UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Department of Computer Science and Software Engineering

2012 Departmental Postgraduate Conference

August 23-24, 2012
Lecture Theatre 031, Erskine Building

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Thursday 23rd August (Erskine room 031)

Session 1a – Welcome

Session Chair: Professor Tim Bell

8:30	9:00	Coffee/Tea/Orange Juice and scones
9:00	9:45	Welcome: Professor Tanja Mitrovic (HOD) and Professor Lucy Johnston (Dean of Postgraduate Research)

Session 1b – Honours

Session Chair: Professor Tim Bell

9:45	10:00	Joel Harrison: Improving Users' Command Selection Performance
10:00	10:15	Matt Lang: The Emotiv EPOC as a Consumer-Grade BCI Controlled by Imagined Motor Movements
10:15	10:30	Adam Freeth: A Sequential Method for the Detection of the Onset of Steady-State in Discrete-Event Simulation
10:30	10:45	Simon Flowers: Low-Level Image Segmentation for a Vine Pruning Robot
10:45	11:00	*MORNING REFRESHMENTS*

Session 2 – Honours

Session Chair: Dr. Kourosh Neshatian

11:00	11:15	Joshua Leung: Improving File Navigation with Spatially Consistent Revisitation Visualisation
11:15	11:30	Ellie Rasmus: Improving face recognition with genealogical and contextual information
11:30	11:45	Sam Corbett-Davies: Artificial Intelligence for a Grape Vine Pruning Robot
11:45	12:00	Robin Candy: Towards Concurrent Hoare Logic
12:00	1:00	*LUNCH*

Session 3 – Masters

Session Chair: Professor Andy Cockburn

1:00	1:30	**Keynote Speaker: Dr. James Smithies** UC CEISMIC: Building the Canterbury Earthquakes Digital Archive
1:30	1:45	Myse Elmadani: Using Eye Gaze Data to Understand Student Interactions with Tutorial Dialogues in Intelligent Tutoring Systems
1:45	2:00	Benjamin Gibson: Teaching Computer Science with Educational Games
2:00	2:15	Tim King: Computer Vision Based Docking for Smart Wheelchairs
2:15	2:30	Jessica Emerson: Tag Clouds in Software Visualisation
2:30	3:00	*AFTERNOON REFRESHMENTS*

Session 4 – Masters/PhD

Session Chair: Dr. Walter Guttmann

3:00	3:15	Sasha Wang (Masters): Investigations on Forward Error Correction Schemes for Broadcast Communication Systems
3:15	3:30	Samuel Williams (Masters): Improved Hybrid Tracking for Mobile Outdoor Augmented Reality
3:30	3:45	Thomas Young (PhD): Winnowing a Field – a structured method for my literature review, in context

Friday 24th August (Erskine room 031)

Session 5 – Masters/PhD

Session Chair: Dr. Dong-Seong Kim

8:30	9:00	Coffee/Tea/Orange Juice and nibbles
9:00	9:30	**Keynote Speaker: Dr. Ray Hidayat** Interesting Algorithms in Telogis Route
9:30	9:45	Saima Ali (Masters): Investigations on Passive Discovery Strategies in IEEE 802.15.4-based wireless mobile body sensor networks
9:45	10:00	Ravikanth Kamarushi (PhD): Global and Local Image Features
10:00	10:15	Amir Shareghi Najar (PhD): Using Examples in Intelligent Tutoring Systems
10:15	10:30	Ehsan Tabatabaei Yazdi (PhD): Adaptive Resource Allocation for Mobile Body Sensor Networks
10:30	11:00	*MORNING REFRESHMENTS*

Session 6 – PhD

Session Chair: Associate Professor R. Mukundan

11:00	11:15	Davide Floriello: Statistical methods for corresponding problems in Computer Vision
11:15	11:30	Ricardo David Castaneda Marin: 2D Vine Structure from Images
11:30	11:45	Jin Hong: Complexity Analysis of Hierarchical Attack Representation Models
11:45	12:00	Chris Lee: Shortest Path Problems and Matrix Multiplication
12:00	12:15	Mashitoh Hashim: New Algorithm and Data Structure to Solve the All Pairs Shortest Path Problem
12:15	1:15	*LUNCH*

Session 7 – PhD

Session Chair: Dr. Neville Churcher

1:15	1:30	Saikath Bhattacharya: Cooperative Communication and Relays
1:30	1:45	Muhammad Arfeen: Towards a Combined Traffic Modeling framework for Access and Core Networks
1:45	2:00	Stephen Fitchett: Finding Your Files Faster
2:00	2:15	Joey Scarr: Exploiting Spatial Memory for Fun and Profit
2:15	2:30	Mofassir Haque: Use of Blind Routing Algorithms for Solving Deadlock Problem in CCNx Transport Layer Protocol
2:30	3:00	*AFTERNOON REFRESHMENTS*

Session 8 – PhD

Session Chair: Professor Tanja Mitrovic

3:00	3:15	David Thompson: Data Capture in Virtual Learning Environments
3:15	3:30	Huidong Bai: Natural Feature Tracking and Gesture-based Interaction for Mobile Augmented Reality
3:30	3:45	Philip Buchanan: Modifying the Visual Style and Dimensionality of Images
3:45	4:00	Kapila Pahalawatta: Histogram Maximum Value Index Based Nano-scale Particle Classification
4:15	4:30	Thammathip Piumsomboon: Toward a standard gesture set in Augmented Reality
4:30	6:30	**Social gathering/Award Ceremony in Erskine Room 447**

Abstracts

Keynotes

Dr. James Smithies: Building the Canterbury Earthquakes Digital Archive
Senior Lecturer in Digital Humanities, University of Canterbury

Dr. Ray Hidayat: Interesting Algorithms in Telogis Route
Telogis Route is full of complex algorithms. When planning driver territories, how can we estimate the required driving time quickly? When optimising routes, how can we discourage routes from overlapping where possible? When distributing work to a server farm, how can we find the optimal assignment of jobs to servers? Every level of Telogis Route involves some interesting challenges. This talk will give you a peek into some of these challenges and the algorithms used to solve them.

Ray Hidayat graduated with his PhD from the University of Canterbury in 2010, and has since been working for Telogis forging advancements in route optimisation algorithms for Telogis Route, Telogis' SaaS route planning application. Ray's interests lie in optimisation, machine learning and parallel processing.

Honours

Joel Harrison: Improving Users' Command Selection Performance
We present an interface technique called ExposeHotkey that helps users browse, perform and learn interface hotkeys to improve command selection performance. ExposeHotkey removes the need to use the pointer to activate hotkey feedback, therefore allowing users to browse, inspect, confirm and issue hotkey commands within the hotkey modality; negating the need to move the hands away from the keyboard.

Matt Lang: The Emotiv EPOC as a Consumer-Grade BCI Controlled by Imagined Motor Movements
Brain-computer interfaces, utilising electroencephalography (EEG), have been studied for many years as a means of communication and control for physically disabled individuals. Through training, people can learn to use kinaesthetic motor imagery as computer input or to control assistive technology. Although typical EEG devices are very expensive, large, and require much effort to use, recent consumer-grade devices have become available. The Emotiv EPOC is an inexpensive, lightweight, wireless headset that has now been used in a number of similar research applications. However, many of these studies fail to indicate the length of time taken to achieve the reported results. As an initial step to provide a quantification of the training time required, we ran two studies investigating cognitive control. Using just their mind, participants in the first experiment moved a virtual cube left and right, and in the latter made three-choice selections. The first employed a fixed training scheme approximating 11 minutes, and resulted in a poor 36% average success rate. The latter task was defined better, and allowed 15 minutes of self-directed training, increasing the average success to 46.8%. We investigate different detection filters for maximising cognitive control, and also review the proprietary "Affectiv suite", which provides some measures of the user's emotional state.

Adam Freeth: A Sequential Method for the Detection of the Onset of Steady-State in Discrete-Event Simulation
In stochastic discrete-event simulation, an initial transient phase in the output data can bias estimates of steady-state performance measures. To ensure estimates are credible, the effect of this transient phase must be mitigated. A common approach for this is to truncate the data from this phase and calculate estimates based on the remaining sample. Finding a reliable method for determining this truncation point for a wide variety of simulation models is not trivial.

Akaroa2 is a research package developed by the Simulation Research Group that utilises automated sequential analysis to collect credible results from stochastic simulation. As part of this, it requires a sequential method for detecting the onset of steady-state to determine an appropriate truncation point. Although at least 43 truncation methods have been proposed, no such sequential method has yet been shown to work reliably and effectively for a range of simulation models. This research project attempts to develop a sequential truncation method based on

the convergence of the cumulative mean of output data to its steady-state value. In particular, the method uses time-series forecasting methods to determine when the cumulative mean plot approaches a horizontally flat line, an extension of both Welch's method and the stopping rule proposed by Mackulak et al. The developed method will be tested over a representative sample of simulation output to evaluate its effectiveness as a general purpose sequential method for use in the Akaroa2 simulation package.

Simon Flowers: Low-Level Image Segmentation for a Vine Pruning Robot
Image segmentation is an important preprocessing step in most vision-based applications as it can significantly reduce future computation in tasks such as object classification. By grouping pixels that are similar with regard to a measure such as colour or position, computation can be performed on a per-segment basis, rather than per-pixel. This research examines several segmentation techniques and evaluates their performance at segmenting vine images. The methods examined are k-means, mean-shift, normalised cuts, quadtree and watershed segmentation. Each method is evaluated against five structurally distinct images, based on their accuracy and efficiency at separating scene components such as vines, posts, wires and background. Evaluation is performed using a boundary-based comparison method to compare segmented images against hand generated ground truth segmentations. Clustering methods such as k-means and mean-shift are found to have the best performance, and we provide reasoning behind the relative successes and shortcomings of each method.

Joshua Leung: Improving File Navigation with Spatially Consistent Revisitation Visualisation
Navigating to files and folders is a time consuming and tedious process. Users are required to make a series of selections through their folder hierarchies to reach their targets. However, while file systems have dramatically increased in size and complexity over the past few decades, file browsers have remained fundamentally unchanged. As such, they are ill-equipped to help users cope with this increased complexity, with growing evidence showing that they prevent users from successfully accessing their files in some cases. In particular, we believe that the temporal and repetitive nature of human interaction and the importance of contextual information are somewhat neglected. We present a spatially consistent file system visualisation augmented with revisitation information and temporal search for improving file navigation interfaces. The interactive properties and feasibility of this interface for improving common file navigation tasks are explored.

Ellie Rasmus: Improving face recognition with genealogical and contextual information
As face recognition implementations become more sophisticated, the scope of possible real-world applications has widened, and genealogical research is one such area that could greatly benefit. The aim of this research is to improve the accuracy of face recognition results within a family photograph album through the re-ranking of candidate faces. This re-ranking algorithm makes use of genealogical information from a given family tree to determine familial relationships, as well as contextual measures of co-occurrence, recurrence, and normalised physical distance of individuals within the album to accurately predict identities.

Sam Corbett-Davies: Artificial Intelligence for a Grape Vine Pruning Robot
This talk will discuss the development a system capable of determining which parts of a grape vine to prune with the skill of a human vine pruning expert. The system makes decisions based on the structure of simulated vines, with the results of this work being used to inform the development of the AI for the actual vine pruning robot once the computer vision systems are able to determine the structure of real vines. In order to solve this problem a cost function is developed which determines the fitness of a particular way of pruning a vine. This allows the best possible pruning to be found using brute-force search. Supervised machine learning is used to develop the cost function, using training data acquired from an expert at Lincoln University. Every possible way of pruning a vine is represented as a set of features, and Monte Carlo optimisation is used to find the relative weightings of these features that results in the cost function that best explains the training data.

Robin Candy: Towards Concurrent Hoare Logic
How can we rigorously prove that an algorithm does what we think it does? Floyd-Hoare Logic (or Hoare Logic for short) is a set of rules that describe a type of valid reasoning for sequential program verification. Many different attempts have been made to extend Hoare Logic for concurrent program verification. We combine ideas from many of these extensions to verify the correctness of Sung Bae's mesh algorithm for the maximum subarray problem. We also discuss the extent to which the verification process can be automated.

Masters

Myse Elmadani: Using Eye Gaze Data to Understand Student Interactions with Tutorial Dialogues in Intelligent Tutoring Systems
Eye-movement tracking is a potential source of real-time adaptation in a learning environment. In order to have a more comprehensive and accurate picture of a user's interactions with a learning environment, we need to know which interface features they visually inspected, what strategies they used and what cognitive efforts they made to complete tasks. Such knowledge allows intelligent systems to be proactive, rather than reactive, to users' actions. Intelligent Tutoring Systems (ITSs) have been shown to significantly improve students' learning in a variety of domains, including physics, mathematics, and thermodynamics. Tutorial dialogues is one of the strategies used by ITSs and has been empirically shown to significantly improve learning. This project investigates how students interact with the tutorial dialogues while interacting with EER-Tutor using both eye-gaze data and student-system interaction logs. EER-Tutor is an ITS used to teach conceptual database design. Machine learning techniques will be used on this data to classify students in real-time, for example as poor or good learners. This will allow an ITS to intervene when needed and better guide students' learning.

Benjamin Gibson: Teaching Computer Science with Educational Games
Much work has done on teaching Computer Science by having students program games. In comparison, however, little has been done on teaching Computer Science by having the students learn from playing educational games. The current work in this field does not seem to be particularly cohesive. There is no clear idea of what has already been done. The focus of this thesis is provide a clearer picture of the state of the field. The first and primary part of the thesis was to find and provide detailed information on as much of the existing educational games that teach Computer Science as possible. With this information it can be clearly seen that while a few topics, mainly binary and high level programming concepts, have sufficient coverage, most have barely been touched. The secondary part of the thesis focuses on expansion of the field. This is achieved through providing guidelines on producing new work as well as examples.

Tim King: Computer Vision Based Docking for Smart Wheelchairs
Powered wheelchairs can be difficult to navigate at times, particularly for those with visual or motor impairments. One particular area of difficulty is docking to desks and tables, where docking is defined as manoeuvring the front of the wheelchair as closely as possible to an object. As such there is a need for smart wheelchairs: powered wheelchairs enhanced with sensors that provide awareness about the world for object avoidance and assisted navigation.

This project devises a prototype assisted navigation system for docking that can be retro-fitted to modern wheelchairs. The system is designed to operate in unstructured indoor environments, without a priori knowledge of the scene. Data from ultrasonic sensors, video and depth maps from a Microsoft Kinect are combined to classify and calculate proximity to docking targets. Joystick commands are shaped in order to provide a graceful stop regardless of user input. Movement away and parallel to targets is uninterrupted.

Jessica Emerson: Tag Clouds in Software Visualisation
Modern software systems are notoriously large-scale and complex, making comprehension difficult. Visualisation techniques help people to understand and analyse data. There are some obstacles to effectively visualising software due to the dense structure of the data and its particular characteristics. Tag clouds are a visualisation technique commonly found on social web sites to highlight key items and show their relative importance. We apply tag clouds to the software engineering domain, using eye-tracking technology to work towards assessing their effectiveness for visualising and exploring the special characteristics of a software dataset.

Sasha Wang: Investigations on Forward Error Correction Schemes for Broadcast Communication Systems
At the data link layer of the OSI model, the reliability of data transmission can be improved by forward error correction (FEC) coding technique. This technique is especially important when feedback channels (Automatic Repeat Request) are not feasible in situations such as broadcast systems. The aim of this project is to find an optimum FEC technique for broadcast systems. There are many types of existing FEC techniques and they are differed by their encoding methods. Different encoding methods give the FEC different error correction characteristics which influence on their performance depends on the transmission mode and system requirements. This project aims to find a FEC scheme for broadcast systems that gives maximum overall success probability and minimum overall reception time. Due to the time limit of an MSc thesis, existing coding

schemes cannot all be examined. Therefore four potentially suitable coding schemes are chosen as candidates. The four candidates are repetition codes, Reed-Solomon codes, Tornado codes and Fountain codes.

Saima Ali: Investigations on Passive Discovery Strategies in IEEE 802.15.4-based wireless mobile body sensor networks
The rapid development of low power integrated circuits, wireless communication and sensor devices have triggered an upsurge in wireless body sensor networks (BSN) based solutions for health care and well being. BSN allows physical mobility and can keep track of vital aspects such as blood pressure and body temperature at all times. IEEE 802.15.4 network technology is gaining attention for the implementation of BSN's. The main advantages are low cost deployment and strong communication. IEEE 802.15.4 offers three different types of network discovery systems, out of which we use Passive discovery. Discovery of network is one of the fundamental tasks needed to be performed by BSN. The main goal of this research is to reduce the time and efforts required for the mobile BSN to discover the network, developing a new scheme "Rumor Based discovery scheme" for passive discovery of BSNs. The mobile BSN's are made aware of the nodes (Foreign Personal Area Networks) that exist in its surroundings. Whenever a coordinator hears a beacon from any other coordinator in the network, it stores information like frequency of the channel, beacon order, Mac address and time since it has last heard from that node etc. in a table. The information contained in this table is then spread all over the network as a beacon message. It saves a lot of effort on the part of BSNs for discovering the network and an effective way to get necessary information of finding destinations.

Samuel Williams: Improved Hybrid Tracking for Mobile Outdoor Augmented Reality
Outdoor augmented reality provides many opportunities for improving the way in which information is presented and organised. However, to create a coherent and authentic experience, virtual content must be registered in the physical world such that the user's expectations of reality are respected. Modern mobile devices provide a wide variety of sensor data which can assist with achieving this goal, however few existing platforms explore how this data can be intelligently merged together to provide robust camera tracking and object recognition. For the proposed masters thesis project, I will investigate existing tracking algorithms for outdoor augmented reality with a specific focus on modern mobile devices. Improving on prior research, I will design and implement an adaptive tracking algorithm that integrates available sensor data to maximize accuracy. To evaluate the system, I will develop a prototype outdoor augmented reality browser and review the tracking and recognition quality in relation to sensor degradation.

PhD

Ravikanth Kamarushi: Global and Local Image Features
Generation of key points from an image, in an effective and efficient way, is a well studied problem in the literature. This particular aspect of processing images forms the basis for numerous Computer Vision applications. Image representation and registration, object recognition and matching, 3D scene reconstruction and motion tracking, all rely on the presence of stable, representative features in the image. It is also the main drive behind the research which has yielded a plethora of approaches to this problem. One popular approach is to decompose an image into local regions or patches of interest, features. Descriptors are computed around these interest points. It is a widely applied technique in Computer Vision. The approach is also useful to alleviate complexity while exploiting local appearance properties. Another popular approach is using Global Features such as Histogram, Shape, Pattern, Eigen space etc. Other approaches that have been tried are: Traditional techniques such as Wavelets, Fourier transforms, etc., Statistical approaches such as Active Shape Models and Active Appearance Models etc. and Natural Features such as Textures
or Corners. The research will focus on: a) Comparative analysis of existing popular algorithms using standard data sets, Caltech 101, NORB, MNIST etc. b) Design of algorithms using a combination of Local, Global and Natural Features. c) Development of methods for fast image matching.

Amir Shareghi Najar: Using Examples in Intelligent Tutoring Systems
In the past few years, researchers studied the use of examples compared to tutored problems in different domains, yet the results are not conclusive to decide whether they could replace tutored problems or not. Due to different results in using examples for Intelligent Tutoring System (ITS), there is still a research potential to investigate examples' effects on learning compared to tutored problems. We plan to expand this area to Constraint Based Modeling (CBM) tutors using SQL-Tutor. SQL is a well-defined domain with ill-defined tasks, which makes this research different from prior work. In our first study, we will study the effects of interweaving examples with problem solving while they both are scaffolded with self-explanation prompts.

Afterwards, we will look at the effect of using adaptive examples in ITSs. The result of this research would allow us to develop more effective and efficient ITSs.

Ehsan Tabatabaei Yazdi: Adaptive Resource Allocation for Mobile Body Sensor Networks
One of the problems affecting reliable transmission in wireless devices, like Wireless Sensor Network (WSN) nodes is interference caused by sharing the unlicensed 2.4 GHz ISM band with other protocols such as IEEE 802.11a/b/g/n and IEEE 802.15.1. In this thesis, we will investigate the impact of realistic urban IEEE 802.11 RF interference on packet delivery performance in IEEE 802.15.4 Mobile Body Sensor Networks (MBSNs) using simulation. Having these results, we would propose an adaptive resource allocation extension for the IEEE 802.15.4 standard to dynamically change the communication channel of the network based on the channel quality measurements. We would perform the same realistic urban RF interference measurements with the new proposed extension and compare the results obtained by simulation and real experimentation. The results show a significant improvement on the network life time and packet delivery.

Davide Floriello: Statistical methods for corresponding problems in Computer Vision
My work is part of the "Automated Vision Pruning Project". The aim of my research is to correctly, at least in a probabilistic sense, solve a correspondence problem: given three images of the same vine taken from different cameras in different positions, are we able to associate corresponding points between the three images? This one is a fundamental step to recover and refine the 3D structure of the vines to be used in the pruning step. To achieve that result, we will use intensive and sophisticated statistical methods. The first attempt will make use of Markov Random Models. Indeed we define a Markov property on a space of suitably defined maps describing possible assignments between sets in the two images. Thanks to this, we start solving our problem in a simplified case. Future developments will try to make the situation more complex and real-world like, to define the constraints, the corresponding points have to satisfy, in a probabilistic sense and then estimating their laws via Bayes' theorem. Results in this field could bring new developments in the emerging field of corresponding problems.

Ricardo David Castaneda Marin: 2D Vine Structure from Images
The Vision Aided Automated Pruning project aims to create a robot for automatic vine pruning guided by computerized visual information, and we are interested in retrieving the semantic structure of vines from a set of planar colour images. Current methods for extracting image object's descriptions and structures include skeletonisation algorithms and some common 2D features like blobs, corners and edges. However, given the particular conditions on our problem formulation, they are not suited directly for our purpose, and mixed or novel methods must be developed. I will briefly discuss our ideas for solving this problem and the current state of our research.

Thomas Young: Winnowing a Field: a structured method for my literature review, in context
Some literature reviews can turn into marathons. What can you do when you need to gain an overview of a field? What might help when you are looking for gaps in significant bodies of previous research? Systematic Literature Reviews, and Systematic Mapping Studies, are techniques that can help! Reviews and Maps describe a step-by-step methodical process for identifying sources of relevant papers, reducing the candidates down to manageable levels, and assessing the results. Quality control is a major component of these studies. Clearly these methods are not suitable for all literature reviews, but when the task is overwhelming, the solution might be found in a Systematic Review or Map. Within a frame of the needs of my thesis research into open-ended evolution, I will describe the process for both Reviews and Maps, while attempting to provide some lessons in their use from my own experience.

Jin Hong: Complexity Analysis of Hierarchical Attack Representation Models
The network security is difficult to measure based on the network topology and its features. To quantify and evaluate the network security, attack models can be used and they are mainly divided into two different categories: Graph-based or Tree-based. Purely graph based attack representation model has a state-space explosion problem. Tree-based models cannot capture the path information explicitly. Moreover, the complex relationship embedded between the host and the vulnerability information in these attack models creates difficulty adjusting to the changes in the network configuration, which is impractical for modern dynamic network systems.

To deal with these issues, we propose hierarchical attack representation models; hierarchical attack graph (HAG) and Hierarchical attack tree (HAT). The main idea is to separate the network topology information (in the upper level) from the vulnerability information of each host (in the lower level). We compare the hierarchical models with the general attack representation models including attack graph and attack tree and

show pros and cons using an example network system in the phases of the construction, representation, evaluation and modification of these attack models.

Chris Lee: Shortest Path Problems and Matrix Multiplication
In graph theory, the shortest path problem is the problem of finding a path between two vertices in a graph such that the sum of the weights of its constituent edges is minimized. An example is finding the quickest way to get from one location to another on a road map: in this case, the vertices represent locations and the edges represent segments of road and are weighted by the time needed to travel that segment. There are three popular ways to realize the graph abstract data type with a concrete data structure, usually referred to as the edge list structure, the adjacency list structure, and the adjacency matrix. We can view the problem of computing the shortest path problem as a matrix problem. The matrix multiplication approach to shortest paths is especially useful in contexts where we represent graphs using the adjacency matrix data structure. In this presentation, the shortest path problems and the data structures for graphs will be discussed in detail also with the relationship between the path problems and the matrix multiplication.

Mashitoh Hashim: New Algorithm and Data Structure to Solve the All Pairs Shortest Path Problem
The all-pairs shortest path problem (APSP) is a problem to find the shortest path, from every possible source to every possible destination in a graph. To solve this problem, many APSP algorithms have been developed and so are the data structures used to facilitate these algorithms. In this presentation, a new algorithm is described, which is superior to the previous algorithms by k constant factors. For solving the APSP, a weighted digraph with edge weights drawn from a random probability distribution is used. The expected running time is O(n^2 log n), where n is the number of vertices in a graph. Theoretical analysis proves that this algorithm is twice as good as the existing well known MT algorithm. To contribute more to the shortest path area, a new data structure has also been successfully developed. If m decrease-key operations are called, where m is the number of edges in a graph, empirical study shows that this data structure is able to perform better than the existing binary, Fibonacci and 2-3 heaps.

Saikath Bhattacharya: Cooperative Communication and Relays
Wireless communication is fast evolving, each new generation of wireless device has brought a notable change in terms of communication reliability, data rates, battery life, and network connectivity. Cooperative Communication is new paradigm in communication network where different users cooperate among them-self to transmit each other messages to the destination, instead of competing among them-self for channel resource. In practice, Sensor network do not have multiple antennas installed on their small-size devices. Cooperative communications can generate independent MIMO-like channel links and gains between a source and a destination via the introduction of relay channels. This presentation is basically a tutorial on Cooperative Communication and Relays. Various issues like: Why to Cooperate? Whom to Cooperate With? , Different types of Cooperative Strategies and Real Time Scheduling problems will be discussed in this talk.

Muhammad Asad Arfeen: Towards a Combined Traffic Modeling framework for Access and Core Networks
Both Long Range Dependence (LRD) and Short Range Dependence (SRD) co-exist in Internet traffic. We review the transformation between LRD and SRD at different levels of traffic superposition (ISP tiers) and propose a simple combined framework for traffic modeling for source, access and core (backbone) networks. We use flow level (TCP and UDP) entities for structural modeling of Internet traffic as these Layer 4 entities are invariant to network topology, medium and its provisioning. This flow level framework emphasizes the role of Pareto distribution in source modeling; and, Weibull distribution in access and core network traffic modeling.

Stephen Fitchett: Finding Your Files Faster
Navigating through a file hierarchy is the most common method for people to access their files, yet it can be slow and repetitive when frequently visiting the same locations. We introduce three augmentations for a standard file browser: Icon Highlights, Hover Menus and Search Directed Navigation. Icon Highlights give greater prominence to the items that are most likely to be accessed in the current view. Hover Menus provide a mechanism to skip levels of the file hierarchy when moving towards a target file by presenting a list of commonly accessed files and folders inside a folder. Search Directed Navigation guides users through the file hierarchy by highlighting items that match a query, rather than showing a list of results. Results from a user evaluation show that all three augmentations improve file retrieval times, with Icon Highlights and Hover Menus best suited for frequently accessed items and Search Directed Navigation best suited for less frequently accessed ones. We also show that the benefits are larger in less spatially consistent contexts, and that there is no

evidence that the augmentations negatively affect location learning. Finally, we discuss how the augmentations can be combined into a single interface for maximal gains.

Joey Scarr: Exploiting Spatial Memory for Fun and Profit
Spatial memory is a useful principle in the design of user interfaces. It allows people to locate items quickly, it is long-lasting, and it has a large capacity. Recent research has even proposed using spatial memory as the fundamental principle in UI organisation. However, there are still issues that need to be understood before spatial memory can be treated as a fundamental design principle. In particular, the issue of spatial memory's robustness is of critical importance.
In order to study the robustness of human spatial memory, we performed an experiment studying the effects of translation, rotation, scaling, aspect ratio changes, and perspective distortion on item recall times. Our study showed that most types of transformation had very small negative effects on performance.
We then demonstrate how these spatially consistent transformations can be applied to improve performance in a simple scenario: selecting familiar items after a window has been resized.

Mofassir Haque: Use of Blind Routing Algorithms for Solving Deadlock Problem in CCNx Transport Layer Protocol
Content Centric Networking (CCN) Architecture has been suggested to overcome weaknesses of current Internet architecture. This architecture is based on the concept of decoupling data from location and retrieving contents by name instead of location. Transport layer protocol i.e. CCNx has been proposed for use with CCN. CCNx performs longest prefix match between requested content name and entries stored in Forwarding Information Base (FIB) table of CCN router. A request is discarded if no match is found between them. CCN routers will be required to maintain a large number of entries in FIB table due to shifting of address space from one billion IPs to at least one trillion content names. Currently, CCN routers cannot store mapping for all content names in FIB table. This will cause large number of FIB's misses and can lead to deadlock situation despite the fact that requested content might be held by a nearby router. In this paper, we have accessed suitability of using different alternatives of blind routing algorithms as a fall back scheme for CCNx when FIB miss occurs. We have implemented different blind routing algorithms i.e. flooding, expanding ring and random walk over CCNx in an OPNET simulator using C language. Matrices of routing overhead, end-to-end delay and success rate have been used for making comparisons. Our results suggest that random walk with queries sent on half of the total links can be used as fall back scheme to avoid deadlock problem in CCNx.

David Thompson: Data Capture in Virtual Learning Environments
Traditional approaches to education research tend to involve treating an educational activity as a "black box": assessing the learners before and after an intervention to measure any learning effects. Direct observation is possible, but individual researchers can't easily watch everyone in a full class study, and analysis of recorded video can be a long and involved process. There are also ethical and practical considerations to consider when conducting research in a school environment with young people.

This research investigates capturing data from a virtual learning environment, in which learners perform a problem-solving activity mediated through an avatar in a 3D scene, by adding instrumentation to the environment through multiple vectors. Depending on the configuration and deployment of the virtual environment, researchers may be able to access data from one or more of the following: computer, client, server or simulation capture.

These will be compared against traditional methods to evaluate how they can inform pedagogical research and activity design, and the extent to which the virtual learning environment case can be used as a reference model for understanding learning in other domains.

Huidong Bai: Natural Feature Tracking and Gesture-based Interaction for Mobile Augmented Reality
Augmented Reality (AR) is a technology that involves the seamless overlay of virtual images on the real world, and it has huge potential in providing intuitive information and direct assistance for our daily life. With frequent hardware and software upgrades, current mobile devices can provide powerful capacity for embedded computing, and have already become feasible and effective platforms for AR research. However, mobile AR development is still confronted with many tough challenges, especially in markerless tracking and natural interaction.

The aim of this research is to investigate, develop and evaluate mobile AR tracking and interaction on current mobile devices. We have developed a natural feature tracking system based on "Binary robust invariant scalable keypoints" (BRISK) on Android phones with extra optimization. We also investigated gesture-based interaction

methodologies to offer an alternative to traditional touch-screen interaction for mobile AR, and conducted related user studies.

Philip Buchanan: Modifying the Visual Style and Dimensionality of Images
This presentation showcases work into artistic style transformation and replication. The research focuses on methods that can be used to classify the visual style of objects, and methods that can be used to change the style or transfer it between images. Recent work includes the papers "Transferring Characteristic Proportions to Modify the Artistic Style of Cartoons" and "Structural Vectorization of Raster Images", and the current focus is on the conversion of single-view 2D concept artwork into corresponding 3D models.

Kapila Pahalawatta: Histogram Maximum Value Index Based Nano-scale Particle Classification
In the current study, two proposed histogram maximum value index (MVI) based classification methods are introduced and compared for classifying five different sized airborne nano-scale particles. Method-I uses the histogram MVIs of separate single channelled (red, green and blue) images and MVIs of 4-dimensional complete RGB colour histograms are used by the method-II. Taking into account the selective colour scattering behaviour of the Rayleigh scattering phenomenon, red, green and blue intensities of the scattered light of a continuous spectrum of light by the particles are investigated using the colour histograms of captured video images. Running mode and running mean of histogram MVI over a window of fixed number of frames (N) are used to construct the feature vectors for particle discrimination. Both methods failed to classify wood smoke correctly due to its complex composition of many types of monotype particles. However, method-II classified all the monotype smoke particles correctly with 100% accuracy when $N \geq 90$ and the number of histogram bins=256x256x256. Method-I was faster and also achieved the same accuracy when $N \geq 100$ and the number of bins in each red, green and blue histograms = 256.

Thammathip Piumsomboon: Toward a standard gesture set in Augmented Reality
Augmented Reality (AR) is a technology that overlays virtual content, such as computer graphics, on to the real world in real-time, allowing users to explore and interact with the virtual data as if it were part of the real world.

Despite over four decades of research into AR no standard method of input has been agreed upon - much of the effort being spent on enabling technologies or prototype applications. Recently, new techniques have been introduced to allow hand gestures to perform physically based manipulation on the virtual objects; however hand usage is still limited to simple interaction.

Our research seeks to understand the potential and limits of gestures as a single input modality by developing high degree-of-freedom (DOF) hand pose estimation for gesture recognition. By employing guessability study methodology, which shows the effects of the gestures and elicits responses from the participants, we plan to establish gesture vocabulary which will become standard within the field of AR.

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More than 2300 staff works for the Council across 60 locations around the city and Banks Peninsula. These include professional and administrative positions in core infrastructural areas such as water, waste, roading and parks; as well as jobs within the Council's broader activities including its library network, art gallery and recreation facilities.
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.
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Clarus founder, Edwin Dando, was appointed by one of the founders of Agile, Ken Schwaber, to champion Scrum in New Zealand. To do this he has assembled a team of experts to deliver best-practice Agile contracting, consulting and training to the New Zealand market. Clarus has also developed its own Scrum training programme – 2+2+2 – which consistently achieves performance gains for development teams of between 100 – 800%. A long-time supporter of Canterbury University, Clarus is open to mentoring and supporting the development of its graduates. To talk more contact Pru on pru.harwood@clarus.co.nz or visit www.clarus.co.nz.

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