TABLE OF CONTENTS

Advanced Data Display

A Practical and Efficient Approach to the Stereoscopic Display and Manipulation of Cartographic Objects, H. Moellering, Ohio State U. 1

Visualization Techniques and Applications within GIS, R.A. McLaren, Know Edge, Ltd. 5

Two-Variable Color Mapping on a Microcomputer C.B. Dawsey III, Auburn U. 15

Data Bases - A Continuous Process

Updating Urban Street Network Files with High Resolution Satellite Imagery, L. Li, G. Deecker, K. Yurach, and J. Seguin, Statistics Canada and Environment Canada 21

Establishing a Corporate GIS Data Base from Multiple GIS Project Data Sets, T.R. Johnson and K.C. Siderelis, Land Resources Information Service 874

GIS Education and Training

Education and Training in GIS: The View from ESRI, T.Burns and J. Henderson, Environmental Systems Research Institute, Inc. 31

Geographic Information System Teaching at ITC J. Drummond, J-C. Muller, and P. Stefanovic, ITC 38

GIS-Related Education and Training at Siemens H.J. Vogel, Siemens AG 47

Generalization

Cartographic Generalization in a Digital Environment: When and How to Generalize, K.S. Shea and R.B. McMaster, The Analytic Sciences Corp. and Syracuse U. 56

Conceptual Basis for Geographic Line Generalization, D.M. Mark, SUNY Buffalo 68

Data Compression and Critical Points Detection Using Normalized Symmetric Scattered Matrix, K. Thapa, Ferris State U. 78

Data Structures and Parallel Processing

Transputer-Based Parallel Processing for GIS Analysis: Problems and Potentialities, R.G. Healey and G.B. Desa, U. of Edinburgh 90

Uniform Grids: A Technique for Intersection Detection on Serial and Parallel Machines, W.R. Franklin, N. Chandrasekhar, M. Kankanhalli, D. Sun, M. Zhou, and P.Y.F. Wu, Rensselaer Polytechnic Institute 100

A Geographic Data Model Based on HBDS Concepts: The IGN Cartographic Data Base Model, F. Salge and M.N. Sclafer, Institut Geographique National 110

Demonstration of Ideas in Fully Automatic Line Matching of Overlapping Map Data, R.J. Hintz and M.Z. Zhao, U. of Maine 118

Data Structures and Post-Processing for Digital Terrain

Topographic Grain Automated from Digital Elevation Models, R.J. Pike, W. Acevedo, and D.H. Card, USGS and NASA Ames 128

A Spatial Low-Pass Filter Working for Triangular Irregular Network (TIN) and Restricted by Break Lines, Z.-T. Chen, Environmental Systems Research Institute, Inc. 138

A Compact Terrain Model Based on Critical Topographic Features, L.L. Scarlatos, Grumman Data Systems 146

A Shortest Path Method for Hierarchical Terrain Models, R. Barrera and J. Vazquez-Gomez, U. of Maine and UAM-Atzcapotzalco 156

Topics in GIS and Automated Cartography

Hipparchus Data Structures: Points, Lines, and Regions in Spherical Voronoi Grid, H. Lukatela, Calgary 164

Interactive Analytical Displays for Spatial Decision Support Systems, M.P. Armstrong and P. Lolonis, U. of Iowa 171

Automated Insetting: An Expert Component Embedded in the Census Bureau's Map Production System, A.A. Martinez, Bureau of the Census 181

Accessing Spatiotemporal Data in a Temporal GIS, G. Langran, U. of Washington 191

A GIS Curriculum for Universities

Components of Model Curricula Development for GIS in University Education, T.L. Nyerges, U. of Washington 199

Automated Names Placement

Automated Names Placement in a Non-Interactive Environment, L.R. Ebinger and A.M. Goulette, Bureau of the Census 205

An Expert System for Dense-Map Name Placement, J.S. Doerschler and H. Freeman, Hamilton Standard Division and Rutgers University 215

The Use of Artifical Intelligence in the Automated Placement of Cartographic Names, D.S. Johnson and U. Basoglu, Intergraph Corp. 225

Rule-Based Cartographic Name Placement with Prolog, C.B. Jones and A.C. Cook, Polytechnic of Wales 231

Digital Terrain

The Development of Digital Slope-Aspect Displays, A.J. Kimerling and H. Moellering, Oregon State U. and Ohio State U. 241

Conversion of Contours, B. Shmutter and Y. Doytsher, Technion I.I.T. 245

Relative Errors Identified in USGS Gridded DEMs, J.R. Carter, U. of Tennessee 255

GIS Design: Examining the Alternatives

The Architecture of ARC/INFO, S. Morehouse, Environmental Systems Research Institute, Inc. 266

Algorithms

The Combinatorial Complexity of Polygon Overlay, A. Saalfeld, Bureau of the Census 278

Pushbroom Algorithms for Calculating Distances in Raster Grids, J.R. Eastman, Clark U. 288

Spatial Adjacency - A General Approach, C.M. Gold, Memorial U. 298

Algorithms

Multiscale Data Models for Spatial Analysis, with Applications to Multifractal Phenomena, L. DeCola, U. of Vermont 313

Three-dimensional GIS

Three-Dimensional GIS for the Earth Sciences, D.R. Smith and A.R. Paradis, Dynamic Graphics, Inc. 324

National Capital Urban Planning Project: Development of a Three-Dimensional GIS Model, L.G. Batten, USGS 336

GIS Future: Automated Cartography or Georelational Solid Modeling?, H. Lukatela, Calgary 341

Data Capture Techniques

Spectral/Spatial Exploitation of Digital Raster Graphic Map Products for Improved Data Extraction, T.J. Eveleigh and K.D. Potter, Autometric Inc. 348

Cartographic Data Capture Using CAD, M.E. Hodgson, M.L. Barrett, and R.W. Plews, U. of Colorado and Hunter College, CUNY 357

Tigris Mapper Viewed as a Digital Data Capturing Tool in Object Oriented Environment, J. Mitter, Intergraph Corp. 367

Data Capture for the Nineties: VTRAK, R. Waters, D. Meader, and G. Reinecke, Laser-Scan Laboratories 377

Environmental Applications of GIS

Polygon Overlay to Support Point Sample Mapping: The National Resources Inventory, D. White, K. Chan, M. Maizel, and J. Corson-Rikert, NSI Technology Support Corp. 384

Hazardous Waste Disposal Site Selection Using Interactive GIS Technology, C. Van Zee and J.E. Lee, Ebasco Services and QC Data Collectors, Inc. 391

Testing Large-Scale Digital Line Graphs and Digital Elevation Models in a Geographic Information System, D.R. Wolf and E.T. Slonecker, USGS and Bionetics Corp. 397

Data Structures and Spatial Query Techniques

Quadtree Meshes, W.T. Verts and F.S. Hill, Jr., U. of Massachusetts 406

Storage Methods for Fast Access to Large Cartographic Data Collections - An Empirical Study, A. Kleiner, U. of Zurich 416

Solving Spatial Queries by Relational Algebra, R. Laurini and F. Milleret, INSA-Lyon 426

Structuring Large Spatial Data Bases

Speculations on Seamless, Scaleless, Cartographic Data Bases, S.C. Guptill, USGS 436

Optimal Tiling for Large Cartographic Databases, M.F. Goodchild, UC Santa Barbara 444

The Geographic Database - Logically Continuous and Physically Discrete, P. Aronson, Environmental Systems Research Institute, Inc. 452

Planetary Modeling via Hierarchical Tessellation, G. Dutton, Prime Computer 462

GIS Applications

Use of the 1:2,000,000 Digital Line Graph Data in Emergency Response, H. Walker, Lawrence Livermore National Laboratory 472

Use of a Geographic Information System to Evaluate the Potential for Damage from Subsidence of Underground Mines in Illinois, C.A. Hindman and C.G. Treworgy, Illinois State Geological Survey 483

International Perspectives

Digital Data: The Future for Ordnance Survey, M. Sowton, Ordnance Survey, UK 493

GIS, AM/FM, and Automated Cartography in Japan, S. Kubo, Ochanomizu U. 505

Trends of Computer-Assisted Cartography in Hungary and Eastern Europe, P. Divenyi, Institute of Geodesy, Cartography, and Remote Sensing 513

Quality Control Issues

Error in Categorical Maps: Testing versus Simulation, N.R. Chrisman, U. of Washington 521

Modeling Error for Remotely Sensed Data Input to GIS, M.F. Goodchild and M. Wang, U. of Western Ontario and U.C. at Santa Barbara 530

Spatial Relations and Data Base Models

Concepts of Space and Spatial Language, D.M. Mark and A.U. Frank, SUNY Buffalo and U. of Maine 538

Geographic Information: Aspects of Phenomenology and Cognition, R.J. Williams, Australian Defence Force Academy 557

GIS Support for Micro-Macro Spatial Modeling, T.L. Nyerges, U. of Washington 567

Context-Free Recursive-Descent Parsing of Location-Descriptive Text, M. McGranaghan, U. of Hawaii 580

Object-Oriented Approaches to GIS

Object-Oriented Modeling in GIS: Inheritance and Propagation, M.J. Egenhofer and A.U. Frank, U. of Maine 588

Geographic Logical Database Model Requirements, M. Feuchtwanger, U. of Calgary 599

Educational Tools for GIS

GIST: An Object-oriented Approach to a Geographical Information System Tutor, J.F. Raper and N.P.A. Green, Birkbeck College 610

DEMOGIS Mark 1: An ERDAS-Based GIS Tutor, D.J. Maguire, University of Leicester 620

Poster Session

Cartographic Analysis of U.S. Topography from Digital Data, R.J. Pike and G.P. Thelin, USGS 631

A Full Function GIS Editor, W.H. Moreland, Environmental Systems Research Institute, Inc. 641

Poster Session

A Study of Spatial Data Management and Analysis Systems, C. Christopher and R. Galle, Jackson State U. and Stennis Space Center 648

Sliding Tolerance 3-D Point Reduction for Globograms, S. Prashker, Carleton U. 655

A Reactive Data Structure for Geographic Information Systems, P. van Oosterom, U. of Leiden 665

Challenges for the Future

Challenges Ahead for the Mapping Profession, J.C. Muller, ITC 675

An On-line, Secure and Infinitely Flexible Data Base System for the National Population Census, D.W. Rhind, E. Hayes-Hall, H.M. Mounsey, and S. Openshaw, Birkbeck College and The University of Newcastle 684

Automated Mapping Applications

A Cartographic Extract of the TIGER File: Implications for Mapping Applications, A. Bishton, Bureau of the Census 697

A Versatile Mapping System for the USGS 1:100,000 DLGs, D.J. Cowen and T.R. White, U. of South Carolina 705

New York State's Digital County Mapping Program, T.W. Koch, NY DOT 715

Vector-Based Computer Graphics in Automated Map Compilation, C.F. Scheepers, CACDS 724

Standards and Their Use

First UNIX, then UGIX, D.W. Rhind, J.F. Raper, and N.P.A. Green, Birkbeck College 735

The South African Standard for the Exchange of Digital Geo-Referenced Information, A.K. Cooper, CACDS 745

The Telecommunication of Map and Chart Data, T. Evangalatos, Z. Jiwani, D. McKellar, and C.D. O'Brien, Canadian Hydrographic Service, OMNR, DND, IDON Corp. 754

GIS: Directions for the Future

The ESRC's Regional Research Laboratories: An Alternative Approach to the NCGIA?, J.W. Shepherd, I. Masser, M. Blakemore, and D.W. Rhind, Birkbeck College, U. of Sheffield, and U. of Durham 764

The Institutional Context of GIS: A Model for Development, P.F. Fisher and M.N. DeMers, Kent State U. and Ohio State U. 775

GIS Performance

The Power of Symbology in the GIS World, M.E. Gentles, Synercom Technology, Inc. 781

On the Design of Geographic Information System Procedures, J.A. Guevara, Environmental Systems Research Institute, Inc. 789

Performance Testing of Gridcell-Based GIS, S.E. Amundson, U. of Hawaii at Hilo 798

Use Error: The Neglected Error Component, K. Beard, U. of Maine 808

System Design, Integration, and Application

Extending Entity/Relationship Formalism for Spatial Information Systems, Y. Bedard and F. Paquette, Laval U. 818

A Fully Integrated Geographic Information System, J.R. Herring, Intergraph Corp. 828

AM/FM and GIS

Spatial Tools for the Administration of Major Institutions, J.M. Young, Program Administration Group 838

Displays for Spatial Data

Incorporating the Laborde Projection into an Existing Cartographic Software Package, P.H. Laskowski, Intergraph Corp. 850

IBM PC Animation - Crude but Effective, W.T. Verts, U. of Massachusetts 858

CAD: A Viable Alternative for Limited Cartographic and GIS Applications, R.C. Anderson and L.D. Carmack, Jr. U.S. Military Academy 867