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# SPECTRAL ANALYSIS APPROACHES TO 4D IMAGE RECONSTRUCTION ALGORITHMS FOR DYNAMIC POSITRON EMISSION TOMOGRAPHY

**Andrew J. Reader[1], Julian C. Matthews[2], Florent C. Sureau[3], Claude Comtat[4], Régine Trébossen[4] and Irène Buvat[5]**

[1] Montreal Neurological Institute, McGill University, Montreal, QC, Canada
[2] Wolfson Molecular Imaging Centre, the University of Manchester, United Kingdom
[3] Vrije Universiteit Brussel, Department of Nuclear Medicine, Brussels, Belgium
[4] CEA, DSV, I2BM, SHFJ, Orsay, F-91401, France
[5] IMNC, CNRS UMR 8165 - Paris 7 University - Paris 11 University, Orsay, France

Positron Emission Tomography (PET) can quantitatively image trace concentrations of labelled molecules at high sensitivity, at all locations within the human body. This enables detailed investigation and increased understanding of the physiology underlying healthy as well as diseased states in neurology, psychiatry, oncology and cardiology. PET's remarkable versatility arises from the vast and growing array of radiolabelled compounds (radiotracers) which are available : from water (for imaging blood flow), to fluoro-deoxyglucose (FDG, for imaging glucose metabolic rate) to a whole range of transmitter-specific ligands (e.g. for receptor imaging). In order to reconstruct images of these biological parameters it is necessary to perform dynamic (time-dependent) PET image reconstruction. Conventional 3D reconstruction methods are typically used followed by kinetic analysis to finally estimate the biological parameters of interest. However, this conventional approach can result in high levels of variance in the final images. This work considers the use of a set of temporal basis functions (a set of exponential functions of differing decays, each convolved with the arterial input function) to appropriately constrain the reconstruction of the radiotracer kinetics. The resulting images of biological parameters have lower levels of noise compared to the conventional approach, which in turn allows the spatial resolution of a given PET scanner to be more fully realized.