

**Research Students Day**  
**Wednesday 3<sup>rd</sup> February 2010**  
**Department of Computing Science and Mathematics**  
**2B84**

*The talks of the first year students should last **15 minutes**, others **20 minutes**, including 5 minutes for questions.*

- 9:00                    **tea/coffee**
- 9:30                    Rosalyn Porter  
*Tick control strategies for the management of louping ill virus in red grouse.*
- 9:50                    Nicky McPherson  
*Mathematical models for optimal management strategies which minimize the impact of a severe Argulus outbreak.*
- 10:05                  Scott Denholm  
*Estimating the long-term impact of Gyrodactylus salaris infections in the UK.*
- 10:20                  Stephen Mason  
*The dynamics and control of structured parasite populations.*
- 10:35                  Katarzyna Oleś  
*Searching for the most cost-effective strategy of controlling epidemics spreading on networks.*
- 10:50                  **coffee**
- 11:20                  Soufiene Benkirane  
*Modelling the bubonic plague in prairie dogs*
- 11:40                  Rozniza Ali  
*Intelligent Signal Image Processing Techniques for Aquaculture Applications.*
- 11:55                  Jesse Blum  
*The Design and Evaluation of Personalised Ambient Mental Health Monitors.*
- 12:15                  Thomas Mazzocco  
*Towards intelligent clinical decision support systems for improving healthcare.*
- 12:30                  James McGuinness  
*Implications of Noise and Synchrony in the Dynamics of the Vestibulo-Ocular Reflex.*



13:00

**buffet lunch in 2B85**

*(All Research Students & 1<sup>st</sup> and 2<sup>nd</sup> Supervisors are invited)*

14:00

Andrew K Abel

*Two Stage Audiovisual Speech Filtering.*

14:20

Hicham Atassi

*Towards Multimodal Speech and EEG Signal Processing Based Emotion Recognition Systems.*

14:35

Martin Blunn

*Bushfire: A Peer to Peer Inspired Framework for Mobile Telephones.*

14:55

James Furness

*Blind search methods for structured P2P networks under churn.*

15:10

Erik Cambria

*Application of Common Sense Computing to Enable the Development of Next-Generation Semantic Web Applications.*

15:30

**coffee**

16:00

Larry Tan

*An Integrated Methodology for Creating Composed Web/Grid Services.*

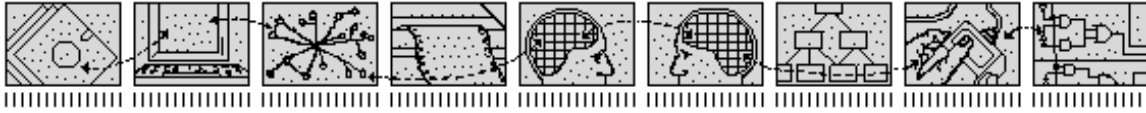
16:20

Claire Maternaghan

*Programming your Home.*

16:45

**announcement of prize and finish**



## **ABSTRACTS:**

### **9:30 Rosalyn Porter**

#### *Tick control strategies for the management of louping ill virus in red grouse*

The management of moorland for red grouse shoots is important both to the economy and biodiversity of upland Britain. However successful shoots are perceived to be under threat from Louping ill virus; a tick borne disease primarily affecting sheep and red grouse, with up to 80% mortality in infected red grouse. This talk considers a mathematical model of two tick control strategies; the use of (i) treated sheep as "tick mops", currently being trialled on some Scottish estates and (ii) treated deer as tick mops, not currently viable under British Law but trialled in the US. In these experiments the (i) sheep, and (ii) deer, are treated with acaricide to kill the ticks that try to attach thus reducing the tick population and therefore the rate of infection of the pathogen to grouse. The model is used to predict the potential effectiveness of these two strategies under different scenarios for the case of louping ill virus in grouse.

### **9:50 Nicola McPherson**

#### *Mathematical models for optimal management strategies which minimize the impact of a severe Argulus outbreak*

*Argulus* species are a growing concern in the UK's stillwater trout fisheries. Currently only one treatment, Emamectin Benzoate, exists, and there is concern that resistance will develop if it is not used responsibly. I am jointly funded by CEFAS and the University's Mathematics and Aquaculture departments to build mathematical models which allow us to determine optimal management strategies which minimize the impact of a severe *Argulus* outbreak. I will talk briefly about the problem, its impact, and how I plan to tackle it.

### **10:05 Scott Denholm**

#### *Estimating the long-term impact of Gyrodactylus salaris infections in the UK*

*Gyrodactylus salaris* (*G. salaris*) is a small ectoparasite that infects both wild and farmed populations of Atlantic salmon (*Salmo salar*). It gained notoriety when its introduction into Norway caused a catastrophic decline in salmon numbers. Currently the UK is free from *G. salaris*. However, it is believed that if the parasite found its way to the UK, the impact would be similar to that witnessed in Norway. If *G. salaris* was introduced to a UK river, it is believed that the main priority of authorities will be the prevention of further spread. In order to plan for such an event, a greater knowledge of the possible consequences is required. Mathematical models, of some form, have been used to understand disease and host-parasite interactions for many years. The aim of this project



is to use modern mathematical modelling techniques to gain a greater understanding of the long-term impact of a *G. salaris* infection.

### **10:20 Steve Mason**

*The dynamics and control of structured parasite populations*

*Lepeophtheirus salmonis* and *Caligus elongatus* are two species of salmon louse that feed off the skin and blood of farmed Atlantic salmon. The cost to the British industry runs into tens of millions of pounds, due to both death of salmon and damage to them that renders them useless for sale. Salmon welfare is also a concern and various control strategies have been put in place over the last 30 to 40 years, not so much to eradicate salmon lice, as this is currently impossible, but to reduce salmon lice counts. Treatments have taken different forms, from hydrogen peroxide baths to emamectin benzoate mixed into food pellets in varying quantities. Organophosphates have been used, but both species of salmon louse are now resistant to these chemicals, which are also harmful to the environment. Salmon lice are also now largely resistant to emamectin benzoate, and hydrogen peroxide baths are distressing for the salmon, so the development of new treatments is essential and legislation is currently going through the British Parliament to introduce other treatments, such as diflubenzuron and teflubezuron. Wrasse are also under consideration, as they feed of the lice, and their re-introduction into salmon farms, especially in British waters, may well be one solution.

### **10:35 Katarzyna Oleś**

*Searching for the most cost-effective strategy of controlling epidemics spreading on networks.*

The main purpose of my research is to model disease spreading on networks and to search for the most cost-effective strategy to stop the epidemic. In order to quantify the effectiveness of the strategy the economic cost (such as the cost of vaccination, quarantine of infected organisms, transport of drugs etc.) as well as infection cost (e.g. deaths, absence at work, lower productivity) have been taken into account. Considering these factors three optimal strategies can be proposed: (1) to treat the whole population (2) to treat only the crucial, well defined proportion of the population and (3) not to treat any individual. Influence of both economic and epidemiological factors (such as infectiousness of a disease, size of the infected neighbourhood, rate at which symptoms of a disease occur, number of initial foci) has been investigated to measure the range and applicability of these strategies. The spatial structure of contacts among the population also plays an important role in designing control strategies.



### **11:20 Soufiene Benkirane**

#### *Modelling the bubonic plague in prairie dogs*

The process algebra PEPA (Performance Evaluation Process Algebra) was originally created in order to deal with issues arising from computer science. However, we have shown, through a model of the bubonic plague in prairie dogs, that it can also deal with epidemiological problems. This example proved that it was possible with PEPA to reproduce the results obtained with conventional methods (differential equations in this case). However, PEPA still suffers drawbacks, such as its limitations concerning the model's size and complexity, as well as the difficulty to include a realistic representation of the births.

### **11:40 Rozniza Ali**

#### *Intelligent Signal Image Processing Techniques for Aquaculture Applications*

The proposed research will assist pathogen management in wild and cultured fish stocks with attendant improvement in fish health and welfare and accompanying economic benefits. Research will focus on the Neural Network and intelligent signal processing techniques to be developed in the course of this project are envisaged to have wide utility for species recognition within and outside the aquatic science and may have attendant intellectual property benefits within these fields and potentially in other fields where image recognition or classification is important.

### **11:55 Jesse M Blum**

#### *The Design and Evaluation of Personalised Ambient Mental Health Monitors*

Mobile and environmental sensing technology is being assessed for use in human behaviour and mental health monitoring outside of laboratories and in ecologically-relevant settings. To achieve maximum benefit, the set of equipment and the monitoring patterns must be personalised to respect individual needs and fit into individual lifestyles. This talk describes work on a sensor network infrastructure that connects wearable devices and home-installed equipment. A rule-oriented programming architecture is used to monitor the activity signatures of subjects, particularly focussing on those with affective disorders. The use of this rule-based paradigm within the network for mental health monitoring is a contribution of this work. This presentation reports on the design and development of the system along with preliminary findings from a technical trial and discussion regarding future developments.



**12:15 Thomas Mazzocco**

*Towards intelligent clinical decision support systems for improving healthcare*

Multiple studies have shown that health care is suboptimal: it is estimated that thousands of patients die each year due to preventable medical errors; other studies have shown there is a major discrepancy between clinical care actually delivered and optimal patient care. As the costs of health care continue to grow exponentially, alternative care models in traditional primary care are being actively explored. Published studies of clinical decision support systems (CDSSs) are increasing rapidly and their quality is improving: such systems can enhance clinical performance for example, drug dosing, preventative care and other aspects of medical care. This interdisciplinary PhD project aims to apply novel computational intelligence and machine learning techniques such as artificial neural networks, support vector machines and artificial immune systems in order to process clinical data and build more natural adaptive human-computer interfaces. The new intelligent CDSSs will be developed, assessed and validated using real clinical data in collaboration with clinicians/domain experts and target end-users and their performance compared with state-of-the-art CDSS solutions. At this stage of the PhD project, three intelligent CDSSs are currently being researched: 1) a new model for prediction of side-effects in patients receiving chemotherapy, 2) a decision support system for dementia diagnosis, 3) a cardiovascular CDSS for preventative care. Preliminary results obtained in the first two healthcare problem areas are very encouraging and have led to two journal papers (currently) in preparation. Collaborators: Stirling Dementia Centre (Prof. A. Bowes), Stirling Cancer Care Centre (Prof. N. Kearney), Stirling Care Technology Group (K. Swingler), Raigmore Hospital, Inverness (Prof. S. Leslie), Harvard Medical School (Prof. C. MacRae), Sitekit Solutions Ltd. (C. Eckl)

**12:30 James McGuinness**

*Implications of Noise and Synchrony in the Dynamics of the Vestibulo-Ocular Reflex.*

The Vestibulo-ocular reflex (VOR) is a reflex eye movement responsible for stabilising images and maintaining gaze fixation during head movement, through the production of compensatory eye movement in the opposite direction to head movement. It is characterized by high fidelity eye movement in response to head rotations at frequencies approaching 20 Hz. However, studies of the response fidelity of individual Medial Vestibular Nucleus (MVN) neurons to inputs greater than 10-12 Hz show that the functioning of single MVN neurons is not sufficient to describe the functioning of the system. Instead, it has been shown that the necessary responses of the VOR are achieved through encoding at the population level. Further, it has been theorised that these population responses are facilitated by the asynchronous nature of the MVN populations and the presence of diffusive synaptic noise. The dynamics of the noise and asynchrony of the population, and how these facilitate the observed functioning of the VOR are explored. Computational modelling and simulation, utilising parallel hardware and using previously published biophysically detailed models of MVN neurons, is described



and discussed. Two stages of simulation are introduced. In the first stage large populations of synchronous and asynchronous MVN neurons, in the presence and absence of noise, are simulated, and their response to input (modelled as a current injected directly into the soma of the neurons) is recorded and analysed. In the second stage a more realistic method of providing input to the simulated neurons is implemented (an input closer to the "real" in-vivo input, which is comprised of a population of spiking inputs from vestibular neurons). The data to be collected and the analysis to be implemented are described and discussed. Finally, the expected results and future directions for investigation are also discussed briefly.

#### **14:00 Andrew K Abel**

##### *Two Stage Audiovisual Speech Filtering*

In recent years, the established link between the various human communication production domains has become more widely utilised in the field of speech processing. In this work, we present a preliminary two stage audiovisual speech enhancement system, making use of audio only beamforming, automatic lip tracking, and visual speech filtering. Preliminary results have shown that this two stage speech enhancement approach can produce positive results. It is also shown that there are also situations when a more intelligent use of individual audio and visual elements is desirable, and future research directions towards this end are proposed.

#### **14:20 Hicham Atassi**

##### *Towards Multimodal Speech and EEG Signal Processing Based Emotion Recognition Systems*

Emotions play an essential role in many aspects of our daily lives, including decision making, perception, learning and behavior. Scientists have found that emotional skills can be important component of intelligence, especially for inter-human communication. Human-machine interaction has been investigated for several decades. In spite of the fact that this kind of interaction is different than inter-human activities, some theories have shown that that human-computer interaction essentially follows the basics of human-human interaction. The first part of the present work deals with human emotion recognition from both speech and EEG signals, where a very important question is raised: should we select one of the modalities used or fuse them? In other words: we will try by experiments to either prove or disprove the well known fact that exploiting several modalities (sources in general) yields to improve the classification accuracy of emotions. The second part of work is devoted to find new methods to improve the classification accuracy of emotions, by using each modality separately. In particular, "emotions coupling" approach is presented. This approach significantly improves the classification accuracy of emotions in speech.



#### **14:35 Martin Blunn**

##### *Bushfire: A Peer to Peer Inspired Framework for Mobile Telephones.*

The latest mobile telephones have more in common with computers than with their traditional ancestors. Coupled with the increased availability of fast, inexpensive data connections which allow users to access the internet, a proliferation of data-centric applications have emerged. 'BushFire' is a software framework that has sought to capitalise on this trend by allowing developers to quickly create networked applications. The framework allows ad-hoc groups to develop and share information and then disperse as quickly as they formed. The framework has been developed by adapting established Peer to Peer networking designs for use in the mobile telephone environment. Applications that utilise this framework can be developed to focus on particular professions, such as social care or sales, where communication is essential. 'BushFire' is a collaborative project operating through the Knowledge Transfer Partnership (KTP) programme between Sysnet and the University of Stirling Computing Science Department. The presentation will discuss general aspects of the KTP programme, technical topics associated with the 'BushFire' project and how this all relates to my current MPhil research.

#### **14:55 Jamie Furness**

##### *Blind search methods for structured P2P networks under churn*

While structured P2P networks can provide efficient put and get operations via a DHT (Distributed Hash Table), they traditionally do not provide any methods for blind search. This means in a traditional DHT it is not possible to perform wild-card or full text searching, which limits their application in the real world. Unstructured networks usually implement blind search by a form of flooding or random walks. Flooding is inherently inefficient due to the large number of redundant messages sent, and random walks tend to be slow with a lower chance of finding the data. Making use of the structure inherent in DHTs we can perform blind search over structured networks by means of efficient broadcast, with zero redundant messages being sent and 100% coverage under optimal conditions. Comparing these broadcast methods through simulation we see that churn, in particular nodes leaving the network, has a high impact on the performance. While some approaches perform better than others they tend to cost more in terms of bandwidth. By studying the strengths and weaknesses of the different approaches we aim to produce a solution which can perform well in a less optimal environment where we have high levels of churn yet limited available bandwidth, such as usually found in mobile networks.



## **15:10 Erik Cambria**

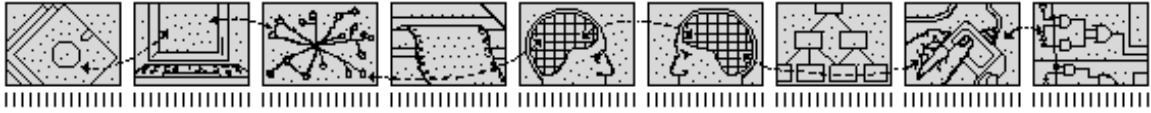
### *Application of Common Sense Computing to Enable the Development of Next-Generation Semantic Web Applications*

The main aim of this EPSRC CASE project is to develop and apply software agent and NLP based technologies in order to blend the Open Mind database with any given ontology, and hence build a novel intelligent software engine for the enhancement of HCI and the auto-categorization of documents. The primary researcher is Erik Cambria, working under the academic supervision of Amir Hussain and with industrial supervision of Chris Eckl, research director at Sitekit Labs, the research arm of Sitekit Solutions Ltd. The research is in collaboration with Catherine Havasi of MIT Media Lab who was part of the research team that pioneered the Common Sense Computing Initiative, which is being further developed as part of the project in the context of semantic web mining. In 2009 the research team was invited to MIT Media Lab in Boston to define the scientific and technical infrastructure of the project and participated in many important international conferences such as WebSci09, BioID\_MultiComm09 and CAEPIA09, where the recent developments of the project were presented and published. In particular, in the field of affective categorization, a new process and a new paradigm for the inference of emotions from text were introduced. The former, AffectiveSpace, is a vector space of concepts and emotions to perform emotive reasoning, the latter, Sentic Computing, is a new paradigm in which a novel emotion representation coupled with a Common Sense based approach are used to infer affective states from short texts over the web. In 2010 the research team is invited again to the Media Lab and to the Chinese Academy of Sciences (CAS) in Beijing. Many exciting conferences are also scheduled for this year: among these WebSci10 (26-27th April - Raleigh, USA), KES10 (8-10th September - Cardiff, UK) and ICSP10 (25-28th October - Beijing, China). For more information please visit <http://cs.stir.ac.uk/~eca/commonsense>

## **16:00 Larry Tan**

### *An Integrated Methodology for Creating Composed Web/Grid Services*

Web/grid services are leading distributed computing technologies which are based on the concepts of service-oriented architecture. This enables services to be combined to create new and more complex services, an activity generally known as service composition/orchestration. There is growing development of web/grid services and their compositions to support mission-critical business and research. This is supported by technologies that increase productivity in implementation. Service quality is usually checked by implementation testing, which can be costly to fix if errors are found. Although the benefits of formal techniques are acknowledged by the community, there is a lack of application due to differences in technical knowledge and practice, and the emphasis on delivering running code. In this talk, I present an integrated methodology that supports rigorous development of composed web/grid services. There is high-level, automated support for design, specification, analysis, implementation, testing and performance evaluation.



## **16:20 Claire Maternaghan**

### *Programming your Home.*

This talk will address the problem that home owners are often frustrated with the lack of control they have over their home. They wish they could do simple things such as turn off the lights when there is no one in the house, or remotely turn on the heating before they return home. The talk will describe an approach that allows users to program their home effectively. It is then possible to define actions to be taken when certain events occur, subject to specified conditions being met. Policies are a suitable representation for this. A system has been developed to address the technical challenges of these problems.