The South African Institute for Computer Scientists and Information Technologists

ANNUAL RESEARCH AND DEVELOPMENT SYMPOSIUM

23-24 NOVEMBER 1998
CAPE TOWN
Van Riebeeck hotel in Gordons Bay

Hosted by the University of Cape Town in association with the CSSA, Potchefstroom University for CHE and The University of Natal

GENERAL CHAIR: PROF G. HATTINGH, PU CHE

PROGRAMME CO-CHAIRS:
PROF. L VENTER, PU CHE (Vaal Triangle), PROF. D. PETKOV, UN-PMB

LOCAL ORGANISING CHAIR: PROF. P. LICKER, UCT - IS

PROCEEDINGS

EDITED BY
D. PETKOV AND L. VENTER

SYMPOSIUM THEME:
Development of a quality academic CS/IS infrastructure in South Africa

SPONSORED BY

ABSA Group
Copyrights reside with the original authors who may be contacted directly.

Edited by Prof. D. Petkov and Prof. L. Venter
Van Reebec Hotel, Gordons Bay, 23-24 November 1998


Keywords: Computer Science, Information Systems, Software Engineering.

The views expressed in this book are those of the individual authors and not of the South African Institute for Computer Scientists and Information Technologists.

Office of SAICSIT: Prof. J.M.Hatting, Department of Computer Science and Information Systems, Potchefstroom University for CHE, Private Bag X6001, Potchefstroom, 2520, RSA.

Produced by the Library Copy Centre, University of Natal, Pietermaritzburg.
FOREWORD

The South African Institute for Computer Scientists and Information Technologists (SAICSIT) promotes the cooperation of academics and industry in the area of research and development in Computer Science, Information Systems and Technology and Software Engineering. The culmination of its activities throughout the year is the annual research symposium. This book is a collection of papers presented at the 1998 such event taking place on the 23rd and 24th of November in Gordons Bay, Cape Town. The Conference is hosted by the Department of Information Systems, University of Cape Town in cooperation with the Department of Computer Science, Potchefstroom University for CHE and and Department of Computer Science and Information Systems of the University of Natal, Pietermaritzburg.

There are a total of 46 papers. The speakers represent practitioners and academics from all the major Universities and Technikons in the country. The number of industry based authors has increased compared to previous years.

We would like to express our gratitude to the referees and the paper contributors for their hard work on the papers included in this volume. The Organising and Programme Committees would like to thank the keynote speaker, Prof M.C Jackson, Dean, University of Lincolnshire and Humberside, United Kingdom, President of the International Federation for Systems Research as well as the Computer Society of South Africa and The University of Cape Town for the cooperation as well as the management and staff of the Potchefstroom University for CHE and the University of Natal for their support and for making this event a success.

Giel Hattingh, Paul Licker, Lucas Venter and Don Petkov
## Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynette Drevin: Activities of IFIP wg 11.8 (computer security education) &amp; IT related ethics education in Southern Africa</td>
<td>1</td>
</tr>
<tr>
<td>Reinhardt A. Botha and Jan H.P. Eloff: exA Security Interpretation of the Workflow Reference Model</td>
<td>3</td>
</tr>
<tr>
<td>Willem Krige and Rossouw von Solms: Effective information security monitoring using data logs</td>
<td>9</td>
</tr>
<tr>
<td>Carl Papenfus and Reinhardt A. Botha: A shell-based approach to information security</td>
<td>15</td>
</tr>
<tr>
<td>Walter Smuts: A 6-Dimensional Security Classification for Information</td>
<td>20</td>
</tr>
<tr>
<td>Philip Machanick and Pierre Salverda: Implications of emerging DRAM technologies for the RAM page Memory hierarchy</td>
<td>27</td>
</tr>
<tr>
<td>Susan Brown: Practical Experience in Running a Virtual Class to Facilitate On-Campus Under Graduate Teaching</td>
<td>41</td>
</tr>
<tr>
<td>H.D. Masethe, T.A Dandadzi: Quality Academic Development of CS/IS Infrastructure in South Africa</td>
<td>49</td>
</tr>
<tr>
<td>Philip Machanick: The Skills Hierarchy and Curriculum</td>
<td>54</td>
</tr>
<tr>
<td>Theda Thomas: Handling diversity in Information Systems and Computer Science Students: A social Constructivist Perspective</td>
<td>63</td>
</tr>
<tr>
<td>Udo Averweg and G J Erwin: Critical success factors for implementation of Decision support systems</td>
<td>70</td>
</tr>
<tr>
<td>Magda Huisman: A conceptual model for the adoption and use of case technology</td>
<td>78</td>
</tr>
<tr>
<td>Paul S. Licker: A Framework for Information Systems and National Development Research</td>
<td>79</td>
</tr>
<tr>
<td>K. Niki Kunene and Don Petkov: On problem structuring in an Electronic Brainstorming (EBS) environment</td>
<td>89</td>
</tr>
</tbody>
</table>
Derek Smith: Characteristics of high-performing Information Systems Project Managers and Project Teams 90

Lucas Venêter: INSTAP: Experiences in building a multimedia application 102

Scott Hazelhurst, Anton Fatti, and Andrew Henwood: Binary Decision Diagram Representations of Firewall and Router Access Lists 103

Andre Joubert and Annelie Jordaan: Hardware System interfacing with Delphi 3 to achieve quality academic integration between the fields of Computer Systems and Software Engineering 113

Borislav Roussev: Experience with Java in an Advanced Operating Systems Module 121

Conrad Mueller: A Static Programming Paradigm 122

Sipho Langa: Management Aspects of Client/Server Computing 130

T Nepal and T Andrew: An Integrated Research Programme in AI applied to Telecommunications at ML Sultan Technikon 135

Yuri Velinov: Electronic lectures for the mathematical subjects in Computer Science 136

Philip Machanick: Disk delay lines 142

D Petkov and O Petkova: One way to make better decisions related to IT Outsourcing 145

Jay van Zyl: Quality Learning, Learning Quality 153

Matthew O Adigun: A Case for Reuse Technology as a CS/IS Training Infrastructure 162

Andy Bytheway and Grant Hearn: Academic CS/IS Infrastructure in South Africa: An exploratory stakeholder perspective 171

Chantel van Niekerk: The Academic Institution and Software Vendor Partnership 172

Christopher Chalmers: Quality aspects of the development of a rule-based architecture 173

Rudi Harmse: Managing large programming classes using computer mediated communication and cognitive modelling techniques 174
Michael Muller: How to gain Quality when developing a Repository Driven User Interface

Elsabe Cloete and Lucas Venter: Reducing Fractal Encoding Complexities

Jean Bilbrough and Ian Sanders: Partial Edge Visibility in Linear Time

Philip Machanick: Design of a scalable Video on Demand architecture

Freddie Janssen: Quality considerations of Real Time access to Multidimensional Matrices

Machiel Kruger and Giel Hattingh: A Partitioning Scheme for Solving the Exact k-item 0-1 Knapsack Problem

Ian Sanders: Non-orthogonal Ray Guarding

Fanie Terblanche and Giel Hattingh: Response surface analysis as a technique for the visualization of linear models and data

Olga Petkova and Dewald Roode: A pluralist systemic framework for the evaluation of factors affecting software development productivity

Peter Warren and Marcel Viljoen: Design patterns for user interfaces

Andre de Vaal and Giel Hattingh: Refuting conjectures in first order theories

Edna Randiki: Error analysis in Selected Medical Devices and Information Systems
AN INTEGRATED RESEARCH PROGRAMME IN AI APPLIED TO TELECOMMUNICATIONS AT MLSULTAN TECHNikon

T Nepal, T Andrew
ML Sultan Technikon, 41 Centenary Road, Durban 4001 South Africa

Abstract:

With the introduction of the degree programs in technikons the call for research outputs sounds increasingly urgent. Technikons have now realised that they are well positioned to also undertake applied and experimental research.

The need for a sustainable research programme in the area of AI and telecommunications was identified at M L Sultan Technikon about three years ago. Positive spin-offs of such a programme include improved co-operation in research among the staff and students in the departments of Electronic Engineering and Computer Studies, partnerships with academic institutions such as University of Durban Westville, University of Natal and other research organisations. This provides also an opportunity for staff to continually update their skills and knowledge base in terms of rapidly-changing technology, and an improved ability for the Technikon to continue to offer relevant and appropriate qualifications.

The paper will present the Technikon's focus areas of research in AI and its application to Telecommunications. It is funded by the Foundation of Research and Development, Telkom and Ericson. Its outputs are envisaged to be in the form of practical and theoretical results, useful to both the of IT field and to the telecommunications industry. The results of the research will have implications for the local, regional and international communities. Another effect is improving the qualifications of least one third of the staff members within the departments of Computer Studies and Electronic Engineering.

Development of telecommunications infrastructure and in particular rural telecommunications is a complex process that involves both technical and socio-economic factors. It requires the building the technical base for rural telecommunications, assessment procedures for the evaluation of opportunities and strategic planning, improvement of maintenance and repair activities. A crucial element in all these activities is the need for improvement of decision support. The latter is provided at different levels depending on the nature of the tasks. Thus a service engineer needs a decision support system for better identification of technical faults that affects mainly the work of a single person at a time. On the other hand decisions that need to be taken on the development of telecommunications infrastructure in larger rural areas are not only technical decisions but also socio-economic decisions involving groups of many stakeholders. This paper examines various research topics undertaken at ML Sultan Technikon related to the following aspects of decision making or technological issues associated with the development of rural telecommunications:

- Investigation of Problem Structuring in the Analytic Hierarchy Process and Soft Systems Methodology for the Evaluation of the Socio Economic Impact of Telecommunications Services in Rural Areas.
- Investigation of the Role of Different Measurement Scales in the Analytic Hierarchy Process when applied to the evaluation of research projects in the area of telecommunications.
- Handling of Uncertainty in Judgements in the Analytic Hierarchy Process when applied to the selection of equipment for rural telecommunications development.
- Investigation into Case Based Reasoning for fault identification and repairs in telecommunications.
- Expert systems approach to equipment maintenance for the telecommunications industry.
- The application of Artificial Intelligence in Digital Signal Processing. This project focuses on speaker identification using Artificial Neural Networks.

The above topics are initiated at the Centre of Excellence in Rural Telecommunications uniting the human resources of the departments of Computer Studies and Electronic Engineering. The projects are varied but at the same time sufficiently coherent. This will ensure that the Technikon will build a critical mass in the area of Artificial Intelligence and Telecommunications and will be able to offer the local industry wider expertise and assistance.