A NEW TECHNIQUE FOR RECONSTRUCTING POSITRON EMISSION TOMOGRAPHY DATASETS FROM ROTATING SCANNERS

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Introduction: The positron emission tomography (PET) image reconstruction can be formulated as an equation system where each element of a system response matrix (SRM) represents the probability of detecting in every line of response (LOR) an annihilation event emitted from every voxel of the image volume. In the case of scanners based on pairs of opposite detectors fixed in a rotating gantry this SRM can be decomposed into a projection and rotating components. In this work we propose a new strategy to invert the SRM.

Material and Methods: The reconstruction strategy is based on separating the process into two steps: 1) the projection part is solved using the pseudo-inverse of the projection component and then 2) this estimated image is rotated and added to the final image. This strategy reduces the computation requirements to invert the complete SRM, maintaining 3-D information. This new reconstruction was tested with real data from a hot Derenzo-like phantom and data from a mouse study (20-40 g), acquired in list mode during continuous rotation of the gantry. The data were organized as a histogram of LORs' with an angular binning of 1º, covering 180º.

Results: Our reconstruction achieved results visually indistinguishable from those obtained by 3-D-OSEM, while reducing by a factor of two the computation time. Moreover, the pseudoinverse strategy permits a finer control of the noise level in the final reconstructed image. Conclusion: Our method represents an intermediate solution between the speed of analytical algorithms and the quality of standard iterative reconstruction applied to rotating PET scanners.