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VRIJE UNIVERSITEIT BRUSSEL

PhD in Medical Sciences
2017-2018

INVITATION to the Public defence of

Koen SALVO

To obtain the academic degree of **'DOCTOR IN MEDICAL SCIENCES'**

Joint Reconstruction of Activity and Attenuation in TOF-PET – A Theoretical Study.

Wednesday 27 June 2018
Auditorium **Vanden Driessche**, 17:00
Faculty of Medicine and Pharmacy, Laarbeeklaan 103, 1090 Brussel

How to reach the campus Jette:
http://www.vub.ac.be/english/infoabout/campuses

Summary of the dissertation

In time-of-flight (TOF) positron emission tomography (PET) imaging, attenuation correction is required to reconstruct the activity image accurately. The standard way of applying attenuation correction makes use of a computed tomography (CT) scan. It is however, possible to correct for attenuation using only the TOF-PET data, without making use of the CT data.

In this work we aim at:
(i) Obtain a full understanding of the fundamental properties of this problem;
(ii) Improve the existing methods (i.e. MLAA and MLACF);
(ii) Develop new algorithms (i.e. sMLACF);
(iv) Evaluate all those methods on simulated, phantom and clinical data.

The main contributions of this work are:
(i) Listing sufficient conditions under which the Poisson-model is valid for (TOF-)PET;
(ii) Proving an equality helpful for showing that some of the sufficient conditions are fulfilled under which a (Generalized, Poisson PET) Expectation-Maximization (EM) algorithm converges;
(iii) Applying these convergence theorems to generalize the proof of convergence of MLEM with fixed background and correct the conditions under which the limit is unique;
(iv) Proposing small changes to the MLAA and MLACF algorithms to overcome possible numerical instabilities and proving the asymptotic regularity of MLACF ;
(v) Proposing a new algorithm (sMLACF) and proving its asymptotic regularity.

Curriculum Vitae

Koen Salvo obtained a masters degree in applied physics from the University of Ghent.
He then went one year to Mexico where he looked into numerical methods at Colima University.
Back in Belgium he taught mathematics at secondary school and obtained a master in medical radiation physics at the KU Leuven. After working one year as a medical physicist at IBA he started his Phd at the Vrije Universiteit Brussel. Currently he works as a medical physicist at UZ Leuven.