

PROCEEDINGS of the
TWENTIETH HAWAII
INTERNATIONAL CONFERENCE
ON
SYSTEM SCIENCES
1987



VOLUME III

HEALTHCARE SYSTEMS
SPECIAL TOPICS

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HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES

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13000 Raymer Street
North Hollywood, California 91605

PREFACE TO THE PROCEEDINGS

This volume is one of three that comprise the Proceedings of the Twentieth Hawaii International Conference on System Sciences (HICSS) held in Kailua-Kona, Hawaii on January 6-9, 1987. The conference is an annual presentation of refereed papers in the information and system sciences to provide a forum for the interchange of ideas, advances and applications among the academicians and practitioners. HICSS is sponsored by the University of Hawaii and the University of SW Louisiana, in cooperation with the ACM, and the IEEE Computer Society Technical Committee on Computational Medicine. The Twentieth conference emphasized developments in the areas of software, architecture, decision support systems and knowledge-based systems, healthcare systems, and special topics. Our most sincere thanks to all those paper presenters, attendees, coordinators, chairpersons, referees, and administrative support people who made the conference a success.

Bruce D. Shriver
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ACKNOWLEDGEMENTS

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INTRODUCTION

The Hawaii International Conference on System Sciences is pleased to offer this proceedings in the Healthcare Systems Track. This year marks the 20th anniversary of HICSS, and this program highlights the process of technology transfer for the business and healthcare sectors. We are pleased to have Drs. Mason and Applegate who will be presenting a combined seminar and tutorial program on an executive support system for hospital strategic planning. This joint venture represents our first attempt to integrate the activities of the healthcare systems track and the decision support and knowledge based systems program.

Carrying on with the traditional subjects in the healthcare field, this year's program includes papers in medical image analysis, radiology, medical genetics and the computer, and medical decision support systems. We also have a series of presentations on hospital systems which cover corporate development, as well as the traditional areas of hospital data processing and many of the personnel and hardware problems related to this complex environment. Along with these areas of applied research, we also have a biomedical applications program that deals with topics such as cardiovascular physiology, as well as specialized techniques in robotics and physiologic monitoring.

I hope that this 20th anniversary proceedings will provide you with new concepts and ideas and, as a participant, you will find opportunities for growth and development during this intensive three-day conference.

Ralph R. Grams

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The quality of the papers published in the Proceedings of HICSS is the result of many hours of careful review by independent referees. We acknowledge and thank the following people for serving as referees for the Twentieth Annual Hawaii International Conference on System Sciences.

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**HEALTHCARE SYSTEMS TRACK
HICSS-20
Volume III**

TABLE OF CONTENTS

INTRODUCTION	Page
 HCS-1: MEDICAL IMAGE ANALYSIS/RADIOLOGY SYSTEMS I Coordinator: Richard A. Robb (Mayo Medical School)	
Image Compression for Medical Imaging Systems, Marcus E. Glenn, The MITRE Corporation, McLean, Virginia	1
Evaluation of Errors Using Graphical Techniques, G. Q. Maguire, Columbia University, New York University, New York, New York; J. Jaeger, Nathan S. Kline Institute for Psychiatric Research, Orangeburg, New York, New York University, New York, New York; L. Farde, Karolinska Institute, Stockholm, Sweden; M. E. Noz, P. Ehrlich, New York University, New York, New York.	9
Processing of Neuropsychological Data for Computer Graphics Display, Sushma S. Trivedi, Ruben C. Gur, University of Pennsylvania, Philadelphia.	16
 HCS-2: MEDICAL IMAGE ANALYSIS/RADIOLOGY SYSTEMS II Coordinator: Richard A. Robb (Mayo Medical School)	
A System for Interactive Volume Analysis (SIVA) of 4-D Biomedical Images, Jon J. Camp, Mahlon C. Stacy, Richard A. Robb, Mayo Medical School, Rochester Minnesota.	23
Radplanet – A Functional Radiology Pacs and Much Much More, Ivan R. Neilsen, James M. Slater, Benjamin Fischer, Loma Linda University School of Medicine, Loma Linda, California.	37
 Roundtable for speakers: HCS-1 and HCS-2.	
 HCS-3: MEDICAL GENETICS AND THE COMPUTER Coordinator: John M. Gersting (Purdue University)	
Data Bases for Genetic Services: Current Usages and Future Directions, F. John Meaney, Indiana University School of Medicine, Indianapolis, Indiana.	53
Rapid Prototyping of Database Systems in Human Genetics Data Collection, John M. Gersting, Indiana University, Purdue University, Indianapolis, Indiana.	58
The Use of Relational Database Commands In Retrieval of Pedigree Information, Emily A. Yount, Indiana University School of Medicine, Indianapolis, Indiana.	67

Medical Genetics – Patient Information Storage/Retrieval Survey, Harvey A. Bender, University of Notre Dame, Notre Dame, Indiana.	73
---	----

HCS-4: MEDICAL DECISION SUPPORT SYSTEMS I

Coordinator: Ralph R. Grams (University of Florida)

Expert Systems in Psychiatry: A Review, Ralph A. Morelli, Joseph D. Bronzino, John W. Goethe, Trinity College, Hartford, Connecticut.	84
--	----

Medical Decision Trees for Assisting in the Treatment of Combat Casualties, William J. Sacco, Cyometrics, Bel Air, Maryland; William B. Long, Emanuel Hospital, Portland, Oregon; Michael E. Carey, Louisiana State University Medical Center, New Orleans, Louisiana.	94
---	----

An Iterative Requirements Specification Procedure for Decision Support Systems, Cyril H. P. Brookes, The University of New South Wales, Sydney, Australia.	101
--	-----

HCS-5: MEDICAL DECISION SUPPORT SYSTEMS II

Coordinator: Ralph R. Grams (University of Florida)

Locative Inferences in Medical Texts, Paula S. D. Mayer, Guy H. Bailey, Richard J. Mayer, Knowledge Based Systems Laboratory, College Station, Texas; Argye Hillis, John E. Dvoracek, Temple, Texas.	114
--	-----

A PC-Based Free Text Retrieval System for Health Care Providers: Design and Development, James K. Massey, Ralph R. Grams, Ming Jin, University of Florida, Gainesville, Florida.	122
---	-----

A PC-Based Free Text DSS for Health Care – Case Studies and Applications, Ralph R. Grams, James K. Massey, Ming Jin, University of Florida, Gainesville, Florida; Paul Buchanan, NASA Kennedy Space Center, Titusville, Florida.	132
--	-----

HCS-8: HOSPITAL SYSTEMS I

Coordinator: Ronald J. White (NASA)

Medical Nomenclature and Common Conventions for Trauma Registries, A. W. Forrey, S. Pilcher, S. Pence, M. Williams, B. Dayton, C. M. Herman, University of Washington.	141
---	-----

A New Nosologic System – A Proposal, Elmer R. Gabrieli, Gabrieli Medical Information Systems, Inc., Buffalo, New York.	149
---	-----

Issues Involved in the Computerization of Patient Medical Records at a Large Multispecialty Clinic and Hospital,	158
J. David Raney, Cynthia J. Smith, Straub Clinic and Hospital, Inc., Honolulu, Hawaii.	

HCS-9: HOSPITAL SYSTEMS II

Coordinator: Richard J. Annis (Columbus-Cuneo-Cabrini Medical Center)

A Measure of Computer-Based Information Systems Success,	163
Alan F. Dowling, Case Western Reserve University, Cleveland, Ohio.	
Product Line Planning and Software,	187
Spyros Stavarakas, Travenol Laboratories, Inc., Deerfield, Illinois.	
Resistance to Computerization: An Examination of the Relationship Between Resistance and the Cognitive Style of the Clinician,	194
Steven F. Mandell, The Kennedy Institute for Handicapped Children, Baltimore, Maryland.	

HCS-10: HOSPITAL SYSTEMS III

Coordinator: Alan F. Dowling (Ernst & Whinney, Cleveland)

Implementation of an After-Hours Triage and Utilization Control System,	201
Christina A. Van Hoorebeke, American Medical International, Los Angeles, California;	
Randolph Farber, CIGNA Medical Center.	
Measurement of Physician Specimen Handling Errors and Its Contribution to Laboratory Information System Quality,	205
Alan Chmura, Portland State University, Portland, Oregon.	
Utilizing a Micro Computer Based Physician Incentive Compensation Program to Increase Inpatient Hospital Utilization and Improve Cost Management,	216
Richard J. Annis, Jack W. Holton,	
Columbus-Cuneo-Cabrini Medical Center, Chicago, Illinois.	

HCS-11: HOSPITAL SYSTEMS

Coordinator: Mark Gross (Ernst & Whinney, Cleveland)

A Preliminary Conceptual Framework for the Design, Development and Use of Client-Oriented Information Systems in Health,	223
Mary H. Partin, Case Western Reserve University, Cleveland, Ohio.	

- Initial Impact of a Clinical Laboratory Computer System:
Themes Common to Expectations and Actualities,** 236
Bonnie Kaplan, University of Cincinnati, Cincinnati, Ohio.

- Using Video-Interactive Simulation to Validate RN Competencies,** 244
Shirley L. Dooling, University of Missouri, Columbia, Missouri.

HCS-12: BIOMEDICAL APPLICATIONS I

Coordinator: James K. Massey (University of Florida)

- Sensitivity Analysis of a Simple Cardiovascular Model with Limited Feedback,** 252
Barbara F. Lujan, Uniformed Services University of the Health Sciences,
Bethesda, Maryland;
Ronald J. White, National Aeronautics and Space Administration,
Washington, D.C.

- A Robotic Hand as a Communication Aid for the Deaf-Blind,** 264
Deborah Gilden, The Smith-Kettlewell Eye Research Foundation,
San Francisco, California.

- A Method of Detecting Falling Cerebrum Activity
and Arising Vehicle Driving,** 274
F. Yano, H. Kodama, S. P. Ninomija, K. Sato,
Aoyama Gakuin University, Tokyo, Japan.

- On the Use of Statistics for Representing
the Knowledge Acquired From Experts,** 278
Mariko Fujikake, Ashikaga Institute of Technology;
Satoki P. Ninomija, Aoyama Gakuin University;
Hideki Fujita, Takasaki National Hospital, Tokyo, Japan.

HCS-13: BIOMEDICAL APPLICATIONS II

Coordinator: James K. Massey (University of Florida)

- Automated Interpretation of Sensory Evoked Potentials,** 288
J. Robert Boston, University of Pittsburgh School of Medicine,
Pittsburgh, Pennsylvania.

- The Problem of Diagnosing Lumbar Spine Disorders,** 295
S. A. Gracovetsky, Concordia University and McGill University;
A. G. Hadjipavlou, Diagnospine Research Incorporated,
Montreal, Quebec, Canada.

- A Consideration of the Weighted Periodogram Method in a Computer-
Assisted Fetal QRS Complex Detection Method,** 301
Fumihiko Yano, Satoki P. Ninomija,
Aoyama Gakuin University, Tokyo, Japan.

SPECIAL TOPICS TRACK HICSS-20

TABLE OF CONTENTS

SPT-1: SPECIAL TOPICS 1

Coordinator: Raymond Panko (University of Hawaii at Manoa)

- Managing User Developed Systems,** 309
Mehdi Beheshtian, Loyola University of Chicago;
Paul Vanwert, Annheuser-Busch Corporation;
Parviz Partow, California State University – Los Angeles.
- Management Support to Information Systems Development,** 310
Vesa Savolainen, University of Jyväskylä, Finland.
- The Management of End-User Computing:** 320
Critical Attributes for Organization Success,
Maryam Alavi, R. Ryan Nelson, Ira R. Weiss, University of Houston.

SPT-2: SPECIAL TOPICS 2

Coordinator: Hiram Tompkins (University of Hawaii at Manoa)

- Information Systems Evolution in Small Business:** 329
An Applications Portfolio Approach,
Louis Raymond, Universite du Quebec a Trois-Rivieres.
- Power, Politics and the Integration of Computer Based** 336
Information Processing Activities,
David V. Gibson, Thomas W. Roach, University of Texas at Austin.
- Safeguarding Information Systems Technology:** 338
Guarding the Competitive Edge,
Blake Ives, Harvard Business School;
Paul Cheney, The University of Georgia.

SPT-3: SPECIAL TOPICS 3

Coordinator: Terry M. Walker (University of SW Louisiana)

- Search for Serial Homicides,** 343
Anna Burke Harris, Kris Sperry, Patricia J. McFeeley,
and the staff of the Office of the Medical Investigator
for the State of New Mexico, University of New Mexico.
- Automated Legal Analysis,** 349
F. Golshani, D. T. Shannon, Arizona State University.

Computers: Legal Protection,	356
Marlene Campbell, Murray State University.	
 SPT-4: SPECIAL TOPICS 4	
Coordinator: J. Daniel Couger (University of Colorado at Colorado Springs)	
Managing Stress in Information Systems,	362
D. D. (Don) Warrick, Donald G. Gardner, J. Daniel Couger, Robert A. Zawacki, University of Colorado at Colorado Springs.	
Motivating Norms for Artificial Intelligence Personnel,	370
J. Daniel Couger, Scott C. McIntyre, University of Colorado at Colorado Springs.	
 SPT-5: SPECIAL TOPICS 5	
Coordinator: William Remus (University of Hawaii at Manoa)	
Distributed Cycle Detection and Its Application to Concurrency Control,	375
Jian Xu, Kazuo Sugihara, University of Hawaii at Manoa.	
A Give-Up Based Protocol for TOKEN PASSING,	385
Herman Hughes, Ke Ren Chuang, Parviz Yegani, Michigan State University.	
Performance Evaluation of Distributed Loop Computer Networks Using SLAM,	393
S. Akhtar, University of Toledo; M. Alam, University of Windsor.	
 SPT-6: SPECIAL TOPICS 6	
Coordinator: William Chismar (University of Hawaii at Manoa)	
The File Allocation Problem: An Expanded Perspective,	394
Sudha Ram, University of Arizona.	
Selecting Financial Accounting Databases for Management Information Systems,	406
David C. H. Yang, University of Hawaii at Manoa; Miklos A. Vasarhelyi, Columbia University.	
RTMS: Toward Close Integration Between Database and Application,	413
C. Thompson, S. Corey, M. Rajinikanth, P. Bose, S. Martin, R. Roberts, R. Lewis, Texas Instruments, Inc. R. Enand, Carnegie Group, Inc.; T. DiPesa, Massachusetts Institute of Technology; S. Cha, Stanford University.	

SPT-7: SPECIAL TOPICS 7

Coordinator: Steven O. Kimbrough (University of Pennsylvania)

- (Default) Reasoning and (Non-Monotonic) Logic,** 423
Kent Bach, San Francisco State University.
- Logic Modeling: A Tool for Management Science,** 424
Steven O. Kimbrough, University of Pennsylvania;
Ronald M. Lee, University of Texas at Austin.
- Why Non-Monotonic Logic?,** 435
Steven O. Kimbrough, University of Pennsylvania;
Fred Adams, Central Michigan University.
- Default Rules, Acceptance, and Expectations in Belief Systems,** 445
Marvin Belzer, University of Georgia;
Barry Loewer, University of South Carolina.

SPT-8: SPECIAL TOPICS 8

Coordinator: Steven O. Kimbrough (University of Pennsylvania)

- Temporal Reasoning – Past and Future,** 455
Ronald M. Lee, University of Texas at Austin.
- Logic-Based Representation of System Requirements,** 463
Peter C. Scott, RCA Communication and Information Systems Division.
- Defeasible Reasoning,** 470
Donald Nute, University of Georgia.

SPT-9: SPECIAL TOPICS 9

Coordinator: Lance B. Eliot (University of Southern California)

- Robotics in the Factory Environment,** 478
Donna M. Schaeffer, Claremont Graduate School.
- Production System Application to Inverse Kinematics of PUMA Robot,** 484
Luanne Burns, Paul Krzyzanowski, Columbia University.

SPT-10 SPECIAL TOPICS 10

Coordinator: Jack Stott (University of Hawaii at Manoa)

- Reliability Modeling of Systems with Human Errors,** 493
Balbir S. Dhillon, Subramanyam N. Rayapati, University of Ottawa.
- Decreasing Human Resistance to System Usage: An Analysis,** 502
Paulette Rose Di Angi, Barbara Stevenson Christy,
Case Western Reserve University and Butler Memorial Hospital.

IMAGE COMPRESSION FOR MEDICAL IMAGING SYSTEMS

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Abstract

Over the past 15 years, the field of radiology has grown in scope significantly from the relatively simple x-ray to computed tomography, magnetic resonance imaging, and nuclear imaging. The development of these various types of modalities, along with the ability to digitize x-ray films to a satisfactory resolution, engendered the concept of a Digital Imaging Network/ Picture Archiving and Communications Systems (DIN/PACS). This system, as the name implies, deals with the transmission and storage of digital medical images.

The physical size of typical digital images, in terms of the number of bytes of data one image contains, is large; e.g., a 1024 x 1024 image with 8 bits of data per pixel contains a megabyte of data. Given that a DIN/PACS will transmit many such images over a network, sometimes over low-capacity phone lines to remote sites, and that large numbers of images will need to be stored over a long period of time as part of the medical records for patients, the need for image compression arises to alleviate these large demands for image data storage and transmission capacity.

This paper discusses image compression in terms of the information theory upon which it is based. The two basic categories of algorithms for implementing image compression are presented along with considerations for image quality and accuracy, which are of primary importance to the medical imaging community.

1. INTRODUCTION

The field of radiology began with the illumination of some region of the human anatomy with x-rays and the capture of the resulting image upon a photographic film. During the past decade, the field has expanded to a variety of modalities as a result of an increase in computer assisted image generation and image enhancement techniques. X-ray films will eventually be replaced with a medium that allows for a direct digital image generation. The recently developed image modalities also yield digital representations of images due to the digital nature of the image generation technique. The advent of medical images in a digital format

raises the question of using image compression to reduce the amount of data needed to represent an image without sacrificing the integrity of the reconstructed image.

There are two main applications when image compression is beneficial for medical imaging systems:

- (1) the storage of medical images, either for archival or short-term storage
- (2) the transmission of medical images over a network or long distance communications link.

This work is supported in part by the U.S. Army Medical Research Acquisition Activity, Contract No. DAMD17-86-C-6145. The views, opinions and/or findings contained in this report are those of the author and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other documentation.