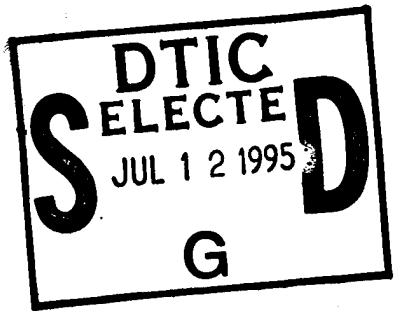
TEC-0058

Bibliography of In-House and Contract Reports, Supplement 19

Jean R. Diaz



October 1994

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US Army Corps of Engineers
Topographic Engineering Center

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U.S. Army Corps of Engineers
Topographic Engineering Center
7701 Telegraph Road
Alexandria, Virginia 22315-3864

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Jean R. Diaz

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U.S. Army Topographic Engineering Center
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Alexandria, VA 22315-3864

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This is Supplement 19 to the TEC Bibliography of In-House and Contract Reports. This supplement provides author and title indexes, abstracts, and AD numbers for the 1992 through 1994 additions to the continuing bibliography. It also contains a complete title index designed to be used in conjunction with the 19 published bibliographies and refers to them by year and number.

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PREFACE

This is Supplement 19 to the report titled, "Bibliography of In-House and Contract Reports" AD-877 653L; Supplement 1, AD-890 066L; Supplement 2, AD-905 548L; Supplement 3, AD-B005 275L; Supplement 4, AD-B010 642L; Supplement 5, AD-B019 966L; Supplement 6, AD-055 468; Supplement 7, AD-A068 744; Supplement 8, AD-A084 111; Supplement 9, AD-A099 803; Supplement 10, AD-A113 006; Supplement 11, AD-A128 400; Supplement 12, AD-A141 778; Supplement 13, AD-A160 607; Supplement 14, AD-A173 750; Supplement 15, AD-A195 953; Supplement 16, AD-A215 154; Supplement 17, AD-A252 543 and Supplement 18, AD-A265 475. It is a continuing bibliography of reports prepared by and for the U.S. Army Topographic Engineering Center, Alexandria, Virginia. This bibliography includes reports that were published from 1 October 1992 through 1 October 1994.

Reports with AD numbers can be purchased by Department of Defense agencies from the Defense Technical Information Center; other agencies and individuals can purchase copies from the National Technical Information Service, Springfield, Virginia 22161-2171. Reports with a "B" in the AD number are limited in distribution to U.S. Government agencies unless permission for release is granted from the controlling office.

Mr. Walter E. Boge was Director, and Lt. Col. Louis R. DeSanzo was Commander and Deputy Director of the Topographic Engineering Center at the time of publication of this report.

TEC-0025 AD A282 963

EXISTING RESOURCES, STANDARDS, AND PROCEDURES FOR PRECISE MONITORING AND ANALYSIS OF STRUCTURAL DEFORMATIONS - VOLUME I

September 1992

Adam Chrzanowski
Saverio Avella
Chen Yong-qi
James M. Secord

University of New Brunswick

DAAL03-91-C-0034

Keywords: Deformation Monitoring, Deformation Analysis, Dam Deformations

This report is based on a review of literature, international reports, and results of a questionnaire sent to national representatives of about 70 countries to the International Commission on Large Dams. The study focused on monitoring and analysis of deformations of large dams. The main conclusions of the study are: (1) There are no available standards and specifications in any of the reviewed countries which could be recommended for direct adaptation to dam deformation monitoring in the United States; (2) With the recent technological developments in both geodetic instrumentation, at a cost one may achieve almost any, practically needed, instrumental resolution and precision, full automation, and virtually real-time data processing; (3) Over the past 10 years there has been significant progress in the development of new methods for the geometrical and physical analyses of deformation surveys. However, due to a lack of an interdisciplinary cooperation and insufficient exchange of information, the developments have not yet been widely adapted in practice; and (4) Generally, the overall qualifications and educational background of the personnel placed in charge of monitoring surveys in the U.S. seem to be inadequate, particularly in the areas of data processing and analyses.

TEC-0026 AD A261 693

U.S. ARMY EVALUATION OF THE ELECTRONIC MAP DATA (EMD) PROTOTYPE

December 1992

John P. Bradley

Keywords: Map Background, Raster, Color Separates, Resolution, Color Normalization, Declutter

This report provides a consolidated U.S. Army evaluation of the Electronic Map Data (EMD) prototype. This prototype was developed by the Digital Concepts and Analysis Center (DCAC) of the U.S. Army Topographic Engineering Center (TEC). The intent of this prototype was to refine Army map background requirements by providing a real example of an alternative product. Participants in the evaluation included program managers and support contractors representing the Army components, government agencies, and private industry. Overall, evaluator comments indicated that EMD, as defined by the prototype, cannot be definitively recommended as the Army's standard map background product. Although the color separate approach does not provide desirable capabilities not afforded by a composite image map, these advantages are outweighed by inherent limitations associated with decluttering by color. From user feedback indications, the original documented map background requirement submitted to the Defense Mapping Agency, which was for a product that contains declutterable feature data, requires minimal storage, and provides normalized color across map sheets, remains unchanged.

TEC-0027 AD A268 770

STATISTICAL ANALYSIS OF GEOMORPHIC, PETROGRAPHIC AND STRUCTURAL CHARACTERISTICS OF THE DARTMOOR TORS, SOUTHWEST ENGLAND
May 1993

Judy Ehlen

Keywords: Map Background, Raster, Color Separates, Resolution, Color Normalization, Declutter

The granite tors on Dartmoor are characterized and described by a combination of 21 geomorphic, petrographic and structural variables using two statistical approaches: analysis of significant correlations and multivariate analyses. Whereas an analysis of correlations enables relations between pairs of individual variables to be determined, the multivariate procedures addresses all variables at the same time. Spearman's rank correlation coefficient was used to correlate the variables so that nominal and ordinal variables could be included. The characteristics of summit tors and spur tors were defined by analyzing the significant correlations as well as by analyzing indirect relations between related variables. The multivariate procedures separated the sample of 58 tors into five clusters. Principal coordinates analysis and a non-hierarchical classification were used to determine the characteristics of each cluster. The joint spacing frequency distributions for the clusters were compared to determine statistically significant differences between them; each group is significantly different from at least two others. Comparing the results of the two procedures indicated that although all variable types are important to landform development, the geologic factors are most important. The most important variable types are rock texture, grain size, composition and structure.

TEC-0028 AD A282 904

VISION-BASED NAVIGATION FOR AUTONOMOUS GROUND VEHICLES
May 1992

Larry S. Davis
Daniel DeMenthon

University of Maryland DACA76-88-C-0008

Keywords: Border Following, Graph Matching, Hough Transforms, Matrix Operations, Parallel Search, Path Planning, Pose Estimation, Pyramids, Quadtrees, Range Imagery, Road Following, Terrain Navigation

This report describes research on ground navigation, dynamic visual surveillance, parallel vision, parallel search, and parallel matrix operations. Specific problems addressed include planning safe paths on terrain, estimating range shadows, road reconstruction, dynamic object pose estimation and tracking, quadtree and pyramid algorithms, border following, Hough transformation, and graph matching.

TEC-0029 AD A270 596

IMAGE UNDERSTANDING ARCHITECTURE FINAL REPORT
September 1991

Charles C. Weems
Edward M. Riseman
Allen R. Hanson
James Burrill
Martin Herbordt
Michael Scudder
Deepak Rana

University of Massachusetts

DACA76-86-C-0015

Keywords: Image Understanding Architecture, Knowledge-Based Vision, Real-Time Computer Vision, Software Simulator, Parallel Processor

The primary goal of the Image Understanding Architecture (IUA) project was to build a proof-of-concept prototype of a 1/64th slice of a parallel architecture to support real-time, knowledge-based image understanding, and develop the software support environment that will be needed to utilize the hardware. The unique feature of the IUA is that it tightly couples three distinctly different parallel architectures whose capabilities are matched to the computational requirements of the three primary levels of abstraction in knowledge-based computer vision. The low-level processor (CAAPP) is a SIMD cellular array designed to perform sensory preprocessing. The intermediate-level processor (ICAP) is intended to support computation on symbolic data that has been extracted from the images or instantiated from stored models. The high-level processor (SPA) supports the general knowledge-based processing which employs multiple strategies to form an interpretation of a scene. The majority of the hardware effort has taken place at Hughes Research Laboratories, Malibu, California, although UMass has principle responsibility for the design of the IUA architecture. UMass has also undertaken some smaller portions of the hardware development (the feedback concentrator for the low and intermediate-level arrays, and the communications router for the intermediate-level array). The majority of the software effort took place at UMass, although Hughes was also involved in some software development, both in support of their hardware efforts, and in the form of algorithm development for specific applications on the IUA.

TEC-0030 **AD B173 208L**

DEVELOPMENT OF A STATISTICAL METHOD FOR THREE-DIMENSIONAL TERRAIN ELEVATION ERROR ANALYSIS
October 1991

Marshall B. Faintich
David J. Dermody

TRIFID Corporation

DACA76-91-C-0002

Keywords: Digital Terrain Data, Digital Elevation Models, Error Analysis, Tactical Decision Aids, Command and Control

Most DoD users are not familiar with the accuracy limitations of the Digital Terrain Elevation Data (DTED) as a result of the specification limitations, the materials used in DTED production, the production processes employed in the generation of DTED, and is in general, unaware of existing and conceptual methodologies for the accuracy evaluation of DTED. This unawareness of DTED limitations may lead to critical errors in the tactical decision making process. The primary application area considered in this Phase I investigation is the effect of DTED errors on Radial Terrain Masked Area (RTMA) plots. These plots are used to provide the mission planner with the ability to locate ground areas masked by terrain when viewed from any location and height. Applications of RTMA displays include both decision making on location of communication, radar, and observation towers at a command post, as well as the inverse problem of unobserved movement through terrain masked areas. Selection of the effect of DTED errors on RTMA plots was chosen to limit the scope of the Phase I effort.

TEC-0031 **AD A276 817**

DFAD PLUS SYSTEM DEVELOPMENT
May 1992

Lawrie Jordan[1] John Gilmore[2]
Nick Faust[1]

[1]ERDAS, Inc.
[2]Gilmore Aerospace Corporation

DACA72-87-C-0007

Keywords: Geographic Information System, Feature Extraction, Expert System, Digital Feature Analysis Data, Multispectral Imagery

Between 1987 and 1992, ERDAS, Inc., and Gilmore Aerospace Corporation developed a prototype expert system for the update of Digital Feature Analysis Data (DFAD) based on multispectral imagery and a number of commonly available Geographic Information System (GIS) layers. A method was developed by which ERDAS GIS Modeling tools were used to simulate and validate decision rules that were then downloaded to the Ada Based Expert System Testbed (ABEST) for execution. ERDAS developed data acquisition programs for acceptance of DFAD point, line and polygon data and conversion of DFAD into the ERDAS internal polygon file structure. The information is subsequently gridded to produce a raster GIS layer. ERDAS also made improvements to a semi-automatic Digital Terrain Elevation Data (DTED) loader.

TEC-0032 AD A269 560

PHYSICAL CHARACTERISTICS OF SOME SOILS FROM THE MIDDLE EAST
May 1993

Judy Ehlen

Keywords: Particle Size Analysis, Middle East, Soils

This report presents soil moisture and soil texture data on 59 soil samples from eastern Saudi Arabia, Iraq and Kuwait. Very little soil moisture data are available, and although the data reported here are probably overestimates, they are reported because of the apparent lack of such data. With respect to soil texture, the soils were grouped as sandy soils or gravelly soils, and then were further subdivided using a descriptive classification based on particle size differences. A modified version of the U.S. Department of Agriculture classification was used. This classification was tested using cluster analysis. Petrographic descriptions of 11 samples are included as an appendix. Although limited, the data are reported because of an apparent interest in such data with respect to military operations in desert areas.

TEC-0033 AD A266 670

PASSIVE RECOVERY OF SCENE GEOMETRY FOR AN UNMANNED GROUND VEHICLE FIRST ANNUAL REPORT
May 1993

Robert C. Bolles

SRI International DACA76-92-C-0003

Keywords: Stereo Analysis, Evaluation of Stereo, Scene Geometry, Unmanned Ground Vehicle, Computer Vision

The primary goal of this project is to develop a passive technology for recovering scene geometry in order to support an Unmanned Ground Vehicle (UGV) operating in a general outdoor environment. We focus on our evaluation of current stereo techniques. We report the results of the first phase of this evaluation and discuss plans for the second phase. In addition, we briefly describe our progress in the following areas: development of new object tracking techniques; application of a new scene modeling technique (developed on a parallel contract at SRI) to UGV tasks; and development of two auxiliary techniques to support our research: a technique for generating synthetic stereo pairs and a technique for multiplexing imagery from a pair of moving cameras onto a single videotape.

TEC-0034 AD A267 632

ARPA UNMANNED GROUND VEHICLE STEREO VISION PROGRAM AT TELEOS RESEARCH: ANNUAL REPORT April 1993

H. Keith Nishihara

Teleos Research

DACA76-92-C-0005

Keywords: Stereo Vision, Active Vision, Real-Time Vision, Unmanned Ground Vehicle, Disparity Gradients, Area Correlation

This report reviews the work done during 1992 at Teleos Research in support of ARPA's UGV program. It first gives a broad overview of Teleos' approach to studying visual perception. In particular, the concept of minimal-meaningful-measurement tools is developed as a natural methodology for allowing a higher level application process to easily influence and exploit basic measurement modalities. The sign-correlation algorithm under development at Teleos is then described in this context and the current performance benchmarks of our accelerator technology are presented. Several important results in stereo theory were obtained this year including: the development of techniques for automatically setting stereo matcher operating parameters, an analysis identifying the principal parameters affecting the magnitude of the disparity gradient effects, and a technique for improving area correlator performance in the presence of large stereo disparity gradients. Contributions were also made to the development and implementation of methods for evaluating stereo matching algorithms. UGV application specific studies were carried out in the areas of narrow-field-of-view stereo; wide field-of-view, high-resolution stereo mosaic building; stereo landmark navigation; 3-D tracking of moving objects; evaluation of hardware accelerators; and development of a low-cost mobile test facility.

TEC-0035 AD B176 996L

DIGITAL TERRAIN ELEVATION DATA (DTED) RESOLUTION AND REQUIREMENTS STUDY: PHASE 2 REPORT July 1993

Louis A. Fatale
James R. Ackeret
Jeffrey A. Messmore

Keywords: Digital Terrain Evaluation Data (DTED), Resolution, Line-of-Sight (LOS), Sigma-t, Digital Terrain Data (DTD) Requirements, Terrain Visualization, Terrain Roughness

This report is a follow-on study that evolved from U.S. Army Topographic Engineering Center (TEC) Special Report ETL-SR-6, November 1990, titled "Digital Terrain Elevation Data (DTED) Resolution and Requirements Study: Interim Report." This study provides evidence of the influence of DTED resolution (in regions with different terrain roughness) on Army terrain data applications. The report includes extensive field work and terrain visualization undertaken to investigate DTED integrity in comparison to the actual terrain, as well as comparative line-of-sight and statistical analyses of DTED Levels 1 and 2. Finally, the report offers conclusions and recommendations for future DTED production/resolution requirements.

TEC-0036 **AD B176 866L**

PERSONAL NAVIGATION AND REPORTING - PHASE I (CYBERNET)
August 1993

Eric S. Yager

Cybernet Systems Corporation DACA76-93-C-0003

Keywords: Global Positioning System, Navigation, Self-Location, GIS, Cartography, Map-Based Applications

This Phase I effort has been driven by the soldiers' need for very specific map-based software systems. A common thread running through all military operations is their reliance upon maps. Central to soldiers' ability to successfully carry out missions is their ability to accurately locate themselves in their environment. Maps provide the context for critical missions and are an intrinsic part of military operations. High-tech soldiers of the future will use sophisticated equipment in tactical environments to help ensure their success. The following objectives accomplished in Phase I are highlighted in this report: developed a plan for rapid construction of map-based applications and outlined a toolbox upon which specific map/navigation applications can be quickly developed; implemented key components of this plan, representing a vertical slice through the toolbox to demonstrate the feasibility of developing a complete map toolbox; used these components to construct a typical application, a prototype Personal Navigation System, and demonstrate this application on desktop and portable platforms, validating this approach; created a plan to develop and implement the remainder of the toolbox as part of Phase II activities; and identified several commercial paths for transitioning the resulting technology in map-based products.

TEC-0037 **AD B177 200L**

PERSONAL NAVIGATION AND REPORTING - PHASE I (LEVI)
August 1993

Robert W. Levi
Lloyd C. Matthews

Robert Levi Associates DACA76-93-C-0002

Keywords: Navigation, Data Links, Digital Maps, GPS, Position Locating, Dead Reckoning

The concept developed in this project is intended to provide the dismounted soldier with an autonomous low-cost navigation aid and a means for automatic reporting of individual locations to commanders. Three independent navigation aids are used to avoid dependence on a single method: Global Positioning System (GPS), dead reckoning and digital maps. The dead reckoning system will be calibrated by the GPS receiver to produce positioning capability during GPS jamming or outage. Integrated electronic maps will provide the soldier with a reference to local terrain features, rendezvous and target locations, and friendly and enemy forces. A digital radio data link will afford a means for commanders to track the position of individuals for tactical purposes and to help prevent "friendly fire" accidents.

TEC-0038

AD A274 213

CONIFER TREE INFLUENCE ON DIGITAL TERRAIN ELEVATION DATA (DTED): A CASE STUDY AT DULLES INTERNATIONAL AIRPORT
September 1993

Kevin R. Slocum

Keywords: Digital Terrain Elevation Data, Canopy Closure, Auto-Correlation, Modelling, Surveying

Conifer tree influence on the collection and portrayal of Digital Terrain Elevation Data (DTED) is presented. Study sites are investigated which had dense conifer canopy closure. Two separate DTED collection techniques are examined in the context of studying conifer tree influence: (1) photo source auto-correlated, and (2) photo source operator assisted (floating dot). Field surveying is the mechanism used for collecting accurate, verifiable ground elevation data subsequently compared against the elevations of corresponding DTED positions. Estimated conifer tree stand heights (at the time of DTED photo source) are compared against the difference in value between DTED and field surveyed elevations. A close relationship between stand height and difference values demonstrates the potential for conifer tree height inclusion within DTED "ground" elevations. Terrain modelling impacts caused by the addition of tree heights within the DTED are addressed.

TEC-0039

AD A274 142

MULTIVARIATE SPECTRAL ANALYSIS TO EXTRACT MATERIALS FROM MULTISPECTRAL DATA
September 1993

Robert S. Rand
Donald A. Davis

Keywords: Bayesian Discriminant, Mahalanobis Distance, Euclidean Distance, Supervised Classification, Sub-Pixel Demixing, Mixture Analysis, Linear Models, Linear Regression

This effort investigates various multivariate analysis techniques for classification/identification to extract natural and man-made features reliably from broad-band spectral imaging data/multispectral imagery. An enhanced Bayesian method is proposed and demonstrated to exhibit increased accuracy over three conventional supervised classifiers. Broad-band spectral properties of various materials are examined and the perturbations on spectra of pure materials introduced by mixtures are shown. A mixing model that uses multiple linear regression constrained by two physical properties is tested.

TEC-0040 AD A274 141

PROJECT OSTRICH - A FEASIBILITY STUDY: DETECTING BURIED MINES IN DRY SOILS USING SYNTHETIC APERTURE RADAR
September 1993

John V.E. Hansen
Judy Ehlen
Timothy D. Evans
Richard A. Hevenor

Keywords: Ground-Penetrating SAR, Radar, Dry Soils, Minefield Detection, Buried Objects

Metallic and nonmetallic mines were used to construct a minefield in arid soil at Twentynine Palms, California to assess the extent to which long-wavelength radar could be used to detect buried mines by remote sensing. Surface and subsurface mines were placed in accordance with known enemy doctrine, and the site was imaged with X-, C- and L-band radar from a Navy P-3 aircraft. This report describes the construction and physical characteristics of the test sites, and presents and discusses the results of imagery analysis.

TEC-0041 AD A276 658

SELECTION OF CLIMATE STATION DATA USING CLUSTERING AND TRIANGULATED IRREGULAR NETWORK TECHNIQUES
October 1993

Kevin R. Slocum

Keywords: Correlation, Clustering, Triangulated Irregular Networks, Climatology, Modeling

This report presents a methodology of adding an elevation variable to the process of selecting climate station data for computer modeling. Various techniques are used in this method which include statistical correlation of climatic variables, clustering of climate station data, and development of a triangulated irregular network (TIN) internal graphic layer with nodes representing climate station locations. Improvements to the climate station data selection process are documented.

TEC-0042 AD B178 495L

URBAN WARFARE DIGITAL DATABASE SBIR PHASE I
April 1992

MRJ Incorporated DACA76-91-C-0003

Keywords: Automatic Three-Dimensional Wire-Frame Modeling, Urban Terrain, Image Perspective Transformation, Digital Image Correlation

This technical report describes the development of an automatic three-dimensional wire-frame modeling system for creating image perspective transformations in urban terrain. The system creates wire-frames from imagery by reconstruction of elevations derived from registered digital stereo imagery. The process includes image feature segmentation, image correlation to produce a dense elevation matrix of one elevation value per pixel, and polygon generation from a three-dimensional triangular network of those elevations.

TEC-0043 AD B181 085L

LOW INTENSITY CONFLICT VIEWER (LIC-VIEW) PHASE I
January 1992

Arnold H. Lanckton
Robert J. Geiger

Synectics Corporation DACA76-91-C-0011

Keywords: Manually Assisted Stereo Correlation, Integrated Technologies, Urban Terrain

This technical report describes the development of a manually assisted stereo correlation system. The report considers developing a system which integrates the four technologies of computer graphic processing, photogrammetry, image processing, and computer vision systems for modeling and rendering urban terrain.

TEC-0044 AD A282 960

IMAGE UNDERSTANDING ARCHITECTURE PROTOTYPE EVALUATION AND DEVELOPMENT
June 1993

Charles C. Weems
Allen R. Hanson
Martin Herbordt
Deepak Rana
Edward M. Riseman
James Burrill
Michael Scudder

University of Massachusetts

DACA76-89-C-0016

Keywords: Image Understanding Architecture (IUA), Knowledge-Based Vision, Real-Time Computer Vision, Software Simulator, Parallel Processor

The primary goal of this research was to complete the development and proof-of-concept prototype of a 1/64th slice of a parallel architecture to support image understanding, and to test and evaluate the architecture so the next generation Image Understanding Architecture (IUA) can be specified. The majority of the hardware effort has taken place at Hughes Research Laboratories, Malibu, California, although UMass has principle responsibility for designing the IUA architecture and has undertaken some smaller portions of hardware development. The majority of the software effort took place at UMass. Software efforts included development of a detailed software simulator for the IUA, a FORTH interpreter, and Apply and C compilers for the low-level processor of the IUA. Also developed were run-time support libraries, diagnostics, and vision algorithms. Some effort was spent implementing the ARPA IU Benchmark and evaluating the results of the exercise. Included in this report is a summary of accomplishments, an overview of the IUA design and the trade-offs addressed in its development, the design of the intermediate level interconnection network, the design of the IUA simulator and the ARPA benchmark.

TEC-0045 AD A281 594

A PARSER FOR THE ISO 8211 DATA FORMAT
January 1994

Michael McDonnell

Keywords: ISO 8211, Data Parsing, Data Conversion

This report describes a library of functions that parse an ISO 8211 file and convert the parsed data into a form useful to other programs, which can then read user data from the file. The structure of ISO 8211 files will be defined and then it will be shown how these programs interpret data in those files. Finally, an example program will be presented that reads an ISO 8211 file by using this library.

TEC-0046 AD A283 257

REPRESENTATION, MODELING AND RECOGNITION OF OUTDOOR SCENES
FIRST ANNUAL REPORT
November 1993

Martin A. Fischler
Robert C. Bolles

SRI International

DACA76-92-C-0008

Keywords: Machine Vision, Automated Scene Analysis, Interactive Scene Analysis, Object Recognition, Terrain Modeling, Automated Cartography, Feature Extraction, Delineation, Partitioning, Geometric Modeling

The primary goal of this project was to advance the state-of-the-art in scene interpretation for autonomous systems that operate in natural terrain. In particular, techniques are being developed for representing knowledge about complex cultural and natural environments so that a computer vision system can successfully plan, navigate, recognize and manipulate objects and answer questions or make decisions relevant to this knowledge. The initial results are centered on the development of representations and associated methods for rapidly modeling natural terrain (from image sequences) at a level of organization higher than that of the conventional dense array of depths. This work will provide the essential advance needed to turn raw geometric measurements into timely information usable by robotic navigation and planning systems. Work is also progressing on two additional problems: modeling compact 3-D objects from their projected 2-D contours, and the problem of recognizing important classes of natural and man-made objects -- especially roads, trees and rocks.

TEC-0047 AD A282 962

VISION-BASED NAVIGATION AND RECOGNITION
July 1994

Azriel Rosenfeld

University of Maryland

DACA76-92-C-0009

Keywords: Computer Vision, Parallel Algorithms, SIMD Machines, Stereo Matching, Diffusion Processes, Image Morphing, Face Recognition, Invariants, Geometric Computations, 3-D Texture, Motion and Structure Recovery

The research summarized in this report deals with many aspects of computer vision as applied to both navigation and object recognition. In particular, this research has concentrated on eight areas: parallel algorithms for vision; diffusion processes and their roles in early vision; invariant properties and their roles in object recognition; recovery of three-dimensional scene properties from single images; recovery of observer motion and scene structure from image sequences; direct motion analysis; visual interception; and vision-based navigation. Specific topics include algorithms for image and graph computations, parallel search and stereo matching; the application of diffusion processes to image morphing and face recognition; project affine, and deformation invariants of images; reliability of geometric computations on images of three-dimensional scenes; properties of foliage regarded as a three-dimensional texture; monocular and binocular recovery of motion and structure from feature correspondents in an image sequence; a unified treatment of feature-based and flow-based motion estimation; motion analysis based on global properties of the flow field; vision-based target interception; visibility on terrain; and landmark-based localization.

TEC-0048 **AD A276 445**

SMART ENVIRONMENTAL MONITOR BASED ON NEURAL NETWORKS AND MULTI-SPECTRAL PATTERN RECOGNITION
September 1993

Taiwei Lu

Physical Optics Corporation DACA76-93-C-0004

Keywords: Neural Networks, Holographic Optical Spectral Feature Identification, Portable Smart Spectrometer, Hyperspectral Image Processing

In Phase I of this project, Physical Optics Corporation (POC) accomplished the goal of the original proposal which was to develop and optimize a unique neural network (NN) algorithm that performs rapid spectral signal processing and identification. POC's NN algorithm was tested with extremely noisy Raman spectra from Lawrence Livermore National Laboratory and experimentally showed at least ten times better sensitivity and reliability than conventional spectral signal processing methods. POC built a portable demonstration system that integrated a spectrometer with POC's NN and successfully demonstrated real-time spectral signature identification operations. POC proposed, for Phase II implementation, a holographic optical neural network (HONN) system that is capable of rapid hyperspectral imaging through an acoustic-optic tunable filter (AOTF), real-time spectral feature identification, and mapping. The success of the Phase II project will make automatic and rapid hyperspectral image analysis and feature location possible.

TEC-0049 **AD A282 278**

FULL COLOR RECORDER
January 1994

Dean Beilke
William Rozzi

Electronic Imaging Center DACA76-90-C-0006

Keywords: Color, Reproduction, Image Processing, Digital, Scanner

The U.S. Army Topographic Engineering Center (TEC) initiated this program to keep abreast of new and promising color image processing and printing methods that could be used by the U.S. Army. In 1990, new non-impact printing technologies and derived products were rapidly emerging alongside high speed digital image processing capabilities. Linking these two areas held the promise of creating highly flexible digital demand color printing which had not been imagined 10 years earlier. This report studies the feasibility of creating a Full Color Recorder System from available technologies, hardware and software. The next 3 years of R and D under this contract produced results which have been adopted by the U.S. Army into the baseline Quick Response Multi-Color Printer system; a system designed to provide troops' real-time terrain graphic images in the field. This final report documents the rationale, history, processes, technologies and results of this program.

TEC-0050 AD A283 427

ROBUST IMAGE UNDERSTANDING - TECHNIQUES AND APPLICATIONS
October 1993

Azriel Rosenfeld

University of Maryland DACA76-89-C-0019

Keywords: Edge Detection, Slope Estimation, Robust Estimation, Bayesian Estimation, Matching, Segmentation, Shape Recognition, Recovery, Pose Estimation

The research for this report deals with the following topics: feature detection, including both edge detection and line slope estimation; robust and Bayesian estimation of image parameters; image and pattern matching; region segmentation and shape recognition; shape recovery and pose estimation; robot hand-eye coordination; robot navigation and path planning; visibility and navigation on terrain; motion transparency and motion parameter estimation; structure from motion, using both feature-based and normal-flow-based methods and regularization techniques.

TEC-0051 AD A277 460

COOPERATIVE AUTONOMOUS AGENTS TESTBED
November 1993

S.Y. Harmon M.D. Howard
D.M. Keirsey J.A. Krozel
D.W. Payton D.Y. Tsend
S.C. Yang

Hughes Research Laboratories DACA76-89-C-0002

Keywords: SAFOR, SIMNET, DIS, Intelligent Agents, Cased-Based Reasoning, SOAR, Behavior-Based Control, Reactive Planning, Machine Learning

The goal of the Cooperative Autonomous Agents Testbed (CAAT) program is to develop new techniques by which multiple autonomous agents operate intelligently and effectively in both cooperative or competitive modes of operation. Among the most significant accomplishments of this program are the development of two techniques that improve the effectiveness of decision making and that simplify the acquisition of tactics knowledge for computer generated forces used in large-scale distributed interactive simulations. We have developed a concurrent control paradigm that vastly improves decision making in the presence of multiple competing objectives. We have also developed case-based learning techniques to simplify the acquisition of tactics through direct interaction with subject experts. These techniques have been applied to automate simulations of M1 tank platoons as well as F-14 fighter aircraft.

TEC-0052 AD A282 991

ARPA UNMANNED GROUND VEHICLE STEREO VISION PROGRAM
March 1994

H. Keith Nishihara J. Brian Burns
Stanley J. Rosenschein Hans Thomas
Matthew Turk Monnett Soldo

Teleos Research

DACA76-92-C-0005

Keywords: Shape Recognition, Active Vision, UGV

This report documents work carried out at Teleos Research in support of the UGV Demo II mission. This research has been divided between basic studies relating to binocular stereo, shape recognition and technology development. Teleos' approach to the study of visual perception embodies a strategy for focusing on the minimal form of perceptual measurement that is meaningful or useful. Several new stereo techniques were developed under this research program including a way to automatically set stereo matcher operating parameters, an analysis of stereo disparity gradients, and a method for improving area correlator performance in the presence of disparity gradients. Several new techniques for shape detection and recognition are reported. An active vision system for tracking moving objects applies results from the stereo and shape recognition work. A number of efforts were directed at supporting the UGV mission, including the use of narrow-field-of-view stereo for vehicle navigation; very high-resolution wide-field-of-view stereo to support landmark-based navigation; test data collection for comparison and performance evaluation; and collaborative efforts with the other UGV stereo contractors at SRI and Joint Precision Labs to foster technology transfer.

TEC-0053 AD A266 670

PASSIVE RECOVERY OF SCENE GEOMETRY FOR AN UNMANNED GROUND VEHICLE SECOND ANNUAL REPORT
March 1994

Robert C. Bolles

SRI International

DACA76-92-C-0003

Keywords: Stereo Analysis, Evaluation of Stereo, Scene Geometry, Unmanned Ground Vehicle, Computer Vision

The primary goal of this project is to develop a passive technology for constructing three-dimensional descriptions of outdoor scenes to support the navigational needs of an Unmanned Ground Vehicle (UGV) operating both during the day and at night. This report describes the development of a technique for increasing the resolution and robustness of passive range images by integrating stereo and motion analysis. Also, the development of a scene sketching framework for describing the semantic, as well as geometric properties of a scene, will significantly increase the information provided to a navigation path planner. The first step is taken toward night-time operation by producing initial stereo results from FLIR imagery.

TEC-0054 AD B187 424L

NON-COTS DISPLAYS: THE DISPLAY TECHNOLOGY OF THE FUTURE
June 1994

James W. Gladden

Keywords: Flat Panel Displays, 3-D Stereoscopic Displays, Head-Mounted Displays, Projection Displays, CRT Displays

The future display technology for 3-D scene generation may be found in the development of the Advanced Research Projects Agency's (ARPA) High-Definition Display Systems (HDS) program. An assessment of the HDS program was initiated from ARPA literature. The literature was supplemented as needed to provide as complete a picture of this program as possible. Over 40 references are cited. The report is intended for use in developing 3-D scene generation systems needed for fast and effective visualization of battlefield information.

TEC-0055 AD A282 796

SITE MODEL-BASED IMAGE REGISTRATION AND CHANGE DETECTION - FIRST ANNUAL REPORT ON RADIUS PROJECT
June 1994

R. Chellappa Q. Zheng
L.S. Davis C.L. Lin
X. Zhang C. Rodriguez
A. Rosenfeld

University of Maryland DACA76-92-C-0024

Keywords: Aerial Image Understanding, Change Detection, Image Analysis, Quick-Look Profile, Registration

The University of Maryland (with TASC as a subcontractor) is one of a group of institutions doing research on aerial image understanding in support of the RADIUS program. The emphasis of our research is on knowledge-based change detection (CD) using site models and the domain expertise of image analysts (IAs). We are designing a system that allows the IA to specify what are to be considered as significant changes through quick-look (QL) profiles, and to select appropriate image understanding algorithms for detecting these changes. Before CD can be attempted, the acquired images have to be registered to the site model. Two algorithms for image registration have been developed. When no information about the camera is available, we use an efficient constrained search mechanism for image-to-image registration. When an approximate camera model is available, as in RADIUS applications, we use a fast image-to-site model registration algorithm which first projects the site model into the new image domain using the given approximate camera model, and then use five control points to do camera resection and to obtain an accurate camera mode. To enable efficient transfer of technology to the IAs, we have developed our algorithms under the RADIUS Common Development Environment (RCDE).

TEC-0056 **AD A282 927**

TECHNOLOGY REQUIREMENTS FOR MINEFIELD DETECTION FROM SPACE
April 1994

Thomas Anderson
Alan Poirier

The Futures Group DACA76-92-C-0030

Keywords: Minefields, Space, Anti-Armor, LEO Satellite, Multispectral

An analysis of the technology requirements for minefield detection from space has produced a design for a space-based sensor that can be used to detect anti-armor minefields. The project produced some minefield reflectance measurements to support the tactical requirements analysis. The project final report describes some potential signature phenomenology based upon several aircraft flights over an Army test range. The flights were planned to collect reflectance data with a multispectral sensor over the test minefield at Twenty-nine Palms, California. The final report describes the tactical minefield problem as experienced in five hypothetical future battlefield scenarios. The tactical requirements for a space-based minefield detection satellite are derived from the battlefield scenarios and a design is suggested for a low-cost tactical imaging satellite that satisfies that stated requirement.

TEC-0057 **AD A283 361**

REPRESENTATION, MODELING AND RECOGNITION OF OUTDOOR SCENES
SECOND ANNUAL REPORT
April 1994

Martin A. Fischler
Robert C. Bolles

SRI International DACA76-92-C-0008

Keywords: 3Machine Vision, Automated Scene Analysis, Object Recognition, Terrain Modeling

The primary goal of this project was to advance the state-of-the-art in scene interpretation for autonomous systems that operate in natural terrain. In particular, techniques are being developed for representing knowledge about complex cultural and natural environments so that a computer vision system can successfully plan, navigate, recognize and manipulate objects, and answer questions or make decisions relevant to this knowledge. The results include the development of representations and associated methods for rapidly modeling natural terrain, from multiple images, at a level or organization higher than that of the conventional dense array of depths. In particular, we have developed an approach for integration of information acquired from multiple views of a scene that uses a new class of geometric primitives; it allows easy expression of known constraints and observed data, and also allows the use of practical optimization based solution techniques. This work will provide an effective way of allowing a robotic system to incrementally build a progressively more accurate and complete model of the environment in which it is operating. Work is also progressing on the problem of recognizing important classes of natural and man-made objects - especially roads, trees, rocks, and terrain features.

TEC-SR-04 AD B170 617L

MANUAL OF ENVIRONMENTAL EFFECTS, THE HORN OF AFRICA
December 1992

M. Flood S. Fosburgh
J. Huntley J. Neander
J. Sullivan E. Ward
C. Werle T. Niedringhaus

Keywords: Environment, Topography, Climate, Operations, Systems, Personnel, Somalia, Ethiopia, Djibouti, Horn of Africa, Environmental Effects

This is the second in a series of manuals designed to provide, in a concise format, useful information on the potential environmental effects on military materiel, operations, and personnel for a specific region. In the context of this manual, the environment includes general geography, topography, weather, climate, and their effects. A section on human factors and impacts has been added to this volume. This manual focuses on the Horn of Africa (in Northeast Africa), specifically Somalia, the highlands of Ethiopia, and Djibouti. Each of the major geographic elements is covered in turn. Finally, environmental effects are provided in some detail to illustrate the various environmental impacts on military materiel, operations, and personnel.

TEC-SR-05 AD B172 678L

MANUAL OF ENVIRONMENTAL EFFECTS, THE COUNTRIES OF FORMER YUGOSLAVIA AND ALBANIA
March 1993

M. Flood S. Fosburgh
J. Huntley J. Neander
T. Niedringhaus J. Sullivan
E. Ward

Keywords: Environment, Topography, Climate, Operations, Systems, Personnel, Environmental Effects, Former Yugoslavia, Albania

This is a third in a series of manuals designed to provide in a concise format, useful information on the potential environmental effects of military materiel, operations, and personnel for a specific region. In the context of this manual, the environment includes general geography, topography, weather, climate, and their effects. This manual focuses on the countries of former Yugoslavia and Albania. Environmental effects are provided in some detail to illustrate the various environmental impacts on military materiel, operations, and personnel.

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GRAFF, Linda, "An Automated Approach to Classifying Generic Terrain Features Using Digital Elevation Data," 3rd International Geomorphology Conference, 24-29 Aug 93, Ontario, CN, AD-A268 385

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Acousto-Optic Technology for Topographic Feature Extraction and Image Analysis	ETL-0256	1981
Adjunct Development Test II (DT II) of Position and Azimuth Determining System AN/USQ-70	ETL-0217	1980
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ADRIES Prototype System Development Program (1986-1990)	ETL-0577	1990
Advanced Continuous Tone Plate and Process Compatible with Present Military Lithographic Reproduction Equipment and Practices	ETL-0056	1975
Advanced Digital Radar Imagery Exploitation Robust System (ADRIES) Annual Report	ETL-0578	1990
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Lightweight North-Seeking Gyro Azimuth Surveying Instrument, Model 11NG531A	AD 486 317	1965
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L.N.K. Software Systems for Transferring, Merging, and Displaying DFAD/DTED Data on AMS/CAPIR	ETL-0318	1983
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Low Cost Gyrocompass	ETL-0355	1984
Low Intensity Conflict Viewer (LIC-VIEW) Phase I	TEC-0043	1992
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Manual for Maintenance and Operation of the MB-1 Multiband Aerial Camera	ETL-0040	1976
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Map Coating Concept Studies	AD 679 215	1968
Map Illuminator Test, Phase I	ETL-0034	1975
MAPCON Design Study	AD 854 619L	1967
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Materials Research for Holographic Recording (Report No. 1, Multiple Image Storage of Continuous Tone Data in Volume Holograms)	ETL-0088	1976
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Microreduction and Enlargement of Graphic Information Study (MEGIS)	ETL-0063	1977
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TITLE	REPORT NO.	YEAR
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