



# Department of Computer Science and Software Engineering

## 2014 Departmental Postgraduate Conference

August 28-29, 2014  
Lecture Theatre 031, Erskine Building

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## Thursday 28<sup>th</sup> August (Erskine room 031)

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### Session 1 – Welcome/Keynote/Honours

*Session Chair: Professor Tanja Mitrovic*

<b>9:00</b>	9:30	Coffee/Tea/Orange Juice and nibbles <i>upstairs in the level 2 tea room</i>
<b>9:30</b>	9:45	Welcome: Professor Tanja Mitrovic (HOD), Dr Richard Green (PG Coord)
<b>9:45</b>	10:15	<b>Keynote Speaker: Dr Clive Horn</b> (Tait) Applying Research in NZ industry
<b>10:15</b>	10:30	Corey Barnard: Terrain rendering with the modern GPU
<b>10:30</b>	10:45	Anthony Bracegirdle: Investigating the Usability of the Leap Motion Controller: Gesture Based Interaction with a 3D Virtual Environment
<b>10:45</b>	11:15	<i>MORNING REFRESHMENTS upstairs in the level 2 tea room</i>

### Session 2 – Honours

*Session Chair: Dr Walter Guttman*

<b>11:15</b>	11:30	Joshua Chen: Computation of the Local Binary Pattern (LBP) descriptors of large scale images
<b>11:30</b>	11:45	Cain Cresswell-Miley: Multi Centroid classification with Particle Swarm Optimisation on the GPU
<b>11:45</b>	12:00	Jin Kwang Hong: Identifying and responding to disengagement in a constraint-based intelligent tutoring system
<b>12:00</b>	12:15	Sam Jarman: Network Communication Protocols for High School Students
<b>12:15</b>	1:15	<i>LUNCH upstairs in the level 2 tea room</i>

### Session 3 – Masters

*Session Chair: Professor Krys Pawlikowski*

<b>1:15</b>	1:30	Yakir Matusovsky: Reliability optimization strategies for a centralized up-link scheduling with a known user population
<b>1:30</b>	1:45	Amr Dahawi: Quantifying Human Behaviour in a Retail Environment
<b>1:45</b>	2:00	Yen-Ko Huang: Enhancing proxemics interaction by recognising human actions
<b>2:00</b>	2:15	Jill De Jong: Chreos Tutor
<b>2:15</b>	2:45	<i>AFTERNOON REFRESHMENTS upstairs in the level 2 tea room</i>

### Session 4 – PhD

*Session Chair: Associate Professor Mukund*

<b>2:45</b>	3:00	Atefeh Ahmadi: Educational Game for Improving Social Problem Solving Skill of ADHD Children
<b>3:00</b>	3:15	Mohammed Algarni: Morphology and Arabic Information Retrieval
<b>3:15</b>	3:30	Saima Ali: A novel message scheduling scheme for Opportunistic Networks
<b>3:30</b>	3:45	Huidong Bai: 3D Gesture Interaction for Mobile Augmented Reality

## Friday 29<sup>th</sup> August (Erskine room 031)

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### Session 5 – PhD

*Session Chair: Professor Tim Bell*

<b>9:00</b>	9:30	Coffee/Tea/Orange Juice and nibbles <i>upstairs in the level 2 tea room</i>
<b>9:30</b>	10:00	<b>Keynote Speaker: Dr Ray Hidayat</b> (Telogis) What's it like to work in the software industry?
<b>10:00</b>	10:15	Ravishka Arthur: Computer Vision meets Bloodstain Pattern Analysis
<b>10:15</b>	10:30	Oliver Batchelor: Object Recognition using Stochastic Metric Learning
<b>10:30</b>	10:45	Caitlin Duncan: Computer Science and Programming for Young Students
<b>10:45</b>	11:15	<i>MORNING REFRESHMENTS upstairs in the level 2 tea room</i>

### Session 6 – PhD

*Session Chair: Dr Andreas Willig*

<b>11:15</b>	11:30	Davide Floriello: Statistical Methods For Correspondence Problems in the Case of Branched Structures
<b>11:30</b>	11:45	Jin Bum Hong: Assessing the Effectiveness of Moving Target Defence using Security Models
<b>11:45</b>	12:00	Musibau Ibrahim: Development of Multi-fractal and Multi-scale Techniques for Biomedical Applications
<b>12:00</b>	12:15	Joshua Leung: Understanding Highlighting Techniques
<b>12:15</b>	1:15	<i>LUNCH upstairs in the level 2 tea room</i>

### Session 7 – PhD

*Session Chair: Dr Kouros Neshatian*

<b>1:15</b>	1:30	Ricardo Marin: 2D Vine Structure from Images
<b>1:30</b>	1:45	Josh McCulloch: Real-time 3D reconstruction and analysis using multiple autonomous aerial vehicles
<b>1:45</b>	2:00	Amir Moravejsharieh: Adaptive and Collaborative Resource Allocation Schemes For IEEE 802.15.4 Wireless Body Sensor Networks
<b>2:00</b>	2:15	Philip Quinn: Understanding Gesture Typing Input
<b>2:15</b>	2:45	<i>AFTERNOON REFRESHMENTS upstairs in the level 2 tea room</i>

### Session 8 – PhD

*Session Chair: Professor Andy Cockburn*

<b>2:45</b>	3:00	Tong-Wook Shinn: APSP on the Mesh Array
<b>3:00</b>	3:15	David Thompson: Virtually Unplugged: data capture to evaluate pedagogy in 3D virtual worlds
<b>3:15</b>	3:30	Shinichi Yamada: Hyper-leaning in Support Vector Machines
<b>3:30</b>	3:45	Thomas Young: Emergence in an Artificial Chemistry
<b>3:45</b>	4:00	Closing remarks, judges deliberating
<b>4:00</b>	5:00	<b>Social gathering/Awards Ceremony in the Staff Club</b>

# Abstracts

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## Keynotes

### **Dr Clive Horn (Tait): Applying Research in NZ industry**

Dr Clive Horn is the Head of Research at Tait Communications. In this presentation he will highlight the opportunities being created by mobile technologies such as 4G (LTE) and the applications that run over it. He will also put context around the importance and opportunity of research in multi-media, imaging, sensing and usability.

### **Dr Ray Hidayat (Telogis): What's it like to work in the software industry?**

In our industry you face many challenges - deadlines, legacy code, other development teams, non-technical customers - it's hard to manage all of this while creating a codebase that will still be maintainable for years to come! This talk will discuss some lessons we have learnt in light of these challenges, and particularly how those principles have been applied to the mesh of processes, algorithms, architectures and GPU programs that form Telogis Route.

## Honours

### **Corey Barnard: Terrain rendering with the modern GPU**

Terrain rendering is an active area of research in computer graphics, with applications in GIS systems, flight simulation and computer games. We look at several existing algorithms and investigate improvements utilizing new features available in modern GPUs. We describe the OpenGL 4 pipeline, emphasizing features appropriate for terrain rendering. We present a new method which combines features from the Geometry Clipmaps algorithm, introduced in 2004, with features available in modern GPUs and compare this to methods proposed in previous studies.

### **Anthony Bracegirdle: Investigating the Usability of the Leap Motion Controller: Gesture Based Interaction with a 3D Virtual Environment**

And here's the abstract: The Intelligent Tutoring Group at the University of Canterbury has created a 3D virtual environment for stroke rehabilitation, specifically, training the prospective memory in a safe and familiar setting. A gesture-based interface via the Leap Motion was created for navigation and interaction within this environment, in the 3D game creation engine Unity. A study was undertaken in which 30 participants used the Leap Motion to interface with the environment with different modes of interaction and data was gathered from their performance as well as from a questionnaire they completed. Feedback from the study has been positive with many participants claiming this form of control to be more user friendly and intuitive than more traditional devices. The data collected suggests that certain modes of gesture-based interaction are better suited for interaction with the environment.

### **Joshua Chen: Computation of the Local Binary Pattern (LBP) descriptors of large scale images**

Local binary patterns are powerful texture descriptors that have recently found several applications in medical image analysis. Research in this field is currently directed towards parallel implementations suitable for processing large scale images. Programming tool-sets such as the Open Computing Language (OpenCL) opened up opportunities for the development of various parallel algorithms and applications for General-Purpose GPU (GPGPU), all executable across heterogeneous OpenCL compliant platforms. In this presentation, we discuss the computation of LBP descriptors for high resolution tissue images of biopsy samples, and outline various implementation aspects of the algorithm in OpenCL.

### **Cain Cresswell-Miley: Multi Centroid classification with Particle Swarm Optimisation on the GPU**

Training classifiers can be seen as an optimisation problem. With this view, we have developed a method to train a type of nearest centroid classifier with PSO, with limited success. Additionally, both the developed algorithm, and the previous PSO algorithm have been implemented on the GPU, with results showing at least one order of magnitude difference between speeds of the GPU and a 'typical' sequential CPU implementation.

### **Jin Kwang Hong: Identifying and responding to disengagement in a constraint-based intelligent tutoring system**

Numerous studies have shown the effectiveness of Intelligent Tutoring Systems in improving learning. However, there are still students who do not engage with problem solving and therefore miss opportunities for learning. In my project, I am investigating whether it is possible to predict when the student would abandon a problem, thus allowing the system to try to motivate the student to persevere. I will discuss the approach taken to generate a predictor, including identifying the features from log data and the selection of the learning algorithm to produce a predictor. To demonstrate the accuracy of the generated decision tree predictor, we will perform an experiment deploying this predictor in a study with SQL-Tutor.

### **Sam Jarman: Network Communication Protocols for High School Students**

Computer Science was introduced to New Zealand schools as an NCEA topic for the first time in 2011. Development of resources for both teachers and students has been crucial in the topic's success. The Computer Science Field Guide is an open source, online textbook aimed at solving this problem. We present the final chapter of the textbook on network protocols. The textbook includes a video, classroom activities, online games, and a tutorial. The content covers what a protocol is, what they can achieve and how protocols can be layered to achieve suitable abstractions. The work is currently under evaluation by teachers in high schools across New Zealand.

## **Masters**

### **Yakir Matusovsky: Reliability optimization strategies for a centralized up-link scheduling with a known user population**

Reliability is an important aspect of every communication system. Next talk will be focused on a centralized (point to multi-point) wireless data communication. The main challenge of a scheduler located at the Base is to optimally cancel the time-varying interference that affects qualities of multiple user transmissions, by allocating retransmissions to regain lost frames. Here, we develop an unsupervised learning "reliability-oriented" allocation algorithm which adapts to a given environment and, optimally or near-optimally, minimizes the probabilities of served data streams to fail.

### **Amr Dahawi: Quantifying Human Behaviour in a Retail Environment**

Robustly quantifying human behaviour in a retail environment raises research challenges around accurately and reliably recognising motion, age, gender, repeat customers and product acquisition. The motivation for this research is that computer vision can be used in the retail refrigeration industry to provide the shop/product owners with information about their clients, products, sales, stock levels and can also help with understanding the customers' needs and psychology. Some of the algorithms to used are combination of Haar feature cascade classifiers, skin colour detection and eigenfaces for face detection and recognition, skeleton detection and tracking using Kinect camera, combining/stitching multiple images for better 3D construction and recognition of objects. The proposed algorithms will be tested on product acquisition from a retail refrigeration unit in a retail setting.

### **Yen-Ko Huang: Enhancing proxemics interaction by recognising human actions**

An effective street vendor changes their content and pitch of advertisement according to passersby reaction and attention. Similarly, instead of showing static content, a public display is more likely to

attract people if it has the ability to tune displayed content based on passersby's response. Previous research has proposed many framework prototypes that react to the proxemics (spatial) relations between the display and users. In this paper, we enhance a proxemics framework by adding human action recognition features. With pre-trained database, the system enables the display to recognise not only the zone (distance) of passersby, but also personal status, such as walking by, waiting in line, or holding a coffee. Thus, the display can tune its content more specifically to its surrounding users.

### **Jill de Jong: Chreos Tutor**

Chreos is an existing integrated business software system used by businesses in a range of industry sectors. An Intelligent Tutoring System (ITS) is being embedded into Chreos to provide users with opportunities to practice on realistic data input tasks in the actual software environment. The ITS is constraint-based and is being developed using the Aspire authoring tool. Chreos Tutor will be evaluated to determine whether it enhances the learning options available to novice users of the software.

## **PhD**

### **Atefeh Ahmadi: Educational Game for Improving Social Problem Solving Skill of ADHD Children**

Attention deficit Hyperactivity disorder (ADHD) is a developmental disorder that affects different aspects of the sufferers' life, especially their education and social life. I have developed a computer system for ADHD children to teach them social problem-solving skills. The system is an animated educational game with 40 scenarios. I have performed a study to investigate how the social problem-solving skills of ADHD children are affected by interactions with the system. Results show that the system improved social problem-solving of the ADHD children significantly compared to their peers who were in a traditional group intervention.

### **Mohammed Algarni: Morphology and Arabic Information Retrieval**

The chief purpose of this study is to investigate the impact of morphology on Arabic Information Retrieval (AIR), and in doing so, different forms of the words have to be tested as indexing terms in order to learn which is the most efficient in performance. Experiments are needed starting with the root all the way to the surface form so that we can evaluate the difference each selection makes. This has resulted in the development of two experimental stemmers for the Modern Standard Arabic (MSA), one light and the other is root-based. The stemmers were based on the Quran morphology and constructed according to its rules in terms of segmenting the word into the correct morphological combination (prefix-pattern-suffix). The reason for leveraging the Quran as a morphological knowledge base was that the Arabic morphological rules were documented according to the Quran decades after it was descended. Using the Text REtrieval Conference (TREC) 2002 Arabic corpus, which contains 383,872 documents and 75 manually judged queries, the new root stemmer was compared to two widely-used stemmers, Khoja and Sebawai. We showed that placing a restriction on what prefix-pattern-suffix combinations are permissible on the surface lead to fewer over-stemming errors. Our light stemmer was tested against the light10, and Al-Stem stemmers. Another experiment was conducted to measure the difference between the stem and the root as indexing terms. Due to the fact that the root conates so many stems into one form, which in turn had degraded its precision when used as an indexing term, the obtained results favoured choosing the stem as the indexing term.

### **Saima Ali: A novel message scheduling scheme for Opportunistic Networks**

Opportunistic networks refers to a class of mobile wireless networks where no end-to-end path exists between the source and the destination or the path is disrupted because of multiple factors like the node mobility, resource limitation and signal propagation models. Because of these reasons, such networks offer very challenging environment for the message transmission from the source to the destination. The goal of our research is to present a message scheduling scheme that offers a better delivery probability while consuming less resources. The nodes in our scheme estimate the remaining

contact time left between the neighbouring nodes and utilize this information to schedule the messages. The main performance measures of our proposed scheme are the average delivery delay, the delivery probability and the effort (in terms of number of message copies) required for a successful transmission.

### **Ravishka Arthur: Computer Vision meets Bloodstain Pattern Analysis**

Blood is one common form of physical evidence often left behind at the scene of violent crime. The forensic field of Bloodstain Pattern Analysis (BPA) is therefore concerned with the examination of the shapes, locations, distribution and patterns of bloodstains, in order to provide an interpretation of the physical events which gave rise to their origin. An important aspect of BPA interpretation is the classification of bloodstain patterns into defined categories according to characteristic features that are a result of the genesis of different bloodstain pattern types.

The discipline of BPA however, has recently been faulted on the grounds of inadequate science and the lack of an objective classification methodology. Consequently, experts are unable to explain how they have reached conclusions and mechanism-related nomenclature encourages experts to form immediate conclusions about the nature of the events without establishing a full set of observations. Therefore, there is a niche opportunity to automate the classification process. Computer vision and pattern recognition techniques, allow mass pre-processing of digital bloodstain pattern images. This in turn, allows for the extraction of features which may be used to quantify any relationships that occur between individual bloodstain elements. Finally, this can lead to the development of an automated classification protocol. Using different statistical-based approaches such as supervised/unsupervised learning, it is anticipated that bloodstain patterns can be characterised and then classified in a manner that yields objective, quantitative information. Furthermore, this information may be used by the expert to support or refute the classification of a bloodstain pattern in court. This research not only presents a novel contribution to forensic science but will extend the applicability of computer vision to solving modern day crime.

### **Huidong Bai: 3D Gesture Interaction for Mobile Augmented Reality**

We present a prototype for exploring natural gesture interaction with Mobile Augmented Reality (AR) applications, using visual tracking based AR and freehand gesture based interaction detected by a depth camera. We evaluated this prototype in a user study comparing 3D gesture input methods with traditional touch-based techniques, using canonical manipulation tasks that are common in AR scenarios. We collected task performance data and user feedback via a usability questionnaire. The 3D gesture input methods were found to be slower, but the majority of the participants preferred them and gave them higher usability ratings. Being intuitive and natural was the most common feedback about the 3D freehand interface. We discuss implications of this research and directions for further work.

### **Oliver Batchelor: Object Recognition using Stochastic Metric Learning**

Descriptors extracted from deep neural networks have been shown to be very discriminative. Metric learning aims to find a distance metric suitable with good locality, suitable for nearest neighbour. We propose using deep nonlinear metric learning on Convolutional Neural Networks to learn descriptors with good locality for use as part of a large scale object instance recognition and retrieval system. We evaluate some metric learning methods with stochastic training and found surprisingly that as a batch method these methods overfit, whereas as a minibatch training method they produced much better generalization.

### **Caitlin Duncan: Computer Science and Programming for Young Students**

Computer Science and Programming are being introduced to school curricula in the UK, Australia, and here in New Zealand. This is not a traditionally taught subject and the vast majority of teachers are feeling unprepared to teach this and are struggling with a lack of reliable resources. Some have criticised the call to teach every child how to code, while others believe lack of programming knowledge will be equivalent to illiteracy in the future workplace. We have been investigating the motivations behind teaching children CS and programming, the potential benefits and costs of this, and how to effectively teach these subjects. Here we present our research into 'Initial Learning

Environments' for teaching children code, and findings from an ongoing study at Chisnallwood Intermediate School.

### **Davide Floriello: Statistical Methods For Correspondence Problems in the Case of Branched Structures**

Correspondence Problems are among the most studied problems in Computer Vision. They consist of two main steps: understanding the information present in images and associating pixels that represent the same information, between different images. Solving Correspondence Problems is a fundamental task before recovering a three dimensional structure from images. The aim of my research is to solve such problems in the context of self-similar branched structures, especially in case of vine structures. The solution will be then implemented on an automated pruning robot, used in agriculture. Several methods to solve Correspondence Problems have already been proposed, but none of them are directly suitable because not all the assumptions they make hold in the case of network structures and, especially, in my application. I will propose a model-based statistical method, together with a topological constraint, to solve Correspondence Problems with branched structures.

### **Jin Bum Hong: Assessing the Effectiveness of Moving Target Defence using Security Models**

Moving Target Defence (MTD) changes the attack surface of a system that confuses intruders to thwart attacks. Various MTD techniques are developed to enhance the security of a networked system, but the effectiveness of these techniques is not well assessed. Security models (e.g., Attack Graphs (AGs)) provide formal methods of assessing security, but modelling the MTD techniques in security models has not been studied. I will talk about how to incorporate the MTD techniques in security modelling and analysis using a scalable security model, namely Hierarchical Attack Representation Models (HARMs). In addition, we use importance measures (IMs) for scalable security analysis and deploying the MTD techniques in an effective manner.

### **Musibau Ibrahim: Development of Multi-fractal and Multi-scale Techniques for Biomedical Applications**

Multi-fractal analysis has recently found several applications in texture segmentation, shape classification and medical image analysis. An overview of multi-fractal analysis as a tool to develop a novel and efficient algorithm for segmentation and classification of digital images is presented. New approaches for estimating the fractal dimension of digital images, such as the Higuchi dimension are introduced. An application of multi-fractal based approach in the classification of emphysema patterns by calculating the local singularity coefficients of an image using different intensity measures is outlined. Important implementation aspects of the multi-fractal based classification scheme that could be used for improving classification accuracy are also discussed.

### **Joshua Leung: Understanding Highlighting Techniques**

Highlighting techniques are extensively used in user interfaces to raise the salience of visual components. Example uses include alerting users to missed events (e.g., a missed Skype call), pending actions (e.g., an unread email message or uninstalled software update), or time critical actions (e.g., an incoming call). Although psychologists have extensively researched various factors around visual stimuli, there has been limited research into how these stimuli can be put to use in computer systems. In particular, there is a lack of understanding around the relative tradeoffs between noticability and distraction. This presentation will summarise our research on examining fundamental tradeoffs in the design of user interface highlighting techniques. Our method is motivated by prior work in signal detection theory on Receiver Operator Characteristic curves.

### **Ricardo Marin: 2D Vine Structure from Images**

The Vision Aided Automated Pruning project is building a robot for automatic vine pruning. As a part of this, we are interested in retrieving the semantic structure of vines from 2D images. Related methods for extracting articulated object descriptions and structures include skeletonisation and medial representation algorithms. However, given the particular conditions on our problem formulation, they are not suited directly for our purpose, and adaptations or novel methods must be developed. I use Gibbs Sampling and a custom segmentation algorithm to solve this problem.

### **Josh McCulloch: Real-time 3D reconstruction and analysis using multiple autonomous aerial vehicles**

Our research focuses on optimising the process of capturing and analysing 3D data from a local environment. By using video streams from multiple autonomous aerial vehicles, our goal is to generate high resolution 3D models in real-time. We aim to intelligently search these models for areas of interest so as to present relevant information to a coordinator for decision support. We are primarily focused on distributed asset management, such as that required by a power distribution network. In this presentation we will give an overview of the goals of this research and a general outline of our data processing framework.

### **Amir Moravejsharieh: Adaptive and Collaborative Resource Allocation Schemes For IEEE 802.15.4 Wireless Body Sensor Networks**

The IEEE 802.15.4 standard could be considered as a popular technology for use in Wireless Body Sensor Networks (WBSNs). The “Channel Scarcity” phenomenon has recently introduced many challenges in the field of WBSNs. Within a WBSN, nodes communication occurs in a particular period of time called the “active period”. As the number of active WBSNs increases in the channel (eventually the whole spectrum), the ratio of overlapping active periods will be augmented. Consequently, it is expected that WBSN performance degradation will be encountered. Therefore, channel scarcity or, in general, spectrum scarcity and its consequences are required to be addressed in a scrutinised manner. Arguably, Internal Interference caused by overlapping active periods of neighbouring WBSNs is the most destructive consequence of channel scarcity on WBSNs performance. In this research, we address the situations where many people wearing body sensor networks are gathered at the same place, for example at a sport event. Clearly, in such circumstances, WBSNs must compete with each other to gain access to the frequency spectrum at the presence of internal interference. Therefore, we have gradually increased the number of WBSNs to determine the destructive impact of internal interference on WBSNs performance. Here the questions are: “How well are they able to share the same spectrum?”, “How could such a sharing frequency spectrum be improved so that more WBSNs could utilise the same spectrum and while experiencing the lowest possible level of network performance degradation” and also in such a gathering event, “What system parameters are playing the key role on WBSN performance?”. Overall, this research aims to address the question of “How many WBSNs could be located at the same spot so that the given constraint and requirements on packet loss rate or Energy consumption are not violated?” and “How is it possible to maximise the number of active WBSNs under certain circumstances such as sharing the same frequency spectrum, being located at relatively close vicinity and experiencing less than 5% packet loss?”. So far, the attained results have provided crucial information about the internal interference impact on WBSNs performance, before and after utilisation of proposed passive schemes.

### **Philip Quinn: Understanding Gesture Typing Input**

Gestural text input methods allow words to be entered using continuous input strokes. Performance models of gestural input have typically considered such tasks as a series of aiming movements connected by corners; however, this is an oversimplification of the kinematics involved in human pointing movements, which limits our ability to understand the significant variety in gesture forms that we observe from users, and to build models of gesture production. We extend an optimal control approach developed in Neuroscience research to develop a model of gesture production that can predict realistic gesture trajectories for arbitrary text input tasks that accurately reflect what users are expected to produce in both figural shape and dynamics.

### **Tong-Wook Shinn: APSP on the Mesh Array**

The All Pairs Shortest Paths (APSP) problem can be solved with the Floyd-Warshall algorithm in  $O(n^3)$  worst case time complexity, where  $n$  is the number of vertices in the graph. The Floyd-Warshall algorithm can be implemented on an  $n$ -by- $n$  mesh array such that the computation is completed in  $5n$  communication steps, resulting in the total computational complexity of  $O(n^3)$  for this parallel algorithm. Takaoka and Umehara have shown that the number of communication steps

can be reduced to  $3.5n$  by adding more connections between the processors in the mesh array. Alongside Floyd-Warshall algorithm, there is a less well known algorithm for solving the APSP problem called the Cascade algorithm invented by Farby, Land and Murchland, which also runs in  $O(n^3)$  time bound. We show that we can implement the Cascade algorithm on an  $n$ -by- $n$  mesh array to achieve  $3n$  communication steps.

### **David Thompson: Virtually Unplugged: data capture to evaluate pedagogy in 3D virtual worlds**

Being able to teach students about CS concepts effectively is a growing priority in schools. Teachers need to develop not just their content knowledge but also best-practice pedagogical approaches. Video analysis is typically time-consuming and difficult to get quick insights from, so instead we added instrumentation to a 3D virtual world in order to quickly collect rich information from students in a simulated environment.

The presentation reports insights gleaned from this data collection, comparing how students learned in a 3D virtual world with a simpler 2D map-based version of a CS Unplugged problem-solving activity.

### **Shinichi Yamada: Hyper-leaning in Support Vector Machines**

Support Vector Machines (SVMs) are successfully applied in many areas of science. They can deal with a million of variables, select most important variables related with the target variable, and provide a means to analyze the input space itself.

The recent discovery of solution path algorithm made it possible to search for the hyper-parameter spaces in SVMs at low cost.

It poses two questions, how to establish more stable and faster algorithms and how to search for higher-dimensional hyper-parameter spaces.

In this presentation I would like to talk about my research for hyper-parameter search in SVMs.

### **Thomas Young: Emergence in an Artificial Chemistry**

Open-ended artificial evolutionary systems to date have been incapable of truly creative results. The common pattern is of increasing baroqueness without real novelty; trivial complexity without pattern or structure. By contrast, certain types of artificial evolutionary system, such as that formed by the atoms and molecules within an Artificial Chemistry, are capable of interesting emergent behaviours. We suggest that emergence, or the realisation of new structure, could be the missing source for creativity in artificial evolution.

## **Judges**

**Honours:** Moffat, Walter, Andreas

**Masters:** Walter, Mukund, Tim

**PhD:** Moffat, Walter, Tim

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The Christchurch City Council is an organisation committed to achieving sustainable outcomes for the community, environment and people of Christchurch and Banks Peninsula. By working for the Christchurch City Council you will have an opportunity to work on a wide range of projects providing you with opportunities to further develop your breadth of skills whilst contributing toward the development of our beautiful city and surrounding areas.

<http://www.ccc.govt.nz/>



**Assurity** is New Zealand's leading software testing and Agile | Lean consultancy. We give the nation's biggest enterprises confidence in the quality of their software and the confidence to change the way they deliver software. Better testing. Better delivery. Better outcomes. To talk more contact us on 03-3799146.



Positioning-centric information is changing the way people, businesses and governments work throughout the world. By applying **Trimble's** advanced positioning solutions, productivity increases and safety improvements are being realized.

Though best known for GPS technology, Trimble integrates a wide range of positioning technologies including GPS, laser, optical and inertial technologies with application software, wireless communications, and services to provide complete commercial solutions. Its integrated solutions allow customers to collect, manage and analyze complex information faster and easier, making them more productive, efficient and profitable.

Trimble products are used in over 141 countries around the world. Employees in more than 30 countries, coupled with a highly capable network of dealers and distribution partners serve and support our customers. For over 33 years, Trimble has created unique positioning products that help customers grow their business. Our portfolio includes over 1,800 patents and serves as the basis for the broadest positioning offerings in the industry. Trimble augments its organic product development with strategic acquisitions to bring the latest positioning technologies to a wider market.

<http://www.trimble.com/>



Since 1978, Jade Software has worked with leading companies around the world to solve complex business problems through the design, delivery, and support of innovative software and technology.

We're natural innovators. Over 200 Jade employees create and manage high performance enterprise systems, work on digital strategy and experience design, and develop software platforms used by thousands of companies around the world. We work with industry standard technology as well as within our own JADE™ development environment.

We collaborate closely with our customers. Our clients and technology partners cover a wide range of industries including retail, telecommunications, primary production, and NGOs. Jade systems sit at the core of banks and building societies, at the logistical center of shipping ports all around the world, and at 2.1 million electricity and gas connection points in New Zealand.

Today we have three lines of business: Jade Master Logistics for ports and freight; Jade Solutions for businesses looking to bring information, systems, and people closer together; and Jade Technologies for developers and technology partners.

Our global headquarters are in Christchurch, where we started out. There are also Jade offices in Auckland and Dunedin, as well as Australia, USA, UK, and the United Arab Emirates.

[www.jadeworld.com](http://www.jadeworld.com)



**Dynamic Controls** is the world's leading manufacturer of electronic controls for power wheelchairs and scooters. Focusing on innovation and growth in the bio medical engineering sector, Dynamic Controls works to go above and beyond expectations to ensure end users receive the best product possible in order to enhance their quality of life. Dynamic Controls is unique in that we specialize in the medical mobility market. Products range from cost effective integral controllers to a world leading modular control system that can be customised to suit a wide range of user needs. In addition we have a range of scooter controllers suitable for small, lightweight mini shoppers to rugged outdoor scooters. All our products are renowned for reliability. Dynamic Controls is a global organization which employs 333 people, with corporate headquarters in New Zealand and regional offices in the United Kingdom, North America and Asia.

<http://www.dynamiccontrols.com/>



**Orion Health's** 350 (and expanding) employees supply technology and services to over 1100 clients worldwide.

Orion Health is a leading provider of clinical workflow and integration technology for the healthcare sector. Orion Health's clinical information software meets the information needs of clinical staff and healthcare managers, delivering secure, universal access to healthcare information and helping healthcare providers proactively manage and coordinate patient care across the community. Orion Health's integration and messaging products streamline the exchange of healthcare data within organisations and between business partners. Integrating healthcare systems throughout the world since 1993, Orion Health contributes to integration and clinical workflow projects across the globe for clients including Abbott Laboratories, New York State Department of Health, Capital Health, New South Wales Health, and the New Zealand Ministry of Health. Orion Health has offices in the United States, Canada, United Kingdom, Spain, Dubai, Singapore, Bangkok, France, Australia and New Zealand, and our growing network of partners includes leaders in technology and services such as Oracle Corporation, LogicaCMG, Sierra Systems, Sun Microsystems, Philips Medical Systems, Hewlett-Packard and IBM. Further information including a video featuring staff in our Auckland office can be found at [www.orionhealth.com](http://www.orionhealth.com).



**Tait Communications:** Our clients protect communities, power cities, move citizens, harness resources and save lives all over the world. We work with them to create, support and unify the critical communication solutions they depend on to do their jobs.

Digital mobile radio communication forms the central nervous system of everything we do. Around this resilient, robust core we design, develop, manufacture, test, deploy, support and manage innovative communication environments for organizations that have to put their total trust in the systems and people they work with.

Our global Service Management Centres are staffed with trained and experienced professionals using industry-leading management applications to monitor and manage our client's critical communications networks, allowing them to focus on their core objectives.

We've worked hard to develop genuine insight into our clients' worlds, and have pursued engineering, operational and services excellence for more than 40 years. This understanding, and our belief in championing open-standards technology, means we can give our clients the best possible choice and value to achieve the human outcomes they're driven by.

We're not simply aligned with our clients, we're devoted to their cause.



**SLI Systems** makes site search and merchandising easy. We install, customize, integrate, host and maintain everything for site visitors find the products and information they want. Most search technologies use complex algorithms to determine which results should be returned for a query. Our patented Learning Search technology takes relevance a step further by learning from site visitors' behaviour over time to deliver more relevant results. We are a global business with over 50 staff in Christchurch, with additional offices in California, London and Melbourne. The Christchurch office is the anchor tenant for the new Enterprise Precinct and Innovation Campus Project (EPIC).

<http://www.sli-systems.com/>