Funded Ph.D. Studentships in Computing and Mathematics at Manchester Metropolitan University

The Department of Computing and Mathematics at Manchester Metropolitan University has a leading reputation for research excellence. In the 2008 Research Assessment Exercise, 75% of Computer Science Informatics research was judged to be at least "internationally recognised", and 35% was deemed to be at least "internationally excellent". As a result of this, the Department has secured significant research funding, and, with the support of the MMU Dalton Research Institute, we are able to offer **four fully-funded*** **Ph.D. studentships** in the following areas:

Novel Computation (http://www.docm.mmu.ac.uk/RESEARCH/ncg)

Simulation of Biologically-inspired Computational Models (Dr Andy Nisbet and Dr Martyn Amos)

Biologically inspired techniques such as neural-networks, genetic algorithms, artificial immune systems and ant colony simulations have been successfully applied to diverse areas such as computational finance, crowd simulation, lie detection systems, image processing and optimisation problems found in scientific and engineering applications. A significant problem in the successful application of such techniques can be the prohibitively large number of iterations to be performed, and/or the extremely high number of biological components that must be modelled in order to effectively represent and solve realistic problems. For example, modelling half the brain of a mouse is thought to require in excess of 8 million neurons, where each neuron can itself have around 8000 connections or synapses. The main aim of the Ph.D studentship is to develop efficient scalable techniques for the simulation of biologically inspired computational models, exploiting multiple NVidia (CUDA programmed) Graphics Processor Units (GPUs). The successful applicant will gain significant expertise and skills that are highly sought after by both industry and university research teams. There is considerable scope to investigate biological computational models, ranging from a single cell up to complex multicellular lifeforms. Experience of CUDA/GPUs, concurrent/parallel programming, compilation, or biologically inspired models of computation would be beneficial (but not essential).

Synchronization in Coupled Systems with Time Delays (Dr Jon Borresen and Dr Martyn Amos)

Synchronization occurs in a variety of systems throughout nature, from simple coupled pendulums to complex neural synchronization and is an essential feature in a wide variety of applications in fields as diverse as; electrical engineering , chemistry, telecommunications, data encryption, photography and medicine. Coupled systems with time delays, of which the neurones in the human brain are a prime example, are known to exhibit a wide variety of synchronous behaviour. Much research is currently underway to understand the dynamics of such interacting systems, particularly how and why synchronization arises. Although fundamentally mathematical, the research applies techniques from a variety of scientific fields and offers many opportunities for interdisciplinary work. A suitable candidate for this position should have a mathematical background. with some knowledge of dynamical systems, and a strong general scientific interest.

Logic and Computation (http://www.docm.mmu.ac.uk/RESEARCH/logicgrp)

Logical Consequence Relations and Inference Rules in Logics Originating in AI and CS (Prof. Vladimir Rybakov)

The project will study various mathematical models and algorithms for representating human reasoning in AI and CS. The research is connected with descriptions of reasoning and knowledge by Kripke-like Second Order Models, methods of Universal Algebra and Model Theory of First Order Logic. Logical inference rules will be investigated via admissibility, derivability and validity. Well-established non-classical mathematical logical systems (as temporal, modal and constructive logics) will be involved with models for knowledge representation and elicitation. We are particularly interested in finding and evolving algorithms for decidability problems arising from logical consequence and, in particular, to the satisfiability problem. A good background in Kripke Models, Non-Classical Mathematical Logic and Algebra is essential.

Intelligent Systems (http://www.docm.mmu.ac.uk/RESEARCH/Intelgrp)

Optimisation by Quantum Annealing (Dr Alan Crispin)

The field of combinatorial optimisation consists of a range of problems that are core to the disciplines of computer science and engineering. These problems typically involve rearrangement operations to find either the minimum or maximum of a cost function. Classic examples of such combinatorial optimisation problems are the travelling salesman and vehicle routing problems. Research in the field has focused on exploring heuristic techniques for the NP complete class of problems. Our current work has investigated the use of evolutionary algorithms for solving optimisation problems in electronic design automation. This project will investigate the use of quantum annealing for solving practical combinatorial problems subject to constraints. Quantum annealing is an optimisation technique where the annealing process is controlled by the quantum tunnelling field strength. A suitable candidate for this position should have a background in computing or a related subject, knowledge and experience of software development and a strong interest in algorithm design.

Applicants for each studentship should possess a good (2.1 or above) honours degree (and preferably a higher degree such as an M.Sc. or equivalent industrial experience), in any appropriate scientific or technological discipline (e.g. mathematics, physics, computer science). Each studentship fully covers University tuition fees (at EU/UK level*) and provides a tax-free bursary of £12,000 per year for a 3-year duration. *EU/UK fees £3,390 per annum. Overseas students are welcome to apply, but should be aware that they will be required to self-fund the difference between EU/UK and international fees (international fees are currently £9,065 per annum).

In order to apply for any of these studentships, in the first instance please send your up-to-date CV, along with a cover letter and details of two academic referees, ***directly to the first-named supervisor of the project in which you are interested (to whom informal enquiries should also be addressed)***:

- Dr Andy Nisbet: A.Nisbet@mmu.ac.uk
- Dr Jon Borresen: J.Borresen@mmu.ac.uk
- Prof. Vladimir Rybakov: V.Rybakov@mmu.ac.uk
- Dr Alan Crispin: A.Crispin@mmu.ac.uk

The deadline for receiving initial applications is Friday 29th January 2010. Studentships will commence as soon as possible after that date.

For further information on the Department and its research groups, please visit

http://www.docm.mmu.ac.uk