

Simultaneous PET-MR Modelling and Reconstruction for Imaging Brain Disorders

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Country

United Kingdom

Title of project or programme

Simultaneous PET-MR Modelling and Reconstruction for Imaging Brain Disorders

Source of funding information

EPSRC

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01/08/2015

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3.0

The project/programme is most relevant to:

Alzheimer's disease & other dementias

Keywords

Neurodegenerative disease in general

Research Abstract

Positron emission tomography (PET) combined with computed tomography (PET-CT) is now a very successful medical imaging technique. It has widespread application to the detection and

monitoring of cancer throughout the human body. However, beyond this crucial application, PET is also a powerful method for investigating problems with the human brain. It allows us to understand what is going on in dementia, epilepsy and other distressing brain disorders which afflict in excess of one million people in the UK. One specific example is PET's ability to look at the brain's inflammatory response. This inflammatory response is now recognized as linked not only with dementia and many other disorders of the brain, but is even implicated in mental health problems such as depression. Only PET can allow us to look at this inflammation at the molecular level, which means that PET has a unique role both in diagnosing and seeking to remedy these often debilitating conditions. But there are limits on just how much information we can currently gain from PET, mainly due to the noise levels in the data which limit our ability to accurately measure quantities of interest within small regions of the brain.

Recently, with a view towards the future of medical imaging, PET scanning has been made available with magnetic resonance (MR) imaging in one single scanner, PET-MR. This means we can see the structure of the human body at the same time as seeing how it functions. These images come without the radiation exposure of a CT scan, possess the amazing details of MR, and in contrast to PET-CT all the medical information is obtained at the same time with the patient in the same position in one single and convenient scan. The potential of PET-MR is exciting, not only in terms of its benefits to patients and to research, but also for opening new possibilities for processing the medical imaging data. This is very relevant to PET, where problems with image noise have led many to invest considerable effort into reducing noise in the images, so that more detailed medical information can be gained. This current project seeks to go further by joining together the PET and the MR image reconstruction and processing. We will model what PET does, as well as what MR does, together, at the same time. Also, we will build high quality reference brain images which reflect a number of different functional and anatomical attributes of the human brain, based on PET and MR scans of different people. This will allow future PET-MR scans to benefit from previous knowledge, and so be more intelligent when scanning a new patient. The project will apply these special techniques to three main areas. First, to look at brain inflammation with PET, to gain insight into what is happening in people suffering from depression, especially when their medication is having no effect. Second, we will look at what is happening in the brain for people suffering from epilepsy. Finally we will also look at detecting the presence of a particular type of protein associated with Alzheimer's disease, which is highly important for both understanding and possibly resolving this urgently growing issue (the numbers of sufferers from Alzheimer's is predicted to double in the next 40 years).

The proposed developments for imaging brain disorders is very timely. Firstly, a brand new PET-MR scanner has just arrived at St. Thomas' Hospital, one of the first sites in the UK to obtain such a technologically advanced system. Secondly, brain imaging studies with this scanner will soon get underway during 2015, with a funded study already scheduled to scan 60 participants for research into mood disorders. The timing is therefore perfect for the parallel development of novel methodology suited to the unique capabilities of PET-MR. Though many have seen the potential for joining together the PET and MR data processing, none of the methods so far are as unified and advanced as put forward in this proposal.

Lay Summary

Further information available at:

Types:

Investments > €500k

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United Kingdom

Diseases:

Alzheimer's disease & other dementias

Years:

2016

Database Categories:

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