The University of Queensland - IIT Delhi Academy of Research Joint PhD Project

PROJECT TITLE	**INFORMATION FLOW IN THE NORMAL AND EPILEPTIC BRAIN**
PROJECT CODE	**UQIDAR 00166**
PROJECT DESCRIPTION	Abnormal function within brain networks is a key determinants of seizure generation, spread and termination. Brain networks are also likely to play an important part in determining therapeutic response and in cognitive impairment associated with epilepsy. The combination of high spatial resolution of functional magnetic resonance imaging (fMRI) and high temporal resolution of electroencephalogram (EEG) holds the potential to detect the abnormality in brain network. However, due to the complexity in modelling both kinds of data, limited understanding is available on the altered information flow in the brain of epileptic patient. The Garg lab at IITD have developed a method utilizing sparse (i.e. constrained) regression to model the fMRI signal as a multivariate auto-regressive process at the voxel level allowing the underlying brain dynamics to be modelled accurately and parsimoniously. The method provides insight into the information flow in the fMRI data, which is postulated to reflect the flow of information in the underlying neural networks. Using simultaneous EEG-fMRI data in control subjects and patients with focal epilepsy acquired at UQ, this project will further develop the autoregressive modelling to identify patterns of abnormal connectivity in focal epilepsy, to determine if abnormalities in connectivity allow the identification of the epileptogenic focus and to understand the role of interictal epileptic transients in detected network abnormalities.
PROJECT OUTCOMES	The research has the potential to influence clinical practice by altering the way that patients with refractory epilepsy are investigated. It will also shed light on the changes in the brain in the epileptic brain increasing the understanding of how these changes predispose to the generation of seizures.
ADVISORY TEAM	**Professor David Reutens** https://cai.centre.uq.edu.au/profile/102/david-reutens d.reutens@uq.edu.au Centre for Advanced Imaging The University of Queensland **Professor Rahul Garg** www.cse.iitd.ac.in/~rahulgarg rahulgarg@iitd.ac.in Department of Computer Science & Engineering Indian Institute of Technology Delhi
TYPE OF STUDENT	Applications are open to i/a students who meet eligibility criteria.
DISCIPLINE BACKGROUND OF STUDENT	Ideally, this project requires students with a background in biomedical engineering, applied mathematics, computer science/electronics, neuroscience/neuroimaging, cognitive science/physiology
IDEAL CANDIDATE	Essential capabilities: • Data analytical skills, • Expertise in a programming language (eg, C/C++ or Matlab) • Student should be good at programming and have interest in Neurosciences or Neuroimaging.

	Desirable capabilities: • An understanding of epilepsy Expertise in machine learning / artificial intelligence methods Expected qualifications (courses, degrees, etc): • Bachelor/Master/MPhil in a relevant field of Science, Engineering, Biology, or Medicine • Any major engineering discipline with projects or work experience in Neuroimaging or neuroscience. • Medicine or neuroscience or cognitive science or physiology major with project or work experience in programming and statistics.
APPLICATION PROCESS	Apply online by the due date: https://www.uqidar.org/students/how-to-apply/