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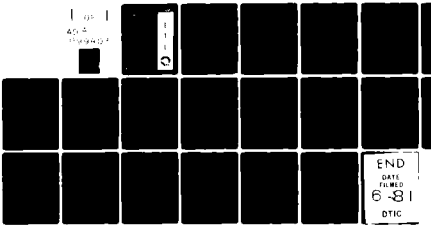

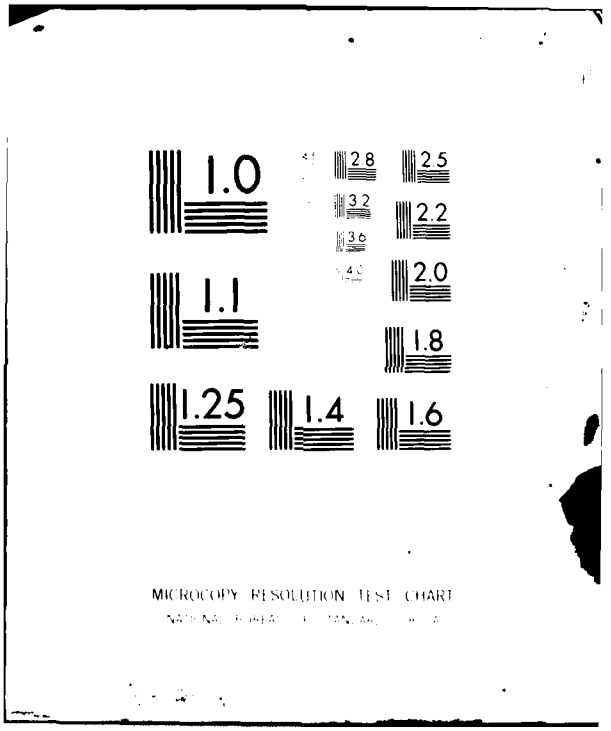
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LEVEL III

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ETL-0255

AD A099803

Bibliography of in-house and contract reports, supplement 9

Rosalinda P. Barrón

FEBRUARY 1981

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PREFACE

This is Supplement 9 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-A055 468), (Supplement 7, AD-A068 744), (Supplement 8, AD-A084 111). It is a continuing bibliography of reports prepared by and for the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, VA. This bibliography includes reports that were published from 1 January 1980 through 31 December 1980.

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COL Daniel L. Lycan, CE, was Commander and Director of ETL during the report preparation. Mr. Robert P. Macchia was the Technical Director.

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ETL-0199 AD A085 996

Handel, S.

FINAL TECHNICAL REPORT
FT. BELVOIR TEXT PLACEMENT SYSTEM
November 1979

Computervision Corporation DAAG53-76-C-0172

Keywords: Aeronautical Charts, Automated Names Locating, Cartographic Text Placement, Computer Controlled.

The objective of the project was to develop a system using off-the-shelf hardware which automates the placement of typeset text on a map. The Final Technical Report documents the results, problems encountered and their solution, conclusions and recommendations, and references used. The Appendices include: Ft. Belvoir Test Plan; Operator's Manual; Computervision's Graphics System Description; and photographs and specifications of the hardware.

ETL-0201 AD A086 002

Wilson, E. A.
Brunfeldt, D. R.
Ulaby, F. T.
Holtzman, J. C.

CIRCULARLY POLARIZED MEASUREMENTS
OF RADAR BACKSCATTER FROM TERRAIN
February 1980

University of Kansas Center for Research, Inc. DAAK70-78-C-0121

Keywords: Backscatter, Circular Polarization, Microwave Remote Sensing, Radar Remote Sensing, Scatterometer, Terrain.

This report documents the design changes to the University of Kansas MAS 8-18/35 scatterometer system required to incorporate a circular polarization capability and a subsequent backscatter measurement program.

The modifications enable the MAS 8-18/35 system to acquire both linear (HH, HV, VV) and circular (RR, RL, LL) radar backscatter data over its entire operating range of 8-18 GHz and 35 GHz.

The measurement program described herein consisted of measurements of the backscatter coefficient, σ°, as a function of the angle of incidence (0° – 80°) at selected frequencies in the 8-18 GHz range using circular polarization. Targets studies included coniferous and deciduous trees, wet and dry asphalt and concrete and bare and plowed ground at various moisture conditions. Coniferous and deciduous tree measurements were taken in both August and November so that seasonal changes could be observed.

ETL-0208 **AD A086 332**

Steller, David D.
Mel, Michael R.
Shiroma, Debra J.
Muir, William
Sowma, Julie A.

MULTI-SOURCE IMAGE ANALYSIS
December 1979

Earth Science Consulting and Technology Corp. DAAK70-78-C-0180

Keywords: Image Interpretation, Panchromatic, Radar, Remote Sensing, Thermal Infrared.

For the purposes of this study, multi-source image analysis is defined as the utilization of imagery from panchromatic photography, radar and thermal infrared systems for providing military geographic information. The imagery was limited to sets available from a variety of governmental and commercial sources. Effort was made to obtain images from all three sensor systems, but at some test sites only one or two types were utilized. Sensor characteristics were evaluated in relationship to the targets of interest and sensor keys determined. Several useful enhancement techniques were utilized to emphasize feature parameters. Comparison interpretation using all three image types provided valuable complementary target information.

ETL-0209 **AD A095 156**

Hannah, Marsha Jo

TOPOGRAPHIC RELAXATION STUDY
September 1979

NASA/AMES Research Center MIR3205

Keywords: Terrain Classification Constraint on Digital Elevation Model, Topographic Relaxation, Slope Correction Algorithm.

Digital terrain models produced by computer correlation of stero images are likely to contain occasional gross errors in terrain elevation. These errors typically result from having mismatched sub-areas of the two images, a problem which can occur for a variety of image-and terrain-related reasons. Such elevation errors produce undesirable effects when the models are further processed, and should be detected and corrected as early in the processing as possible.

IAC has developed algorithms to detect and correct errors in digital terrain models. These algorithms focus on the use of constraints on both the allowable slope and the allowable change in slope in local areas around each point. Relaxation-like techniques are employed in the iteration of the detection and correction phases to obtain best results.

ETL-0210 AD A084 742

Singh, A.
Haralick, R.

INVESTIGATION OF EXTREMA IN DIGITAL IMAGES FOR TEXTURE ANALYSIS
March 1979

University of Kansas Center for Research, Inc. DAAK70-77-C-0156

Keywords: Clustering, Digital Images, Extrema, Extrema Density, Image Extrema, Image Segmentation, Reachability Sets, Pattern Recognition, Texture.

This report investigates the use of extrema (relative minima and maxima) graytones of a digital image, as primitives for texture analysis. Texture in images may be described in terms of extrema density as well as by the attributes of the extrema primitive. The structure of the reachability set of the extrema is examined. Included are algorithms to extract these as well as their properties. The report also demonstrates how image segmentation can be achieved on textured regions by the use of primitives such as the reachability sets.

ETL-0211 AD A090 195

Strikwerda, Thomas E.
Junkins, John L.

STAR PATTERN RECOGNITION AND SPACECRAFT ATTITUDE DETERMINATION PHASE II
December 1979

Virginia Polytechnic Institute and State University DAAK70-78-C-0038

Keywords: Attitude, Control, CCD, Pointing, Spacecraft, Triangulation.

Interim results (PhaseII) are reported from a research and development project concerned with exploitation of CCD matrix detectors in a new generation of autonomous, real-time star sensing, indentification, and spacecraft attitude determination. The results reported include the following:

(1) Continued development of an approach for real-time, on-board estimation of spacecraft attitude with sub-five arc-second precision.

(2) Implementation and validation of several variations of the approach in a laboratory microcomputer – the objective being to ascess the problems associated with a real-time, on-board version of this system.

(3) Development of truth models to generate realistic input data for the star pattern recognition and Kalman filter strategies.

(4) Conversion from use of Euler angles to Rodrigues parameters to define vehicle attitude, affecting the algorithms for star-pattern recognition, least-squares differential correction to refine estimated attitude, and the Kalman filter strategy to obtain the optimal attitude estimate.

(5) Formulation of algorithms using Euler parameters to define orientation.

The Phase III effort (in progress) will continue the above developments, culminating in extensive validation tests and documentation of the results.

ETL-0213 AD A095 157

Grosso, P. F. *DEVELOPMENT OF HIGH SPEED CRT PRINT HEAD SYSTEMS FOR CARTOGRAPHIC APPLICATIONS*
February 1980

Image Graphics, Inc. DAAG53-76-C-0182

Keywords: Automated Cartography, Computer Output Graphics, CRT Print Head Systems, Symbol/Vector Generator.

The CRT 2000 Print Head System is a high speed, large format, flatbed plotter photocomposition system developed for the Defense Mapping Agency (DMA) to produce color seperation film masters for maps and charts from digital names/symbols and cartographic data. The color separations are used to prepare press-ready printing plates for conventional multi-color printing presses for the printing of color charts and maps.

Three engineering models of CRT 2000 Print Heads were developed, installed and integrated with government owned Plotter Tables at the Defense Mapping Agnecy's Hydrographic, Topographic and Aerospace Centers located in Washington, DC and St. Louis, MO respectively.

ETL-0215 AD A092 017

Lang, Roger H. *DISCRETE SCATTERING APPROACH TO VEGETATION MODELING*
April 1980

George Washington University DAAK70-77-C-0142

Keywords: Electromagnetic Wave Scattering, Random Media, Vegetation.

This report studies microwave backscattering from a forest canopy which is modeled by a collection of dielectric discs with random orientation and position. The report begins by analyzing the mean field in a tenuous distribution of discrete scatterers. The correlation of the field is found by employing the distorted Born approximation. The above is then specialized to a half space of discrete scatterers with azimuthal symmetry. Horizontal, vertical and cross polarized backscattering coefficients for the half space are found. A comparison with experiment is made for the special case of lossy dielectric discs.

ETL-0216 AD A084 111

Barrón, Rosalinda P.

BIBLIOGRAPHY OF IN-HOUSE AND CONTRACT CONTRACT REPORTS, SUPPLEMENT 8

March 1980

This is supplement 8 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-A055 468), (Supplement 7, AD-A068 744). It is a continuing bibliography of reports prepared by and for the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Virginia. This bibliography includes reports published from 1 January 1979 through 31 December 1979.

ETL-0217 AD B048 347L

Brackett, William R.
Godfrey, Ray B.

ADJUNCT DEVELOPMENT TEST II (DT II) OF POSITION AND AZIMUTH DETERMINING SYSTEM: AN/USQ-70

March 1980

Keywords: Azimuth Determination, Field Artillery Surveying, Inertial Guidance Equipment, Position Determination, Surveying System, Vehicular Surveying.

Two Position and Azimuth Determining Systems (PADS) were tested at the Cold Regions Test Center, Fort Greely, Alaska from 5 January to 1 March 1979 to determine the effects of the cold temperatures and high latitude on the operation, accuracy, reliability, maintainability, safety, and human factor characteristics of the PADS. The PADS proved to be operable, and the accuracy for horizontal positioning, grid azimuth, and vertical positioning was well within the specifications and not effected by the environment. Although one PADS had one hardware failure and the other PADS had several, investigation at the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia, revealed that none of the failures were the results of the environment. It was difficult to operate the theodolite and to connect the power cables on the PADS when wearing arctic mittens. The winterized ¼-ton truck proved to be a suitable vehicle for the PADS arctic operations; however, the driver must be made aware of the increased load requirements on the vehicle.

ETL-0218 AD A084 183

Krause, Paul F.

ACQUISITION AND EVALUATION OF THERMAL STANDARD DATA
March 1980

Keywords: Environmental Design Criteria, Environmental Effects, Environmental Tests, High Temperatures, Ordnance Temperature Measurements, Temperature Prediction, Thermal Environment, Thermal Standard.

A Naval Weapons Center (NWC) thermal standard was installed at Fort Belvoir, VA, and monitored for a year. Extreme temperatures of 129°F and 113°F occurred at the top surface and center of the thermal standard, respectively. Data were compared to thermal standard data from prior investigations. Methodologies involving data display, sampling strategies, and predictive capabilities were examined. The original predictive equation was examined, and it was found that a derivation was more suitable at Fort Belvoir, indicating that geographic and/or climatic limitations to certain analytical methods could exist.

ETL-0219 AD A085 992

Corbett, Francis J.
Tuft, Richard A.
Faccenda, W.
Cooper, R.
Rux, A.

RESEARCH AND DESIGN OF A PROM COHERENT OPTICAL PROCESSOR
April 1980

Itek Corporation DAAK70-79-C-0164

Keywords: Algorithm Development, Automatic Feature Extraction, Coherent Optics, Electro-Optics, Hybrid Image Processing, Optical Processing, Pattern Recognition, PROM (Pockels Readout Optical Modulator).

This program produced a design for a coherent optical image processor utilizing a PROM(s). The PROM Coherent Optical Processor or PCOP is a subsystem of the USAETL Hybrid (Optical/Digital) Image Processor. The design and supporting analysis tasks are detailed in the report. The purpose of development of this processor is to evaluate automatic image feature extraction algorithms.

The PCOP is a two PROM Fourier plane filter processor which operates in the following manner. The first PROM is the input image plane. Imagery is scaled through a lens system and then manipulated in intensity space at the input PROM. The image

transform is taken next in the processing sequence and then filtered at the second PROM. Filters are generated with a laser optical scanner. The reconstructed image is produced on a charge integrating camera and displayed on a CRT.

The system functions interactively. An operator will control the PROM, filtering, and display parameters with the goal of optimizing the feature extraction process.

This design is unique in the following ways: First, the optical imaging and filtering operations have been made compatible with the frequency response of the PROM; and second, Fourier filtering is implemed by generation of the appropriate pattern with the laser optical scanner and then with rotation of the filter medium or PROM, as opposed to rotation of the data with respect to a stationery filter.

Image quality and data throughput were determined and the PCOP design was made to insure the output quality was compatible with the USAETL program objectives.

ETL-0220 **AD A084 007**

Pearson, Alexander R.
Wright, Janet S.

SYNTHESIS GUIDE FOR CROSS-COUNTRY MOVEMENT (Report No. 4 in the ETL series on Guides for Army Terrain Analysts)
February 1980

Keywords: Cross-Country Movement, Off-Road Mobility, Trafficability, Vehicle Mobility.

This report provides step-by-step instructions for compiling a cross-country movement map from previously prepared factor overlays. The information on the factor overlays is combined, or synthesized, manually with or without the aid of a simple mathematical model. Three synthesis methods are given: (1) using a mathematical model; (2) using a mathematical model with a programable calculator (HP-97), and (3) using a qualitative, nonmathematical procedure.

ETL-0221 **AD A087 518**

Rice, W. C.
Shipman, J. S.
Spieler, R. J.

INTERACTIVE DIGITAL IMAGE PROCESSING INVESTIGATION, PHASE II
April 1980

International Business Machines Corporation DAAK70-77-C-0166

Keywords: Classification, Digital Image Processing, Feature Extraction, Pattern Recognition, Photogrammetry, Remote Sensing.

The objective of the second phase of this investigation was to continue the development of the interactive multi-channel image classification capabilities of the DIAL system. This development proceeded in four directions. Formal demonstrations and a "hands on" course in the DIAL algorithms implemented under the first phase of the investigation were given. Additional DIAL algorithms to support classification were developed, coded, and tested. These included a Program Module (PM) to apply the Karhunen – Loeve transformation to a multi-channel image, which has the effect of reducing the dimensionality of an image without significantly decreasing its information content. In addition two algorithms in refining class assignment by relaxation methods were developed. One was selected, then coded on DIAL and was applied to a classification of a LACIE intensive site, where it removed "speckle," sharpened field boundaries, and increased the overall classification accuracy. A task to program the computationally intensive part of the maximum likelihood method on the STARAN was undertaken jointly with ETL. Finally an experiment in the maximum likelihood classification of a LANDSAT scene using the DIAL PMs was performed in cooperation with an ETL botanist. This experiment demonstrated the utility of the interactive classification algorithms in the study of the relationship between flora and geological structures.

ETL-0222 **AD A085 881**

Margerum, Eugene A.

APPLICATION OF BIORTHOGONAL FILTER FUNCTIONS TO PATTERN RECOGNITION AND FEATURE EXTRACTION
March 1980

Keywords: Adaptive Learning, Biorthogonal Functions, Feature Extraction, Filter Function, Pattern Recognition, Signatures.

A mathematical method is developed for generating a set of filter functions from a given set of signatures. The filter function set of functions is biorthogonal to the set of signature functions; therefore, any one filter function gives a perfect response to one signature, and a response to all other given signatures is completely suppressed. The method can be used to decompose superpositions of signatures as well as for improving separation of measured parameters for pattern recognition. It can also be used to suppress interferences from the background when it is included in the given set of signatures. A method of adding new filter functions to an existing set without complete recomputation (adaptive learning) is discussed.

ETL-0223 **AD A085 872**

Cullis, Brian J.

ADVANCED FEATURE SYMBOLIZATION FOR THREE-DIMENSIONAL VIEWS

April 1980

Keywords: Three-Dimensional Views, Map Data, Symbolization, Tactical Graphics, Vertical Features.

This report documents initial research into the development of line-drawn symbols for point features in tactical terrain computer graphics. In this report, 21 significant point features for aircraft in tactical operations were selected for study. Symbols were designed for these 21 point features, with primary emphasis placed upon enhancing rapid user recognition, minimizing computer drawing time and computer storage requirements. Three candidate computer storage strategies, X-Y Absolute, Starburst and Run-Length-Starburst, were evaluated. The most efficient storage strategy for these symbols was the X-Y Absolute technique. The symbols were digitized, and software was developed to plot them in conjunction with existing three-dimensional terrain view software.

ETL-0224 **AD A091 692**

Lindblom, Kenneth A.
Wright, Malor

TECHNICAL DATA ON KC-FILM, TONERS AND PROCESSES

April 1980

Coulter Systems Corporation DAAK70-79-C-0116

Keywords: Acutance, D-Max, Gamma Range, Granularity, Grey Scale Responses, KC-Film, Reciprocity, Resolution Capability, Spectral Sensitivity, Toner, Voltage-Log E Response.

The work accomplished includes measurements of the response of KC-Film, toners and processes. Data is included on charge levels, dark decay, voltage-log E response, reciprocity characteristics, as well as spectral sensitivity of KC-Film. This report includes grey scale responses for each of two toner types, including D-max and gamma ranges. Resolution capability is included as a function of toner type, surface voltage, toning time, exposure and image contrast. Resolution data is also provided as a function of time from imaging to toning. Granularity as well as acutance (edge sharpness) determinations are presented as a function of toner type.

ETL-0225 **AD A091 959**

Spencer, R.
Ho, R.
Kabat, F.
Smith, D. M.
Fries, R.
Hicks, G.

ADVANCED SATELLITE HARDWARE/ SOFTWARE SYSTEM STUDY
April 1980

General Electric DAAK-70-79-C-0009

Keywords: Digital Image Processing, Image Data Analysis Systems, Landsat-D, Thematic Mapper Digital Data Analysis.

This report provides an overview of the Landsat-D program and the anticipated requirements of the Corps of Engineers for the application of Landsat data to operational programs. A general discussion of the candidate data analysis requirements, including data input and output and other data preparation processes provides a complete description of the capabilities which will be required of an advanced satellite hardware/software image analysis system. A brief overview of the currently available hardware technology provides a basis for the synthesis of the hardware system design, and an example of a typical software structure, based on that for an actual system, is presented. Descriptions of three candidate system architectures provide examples of different approaches to the development of a system meeting the Corps of Engineers requirements, and the problems of communication between remoted terminals and a host processor are addressed, together with the problems related to the dissemination of data to remotely located independent systems. A brief cost analysis indicates the system cost drivers, and shows how cost tradeoffs may be made in developing a specific system. A candidate system design for the Corps of Engineers is presented, based on the concept of independent systems with capabilities tailored to local requirements.

ETL-0226 **AD A087 371**

Satterwhite, Melvin B.

EVALUATING SOIL MOISTURE AND TEXTURAL RELATIONSHIPS USING REGRESSION ANALYSIS
May 1980

Keywords: Sand and Water Relations, Soil Moisture Constants, Soil Texture.

Soil moisture and textural conditions are described for 179 soil samples from an arid to semiarid climate. Stepwise multiple regression analysis of these data produced four regression equations that related (1) the percent sand and clay and (2) the percent fines, with the percent soil water held at 0.33 bar (FC) and the 15 bar (WP) potentials. Evaluation of these equations showed no differences between the

estimates at the 0.33 bar potential using either the percent sand and clay or the percent fines. Better estimates for the WP were obtained when the percent sand and clay were used instead of the percent fines. The differences between the estimated soil moisture at FC or WP varied less than 30 percent from the measured soil moisture values for 161 (90 percent) of the 179 soil samples. The differences between the estimated and the measured soil moisture values were not significant at the 95 percent level of confidence.

The regression equations provide a method by which the potential percent soil water held at the FC or WP can be estimated from soil textural data. The accuracy and precision of the results of applying these equations to soils of other areas has not been determined. It would seem, however, that they would be applicable in those instances where only general working estimates are needed.

ETL-0227 AD A091 691

Biecker, G. A.
Potter, J. L.
Paden, D. S.

FEATURE TAGGING
March 1980

Goodyear Aerospace Corporation DAAK70-79-C-0070

Keywords: Automated Cartography, Feature Tagging, Pattern Recognition.

The automated recognition of cartographic symbols such as dual cased roads and railroads would significantly reduce the manual labor involved in generating digital cartographic data bases. The effort described in this report was successful in detection 96.5% of the railroad symbol components. There were only 1.5 false taggings. 98.3% of the dual cased roads were tagged with only .7% false taggings. Goodyear Aerospace Corporation (GAC) believes that minor modifications to the algorithms would produce near perfect results for both features. Because of the success of this effort, GAC feels that the project should be continued to allow evaluation on existing map sheet data and expansion of the effort to additional cartographic symbols.

ETL-0228 **AD A091 736**

Adams, N. J.
Anderson, M.
Biecker, G.
Messner, R.

CONTOUR DIGITIZING AND TAGGING SOFTWARE (CONTAGRID)
April 1980

Goodyear Aerospace Corporation DAAK70-77-C-0223

Keywords: Automated Cartography, Automatic Gridding, Automatic Tagging.

The Contour Digitizing and Tagging Software (CONTAGRID) program demonstrates that a parallel sequential processor combination can effectively perform automated elevation tagging and elevation gridding operations. It demonstrates that such a processor set is capable of automating the entire Digital Terrain Elevation Data generation task from processing the rasterized input map sheet overlay data to outputting the final digital product.

ETL-0229 **AD A092 146**

Tenenbaum, Jay M

VIDEO STREAM PROCESSORS: A COST-EFFECTIVE COMPUTATIONAL ARCHITECTURE FOR IMAGE PROCESSING
June 1980

SRI International DAAK70-78-C-0114

Keywords: Display Processor, Image Processing, Video Stream Processor

This report evaluates the capabilities of a new class of image-processing systems, known generically as video stream processors (VSPs). VSPs are an outgrowth of image display technology; image data from the display memory are streamed at video rates through a digital-processing unit and back to memory for subsequent display or further processing. This architecture serially simulates a parallel-array processor and is capable, in principle, of executing any locally parallel operation, such as convolution and edge detection, at a fraction of the cost of a truly parallel system.

Our evaluation begins with a general discussion of the architecture and use of VSPs that highlights the fundamental concepts and vast application potential of this class of machines. This discussion is based on a hypothetical VSP design in order to avoid artificial constraints imposed by design limitations of any particular commercial product. The hypothetical design also serves as a standard against which current implementations can be evaluated.

The report next summarizes our experience with the IP-5000 Image Array Processor (manufactured by De Anza Systems, Santa Clara, California), currently the most advanced commercially available VSP. The IP-5000 design is critiqued in the context of the hypothetical design, followed by a presentation of experimental results at SRI. The concluding discussion analyzes the IP-5000's limitations and proposes design refinements that would significantly improve its utility.

ETL-0230 **AD A088 659**

Shine, James. A.
Margerum, Eugene A. ***CORRELATION OF NOISY IMAGES***
June 1980

Keywords: Computer Simulation, Correlation, Filtering, Fourier Transform, Image Processing.

A computer program can simulate star-shaped images and a correlation between two different images on 128 by 128 matrices. The Fourier transform, in a timesaving algorithm, is used to carry out the correlation. Different factors in the image (contrast, noise, size) are varied and the effects are observed. The results showed good correlation except when the contrast was low and the noise was high. Using a filtering function in the correlation process produced good results in improving poor correlation patterns.

ETL-0231 **AD A087 370**

Schwarz, Gunther ***TERRAIN ANALYST SYNTHESIZER STATION***
June 1980

Keywords: Factor Maps, Multispectral Projection System, Terrain Analyses.

This report describes the Terrain Analyst Synthesizer Station built under contract for USAETL. Tests were performed to determine the characteristics and adherence to the specifications set forth in the Purchase Description.

ETL-0232 **AD A087 443**

Crombie, Michael A. ***ERRORS IN AUTOMATIC PASS POINT MENSURATION USING DIGITAL TECHNIQUES***
June 1980

Keywords: Correlation, Digital Pictures, Pass Point, x-Parallax, y-Parallax.

A technique for automatically measuring pass points from digital stereo images is evaluated. Numerical estimates of x-parallax and y-parallax for a specific stereo pair of images is presented as a function of terrain relief.

ETL-0233 **AD A091 533**

Pazak, Robert S.

ARTIFACT REMOVAL IN FREQUENCY DOMAIN COMPRESSED IMAGERY

July 1980

Keywords: Compression, Convolution, Discrete Cosine Transform, Entropy, Filtering, Frequency Domain, Power Spectrum, Spatial Domain.

Two types of images were compressed in the frequency domain and expanded back to the spatial domain. A technique was invested that retransforms the images into the frequency domain, where artifacts generated during the original compression phase are removed and images are again converted to the spatial domain.

ETL-0234 **AD A092 077**

Stiles, W. H.
Ulaby, F. T.
Wilson, E. A.
Holtzman, J. C.

CIRCULARLY POLARIZED MEASUREMENTS OF RADAR BACKSCATTER FROM TERRAIN AND SNOW-COVERED TERRAIN

July, 1980

University of Kansas Center for Research, Inc. DAAK70-78-C-0121

Keywords: Backscatter, Circular Polarization, Microwave Remote Sensing, Radar Remote Sensing, Snowcover, Terrain.

This report covers a measurement program to obtain circularly polarized radar backscatter coefficient (σ°) data along with associated ground-truth information on snow-covered terrain. Snow-covered grass, asphalt and ice were observed at selected frequencies from 8 to 18 GHz for angles of incidence between 0° (nadir) and 80°. Also included are some analyses of the effects of snowcover on the backscatter from terrain.

ETL-0235 **AD A090 465**

A STUDY OF KNOWLEDGE-BASED SYSTEMS FOR PHOTO INTERPRETATION

Duda, Richard O.
Garvey, Thomas D.

June 1980

SRI International DAAK70-78-C-0114

This report discusses applications of knowledge-based programming techniques to a selection of photo interpretation tasks. The technology of knowledge-based programming is reviewed, several relevant photo interpretation problems are described, and the most promising applications are discussed in detail. Recommendations are presented for developing knowledge-based systems as expert consultant programs to assist military geographic intelligence analysts and to aid users of advanced photo interpretation tools.

ETL-0236 **AD A088 885**

RADIATIVE TRANSFER IN ONE-DIMENSIONAL, DISCRETELY STRATIFIED MEDIA

Margerum, Eugene A.

August 1980

Keywords: Diffuse Reflection, Discrete Methods, Invariant Imbedding, Layered Media, Multiple Scattering, Radiative Transfer.

The theory of one-dimensional radiative transfer is derived for media composed of layers of varying scattering properties. An illuminating interpretation of the formulas is given in terms of the various possible paths of multiple scattering. The semi-infinite homogeneous case is treated by introducing an invariance condition. Then, the transition to the continuous case is made by passage to a mathematical limit. Tabulated diffuse reflection coefficients are given for this last case.

ETL-0237 AD A091 840

Craig, Samuel E.
Moyer, Alan L.

IMAGE ALIGNMENT AND CORRELATION SYSTEM
July 1980

Deft Laboratories, Inc. DAAK70-78-C-0217

Keywords: Acousto-Optics, Image Processing, Microprocessors.

This report documents the development and design of the Image and Alignment and Correlation System built for the U.S. Army Engineer Topographic Laboratories by Deft Laboratories, Inc. The purpose of the system is to provide a hardware demonstration of the applicability of DEFT (Direct Electronic Fourier Transform) technology to the problems of image alignment and image cross-correlation measurement. These problems are related generally to the areas of topographic mapping, feature extraction and change detection, and photo-interpretation.

The system uses a highly developed image-adaptive alignment algorithm which exploits the spatical frequency analysis capability of the DEFT sensor. With high-contrast images having prominent spatial frequencies, residual alignment errors are typically 50 microns in translation and 0.1 degree in angle. The system also has the capability of displaying the spatial frequency content of an image, and of computing normalized cross-correlation coefficients based on spatial frequency data.

The major limitations of the system are its slow operating speed, which is caused by certain parts of the circuitry rather than the sensor, and its dependence on the image.

ETL-0238 AD B054 802L

Perrin, Jack L.

TEST RESULTS OF THE SINGER KEARFOTT DIVISION, MODIFIED LAND NAVIGATION SYSTEM
August 1980

Keywords: Land Navigation, Position Determination.

This report describes the test results of the Singer, Kearfott Division, modified land navigation system. The system was tested from 28 April 1978 to 15 June 1979. Both laboratory and field tests were performed. Most of the field tests were performed with the system mounted in a 151A1 Jeep, but some were performed in an M113 Armored Personnel Carrier. The tests were conducted to determine the potential of the modified system to provide UTM coordinates of suitable accuracy for positioning weapon/target acquisition systems and target-locating systems. The test results indicate that the modified system has sufficient accuracy, but that further developments will be necessary to correct deficiencies and to expand capability.

ETL-0239 **AD A091 600**

Loew, Murray H.
Pickholtz, Raymond L.
Goldman, Lee
Hill, Fred
Lawler, Fred
Van Meter, Joseph

ANALYSIS AND DEVELOPMENT OF IMAGE STATISTICS AND REDUNDANCY REMOVAL
September 1980

George Washington University DAAK70-79-C-0147

Keywords: Cartography, Hough Transform, Image Coding, Image Processing, Medial Axis Transform, Pattern Recognition.

The goal of classifying objects of cartographic interest in aerial photographs was approached using techniques from pattern recognition and image processing. Bridge and airport images were chosen as the initial objects of interest and segments of photographs containing them were digitized for the data base. Edge-detection and Hough transform algorithms identified structures as candidate bridges; additional decision logic (using global contrast and other attributes) further reduced the set. Results indicate the feasibility and low computational cost of the approach.

Additional results in discrete medial-axis transformation are presented, as are methods for encoding the two kinds of images. The characteristics of the two kinds of targets are so distinctive that encoding promises substantial efficiencies.

ETL-0244 **AD A092 813**

Rhines, Don S.

FINAL REPORT, STUDY OF DIGITAL MATCHING OF DISSIMILAR IMAGES
October 1980

E-Systems, Inc DAAK70-79-C-0235

Keywords: Dissimilar Images, Feature Extraction, Matching, Physical Commonalities, Similarity Measures.

This final report presents the results of a study conducted for the U.S. Army Engineering Topographic Laboratories on the digital matching of dissimilar images. This report develops a practical approach for the digital determination of corresponding points on dissimilar images. This approach could be used to register a large number of points automatically in a reasonable short period of time. The algorithms required are presented in a manner that can be coded in FORTRAN IV and tested on the DIAL facility at USAETL.

ETL-0245

AD A095 159

Satterwhite, Melvin B.
Ehlen, Judy

VEGETATION AND TERRAIN RELATIONSHIPS IN SOUTH-CENTRAL NEW MEXICO AND WESTERN TEXAS
November 1980

Keywords: Arid Climates, Chihuahuan Desert, Desert, Ecology, Geobotanical Studies, Geology, Grassland, Landforms, Plant Communities, Semi-arid Climates, Shrublands, Soil Conditions, Soil Depth, Soil Moisture, Soil Texture, Soil, Southwestern U.S.

Relationships between landforms and plant communities for a 650,000 hectare area in the Chihuahuan Desert; New Mexico and Texas, were studied using aerial photography and field observations. Techniques used showed that plant communities were associated with definite landform units, and with the soil depth, texture, and moisture characteristics in the various units. Four major landform-soil units were identified on which a specific plant community was found, accounting for more than 30 percent of the community's distribution.

ETL-0247

AD A095 158

Frodigh, Roland J.

TERRAIN ANALYSIS PROCEDURAL GUIDE FOR CLIMATE
(Rpt. No. 5 in the ETL Series on Guides for Army Terrain Analysts)
September 1980

Keywords: Climatic Analysis, Factor Mapping, Military Geographic Information, Photo Interpretation, Terrain Analysis, Thematic Mapping.

This procedural guide provides the Army Terrain Analyst with the methods and procedures necessary to generate a thematic or factor overlay with supportive tables for portraying climate. Seven potential sources of information are considered: climatic summaries; climatic studies and climatic atlases; geographic studies and atlases; maps (climatic); technical literature; aerial photography; and maps (topographic). Procedures for extracting climatic information (data elements) from these sources are presented. Appendices provide the analysts with additional sources of information.

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