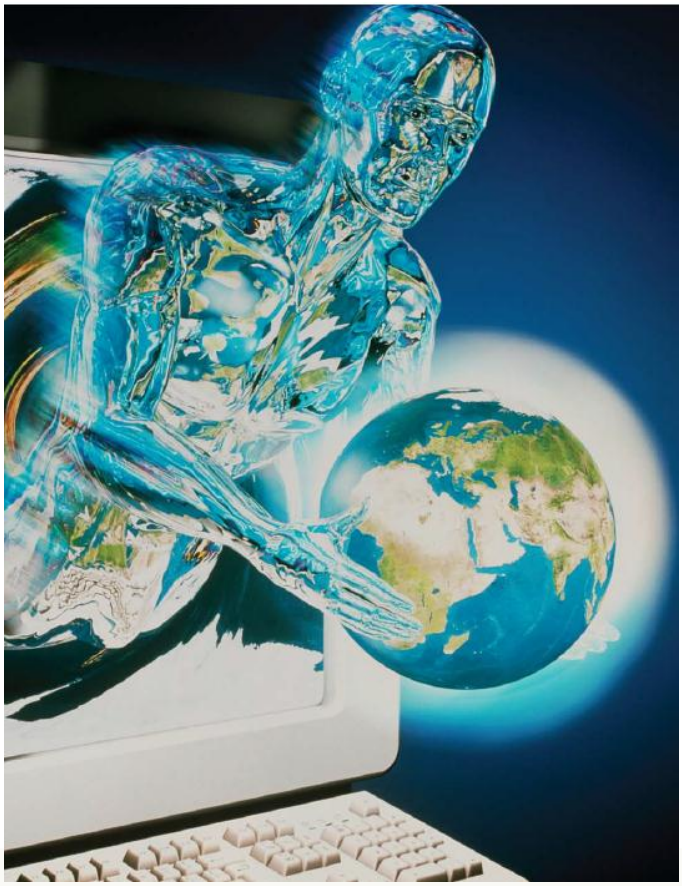
UNIVERSITY OF SURREY

11th Annual Computing Department PhD Conference - CompConf2014



University of Surrey,

Duke of Kent Building and Lecture Theatre L

10th March 2014

Contents

Schedule of Events

Time	Event	Presenters/Speakers
Morning Session: Room 01DK02		
08:30	Registration (Tea and Coffee will be served)	
09:00	Opening Speech	Opening by **Professor Steve Legg** (Royal Academy of Engineering, Visiting Professor, IBM)
09:15	Keynote Speech -"Science at AWE: a journey from Plasma Physics to Chief Scientist"	**Professor Andrew Randewich**, (Head of Plasma Physics, AWE)
10:00	Student Presentation Session 1 (group presentations)	Chair: **Ran Cheng** 10:00-10:20 MSF Group, 10:25-10:45 FMS Group 10:50-11:10 NICE Group
11:10	Tea and coffee break	
11:30	Student Presentation Session 2 (papers)	Chair: **Aamo Iorliam** 11:30-11:50 **Ran Cheng** 11:55-12:15 **Andrew Larkham** 12:20-12:40 **Yin Hu** 12:45-13:05 **Mohd-Hanif Yusoff**
Lunch Session: Computing Department Meeting Room (39BB02)		
13:10	Lunch/ Poster Session	Posters by **Elissavet Chotzoglou,** **Ataollah Ramezan Shirazi, Nouf Aljafan,** **Amin Safaei, Anna Vartapetiance**
Afternoon Session: Lecture Theatre L		
14:15	Keynote Speech - "Optimization for Robust Design"	**Professor Peter Fleming,** (Professor of Industrial Systems and Control, University of Sheffield)
15:00	Student Presentation Session 3 (papers)	Chair: **Veronika Kuchta** 15:00-15:20 **Su Wang** 15:25-15:45 **Aamo Iorliam** 15:50-16:10 **Shirin Enshaeifar**
16:15	Judges Convene/ Afternoon tea	
16:40	Prize Presentation - Closing Speech	Closing by **Professor Yaochu Jin** (PGR Director, Department of Computing)

Keynote Speaker Biography

Prof Andrew Randewich

Head of Plasma Physics, AWE

Professor Andrew Randewich is AWE Chief Scientist. After completing a PhD in plasma physics, he joined the company in 1997 in the High Altitude Nuclear Effects Team where he developed a novel capability to model Artificial (Nuclear Induced) Van Allen Belts. He also worked to improve AWE's understanding of and capability in Electromagnetic Pulse (EMP) phenomenology, and won the Discovery Award for Early Career Scientific Innovation. Andrew later worked on thermonuclear burn modelling in support of Inertial Confinement Fusion (ICF), and as a Team Leader for transport algorithms in the Computational Physics Group. Since then, Andrew spent two years managing the Physics Certification programme, and in 2009 moved to lead the High Performance Computing Group where he was involved in the procurement and installation of some of the largest computers in the UK. After 6 months as acting Head of Design Physics, Andrew was appointed Head of Plasma Physics in November 2011. The Plasma Physics Department's main role is using high power lasers to underwrite high energy density physics simulations. As part of the role, Andrew was Asset Manager for the ORION laser, one of the largest science capital investments in the UK. Andrew also managed several other science facilities such as the ASP neutron accelerator. Also in 2011, Andrew became Head of Profession for Physics with responsibility for the Continuous Professional Development of all Physicists at AWE, and the company's interactions with the Institute of Physics. Andrew became AWE Chief Scientist in 2013. Andrew is a Chartered Physicist and a Fellow of the Institute of Physics and the Royal Institute. He was also appointed as a visiting professor at Imperial College, London in April 2012.

Title of talk: Science at AWE: a journey from Plasma Physics to Chief Scientist

Abstract: This talk will outline some of the main science areas at AWE and the context of our work, and then charts the journey of the author from completion of his PhD to Chief Scientist. The talk will dwell on HPC at AWE, and describe some of the supercomputing architecture and expertise for which AWE has an enduring requirement in the era of science-based certification.

Keynote Speaker Biography

Prof Peter Fleming

Professor of Industrial Systems and Control, University of Sheffield

Peter Fleming is Professor of Industrial Systems and Control in the Department of Automatic Control and Systems Engineering and was Director of the Rolls-Royce University Technology Centre for Control and Systems Engineering at the University of Sheffield, UK from 1993-2012. His systems and control engineering research interests include multi-criteria decision-making, optimisation and scheduling, and applications of e-Science. He has over 400 research publications, including six books, and his research interests have led to the development of close links with a variety of industries in sectors such as automotive, aerospace, energy, food processing, pharmaceuticals and manufacturing. Further details may be found at http://www.shef.ac.uk/acse/staff/peter_fleming.

Title of talk: Optimization for Robust Design

Abstract: Many real-world design problems can be usefully cast as multi-criteria search and optimization problems that, in turn, can often benefit from the application of evolutionary computing methods. These real-world problems arise in a variety of forms, such as design exercises, trade studies or allocation problems. The sought outcome is a single solution, often a compromise that takes account of conflicting criteria and is robust to underlying assumptions. Such a problem-solving process has at its core a search and optimization algorithm. However, first, problem requirements must be captured and appropriate models identified to enable the evaluation of objectives and constraints. A search algorithm is applied to generate potential solutions and this stage is followed by an interactive data analysis decision-making stage leading to the problem solution. Each of these phases generates its own research challenges. Using real-world problem examples, these challenges will be discussed, some solutions suggested and other questions left open. And what if there are a number of these designs being undertaken in parallel that have dependencies on one another?

ORAL PRESENTATION ABSTRACTS

(Group Presentations)

Session 1 - 10:00

Multimedia, Security and Forensic (MSF) Group

Aamo Iorliam, Nik Suki and Nouf Aljaffan

Multimedia, Security and Forensics (MSF) group focuses mainly on the interaction among multimedia, security and forensic technologies. Areas of research covers digital watermarking and authentication, data hiding, steganography and steganalysis, multimedia content protection, biometrics, usable security involving multimedia human-computer interface, and their applications for image, video, audio and binary content. Recent research is also targeted at combining two or more research areas into a single domain e.g. Forensic Biometrics. This presentation gives a brief overview of the individual research topics carried out by members of the MSF group.

Session 1 - 10:25

Formal Methods and Security (FMS) Group: Applied Cryptography

Franziskus Kiefer and Veronika Kuchta

We live in a world where we are surrounded with information; therefore there is also an ability to manipulate it. Cryptography develops the tools which are required for the study of algorithms and protocols that provide information security. Our work presents a general overview of modern cryptography. We survey a definition of provable security and introduce two security models, namely the standard model and random oracle model. We also present the difference between symmetric and asymmetric cryptography. As an application of asymmetric cryptography we present the digital signature and their application to e-voting systems. We also present the significance of passwords in cryptography and show their applications in the real world.

Session 1 - 10:50

Nature Inspired Computing and Engineering (NICE)

Wissam Albukhanajer

Nature presents the best example of how to solve complex problems efficiently and effectively. The main objectives of the Nature Inspired Computing and Engineering (NICE) research group are therefore to develop computational models and algorithms inspired from natural intelligence found in physical, chemical, social and biological systems. The NICE group adopts researches aim to build up computational models for understanding biological and social intelligence found in nature. It also adopts researches to develop efficient mathematical and statistical, machine learning and optimization algorithms for solving complex problems found in different areas. Examples of these areas include optimization and control, pattern recognition data mining, knowledge extraction and self-organization of collective systems and, multi-criterion decision making. Real-world applications include brain-computer interfacing, medical image analysis, source localization and separation, copyright protection, threat detection, aerodynamic design optimization, and robotics. This talk gives an overview and highlights some of these research topics within NICE research group.

ORAL PRESENTATION ABSTRACTS

(Paper Presentations)

Session 2 - 11:30

PSEA: A Pareto Set Estimation Algorithm for Multiobjective Optimisation

Ran Cheng, Kaname Narukawa and Yaochu Jin

In most multiobjective evolutionary algorithms (MOEAs), the optimisation target is to obtain a group of non-dominated solutions (Pareto set) to estimate the Pareto front. In order to well approximate the Pareto front, the solutions are expected to show not only good convergence, but also good spread as well. However, restricted by the limited number of solutions, some part of the Pareto front can be easily missed, thus losing some information that may be preferred by the decision maker. Inspired by the paradigm of Estimation Distribution Algorithms (EDAs), we seek to propose an algorithm to estimate the structure of the Pareto front, and further estimate the distribution of the Pareto set, termed as the Pareto Set Estimation Algorithm (PSEA). With this algorithm, ideally, the decision maker is able to sample arbitrary solutions according to his/her preference. Experimental results show that the proposed PSEA has good sampling ability, and furthermore, the good quality of the sampled solutions is confirmed using the generational distance (GD) metric and the Δ metrics, in comparison with the real coded NSGA-II and MOEA/D.

Session 2 - 11:55

Applying Game Theory to ICT Procurement in a market with carbon taxes

Andrew Larkham

Computational behavioural modelling can be applied to numerous social and economic situations – for example housing, “arms race” simulations and “prisoner dilemmas”. There are number of techniques available to researchers wishing to analyse such issues and calculate possible outcomes for given scenarios. These include statistical and probabilistic analysis (e.g. econometrics), game theory (play once and repeat game), algebraic analysis and agent based modelling (ABMs). These techniques can be combined and in this research paper the principles of game theory will be applied to the techniques of agent based modelling to produce simulations where “agents” interact with both logic and memory to achieve the “best” outcomes for themselves.

Session 2 - 12:20

Time-Lapse Image Analysis for the Study of Mycobacterium Cell Growth

Yin Hu, Su Wang and H Tang

As one of the world's most devastating diseases of mankind, tuberculosis is a global health crisis. Despite extensive research into the disease spanning more than a century, it remains the number one killer due to a single causative and infectious agent, Mycobacterium tuberculosis, which is one of the successful human pathogens. The bacterium is able to persist as a long-term infection, known as latent tuberculosis. To gain insight into persistence of tuberculosis, confocal microscopy is used to capture the cell growth and division behaviour so that large amount of time-lapse image data is collected. These data, although very challenging for human observers to grasp directly, become valuable information source for a computational system to process. In this work, we aim to develop a system that is able to track and analyse the cell growth patterns automatically. We propose novel methods with Level set segmentation and Kalman filter for cell extraction and tracking. The experiment demonstrated the system's ability to track cell growth and division until antibiotics is administrated in order to discover the persisters and analyse their historical and current behaviour. The experiments to date have shown that the persisters exhibit certain degree of different growth rate from those of the rest of population.

Session 2 - 12:45

Modelling Neural Plasticity in Echo State Network for Time-series Prediction

Mohd-Hanif Yusoff and Yaochu Jin

In this paper, we investigate the influence of neural plasticity on the learning performance of ESNs and the supervised learning algorithms in its readout connections training process for a prediction of time-series sunspots activity. For the plasticity rules in the reservoir, we implement two different plasticity rules that are expected to improve the prediction performance. The two rules are: Anti-Oja learning rule and the Bienenstock- Cooper-Munro (BCM) learning rule in both offline and online learning. The experiments have demonstrated that neural plasticity works well in offline learning compared to online learning.

Session 3 – 15:00

Detection of Blood Vessels in Fundus Images using Forward and Backward Tracking

Su Wang, Yin Hu and H Tang

In any diabetic retinopathy screening programme or population based clinical study, a large number of digital fundus images are collected. However, many are expected to have no abnormality. In this work, we focus on the detection of vascular networks in fundus images in order to detect anatomy and pathology in the retinal images. We propose an integrated approach with prior knowledge extraction and vascular structure tracking to detect blood vessels network. The experiments have demonstrated the robustness of the approach when testing on large sets of fundus images from different populations with promising accuracy, sensitivity and specificity.

Session 3 – 15:25

Do Biometric Images Follow Benford's Law?

Aamo Iorliam, Anthony TS Ho and Norman Poh

Tampering of biometric samples is becoming an important security concern. Tampering can take place at the sensor level (spoofing), and through the backend, e.g., replacing the template with another sample. One example of backend attack is manipulating the original biometric image i.e. contaminating the template. We study one particular aspect of tampering: image manipulation. In the forensics literature, Benford's law has been reported to be very effective in detecting tampering of natural images. In this paper, our motivation is to examine whether biometric images will follow the Benford's law and whether or not they can be used to detect potential malicious tampering of biometric images. We find that, the biometric samples do indeed follow the Benford's law; and the method can detect tampering effectively, with Equal Error Rate (EER) of 0.55% for single compressed face images, 2.7% for single compressed fingerprint images, 4.3% for double compressed face images and 3.7% for double compressed fingerprint images.

Session 3 - 15:50

Multi-dimensional Signal Processing

Shirin Enshaeifar, Clive Cheong Took

Recently singular spectrum analysis (SSA) has been established as a powerful tool for signal analysis. So far SSA is mostly defined for single or multichannel real-valued time series. Since many important signal processing areas such as radar or telecommunications is involved with inherent complex data, we tried to extend the SSA framework for complex domain. Furthermore, in order to generalize the optimal CSSA for both circular and non-circular data, this algorithm is developed based on augmented complex statistics. The proposed method was implemented in two types of applications: prediction and P300 analysis.

POSTER PRESENTATION ABSTRACTS

1

Regularised Common Spatial Patterns Algorithms for EEG Analysis

Elissavet Chotzoglou and Saeid Sanei

We focus on the stage of feature extraction of EEG signals and especially the use of spatial filters that maximize the discriminability of different brain conditions. The method that is used to estimate spatial filters includes the Common Spatial Patterns (CSP) algorithm and its variations.

2

Morphogenetic Self-organisation of a Swarm of Robots for Adaptive Pattern Formation

Ataollah Ramezan Shirazi and Yaochu Jin

Swarm robotics is a promising field which can solve many problems in the future. Some of their potential applications are foraging, discovering, search and rescue, harvesting, micro-surgery and swarming nano-satellites. Due to the large number of robots in a swarm, their short communication ranges and typically unknown environments that they work in, decentralized control systems outweigh central controllers. In nature, complex living organs developed from a core of identical cells without a central controller. Growth mechanisms in the embryonic stage of living beings such as morphogenesis can be implemented in swarm robotic to generate patterns and predefined shapes and accomplish cooperative tasks.

3

New Approach for Car License Plate

Amin Safaei and Saeid Sanei

An efficient technique in localization and recognition of car number plates is to compute and use suitable statistics of the image/video patterns and exploit the raw images as well as the edge map and the video information simultaneously. It can be shown that a more robust approach requires exploitation of various features from different modality data (image, video, and the edge map).

4

Visual Password Checker

Nouf Aljaffan and Shujun Li

This poster presents the design and implementation of a new class proactive password checker named Visual Password Checker (VPC), which works in a 2-D space and can be used to educate users about various threats to textual passwords so that they can make more informed decisions in their password choices. The VPC provides users with direct, detailed and tailored visual guidance by evaluating a given password against multiple password attacks and visualising multiple threats detected simultaneously. Also, more detailed information about each detected attacks is offered including hints on how to overcome it. The system is designed to be reconfigurable, allowing for adding multiple and different types of dictionaries. The system can be easily integrated into any website because it is a pure client-side solution based on HTML, CSS and JavaScript. It is also fairly fast to run the system from resource-constrained devices like smartphones. In order to verify the system's effectiveness in real-world settings, a number of user studies are currently being planned.

5

A Textual Modus Operandi: Surrey's System of Author Identification

Anna Vartapetiance and Lee Gillam

Detecting deceptions of various kinds may be variously possible, but has little value if the deceiver cannot be identified. For this poster, we discuss our approach to Authorship Attribution that uses vector similarity with a frequency-mean-variance framework for patterns of stopwords (no more than ten). The high frequency individual occurrences, and patterns of co-occurrence, can be used as identifier of an author's style, and operates similarly across certain languages without prior linguistic knowledge. This simple system achieved F1 values of 0.66, 0.74 and 0.78 for Early Bird, Final, and Post submission assessment of the Train Corpus of Authorship Identification competition as part of the 7th International Workshop on Uncovering Plagiarism, Authorship, and Social Software Misuse (PAN2013).

Organising Committee

Veronika Kuchta – PhD student, PhD Representative
Shahrzad Shapoori – PhD student, PhD Representative
Ran Cheng – PhD student, PhD Representative
Aamo Iorliam – PhD student, PhD Representative
Denise Myers – Department Administrator
Sarah Turnbull – Assistant Administrator
Wissam Albukhanajer – PhD Student, Web Support
Prof. Yaochu Jin – Director of PGR Studies

Panel of Judges

Dr Dawn Duke – Researcher Development and Training Officer, University of Surrey
Prof Steve Legg – Royal Academy of Engineering Visiting Professor, IBM
Dr Shujun Li – Department of Computing, University of Surrey
Prof Bob Malcolm – Visiting Professor, Department of Computing, University of Surrey
Prof Andrew Randewich – Keynote speaker, AWE Chief Scientist
Dr Saeid Sanei – Department of Computing, University of Surrey

Academic Review Committee

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