Postdoctoral and PhD studentship research opportunities
King's College London, United Kingdom

ADVANCED IMAGE RECONSTRUCTION FOR SIMULTANEOUS PET/MR

Positron emission tomography (PET) provides a powerful array of capabilities for functional and molecular imaging in the human body, through detection of trace concentrations of radioactively-labeled compounds within any chosen volume of interest. PET finds application in many fields of importance to human health, including oncology, neurology and cardiology. More recently, PET has been combined with magnetic resonance (MR) imaging in order to deliver simultaneously acquired PET/MR images, providing synergistic anatomical and functional information.

However, the capabilities of PET are often limited by the noise level in the data. This has led to considerable research in the last two decades into statistical image reconstruction methods. Statistical image reconstruction for PET permits more accurate modeling of both the noise in the raw data as well as the mean of the data. These two modeling advantages have meant that statistical methods, such as maximum likelihood reconstruction, have delivered notable improvements compared to conventional techniques, in terms of image spatial resolution and noise reduction. Even with such advances, PET images are still noise limited, and for this reason Bayesian, or maximum a posteriori, reconstruction methods have also been explored, delivering further reductions in image variance according to the strength of the prior information supplied.

The new context of PET with simultaneously acquired MR data provides many research opportunities for image reconstruction, data modeling and correction, not only for PET but also for MR. Research projects in this area will explore new frontiers in Bayesian PET/MR image reconstruction, including

i) exploiting the potential of novel functional and anatomical priors for 4D PET/MR reconstruction
ii) developing 4D PET/MR templates for simulation studies and prior information
iii) advancing PET/MR system modeling with hybrid simulation and measurement techniques
iv) designing validation methodologies via adaptation and analysis of highly realistic dynamic (4D) imaging phantoms
v) exploiting multiple data sets in image reconstruction for longitudinal studies assessing therapy response

The work will take place under the supervision of Dr. Andrew Reader, at St. Thomas' Hospital in the Division of Imaging Sciences and Biomedical Engineering at King's College London. The Division is a truly multidisciplinary group including physicists, mathematicians, computer scientists, chemists and clinicians, with over 70 academic staff and more than 100 researchers. Its imaging facilities include two new PET/CT scanners and, importantly to this project, a new Siemens Biograph mMR simultaneous PET/MR scanner.

For more information please contact Dr. Andrew Reader by email: andrew.reader@kcl.ac.uk
Please include an up to date CV. Both postdoctoral and PhD opportunities are available.