Fully funded studentship opportunities in Information Engineering

The following studentships will be available to start in October 2018. Full funding for fees and maintenance is available via EPSRC funds for UK and some EU students (see eligibility criteria here https://www.epsrc.ac.uk/skills/students/help/eligibility/).

Supervisor	Project
Dr Fulvio Forni Control Group ff286@cam.ac.uk	**Analysis and control of soft-robotics actuators** Soft-robotics is a growing field of robotics that aims at extending robot dexterity, autonomy and applications via active soft materials. The aim of the project is to develop control algorithms for soft robotics and study novel actuators based on soft materials. Natural applications for the project are prosthetics and rehabilitation, haptic interfaces, and general robotic applications (motion, exploration, grasping, etc). Control theory and robotics have a long, successful history, but applications are essentially confined to rigid robots. Soft materials introduce new possibilities and new challenges. Their natural compliance and deformability are key in exploring new applications but introduce a level of complexity that call for refined control algorithms. The goal of the project is to design and control novel actuators based on distributed configurations of active and sensing components embedded in soft materials. (Methods: Distributed control theory and differential analysis (dominance theory, differential dissipativity). Dynamic allocation techniques for redundant actuators. Prototyping and experimental analysis of actuators based on soft-materials).
Prof Mark Gales Speech Group, Machine Intelligence Laboratory mjfg@eng.cam.ac.uk	**Incorporating Uncertainty in Deep Learning**
Prof Simon Godsill Signal Processing and Communications Group sjg30@cam.ac.uk	**Behavioural models in sequential inference about spatio-temporal structures** The project will involve new models and scalable inference methods for dynamic learning of behaviours and intentionality in multiple interacting objects, e.g. animals hunting prey, sea mammals/fish interacting in schools/ shoals, aircraft or birds interacting in formation and high frequency financial modelling of multiple order books. The methodology will use multiple dimensional stochastic processes in continuous time. The underlying principles will be Bayesian updating of dynamically evolving objects, implemented using novel scalable combinations of Sequential Monte Carlo, message passing and

	machine learning algorithms. We will provide new methodologies for scientists and zoologists wishing to test/ develop hypotheses about behavioural interactions, new methods for improved situational awareness/intent prediction in general tracking applications (civilian or military), and scalable inference in larger scale problems than currently manageable. This project has applications in many domains of national and international importance, including the monitoring of wildlife (changes in arctic seal behaviours/ populations, sea mammals, fish), monitoring of large scale spatio-temporal effects in climate change, enhanced situational awareness in defence applications. The candidate should have, or be expected to gain a 1st class honours degree in Engineering, Mathematics or Statistics. A good knowledge or experience of probability theory, state space models, tracking algorithms and parallel computer architectures would be beneficial.
Dr Ioannis Lestas Control Group Informal enquiries may be addressed to Dr Ioannis Lestas icl20@cam.ac.uk	**Highly distributed mechanisms for demand side management in power systems and smart grids** The aim of this project is the design of such distributed mechanisms for control and optimization in power systems and smart grids that will improve their efficiency and reliability. The analysis will be based on various advanced methodologies in control theory and optimization that will be used in this context. Distributed feedback mechanisms will be designed for general network topologies with higher order dynamics and these will be validated with simulations on realistic power system models. Candidate Profile: With, or expected to gain a degree in Electrical or Information Engineering or related areas such as Mathematics or Physics. Good analytical skills would be beneficial
Dr Miguel Hernandez Lobato, Machine Learning Group jmh233@cam.ac.uk	**Semi-supervised Bayesian optimization** This project aims at creating new Bayesian optimization (BO) algorithms that use semi-supervised learning for making better predictions in high-dimensional structured spaces, enabling the solution of complex optimization problems in engineering design. The project outcomes will be a) novel models (based on deep neural networks) and approximate inference methods for full Bayesian semi-supervised learning, b) new semi-supervised Bayesian optimization methods and b) a practical solution to challenging optimization problems in high-dimensional structured spaces.
Dr Fumiya Iida, Biologically Inspired Robotics Laboratory fi224@cam.ac.uk Please contact Dr Iida for more information	**Reconfigurable modules for rapid design iteration of soft robot applications** This project aims to establish a developmental framework of reconfigurable robotic modules that can significantly speed up the design iterations of soft robot applications. The reconfigurable robotic modules should be comparatively small and flexible, such that they can be quickly applied to many variations of soft mechatronics devices by employing rapid fabrication methods such as 3D Printing and silicon moulding. The modules should also be supported by a software library and/or middleware for rapid development of controllers. The

	developed framework will be used for the case study of developing dextrous robotic hands for manipulation of unknown/unstructured objects.
Dr Timothy O'Leary, Control Group tso24@cam.ac.uk	**Flexible modulation of rhythmic circuits across scales** We are beginning to understand how the brain integrates sensory information and selects actions, but we do not know how neural circuits flexibly switch attention between competing stimuli, or select a single action among many potential actions. Understanding these principles will allow us to develop neural-inspired algorithms and hardware, and to understand how biological brains work. There is widespread evidence that brains use a novel form of information routing based on selective modulation of positive feedback in neural circuits. A hallmark of this feedback is coherent oscillations across brain areas, which are readily detectable in animals and humans and currently lack an explanation. This project will use cutting-edge tools from nonlinear control, computational modelling and biological data analysis to build neural circuits that use biologically plausible mechanisms to flexibly control computations. The project will involve close interaction with neuroscientists.
Dr Ramji Venkataramanan, Signal Processing and Communications Laboratory Interested applicants may contact Dr Venkataramanan with a CV rv285@cam.ac.uk	**Information-theoretic performance limits for statistical machine learning algorithms** This project will investigate the fundamental limits of statistical learning algorithms. For canonical tasks such as classification and high-dimensional regression, the goal is to answer questions such as: "How fast can the accuracy of any algorithm improve as the number of available data samples grows?" The project will also explore the design of efficient algorithms that approach the optimal performance limits.