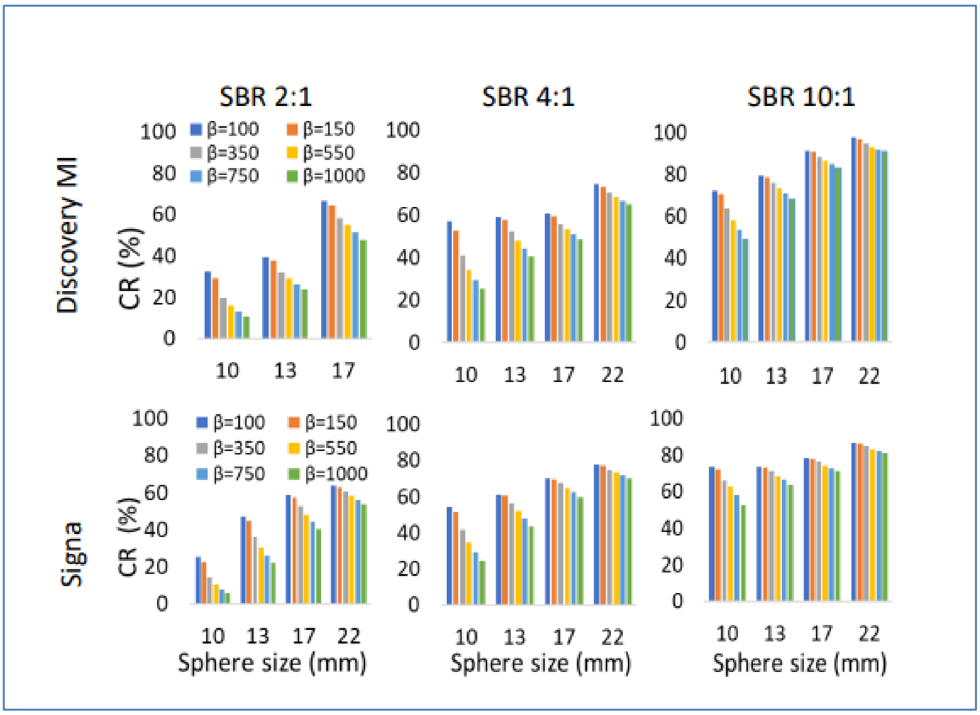

Figure 2: CR versus sphere size for Discovery MI and Signa systems with varying β and SBR values.

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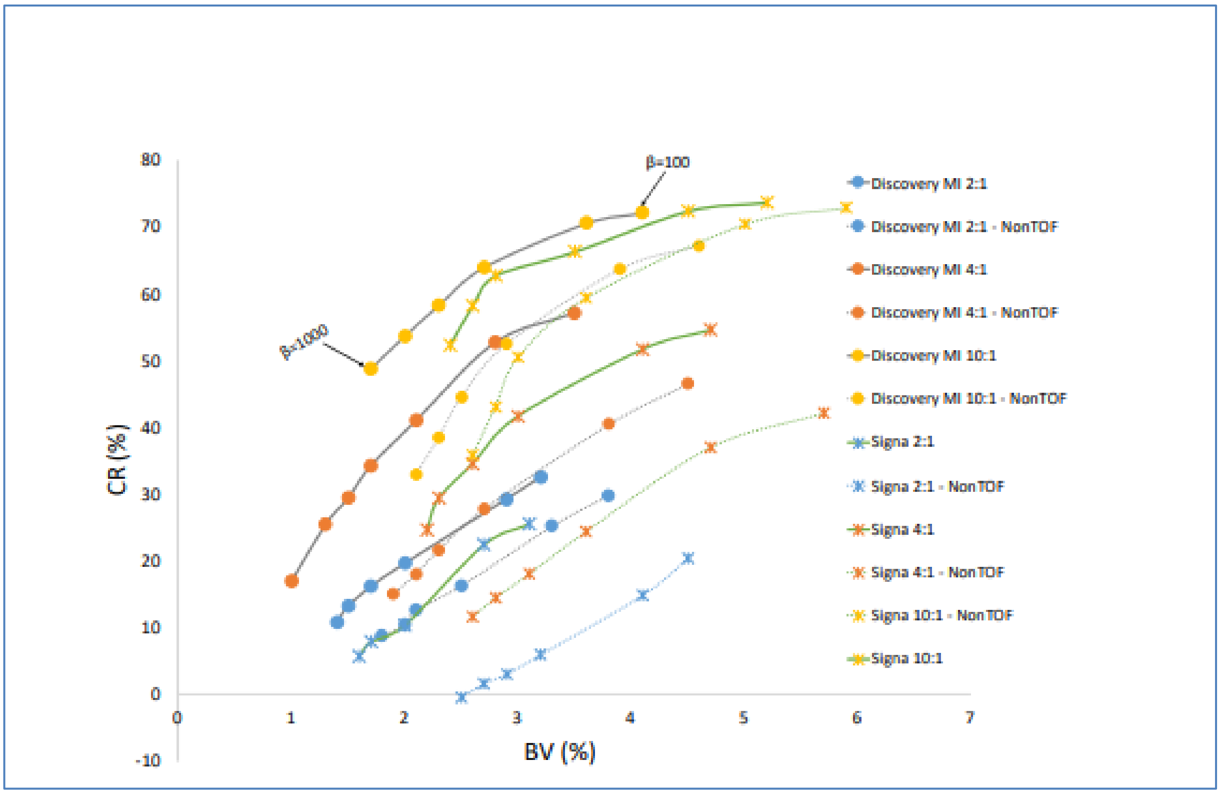

Figure 3: CR versus background variability for the smallest hot sphere (10 mm) with a matrix size of 256x256 and 5 mm FWHM Gaussian filter

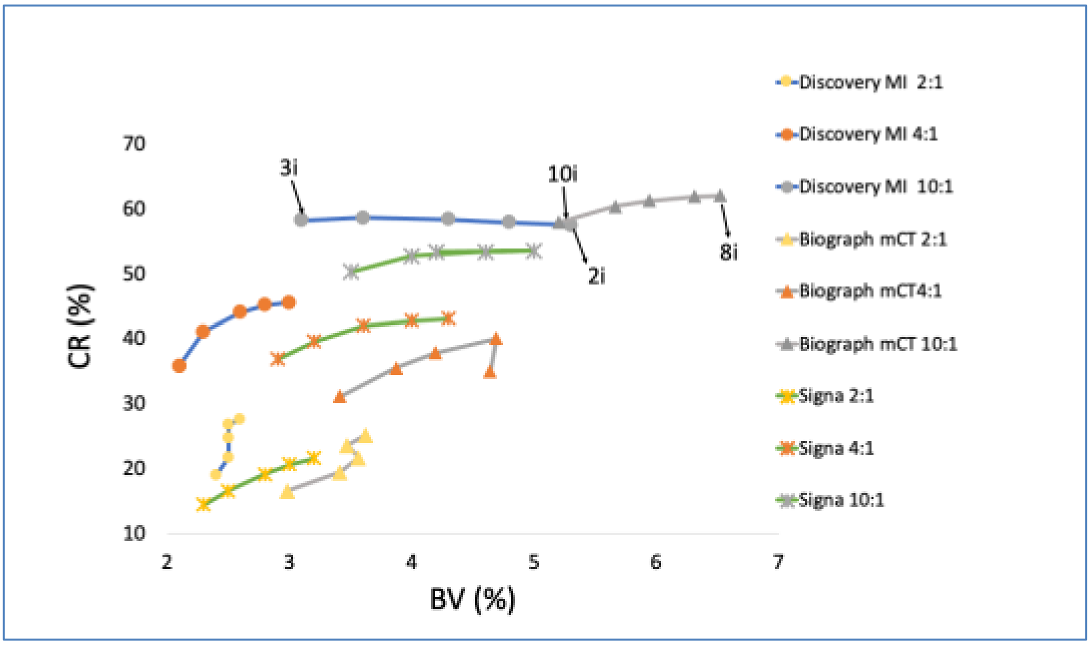

Figure 4: CR plotted against BV for the smallest hot sphere (10 mm)

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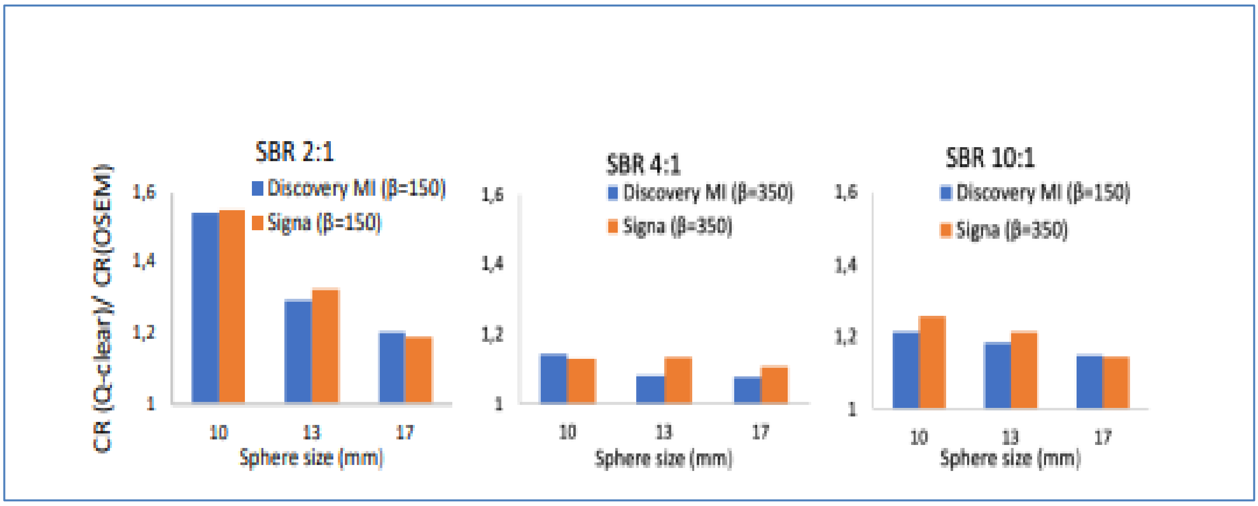

Figure 5: CR(Q-clear)/CR(OSEM) value as a function of sphere size for SBR 2:1, 4:1 and 10:1

Multimodality imaging with 2-[^{18}F]FDG in PET/MR and PET/CT frameworks has opened another field in clinical oncologic imaging because of its capacity to consolidate utilitarian and underlying data utilizing a solitary gadget and in a solitary imaging meeting. In this review, the PET pictures from Signa, Revelation MI, and Biograph m CT PET frameworks were broke down utilizing the NEMA IQ apparition,which is the standard technique to survey the exhibition of PET frameworks . The PET picture quality and measurement precision for various SBR levels were explored by estimating CR also, BV in pictures got with various recreation calculations and boundaries.

CR results showed a similar pattern for all SBR values and camera frameworks: CR diminished with expanded β-esteem (in BPL remaking technique) and diminished with the expanded number of emphases (in OSEM remaking strategy). There was likewise a general expansion in CR with expanded circle size. The size of the circle is practically speaking hard to get from PET pictures because of the fractional volume impact. In a perfect world, CR ought to be 100 % for the ROI, yet the halfway volume impact in PET pictures can bring about a misjudgement or error (or loss) of action in the ROI because of spill-in and pour out impacts .CR was higher for the GE PET/CT camera contrasted and the GE PET/MRI framework. BV diminished with expanded β-an incentive for the two cameras, where BV mirrors the commotion level of the picture.

The outcomes present that Q-clear with TOF utilizing a β-esteem somewhere in the range of 150 and 350 for GE PET/MRI. furthermore, GE PET/CT is a suitable decision to use for Q-clear recreation. β-values were picked as a compromise between contrast improvement and staying at a similar clamour level as OSEM.The ideal OSEM was with TOF data utilizing three cycles, 16 subsets, and 5 mm FWHM Gaussian channel for GE Discovery MI and GE frameworks, and two cycles, 21 subsets, and 5 mm FWHM Gaussian channel for Siemens Biography CT framework. The ideal reproduction calculations and boundaries can't be straightforwardly applied for clinical imaging in light of the fact that the current review depends on an improved on circumstance utilizing the NEMA ghost. Further investigations are expected to inspect how clinical PET pictures ought to broke down, incorporate decision of recreation calculation, boundaries, contingent upon the T/B proportion.

CONCLUSION

The reconstruction algorithm comparison showed that Q-clear gave higher CR and lower BV values with Q-clear than with OSEM. Sphere with higher SBR values gave a higher noise level with increased number of iterations. While those with lower SBR values gave increased contrast levels with the increased number of iterations. High β-value gave a lower noise level and poorer contrast. Thus, the Q-Clear resulted in better PET image quality and quantitative assessment than OSEM. Comparing the performance of the systems to detect the smallest sphere (10 mm) with the Qclear algorithm, showed a higher CR and lower BV for PET images from GE Discovery MI than GE Signa systems. The Siemens Biograph mCT, which only uses the OSEM algorithm, gave the lowest performance due to higher BV, which indicates a higher noise level in the image.

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