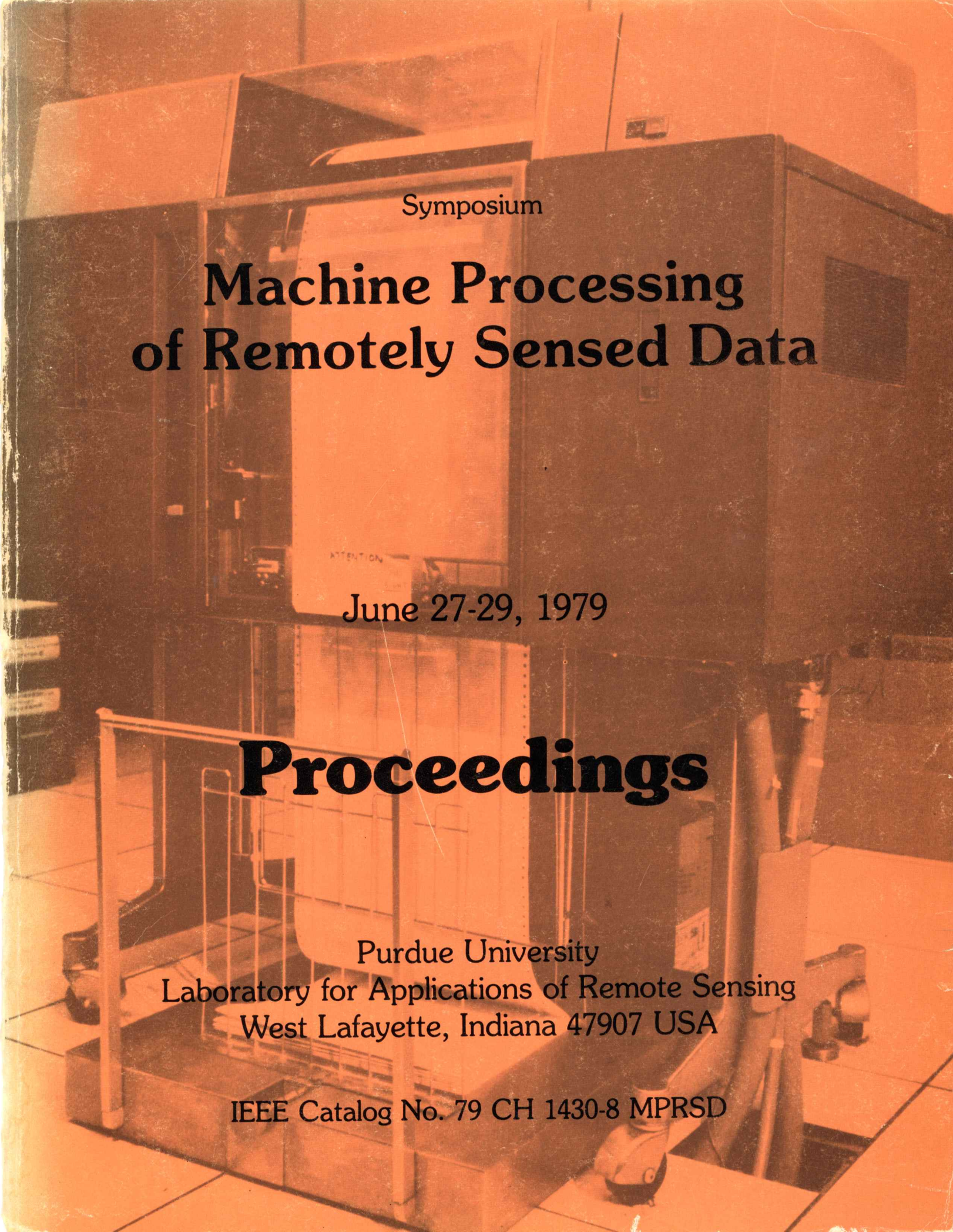

Symposium

Machine Processing of Remotely Sensed Data

June 27-29, 1979

Proceedings

Purdue University
Laboratory for Applications of Remote Sensing
West Lafayette, Indiana 47907 USA

IEEE Catalog No. 79 CH 1430-8 MPRSD

Symposium at a Glance

Wednesday June 27th

Time	Event & Location
7:45- 8:30am	Registration East Foyer (All events in Stewart Center unless otherwise noted.)
8:30- 8:40am	Welcome
8:40-12:00pm	1.0 Plenary Session Thematic Mapper Fowler Hall
12:00- 1:25pm	Lunch
1:30- 5:00pm	2.1 Data Processing I Preprocessing Room 214
	2.2 Applications to Agricultural Crops Room 210
	2.3 Land Use Applications Room 206
7:30- 9:30pm	Discussion Groups

Thursday June 28th

Time	Event & Location
8:30-11:55am	3.1 Data Processing II Systems Room 214
	3.2 Applications to Soils Room 210
	3.3 Technology Transfer Room 206
12:00- 1:25pm	Lunch
1:30- 5:00pm	4.1 Data Processing III Information Extraction Room 214
	4.2 Applications to Forestry Room 206
	4.3 Applications to Agricultural Crops II Room 210
6:00- 8:30pm	Banquet Speaker - Dr. Earl Butz The Trails

Friday June 29th

Time	Event & Location
8:30-12:00pm	5.0 Plenary Session: A Look at the Future of Data Processing in Remote Sensing Fowler Hall
12:00- 1:25pm	Lunch
2:00- 3:30pm	LARS Open House Flexlab I & II Purdue Research Park

Fifth Annual Symposium

Machine Processing of Remotely Sensed Data

Purdue University

Laboratory for Applications of Remote Sensing
West Lafayette, Indiana 47907 USA

June 27-29, 1979

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1973 CH 0834-2 GE
*
1975 CH 1009-0-C
1976 CH 1103-1 MPRSD
1977 CH 1218-7 MPRSD
*
1979 CH 1430-8 MPRSD

* There was no symposium in 1974 or 1978.

PREFACE

These Proceedings contain the written text of the long papers and the short paper abstracts presented during the Fifth Symposium on Machine Processing of Remotely Sensed Data. The program features an Opening Plenary Session focusing on the Landsat-D project and Thematic Mapper (TM) development, nine Technical Sessions on the theory, implementation and applications of machine processing of remotely sensed data, and a Closing Plenary Session projecting the Future of Data Processing in Remote Sensing. This symposium was designed to provide an opportunity for scientists working in machine processing of remotely sensed data to share current research and applications results with the scientific and user community at large and to serve as a catalyst to foster further development of the technology.

In addition to the formal presentations which are documented in these Proceedings, an evening discussion session was also included in the program to stimulate a more direct interchange of ideas on specific topics of interest.

The success of this symposium rests largely on the cooperation that the Laboratory for Applications of Remote Sensing has had from the co-sponsoring organizations, and the valuable technical and organizational input received from the program committee members and session chairmen.

SYMPOSIUM CO-CHAIRMAN: LUIS A. BARTOLUCCI

Dr. Bartolucci received his B.S., M.S., and Ph.D. in Geophysics from Purdue University. He has been involved in Remote Sensing research since 1969. He has played an active role in the development of remote sensing technology applied to water resources and in the field of thermal infrared radiation. Dr. Bartolucci has served as consultant to the U.S. Information Agency, the U.S. Agency for International Development, the Interamerican Development Bank and to several Latin American development agencies. He has been Principal Investigator and Project Director of several domestic and international research and training programs involving computer-aided processing and analysis of remotely sensed data for earth resources inventories. Dr. Bartolucci is currently responsible for the LARS educational and training programs.

SYMPOSIUM CO-CHAIRMAN: LEROY F. SILVA

B.S.E.E., Purdue University; M.S.E.E., Massachusetts Institute of Technology; Ph.D., Purdue University. He has been employed by Lincoln Laboratories; Ballistic Research Lab, Aberdeen Proving Ground, Maryland; and C P Electronics, Inc., Columbus, Indiana. He has also been a consultant in electronics and magnetics to several companies. Dr. Silva has been associated with LARS since 1969, and has published in the areas of electronics, magnetics, optics, bioengineering and remote sensing. He is a member of the Institute of Electrical and Electronic Engineers (Senion Member) and the National Society of Professional Engineers and the American Association for the Advancement of Science. He is a Registered Professional Engineer, State of Indiana.

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DOUGLAS B. MORRISON

JOHN B. PETERSON

TERRY L. PHILLIPS

RICHARD A. WEISMILLER

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1.0
Opening Plenary Session
Thematic Mapper

SESSION CO-CHAIRMAN: DR. VINCENT SALOMONSON

Dr. Salomonson has been with NASA and the Goddard Space Flight Center since 1968. His principal research contributions have been in the use of satellite data for meteorological studies and applications to water resources management. He has served as the Head of the Hydrospheric Sciences Branch in the Laboratory for Atmospheric Sciences since 1973. He was appointed Landsat-D Project Scientist in May of 1977.

SESSION CO-CHAIRMAN: DR. A.B. PARK

Dr. Park has been involved with remote sensing research and NASA, User Agency, and aerospace programs for nearly two decades. He served as remote sensing coordinator for the U.S. Dept. of Agriculture in the early 1960's. In the late 1960's and early 1970's, he was the Chief Scientist for Earth Observations Programs at NASA Headquarters. In recent years he has served in private industry in efforts dealing with the applications of Landsat data and systems to a variety of applications with emphasis on agriculture.

SESSION COORDINATOR: DR. DAVID LANDGREBE

Dr. Landgrebe is Professor of Electrical Engineering and Director of LARS. His specialty area is data representation and analysis and he has been active in the remote sensing field since 1965. He received NASA's Exceptional Scientific Achievement Medal in 1973. He served as Chairman of the NASA Working Group to define the Thematic Mapper parameters in 1975. He is a Fellow of the IEEE, a member of several other professional and honorary organizations, an associate editor of the journal, Remote Sensing of the Environment and a member of the administrative committee of the IEEE Geoscience Society.

2.1
Data Processing I
Preprocessing

SESSION CHAIRMAN: L.F. GUSEMAN, JR.

L. F. Guseman, Jr. received the B.S. and M.S. degrees in mathematics from Texas A&M University in 1960 & 1962, respectively. From 1962 to 1964 he was on active duty in the Army Signal Corps assigned to the NASA/Manned Spacecraft Center. From 1964 to 1968 he was employed by NASA and spent three academic years at the University of Texas where he received the Ph.D. degree in mathematics in 1968. In 1968 he joined Texas A&M University and is currently an Associate Professor of Mathematics. He has published journal articles in the areas of functional analysis, nonlinear fixed point theory, and mathematical techniques in pattern recognition. Since 1974 he has worked closely with the Earth Observations Division, NASA/Johnson Space Center, in the development of mathematical techniques for the analysis of LANDSAT data. Dr. Guseman is a member of AMS, SIAM, MAA, ACM and ORSA.

SESSION COORDINATOR: PHILIP H. SWAIN

Philip H. Swain is assistant professor of Electrical Engineering, Purdue University, and program leader for Data Processing and Analysis Research at the University's Laboratory for Applications of Remote Sensing (LARS); B.S.E.E., Lehigh University; M.S.E.E. and Ph.D., Purdue University. Prof. Swain has been affiliated with LARS since 1966 and has contributed extensively to the development of data processing methods for the management and analysis of remote sensing data. His areas of specialization include theoretical and applied pattern recognition and methods of artificial intelligence. He is co-editor and contributing author for the textbook Remote Sensing: The Quantitative Approach (McGraw-Hill, 1978).

2.2
Applications to Agricultural Crops I

SESSION CHAIRMAN: MARVIN W. PHILLIPS

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SESSION COORDINATOR: MARVIN E. BAUER

Marvin E. Bauer, research agronomist and program leader of LARS' Crop Inventory Systems Research; B.S.A. and M.S., Purdue University; and Ph.D., University of Illinois. Dr. Bauer has had key roles in the design, implementation, and analysis phases of several major remote sensing projects including the 1971 Corn Blight Watch Experiment and the Crop Identification Technology Assessment for Remote Sensing Project. He has been the principal investigator of a Landsat investigation for crop area estimation survey. Currently, he is the technical leader of the agricultural field research program at LARS.

2.3
Applications to Land Use

SESSION CHAIRMAN: DONALD W. LEVANDOWSKI

B. S. (Geological Engineering) Montana College of Mineral Science and Technology, M. S. and Ph.D. University of Michigan. Twelve years experience as Research Geologist and geophysicist for major oil company. Extensive field experience in Canada and the western U.S. Published in the area of mineral and petroleum geology, and petrology. Primary interest is in the area of application of remote sensing to mineral and petroleum exploration.

SESSION COORDINATOR: LUIS A. BARTOLUCCI

Dr. Bartolucci received his B.S., M.S., and Ph.D. in Geophysics from Purdue University. He has been involved in Remote Sensing research since 1969. He has played an active role in the development of remote sensing technology applied to water resources and in the field of thermal infrared radiation. Dr. Bartolucci has served as consultant to the U.S. Information Agency, the U.S. Agency for International Development, the Interamerican Development Bank and to several Latin American development agencies. He has been Principal Investigator and Project Director of several domestic and international research and training programs involving computer-aided processing and analysis of remotely sensed data for earth resources inventories. Dr. Bartolucci is currently responsible for the LARS educational and training programs.

3.1
Data Processing II Systems

SESSION CHAIRMAN: DAVID GEORGE GOODENOUGH

David George Goodenough is a senior research scientist at the Canada Centre for Remote Sensing of Energy, Mines and Resources Canada. He is Head of the Methodology Section which is concerned with the physics, pattern recognition, systems development, and engineering of systems and spectroscopic laboratories for remote sensing data analysis. He is a member of several national committees concerned with remote sensing and space science and is the author of more than 34 technical publications.

Goodenough is an active member of the IEEE, the Canadian Remote Sensing Society, the American Astronomical Society, and the Pattern Recognition Society. He is a non-resident professor in the Department of Electrical Engineering of the University of Ottawa and an Adjunct Professor in the Centre for Research in Experimental Space Science of York University.

SESSION COORDINATOR: PHILIP H. SWAIN

Philip H. Swain is assistant professor of Electrical Engineering, Purdue University, and program leader for Data Processing and Analysis Research at the University's Laboratory for Applications of Remote Sensing (LARS); B.S.E.E., Lehigh University; M.S.E.E. and Ph.D., Purdue University. Prof. Swain has been affiliated with LARS since 1966 and has contributed extensively to the development of data processing methods for the management and analysis of remote sensing data. His areas of specialization include theoretical and applied pattern recognition and methods of artificial intelligence. He is co-editor and contributing author for the textbook Remote Sensing: The Quantitative Approach (McGraw-Hill, 1978).

3.2
Applications to Soils

SESSION CHAIRMAN: RAY SINCLAIR

Ray Sinclair was born at Havanna, IL, and was raised on a grain-livestock farm. He attended the University of Illinois where he received a B.S. in 1959 and an M.S. in 1961. He started with the Soil Conservation Service in August, 1961 as a soil scientist. Mr. Sinclair worked in the states of Vermont and Michigan from 1967 to 1972 as assistant state soil scientist. In June, 1972, he moved to Indiana to assume the responsibility as state soil scientist.

SESSION COORDINATOR: RICHARD A. WEISMILLER

Richard A. Weismiller, B.S., M.S., Purdue University; Ph.D., Michigan State University, joined the Laboratory for Applications of Remote Sensing in 1973. His primary research interests are the relation of the spectral reflectance of soils to their physical and chemical properties and the application of remote sensing technology to soils mapping, land use inventories and change detection as related to land use. He is a member of Phi Eta Sigma, Alpha Zeta, and Sigma Xi honoraries, the Soil Science Society of America, the American Society of Agronomy, the Clay Minerals Society, and the Soil Conservation Society of America.

3.3
Technology Transfer

SESSION CHAIRMAN: RICHARD H. WEINSTEIN

Mr. Weinstein is currently the manager for NASA's Regional Remote Sensing Applications Program which provides technology transfer in remote sensing to state and local governments and other potential users. He has been with NASA since 1959 and worked previously at NASA's Langley Research Center in the areas of theoretical and applied plasma physics, space systems technology and environmental quality program development. After coming to NASA Headquarters in 1975, he worked two years with agency-wide institutional management programs prior to his current involvement in technology transfer programs beginning in 1977.

SESSION COORDINATOR: SHIRLEY M. DAVIS

Education and Training Specialist at Purdue University's Laboratory for Applications of Remote Sensing. As a member of the technology transfer staff, she is responsible for the design and development of educational materials in the field of remote sensing. At LARS she has served as editor, data analyst, writer and instructional developer in both print and electronic media. Her major contributions to remote sensing education have been as co-author and editor of the LARSYS Educational Package (1974), co-author and producer of 19 multi-media instructional modules, The Fundamentals of Remote Sensing (Purdue Research Foundation, 1976) and co-editor and contributing author of Remote Sensing: The Quantitative Approach (McGraw-Hill Book Company, 1978). Since 1977, she has been a Consultant in Instructional Development for the International Institute for Aerial Survey and the Earth Sciences (ITC).

4.1
Data Processing III
Information Extraction

SESSION CHAIRMAN: PAUL E. ANUTA

PAUL E. ANUTA is the Associate Program Leader for Data Handling Research at the Laboratory for Applications of Remote Sensing at Purdue University, West Lafayette, Indiana. He received a B.S., Electrical Engineering, Purdue University in 1957; M.S.E.E., University of Connecticut in 1967; and an M.S. in Computer Science in 1969, Purdue University. As an employee of the IBM Federal Systems Division he investigated hybrid computer applications. Mr. Anuta joined the LARS staff in 1967 and is responsible for research and evaluation of remote sensor data preprocessing techniques.

SESSION COORDINATOR: PHILIP H. SWAIN

Philip H. Swain is assistant professor of Electrical Engineering, Purdue University, and program leader for Data Processing and Analysis Research at the University's Laboratory for Applications of Remote Sensing (LARS); B.S.E.E., Lehigh University; M.S.E.E. and Ph.D., Purdue University. Prof. Swain has been affiliated with LARS since 1966 and has contributed extensively to the development of data processing methods for the management and analysis of remote sensing data. His areas of specialization include theoretical and applied pattern recognition and methods of artificial intelligence. He is co-editor and contributing author for the textbook Remote Sensing: The Quantitative Approach (McGraw-Hill, 1978).

4.2
Applications to Forestry

SESSION CHAIRMAN: THOMAS M. LILLESAND

Tom is an Associate Professor in the Department of Forest Resources and an associate member of the Department of Civil and Mineral Engineering at the University of Minnesota. He is also the director of the Minnesota Remote Sensing Laboratory. His teaching, research, and public service activities deal with the application of remote sensing to natural resource management and environmental monitoring. Prior to joining the faculty at Minnesota, Tom taught for five years at the SUNY College of Environmental Science and Forestry, Syracuse, New York.

Tom is currently the Director of the Remote Sensing Applications Division of the American Society of Photogrammetry. He has presented many papers on the quantitative aspects of remote sensing and he is the senior author of the book Remote Sensing and Image Interpretation.

SESSION COORDINATOR: ROGER M. HOFFER

Roger Hoffer is Professor of Forestry, and Leader, Ecosystems Research Programs, LARS, Purdue University. He was a co-founder of LARS in 1966; has lectured and participated in remote sensing projects in various countries throughout South America, Asia, and Europe; has served as a principal investigator on Landsat, Skylab, and other remote sensing projects; has authored over 100 scientific papers on remote sensing. Dr. Hoffer teaches three courses in Remote Sensing; is a member of the American Society of Photogrammetry (where he has served as Director of the Remote Sensing and Interp. Div., and Assoc. Editor of Photogrammetric Engineering and Remote Sensing), Society of American Foresters, Sigma Xi, Phi Kappa Phi, and other professional and honorary societies. He is a Certified Photogrammetrist and is listed in American Men and Women in Science.

4.3
Applications to Agricultural Crops II

SESSION CHAIRMAN: WILLIAM H. WIGTON

In 1971 he received a Masters Degree in Expermental Statistics from North Carolina State University. In 1972 he became involved in one of USDA's first LANDSAT investigations and later became a Principal Investigator. Presently, he is Section Head of the New Techniques Section with a main objective to integrate LANDSAT Data into the ongoing USDA program to improve estimates of crop areas.

SESSION COORDINATOR: MARVIN E. BAUER

Marvin E. Bauer, research agronomist and program leader of LARS' Crop Inventory Systems Research; B.S.A. and M.S., Purdue University; and Ph.D., University of Illinois. Dr. Bauer has had key roles in the design, implementation, and analysis phases of several major remote sensing projects including the 1971 Corn Blight Watch Experiment and the Crop Identification Technology Assessment for Remote Sensing Project. He has been the principal investigator of a Landsat investigation for crop area estimation survey. Currently, he is the technical leader of the agricultural field research program at LARS.

5.0
Closing Plenary Session
A Look at the Future of Data Processing in Remote Sensing

SESSION CO-CHAIRMAN: PITT THOME

Following his B.S. from Notre Dame and M.S. from MIT in Aeronautical Engineering, Mr. Thome worked with United Aircraft and GE before starting with NASA in 1966. Prior to NASA employment he had also earned an MBA from Xavier University. Since joining NASA Mr. Thome has been Director of several different programs such as: Advanced Programs, Office of Space Science & Applications, Weather and Climate Program, Office of Applications and currently, Resource Observation Division, Office of Space and Terrestrial Applications, NASA Headquarters.

SESSION CO-CHAIRMAN: DAVID A. LANDGREBE

Dr. Landgrebe is Professor of Electrical Engineering and Director of LARS. His specialty area is data representation and analysis and he has been active in the remote sensing field since 1965. He received NASA's Exceptional Scientific Achievement Medal in 1973. He served as Chairman of the NASA Working Group to define the Thematic Mapper parameters in 1975. He is a Fellow of the IEEE, a member of several other professional and honorary organizations, an associate editor of the journal, Remote Sensing of the Environment and a member of the administrative committee of the IEEE Geoscience Society.

SESSION COORDINATOR: TERRY L. PHILLIPS

Terry L. Phillips, Deputy Director of LARS, received his B.S. and M.S. degrees in Electrical Engineering from Purdue in 1964 and 1966 respectively. He has held positions in Purdue's EE Department, National Cash Register Co., and the U.S. Navy. He has also consulted for the Computer Sciences Corp., the U.S. and Iowa Geological Surveys, and the Colorado Intergovernmental ADP Council. He is engaged in the development of Data Handling and Processing Systems and has been active in the application of these systems for remote sensing since 1966. Mr. Phillips is the author of several publications in the area of remote sensing, data systems, information systems, and earth resources, and he is responsible for the design and implementation of LARSYS. Recognized by NASA for the creative development of technology, he is principal investigator of several of LARS' contracts. Mr. Phillips is a member of IEEE, the Association of Computer Machinery, Tau Beta Pi, and Eta Kappa Nu.

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4.2 APPLICATIONS TO FORESTRY

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4.3 APPLICATIONS TO AGRICULTURE - CROPS II

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5.0 CLOSING PLENARY SESSION

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