

Computing Science and Mathematics

Research Students PhD Day timetable.

Tuesday 21st April 2015

Talks: LTB4 / Refreshments 2X4, 2X6

0900-0920: Tea/coffee in 2X4/2X6

0920-0930: Introduction - Leslie Smith

0930-1045: Session 1: Chair: Carron Shankland

0930-0950: Paul McMenemy

Norovirus within bivalve molluscs: modelling mitigation of the virus during depuration

0950-1010: Iona Paterson

Controlling antibiotic resistance in an aquatic environment

1010-1030: Brian Lee

Mathematical Models of Invasive Species

1030-1050: Adrian Worton

Incorporating environmental factors into tick-borne disease models

1050-1110: Tea/coffee in 2X4/2X6

1110-1230: Session 2: Chair: Leslie Smith

1110-1130: Omair Ameerbakhsh

Towards a Participatory Simulation Framework for potentially effective E-learning in Classroom environments

1130-1150: Dalila Hamami

When Data mining brings its force to modelling!

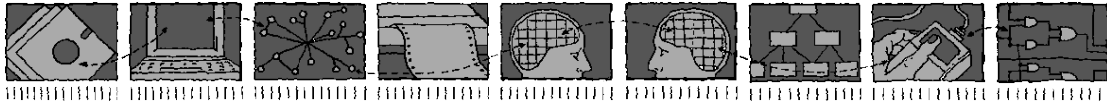
1150-1210: Jason Adair

Using Evolutionary Algorithms for Feature Selection in Brain Computer Interfaces

1210-1230: Madhu Pahar

A Novel Reconstruction Technique based on a spike code (event) representation

1230-1330: Lunch in 2X4/2X6



1330-1500: Session 3: Chair: Rachel Norman

1330-1350: Mohammed Al-Mojamed

Design and Evaluation of a Peer-to-Peer MANET Cross-layer Approach: OnehopMANET

1350-1410: Dhaifallah Alwadani

Overlay Hybrid Multicast Platform

1410-1430: Farida Chowdhury

Structured Peer-to-Peer Overlays for Mobile Networks

1430-1450: Saemundur Haraldsson

Genetic Improvement of Energy Usage is only as Reliable as the Measurements are Accurate

1500-1530: Tea/Coffee in 2X4/2X6

1530-1630: Session 4: Chair Leslie Smith

1530-1550: Kevin Swingler

Structure Discovery in Mixed Order Hyper Networks

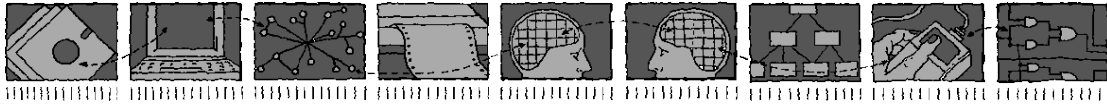
1550-1610: Annan Yearian

Subtle higher order mutants in Python

1610-1630: Kevin Graham

Identifier Splitting for SBSE Software Maintenance

1630-1640: Closing Remarks: Leslie Smith



ABSTRACTS

Session 1: Chair: Professor Carron Shankland

0930-0950 Paul McMenemy

Norovirus within bivalve molluscs: modelling mitigation of the virus during depuration.

Abstract: Norovirus can be transmitted by the consumption of contaminated foodstuffs, especially if eaten raw, and oysters can be particularly prone to transmission of the pathogen. Shellfish can be further cleansed using a process called depuration which removes many contaminants such as *E. coli*, and can also reduce norovirus counts. However this is at a financial cost to the industry. Modelling the depuration process could provide insight into the system dynamics and provide guidance to stakeholders. Our model predicts a worst case scenario regarding the variability of NoV levels within shellfish, which could remove much of the testing burden from regulators. The model also provides per site estimates of optimal depuration duration.

0950-1010 Iona Paterson

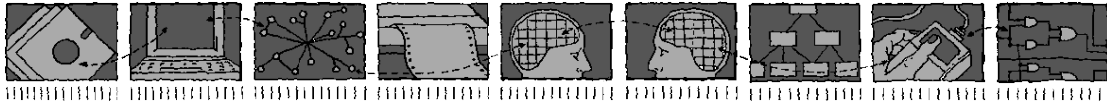
Controlling antibiotic resistance in an aquatic environment

Abstract: Antibiotic resistance is one of the major health concerns of the 21st century. Since their formal discovery in 1928 antibiotics have been at the forefront in the fight against bacterial diseases. However, the increased availability of antibiotics has led to the overuse and often misuse of these substances resulting in the emergence of multi-drug resistant bacteria e.g. MRSA. Antibiotic resistance is not only of great concern within the human population but also within the aquatic industry where disease causes significant economic losses. Aquatic systems are particularly vulnerable to the evolution of resistance bacteria as water is an ideal medium for bacterial growth and these systems act as a sink to antibiotics and toxins from the environment. With few antibiotics licenced for use in aquaculture and few antibiotics being produced the need to slow down and even stop the spread of resistance is imperative. By using mathematical models to model the spread of antibiotic resistance within a bacterial population, we aim to make predictions on the duration between introduction of antibiotics and the emergence of resistance. This information can then be used to optimise antibiotic usage strategies to minimise the emergence of antibiotic resistance and prolong existing antibiotics.

1010-1030 Brian Lee

Mathematical Models of Invasive Species

Abstract: Non-indigenous species (NIS) pose a major threat to global biodiversity, and incur significant economic costs, estimated at £1.7 billion per annum to GB. As a result it is necessary to prevent further introductions and spread. This is reflected both GB and EU legislation, such as the requirement to reduce the impact of marine NIS under the EU Marine Strategy Framework Directive (MSFD). The ability to predict where, and by which pathway NIS are most likely to arrive, establish and spread, is invaluable in reducing their



impact on our marine environment. Previous work at Cefas has identified the pathways most likely to introduce NIS to the UK and Ireland and identified high and low risk pathways for different geographical regions. For each geographic region they have then determined how likely general taxonomic groups are to be introduced and establish using environmental variables.

The aim of this interdisciplinary project is to develop this work further in order to produce a user friendly modelling tool which managers could use to look at both biosecurity and where to focus monitoring efforts. Dynamical models of the introduction and spread of a number of key invasive species will be developed and different control mechanisms will be investigated. For example, the invasive seasquirt (*Didemnum vexillum*) is having significant impact so there is a need to consider how to prevent further introductions and spread as well as how to control measures could be most effectively implemented. We will use a variety of mathematical techniques to address these three different questions.

1030-1050 Adrian Worton

Incorporating environmental factors into tick-borne disease models

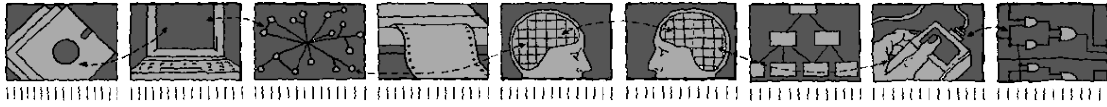
Abstract: *Ixodes ricinus* ticks are the most important vectors of disease-causing pathogens in Europe. The population of *I. ricinus* is largely dictated by environmental factors, the three most influential being temperature, habitat and host density. It is crucial to be able to forecast the impact of changes in these in order to aid disease mitigation. A deterministic modelling approach has been employed to explore how changes in temperature, hosts and habitat may change tick abundance and disease risk. By simulating this model across Scotland the effect of various environmental scenarios can be explored.

Session 2: Chair: Professor Leslie Smith

1110-1130 Omair Ameerbakhsh

Towards a Participatory Simulation Framework for potentially effective E-learning in Classroom environments.

Abstract: We aim to develop a novel state-of-the-art generalised agent-based participatory simulation framework for group e-learning applications. We initially focus on a case study: researching and teaching of unsupervised clustering, one of the most popular techniques in artificial intelligence and machine learning, through a new NetLogo based simulation framework. We will also explore the idea of implementing the use of participatory simulation in a game theory course taught at Stirling University, in which we will focus on a number of game theory exercises; a "Golden Balls" example, and a card game example computerised in a participatory simulation. Also, Iterated Prisoners dilemma and a "tournament" between competing strategies is another possibility. These activities could be used to complement existing tutorial activities, or as part of student projects.



1130-1150 Dalila Hamami

When Data mining brings its force to modelling!

Abstract: The epidemiological field has made extensive use of modelling and simulation techniques for making decisions. Still nowadays the problem of capturing accurately the real characteristics of epidemics is considered hard for both epidemiologists and developers, for two main reasons: 1) Big data, 2) unknown information. In this research, we propose to combine data mining techniques with modelling. Simulation of an initial simple model exposes mismatches between the model output and the observed data. By analysing the observed data set, data mining techniques can extract pertinent information. This new information can be integrated with the initial simple model to enhance the study of epidemic. Applying this combination to a tuberculosis case study, leads us to provide much better results, which help to understand where the initial simulated model failed.

1150-1210 Jason Adair

Using Evolutionary Algorithms for Feature Selection in Brain Computer Interfaces

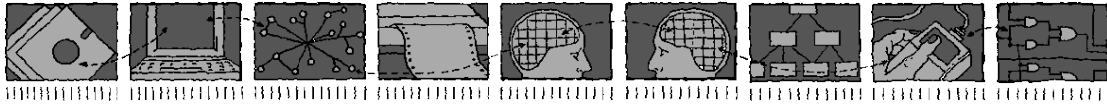
Abstract: Brain Computer Interfaces allow individuals with physically debilitating illnesses to communicate and gain some control over their environment. It does this by recording brain activity and classifying the signals according to the underlying neural process. Due to the huge dimensionality of the data generated across a range of bands and sensors, training classifiers is problematic without feature selection. The aim of this project is to apply domain knowledge to intelligent operators within genetic algorithms to perform this task.

1210-1230 Madhu Pahar

A Novel Reconstruction Technique based on a spike code (event) representation

Abstract: - Resynthesizing sound from auditory nerve (AN) spikes and the Auditory Nerve version of Onset spikes have been completed. At this final stage of the PhD, three major spike coding techniques have been compared with each other by testing the quality of the reconstructed sounds from them. They are – 1. Auditory Nerve Spikes 2. Onset Spikes and 3. A hardware based spike codes developed by Thomas Kiockal.

About 21 participants from different age group have contributed to this Sound Testing. A Binomial Hypothesis Testing provides evidences to select one technique 'better' than the other.



Session 3: Chair: Professor Rachel Norman

1330-1350 Mohammed Al-Mojamed

Design and Evaluation of a Peer-to-Peer MANET Cross-layer Approach: OnehopMANET

Abstract: P2P overlay can be deployed over Mobile Ad hoc Networks (MANET) to address content discovery issues. However, previous research has shown that deploying P2P systems straight over MANET do not exhibit satisfactory performance. OnehopMANET is

proposed to exploit the synergies between MANET and P2P overlays through the use of cross-layering. OnehopMANET is designed to combine structured P2P overlays with MANET underlay routing protocols to achieve one logical hop overlay. In this talk, we present OnehopMANET and evaluate its performance when combined with different MANET underlay. The performance of onehopMANET is then compared to two recent structured P2P over MANET systems (MA-SP2P and E-SP2P).

1350-1410 Dhaifallah Alwadani

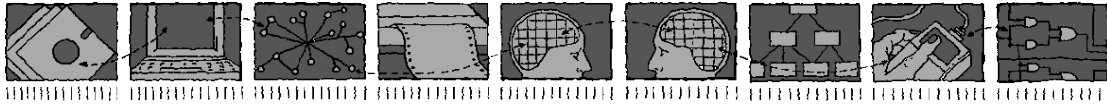
Overlay Hybrid Multicast Platform

Abstract: We propose a hybrid multicast protocol that opportunistically combines Application Layer Multicast and native multicast protocols. It is expected that this hybrid approach will improve both efficiency and availability of multicast. We will compare our approach to existing ALM protocols such as Scribe. Due to the lack of the tools that can measure and analyse our proposed model, we needed to adapt Oversim/Omnet++ simulation framework to evaluate the performance of the hybrid multicast approach. The comparison here was done in two metrics: Stress and Stretch. In both, our proposed model has shown improved results. Moreover, we investigated the effect of number of islands that the receivers are distributed into.

1410-1430 Farida Chowdhury

Structured Peer-to-Peer Overlays for Mobile Networks

Abstract: Major hurdles to implement P2P in mobile networks are churn, energy consumption and NAT restrictions and this research is seeking solutions to these issues. To address the first two concerns, we have experimented with the performance of various P2P overlays and found that EpiChord and Kademia exhibit the best performance for use on mobile networks. We also integrated a NAT traversal approach in our working P2P simulator – OverSim. We propose a NAT traversing approach without the use of single server components. We will discuss that the presence of NATs and node churn have contradicting requirements on the routing techniques used in P2P overlays. Therefore we propose an adaptable routing protocol that utilise both recursive and iterative routing depending on the state of the network in terms of the level of node churn and NAT connectivity.



1430-1450 Saemundur Haraldsson
Genetic Improvement of Energy Usage is only as Reliable as the Measurements are Accurate

Abstract: Energy has recently become an objective for Genetic Improvement (GI). Measuring software energy use is complicated which might tempt us to use simpler measurements. However if we base the GI on inaccurate measurements we can not assure any improvements. This talk will seek to highlight important issues when evaluating energy use of programs.

Session 4: Chair: Professor Leslie Smith

1530-1550 Kevin Swingler
Structure Discovery in Mixed Order Hyper Networks

Abstract: A mixed order hyper network (MOHN) is capable of representing any real valued function of a binary vector as a linear weighted sum of the products of subvectors. From a vector of n variables, there are 2^n possible subvectors, meaning that even moderately sized MOHNs need to be built from a small subset of the possible subvectors. This talk presents a heuristic method for discovering the correct subvectors for a function based on samples from the input/output space of that function.

1550-1610 Annan Yearian
Subtle higher order mutants in Python

Abstract: This presentation will discuss the construction of subtle higher order mutants (HOMs) in Python for use in mutation testing. Subtle HOMs are of interest as they represent subtle hard to discover defects.

1610-1630 Kevin Graham
Identifier Splitting for SBSE Software Maintenance

Abstract: Research into the cognitive and psychological processes of human program comprehension during the various stages of software development has sparked the development of several autonomous and semi-autonomous tools to aid developers in comprehension tasks. Software maintenance in particular, where maintainers are possibly new to the system, would benefit from more accurate tools to aid comprehension. It has been realised that natural language embedded in source code; identifier names, program literals and comments can be leveraged to increase the effectiveness of tools.

As a necessary first step in processing natural language, the lexical elements in the plaintext or source code for that matter must be identified and extracted before any meaningful work can take place, a practice in software terms known as 'Identifier Splitting' or 'tokenisation'. This task is often extended to include the expansion of abbreviations and/or acronyms. In this talk I discuss the state-of-the-art of identifier splitting and expansion and highlight the practical difficulties presented within this area of study