

Contents

	Page
Staff Profile	2
IPOM	5
Algorithms & Strings	7
Artificial Machine Intelligence	11
Computer Graphics	31
Database Systems	34
Network & Communication	39
Parallel & Distributed Computing	47
Software Engineering	53

Staff Profile

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 Interests: String matching, algorithms, combinatorics.

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Intelligent Process Operations Management

Software for the Process Industry

Curtin's School of Computing and Murdoch University's School of Engineering have been jointly funded to establish the Centre for Intelligent Process Operations Management (iPOM) to develop software for process industries, including the minerals industry. iPOM is conducting high-quality research in the inter-disciplinary area of intelligent process operations management which tackles the complex task of maintaining safe and economic operation of various interlinked sub-processes in the minerals industry.

iPOM's collaborators include the Gensym Corporation, Western Power and Alcoa of Australia Limited and BP Kwinana.

The Centre results in the marriage of two disciplines, computing and process control. The partners come from Curtin University of Technology and Murdoch University respectively. Together they combine the skills necessary to resolve a well-recognised high-level industrial control problem that has evaded solution. Once the major problem, making sense and assigning cause to variations in plant data has been cracked, an array of dependent problems will be capable of solution and refinement.

The Centre is devoted to applied research. The products and services arising from the work of the Centre will be channelled for commercialization through a variety of mechanisms.

Focus

Through existing industry collaboration, the focus of iPOM is in **intelligent alarm management**. This area offers the potential to capture significant economic benefit for the process industries. This research involves developing intelligent alarm management tools for providing the following capabilities:

- Analysis and presentation of alarm data.
- Minimisation of the number of nuisance, standing or repeating alarms (repeating alarms account for 50% of alarms).
- Prioritisation of control problems and aid process operators in carrying out the remedial actions.

Staff of the Centre

Directors

- Professor Peter Lee – Process Operations
- Professor Svetha Venkatesh – Pattern Recognition

Senior Project Staff

- Dr Peng Lam – Project Leader, Pattern Recognition
- Professor Geoff West – Pattern Recognition
- Dr S Shastri – Process Operations

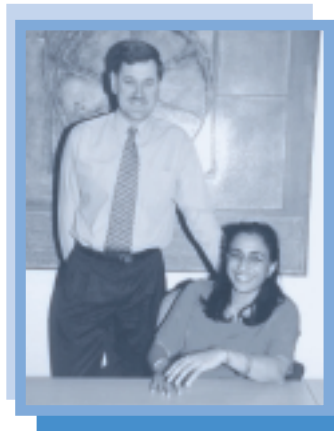
Project Staff:

- James Ko – Research Officer
- Kheng Teo – Research Officer

Funding: ARC Large grant 2001-2003 \$1,033,671



"The Team"



Co-Directors:
Professor Peter Lee
Professor Svetha Venkatesh



The Directors and Senior Researchers:
Professor Geoff West
Dr Peng Lam

We are developing new techniques and algorithms that we expect will have a major impact on these areas over the next several years. The algorithm that achieves this has potential application both to data compression and computational biology.

In 2002 we will publish a series of papers that show how to compute repeating substrings with time and space efficiency, greatly improved over existing methods.

We expect these new algorithms to be particularly useful for data compression, an area to which we have already started to contribute. Also in 2002 we will be submitting another series of papers that describe properties of a new class of strings whose repetitions can be computed in linear time.

In 2001 we published the very surprising result that the "quasiperiods" of a string could be computed as quickly as its periods.

● Members

Prof C Iliopoulos
Dr M Kumar
Prof W F Smyth
Dr A Turpin



Current Research Projects

Algorithms for String Processing

Prof C S Iliopoulos and Prof W F Smyth

This research has focused on identifying various kinds of patterns, especially various kinds of 'approximate periodicity' in strings; much of it turns out to bear directly on problems that arise in computational biology.

A string is a concatenation of elements, called letters, drawn from an identified set, called the alphabet. The letters can be ordered or not, and the alphabet can be finite or not. In biological applications, the DNA alphabet $A = \{c,g,a,t\}$ of cardinality 4 and the protein alphabet of cardinality 20 are most common: $z = \text{ccgattcgacgat}$ is an example of a string on A . Properties of strings have been studied by mathematicians throughout the 20th century, but it was only with the advent of computer science as a discipline that attention shifted to algorithms on strings. The initial focus of these algorithms was the location of fixed patterns in strings; for example, of cgat or tcg in the DNA string z given above. The most notable such 'pattern-matching' algorithms have given rise to dozens of descendant/hybrid algorithms over the last 20 years. These algorithms, modified to accommodate 'don't-care' letters, continue to have application to DNA/protein problems.

In the 1980s however, in response to requirements arising out of a variety of applications, interest arose in algorithms for finding repetitions in strings; that is, equal adjacent substrings such as cc or cgacga in z . Three optimally efficient algorithms were discovered in short order. This success, together with the fact that in practice it was often desirable to relax the meaning of 'repetition', has led more recently to the study of a collection of related patterns ('weak repetitions', 'covers', 'seeds') which we say exhibit approximate periodicity. Of particular importance is the idea of a cover: a set U of strings is said to cover a given string x if and only if every position in x is included in an instance of some string of U . Much of the investigators' recent work has focused on approximate periodicity and algorithms to identify it. There has also been substantial work done on issues arising out of these algorithms: on the computation of 'distinct' strings and on Sturmian strings which constitute worst cases for almost all of the algorithms.

Compute All Repetitions

Assoc Prof C S Iliopoulos and Prof W F Smyth

Building on previous work done in this area, team members have devised a new algorithm that will for the first time permit all the "nonextendible" repeating substrings of a given string to be computed efficiently. Furthermore, these repetitions can be presented in space that is linear in string length. This is a major breakthrough in an area that has been heavily researched for 20 years.

Data Compression Algorithms

Assoc Prof C S Iliopoulos, Prof W F Smyth, Dr A Turpin

As an immediate consequence of being able to efficiently compute all the repetitions in a string, it becomes possible to design data compression schemes that take account of global patterns in a long string rather than just local ones. This should lead to substantial improvement on current data compression techniques such as Ziv-Lempel and its variants, and offline data compression algorithms.

Analysis of Musical Texts

Assoc Prof C S Iliopoulos, Prof S Venkatesh and Dr M Kumar

Work done on string covering problems has immediate application to this important interdisciplinary area: in future, it will be possible to establish musical databases in such a way that repeated motifs can be located efficiently, both within a given score and over many scores.

Linear-Time Reporting of Repetitions

Assoc Prof R J Simpson and Prof W F Smyth

Using insights gained from previous work done by the team members on special strings, techniques are being developed that are expected to permit linear-time reporting of repetitions. This will have immediate application both to computational biology and data compression.

String Complexity

Prof C S Iliopoulos, Assoc Prof R J Simpson and Prof W F Smyth

This fundamental theoretical work arises out of previous work done by team members: it has become clear that for strings of low complexity, the repetitions can be computed in linear time, even though such strings generally contain large numbers of repetitions. The apparent paradox is resolved by the device of computing "runs" rather than repetitions. In 2001 three papers were written that introduced a new class of strings called "two-pattern" strings, and that show how to compute the runs in such strings in linear time. Further work in this area will be submitted for publication in 2002.

Algorithms for Human Vision Testing

Dr A Turpin

A fast and reliable visual field testing algorithm is a vital tool for ophthalmologists in diagnosing eye diseases such as glaucoma. This project explores the application of standard searching and search-with-errors algorithms to visual field threshold determination.

This project also includes work on a fast, automated, visual acuity testing algorithm, which is supported by the JAEB Center for Health Research, Tampa, Florida.

Publications

Journal Articles

Sim, S., **Iliopoulos, C.S.**, Park, K. and **Smyth, W.F.** (2001)
Approximate periods of strings. *Theoretical Computer Science*, 262, pp 557-568.

Turpin, A., McKendrick, A., Johnson, C. and Vingrys, A. (In Press)
Development of efficient threshold strategies for frequency doubling technology perimetry using computer simulation. *Journal of Investigative Ophthalmology & Visual Science*.

Yin, L. and **Smyth, W.F.** (In Press)
Computing the cover array in linear time. *Algorithmica*.

Franek, F., Gao, S., Lu, W., Ryan, P.J., **Smyth, W.F.**, Sun, Y., and Yang, L. (In Press)
Verifying a border array in linear time. *Journal of Combinatorial Math.and Combinatorial Computing*.

Conference Proceedings

Franek, F., Lu, W., and **Smyth, W.F.** (2001)
Repetitions in Two-Pattern Strings, Proc. Fifth World Multiconference on Systemics, Cybernetics & Informatics, Volume VII. pp132-135.

Turpin, A. and **Smyth, W.F.** (In Press)
An approach to phrase selection for offline data compression. Proc. 25th Australasian Computer Science Conference, Melbourne, Australia, January 2002.

Iliopoulos, C., Kumar, M., Mouchard, L. and Venkatesh, S. (2000)
Motif Evolution in Polyphonic Musical Sequences. 11th Australasian Workshop on Combinatorial Algorithms, Newcastle, Australia, pp 53-66.

Turpin, A. and **Smyth, W.** (In Press)
An approach to phrase selection for offline data compression. Australasian Computer Science Conference (ACSC), Melbourne, Australia.

Seminars & Invited Talks

Professional

Dr A Turpin
Co-editor of a special issue of the *Journal of Discrete Algorithms* (2001).

Editor of special issue of *Fundamenta Informaticae* (to appear 2002).

Travel

Dr A Turpin
JAEB Center for Health Research, Tampa, Florida, USA.

The artificial and machine intelligence group have well focused areas of research involving theoretical and practical aspects. The main focus is on techniques for multi-dimensional data analysis including video, sound, 3D intensity and range data, and complex spatial patterns.

The main focus is on techniques for multi-dimensional data analysis including video, sound, 3D intensity and range data, and complex spatial patterns.

Much of this work is in the areas of large scale pattern recognition and machine learning for image and video interpretation and query systems.

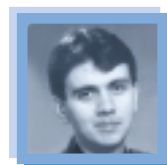
pattern recognition and machine learning

The work is mainly funded by the state and federal governments (ARC, CSIRO, DSTO) and industrial sources. Sponsorship from all these sources has increased in value and a future objective is to attract more industrial contracts.

Sponsorship from all these sources has increased in value and a future objective is to attract more industrial contracts.

● Members

Prof S Venkatesh
 Prof G West
 Dr M Robey
 Dr H H Bui
 Dr J Ivins
 Dr S Greenhill
 Dr M Lazarescu
 Dr W Q Liu



Current Research Projects

Verification and Feature Performance

Prof G West

Object recognition can be regarded as consisting of two stages: indexing and verification. Indexing analyses features and produces one or more hypotheses about the objects. Verification tests each of these hypotheses reducing the number to ideally one. This project is concerned with analysing the usefulness of different features for verification using different match metrics. A major goal is to develop objective measures that can be used to design recognition systems.

Detecting and Analysing Patterns of Human Behaviour from Image Sequences

Prof S Venkatesh, Prof G West and Dr R Hosie (Harvest Road)

There is a desire in surveillance of public and private areas for systems to trigger alarms when something unusual occurs such as a medical emergency, robbery etc. We have implemented a flexible system that can classify a set of movements exhibited by pairs and groups of targets. By characterising and learning a small set of simple general movements between pairs of targets, we characterize complex movements in terms of sequences of these primitive behaviours. The benefit of the system is that a small set of symbols and rules can be used to detect complex behaviour over different time periods and numbers of people.

Content Based Image Retrieval

Prof S Venkatesh, Miss H Raman,
Dr K Shearer and Dr Peng Lam (Murdoch University)

This project looks at the issues of image retrieval from image databases. We address the problem by answering the question "Find me an image that looks like these ones". In the first stage the system analyses the aspects of similarity in the given image and then uses these aspects for retrieval from the database.

Negotiating Between Intelligent Agents

Prof S Venkatesh, Dr D Kieronska, and Dr H Bui

This project examines the issues that are central to negotiation between software agents. The project aims to devise formalisms and appropriate algorithms for software agents to resolve conflicts co-operatively when trying to achieve common goals.

Funding: Overseas Postgraduate Research Scholarship

Video Indexing and Retrieval

Prof S Venkatesh, Dr K Shearer, and Prof H Bunke (University of Berne)

This project examines two aspects of multimedia indexing and retrieval: The development of video indices based on spatial relations between objects. The system develops algorithms for query and retrieval of single frames or multiple frames from video sequences. Application areas include development of adaptive video re-sequencing.

We develop graph based algorithms for efficient query of video data based on the above representation. We develop efficient algorithms for graph and sub-graph isomorphism, and largest subgraph isomorphism detection and demonstrate their use for video indexing and retrieval. We extend the work to develop algorithms for resolution of a sequence of incrementally changing iconic queries against a known database of model graphs.

Funding: Partial Funding from Large ARC: 1996 - 1998

Narration Based Video Indexing

Prof S Venkatesh, Dr K Shearer, and Dr M Lazarescu

In this project, we investigate techniques to index and query video combining information from natural language (such as scripts and commentary), audio and video interpretation. The following projects are being investigated: American football, in which plays can be automatically queried and classified, based on an analysis of the commentary and video.

Documentaries with accompanying scripts in which we are seeking robust methods for automatically indexing the video. For example, we show how a shot list can be analysed to provide a simple summary of " who and where" of a documentary or interview video.

Funding: Large ARC: 1996-1998 \$120,000

Generating CAD Descriptions from Range Data

Prof G West, Dr M Robey, Dr J Ivins, Mr A Loh, and Mr K Ijimo

This large project is concerned with the building of CAD models (either CSG trees or Breps) from range and intensity data. Currently range data is segmented into features (surface patches) using a number of techniques and then into 3D features. Issues include how to segment the range data (curvature, covariance, model fitting) and the use of intensity and other data sources to clean up the results and remove ambiguities.

Funding: Large ARC: 1998-2000 \$167,000

Intelligent Inspection by Autonomous Programs Ensemble (APE)

Prof G West, Prof S Venkatesh and Dr M Takatsuka

The inspection task, which checks local and global validity between a blueprint and the corresponding sensed data, can have at least three types of tasks. The first task is to interpret the blueprint and find the corresponding sensed data.

The second task is to analyze sensed data and find the corresponding blueprints. The last task is to find both blueprints and sensed data from the generic description of them - such as symbolic representation of objects. The main aim of this project is to develop an intelligent inspection system, which can handle those three different inspection tasks, using distributed artificial intelligence technology and machine learning.

Funding: Large ARC 1997-1999 \$156,000

Actions and Events in Dynamic Environments: Flight Mission Modelling

Prof T Caelli, Dr A R Pearce and Dr S Goss (Aeronautical and Maritime Research Laboratories, DSTO)

This project involves the interpretation of actions and events in dynamic domains. This includes the recognition and description of aeroplane manoeuvres and pilot intentionality in agent-oriented flight mission modelling. One of the aims of this work is to bind descriptions to the spatio-temporal "trajectories" present in time-series output. In particular, the support of relational queries for agent-oriented procedural reasoning systems, this includes the belief, desires and intentionality (BDI) planning model. The approach involves supporting queries, automatic descriptions and or predictions from spatio-temporal action sequences those of states and their continuous valued, attributed relationships (the scenery) and actions (the scenario). For example in describing flight, an approach to land manoeuvre is defined by the subsequence of different roll-pitch yaw states of the aeroplane and different actions on the control yoke. Relational learning techniques such as decision trees and inductive logic programming are utilised and adapted to the constraints present in time series data. A relational evidence framework and dynamic programming are used to achieve realtime interpretation.

Funding: Aeronautical and Maritime Research Laboratories, DSTO (\$100,000: 1997-1998)

Spatio-temporal Pattern Retrieval from Large Databases

Prof S Venkatesh, Dr A Pearce and Dr L Narasimhan (DSTO partners: Information Technology Division)

This project is in conjunction with the Information Technology Division of DSTO (Defence Science & Technology Organisation). It seeks to retrieve patterns of interest from a database of spatio-temporal patterns, and develop classification procedures for spatio-temporal patterns, enabling the development of efficient tools for threat indicators and situation assessment.

The project seeks to develop methodologies for multimedia processing with particular emphasis on video and image processing from large databases with temporal attributes.

Funding: 1998-1999 \$40,000 (DSTO) \$40,000 (Curtin)

Development of a Situation Assessment Tool for Submarines

Prof S Venkatesh, Dr A Pearce and Dr S Greenhill

This project is in conjunction with the Maritime Operations Division (MOD) of DSTO (Defence Science and Technology Organisation) and seeks to develop a system that can recognise situations experienced in submarine domain, develop a situation assessment processor to recognise a situation in tactical simulation and generate a description in human readable form. It will develop a language to describe spatio-temporal situations in a submarine domain, develop a situation assessment processor to recognise a situation in tactical simulation and generate a description in human readable form. Graphical tools for describing the situation using the formal specifications will also be developed.

Funding: DSTO 1998-2001 \$200,000

The Balanced Realization and Identification Techniques for Singular Systems and their Applications

(Dr W Q Liu)

In this five year project, two important issues for singular systems will be tackled: Balanced Realization and Identification. Many important problems will be investigated around these two issues, such as balanced realization algorithms, model reduction issue, characterization of impulsive outputs and initial jumps. Several new concepts will be proposed and some existing gaps in the study of singular systems will be filled.

Funding: ARC 1999-2004 \$260,000

A Unified Approach to Singular Systems Control Design

(Dr W Q Liu)

This project is intended to characterize singular systems from the information point of view and this will put many control problems into one framework structure. Also the impulsive feature will be given new interpretations in this structure.

Funding: ARC 2000 \$14,000

Human Vision Meets Machine Vision for Real-World Object and Pattern Recognition

Prof I Rentschler, Dr M Juttner, Dr A Pearce and Mr E Osman

This project involves modelling human object recognition and investigating the significance of different kinds of representations used. The present discussion about the quality of mental representations of spatial objects is mainly determined by two positions. The assumption of an object-centred three-dimensional (3D) representation on the one hand, versus the model of viewer-centred representation in the form of multiple two-dimensional (2D) views on the other. On a simple object recognition task the dependency of learning time and ability for spatial generalisation of human observers on previous knowledge is investigated. The subjects are trained using a supervised learning paradigm and different degrees and types of previous knowledge used. The performance of human subjects is modelled using machine learning methods. Especially useful is a recognition by parts technique, used for machine matching, which combines graph matching methods with relational evidence theory. Use of a matching algorithm, CLARET, allows the investigation of the importance of relationships and features used in building prototypic descriptions of objects. It provides a computational model, which allows for detailed analysis and predictions. Applications include clinical diagnosis of visual perception disturbances and modelling brain function.

Funding: German Research Council (DFG) 1998-1999.

Layered Dynamic Probabilistic Networks for Spatio-temporal Modelling

Prof S Venkatesh, Prof G West and Dr H H Bui

In applications such as tracking and surveillance in a large spatial environment, there is a need for representing dynamic and noisy data and at the same time dealing with them at different levels of detail. In the spatial domain, there has been work dealing with these two issues separately, however, there is no existing common framework for dealing with both of them. We propose a new representation framework called Layered Dynamic Probabilistic Network (LDPN), a special type of Dynamic Probabilistic Network (DPN) capable of handling uncertainty and representing spatial data at various levels of detail. The framework is thus particularly suited to applications in wide-area environments, which are characterised by large region size, complex spatial layered multiple sensors/cameras. To avoid the problem of a relatively large state space associated with a large spatial environment the LDPN explicitly encodes the hierarchy of connected spatial locations, making it scalable to the size of the environment being modelled. There are three main advantages of the LDPN: the reduction in state space makes it suitable for dealing with wide area surveillance involving multiple sensors. Second, it offers a hierarchy of intervals for indexing temporal data, a feature that is not present in other Bayesian representations. Lastly, the explicate representation of intermediate sub-goals allows for the extension of the framework to easily represent group interactions by allowing coupling between sub-goal layers of different individuals or objects. We describe an adaption of the likelihood sampling inference scheme for the LDPN, and illustrate its use in a surveillance scenario.

Funding: Large ARC 1998-2000 \$180,000

Semantic compression: Using Accelerometers to Recognise Complex Human Gestures for Video Annotation and Event Detection

Prof S Venkatesh, Prof G West, Dr H Bui, Dr S Smith

The latest developments in video-on-demand and the desire for customised content delivery has unearthed the new issue of semantic compression that seeks to label video with events about objects and scene content. We aim to use accelerometers worn by sports officials to augment video annotation and interpret the signals such that the video broadcast can be annotated by timestamped officials' gestures. The significance lies in the use of non-visual sensors in a novel probabilistic framework required to detect the rich and complex gestures to detect the sport highlights. Outcomes and deliverables will be methods, software tools and techniques to annotate non-visual sensors.

Funding: Large ARC 2001-2003 \$167,000

The Inverse Spielberg Problem: Extracting Elements of Visual Grammar from Video for Synthesis, Training, and Retrieval Applications

Prof S Venkatesh, Dr C Dorai (IBM T J Watson Research Center), B Adams, B Truong, and S Moncrieff.

This project will develop a computational scheme to analyse and understand the grammar that underlies the film language. It aims to discover the cinematic elements of visual presentation from the basic elements of visual grammar namely, the shot, the movement, the recording distances, and the rules of combination that are commonly followed during the visual narration of a story. In particular we aim to identify and extract computable features from video sequences that will identify aspects of film techniques such as camera work, lighting, sound recording, editing, and the use of iconography. Further, we aim to learn patterns and rules of associations in primitive and higher order features with the primary aim of data-mining for film "idioms."

Funding: Large ARC 2000-2002 \$173,700

Layered Dynamic Probabilistic Networks for Co-ordination of Multiple Sensors

Prof S Venkatesh, Prof G West, Mr Nam, Mr M Petrovsky and Dr H Bui

We will investigate techniques to co-ordinate multiple cheap cameras to deal with complex spatial temporal scenarios in wide-area scenes such as for surveillance and outdoor broadcasting. The main issues we address are: Representation of the domain knowledge, i.e. actions and interactions of a group of tracked objects (people in this case). In particular, the representation must encode the inherent spatio-temporal characteristics of the domain, deal with uncertainties of noisy observations and represent coupling of goals and sub-goals to allow for recognition of multi-object actions.

Co-ordination of multiple cameras: each has limited resources, and the problem is for each camera to decide the best course of action (which objects it should track), so that the overall objective of tracking all objects reliably is best satisfied. Recognition of complex multi-object actions: that is, to be able to interpret group behaviour where a group consists of more than one interacting object.

This long term project is concerned with investigating multi-camera computer-based surveillance techniques for wide area scenes such as buildings. It uses the latest technology in image compressing, image processing and computer vision to build low-cost solutions using PCs, cheap cameras and the Linux operating system.

Funding: CISS

Journal Articles

Ivins, J., Porrill, J., and Frisby, J. (1999)

Instability of torsion during smooth asymmetric vergence, *Vision Research: Vol 39*, pp 993–1009.

Ivins, J., Porrill, J., Frisby, J., and Orban, G. (1999)

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- Shearer, K., **Venkatesh, S.** and Bunke, H. (2001)
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- Lam, P., **West, G.**, and **Venkatesh, S.**, (2001)
Obtaining functional parametric models using active vision strategies, *Journal of Pattern Recognition*, Vol 34, No 1, pp 79-94.
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- Wang, G., Sreeram, V. and **Liu, W. Q.** (In Press)
Balanced performance preserving controller reduction, *IEEE on Automatic Control*.
- Liu, W. Q.**, Dong, Z., Zhang, C. and Hill, D. (In Press)
Minimum order stable recursive filter design via genetic algorithm approach, *International Journal of System Science*.
- Bui, H., Venkatesh S. and West, G.** (In Press)
Policy recognition in the abstract hidden Markov model, *Journal of Artificial Intelligence Research*.
- Loh, A, Robey, M. and West, G.** (In Press)
Analysis of the interaction between edge and line finding techniques. *Pattern Recognition*.
- Takasuka, M., **West, G., Venkatesh, S.** & Caelli, T. (In Press)
Low cost interactive active monocular range finder, *Journal of Machine Vision and Applications*.

Conference Proceedings

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Shearer, K. and **Venkatesh, S.** (1999)

Detection of setting and subject information in documentary video, International Conference on Multimedia Computing and Systems, Florence, Italy, pp 797-801.

Lazarescu, M. and Venkatesh, S. (1999)

Applications of Machine learning to dynamic scene analysis. Digital Image Computing, Techniques and Applications, Perth, Australia, pp 57-62.

Shearer, K., Bunke, H. and **Venkatesh, S.** (1999)

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Lazarescu, M., Venkatesh, S. and West, G.,(1999)

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Shearer, K. and **Venkatesh, S.** (1999)

Detection of setting and subject information in documentary video, International Conference on Multimedia Computing and Systems, Florence, Italy, pp 797-801.

Lazarescu, M., Venkatesh, S., West, G. and Caelli, T. (1999)

Applications of machine learning to dynamic scene analysis, Digital Image Computing, Techniques and Applications, Perth, Australia, pp 57-62.

Shearer, K., **Venkatesh, S.** and Dorai, C. (1999)

Automatic isolation of speech in news footage for audio event detection, Digital Image Computing, Techniques and Applications, Perth, Australia, pp 78-83.

Keith-Magee, R., **Venkatesh, S.** and Takatsuka, M. (1999)

The importance of neighbourhood size in self organising systems, 6th International Conference on Neural Information Processing, Perth, Australia, pp 267-272.

Keith-Magee, R., **Venkatesh, S.** and Takatsuka, M. (1999)

Beyond the topological map: developing alternate mappings in self organisation, Digital Image Computing, Techniques and Applications, Perth, Australia, pp 88-93.

Takatsuka, M., Caelli, T., **West, G.** and **Venkatesh, S.** (1999)

Schematics and 3D object interpretation using symbolic representation and distributed matching strategies, Third International Workshop on Graphics Recognition, Jaipur, India, pp 293-306.

Lazarescu, M., Venkatesh, S. and West, G. (1999)

Classifying and learning cricket shots using camera motion, AI'99, Sydney, Australia, pp 13-22.

Keith-Magee, R., **Venkatesh, S.** and Takatsuka, M. (1999)

An empirical study of neighbourhood decay in Kohonen's self organising map, International Joint Conference on Neural networks, Washington, USA.

Takatsuka, M., Caelli, T., **West, G.** and **Venkatesh, S.** (1999)

Symbolic representation and distributed matching strategies for schematics, 5th International Conference on Document Analysis and Recognition, Bangalore, India, pp 693-696.

Takatsuka, M., **West, G., Venkatesh, S.** and Caelli, T. (1999)

Low cost interactive active monocular range finder, CVPR, 99, Fort Collins, Colorado, USA, Vol 1.

Lim, F., Lam, P. and **Venkatesh, S.** (1999)

Determining object function based on its motion, International conference on Computational Intelligence for Modelling, Control and Automation, Vienna, pp 54-59.

Lam, P., **West, G.** and **Venkatesh, S.** (1999)

Obtaining the functional parametric models using active vision strategies, International Conference on Visual Information: VI'99, Quebec, Canada, pp 344-351.

Rolfe, B., Cardew-Hall, M., Abdullah, S. and **West, G.** (1999)

Identification of a model which relates variations in shape geometry to discrete process variables in shape forging, IPMM-99, Hawaii, USA, pp 1017-1072.

Von Dietze, E. and **West, G.** (1999)

Virtual advertising: An ethical perspective, 1st Australian Institute of Computer Ethics Conference: AICEC99, Melbourne, Australia, pp 399-414.

Ivins, J., Robey, M. and West, G. (1999)

Describing objects and parts for classification and segmentation by induction, Digital Image Computing: Techniques and Applications-DICTA'99, Perth, Australia, pp 122-126.

Ivins, J., Robey, M. and West, G. (1999)

An interactive surface model for segmenting triangle-based 3-D data, Conference on Image and Vision Computing: IVCNZ'99, Christchurch, New Zealand, pp 37-42.

Loh, A., **Robey, M. and West, G.** (1999)

Incremental FOSART, Conference on Image and Vision Computing: IVCNZ'99, Christchurch, New Zealand, pp 241-246.

West, G. and Clay, C. (1999)

The use of store and forward technology for tele-dermatology, The ARC Special Research Workshop on Aspects of Telemedicine, Gold Coast, Australia, pp 9.

Gang, Z., Qinging, Z., Haiying, J. and **Liu, W.Q.** (2000)

Generalized Lyapunov equations for stable singular system, IEEE Conference on Decision and Control, Sydney, Australia.

Chen, Y. P., Zhang, Q. and **Liu, W. Q.** (2000)

Fault-Tolerant Control About Integrity for Descriptor Systems, IEEE Conference on Decision and Control held in Sydney, Australia.

An, S., J., Hu, X., Vucetic, B. and **Liu, W. Q.** (2000)
Results for parametric shifted H-infinity performance of weighted interval plants, IEEE Conference on Decision and Control, Sydney, Australia.

Liu, W. Q. and Sreeram, V. (2000)
Model reduction for singular systems, IEEE Conference on Decision and Control held in Sydney, Australia.

Gao, F. and **Liu, W. Q.** (2000)
Nonlinear feedback control on Lorenz chaotic systems, Asian Control Conference, Shanghai, China.

Lazarescu, M. and **Venkatesh, S.** (2000)
On the recognition of American Football formations from images, IEEE Pacific Rim Conference on Multimedia, Sydney, Australia, pp 261-264.

Tassone, E, **West, G.**, and **Venkatesh, S.** (2000)
Determining motion components using point distribution model, 3rd International Conference on Multimodal Interfaces, Beijing, China, pp 363-370.

Adams, B., Dorai, C., and **Venkatesh, S.** (2000)
Study of shot length and motion as contributing factors to movie tempo, ACM Multimedia. Los Angeles, pp 353-355.

Adams, B., Dorai, C., and **Venkatesh, S.** (2000)(**Best Paper Award**)
Role of Shot length in characterising tempo and dramatic story sections in motion pictures, IEEE Pacific Rim Conference on Multimedia, Sydney , Australia, pp 54-57.

Truong, B., Dorai, C., and **Venkatesh, S.** (2000)
New enhancements to cut, fade and dissolve detection process. ACM Multimedia, Los Angeles, pp219-227.

Truong,B., Dorai, C. , and **Venkatesh, S.** (2000)
Automatic genre identification for content based video, International Conference on Pattern Recognition, Barcelona, Spain, pp 230-233.

Lazarescu, M., Bunke, H. and **Venkatesh, S.** (2000)
Graph Matching: Fast candidate elimination using machine learning techniques, International Workshop on Syntactic and Structural Pattern Recognition, Alicante, Spain, pp 236-245.

Adams, B., Dorai, C., and **Venkatesh, S.** (2000)
Novel approach to detecting movie tempo and dramatic story sections in motion pictures, International Conference on Image Processing, Vancouver, Canada, pp 283-286.

Truong, B., Dorai, C. , **Venkatesh, S.** (2000)
Improved fade and dissolve detection, International Conference on Image Processing, Vancouver, Canada, pp 961-964.

Bui, H., Venkatesh, S. and **West, G.** (2000)
On the recognition of abstract Markov policies, 17th National Conference on Artificial Intelligence, AAAI 2000, Austin, Texas, pp 524-530.

Adams, B., Dorai, C. and **Venkatesh, S.** (2000)
Towards automatic extraction of expressive elements from motion pictures: Tempo, IEEE International Conference on Multimedia and Expo, New York, USA.

Bui, H., Venkatesh, S. and **West, G.** (2000)
A probabilistic framework for tracking in wide area environments, International Conference on Pattern Recognition, Barcelona, Spain, pp 720-705.

Lazarescu, M., Venkatesh, S. and West, G. (2000)

On the incremental learning and recognition of the pattern of movement of multiple labelled objects in dynamic scenes, International Conference on Pattern Recognition, Barcelona, Spain, pp 652-655.

Chambers, G., and **West, G.** (2000)

Segmentation of video sequences using principles of perceptual organization, APRS/IEEE Workshop on Stereo Image and Video Processing (WSIVP), Sydney, pp 15-18.

West, G. and Tassone, E., (2000)

Assessing different features for pose refinement, International Conference on Pattern Recognition: ICPR'2000, Barcelona, Spain, pp 687-690.

Loh, A., **Robey, M.** and **West, G.** (2000)

IFOSART: A noise resistant neural network capable of incremental learning, International Conference on Pattern Recognition: ICPR'2000. Barcelona, Spain, pp 989-992.

Moncrieff, S., Dorai, C. and **Venkatesh, S.** (2001)

Analysis of environmental sounds as indexical signs in film, IEEE Pacific Rim Conference on Multimedia, Beijing, China.

Moncrieff, S., Dorai, C., and **Venkatesh, S.** (2001)

Affect computing in film through sound energy dynamics, ACM Multimedia Conference, Ottawa, Canada, pp 525-527.

Dorai, C. and **Venkatesh, S.** (2001)

Bridging the semantic gap in content management: Computational media aesthetics, COSIGN 2001, Conference on Computational Semiotics for Games and New Media, Amsterdam, pp 94-100.

Iverach, R., West, G., and Cox, S. (2001)

Extracting edges from an edge encoded quadtree, IASTED Int. Conference on Signal Processing, Pattern Recognition and Applications, SPPRA, Rhodes, Greece, pp 138-142.

Lazarescu, M., Venkatesh, S. and Bui, H. (2001)

An application of concept drift tracking to average frame interpretation, Conference on Artificial Intelligence and Applications, Marbella, Spain.

Lazarescu, M., Venkatesh, S. and Bui, H. (2001)

Tracking concept drift robustly, Conference on Applied Informatics, Innsbruck, Austria, pp 38-43.

Moncrieff, S., Dorai, C., and **Venkatesh, S.** (2001)

Detecting indexical signs in the film audio for scene interpretation, International Conference on Multimedia and Expo, Tokyo, Japan, pp 1192-1195.

Adams, B., Dorai, C., and **Venkatesh, S.** (2001)

Towards automated film rhythm extraction, International Conference on Multimedia and Expo, Tokyo, Japan, pp 1056-1059.

Truong, B., Dorai, C., and **Venkatesh, S.** (2001)

Determining dramatic intensification via flashing lights in movies, ACM Multimedia, International Conference on Multimedia and Expo, Tokyo, Japan, pp 61-64.

Tuah, N., Kumar, M. and **Venkatesh, S.** (2001)

Effect of speculative prefetching on network load in distributed systems, International Parallel and Distributed Processing Symposium, San Francisco, USA.

Seminars & Invited Talks

Presentations

Prof S Venkatesh

"Bridging the semantic gap in content management", Computational Media Aesthetics, COSIGN 2001, Computational Semiotics for Games and New Media, Amsterdam.

"Towards automated film rhythm extraction", International Conference on Multimedia and Expo, Tokyo.

"Affect computing in film through sound energy dynamics", ACM Multimedia, Ottawa, Canada.

Invited Talks

Prof S Venkatesh

The Inverse Spielberg Problem, Mitusubishi Electric Research Labs, New Jersey, USA.

The Inverse Spielberg Problem: Extracting elements of visual grammar, University of Texas, Arlington, USA, Arizona State University, Phoenix, USA, National University of Singapore, Singapore, Nanyang Technological University, Singapore.

Finding the Beat: extracting visual rhythm, Arizona State University, Phoenix, USA.

Conferences Chaired/Co-chaired

Prof S Venkatesh

Program Committee Second IEEE Pacific-Rim Conference on Multimedia, Beijing, 2001.

Program Committee Image and Vision Computing New Zealand, Dunedin, 2001.

Professional

Prof G West

Member of Editorial Board: Image and Vision Computing.

Prof S Venkatesh

Member of Program Committee: IEEE Pacific Rim Conference on Multidmedia, Sydney, Australia.

Travel

Prof S Venkatesh

Mitsubishi Electric Research Labs, New Jersey, USA.

University of Texas, Arlington, USA.

Arizona State University, Phoenix, USA.

National University of Singapore, Singapore.

Nanyang Technological University, Singapore.

Arizona State University, Phoenix, USA.

Computational Semiotics for Games and New Media, Amsterdam.

International Conference on Multimedia and Expo, Tokyo, Japan.

ACM Multimedia, Ottawa, Canada.

MIRI - Kuching, Malaysia.

Prof G West

MIRI - Kuching, Malaysia.

University of South Florida - visiting Prof K Bowyer.

University of Detroit Mercy, Detroit.

George Washington University, Washington, DC.

University of South Michigan.

External Research Grants

- 1) DSTO MOD - Development of a situation assessment tool for submarines.
(Prof S Venkatesh and Dr A Pearce)
1998-2000 \$200,000
- 2) Curtin/CSIRO collaborative grant
(Prof S Venkatesh)
1998 \$15,000
- 3) ARC - Optimising vision-based measurement and surface inspection systems .
(Prof G West, Prof T Caelli and Dr M Cardew-Hall)
1995-1997 \$195,000
- 5) ARC - Developing methods for building a 3D solid model object description from multiple sensor types.
(Dr M Robey, Prof G West and Prof T Caelli)
1998-2000 \$167,000
- 6) State Government of Western Australia, Funds for preparing Business plan for Center of Excellence.
(Prof S Venkatesh and Prof P Lee - Murdoch University)
1999 \$20,000
- 7) Large ARC - The inverse Spielberg problem: Extracting elements of visual grammar for synthesis, training and retrieval from video.
(Prof S Venkatesh and Dr C Dorai - IBM T J Watson)
2000-2003 \$173,700
- 8) SPIRT - Human centered tools and techniques for interactive data mining in financial systems,
(Prof S Venkatesh, Prof G West and Mr J Wong - CCK Treasury systems)
2000-2003 \$63,240
- 10) Terravision Scholarship - Encoding and compressing weather data for low data rate transmission.
(Prof S Venkatesh, Prof G West)
1999 \$28,000
- 11) Support for Store and Forward Tele-dermatology Research and Development.
(Dr C Clay and Prof G West)
1999 \$10,000
- 12) ARC Large grant-Learning to recognise actions and functions in image sequence.
(Prof S Venkatesh and Prof G West)
2000 \$60,000
- 12) ARC Large Grant - Semantic Compression: Using accelerometers to recognise complex human gestures for video annotation and event detection.
(Prof G West and Prof S Venkatesh)
2001-2003 \$167,000
- 13) Centre of Excellence Program: iPOM, intelligent Process Operation Management
Co-Directors: Prof S Venkatesh, Prof P Lee (Murdoch University)
Other Participants: Prof G West, Dr P Lam (Murdoch University)
2000 \$1,033,671

- 14) The University Grant Scheme, combined with small ARC (University of Sydney): A unified approach to singular systems control design.
(Dr W Q Liu)
2000 \$14,000
- 15) ARC Fellowship Grant: The balanced realization and identification techniques for singular systems and their applications.
(Dr W Q Liu)
1999-2004 \$260,000
- 16) Australian Academy of Science, scientific visit.
(Prof S Venkatesh)
2001 \$7,750

Infrastructure

Prof S Venkatesh \$29,914
Prof G West \$16,944

Prizes

Prof S Venkatesh

Best Paper Award, IEEE Pacific Rim Conference on Multimedia: "Role of shot length in characterising tempo and dramatic story sections in motion pictures".

Theses in Progress

Doctor of Philosophy

Leon Blackwell (Multidisciplinary stream Computer Graphics)

Thesis Title: Constrained optimal view selection and automated direction.

Ezra Tassone

Thesis Title: The representation and recognition of human motion using spatial and spatio temporal characteristics.

Scholarship: Australian Postgraduate Award

Graham Chambers

Thesis Title: Semantic compression: Using accelerometers to recognise complex human gestures for video annotation and event detection.

Scholarship: Australian Postgraduate Award

Gordon Thomas

Thesis Title: Optimisation of mine scheduling.

Robert Iverach

Thesis Title: Investigating N-Dimensional spatial data structures that encode both region and edge information for use in the geosciences.

Scholarship: CSIRO

Allan Loh

Thesis Title: Intelligent acquisition of 3D information for generation of CAD models.

Scholarship: Australian Postgraduate Award

Simon Moncrieff

Thesis Title: A computational understanding of audio aesthetics.

Scholarship: Australian Postgraduate Award

Nam Nguyen

Thesis Title: Co-ordination of multiple sensors to track and recognise multi-object actions.

Scholarship: Overseas Postgraduate Research Scholarship

Ba Tu Truong

Thesis Title: Extracting elements of visual grammar from films and television.

Scholarship: Curtin International Student Scholarship

Brett Adams

Thesis Title: Automatic extraction of semantic features from video programs.

Scholarship: Australian Postgraduate Award

Bernard Rolfe

Thesis Title: Classification of genetic reformation with respect to manufacturing central variables.

Scholarship: Australian Research Council/ANU

Simon Beard

Thesis Title: MetaFace: A virtual face metaphor and framework.

Scholarship: Australian Postgraduate Award

Quoc Dinh Phung

Thesis Title: Structuralising education and training videos: Towards the next generation of digital content management systems.

Scholarship: Curtin International Student Scholarship

Master of Science

Boaz Kogon

Thesis Title: Functional communication in autonomous software agents.

Hiep Quoc Pham

Thesis Title: Weather information system.

Scholarship: Industry (Terravision)

Honours

Monica Ou

Thesis Title: Decision support in teledermatology using case-based reasoning.

Ambrose Voon

Thesis Title: Alarm data analysis - Bayesian network approach.

James Ko

Thesis Title: Application of artificial intelligence techniques for locating alarm patterns.

Theses Passed

Doctor of Philosophy

Mark Ollila

Thesis Title: Automatic geometric reasoning using algebraic methods with Image processing techniques.

Scholarship: Australian Postgraduate Award

Master of Science

Daniel Tan

Thesis Title: Investigation into depletion algorithms for image compression and decompression.

Scholarship: Australian Postgraduate Award - Industry, Federal Government

Honours

Sebastian Luhr

Thesis Title: Providing portable hand-held access to a wireless video surveillance system.

Patrick Peursum

Thesis Title: Investigation into the use of simple metrics for predicting web page design rating.

Research in graphics is geared to facilitate such application areas as architecture, medicine, physiotherapy and printing.

architecture, medicine, physiotherapy and printing.

● Members

Dr B von Konsky
Mr A Marriott



Current Research Projects

Facial Animation

Mr A Marriott

Research into facial animation continues with over 1000 sites throughout the world using the fascia or fax system. The system and images have been used in computer generated animations in Europe and Australia.

Human Animation

Dr B von Konsky

Medical and physiotherapy students are required to visualize internal anatomic structures to develop hypothesis regarding anatomic function. While cadaver dissection, medical illustrations, and physical models have been traditionally used for this purpose, this research project examines the supplemental; uses of advanced 3D computer visualizations in medical education. A dynamically driven model of muscle and limb dynamics is used to animate the human form, in conjunction with an image database to correlate external surface features with rendered representations of internal anatomy.

Publications

Journal Articles

Papa Petros, P. and **von Konsky, B.** (1999)

Anchoring the midurethra restores bladder-neck anatomy and continence, *The Lancet*, Vol 354, No 9183.

Conference Proceedings

Hunt, M., **von Konsky, B., Venkatesh, S.,** and Petros, P. (2000)

Bayesian networks and decision trees in the diagnosis of female urinary incontinence, *World congress on medical physics and biomedical engineering*, in conjunction with the IEEE Engineering in Medicine and Biology Society, Chicago, USA.

External Research Grants

Theses in Progress

Doctor of Philosophy

Andrew Marriott

Thesis Title: Software based mentoring system.

Leon Blackwell (Multidisciplinary stream - Artificial Intelligence)

Thesis Title: Constrained optimal view selection and automated direction.

Scholarship: Australian Postgraduate Award

Honours

Darren Wan

Thesis Title: A black box designed text to speech module in a talking head.

Theses Passed

Honours

Elizabeth Gulland

Thesis Title: Psychological modelling of an asynchronous idle-time personality for a talking head.

Yaugoh Chow

Thesis Title: Realistic motion tracking.

The main areas of research being pursued include content based retrieval of multimedia data, and discovery of interesting patterns (or knowledge discovery) in large databases.

content based retrieval of multimedia data, and discovery of interesting patterns (or knowledge discovery) in large databases.



Members

Dr R Gopalan
Dr D Reid
Dr A Turpin

Current Research Projects

Content-based Search of Video Databases

Dr R Gopalan and Dr M G Nair (Maths and Stats)

Investigations and approaches to searching compressed video data for information retrieval.

Objective Comparator

Dr D Reid

This is research into a mathematical concept of comparisons in an attempt to explore means by which algorithms can be developed. The technique was first developed by G Rasch in the 1960's in attempting to determine a model in the midst of a mass of educational data.

Data Warehousing Using a Cluster of PCs

Dr R Gopalan

Aims to study the suitability of a cluster of PCs for processing queries on data warehouse.

Algebraic Specification of Data Mining Queries

Dr R Gopalan

This project is aimed at seamlessly integrating data mining queries with database systems.

Optimisation of Data Mining Queries

Dr R Gopalan

A tightly coupled optimizer is being developed in this project. It also explores faster algorithms for association rule mining.

Information Retrieval Systems.

Dr A Turpin, Assoc Prof W Hersh (Oregon Health and Sciences University)

While batch experimentation has shown that IR systems have improved dramatically over recent years, our experiments with real users show that they perform just as well with old technology. This research investigates why the seemingly improved systems seem to offer little benefit to human searchers.

Publications

Conference Proceedings

Hendra, Y., **Gopalan, R.** and Nair, M.G. (1999) (**Finalist - Best Paper Award**)

A method for dynamic indexing of large image databases, IEEE International Conference on Systems, Man, and Cybernetics, Tokyo, Japan, pp 302-307.

Rudra, A. and **Gopalan, R.** (2000)

Adaptive use of a cluster of PCs for data warehousing applications: Some problems and Issues, ACM Symposium on Applied Computing 2000, Como, Italy, pp 698-703.

Fung C., Law K., Wong K., and **Gopalan R.** (2000)

Lithofacies characteristics discovery from well log data, Intelligent Data Engineering and Automated Learning - IDEAL 2000, K.S. Leung, L-W. Chan, and H. Meng (Eds.), LNCS 1983, Springer-Verlag.

Rudra, A. and **Gopalan, R.** (2001)

Data warehousing and OLAP in a cluster computer environment. Americas Conference on Information Systems (AMCIS 2001), Boston, Massachusetts, USA, pp 336-342.

Gopalan, R., Nurrudin, T., and Sucahyo, Y.G. (In Press)

Algebraic specification of association rule queries. SPIE International Conference on Data Mining and Knowledge Discovery: Theory, Tools and Technology, Orlando, Florida, USA.

Turpin, A. and Hersh, W. (2001)

Why batch and user evaluations do not give the same results, 24th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, New Orleans LA, USA, pp 225-231.

External Research Grants

Dr R Gopalan

Curtin Travel Grant \$2,500

Prize - IEEE SMC'99 US\$500

Theses in Progress

Doctor of Philosophy

Amit Rudra

Thesis Title: On-line analytical processing and data mining in large distance.

Funding: Curtin Res Grant Scheme: \$7,500

School of IS R&D fund: \$29,000

CBS-R&D Fund: \$10,000

Total: \$46,500

Yudo Giri Sucahyo

Thesis Title: A tightly coupled optimiser for data mining with database systems.

Scholarship: AUSAID

Master of Science

Mr Tariq Nuruddin

Thesis Title: Integration of data mining into database management.

Seminars & Invited Talks

Presentations

Dr A Turpin

ACM SIGIR Conference on Research and Development in Information Retrieval, New Orleans, Louisiana, USA.

Invited Talks

Dr A Turpin

Why batch and users evaluations do not give the same results.
Invited talk at University of Melbourne, Australia.

Professional

Dr A Turpin

Member of the Program Committee: ACM SIGIR2001

Travel

Dr A Turpin

ACM SIGIR Conference on Research and Development in Information Retrieval, New Orleans, Louisiana, USA.
University of Melbourne, Australia.

The School is actively involved in research into Computer Networks and Communication. The School has already produced several highly regarded software packages for computer management.

The School has already produced several highly regarded software packages for computer management.

Research is moving from passive monitoring into active monitoring of the network including remote capturing, and the interplay of RMON agents with intelligent agents to automate network management.

Other research involves setting up automated tests for distributed protocols and in analysis and generation of distributed programs.

active research in uniform information access in mobile computing environments

Recently we have started active research in uniform information access in mobile computing environments with grants from ARC (Small) and the Australian Telecommunication Education and Research Board. Problems related to QOS for video on wireless and prefetching in wireless networks are under investigation.

● Members

Prof S Venkatesh
Dr A Turpin
Dr M Kumar
Dr D Reid
Dr W Q Liu



Current Research Projects

Detecting Change in Dynamic Communication Networks

Prof S Venkatesh, Dr M Kumar, Dr S Campbell and Mr K. Y. Lim

This project is in conjunction with the communications division of the DSTO (Defence Science & Technology Organisation). It seeks to find changes in dynamic communication networks using:

- a) graph theoretic methods
- b) pattern recognition methods like clustering

It also seeks to predict changes in dynamic networks by using hidden Markov models and time delay neural networks. The networks have size ranging from 500 nodes, 500 edges to 1 million nodes, 1 million edges.

Funding:(DSTO) 1998-2000 \$50,000

Using PDAs for Medical Research Data Collection

Dr A Turpin, P. Moke (JCHR), & Dr R Beck (JCHR)

This project is in collaboration with the JAEB Center for Health Research, Tampa, Florida, and involves development of Palm Pilot software to facilitate several large clinical studies of children's vision currently running in the USA.

Funding: Consultancy fees from JAEB Center for Health Research \$55,000

Publications

Journal Articles

Kumar, M., Venkatesh, S., Lim, K.Y. and Santoso, H. (1999)

Information access and QOS issues in a mobile computing environment, *Journal of Network and Computer applications*, Vol 22, pp 91-118.

Santoso, H., **Venkatesh, S.** and **Kumar, M.** (2000)

Adaptive MPEG filtering for mobile computing environment, *Journal of Visualization*, Vol 2, No 1.

Lim, K., **Kumar, M.** and Das, S. (2000)

Message ring-based channel reallocation for cellular wireless networks, *Computer Communications*, Vol 23, pp 483-498.

Chin, K. and **Kumar, M.** (2000)

AMTree: An active approach to multicasting in mobile networks, Special Issue on Wireless Multicast and Routing, ACM/Baltzer MONET.

Chin, K., **Kumar, M.** and Farrell, C. (2000)

A model for connection rerouting in mobile networks, ACM/Baltzer WINET.

Liu, W.Q. and Sreeram, V. (2001)

Model reduction of singular systems, *International Journal of Systems Science*, Vol 32 No10, pp 205-1215 .

Wang, G., Sreeram, V., **Liu, W.Q.** (2001)

Balanced performance preserving controller reduction via additive perturbation, *Journal of IEEE on Automatic Control*, Vol 469, No 5, pp 771-775.

Liu, W.Q. and Sreeram, V. (2001)

Model reduction of singular systems, *International Journal of Systems Science*, Vol 32 No 10, pp 205-1215 .

Moke, P., **Turpin, A.**, Beck, R., Holmes, J., Repka, M., Birch, E., Hurtle, R., Kraker, R., Miller, J. and Johnson, C. (2001)

Development of a computerized method of visual acuity testing: adaption of the Amblyopia Treatment Study visual acuity testing protocol, *American Journal of Ophthalmology*, pp 903-909.

Duan, G., **Liu, W. Q.** and Thompson, S. (In Press)

Robust model reference control for multivariable linear systems: A parametric approach, *Journal of Systems and Control Engineering of Imech.*

Zhang, Q., **Liu, W. Q.** and David Hill, (In Press)

A lyapunov approach to analysis of discrete singular systems, *Journal of Systems and Control Letters.*

Wang, G.Q., Sreeram, V. and **Liu, W. Q.** (In Press)

Balanced performance preserving controller reduction, *Journal of Systems and Control Letters.*

Liu, W.Q., Yan, Y.W. and Sreeram, V. (In Press)

Generalized Oja flow convergence analysis, *Journal of IEEE Transactions on Signal Processing.*

Gao, F., **Liu, W.Q.**, Sreeram, V. and Teo, K.L. (In Press)

Feedback control of chaos of the lorenz systems, *Journal of Dynamics and Control.*

Conference Proceedings

Tuah, N.J., **Kumar, M.** and **Venkatesh, S.** (1999)

A performance model of speculative prefetching in distributed information systems, International Parallel Processing Symposium, San Juan, Puerto Rico, pp 75-81.

Chin, K., Farrell, C. and **Kumar, M.** (1999)

Enhancing mobile IP routing using active routers, International Conference on High Performance Computing to be held in Calcutta, India, pp 229-233.

Chin, K., **Kumar, M.** and Farrell, C. (1999)

A model for enhancing connection rerouting using active networks, SwiM-99, Mobicom 99, Seattle, pp 77-86.

Chin, K. and **Kumar, M.** (1999)

AMTree: An active approach to multicasting in mobile networks, International Conference on Computer Communications and Networks ICCCN'99, Boston, pp 615-620.

Santoso, H., **Kumar, M.** and **Venkatesh, S.** (1999)

Adaptive MPEG filtering for mobile computing environment, 5th Asian Symposium on Visualization, Serpong, Indonesia, pp 482-488.

Lim, K., **Kumar, M.** and Das, S. (1999)

MRCR: An agent-based scheme for channel re-allocation in cellular wireless networks, IEEE Wireless Communications and Networking Conference, New Orleans.

Williamson, B., Farrell, C. and **Reid, D.** (1999)

An active approach to consolidating TCP and ABR flow control. IEEE Proceedings of the Eight International Conference on Computer Communications and Networks, Boston, Massachusetts.

Lim, K. and Kumar, M. (1999)

Message ring-based channel re-allocation scheme for cellular networks, International Symposium on Parallel Architectures and Networks, Fremantle, Australia, pp 426-431.

Chin, K., **Kumar, M.** and Farrell, C. (2000)

Enhancements to mobile IP with active networks. 2nd International Working Conference on Active Networks, Tokyo, Japan.

Tuah, N., **Kumar, M.** and **Venkatesh, S.** (2000)

Performance modelling of speculative prefetching for compound requests in low bandwidth networks. 3rd ACM/IEEE International Conference on Wireless and Mobile Multimedia (WoWMoM'00), Boston, USA.

Beck, R., Moke, P., **Turpin, A.**, Holmes, J., Repka, M., Birch, E., Miller, J. and Johnson, C. (2001)

Measuring visual acuity in children with a pc-based version of the amblyopia treatment study visual acuity testing protocol, Annual meeting of The Association for Research in Vision and Ophthalmology (ARVO), Ft Lauderdale, Florida, IOVS pp 42:4:s384

Lau, W., **Kumar, M.** and **Venkatesh, S.** (2001)

A flexible receiver-driven cache replacement scheme for continuous media objects in best-effort networks, 34th Hawaii International Conference on System Sciences, IEEE, Maui, Hawaii, USA.

Lau, W., **Venkatesh, S.** and **Kumar, M.** (2001)

A cache based mobility aware scheme for real time continuous media delivery in wireless networks, International Conference on Multimedia and Expo, Tokyo, Japan, pp 1236-1238.

Xu, L., **Liu, W.Q.** and **Venkatesh, S.** (In Press)

A new vector quantization approach via self-organizing map, 3rd WSEAS International Conference on Neural Networks and Applications (NNA '02)

Yan, W., Zhang, Q., and **Liu, W.Q.** (In Press)

Stability analysis and design of t -s fuzzy descriptor systems, IEEE Conference on Decision and Control, Orlando, Florida, USA.

Jin, L. and **Liu, W.Q.** (In Press)

Lyapunov equations for stable singular systems, ICOTA2001, HongKong.

Gao, Z., **Liu, W.Q.** and T. and So, T (In Press)

Decentralized Bezout factorization for generalized decentralized control systems", ICOTA2001, HongKong.

Zhang, Q. and **Liu, W.Q.**, and Hill, D. (In Press)

Lyapunov approach to the study of singular systems, IEEE Conference on Decision and Control, Orlando, Florida, USA.

Senjian, A and **Liu, W.Q.** (In Press)

Robust stability of polynomials with nonlinear dependent coefficient perturbations. IEEE Conference on Decision and Control, Orlando, Florida, USA.

Xing, W., Zhang, Q.L, **Liu, W.Q.** and Wang, Q. (In Press)

Control based on state observer for descriptor systems, International Workshop on Optimization and Control Application, Erice, Italy.

Seminars & Invited Talks

Visits/Invited Seminars

Dr M Kumar

CNUCE, Pisa, Italy, 2000 (Under AAS grant).

International Conference on Computer Communications and Networks - ICCCN'99 - Boston, USA.

Edinburgh Parallel Computing Centre, Edinburgh, 1999.

CNUCE, Pisa, Italy, 1999.

Dr W.Q. Liu

Northeast University, P. R. China.

ICOTA2001, HongKong.

Qufu Normal University, P. R. China.

Workshop on Global Optimization, Sicily.

Presentations

Dr A Turpin

Meeting of Association for Research in Vision and Ophthalmology: ARVO 2001, Ft Lauderdale, Florida, USA, 2001.

Conferences Chaired/Co-chaired

Dr M Kumar

Co-chair - Workshop in Mobile Computing, Intl. Symposium on Parallel Architectures and Networks, ISPAN-99, Perth, Australia.

Participation in Editorial Boards

Dr M Kumar

Guest Editor Special Issue of The Computer Journal (British Computer Society) on Mobile Computing.

Member, Editorial Board, The Computer Journal (British Computer Society)

Editorial Board Meeting of the Computer Journal, Edinburgh.

Special Issue on Quality Service Issues in Internet Services, IEEE Transactions on Computers.

Collaborations

Prof. K.L Teo, School of Applied Mathematics, Hong Kong Polytechnic University, Hong Kong.

Dr. Weiyong Yan, School of Electrical and Computer Engineering, Curtin University of Technology.

Prof. Q.L. Zhang, College of Science, Northeastern University P. R. China.

Prof. Xing Wei, College of Science, Northeastern University P. R. China.

Dr. G.R. Duan, School of Mechanical and Manufacturing Engineering, The Queen's University of Belfast, Belfast.

Prof. David Hill, School of Information and Electronical Engineering, University of Sydney, Australia.

Assoc. Prof. Seeram, Dept. of EEE, University of Western Australia, Perth, Western Australia.

Lixin Xu, Beijing Institute of Technology, P. R. China.

Dr, An Senjian, Dept. of EEE, Melbourne University, Victoria, Australia.

Assoc. Prof. Cishen Zhang, Dept. of EEE, Melbourne University, Victoria, Australia.

Dr. Zhiwei Gao, Hong Kong City University, Hong Kong.

Travel

Dr W. Q. Liu

ICOTA2001, HongKong.

Peking University, P.R. China.

Qufu Normal University, P. R. China.

Workshop on Global Optimization, Sicily, Italy.

Northeast University, P. R. China.

Hong Kong Polytechnic University.

Dr A Turpin

ARVO 2001, Ft Lauderdale, Florida, USA.

External Research Grants

DSTO - Subgraph prediction algorithms
(Dr M Kumar and Prof S Venkatesh)
1999 \$20,000

Travel Grant - Australian Academy Sciences - Research in the area of quality service in wireless networks with an Italian collaboration.
(Dr M Kumar)
2000 \$6,000

IREX Grant for collaboration with Italian scientists
(Dr M Kumar)
2001 \$5,000

ARC Fellowship
(Dr W. Q. Liu)
(Basic salary plus \$7000 research funds)

Infrastructure

Dr W. Q. Liu
\$10,296

Theses in Progress

Doctor of Philosophy

William Hock Lau

Thesis Title: An investigation into information access improvement techniques for continuous media in distributed environments.

Kok Yong Lim

Thesis Title: QOS issues in ad-hoc networks.

Master of Science

Donald Griffiths

Thesis Title: A method for program execution and migration between heterogeneous architectures.

Justin Lee

Thesis Title: Wireless sensor networks.

Honours

Dong-Kun Mun

Thesis Title: A centralized network management strategy using SNMP

Active research is in progress in the design and implementation of parallel algorithms on special architectures and distributed computing environments.

Investigations in the areas of task allocation, parallel string matching, graph matching, and text parsing are in progress.

design and implementation of parallel algorithms on special architectures and distributed computing environments.

● Members

Prof S Venkatesh
Dr M Kumar
Dr D Reid
Dr T Soh



Current Research Project

Clustering and Scheduling in Parallel Computers

Dr M J Kumar, Mr S Chingchit and Prof L N Bhuyan (Texas A and M University)

We are investigating a novel approach for clustering of tasks based on the ratio of costs of computation and communication of task clusters. The clustering scheme is being used for achieving desired performance under varying conditions.

Funding: AusAid

Parallel String Matching

A/Prof D Moore, Dr M J Kumar, Prof C Iliopoulos and Prof W Smyth

Designing efficient parallel algorithms for string matching problems and implementation of application problems on the Maspar SIMD system.

Architectures for High Performance Text Parsing

Dr M Kumar, Prof S Venkatesh and A/Prof L Narasimhan (DSTO)

The objective of this project is to develop tools and technologies that intelligently and automatically assist humans in analysing large amounts of information. The proposed work looks at extracting irrelevant information that has phrases identical to or close to key concepts the user is interested in finding on inexpensive state of the art high performance computing systems.

Funding:(DSTO) \$22,000

Publications

Journal Articles

Kumar, M. (1999)

Mobile computing, Computer Journal, Vol 42, No 6, pp 441.

Conference Proceedings

Campbell, S., **Venkatesh, S., Kumar, M.**, Kraetzl, M. and Shoubridge, P. (1999)

Change detection in communication networks, 5th Biennial Conference of the Australian Pattern Recognition Society, DICTA'99, Perth Australia, pp 94-98.

Chingchit, S., **Kumar, M.** and Bhuyan, L. (1999)

A flexible clustering and scheduling scheme for efficient parallel computation, International. Parallel Processing Symposium, San Juan, Puerto Rico, pp 500-505.

Seminars & Invited Talks

Conferences Chaired/Co-chaired

Dr M Kumar

Member, Program Committee, Third Workshop on Biologically Inspired Solutions to Parallel Processing Problems (BioSP3), IPPS 2000.

Member, Program Committee, ACM MSWiM 2000, The Third ACM International Workshop on Modeling, Analysis and Simulation of Wireless and Mobile Systems MSWiM 2000 Boston.

Member, Program Committee, International Conference on Parallel Processing, Toronto.

Participation in Editorial Boards

Dr M Kumar

Special Issue of the Journal of Interconnection Networks on Mobile Computing and Wireless Communications.

Special Issue of The Computer Journal (British Computer Society) on Mobile Computing.

Travel

Dr M Kumar

International Parallel Processing Symposium, San Juan, Puerto Rico.

Third ACM/IEEE International Conference on Wireless and Mobile Multimedia (WoWMoM'00), Boston, USA.

ACM/IEEE Conference on Mobile Computing 2000, Boston.

International Conference on Parallel Processing, Toronto.

External Research Grants

DSTO - Architectures for high performance text parsing.
(Dr M Kumar and Prof S Venkatesh)
1997-1998 \$22,000

DSTO - Learning and subgraph matching techniques.
(Prof S Venkatesh and Dr Kumar)
1998-1999 \$47,000

Travel Grant - Oxford University
(Dr M Kumar)
1999 \$3,000

Software engineering is a fast emerging area of research. The current research of the School in this area is focused on developing appropriate engineering techniques for parallel and distributed software and real-time and fault-tolerant software.

developing appropriate engineering techniques for parallel and distributed software and real-time and fault-tolerant software.



Members

Dr B Vonkowsky
Dr D Reid
Dr J Ivins
Dr M Robey

Current Research Project

Validation of Object Orientated Software Designs

Dr J Ivins , Dr M Robey, and Dr B Von Kinsky.

This project is concerned with developing methods for automated comparison of user requirements (in the form of a Use Case Model) and the UML software design. The group also intends to investigate automated methods for checking the consistency of a UML software design.

Software Metrics for Large Scale Software Engineering Projects

Dr J Ivins , Dr M Robey, and Dr B Von Kinsky.

This project is concerned with furthering the development of metrics that can be applied to both a software design and its implementation in source code.

Publications

Conference Proceedings

Blackwell, L., **von Kinsky, B.**, and **Robey, M.** (2001)

Petri net script: A visual language for describing action, behaviour and plot. Twenty-Fourth Annual Australasian Computer Science Conference, Australian Computer Society. pp29-37.

Travel

Brian von Kinsky

Australian Software Engineering Conference (ASWEC' 2001, Canberra, ACT, Australia).

