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Precision Imaging Beacon of Excellence
Studentship Form

Supervisors	**Susan Francis** **Rosa Sanchez Panchuelo** School of Physics and Astronomy		
Co-supervisors	**Xin Chen** School of Computer Science **Katrin Krumbholz** School of Medicine		
Start date	September 2018	**Duration**	3 years
Project	**Ultra-high resolution 7 Tesla fMRI, pushing the resolution to cortical layers: implications for understanding brain plasticity**		
Abstract	There are many basic questions of the neuroscience underlying human sensory processing that remain unanswered. This project will build on our recent advances in high-resolution fMRI studies at ultra-high field (7T) in humans to push the boundaries of MR imaging techniques to study cortical and subcortical organization and the distribution of responses across the cortical layers. **Objectives** The key objectives of this studentship are to develop ultra-high field structural and functional MR imaging and advanced data analysis methods to measure (a) fine function and functional connectivity maps in the cortical and in subcortical regions (we have shown this at the scale of a millimetre); (b) functional maps across cortical layers (these maps are at the scale of fractions of a millimetre) and require the development of new, novel fMRI techniques and analysis methods; and (c) myelination patters at ultrahigh spatial resolution (fractions of a millimetre). These methods will be applied to study somatosensory and auditory processing, and how function and structure are re-organized in the brains of individual patients with somatosensory loss, and cortical tonotopic reorganization as a result of peripheral hearing loss. For example, we predict lesser myelination/connectivity in hearing-loss-affected regions (high-frequency regions in presbycusis), and decrease in myelination/connectivity may be associated with tonotopic reorganization or disorganization. The student will acquire key skills to develop high resolution fMRI data (<750μm isotropic resolution) in a short acquisition time (TR), using simultaneous multislice (SMS) imaging techniques and surface coils. The student will develop MR techniques for high spatial resolution layer specific activity, and develop alternative measures to BOLD signals such as arterial spin labelling (ASL) and vascular space occupancy (VASO) methods, as well as using ultra-high resolution anatomical data on gyration and myelination. To address these aims the student will learn advanced image analysis techniques (such as weakly-supervised machine learning methods for classification and pattern recognition, of particular importance to develop cortical laminar fMRI segmentation. This new cross-disciplinary project will be supervised by a cross-disciplinary team comprising Prof Francis and Dr Sanchez-Panchuelo (Sir Peter Mansfield Imaging Centre, School of Physics and Astronomy) who have expertise in high resolution MRI and fMRI techniques and somatosensory processing. Dr Chen (School of Computer Science) brings new research expertise to this project on image processing, computer vision and machine. learning for medical image		

	analysis, this will be particularly applicable to develop a unified/generic framework to addresses segmentation of high resolution fMRI data and cortical layers. Dr Krumbholz (School of Medicine), leads research on the study of mechanisms of hearing and hearing impairment, and methods will be applied to patient populations.
Queries	Please contact **PI-Beacon@nottingham.ac.uk**
To apply	Please apply online via **the University of Nottingham application page**