Project Title	Mechanisms of Inhibition Failure in Traumatic Brain Injury
Supervisor	Professor Adam Hampshire Professor David Sharp
Themes	Biomedical Sensing Diagnostics and Imaging
Project Type	Desk Based
Project Description	This project will involve application of multi-kernel machine learning to multi-modal imaging data in order to predict deficits of motor and cognitive inhibition control in traumatic brain injury patients. Inhibition control refers to the set of neurocognitive processes that enable people to wilfully withhold or countermand behaviours that are routine, habitual, impulsive or otherwise prepotent. Deficits of inhibition control are closely related to the psychiatric construct 'impulsivity' and are associated with a range of important clinical populations. Early neuroscience research into inhibition control focused on the roles of specific circuits and putative modules in the brain. However, research over the past decade has shown that the neural mechanisms underlying inhibition control are far more complex than this. An alternative school of thought has been that inhibition control is better understood as an emergent property of interactions that occur across distributed networks in the brain – also referred to as task-evoked network states. A key challenge is to better understand how it is that structural brain networks support such states in order to enable optimal inhibition control. Traumatic brain injury patients provide an ideal context for determining this, because they can suffer different patterns of damage to the structural connectome, affecting cortical networks and neuromodulatory systems in heterogeneous ways that often precipitate deficits in inhibition control. In this project, the student will apply multi-kernel machine learning methods to identify the brain imaging features that best predict behavioural deficits in inhibition control. All data already have been collected, therefore, this is an analysis project. The dataset includes a combination of patients and controls, who have undergone structural, diffusion weighted, DAT, structural and resting state imaging scans, as well as a set of behavioural tasks that measure inhibition control abilities. The main supervisor is Adam Hampshire, who is a leading expert in network mechanisms of inhibition control. The second supervisor is David Sharp, who is a leading expert in traumatic brain injury and its cognitive sequalae. We also include Valentina Guinchiglia, a technician with machine learning background who is an expert in multi-modal imaging and multi-kernel learning. During this project, the student will gain knowledge and experience with machine learning methods, cognitive neuroscience, neurology and brain imaging.