Curriculum Vitae of SHASHI SHEKHAR

April 9, 2009

Contents

1 Brief Biography

Shashi Shekhar is currently a Mcknight Distinguished University Professor of Computer Science at the University of Minnesota, Minneapolis, MN, USA. He was elected and *AAAS*[1] *Fellow* an *IEEE* [2] *Fellow* and received the *IEEE Computer Society Technical Achievement Award* for contributions to spatial database, spatial data mining, and geographic information systems(GIS). He is serving as a *co-Editor-in-Chief* of the Geo-Informatica: An International Journal on Advances in Computer Sc. for GIS (ISSN 1384-6175), a top-tier [3] journal in the interdisciplinary area of GIS. He is a member of the mapping science committee of the National Research Council National Academy of Sciences. He has served as a member of the Board of Directors of University Consortium on GIS (2003-2004), the editorial boards of IEEE Transactions on Knowledge and Data Engineering, and the IEEE-CS Computer Science & Engineering Practice Board. He contributed via major service roles in many conferences and workshops including the ACM SIG-Spatial Intl. Conference on GIS, IEEE Intl. Conf. on Data Mining (ICDM), IEEE ICDM Intl. Workshop on Spatial and Spatio-temporal Data Mining, SIAM Intl. Conf. on Data Mining, etc. He served as a technical advisor to United Nations Development Program (UNDP), Environmental Systems Research Institute (ESRI), and other organizations. His research projects have been sponsored by the NSF, NGA, NASA, Army Research Laboratories, USDOT, FHWA, MN/DoT etc. He co-edited an Encyclopedia of GIS (Springer, 2008, isbn 038730858X) and co-authored a textbook on Spatial Databases (Prentice Hall, 2003, ISBN 0-13-017480-7), which has been translated into two foreign languages. He has co-authored over 225 research papers in peer-reviewed journals, books, and conferences, and workshops. He received a Ph.D. degree in Computer Science and M.S. degrees in Business Administration as well as Computer Science from the University of California (Berkeley, CA).

[1] American Association for Advancement of Science

[2] Institution of Eletrical and Electronics Engineers

[3] C. Caron et al, GIScience Journals Ranking and Evaluation: An International Delphi Study, Transactions in GIS, 12(3), 2008, Blackwell Publishing Ltd. (Table 5, pp. 308 provide a summary).

2 BASIC INFORMATION

CONTACT INFORMATION

Address:	4-192, EE/CS Bldg., 200 Union St. SE, Minneapolis, MN 55455.
Phone:	(612) 624-8307 :: Fax: (612) 625-0572 :: Cell: (651) 238-9223
Electronic:	shekhar@cs.umn.edu, http://www.cs.umn.edu/~shekhar

RESEARCH INTERESTS

Spatial databases, spatial data mining, geographic information systems, mining spatial datasets.

EDUCATION

- 1989 , Ph.D., Computer Science, University of California, Berkeley. (Thesis: Cooperating Expert Systems.)
- 1989 , M.S., Business Administration, University of California, Berkeley. (Thesis: A Stochastic Learning Algorithm for Neural Networks.)
- 1987 , M.S., Computer Science, University of California, Berkeley. (Thesis: Intelli-Genesis: Software Engineering Environment for AI Programs)
- 1985 , B.S., Computer Science, Indian Inst. of Tech. (IIT), Kanpur (India). (Thesis: Implementation of a Programming Environment for 'C'.)

APPOINTMENTS

- 2005 – present, McKnight Distinguished University Professor, University of Minnesota, Minneapolis, Minnesota.
- 2005 – 07, Director, Army High Performance Computing Research Center, University of Minnesota, Minneapolis, Minnesota.
- 2001– present, Professor, University of Minnesota, Minneapolis, Minnesota.
- 1995– 01, Associate Professor, University of Minnesota, Minneapolis, Minnesota.
- 1989–95 , Assistant Professor, University of Minnesota, Minneapolis, Minnesota.
- 1985–99 , Research Asst. / Post graduate researcher, University of California, Berkeley, California. Worked on cooperating expert systems, reasoning under uncertainty, and neural networks.
- 1985 (summer) , Instructor, Regional Institute of Technology, Jamshedpur, India. Developed courses on programming paradigms.
- 1984 (summer) , Software Engineer, Taj Services Ltd., New Delhi, India. Designed and implemented a Report Generator Package for a Hotel Management System.

PROFESSIONAL MEMBERSHIPS

- IEEE Computer Society (Fellow)
- American Association for Advancement of Science (Fellow)
- Association for Computing Machinery
- University Consortium on Geographic Information Systems (Delegate).

2.1 Awards and Honors

- Fellow, American Association for Advancement of Science (2008 onwards). A Fellow is defined as "a Member whose efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished." Examples of areas in which nominees may have made significant contributions are research; teaching; technology; services to professional societies; administration in academe, industry, and government; and communicating and interpreting science to the public. Fellows are elected annually by the AAAS Council.
- Technical Achievement Award, Institution of Electrical and Electronics Engineers (Computer Society), 2006. It recognizes outstanding and innovative contributions to the fields of computer and information science and engineering or computer technology, usually within the past ten, and not more than fifteen years.
- McKnight Distinguished University Professorship, University of Minnesota, 2005 onwards. It honors and rewards highest-achieving faculty, whose work has brought great renown and prestige to the University of Minnesota. Selectivity is less than one sixth of one percent.
- Fellow, Institution of Electrical and Electronics Engineers (Computer Society), 2003 onwards. the IEEE Grade of Fellow is conferred by the Board of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The total number selected in any one year does not exceed one-tenth percent of the total voting Institute membership.
- Fellow, Minnesota Supercomputing Institute, University of Minnesota, 2005 onwards.
- The Center for Transportation Studies (CTS) **2006 Research Partnership Award**, which recognizes research projects within the CTS program that have **resulted in significant impacts on transportation**, and rewards teams of individuals who have drawn on the strengths of their diverse partnerships to achieve those results.
- Selected to present at Congressional breakfast program on GIS and homeland security, University Consortium on GIS, 2/2004.
- Member, Dean's ad-hoc Committee, Division of Engineering and Applied Sciences, Harvard University, January, 2007.
- Member, DARPA IXO Panel on "Model the Planet" for the very large spatial database program, 2006.
- Member, Mapping Science Committee, National Research Council of national academies, 2004-9.
- Member, National Research Council (national academies) Committee to review basic and applied research at the National Geo-spatial Intelligence Agency, 2004-5.
- Member, Rand Committee to review Geo-knowledgebase prototype (GKB-p) project at the National Geo-spatial Intelligence Agency, July 2005.
- Board of Directors, University Consortium on GIS, 2003-4.
- Member, Review and Advisory Committee, Strategic Research Cluster in Advanced Geotechnologies, Science Foundation Ireland (ICT Division), Dublin, Ireland, 2007.
- Member, Review and Advisory Committee, GEOIDE: A national nesearch network of excellence on Geomatics, Canada, 2004.
- Member, FY 2008 Director's R&D Fund Review Committee, Laboratory Directed Research and Development (LDRD), Ultrascale Computing Initiative Oak Ridge National Laboratory, U.S. Department of Energy, 2007.
- Member, Review Committee, Pennsylvania Department of Health Final Performance Review, Oak Ridge Associated Universities (ORAU), 2008.
- Member, Review Committee, Florida Centers of Excellence proposals, Oak Ridge Associated Universities (ORAU), 2008.
- Member, Advisory Board, NSF IGERT in Geographic Information Science, SUNY Buffalo, 2004-9.
- Member, Review Board, NSF EPSCoR Center in Geographic Information Science, U. Maine, 2003.
- One of 4 best papers, ACM SIGKDD Workshop on Sensor Data Mining, 2007.

- One of 4 best papers, CoMoGIS 2006 - 3rd International Workshop on Conceptual Modeling for Geographic Information Systems.
- One of 4 best papers, IEEE Workshop on Spatial and Spatio-temporal Data Mining, 2006.
- One of 4 best papers, ACM Conference on Geographic Info. Systems, 2003.
- One of 4 best papers, ACM Conference on Geographic Info. Systems, 1998.
- One of the 4 best papers, Symposium on Spatial Databases, 1997.
- Bush Foundation Fellowship, Sabbatical Supplement Program Award, 1997-98.
- Selected as a *site visitor* to review NSF research infra-structure grant proposals, May 1999 along with invitations to multiple panels at NSF and NASA.
- Research results reported in major media including FoxTV (2006), the Star Tribune (2006, 1999), the Pioneer Press (2006, 1996) and on public radio (1992). These were also highlighted by the Office of Vice President of Research (2006), University of Minnesota Foundation (2007), Office of Vice President of Public Engagement (2006), and Center of Transportation Studies (2005) within the University of Minnesota.
- Selected as a delegate to represent the University of Minnesota in the University Consortium on GIS, 1999-2000.
- Selected as the Computer Science representative in the national Curriculum Committee of University Consortium on GIS, 1998-99.
- Selected as United Nations international advisor for UNDP projects 1997-98.
- Invited Expert, CalTrans/NCGIA Conference on Navigable Databases, 1996.
- Excellence in Teaching Award, Bush Foundation 1992 - 93.
- Best paper award, Indian Computing Congress, 1991.
- Certificate of Appreciation, IEEE Computer Society, 1991.
- Pass with distinction, Qualifying Exam., (thesis proposal defense), 1988, U. C. Berkeley.
- Eugene C. and Mona Fay Gee Fellowship 1987, U. C. Berkeley.
- Best Graduating Student (among 250 students), B. Tech. Computer Sc., 1985, I. I. T., Kanpur, India.
- All India Rank *2* among 100,000 students, Joint Entrance Exam. 1981 for all Indian Institute of Technology, India.
- National Talent Search Scholarship, 1979 to 1985 from the Government of India.
- Silver medal for *2nd* rank in a merit list of 300,000 students, Bihar State Secondary School Examination 1979. Also awarded four gold medals for winning the competitions for debate, general knowledge, personality, and mental ability.

2.2 List of Invited Presentations

- **Annual Dangermond Distinguished Lecture**, University of California, Santa Barabara, May 28th, 2009.
- Geospatial Technology Working Group, Mapping and Analysis for Public Safety, National Institue of Justice, U.S. Department of Justice, Annapolis, MD, April 16th, 2009.
- Innovision, National GeospatialIntelligence Agency (Reston, VA), Washington D.C., March 18th, 2009.
- Panel on GIScience and Computational Transportation Science, University Consortium on GIS, Winter Assembly, Jefferson Building (Library of Congress), Washington D.C., February 5th, 2009.
- **Keynote Speech**, Geospatial Science Forum (www.mapworldforum.org/2009/conference/gs.htm), Mapworld Forum, HICC Hyderabad, India February 12th13th, 2009.
- National Science Foundation Workshop on GeoSpatial and GeoTemporal Informatics, Washington D.C., January 89, 2009.
- Board on Earth Sciences and Resources, National Research Council, National Academy of Sciences Beckman Center, Irvine, CA, December 910, 2008.
- NATO NetworkofExperts Workshop Visualizing Network Dynamics, NATO Research Task Group "Visualisation Technologies for Network Analysis", QinetiQ Malvern Technology Centre, United Kingdom, 4th6h Nov. 2008.
- GIScience Journal Editors Panel, Biannual, Intl. Conference on Geographic Information Science, Salt Lake City, Utah, Sept. 2008
- Plenary Session on What have we learned? Suggestions for future IWCTS workshops? Intl. Workshop on Computational Transportation Science (IWCTS), Trinity College, Dublin, Ireland, July 2008.
- Education Plenary Session on Teaching GIScience: A Computational Perspective, University Consortium on GIS, Summer Assembly, Minneapolis, MN, June 2008.
- Informatics Workshop, Summer Institute and Science Advisory Meeting, NSFF IGERT on Sensor Science, Engineering and Informatics, University of Maine, Orono, June 2008.
- Panel on Cyberinfrastructure and Geographic Information Sciences at the "Annual Meeting of the American Association of Geographers", Boston, MA, April 2008.
- Minnesota Population Center, University of Minnesota, MN, February, 2007.
- **Keynote Speech** on "GIS in 2015" at at the "Research & New Venture Showcase: Geospatial Sciences", University of Texas, Dallas, TX, January 2008.
- Electrical Engineering and Computer Science Department, University of Tennessee, Knoxville, TN, December, 2007.
- National Geospatial Intelligence Agency, Workshop on Complicated Features, Airlie Conference Center, Virginia, Novemeber, 2007.
- NSF Workshop on Next Generation Data Mining (NGDM), Baltimore, October, 2007.
- National Geospatial Intelligence Agency PI Workshop, National Academies, Washington D.C., September, 2007.
- Transportation Research Board / Federal Highway Authority Workshop on Advanced Research in Geospatial Information Technologies for Transportation, National Academy of Science, Washington DC, September, 2007.
- China National Laboratory on Machine Perception, Center for Information Sciences, Peking/Beijing University, Beijing, China, August, 2007.
- China State Key Laboratory of Software Engineering, Wuhan University, Wuhan, China, August, 2007.
- China State Key Lab of Information Engineering in Surveying Mapping and Remote Sensing , (LIEMARS), Wuhan University, Wuhan, China, August, 2007.
- Computer Science Department, Fudan University, Shanghai, China, July, 2007.
- Spatial Database Group, Oracle Corporation, Nashua, NH, July, 2007.

- Volpe National Transportation Systems Center, USDOT Research and Innovative Technology Administration, MIT Campus, Cambridge, MA, July 2007.
- IEEE Computer Society President's Awards Banquet, Los Angeles, CA, May, 2007.
- **Keynote Speech**, NSF Workshop on Discrete Mathematical Problems in Computational Biomedicine, DIMACS Center, Rutgers University April, 2007.
- Computer Science Department, University of Houston, February, 2007.
- Workshop on Ubiquitous and Mobile Computing, Workshop on Ubiquitous and Mobile Computing, National Center on Geographic Information and Analysis, January, 2007, Portland, Maine.
- **Keynote Speech** at the IEEE ICDM Workshop on Spatial and Spatiotemporal Data Mining (SSTDM), Dec. 18th, 2006, Hong Kong.
- Computer Science Department, Hong Kong University, Hong Kong, December, 2006.
- Microsoft Virtual Earth Workshop (11/3012/1, 2006), Seattle, USA.
- Panel on Model the Planet, Defense Advanced Research Projects Agency, Summer, 2006.
- Defense Advanced Research Projects Agency, Information Exploitation Office, May, 2006.
- Army Research Laboratory, Computational Science Workshop on Future Directions, June, 2006, Aberdeen, MD.
- 38th Sympoium on the interfaces of statistics, computing science, and applications (Interfaces 2006: Massive Data Sets and Streams), Pasadena, CA, May, 2006.
- 2nd Intl. Statistical Challenges in ECommerce Research Symposium, Carlson School of Management, University of Minnesota, May 2223, 2006 (http://www.misrc.umn.edu/symposia/20060522/)
- IBM T. J. Watson Research Center, NY, March, 2006.
- Panel on Evacuation Planning for Twincities Metropolitan, Minnesota Intelligent Transportation Systems Conference, March, 2006.
- Computational Research Institute, Purdue University, January, 2006.
- Oakridge National Laboratory, TN, February, 2006.
- National Research Council, National Academy of Science, Committee on Confidentiality Issues in linking GeographicallyExplicit and SelfIdentifying Data, Washington DC, December, 2005.
- **Keynote Speech**, ISPRS International Workshop on Spatial Data Mining, Middle Eastern Technical University, Ankara, Turkey, Novemeber 2005.
- **Keynote Speech**, Brazilian National GeoInformation Conference, Campos dos Jordao, Brazil, Novemeber 2005.
- Topographic Engineering Center (an Army ERDC), Alexandria, VA, October 2005.
- IEEE Fellows Local Conference, University of Minnesota, October 2005.
- **Keynote Speech**, Ninth International Symposium on Spatial and Temporal Database, Angora dos Rias, Brazil, August 2005.
- PI Workshop on Sensor Networks for Homeland Defense, Oakridge National Laboratory and Office of Naval Research, Washington D.C., July 2005.
- **Keynote Speech**, NSF Workshop on National Phenology Network, University of Nebraska, Lincoln, May 2005.
- Workshop on Voter Registration Databases for Election Assistance Commission, Computer Science and Telecommunication Boards, National Research Council, National Academies, May 2005.
- Remote Sensing Center, Boston University, Boston, March 2005.
- Topographic Engineering Center, Army Core of Engineers, Alexandria, VA, Feb. 2005.
- National Geospatial Intelligence Agency (NGA) specialist workshop on spatial web, University of California, Santa Barbara, Dec. 2004.
- **Keynote Speech**, Biannual conference on Geographic Information Science, American Association of Geographers, Washington D.C., October 2004.

- Invited speaker, INFORMS annual conference, Denver, Oct. 2004.
- Invited testimony, Minnesota Senate Election Committee, Hearing on the voter registration database for the 2004 presidential election , Aug. 2004.
- Dagstuhl Workshop on Data Warehouses, Dagstuhl, Germany, August 2004.
- Presentation to the Undersecretary for Research and Development, Department of Homeland Security, on Evacuation Planning for Homeland Security, University of Minnesota Science and Technology Day, April 2004.
- Congressional breakfast on GIS for Homeland Security, University Consortium on GIS, February 2004.

- NSA Workshop on Visualization and Mining, University Consortium of GIS, Washington D. C., Novemeber 2003.
- NSF Workshop on Next Generation Geographic Information Systems,, Boston, Novemeber 2003.
- Data Mining and Education Conference, SAS, Las Vegas, October, 2003.
- Workshop on Spatial Data Mining, Army Research Laboratory, Aberdeen, MD, August, 2003.
- Workshop on Data Mining, Army Research Laboratory, Aberdeen, MD, May, 2003.
- AHPCRC/Army Research Lab. PI Workshop on Enabling Technologies, Howard University, May 2003.
- Computer Science Department, University of Illinois, Chicago, March 2003.
- Workshop on Mining Weather Data, Army Research Laboratory, Whitesands, New Mexico, February, 2003.
- NSF workshop on Spatiotemporal Data Models for Biogeophysical Fields, San Diego Supercomputer Center, La Jolla, California, April, 2002.
- NSF Specialist Meeting on Spatial Data Analysis Software Tools, CSISS, Santa Barbara, CA, May 2002.,
- AHPCRC/Army Research Lab. PI Workshop on Enabling Technologies, Minneapolis, MN, summer 2002.
- AHPCRC/Army Research Lab. PI Workshop on Virtual Computing Environments, Florida A&M University, summer 2002.
- Invited plenary talk on spatial data mining, Annual summer assembly of University Consortium on Geographic Information Systems, Buffalo, NY, July 2001.
- University Consortium on GIS Panel on "Critiques of 2010 visions fo GIS Research: A Report from NSF Workshop" May 1999.
- National Science Foundation Workshop on Data Mining in Geographic Information Systems, March 1999.
- National Science Foundation Workshop on Integrating Vector and Rastor Geographic Information Systems, May 1999.
- National Science Foundation Workshop for PIs in Information and Data Management (IDM) Program, March 1999.
- Army Research Lab. PI Workshop, Dec. 2001.
- NASA PI Workshop for Intelligent Data Understanding program, Missoula, Montana, March 2001.
- Army Research Lab. workshop on Virtual Computing Environment, Dec. 2001.
- Army workshop on Scientific Data Mining, July 2000.
- Army workshop on Scientific Data Mining, Fall 1999.
- NASA Workshop for PIs in TerraSIP program, May 1999.
- NASA Workshop for PIs in TerraSIP program, December 1998.
- National Science Foundation Industrial/Academic Workshop on Research Directions in Databases, October 1998.

- Ministry of Science and Technology, Government of India, September 1998.
- Indian Institute of Technology, Delhi (India), September 1998.
- Indian Institute of Technology, Bombay (India), September 1998.
- University of British Columbia, Computer Engineering Dept., January 1998.
- Microsoft Research, Database Group, January 1998.
- Boeing Corporate Research, Database Group, January 1998.
- Ministry of Science and Technology, Government of India, December 1997.
- United Nations Development Program, New Delhi, December 1997.
- Pune University (India), Center for Design of Advanced Computers (CDAC) and Computer Science Dept., December 1997.
- Army Research Laboratory, Workshop on Databases and Object Orientations, July 1997.
- Purdue University, Computer Science Department, November 1997.
- Army Research Laboratory, Digital Battlefield Workshop, July 1997.
- Bell Laboratories, Database Systems Group, March 1997.
- Waterways Experimentation Station, Army Core of Engineers, February 1997.
- Army High Performance Computing Research Center, Support Scientist Workshop ,February 1997.
- Univ. of California, Berkeley, Electrical Eng. and Computer Sc., PATH Project, May 1996.
- CalTrans Center for Interoperability and National Center for Geographic Info. and Analysis (NCGIA, UCSB), March 1996.
- INFORMS Conference on Computer Sc. and Operations Research, Winter 1996.
- ACM Intl. Conf. on Geographic Info. Systems (Panel on Interoperability in GIS), December 1995.
- Environmental Systems Research Institute, Networks Group,($1B software company in GIS, founded by Harvard researchers), Winter 1995.
- Foundation Workshop on Mobile and Wireless Information Systems, October 1994.
- Georgia Institute of Technology, College of Computing, April 1994.
- University of Texas at Austin, Electrical and Computer Engineering Department, February 1994.
- Dartmouth College, School of Engineering, November 1993.
- IBM T. J. Watson Research Center, Database group, May 1993.
- Bell Atlantic, Automatic Records Systems Group, August 1993.
- Bell Laboratories, Advanced Software Group, Spring 1989.
- Bell Core, Multimedia Applications Group and Advanced Software Group, Spring 1989.
- MCC, Artificial Intelligence Group, Spring 1989.
- Andersen Consulting, Center for Strategic Research (Chicago) , Spring 1989.
- Syracuse University, Electrical and Computer Science, Spring 1989.
- George Mason University, Software Engineering group, Spring 1989.
- University of California at Berkeley, Artificial Intelligence Seminar, Spring 1989.

3 RESEARCH GRANTS

3.1 External Grants From Federal/State Agencies & Companies

- P.I., USDOD Army Corps of Engineers (Topographic Engineering Center W9132V-09-C-0009), Cascase Models for Multi-Scale Spatio-temporal Pattern Discovery, $150,000, 02/03/09 - 01/31/12.
- P.I., IGERT: Non-equilibrium Dynamics Across Space and Time: A Common Approach for Engineers, Earth Scientists and Ecologists, $2,269,282 (approx), National Science Foundation (**NSF**), DGE-0504195, Aug. 2005 - July 2010. (w/ C. Neuhauser, C. Paola, M. Hondzo, R. Hozalski, S. Sugita). Grant transferred to Computer Science Department in Summer 2008 with a balance of over $1.2 M.
- P.I., Dynamic Purpose-Aware Graph Models for Composite Networks, $750,000, US Department of Defense (HM1582-08-1-0017), Aug. 14th, 2008 - Aug. 13th, 2013.
- P.I., III-CXT: Spatio-temporal Graph Databases for Transportation Science, $449,993 (approx), National Science Foundation (**NSF**), IIS-0713214, Aug. 2007 - July 2010. (w/ H. Liu)
- P.I., Spatio-Temporal Pattern Mining for Multi-Jurisdiction Multi-Temporal Activity Datasets, $750,000, US Department of Defense (HM1582-07-1-2035), Aug. 14, 2007 - July 31st, 2012. (w/ L. Khan, U. T. Dallas).
- Co-P.I., CRI:IAD Infrastructure for Research in Spatio-Temporal and Context-Aware Systems and Applications, $140,403, National Science Foundation (**NSF**), CNS-0708604, July 2007 - June 2010. (w/ A. Tripathi, M. Mokbel).
- P.I., Spatial Database Research for Mapping and Analysis for Public Safety, $100,000 (unrestricted gift), Ned Levine & Associates, 2006-2009.
- P.I., Modeling and Mining Spatio-temporal Data, USDOD Army Corps of Engineers, $111,000, 03/15/06 - 09/30/08.
- P.I., Army High Performance Computing Research Center (AHPCRC), $5,000,000 (approx.), Army Research Lab. and Network Computing Services, Jan. 2006 - Jan. 2007.
- P.I., Discovering perosnal gazetteers from travel histories (GPS tracks), $40,000 (unrestricted gift), Microsoft Mappoint Research Program, 2005-2006.
- P.I., Spatio-temporal data analysis techniques for behavioural ecology, $576,395, National Science Foundation (**NSF**), September 2004 - August 2007. (w/ J. Srivastava, A. Pusey).
- P.I., Spatio-temporal data mining for sensor networks, $200,000, Oakridge National Laboratory, Department of Energy (DOE), June 2005 - June 2008.
- P.I., High Performance Spatial Data Mining, $100,000, Army Research Lab. (AHPCRC), Jan. 2005 - Jan 2006.
- P.I., Evacuation Planning Software for Twin Cities Metro Area Scenario, $53,011, Minnesota Department of Transportation, February 4th, 2005 to November 30th, 2005.
- co-P.I., Planning for full-scale CLEANER: Options for field facilities and cyberinfrastructure in America's heartland, $69,960, National Science Foundation (**NSF**), August 2004 - July 2006. (w. M. Hondzo et al).
- P.I., Decision Support System for Evacuation Planning, $60,000, Federal Highway Authority (FHWA), August 2004 - November 2005.
- Co-P.I., Complexity of Spatial and Categorical Scale in Land Use Classification, $535,914, National Science Foundation (**NSF**), July 2003 - June 2006. (w/ S. Gopal, Boston U).
- P.I., Evacuation Planning for Homeland Security, $120,000, Army Research Lab. (AHPCRC), Jan. 2004 - Jan 2005.
- P.I., Capacity constrained route planning and Parallelizing Spatial Autoregression, $90,000, Army Research Lab. (AHPCRC), Jan. 2003 - Jan 2004.
- Co-PI, Being There: Mobile Devices for Community and Commerce $120,000, National Science Foundation (**NSF**) EIA-0224392, 2002-2004, with L. Terveen et al. (CISE Research Resource).

- Co-P.I., Discovery of Changes from the Global Carbon Cycle and Climate, **NASA** (Ames Research Center), $525,091.00 , March 2001 - February 2004.
- Co- P.I., Map accuracy assessment for A New Approach to Assessing Road User Charges, $250,000, Department of Transportation from 10 states, April 2001 - June 2003. (w/ M. Donath et al).
- P.I., Research in Virtual Computing Environment, $90,000, Army Research Lab. (AHPCRC), Sept. 2001 - August 2002.
- P.I., Research in Mining Geo-spatial Datasets, $190,000, Army Research Lab. (AHPCRC), Jan. 2000 - Jan. 2001.
- P.I., High Performance Spatial Visualization of Traffic Data, $122,929, USDOT (ITS Inst.), 1/2000 - 2/2001.
- Co-PI, Cluster Computing for Mining Diverse Datasets, $74,000, National Science Foundation (**NSF**), 2000-2001, with G. Karypis et al. (shared equipment grant).
- Co-PI, Research in Networked Information Systems, $97,000, National Science Foundation (**NSF**), Jan. 1999 - Dec. 2001, with A. Tripathi et al. (shared equipment grant).
- Co-PI, Precision Agriculture Center, $3,840,000, U. S. Department of Agriculture, 2000-2003, with R. Pierre et al. (CS share is $50,000)
- Co-PI, A New Approach to Assessing Road User Charges $770,000, U of Minn share is $350,000, Federal Highway Administration and the states of California, Illinois, Indiana, Iowa, Michigan, Minnesota, Nevada, S. Dakota, Texas, and Wisconsin, July 1999 - December 2001, with M. Donath et al. (Our share is about $100,000).
- Co-P.I., Institutionalizing MTPE Data for Land and Environment Management, $1,334,552 National Aeronautics and Space Agency (**NASA**), 9/1997- 8/2001. with T. Burke et al. (Our share is about $100,000).
- P.I., Databases for Spatial Graph Management, $103,647, National Science Foundation (**NSF**), 8/1996-7/99.
- P.I., Research in High Performance Geographic Information Systems, $80,000, Army Research Lab. / AHPCRC, Jan. 1999 - Jan. 2000.
- Co-P.I., Research in Enabling Technologies for High Performance Computing, $248,000, Army Research Lab. / AHPCRC, with Prof. G. Karypis and Prof. V. Kumar, Jan 98 -Jan 99 (Our share was $80,000).
- P.I., Archival of Traffic Data (phase II), $100,000, Federal Highway Authority (FHWA), 1997-98.
- Co-P.I., Enabling Technologies: High Performance Geographic Information Systems, $263,432, Army Research Lab. / AHPCRC, with Prof. V. Kumar, Jan. 97 - Jan. 98 (our share was $80,000).
- P.I., Evaluation of Seven County Twincities Roadmap, $59,591, U.S. Dept. of Transportation, 3/16/96-3/15/97.
- P.I., Archival of Traffic Data From TMC, $100,000, Federal Highway Authority (FHWA), 1995-97.
- P.I., High Performance Geographic Information Systems for DIS, about $90,000, Army Research Lab. / AHPCRC, with Prof. V. Kumar, Jan. 94- Jan. 97 (Our share was $50,000).
- P.I., High Performance Neural Network (Technology Transfer), Army Research Lab. / AHPCRC, with Prof. V. Kumar, 1994 (Our share was about $30,000).
- P.I., Application of GLMX to updating digital roadmaps for the Intellegent Vehicle Highway Systems, $30,000 support for one graduate student for 1 year (Industrial Affiliates Program), with Prof. D. Du, Computing Devices International, 1993-94.
- P.I., Traffic Data Management For Advanced Driver Information Systems, $43,000 from Federal Highway Authority (FHWA), 1993-94.
- P.I., Multimedia Information Presentation in Smart Cars and Highways, $43,000 from Federal Highway Authority (FHWA), 1993-94.
- P.I., Evaluation of Data Management Architecture For Advanced Traveler Information Systems, $20,000 from Federal Highway Authority (FHWA), 1993-94.

- P.I., Trace-driven Driving Simulation, $43,000 from Minnesota Dept. of Transportation, 1992-93.
- P.I., Program Visualization Environment, $6,000 equipment grant from MinnNeXT project, NeXT Corporation, 1991-92.
- P.I., Emulation of an External Laboratory in Driving Simulator, $43,000 from the Center for Transportation Studies, 1991-92.
- P.I., Data Management for Driving Simulation, Collision Detection and Incident Detection, $45,000 from Minnesota Dept. of Transportation, 1991-92.
- Co-P.I., Human Factors in Highway Signage, with P. Hancock, $45,000 from Minnesota Dept. of Transportation, 1991-92 (Our share was about $10,000).
- Co-P.I., An Incidence Detection Expert System, with Y. Stephanades. (The Computer Science share was $10,000.) $45,000 from the Center for Transportation Studies 1990-1991 (Our share was $10,000).

- Co-P.I., Information Presentation in Vehicles, with P. Hancock (The Computer Science share was support for one graduate student, one undergraduate student and $7,667.) $50,000 from the Center for Transportation Studies in 1990-1991.

3.2 Internal Grants

- $25,000, Minnesota Futures (Phase I: Symposium Grant), Office of Vice President of Research 2008-2009.
- $100,000, McKnight Distinguished University Professorship, 2005-2010.
- P.I., Indoor navigation system for visually impaired, $29,000, Digital Technology Center, July 2005 - June 2006.
- Co-P.I., A digital library to archive research material from Jane Goodall's Gombe chimpanzee project, $27,924, Digital Technology Center, July 2004 - June 2005.
- P.I., Exploring Policy Implications of Traffic Management Center Data, $40,000 from Center for Urban and Regional Affairs, Summer 98 - Summer 1999.
- $10,000, In eight Undergraduate Research Opportunity Program Awards and a CTS Undergraduate Research Assistants Program Award from 1990-present for J. Mitchell, M. Kalantar, A. Fetterer, P. Khandelwal, Hsiang Wu, M. Coyle, B. Amin, and Y. Hooshmand.
- $9000 from the Graduate School in 1992-1993, Geographical Data Management
- $8000 from the Graduate School in 1991-1992, Real Time Search Algorithms.
- $8000 from the Graduate School in 1990-1991, Cooperating Expert Systems.
- Summer Support (1 month) from the Graduate School for 1991, Neural Networks for Generalization.

4 GRADUATE STUDENTS, VISITORS, etc.

4.1 Faculty, Postgraduate and Graduate Visitors

1. Pronab Mohanty, a Humphrey Fellow (U S Dept. of State), is visited our group in Spring 2009 to collaborate on spatial data mining for public safety and security. He is with the Indian Police Service (Banglore, India).
2. Prof. Prabhat Ranjan visted our group for a month in summer 2008 to explore collaboration on india center initiative at the University of Minnesota. He heads the Embedded Systems and Sensor Networks research group at the D. Ambani Institute of Information & Communication Technology (intranet.daiict.ac.in), India. His projects include detection of water on the Moon (a part of indian lunar mission, Chandrayaan-2), tracking and preserving wildlife, detection of forest fires, etc.
3. Prof. Sungwon Jung spent a large part of his sabbatical with our group in Fall 2007 and Spring 2008 to collaborate on spatio-temporal databases and query processing. He is with Department of Computer Science, Sogang University, Seoul, Republic of Korea.
4. Prof. Christopher Eick visted our group for a month in two summers (2008, 2006) to explore collaboration on spatial data mining. He is affiliated with the Computer Science faculty at the University of Houston.
5. Dr. (Ms.) Vania Bogorny visited our group during the 2004-5 academic year. She was supported by a government fellowship for the federal government of **Brazil**. She is currently a research fellow (PRODOC/CAPES) at Instituto de Informatica da UFRGS/Brazil.
6. Mete Celik visited our group from Fall 2002 to Summer 2007. He was supported by a NATO fellowship from the governement of **Turkey**. He joined the Computer Eng. faculty at the Erciyes University, Turkey.
7. Dr. Sanjay Chawla worked as a post-doctoral fellow with our group from Fall 1997 to Summer 2000 in the Army High Performance Computing Research Center. He is currently with the Department of Computer Science at the University of Sydney, **Australia**.
8. Prof. B. Y. Hwang visited for his sabbatical year in 1999 from the Department of Computer Science, The Catholic University of Korea, Seoul 121250, **Korea**.
9. Prof. Hemlata Diwakar visited on a **United Nations fellowhip** during Fall 1997 from the Faculty of Computer Science, University of Pune, India.
10. Prof. F. Polat visited on a N.A.T.O. fellowship from Fall 1992 to Spring 1993 from Bilkent University, **Turkey**. He is with the Computer Eng. faculty of the Middle East Technical University (METU), Ankara, Turkey.
11. Prof. I. Singh visited on **a Fullbright fellowhip** during from Fall 1991 to Spring 1992 from the National Inst. of Tech., India.
12. Hosted colloquium and workshop speakers included

    - Prof. Michael Goodchild (U. C. Santa Barbara and a NAS member),
    - Prof. May Yuan (Assoc. Dean, U. Oklahoma),
    - Dr. Kentaro Toyama (Microsoft Research),
    - Prof. Michael Worboys (University of Maine, NCGIA),
    - Jack Dangermond (President, ESRI),
    - Prof. Hanan Samet (University of Maryland),
    - Prof. Benjamin Wah (Univ. of Illinois, Urbana-Champaign),
    - Prof. Sham Navathe (Georgia Tech.),
    - Prof. K. Y. Whang (KAIST, Korea), etc.
    - Prof. Bruce Berra (Syracuse U), etc.
    - Prof. Arif Ghafoor (Purdue U), etc.
    - Dr. Eric Hoel (ESRI Geodatabase lead),
    - Dr. Budhendra Bhaduri (OakRidge National Lab., GIS lead),
    - Dr. Tim McGrath (Microsoft Mappoint lead),

- Dr. Bhavani Thuraisingham (NSF, UT Dallas),
- Dr. Jim Shine (Topographic Engineering Center, Engineering Research and Development Center, Army Core of Engineers)
- Dr. Ratko Orlandic (Illinois Inst. of Tech.), etc.

4.2 List of Ph. D. Students (18 graduated, 6 current)

1. Prof. Andrew Yang GRADUATED with a Ph.D. in January 1993. He completed a thesis titled "Spatial Data Management for Motion Processing". He is currently with the Computer Sc. faculty, University of Houston (Clear lake). He wa previously with University of Conneticut.
2. Prof. Babak Hamidzadeh GRADUATED with a Ph.D. in July 1993. He is currently with Boeing Research. He was previously an Associate Professor of Computer Engineering at the University of British Columbia. Babak completed a thesis titled "Dynamic Scheduling Of Real Time Tasks: A Graph Theoretic Approach". He was selected to be the *program chair* for the IEEE International Conference on Tools with AI, 2000.
3. Prof. Du-Ren Liu GRADUATED with a Ph.D. in July 1995. He is currently with the faculty of Inst. of Info. Management at National Chiao Tung University in Taiwan. His thesis focused on the design and evaluation of geographic databases to support network computations for transportation networks.
4. Dr. Mark Coyle GRADUATED with a Ph.D. in March 1996. He is currently with Siebel Systems. He was previously with the kernel group at Oracle Corporation. His thesis focused on declustering methods for parallel databases for geographic applications. He is with Oracle Corporation with a rank of Vice President.
5. Dr. Siva Ravada GRADUATED with a Ph.D. in June 1997. He is a technical lead in the Spatial Data Product Division at Oracle Corporation. His thesis focused on high performance parallel formulation of the range query and spatial join problems in spatial databases. He was selected to be the *program chair* for the ACM International Conference on Geographic Information Systems, 2000.
6. Dr. Ms. Xuan Liu GRADUATED with a Ph.D. in August 2000 and joined IBM T. J. Watson Research Center. Her thesis focused on the modelling and processing of direction predicates for spatial query languages. The pioneering nature of her work was recognized by peer scholars via a best paper award.
7. Prof. C. T. Lu GRADUATED with a Ph.D. in Spring 2002. His thesis focussed on algorithms for spatial data analysis focussing on problems of spatial outlier detection and join index processing. He is a tenured Computer Science faculty member with Virginia Polytechnic University.
8. Prof. Ms. Wei Li Wu GRADUATED with a Ph.D. in Spring 2002. Her thesis focussed on modeling spatial dependence in location prediction problem for geospatial data mining. She is a tenured Computer Science faculty member with the University of Texas at Dallas.
9. Prof. Ms. Huang Yan GRADUATED with a Ph.D. in Spring 2003. Her thesis developed new techniques for mining co-location patterns in spatio temporal datasets. She joined the faculty of Computer Science at University of North Texas.
10. Dr. Pusheng Zhang GRADUATED with a Ph.D. in Summer 2005 and joined Microsoft Mappoint group. His thesis focussed on the problem of efficient indexing methods and query processing strategies for correlation based selection and join over spatial time-series datasets in context of climate modelling applications with Earth Science researchers from NASA. He was awarded a doctoral dissertation fellowship from the University of Minnesota in a university wide competition. He was co-advised by Prof. V. Kumar.
11. Prof. Hui Xiong GRADUATED with a Ph.D. in summer 2005 and joined the faculty of Rutgers University. His thesis explored the problem of identifying correlated item pairs from a large collection of items and transactions. He was co-advised by Prof. V. Kumar. He is a tenured Management Science and Information Systems faculty member with the Rutgers University.
12. Dr. Baris Kazar GRADUATED with a Ph.D. in summer 2005 and joined the Spatial Database group at Oracle corporation. His thesis explores computationally-efficient parameter-estimation methods for the spatial autoregression model. He joined Oracle corporation (Spatial group).

13. Dr. Qing Song Lu GRADUATED with a Ph.D. in Winter 2006 and joined the Microsoft Mappoint group. His thesis developed novel capacity constrained routing algorithms for identifying evacuation routes to minimize evacuation time for homeland security applications. The societal impact of his work was recognized by the CTS partnership award (2006). He joined Microsoft (Virtual Earth group).
14. Dr. Vatsai Ranga Raju GRADUATED with a Ph.D. in Summer 2006. His thesis explored semi-supervised methods for producing land-use classification maps from satellite imagery with very limited ground truth information. He is currently with Oakridge National Laboratory (ORNL) and earlier worked with IBM India.
15. Prof. Ms. Jin Soung Yoo GRADUATED with a Ph.D. in Spring 2007. Her thesis explored spatio-temporal data mining problems. Earlier she explored the nearest neighbor problem in context of open location based services. The pioneering nature of her work was recognized by peer scholars via a best paper award. She joined faculty of Computer Science at Indiana University - Purdue University.
16. Dr. Sangho Kim GRADUATED with a Ph.D. in Spring 2007. His thesis explored large scale flow network algorithms for contra-flow aware evacuation route planning. The societal impact of his work was recognized by the CTS partnership award (2006). He joined the Geo-database group at the Environment Systems Research Institute.
17. Prof. Mete Celik GRADUATED with a Ph.D. in Spring 2008. His thesis investigated scalable methods to quantify and discover the mixed-drove co-occurrence patterns to identify subsets of vehicle-types which often move together given a spatio-temporal datasets describing vehicle trajectories. He also worked closely with Jane Goodall Institute. He joined the Computer Engineering faculty of the Erciyes University, Turkey.
18. Dr. Ms. Betsy George GRADUATED with a Ph.D. in Spring 2008. Her thesis noted that well-known shortest-path algorithms (e.g. A*, Dijktra's) assumed stationary ranking of alternative routes. This assumption is not true due to change in travel time due to rush hours, HOV/Toll lanes, congestions, intersection-control traffic-signals, etc. She proposed new data structures (e.g. time-aggregated graphs) and algorithms to address these challenges. The path-breaking nature of her work was recognized by peer scholars via multiple best paper awards.
19. Mr. James Kang passed the oral thesis examination in Spring 2008. His thesis is exploring spatio-temporal data mining problems in context of environmental science application such as water quality monitoring. He is an active member of an NSF IGERT program. Earlier he worked on reverse nearest neighbor queries, as well other computational problems related to Ecology and Environmental Sciences.
20. Mr. Xiaobin Ma passed the oral thesis examination in Spring 2008. His thesis is exploring scalable algorithms for multi-type nearest neighor problem.
21. Mr. Pradeep Mohan joined spatial database research group in Fall 2007. He is exploring computational problems related to spatial statistical models in hot-spot analysis in context of mapping and analysis for public safety.
22. Mr. Michael Robert Evans joined spatial database research group in Fall 2008 on an NSF IGERT fellowship. He will be exploring computational problems related to Ecology and Environmental Sciences.
23. Mr. Xun Zhou will be joining the spatial database research group in Fall 2009. He will be exploring computational problems related to Spatial Databases and Spatial Data Mining.
24. Mr. Jeffery Wolffe completed a M.S. degree recently and is joined the Ph.D. program in Fall 2007. His interests include computational problems related to evacuation route planning.
25. Mr. Stuart Ness will be joining spatial database research group in Fall 2006 on an NSF IGERT fellowship. He is on leave currently. His interests include computational problems related to Ecology and Environmental Sciences.
26. Mr. ChangQing Zhou passed the major written preliminary examination in Spring 2003. He is working on map compression, caching and pre-fetching issues in context of wireless mobile geographic information systems.

4.3 List of M.S. Students (47 graduated, 3 current)

Two students graduated with Plan A option as indicated in bold font.

1. Mr. Wai Yat Wong GRADUATED in Fall 1990 with plan B project option. His project was a controlled study of the generalization ability of neural networks.
2. Mr. Cary Bates GRADUATED in Spring 1992 with plan B project option. His project work focused on the design and evaluation of a garbage collection system for Modula 2. Cary is currently with IBM Rochester, MN.
3. Mr. Meir Shargal GRADUATED in Fall 1992 with plan B project option. His project was titled "Evaluation of Search Algorithms and Clustering Efficiency Measures for Part Machine Clustering". He is currently with IDEAS, Bloomington, MN.
4. Ms. Janelle Kojak GRADUATED in Fall 1992 with plan B project option. Her thesis was titled "Is there transfer of training from virtual reality to the real world?". She is currently with the Electronics and Hardgoods Division of the 3M Corporation, St. Paul, MN.
5. Ms. Hua Ping Li GRADUATED in Summer 1993 with plan B project option. Her project was titled "Supporting Computer Aided Teaching of Access Methods". She is currently with Opin Systems, Bloomington.
6. Ms. Yvonne Zhou GRADUATED in Fall 1993 with an M.S. **(Plan A thesis option)** . She worked on disk allocation methods for parallelizing Grid Files for geographic databases. She is currently with Sybase Inc. in California.
7. Ms. Kathleen Mallery GRADUATED in Spring 1994 with plan B project option. She designed a Group Revenue and Displacement System (GRanD) for Northwest Airlines.
8. Mr. C. F. Lee GRADUATED in Fall 1994 with plan B project option. He designed an integrated database system for the Minnesota Department of Commerce. He is currently with the Dept. of Commerce.
9. Mr. Ashim Kohli GRADUATED in Fall 1994 with plan B project option. He evaluated single pair path computation on road map databases. He is with Oracle Corporation with a rank of Director.
10. Mr. Nitin Jain GRADUATED with a M.S. degree in Summer 1996 with plan B project option. He worked on the design and evaluation of algorithms for spatial join. He is currently with SpanLink Corp. in Minneapolis.
11. Mr. A. A. El Haddi GRADUATED with a M.S. **(Plan A thesis option)** in Summer 1996. He worked on parallelizing spatial databases for managing satellite imagery for ice coverage for the data collection center of the National Weather Service.
12. Mr. Brajesh Goyal GRADUATED with a M.S. degree (plan B) in Summer 1996. He worked on the evaluation of hierarchical formulations of algorithms to compute shortest paths for advanced traveller information systems.
13. Ms. Varsha Kelkar GRADUATED with a M.S. degree (plan B) in summer 1996. She carried out the evaluation of newly emerging extensible relational database technologies for advanced traveller information systems.
14. Mr. Rajat Aggarwal GRADUATED with a M.S. degree (plan B) in Winter 1997. He developed HMETIS, a public domain software incorporating hierarchical algorithms for partitioning hypergraphs.
15. Mr. Ron Grenier GRADUATED with a M.S. degree (plan B) in Spring 1997. He benchmarked the typical network traffic at Medtronics and experimentally compared the performance of computer networks, e.g. 155Mbs ATM and 100 Mbs fast ethernet, for the environment.
16. Mr. Andrew Fetterer GRADUATED with a M. S. degree (plan B) in Summer 1997. He worked on hierarchical algorithms for routing.
17. Ms. Anuradha Thota GRADUATED with a M. S. degree (plan B) in Fall 1997. She worked on storage management for traffic data archival.
18. Mr. Thananjayan GRADUATED with a M. S. degree (plan B) in Winter 1997. He worked on temporal data modeling for storing traffic data.

19. Mr. Seshu Guddanti GRADUATED with a M.S. (plan B) in Fall 1998. He worked on algorithms for data mining for patterns in strings.
20. Mr. Leijun Zheng GRADUATED with a M.S. (plan B) in Spring 2000. He worked on a Java based visualization of path descriptions based on direction predicates.
21. Mr. Chang Qing Zhou GRADUATED with a M.S. (plan B) in Spring 2000. He worked on topological data model based implementations for spatial operators specified in Open Geodata Interchange standard.
22. Mr. Neill Michael GRADUATED with a M.S. (plan B) in Spring 2000. He worked on spatial clustering algorithms for shipping affinities among a set of destinations.
23. Ms. Xinhong Tan GRADUATED with a M.S. (plan B) in Fall 2000. She worked on relational table design for the archival of traffic data collected by the Traffic Management Center at MNDOT.
24. Ms. Namita Sahay GRADUATED with a M.S. (plan B) in Spring 2001. She compared XML parsers (e.g. DOM and SAX) for supporting spatial queries on data encoded in GML, a XML standard for geo-spatial datasets. Her was accepted for publication in ACM Intl. Workshop on GIS, 2001. She is with Medtronics Inc.
25. Ms. Wei Hsin Fu GRADUATED with a M.S. (GIS) in Spring 2001. She developed a benchmark dataset and queries to learn topological data models within the Open Geodata Interchange Standard.
26. Ms. Carie Peterson GRADUATED with a M.S. (plan B) in Fall 2001. She developed a web crawler to extract details of technical publications inspatial database area to analyze statistical trends in popularity of topics over last decade. She is with West Publishing group in Twincities.
27. Ms. Judy Djugash GRADUATED with a M.S. (plan B) in Fall 2001. She developed techniques to customize code-dictionaries for dictionary based compression of vector maps. Her work was accepted for publication in Data Compression Conference 2002.
28. Mr. RuLin (Alen) Liu GRADUATED with a M.S. (plan B) in Spring 2002. He developed a visualization software for identifying pattern in spatio-temporal dataset, e.g. freeway traffic measurement dataset for Twincities highways.
29. Mr. Marcus Gallagher GRADUATED with a M.S. (plan B) in Spring 2002. He developed a model to specify location based security in spatial databases and efficient algorithms to check the spatial security constraints.
30. Mr. Zhihong Yao GRADUATED with a M.S. (plan B) in Spring 2003. He developed a geographic information system to roadmaps and GPS tracks to assess the positional accuracy and map-matching effectiveness of in-vehicle navigation devices. His work was sponsored by the ITS Institute under a project to evaluate technologies for a new approach to road user charges.
31. Mr. Vatsavai Ranga Raju GRADUATED with a M.S. (plan B) in Spring 2003. He developed an online geospatial processing system, namely MapServer, to provide web based access to NASA satellite imagery and derived data (e.g. forest attributes such as NDVI, NPP) about mid-west. This system has hundreds of registered users and dozens of third party application developers. Main results were reported in refereed conferences including ACM Intl. Conf. on GIS and Symposium on Scientific and Statistical Databases.
32. Mr. Nitin Karnani GRADUATED with a M.S. (plan B) in Summer 2003. He developed a digitization assistant to help scan, digitize and interpret paper-based data-sheets for populating spatial database about the Gombe chimpanjee dataset from Jane Goodall Institure for Studies in Primate Behaviour.
33. Ms. Durga Gumaste GRADUATED with a M.S. (plan B) in Summer 2003. She developed a spatial database to facilitate query by example for analyzing the Gombe chimpanjee dataset from Jane Goodall Institure for Studies in Primate Behaviour.
34. Ms. Alina Rimbu GRADUATED with a M.S. (plan B) in Fall 2003. She implemented an extensible map-cube system to visualize aggregation hierarchies on spatio-temporal datasets. Her software was used by Army Research Laboratory.
35. Ms. Lin Peng GRADUATED with a M.S. (plan B) in Spring 2004. She survey SQL standards and SQL implementations across commercial databases for topics in undergraduate courses on databases.

36. Mr. David Swanson Jr GRADUATED with a MS (Software Eng.) in Spring 2004. His capstone project focussed on selection of data modelling tools for health informatics.
37. Mr. Chee Soon Wong GRADUATED with a MS (Software Eng.) in Spring 2004. His capstone project focussed on selection of data modelling tools for health informatics.
38. Ms. Vamshi GRADUATED with a M.S. (plan B) in Fall 2004. She developed an indoor navigation system to assist blind persons in unfamiliar buildings.
39. Ms. Xuejin Ruan GRADUATED with a M.S. (plan B) in Fall 2004. She developed an extended join index to improve the computational performance of common spatio-temporal queries on national historical census datasets at the Minnesota Population Center..
40. Ms. Roshmi Bhoumik GRADUATED with a M.S. (plan B) in Spring 2005. Her M.S. project evaluated indoor location estimation using wireless local area network infra-structure.
41. Ms. Jin Soung Yoo completed a M.S. (plan B) in Fall 2005 and continued work towards a Ph.D. degree. Her M.S. project explored spatial data mining problem of designing faster joinless algorithms for discovering colocation patterns
42. Mr. Xiobin Ma GRADUATED with a M.S. (plan B) in early 2006. He worked on location based services to address the problem of identifying optimal routes to visit spatial instances of a collection of service types. He joined NCR Corporation (Terradata group).
43. Ms. Xiaojia M Li GRADUATED with a M.S. (plan B) in Spring 2006. She worked on data modeling and database design for the Gombe chimpanzee dataset in the Jane Goddall Institute.
44. Mr. Jeffrey Wolff GRADUATED with a M.S. (plan B) in Summer 2006. He worked on visualization of evacuation routes and schedules. Part of his work was included in a Fox TV news on the evacuation planning project on May 11th, 2006. He joined BAE corporation.
45. Mr. Abhinaya Sinha GRADUATED ith a M.S. (plan B) in Fall 2006. He worked on efficient implementation of spatial database queries for a natural resource software system and mapserver, a public domain software for creating web-sites for distributing geo-spatial information. He joined CNET corporation.
46. Mr. Vijay Gandhi GRADUATED with a M.S. (plan B) in Summer 2007. He worked on computational structure of statistical computations in context of classification of remote sensing imagery using multi-scale models. He joined Oracle corporation.
47. Mr. Chetan Shivarudrappa GRADUATED with a M.S. (plan B) in Fall 2008. His project compared alternative data-structures to support novel routing algorithms for applications where ranking of candidate routes can change over time. He also worked on modularizing CrimeStat, a popular spatial statistical software for mapping and analysis for public safety. He joined amazon.com.
48. Mr. Mark Dietz joined spatial database group in Spring 2008. He is exploring a project on modelling and computing (e.g. routing) with multi-modal transportation systems. He works with Honeywell Corp.
49. Mr. Chintan Patel joined spatial database group in Spring 2009. He is investigating development of a library for the time-aggregated graph data-structure to help researchers using graph representation in exploring temporal questions.
50. Mr. Santosh joined spatial database group in Spring 2009. With Chintan Patel, he is investigating development of a library for the time-aggregated graph data-structure to help researchers using graph representation in exploring temporal questions.

5 EDITORSHIPS, CONFERENCE AND WORKSHOP ORGANIZATION

- Co-Editor-in-chief, *Geo-Informatica: An Intl. Journal on Advances in Computer Science for Geographic Information Systems*, 2002-present.
- General-Chair, Intl. Workshop on Computational Transportation Science, (colocated with ACM SIGSpatial Intl. Conf. on GIS), 2009.
- Vice-Chair (Spatial Data Mining), IEEE Intl. Conf. on Data Mining, 2009.
- Vice-Chair (Spatial Data Mining), SIAM Intl. Conf. on Data Mining, 2009.
- Co-Chair, Workshop on Spatial and Spatio-Temporal Data Mining, IEEE Intl. Conf. on Data Mining, 2007, 2008, 2009. (http://csdl2.computer.org/comp/proceedings/icdmw/2007/3033/00/3019v.pdf)
- Steering Committee, *ACM Intl. Workshop on Geographic Information Systems,* 2003-present.
- Co-Chair, 2nd Statistical Challenges in E-Commerce Research Symposium, Carlson School of Management, University of Minnesota, May 22-23, 2006 (http://www.misrc.umn.edu/symposia/2006-05-22/).
- Member, Board of Director, University Consortium on Geographic Information Science, 2003-4.
- Editor, *Geo-Informatica: An Intl. Journal on Advances in Computer Science for Geographic Information Systems.*, 2001-2002.
- Associate Editor, *IEEE Transactions on Knowledge and Data Eng.*, 1996-98, and 1998-2000.
- Editor, IEEE-Computer Society Computer Sc. and Eng. Practices Publication Board, 1995-97.
- Editor, Intl. Jr. on Computational Intelligence and Organization, Lawrence Erlbaum and Assoc., Inc., 1996-97.
- *Co-Chair*, Inst. of Math and Its Applications (University of Minnesota) Workshop on Data Models for Multimedia Digital Libraries, January 2001.
- *Co-Chair*, Army Research Laboratory Workshop on Battlefield Visualization, April 2000.
- *Program Chair*, ACM International Conference on Geographic Information Systems, 1996.
- Steering Committee Member, National Center on Geographic Information and Analysis (NCGIA) Conf. on Navigable Databases, 1996.
- Co-organizer, Mini-track on Neural Networks in Business, Hawaii International Conference on System Sciences, 1996.
- Publicity Vice-Chair, IEEE Intl. Conf. on Tools with AI, 1995.
- Co-Organizer, Workshop on Neural Networks at the Univ. of Minnesota, 1992, 1993.
- Co-Organizer, AAAI Workshop on Integrating Symbolic AI and Neural Networks, 1992.
- Treasurer, IEEE Intl. Conf. on Tools with AI, 1991.
- Served on numerous program committee, including ACM Intl. Conf. on Geographic Info. Systems (1995-present), ACM Symposium on Spatial Databases (1997-present), World wide web and Geographic Info. Systems (2001-3) IEEE International Conference on Data Mining (2003), SIAM International Conference on Data Mining (2000), IEEE International Conference on Data Eng. (2003), IEEE Intl. Conf. on Tools with AI (1991-97), Int'l Conf. on Software Engineering and Knowledge (1990).
- Refereed for numerous journals, including Intl. Jr. on GIS, IEEE Trans. on Knowledge and Data Engineering, IEEE Trans. on Computers, IEEE Trans. on Software Eng., ACM Trans. on Database Systems, VLDB Journal, IEEE Computer, IEEE Expert, Artificial Intelligence Journal, Journal on Parallel and Distributed Computing, Journal on Intelligent Information Systems, Journal of Software Engineering and Knowledge Engineering , Journal of Computer and Software Engineering, Intl. Jr. on Artificial Intelligence Tools, and Information and Software Technology.
- Refereed for numerous conferences, including IEEE Intl. Conf. on Data Engineering, ACM SIGMOD Natl. Conf. on Management of Data, IEEE Tools with AI, AAAI National Conf. on Artificial Intelligence, IEEE Intl. Conf. on Computer and Software Applications (COMPSAC), Intl. Conf. on Parallel Processing (ICPP), and Scalable High Performance Computing Conference.

- Refereed for several textbook publishers including Addison Wesley (*Software Engineering* by Sommerville) McGraw Hill (*Database System Concepts* by Korth and Silberschatz) and Richard D. Irwin Inc. (Software Engineering by Schach).
- Refereed for the following national and international agencies: National Science Foundation, National Aeronautical and Space Agency, Federal Highway Authority, Center for Transportation Studies and Chinese University of Hong Kong.

6 SERVICE TO UNIVERSITY OF MINNESOTA

6.1 Service to College and University

6.2 Service to College and University

- Member, Committee to review President's Award for Outstanding Service nominations, University Honors and Awards, University of Minnesota, 2008-2009.
- Faculty Representative, All-University Honors Committee, University of Minnesota Senate, 2007-8. Participated in review of nomination for various awards. Helped reformulate honorary degree categories and definitions.
- Member, Geo-spatial Steering Committee, University of Minnesota, 2007-2009. Assisted in creation of GIS undergraduate minor, organizing visit of Jack Dangermond (President and founder, ESRI) to receive a honorary doctorate. Led a successful proposal to Minnesota Futures program (Office of Vice President of Research) and organized a workshop (Jan. 30th-31st, 2009) to bring together the GeoInformatics community across a dozen departments from half a dozen colleges to facilitate. A major goal of the Minnesota Futures initiative is to promote more in-depth work to convert ideas into viable research questions to enable faculty members to respond collaboratively and boldly to emerging opportunities in interdisciplinary research and scholarship.
- Member, Committee exploring India Center, University of Minnesota, 2007-2009. Assisted Vice President McQuaid with strategy formulation towards exploring creation of India Center as requested by Rep. Eric Paulsen and State of Minnesota. Hosted Dr. Mitra, Director of Indo-US Joint Science and Technology Forum (Fall 2008) and Dr. Kentaro Toyama (Microsoft Research). Visited MapForum conference (Feb. 2009) to meet with Secretary of Science & Technology (Government of India), Dr. R Siva Kumar (CEO, National Spatial Data Infrastructure, Govt. of India), Dr. N. L. Sarda (IIT Bombay), to explore possible collaboration opportunities. Also met with Dr. Krishna Kant (NSF, Intel) and Prof. R. Sangal (Director, IIIT-Hyderabad) as well as talked to US leadership of IUSJST to explore opportunities.
- Director, Army High Performance Computing Research Center, Fall 2005-March 2007. Defined strategic focus of the center, helped form a new research cluster around network sciences, interfaced with 5 partner universities, and sponsors.
- Member of the Graduate Research Advisory Committee (GRAC), Graduate School, University of Minnesota, Fall 2000 - Spring 2006. Reviewed faculty research proposals to the grant-in-aid program.
- Recruiting Committee, Distinguished ADC Chair, Digital Technology Center, University of Minnesota, 2003-5.
- Program Committee, Carlson School of Business Conference on Electronic Commerce, 2001-2003.
- Faculty organizer, Army Center Summer Institute, 2000.
- Technical contributer, **congressional presentation to members of US House of representatives** by University Consortium on GIS, 1998-99.
- Technical contributer, **congressional presentation to members of US House of representatives** by University Consortium on GIS, 1997-98.
- Member, University Committee on Professional M.S. degree in Geographic Information Systems, 1998-99.
- Member, Institue of Technology Committee on M.S. degree in Computer Engineering, 1997-98.
- Member, Organizing Committee for the University of Minnesota Digital Technology Summit called by President Yudof. Organized the track on Geographic Information Systems with Prof. T. Burk, Fall 1997.
- Member, Institute of Technology Curriculum Committee, 1996-97.
- Member, Institue of Technology Committee on Professional Courses. Assisted Prof. Doug Ernie plan professional courses.
- Member, Institute of Technology Committee on the Bachelor of Information Networking program, 1993.

6.3 Service to Computer Science Department

- Chair, Awards Committee, 2007-2009. Facilitated preparation of nomination for a variety of faculty award by working closely with nominees, sponsoring faculty members, award committee members, etc. Working on institutionalizing a process for improving awards nomination process.
- Chair, Mentoring Committee for Prof. Mohamed Mokbel, 2007-2009. Organized mentoring committee meeting, advice and feedback on a variety of issues ranging from annual review, summer trip to Microsoft, NSF proposal preparation and revisions in reponse to reviews, etc.
- Chair, Strategic Planning Committee, 2004-2005. Facilitated shared goal setting and creation of an environment of mutual trust. Major accomplishments include
  1. Successful formulation of a consensus policy on faculty recruiting to resolve an going rift on this issue.
  2. Analysis of departmental strengths and weaknesses
  3. Identification of strategies to improve national ranking
- Chair, Colloquia, 2002-2005. Supervised nomination, review and selection of speakers for departmental colloquium. Major accomplishments include
  1. Successfully invited following distinguished speakers:
     (a) A current and a past presidents of ACM
     (b) A current and a past member of the ACM Fellows selection committee
     (c) Two members of the CRA board
     (d) A NSF program manager
     (e) Three NAE memebrs
     (f) A member of the NRC CSTB
  2. Web-based management of nomination, review and selection of speakers
  3. Redesign of the brochure for Cray colloquia
  4. Revision of Csci 8970, Graduate course related to Colloquia. Introduced a web-based reporting by students on the main ideas in each lecture. Helped students identify hypothesis, key claims and supporting evidence.
- Member, Computing Committee, 2002-2003.
- Chair, Computing Committee, 2001-2002. Key achievement include a complete redesign of the departmental web-site (www.cs.umn.edu) content.
- Member, Graduate Committee for Computer Science, 2001-2002.
- Member, Graduate Committee for Computer Engineering, 2001-2002.
- Member, post-tenure evaluation committee, 2000-2001.
- Member, Graduate committee, 2000-2001.
- Member, Curriculum committee, 2000-2001.
- Member, recruiting committee for a joint faculty position with Department of Psychology, 2000-2001.
- Member, External Affairs Committee, 1999-2000.
- Coordinator, Written Preliminary Examinations (software systems area), 1998 - 2000. Key achievements included
  - Developing a consensus strategy for revision of the WPE syllabus in face of the semester conversion.
  - Consolidation of WPE examination schedule from five evening sessions over a week to two Friday afternoon sessions.

  - Succesful negotiation to move compilers to Computer Engineering
  - Smooth coordination of a large group of faculty members working on examination preparations and grading.

- Chair, Curriculum Committee, 1998-2000. Key accomplishments include
  - Developing a consensus strategy for moving our first course (CSci 1902) from C++ to Java to modernize our curriculum.
  - Guiding the development of writing intensive courses
  - Developing detailed week by week syllabi for required undergraduate courses to reduce variation across offerings.
  - Starting discussion of comprehensive curriculum revision towards goals of ACM/IEEE-CS Curriculum 2001.

- Director, Undergraduate Studies (DUGS), 1995-1997. Key accomplishments include
  - Started the COOP program for Computer Science and recruited over two dozen companies and students to participate in it.
  - Started a highly visible WWW-page competition to increase the visibility of the committee among undergraduates, faculty and staff.
  - Created an undergraduate colloquium to allow technical interaction between undergraduates and industries.
  - Streamlined the operation of undergraduate committee by instituting clear division of responsibilities.
  - Substantially improved the relationship of Computer Science department with colleges (IT and CLA) as acknowledged by the head of the department.

7 SOFTWARE DEVELOPED

Evacuation Route Planning Software

In recent years, my research group developed a web-based software system to help transportation professionals and first responders to develop *evacuation route* for many scenarios as mandated by the Department of Homeland Security. It was used by Emergency Management professionals to prepare evacuation plan for Twincities metropolitan area. It is receiving wide publicity in local media including newspaper (March 8th, 2006 Pioneer Press) and TV (FoxTV news, summer 2006). It was also highlighted by the University of Minnesota Vice President of Research in the 2007 annual report (Research magazine) as well as University of Minnesota foundation magazine.

The software uses databases to get transportation network (e.g. road maps), census (e.g. night time population) maps and employment statistics by location. The software tool has a web-based interface to display a map showing evacuation routes (and schedules) to minimize evacuation time after taking critical evacuation parameters including the geographic location and size of evacuation area, destinations, time of evacuation (e.g. day or night) to estimate population, transportation modes (e.g. driving vs. pedestrian). These options help first responders to compare possible alternatives of scenarios and evaluate their impacts. For example, they compared the overall efficiency of evacuation scenarios around the Mall of America when the affected people move out either with vehicles or by walking.

The software system was built on a Web server with mapping technology, thereby, reducing the cost of installation and maintenance and increasing the accessibility and availability. The graphic user interface of the software was improved after feedback given at two major evacuation workshops and a number of user meetings. At the second workshop, we installed a small booth for potential users to play the software. The testing and calibrating tasks were carried out using the five predefined evacuation scenarios. The resulting routes from this software were delivered to the parent project, Metro Evacuation Planning. The software and users manual were finalized in 2005 based on suggestions received from workshop participants including Mn/DOT, State and Local Emergency Management and Public Safety Officials, Transit Providers, and private sector personnel.

Computer Science Contributions

Mass evacuations are among the most difficult challenges faced by transportation professionals, but planning for a complete evacuation of a specific city is particularly difficult because such evacuations are only rarely necessary. As a result, developing evacuation plans has been carried out largely on the basis of engineering judgment and educated guesses about how to best make use of the road system.

Previously, computational techniques for solving evacuation problems often relied on the mathematical programming (MP) approach, which is widely used in optimization problems involving flow within transportation networks. Mathematical programming techniques are proven to produce optimal solutions to network flow problems and are known to work well for computing evacuation plans for smaller networks such as a single building. However, the high computational cost associated with current MP methods makes it difficult to scale MP methods up to problems involving extensive urban transportation networks with large numbers of evacuees.

Our research team focused its efforts on developing a novel and more practical form of heuristic algorithm for evacuation planning one that would take into account the capacity constraints built into transportation networks but also determine a good solution to any large-scale evacuation problem in much less time than a mathematical programming approach would require. After development of two preliminary algorithms, this effort culminated in the Capacity Constrained Route Planner (CCRP) algorithm. Experiments with synthetic and real evacuation datasets showed that CCRP took significantly less computational time and resources to identify evacuation routes. In addition, the evacuation routes produced by CCRP were comparable to those produced by mathematical programming techniques in terms of total evacuation time.

This is a significant scientific breakthrough in terms of the design of the evacuation planning algorithm, which is not only novel but also improved. It is also significant from a transportation perspective, since the reduced computational cost of CCRP helps emergency planners at two different stages. During planning and preparedness, emergency planners can evaluate many more scenarios using CCRP given specific computa-

tional resources relative to mathematical programming techniques. During operation, they have the option of revising evacuation routes using CCRP in response to major events (e.g. bridge failure in New Orleans) which were not anticipated during planning and preparedness.

Accrued, quantifiable benefits

In 2005, the software implementing the novel CCRP evacuation planning algorithm was used to identify evacuation routes for five selected scenarios in the Twin-Cities for the Metro Evacuation Traffic Management Plan, which is now serving as the baseline for the entire mass evacuation plan that the US Department of Homeland Security is requiring every state to submit by March 2006. Discussions are underway with Metro Emergency Management Officials regarding the adoption and use of these tools in their emergency management plans as well.

The CCRP algorithm aims at identifying the most efficient routes among all possible route combinations. Thus, it can identify some critical routes which might be missing in the handcrafted plans typically used by local and state governments. One example is the comparative results of the University of Minnesota scenario. Even though the handcrafted version made by a select group of emergency planners covered several major routes including those to I-94 or I-35, our system was able to find additional routes to reduce evacuation time by using routes through Riverside Avenue or another way to I35 through Como Avenue. In an earlier evaluation, the CCRP algorithm identified ways to reduce evacuation time for the Montecillo Nuclear Power Plan evacuation zone by identifying potential congestion near the destination and adding additional routes to relieve it.

Recognitions

The Center for Transportation Studies (CTS) honored this work via the **2006 Research Partnership Award**, which recognizes research projects within the CTS program that have **resulted in significant impacts on transportation**, and rewards teams of individuals who have drawn on the strengths of their diverse partnerships to achieve those results. This work was invited for presentation in multiple public forums including the Intelligent Transportation Systems forum (March 8th, 2006), and the Annual CTS Conference (May, 2006).

University of Minnesota venture center is evaluating this software towards potential commercialization.

8 PUBLICATIONS

8.1 BOOKS [1 - 6]

1. S. Shekhar and H. Xiong. Encyclopedia of Geographic Information Systems, Spring Verlag, 2008, 1377 page, isbn 038730858X.

2. K. Clark, M. Armstrong, B. Bhaduri, B. Buttenfield, M. Gahegan, M. Jackson, S. Shekhar, C. Tucker, and A. Frazier. Priorities for GEOINT Research at the National Geospatial-Intelligence Agency, The National Academies Press, 2006, isbn 0309101492.

3. S. Shekhar and S. Chawla. Spatial Databases: A Tour, Prentice Hall, 2003, ISBN 013-017480-7.

4. Weili Wu, Hui Xiong, and Shashi Shekhar (Eds.) . Clustering and Information Retrieval, Kluwer Academic Publishers, 2003, ISBN: 1-4020-7682-7.

5. S. Shekhar (Editor) and P. Bergougnoux (Ed.). Proc. of the Fourth ACM Workshop on Geographic Information Systems, ACM Press, 1997, ISBN 0-89791-874-6.

6. S. Shekhar and R. Sun. Proc. of the Workshop on Integrating Symbolic AI and Neural Networks, *in conjunction with AAAI Conference*, AAAI Press, 1992.

8.2 BOOK CHAPTERS [7 - 31]

7. S. Shekhar and B. George. Spatial Network Databases (Field Ed.: R. Guting), *Encyclopedia of Database Systems (EICs: T. Ozsu, L. Liu)*, Springer Publishers, 2009 (Expected), isbn 978-0387355443.

8. S. Shekhar, V. Gandhi, J. M. Kang, and M. Mokbel . Spatial Databases, *Handbook of Database Technology (Ed. Markus Schneider and Joachim Hammer)*, CRC Press, 2009 (expected).

9. S. Shekhar and J. M. Kang. Spatial Databases, *Wiley Encyclopedia of Computer Science and Engineering (Ed. Benjamin Wah)*, John Wiley and Sons Inc, 2009, isbn 978-0471383932.

10. S. Shekhar and J. Kang. Spatial Data Mining (Field Editor: D. Papadis), *Encyclopedia of Database Systems (EICs: T. Ozsu, L. Liu)*, Springer Publishers, 2009 (Expected), isbn 978-0387355443.

11. R. Vatsavai, S. Chawla, and S. Shekhar . Spatial Classification and Prediction Models for Geospatial Data Mining, *Geographic Data Mining and Knowledge Discovery (Eds. H. Miller, J. Han)* , CRC Press, 2009 (Expected), 2nd Edition, isbn 978-1420073973.

12. C. T. Lu and S. Shekhar et al,. Spatial Classification and Prediction Models for Geospatial Data Mining, *Geographic Data Mining and Knowledge Discovery (Eds. H. Miller, J. Han)* , CRC Press, 2009 (Expected), 2nd Edition, isbn 978-1420073973.

13. S. Shekhar and R. Vatsavai et al. Trends in Spatial Data Mining, *Data Mining: Next Generation Challenges and Future Directions (Ed. H. Kargupta, J. Han, P. Yu, R. Motwani, V. Kumar)* , Chapman Hall / CRC, Oct. 2008, ISBN: 1420085867, 2nd Edition.

14. B. George and S. Shekhar . Digital Road Maps, *Encyclopedia of GIS (Ed. S. Shekhar, H. Xiong)*, Springer Verlag, 2008, isbn 978-0387308586.

15. M. Celik, B. M. Kazar, S. Shekhar, D. Boley, and D. J. Lilja. Modellare la dipendenza geografica usando l?Auto-regressione spaziale (in Italian), *Geocomputation, Geosimulation, Geovisualisation: metodi innovativi a supporto della pianificazione urbana e territoriale (Editor: Beniamino Murgante)* , Collana di ingegneria della citt e del territorio, Alinea Editrice Firenze, 2008 (expected), (Italian translation, English version in First ICA Workshop on Geospatial Analysis and Modeling" 8 July 2006, Vienna, Austria.

16. S. Shekhar, V. Gandhi, and J. M. Kang. Spatial Data Mining, *Encyclopedia of Geographical Information Science (Ed. Karen Kemp),* , Sage Publications, 2007, isbn 1412913136.

17. P. Zhang, P. Tan, M. Steinbach, V. Kumar, S. Shekhar, S. Klooster, and C. Potter. Discovery of Patterns in the Earth Science Data using Data Mining, *Next Generation of Data Mining Applications (Ed. J. Zurada and M. Kantardzic)*, IEEE Press, Feb. 2005, ISBN: 0-471-65605-4.

18. S. Shekhar, P. Zhang, and Y. Huang . An Invitation to Spatial Data Mining, *The Data Mining and Knowledge Discovery Handbook: A Complete Guide for Practitioners and Researchers (Ed. O. Maimon and L. Rokach)* , Springer, 2005, isbn 0-387-24435-2.

19. Shashi Shekhar, Ranga Raju Vatsavai, Xiaobin Ma, and Jin Soung Yoo. Navigation Systems: A Spatial Database Perspective, *Chapter 3 in Location Based Services (Ed. A. Voisard and J. Schiller)* , Morgan Kaufmann, May 2004, ISBN 1-55860-929-6.

20. S. Shekhar, P. Zhang, and S. Chawla. Spatial Databases, *Encyclopedia of Social Measurement (EIC K. K. Leonard)* , Academic Press, Nov. 2004, ISBN: 0-12-443890-3.

21. S. Shekhar, P. Zhang, Y. Huang, and R. Vatsavai. Trends in Spatial Data Mining, *Data Mining: Next Generation Challenges and Future Directions (Ed. H. Kargupta, A. Joshi, K. Sivakumar, and Y. Yesha)* , AAAI/MIT Press, Oct. 2004, ISBN: 0-262-61203-8.

22. Shashi Shekhar and Ranga Raju Vatsavai. Techniques for Mining Geospatial Databases, *Handbook of Data Mining (Editor: Nong Ye),* , LEA Publishers, NJ, 2003.

23. S. Shekhar, Y. Huang, W. L. Wu, and C. T. Lu. What's special about Spatial Data Mining: Three Case Studies, *Data Mining for Scientific and Engineering Applications (Ed. R. Grossman et al.)*, Kluwer Academic Publishers, 2001, ISBN 1-4020-0033-2.

24. Sanjay Chawla, S. Shekhar, W. L. Wu, and U. Ozesmi. Modeling spatial dependencies for mining geospatial data: An introduction, *Geographic data mining and knowledge discovery (Ed. H. Miller, and J. Han)*, Taylor and Francis, 2001, ISBN 0-415-23369-0.

25. S. Shekhar, C. Lu, X. Tan, S. Chawla, and R. A. Vatsavai. Map Cube: A Visualization tool for spatial data warehouses, *Geographic data mining and knowledge discovery (Ed. H. Miller and J. Han)*, Taylor and Francis, 2001, ISBN 0-415-23369-0.

26. S. Shekhar and D. R. Liu. Genesis and Advanced Traveller Information Systems (ATIS), *Mobile Computing (Ed. T. Imielinski and H. Korth)*, Kluwer Academic Publishers, Jan. 1996, ISBN 0-7923-9697-9.

27. S. Dutta and S. Shekhar. Bond Rating: A Non-Conservative Application of Neural Networks, *Neural Networks in Finance and Investing*, Probus Publishing Co, 1993, ISBN 1-55738-452-5.

28. S. Shekhar and C. V. Ramamoorthy. Coop: An Environment for Cooperative AI Programs, *Knowledge Engineering Shells: Systems and Techniques*, World Scientific Adv. Series on Artificial Intelligence, 1993, ISBN 981-02-1056-6.

29. S. Shekhar, A. Balakrishnan, and P. Khandelwal. Generalization Performance of Feed-Forward Neural Networks, *Neural Networks, Advances and Applications II*, Elsevier Science Publishers, 1992, ISBN 0-444-89330-X.

30. C. V. Ramamoorthy, S. Shekhar, and V. Garg. Software Development Support for AI Programs, *Computers for Artificial Intelligence*, Wiley Interscience Publishers, 1990, ISBN 0-8186-0706-8.

31. S. Dutta and S. Shekhar. An Artificial Intelligence Approach to Predicting Bond Rating, *Expert Systems in Economics, Banking and Management*, North Holland, 1988.

8.3 REFEREED JOURNAL PAPERS [32 - 85]

32. V. Gandhi, J. M. Kang, S. Shekhar, J. Ju, E. D. Kolaczyk, and S. Gopal. Context-Inclusive Function Evaluation: A Case Study with EM-Based Multi-Scale Multi-Granular Image Classification, *Knowledge and Information Systems (KAIS): An Intl. Journal, (issn 0219-1377)* , Springer, 2009 (Expected), (accepted, in press).

33. J. M. Kang, M. Mokbel, S. Shekhar, T. Xia, and D. Zhang. Incremental and General Evaluation of Reverse Nearest Neighbors, *Transactions on Knowledge and Data Engineering (TKDE)* , IEEE, (Accepted with minor revision in 2008).

34. Sangho Kim and Shashi Shekhar. Evacuation Route Planning: Scalable Algorithms, *Journal of Intelligent Transportation Systems* , Taylor & Francis, 2007, Under review.

35. B. George, S. Shekhar, and S. Kim. Spatio-temporal Network Databases and Routing Algorithms, *Transactions on Knowledge and Data Engineering (TKDE)* , IEEE, (Submitted in 2008, Also Tech. Report 08-039, Computer Sc., Univ. of Minnesota).

36. Sangho Kim, Shashi Shekhar, and Manki Min . Contraflow Transportation Network Reconfiguration for Evacuation Route Planning, *Transactions on Knowledge and Data Engineering (TKDE)*, IEEE, Vol. 20, No. 8, 2008, (pp. 1115-1129).

37. M. Celik, S. Shekhar, J. Rogers, and J. Shine. Mining Mixed-drove Spatio-temporal Co-occurrence Patterns, *Trans. on Knowledge and Data Engineering* , IEEE, Vol. 20, No. 10, 2008, (pp. 1322-1335).

38. Changqing Zhou, Dan Frankowski, Pamela Ludford, Shashi Shekhar, and Loren Terveen. Discovering Personally Meaningful Places: An Interactive Clustering Approach, *Transactions on (Office) Information Systems* , ACM, Vol. 25, No. 3, 2007.

40. M. Celik, B.M. Kazar, S. Shekhar, D. Boley, and D.J. Lilja. NORTHSTAR: A Parameter Estimation Method for Spatial Autoregression Model, *Transactions on Knowledge and Data engineering*, IEEE, Under review.

41. Q. Lu, B. George, and S. Shekhar. Evacuation Route Planning: A Case Study in Semantic Computing, *Intl. Journal of Semantic Computing* , World Scientific, Vol. 1, No. 2, June 2007, issn 1793-351X.

42. B. George and S. Shekhar. Time Aggregated Graphs for Modeling Spatio-temporal Networks, *LNCS Journal on Data Semantics (http://lbdwww.epfl.ch/e/Springer/)* , Springer, Vol. JoDS XI, December 2007, (Special Issue: Selected papers from ER 2006, Guest Editors: J.F. Roddick, S. Spaccapietra).

43. J. S. Yoo and S. Shekhar. A Join-less Approach for Mining Spatial Co-location Patterns, *Transactions on Knowledge and Data Engineering (TKDE)*, IEEE, Vol. 18, No. 10, October 2006.

44. H. Xiong, S. Shekhar, P. Tan, and V. Kumar . TAPER: A Two-Step Approach for All-strong-pairs Correlation Query in Large Databases, *Transactions on Knowledge and Data Eng. (TKDE)*, IEEE, Vol. 18, No. 4, April, 2006.

45. S. Shekhar and J. S. Yoo. Processing In-Route Nearest Neighbor Queries: A Comparison of Alternative Approaches, *Geo-Informatica: An International Journal on Advances in Computer Science for Geographic Information Sciences, (Special issue on best papers from ACM Intl. Conf. on GIS 2003).*, Springer, Vol. 9, No. 5, June 2005.

46. C. T. Lu, L. Sripada, S. Shekhar, and R. Liu. Transportation Data Visualization and mining for emergency management, *Intl. Journal of Critical Infrastructure* , Vol. 1, No. 2/3, 2005.

47. Y. Huang, S. Shekhar, and H. Xiong. Discovering Co-location Patterns from Spatial Datasets: A General Approach, *Transactions on Knowledge and Data Engineering (TKDE),*, IEEE, Vol. 16, No. 12, December 2004.

48. P. Chen, M. Donath, X. Ma, S. Shekhar, and K. Buckeye. Evaluation of Nationwide Differential Global Positioning System for Assessing Road User Charges, *Transportation Research Record: A Journal of Transportation Research Board* , National Academies (Transportation Finance, Economics and Economic Development), No. 1864, 2004.

49. C. Potter, P. Zhang, S. Klooster, V. Genovese, S. Shekhar, and V. Kumar . Understanding the Controls of Historical River Discharge Data on Largest River Basins, *Earth Interactions Journal* , Vol. 8, No. 2, 2004.

50. S. Shekhar, J. S. Yoo, X. Ma, and C. Zhou. Next Generation Navigation Systems: The Challenges, *GIS Development: The Asian GIS Monthly*, Vol. 8, No. 11, Novemeber 2004.

51. S. Shekhar, C. T. Lu, and P. Zhang. A Unified Approach to Spatial Outlier Detection, *Geo-Informatica: An Intl. Jr. on Advances of CS to GIS*, Kluwer Academic (ISSN: 1384-6175), Vol. 7, No. 2, June 2003, 139-166.

52. S. Shekhar, C. T. Liu, S. Ravada, and S. Chawla. Optimizing Join Index Based Spatial-Join Processing: A Graph Partitioning Approach, *Transactions on Knowledge and Data Eng*, IEEE, Vol. 14, No. 6, Nov.-Dec. 2002.

53. S. Shekhar, C. T. Lu, and P. Zhang. Detecting Graph-based Spatial Outliers, *Journal of Intelligent Data Analysis (IDA)*, IOS Press, Netherlands, Vol. 6, No. 5, 2002, ISSN: 1088-467X.

54. S. Shekhar, X. Liu, and S. Chawla. Processing Object-orientation based Direction Queries: An Open-Shape Based Strategy, *Transactions on Knowledge and Data Eng*, IEEE, Vol. 15, No. 2, March - April 2003.

55. S. Shekhar and X. Liu. Consistency Checking for Euclidean Spatial Constraints: A Dimension Graph Approach., *Journal of Artificial Intelligence Tools,*, World Scientific Publishing Co., Vol. 10, No. 4, 2001, ISSN: 0218-2130.

56. S. Shekhar, P. Schrater, W. Wu, V. R. Raju, and S. Chawla. Spatial Contextual Classification and Prediction Models for Mining Geospatial Data, *Transactions on Multimedia*, IEEE, Vol. 4, No. 2, June 2002.

57. S. Shekhar and W. Wu. Optimal placement of data replicas in distributed database with majority voting protocol, *Theoretical Computer Science*, Elsevier Science B. V., 2000, Accepted for publication.

58. S. Shekhar and X. Liu. An Object Model of Directions and Its Implications, *GeoInformatica : An International Journal on Advances of Computer Science for Geographic Information Systems*, Kluwer Academics, Vol. 3, No. 4, Dec. 1999, ISSN 1384-6175.

59. G. Karypus, R. Agarwal, V. Kumar, and S. Shekhar. Multilevel Hypergraph Partitioning : Applications in VLSI Domain, *Trans. on VLSI*, IEEE, Vol. 7, No. 1, March 1999.

60. S. Shekhar, S. Ravada, A. Fetterer, X. Liu, and C. T. Liu. Spatial Database: Accomplishments and Research Needs, *IEEE Trans. on Knowledge and Data Eng.*, IEEE, Vol. 11, No. 1, Jan.-Feb. 1999.

61. S. Shekhar, S. Ravada, G. Turner, D. Chubb, and V. Kumar. Declustering and Load-Balancing Methods for Parallelizing Geographic Information Systems, *IEEE Trans. on Knowledge and Data Eng*, IEEE, Vol. 10, No. 4, July-Aug. 1998.

62. S. Shekhar, M. Coyle, D. R. Liu, S. S. Sarkar, and B. Goyal. Experiences with Data Models in Geographic Information Systems, *Communications of the ACM* , ACM, Vol. 40, No. 4, April 1997.

63. S. Shekhar and D. R. Liu. CCAM: A Connectivity-Clustered Access Method for Networks and Network Computations, *Trans. on Knowledge and Data Engineering*, IEEE, Vol. 9, No. 1, Jan.-Feb. 1997, Also Csci Tech. Report 93-78.

64. S. Shekhar, S. Ravada, G. Turner, D. Chubb, and V. Kumar. Parallelizing a GIS on a Shared Address Space Architecture, *Computer (Special Issue on Shared Memory Multiprocessors)*, IEEE, Vol. 29, No. 12, Dec. 1996.

65. S. Shekhar, A. Fetterer, and D. R. Liu. Genesis: An Approach to Data Dissemination in Advanced Traveller Information Systems, *Bulletin of the TC on Data Engineering (Special Issue on Data Dissemination)*, IEEE, Vol. 19, No. 3, September 1996, (Selection 30 percent).

66. E. Peng Lim, J. Srivastava, and S. Shekhar. An Evidential Reasoning Approach to Attribute Value Conflict Resolution in Database Integration, *Trans. on Knowledge and Data Engineering*, IEEE, Vol. 8, No. 5, October 1996, (A Summary of results appeared in IEEE Data Eng. 1994.).

67. S. Shekhar and D. R. Liu. Partitioning Similarity Graphs: A Framework for Declustering Problems, *Information Systems: An Intl. Journal*, Pergamon Press, Vol. 21, No. 6, September 1996.

68. S. Shekhar and M. Coyle. Evaluation of Disk Allocation Methods for Spatial Queries on Grid Files, *Journal of Computer and Software Engineering*, Jan. 1996, (special issue on Parallel Algorithms and Architectures, Ed. P. Srimani).

69. M. Shargal, S. Shekhar, and S. Irani. Evaluation of Search Algorithms and Clustering Efficiency Measures for machine-part Matrix Clustering, *IIE Transactions*, Inst. of Industrial Engineers, Vol. 7, 1995.

70. S. Shekhar and B. Hamidzadeh. Evaluation of Real-Time Problem Solvers in Dynamic Environments, *Intl. Jr. on Artificial Intelligence Tools*, World Scientific Publishers, Vol. 2, No. 4, 1993, (Selected papers from IEEE Conf. on Tools with AI 1992).

71. S. Dutta and S. Shekhar. Decision Support System in Non-Conservative Domains: Generalization with Neural Networks, *Decision Support System Journal (Special Issue on Neural Networks in Decision Support)*, North Holland, Vol. 1994, No. 11.

72. V. Kumar, A. Balakrishnan, and S. Shekhar. A Scalable Highly Parallel Formulation of Backpropagation Algorithm for Hypercubes and Related Architectures, *Trans. on Parallel and Distr. Systems*, IEEE, Oct. 1994.

73. S. Shekhar, T. A. Yang, and P. Hancock. An Intelligent Vehicle Highway Information Management System, *Intl. Jr. on Microcomputers in Civil Engineering (ISSN 0885-9507)*, Elsevier Applied Science, Vol. 8, No. 3, 1993.

74. S. Shekhar and B. Hamidzadeh. Specification and Analysis of Real Time Problem Solvers, *Trans. on Software Engineering*, IEEE, Nov. 1993.

75. Faruk Polat, S. Shekhar, and Altay Guvenir. A Negotiation Platform for Cooperative Intelligent Systems, *Concurrent Engineering Journal*, Academic Press, London, Vol. 1, 1993.

76. S. Shekhar and B. Hamidzadeh. Dynora II: A Real-Time Search Algorithm, *Intl. Jr. on Artificial Intelligence Tools (Special issue on real-time AI)*, World Scientific Publishers, Vol. 2, No. 1, 1993.

77. Faruk Polat, Altay Guvenir, and S. Shekhar. Distributed Conflict Resolution Among Cooperative Expert Systems, *Expert Systems: The International Journal of Knowledge Engineering and Neural Networks*, Learned Information Ltd., Oxford, Nov. 1993, (ISBN 0266-4720).

78. S. Shekhar and B. Hamidzadeh. Learning Transformation Rules for Semantic Query Optimization: A Data-Driven Approach, *Trans. Knowledge and Data Eng. (Spl. Issue on Discovery in Databases)*, IEEE, Oct. 1993.

79. S. Dutta and S. Shekhar. Generalization with Neural Networks: An Application in the Financial Domain, *Intl. Journal of Information Science and Technology*, Inst. Chartered Computer Professional of India, October 1992.

80. S. Shekhar and A. Balakrishnan. Generalization by Neural Networks, *Trans. on Knowledge and Data Eng., (spl. issue on self-organizing data and knowledge representations)*, IEEE, Vol. 4, No. 2, April 1992.

81. S. Shekhar, J. Srivastava, and S. Dutta. A Model of Trade-offs between Optimization and Execution costs in Query Processing, *Journal of Data and Knowledge Engineering*, North Holland Publishers, Vol. 8, 1992.

82. S. Shekhar and C. V. Ramamoorthy. Coop: A Self-Assessment based approach to cooperating expert systems, (invited paper), *Intl. Jr. on Artificial Intelligence Tools*, World Scientific Publishers, Vol. 1, No. 2, 1992.

83. C. V. Ramamoorthy, S. Shekhar, and V. Garg. Software Development Support for AI Programs, *Computer (Spl. issue on Artificial Intelligence)*, IEEE, Vol. 20, No. 1, January 1987.

84. P. Hancock and S. Shekhar. Human Factor Issues in Vehicles of the Future, *Quarterly Bulleting*, Human Factors Society, Spring 1991.

85. S. Shekhar and P. S. Khedkar. Artificial Intelligence: Applications in Computer Science, *Computing Futures (A Supplement to Computer)*, IEEE Computer Society, Winter 1989.

8.4 PAPERS IN HIGHLY SELECTIVE CONFERENCES [86 - 197]

86. J. Kang, S. Shekhar, C. Wennen, and P. Novak. Discovering Flow Anomalies: A SWEET Approach, *Intl. Conference on Data Mining (ICDM 08)*, IEEE, 2008, (Selection 1 out of 7).

87. Z. Zhang, W. Wu, and S. Shekhar. Optimal Placement in Ring Networks for Data Replicas in Distributed Databases with Majority Voting Protocol, *Intl. Conference on Distributed Computing Systems (ICDCS)*, IEEE, 2008, (Selection 1 out of 8, isbn 978-0-7695-3172-4).

88. Pradeep Mohan, Ronald Wilson, Shashi Shekhar, Betsy George, Ned Levine, and Mete Celik. Should SDBMS support a join index? A Case Study with CrimeStat, *Intl. Conference on Advances in Geographic Information Systems (ACMGIS 08),*, ACM SIG- Spatial, 2008, (Selection 1 out of 4).

89. R. R. Vatsavai, S. Shekhar, T. Burk, and B. Bhaduri. *Miner: A Spatial and Spato-temporal Data Mining System, *Intl. Conference on Advances in Geographic Information Systems (ACMGIS 08),*, ACM SIG- Spatial, 2008, (Selection 1 out of 4).

90. J. Partyka, N. Alipanah, L. Khan, B. Thuraisingham, and S. Shekhar. Content-based ontology matching for GIS datasets, *Intl. Conference on Advances in Geographic Information Systems (ACMGIS 08),*, ACM SIG- Spatial, 2008, (Selection 1 out of 4).

91. S. Shekhar and B. Bhaduri. Sub-class Recognition from Aggregate Class Labels: Preliminary Results, *Intl. Conference on Tools with Artificial Intelligence (ICTAI)*, IEEE, 2008, (Selection 1 out of 4).

92. R. R. Vatsavai, S. Shekhar, T. E. Burk, and B. L. Bhaduri. *Miner: A Suit of Classifiers for Spatial, Temporal, Ancillary, and Remote Sensing Data Mining, *Intl. Conference on Information Technology: New Generations (ITNG 2008)*, IEEE Computer Society, 2008, (Selection 1 out of 4).

93. J. Yoo and S. Shekhar . Mining Temporal Association Patterns under a Similarity Constraint, *20th Intl. Conf. on Scientific and Statistical Database Management (SSDBM 2008)*, Springer LNCS 5069 (isbn 978-3-540-69476-2), 2008, (Selection 1 out of 4).

94. R. R. Vatsavai, S. Shekhar, and B. L. Bhaduri. A Learning Scheme for Recognizing Sub-classes from Model Trained on Aggregate Classes, *Jt. Intl. Workshop on Structural, Syntactic, and Statistical Pattern Recognition (SSPR & SPR 2008)*, International Association of Pattern Recognition (IAPR), 2008, (Selection 1 out of 4, Springer LNCS 5342, isbn 978-3-540-89688-3).

95. M. Celik, J.M. Kang, and S. Shekhar. Zonal Co-location Pattern Discovery with Dynamic Parameters, *In Proc. of 7th IEEE Int l Conf. on Data Mining (ICDM)* , 2007, Omaha, Nebraska (Selection 1 out of 5).

96. Betsy George, Sangho Kim, and Shashi Shekhar. Spatio-temporal Network Databases and Routing Algorithms: A Summary of Results, *10th International Symposium on Advances in Spatial and Temporal Databases (SSTD'07)* , 2007, Boston, MA (Selection 1 out of 4).

97. J. M. Kang, M. Mokbel, S. Shekhar, T. Xia, and D. Zhang. Continuous Evaluation of Monochromatic and Bichromatic Reverse Nearest Neighbors, *23rd International Conference on Data Engineering (ICDE 07)*, IEEE, April 16-20, 2007, Istanbul, Turkey (Selection 1 out of 7).

98. Mallikarjun Shankar, Alexandre Sorokine, Budhendra L. Bhaduri, David Resseguie, Shashi Shekhar, and Jin Soung Yoo. Spatio-temporal Conceptual Schema Development for Wide-Area Sensor Networks, *Second International Conference on. Geospatial Semantics (GeoS 2007)*, 2007, Centro de Investigacion en Computacion. Mexico City, Mexico (Selection 1 out of 3).

99. Betsy George and Shashi Shekhar. Modeling Spatio-temporal Network Computations: A Summary of Results, *Second International Conference on. Geospatial Semantics (GeoS 2007)*, 2007, Centro de Investigacion en Computacion. Mexico City, Mexico (Selection 1 out of 3).

100. Sangho Kim, Betsy George, and Shashi Shekhar. Evacuation Route Planning: Scalable Heuristics, *15th ACM International Symposium on Advances in Geographic Information Systems (ACMGIS'07),*, 2007, Seattle, WA (Selection 1 out of 4).

101. Jin Soung Yoo, Shashi Shekhar, Sangho Kim, and Mete Celik . Discovery of Co-evolving Spatial Event Sets, *Proceedings of the International Conference on Data Mining (SDM)* , SIAM, 2006, (acceptance ratio 1 out of 7).

102. M. Celik, S. Shekhar, J. Rogers, J. Shine, and J.S. Yoo. Mining Mixed-drove Spatio-temporal Co-occurrence Patterns: A Summary of Results, *Proc. of Int'l Conference on Data Mining (ICDM)*, IEEE, December 2006, Hong Kong (Selection 1 out of 10).

103. Ranga Raju Vatsavai, Shashi Shekhar, Thomas E. Burk, and Stephen Lime. UMN-MapServer: A High-Performance, Interoperable, and Open Source Web Mapping and Geo-spatial Analysis System, *Bi-annual Intl. Conference on Geographic Information Science* , 2006, (Selection 1 out of 4).

104. Xiaobin Ma, Shashi Shekhar, Hui Xiong, and Pusheng Zhang. Exploiting Page-Level Upper Bound for Multi-Type Nearest Neighbor Queries, *International Symposium on Advances in Geographic Information Systems (ACM GIS 2006)* , 2006, (Selection 1 out of 3).

105. M. Celik, S. Shekhar, J. Rogers, and J. Shine. Sustained Emerging Spatio-temporal Co-occurrence Pattern Mining: A Summary of Results, *In Proc. of Int'l Conference on Tools on Artificial Intelligence (ICTAI)*, November 2006., (Selection 1 out of 3).

106. J. Yoo, P. Zhang, and S. Shekhar . Mining Time-Profiled Associations: An Extended Abstract, *Proc. of the Pacific-Asia Conf. on Data Mining and Knowlege Discovery (PAKDD),* , 2005, (acceptance ratio 1 out 6).

107. J. S. Yoo, S. Shekhar, and M. Celik. A Join-less Approach for Co-location Pattern Mining: A Summary of Results, *In Proceedings of the Intl. Conf. on Data Mining (ICDM)*, IEEE, 2005, (acceptance ratio 1 out of 10).

108. S. Mane, C. Murray, S. Shekhar, J. Srivastava, and A. Pusey,. Spatial Clustering Of Chimpanzee Locations For Neighborhood Identification, *In Proceedings of the Intl. Conf. on Data Mining (ICDM)*, IEEE, 2005, (acceptance ratio 1 out of 10).

109. H. Xiong, S. Shekhar, P. Tan, and V. Kumar. Exploiting a Support-based Upper Bound of Pearson's Correlation Coefficient for Efficiently Identifying Strongly Correlated Pairs, *in Proc. of the Tenth SIGKDD Int'l Conf. on Knowledge Discovery and Data Mining*, ACM, 2004, (acceptance ratio 1 out of 8).

110. H. Xiong, S. Shekhar, Y. Huang, V. Kumar, X. Ma, and J. Yoo . A Framework for Discovering Co-location Patterns in Data Sets with Extended Spatial Objects, *Proc. International Conf. on Data Mining (SDM)*, SIAM, 2004, (acceptance ratio 1 out of 7).

111. V. R. Raju, S. Shekhar, and T. Burk . A Semi-supervised Learning Method for Remore Sensing Data Mining, *Proc. of the Intl. Conf. on Tools with Artificial Intelligence*, IEEE, 2005, (acceptance ratio 1 out of 4).

112. Q. Lu, B. George, and S. Shekhar . Capacity Constrained Routing Algorithms for Evacuation Planning: A Summary of Results, *Proc. of 9th Intl. Symposium on Spatial and Temporal Databases (SSTD05), Angra dos Reis, Brazil,* , August 22-24, 2005, (acceptance ratio 1 out of 4).

113. S. Kim and S. Shekhar . Contraflow Network Reconfiguration for Evacuation Planning: A Summary of Results, *Proc. of the Intl. Symposium on Advances in Geographic Information Systems (ACMGIS)*, ACM, 2005, (acceptance ratio 1 out of 4).

114. B. M. Kazar, S. Shekhar, D. J. Lilja, D. Shires, J. Rogers, and M. Celik . A Parallel Formulation of the Spatial Auto-Regression Model, *Proc. Intl. Conf. on Geographic Information (GIS PLANET),* , May 2005 (Lisbon, Portugal), (acceptance ratio 1 out of 3).

115. J. S. Yoo and S. Shekhar. A partial join approach for mining co-location patterns, *Proc. of the Intl. Symposium on Advances in Geographic Information Systems (ACMGIS)*, ACM, 2004, (acceptance ratio 1 out of 4).

116. C. Zhou, D. Frankowski, P. J. Ludford, S. Shekhar, and L. G. Terveen. Discovering personal gazetteers: an interactive clustering approach, *Proc. of the Intl. Symposium on Advances in Geographic Information Systems (ACMGIS)*, ACM, 2004, (acceptance ratio 1 out of 4).

117. B. M. Kazar, S. Shekhar, D. J. Lilja, R. R. Vatsavai, and R. K. Pace . Comparing Exact and Approximate Spatial Auto-Regression Model Solutions for Spatial Data Analysis, *Proc. of Third Intl. Conference on Geographic Information Science (GIScience2004),* , Springer Verlag (LNCS 3234), October 2004, (acceptance ratio 1 out of 3).

118. G. Karypus, R. Agarwal, V. Kumar, and S. Shekhar. Multilevel Hypergraph Partitioning : Applications in VLSI Domain, *Design Automation Conference*, ACM/IEEE, 1997, (Selection 20 percent).

119. S. Shekhar and D. R. Liu. A Similarity-Graph Based Approach to Declustering and Its Application Towards Parallelilizing Grid Files, *Proc. Intl. Conf. on Data Engineering (Selection 20 percent)*, IEEE, 1995.

120. S. Shekhar and D. R. Liu. Connectivity-Clustered Access Methods for Networks and Network Computations: A Summary of Results, *Proc. Intl. Conf. on Data Engineering*, IEEE, 1995, (Selection 30 percent).

121. Y. Zhou, S. Shekhar, and M. Coyle. Disk Allocation Methods for Parallelizing Grid Files, *Proc. Intl. Conf. on Data Engineering (Selection 30 percent)*, IEEE, 1994.

122. S. Shekhar, E. Peng Lim, and J. Srivastava. Resolving attribute incompatibility in database integration: An evidential reasoning approach, *Proc. Intl. Conf. on Data Engineering*, IEEE, 1994, (Selection 20 percent).

123. S. Shekhar, A. Kohli, and M. Coyle. Single Pair Path Computation Algorithms for Advanced Traveller Information Systems, *Proc. Intl. Conf. on Data Engineering*, IEEE, 1993, (Selection 20 percent).

124. V. Kumar, M. B. Amin, and S. Shekhar. A Highly Parallel Formulation of Backpropagation on Hypercubes: A Summary of Results, *Proc. Intl. Jt. Conf. on Neural Networks*, November 1992, (Selection 20 percent).

125. S. Shekhar and B. Hamidzadeh. Can Real-time AI Algorithms Meet Deadlines?, *Proc. Int'l Conf. on Artificial Intelligence*, AAAI, 1992, (Selection 14 percent).

126. S. Shekhar and A. Yang. MoBiLe Files and Efficient Processing of Path Queries on Scientific Data, *Proc. Intl. Conf. on Data Engineering*, IEEE, 1992, (Selection 20 percent).

127. S. Shekhar and C. V. Ramamoorthy. A Cooperative Approach to Large Knowledge Based Systems, *Proc. Sixth Intl. Conf. on Data Engineering*, IEEE, 1990, (Selection 20 percent).

128. S. Shekhar and C. V. Ramamoorthy. Analysis of A Stochastic Learning Algorithm for Generalization Problems, *Proc. Intl. Jt. Conf. on Neural Networks*, IEEE, 1989, (Selection 20 percent).

129. S. Shekhar and S. Dutta. Minimizing Response Time in Real Time Planning and Search, *Proc. Intl. Jt. Conf. on Artificial Intelligence*, 1989, (SELECTION 14 percent).

130. S. Shekhar and S. Dutta. Bond Rating: A Non-Conservative Application of Neural Networks, *Proc. Int'l Conf. on Neural Networks*, IEEE, 1988, (also listed in Scientific Software 1988 and reprinted in books).

131. S. Shekhar and S. Dutta. Using Neural Networks for Generalization Problems, *Proc. Annual Conf. of Int'l Neural Network Society*, 1988, (Selection 20 percent).

132. S. Shekhar, J. Srivastava, and S. Dutta. A Model of Trade-offs between Optimization and Execution costs in Query Processing, *Proc. Int'l Conf. on Very Large Databases*, VLDB, 1988, (Selection 14 percent).

133. Y. Huang, H. Xiong, S. Shekhar, and Jian Pei. Mining Confident Co-location Rules without A Support Threshold, *Proc. of 18th ACM Symposium on Applied Computing (ACM SAC), Melbourne, FL,* , March 2003, (Selection 30 percent).

134. Pusheng Zhang, Yan Huang, Shashi Shekhar, and Vipin Kumar. Correlation Analysis of Spatial Time Series Datasets: A Filter-and-Refine Approach, *Proc. of 11th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD)* , 2003, (Selection 18 percent).

135. Pusheng Zhang, Yan Huang, Shashi Shekhar, and Vipin Kumar. Exploiting Spatial Autocorrelation to Efficiently Process Correlation-Based Similarity Queries, Proc. of 8th Intl. Symp. on Spatial and Temporal Databases (SSTD), Santorini island, Greece, July 2003, (Selection 23 percent).

136. Qingson Lu, Yan Huang, and Shashi Shekhar. Evacuation Planning: A Capacity Constrained Routing Approach, *Proc. of First NSF/NIJ Symposium on Intelligence and Security Informatics (ISI 2003)* , 2003, (Selection 30 percent).

137. B. M. Kazar, S. Shekhar, and D. J. Lilja. High performance spatial data mining for very large datasets, *9th ACM SIGPLAN symposium on Principles and practice of parallel programming (PPoPP)* , June 2003, San Diego, California, USA (emerging topics).

138. Chang-Tien Lu, Yufeng Kou, Hongjun Wang, Shashi Shekhar, Pusheng Zhang, and Rulin Liu . Two Web-Based Spatial Data Visualization System: Mapcube & Mapview", *Proc. of the Int'l Workshop on Next Generation Geospatial Information,* , National Science Foundations (Boston, MA), Oct. 2003.

139. Shashi Shekhar, Pusheng Zhang, and Vatsavai Ranga Raju. Research Directions in Spatial Data Mining and Visualization, *Workshop on Geographic Data Visualization* , National Security Agency and University Consortium on GIS, Novemeber 2003.

140. Shashi Shekhar and Jin Soung Yoo,. Processing In-Route Nearest Neighbor Queries: A Comparison of Alternative Approaches (Summary of Results), *Intl. Conference on Geographic Information Systems*, ACM, 2003.

141. Pusheng Zhang, Shashi Shekhar, Yan Huang, and Vipin Kumar . Spatial Cone Tree: An Index Structure for Correlation-based Similarity Queries on Spatial Time Series Data, *Proc. of the Int'l Workshop on Next Generation Geospatial Information,* , National Science Foundations, Oct. 2003, Boston, MA.

142. Pusheng Zhang, Yan Huang, Shashi Shekhar, and Vipin Kumar . Correlation Analysis of Spatial Time Series Datasets: An Efficient Filter-and-Refine Approach, *Proc. of the Seventh Pacific-Asia Knowledge Discovery and Data Mining*, April 2003, Page 532-544, Seoul, Korea.

143. S. Shekhar, Y. Huang, and Judy Djugash. Dictionary Design Algorithms for Vector Map Compression, *Proc. of IEEE Data Compression Conference (DCC), Snowbird, UT,* , April 2002, (Selection 30 percent).

144. S. Shekhar, Y. Huang, Judy Djugash, and Changqing Zhou. Vector Map Compression: A Clustering Approach, *Proc. of The 10th ACM Intl. Symp. on Advances in Geographic Information Systems* , November 2002, (Selection 30 percent).

145. Shashi Shekhar and Qingson Lu. Evacuation Planning Algorithms: A Capacity Constrained Routing Approach, *Proc. of the 23rd Army Science Conference, Orlando, Florida,* , December 2-5, 2002, (Selection 30 percent).

146. S. Shekhar, C. T. Lu, P. Zhang, and Rulin Liu. Data Mining for Selective Visualization of Large Spatial Datasets, *Intl. Conf. on Tools with Artificial Intelligence*, IEEE, 2002, (Selection 30 percent).

147. S. Shekhar, C. T. Lu, and P. Zhang. Cube View: A System for Traffic Data Visualization, *Intl. Conf. on Intelligent Transportation Systems*, IEEE, 2002, (Selection 30 percent).

148. Ajay Pandey, Ranga R. Vatsavai, X. Ma, Jaideep Srivastava, and S. Shekhar . Data Mining for Intelligent Web Prefetching, *proceedings of the Workshop on Mining Data Across Multiple Customer Touchpoints for CRM (MDCRM02)* , SIAM, May 2002, (Selection 50 percent).

149. Ranga R. Vatsavai, Thomas E. Burk, Shashi Shekhar, and Maria Gini. An Efficient Hybrid Classification System for Mining Multi-spectral Remote Sensing Imagery Guided by Spatial Databases, *Proc. 2nd Pattern Recognition for Remote Sensing (PRRS 2002) Workshop* , BMVA Press (ISBN 1 901725 18 9), August 2002, (Selection 50 percent).

150. S. Shekhar, C. T. Lu, and P. Zhang. Detecting Graph-Based Spatial Outliers: Algorithms and Applications, *Seventh ACM SIGKDD Intl. Conf. on Knowledge Discovery and Data Mining*, 2001, (Selection 20 percent).

151. S. Chawla, S. Shekhar, W. Wu, and U. Ozsemi. Modeling Spatial Dependencies for Mining Geospatial Data, *Proc. 1st SIAM Conference on Data Mining*, 2001, (Selection 25 percent).

152. S. Shekhar and H. Yan. Discovering Spatial Co-location Patterns: A Summary of Results, *Proc. of 7th Intl. Symposium on Spatial and Temporal Databases (SSTDO1)*, July 2001, (Selection 30 percent).

153. S. Shekhar, R. R. Vatsavai, N. Sahay, T. E. Burk, and S. Lime. A WMS and GML based Interoperable Web Mapping System, *ACM Intl. Workshop on Geographic Info. Systems*, 2001, (Selection 30 percent).

154. R. R. Vatsavai, T. E. Burk, S. Shekhar, and M. M. Hansen. An Efficient Query Strategy For Integrated Remote Sensing and Inventory (Spatial) Databases, *Proc. 13th Intl. Conf. on Scientific and Statistical Database Management*, IEEE CS Press, 2001, (Selection 30 percent).

155. S. Chawla, R. R. Vatsavai, T. E. Burk, P. V. Bolstad, M. E. Bauer, S. K. Hansen, T. Mack, J. Smedsmo, and S. Shekhar. Multi-Spectral Image Classification Using Spectral and Spatial Knowledge, *Proc. Intl. Conf. on Imaging Systems, Science and Technology (CISST)*, CSREA Press, 2001, Sponsored by DOE Natl. Supercomputing Center for Energy and the Env., and World Sc. and Eng. Society.

157. S. Chawla, S. Shekhar, and W. Wu. An Application of Spatial Data Mining Techniques in Geographic Data, *Proc. of the 20th Intl. Cartographic Conference, Beijing*, 2001, (Selection 30 percent).

158. B. Hamidzadeh and S. Shekhar. Dependability of On-Line Optimization Techniques in Real-Time Applications, *Fourth International Conference on Object-Oriented Real-Time Dependable Systems*, 2000, (Selection 30 percent).

159. V. Rangaraju and S. Shekhar. A Web-based browsing and spatial analysis system for regional natural resource analysis and mapping, *Intl. Conf. on GIS*, ACM, 2000, (Selection 30 percent).

160. S. Shekhar and X. Liu. Processing Object-orientation based Direction Queries: A Summary of Results, *Intl. Conf. on GIS*, ACM, 2000, (Selection 30 percent).

161. S. Shekhar and X. Liu. Consistency Checking for Direction Predicates, *Intl. Conf. on Tools with AI*, IEEE, 2000, (Selection 25 percent).

162. S. Shekhar and S. Chawla. Clustering Spatial Transactions with Hypergraphs, *Workshop on Discovering Geographic Knowledge in Data-Rich Environments*, National Science Foundation Project Varenius at NCGIA, March 1999, (Selection 40 percent).

163. S. Shekhar and X. Liu. Directions As a Spatial Object: A Summary of Results, *Proc. Intl. Conf. on Advances in Geographic Info. Systems*, ACM, Nov. 1998, (Selection 30 percent).

164. S. Shekhar, C. T. Liu, and S. Ravada. Spatial-Join Processing: A Graph Partitioning Approach, *Conference on Reliable Distributed Systems*, IEEE, October 1998, (Selection 30 percent).

165. S. Shekhar and S. Ravada. Parallelizing the Refinement Step of Spatial Join, *Intl. Conf. on Advances in Geographic Info. Systems*, ACM, Nov. 1997, (Selection 30 percent).

166. S. Shekhar, A. Fetterer, and B. Goyal. A Performance Evaluation of Hierarchical Algorithms for Routing, *Proc. Intl. Conf. on Tools with Artificial Intelligence*, IEEE, 1997, (Selection 30 percent).

167. S. Shekhar, A. Fetterer, and B. Goyal. View Materialization Tradeoffs in Hierarchical Shortest Path Algorithms, *Symp. of Large Spatial Databases* , Springer Verlag, 1997, (Univ. of Minnesota, Computer Science Tech. Report 97-003).

168. S. Shekhar, M. Coyle, D. R. Liu, and S. S. Sarkar. Experiences with Data Models in Geographic Information Systems, *Second World Conference on Integrated Design and Process Technology* , Society for Design and Process Science, 1996, (Selection 30 percent).

169. A. A. El Haddi and S. Shekhar. Mirror-Image Round-Robin Spatial Data Partitioning: A Case Study with Parallel SEUS, *Intl. Conf. on Integrating Gegraphic Info. Systems with Environmental Modeling*, National Center for Geographic Info. and Analysis (NCGIA), Jan. 1996, (Selection 30 percent).

170. S. Shekhar and A. Fetterer. Routing Algorithms for Advanced Traveler Info. Systems, *Intl. Conf. on Intelligent Transportation Systems*, ITS America, 1996, (Selection 30 percent).

171. S. Shekhar, S. Ravada, G. Turner, D. Chubb, and V. Kumar. Load Balancing in High Performance GIS: Partitioning Polygonal Maps, *Proc. Intl Symp. on Large Spatial Databases*, Springer Verlag (Lecture Notes in Computer Science #951), 1995, (Selection 30 percent).

172. S. Ravada, G. Turner, D. Chubb, and V. Kumar. Load Balancing in High Performance GIS: A Summary of Results, *Intl. Conf. on High Performance Computing (Goa, India)*, IEEE, CDAC, 1995, (Selection 30 percent).

173. S. Shekhar, S. Ravada, G. Turner, D. Chubb, and V. Kumar. High Performance Terrain Visualization, *Workshop on Simulation and Interaction in Virtual Environments*, ACM SIGGRAPH, ONR, 1995, (Selection 30 percent).

174. S. Shekhar and M. B. Amin. Customizing Parallel Formulations of Learning Algorithms to Neural Network Architectures: A Summary of Results, *Intl. Conf. on Tools with AI*, IEEE, 1994, (Selection 30 percent).

175. S. Shekhar and D. R. Liu. Genesis and Advanced Traveller Information Systems (ATIS): Killer Applications for Mobile Computing?, *Proc. Workshop on Mobile and Wireless Information Systems*, National Science Foundation, Oct. 1994, (selection 30 percent).

176. D. R. Liu, S. Shekhar, and M. Coyle. An Evaluation of Access Methods for Spatial Networks, *2nd Workshop on Advances in Geographic Information Systems* , ACM, 1994, (Selection 30 percent).

177. S. Shekhar and B. Hamidzadeh. Self-Adjusting Real-Time Search: A Summary of Results, *Proc. Intl. Conf. on Tools for Artificial Intelligence*, IEEE, 1993, (Selection 25 percent).

178. B. Hamidzadeh and S. Shekhar. A general search framework for dynamic scheduling of real-time tasks, *Proc. Workshop on Real-Time Operating Systems and Software*, May, 1993, (Selection 30 percent).

179. S. Shekhar and B. Hamidzadeh. Evaluation of Real-Time Search Algorithms in Dynamic Worlds (Summary of Results), *Proc. Int'l Conf. on Tools with AI*, IEEE, 1992, (Selection 30 percent).

180. J. Tan, J. Srivastava, and S. Shekhar. On the Construction of Efficient Match Networks, *Proc. Symposium on Applied Computing*, ACM/SIGAPP, March 1992, (Selection 30 percent).

181. S. Dutta and S. Shekhar. Decision Support in Non-Conservative Domains: Generalization with Neural Networks, *12th World Computer Congress*, IFIP, 1992, (Selection 30 percent).

182. S. Shekhar and S. Dutta. Using Neural Networks for Modeling Corporate Bond Ratings, *Indian Computing Congress*, Dec. 1991, (Selection 30 percent).

183. A. Cosar, J. Srivastava, and S. Shekhar. On the Multiple Pattern Multiple Object Match, *Proc. Intl. Conf. on Management of Data (COMAD)*, Dec. 12-14, 1991, (Selection 30 percent).

184. S. Shekhar and B. Hamidzadeh. DYNORA: Real Time Planning for Dynamic Situations, *Proc. Int'l Conf. on Tools with AI*, IEEE, 1991, (Selection 30 percent).

185. S. Shekhar and A. Yang. Motion in Geographic Databases: MoBiLe Files, *Proc. Intl Symp. on Design and Implementation of Large Spatial Databases*, Springer Verlag (Lecture Notes in Computer Science), 1991, (Selection 30 percent).

186. S. Shekhar, A. Yang, and B. Hamidzadeh. Path Planning and Evaluation in IVHS Databases, *Proc. Int'l Conf. on Vehicle Navigation Information System*, IEEE, 1991, (Selection 30 percent).

187. S. Shekhar and M. Coyle et.al. Design and Validation of Headup Displays for Navigation, *Proc. Int'l Conf. on Vehicle Navigation Information System*, IEEE, 1991, (Selection 30 percent).

188. S. Shekhar and P. Hancock. Factors influencing driver's left turn decision, *Proc. Human Factors Society Annual Meeting*, 1991, (Selection 30 percent).

189. S. Shekhar and B. Hamidzadeh. Real Time Planning: Optimizing Response Time under Dynamic Situations, *Proc. Workshop on Real-Time AI*, AAAI, 1991, (Selection 30 percent).

190. J. Tan, S. Shekhar, and J. Srivastava. Maintenance of Efficient Match Networks, *Hawaii Intl. Conf. on Systems Sciences*, Jan. 1990, (Selection 30 percent).

191. S. Shekhar, H. Shigeta, and C.V.Ramamoorthy. Annotated Prolog: Design and Implementation, *Japanese Nat'l Conf on Info. Proc*, 1990, (Selection 30 percent).

192. S. Shekhar and C. V. Ramamoorthy. Coop: An Environment for Cooperative AI Programs, *Proc. Conf. on AI tools*, IEEE, 1990, (Selection 30 percent).

193. S. Shekhar and C. V. Ramamoorthy. Stochastic Backpropagation: A Learning Algorithm for Generalization Problems, *Proc. Intl. Conf. on Computer Software and Applications (COMPSAC)*, IEEE, 1989, (Selection 30 percent).

194. S. Shekhar and C. V. Ramamoorthy. A Stochastic Learning Algorithm for Generalization Problems, *Proc. Tenth Regional Intl. Conf. (TENCON)*, IEEE, 1989, (Selection 30 percent).

195. S. Shekhar and S. Dutta. An Artificial Intelligence Approach to Predicting Bond Rating, *Proc. Workshop on AI in Economics and Management*, Jan. 1989.

196. S. Shekhar and R. Ashany. Query Optimization for Knowledge base, *Proc. Workshop on Databases in Large AI Systems*, AAAI, 1988, (Selection 30 percent).

197. S. Shekhar, C. V. Ramamoorthy, and R. Ashany. Modeling of Cooperation among Intelligent Agents, *Proc. Modeling and Simulation Conference*, May 1988, (Selection 30 percent).

8.5 PAPERS IN PEER-REVIEWED WORKSHOPS, SYMPOSIUMS [198 - 244]

198. R. R. Vatsavai, S. Shekhar, and B. L. Bhaduri. A Semi-supervised Learning Algorithm for for Recognizing Sub-classes, *Intl. Workshop on Spatial and Spatio-temporal Data Mining*, IEEE ICDM, 2008, (Selection 1 out of 2).

199. J. Partyka, N. Alipanah, L. Khan, B. Thuraisingham, and S. Shekhar. Ontology Alignment Using Multiple Contexts, *Proceedings of the Poster and Demo. Session at the 7th Intl. Semantic Web Conference (ISWC2008)*, Semantic Web Science Association Web (SWSA), 2008, (Selection 1 out of 2).

202. , U.S. Army Office of the Asst. Secy. of the Army for Acquisition, Logistics and Technology, 2008, (Selection 1 out of 3).

203. M. Celik, S. Shekhar, J. Rogers, J. Shine, and J. M. Kang. Mining At Most Top-K percent Mixed-drove Spatio-temporal Co-occurrence Patterns: A Summary of Results, *In Proc. of Workshop on Spatio-Temporal Data Mining (STDM) with Int'l Conference on Data Engineering (ICDE)* , IEEE, April 20, 2007, (Selection 1 out of 2).

204. Changqing Zhou, Nupur Bhatnagar, Shashi Shekhar, and Loren Terveen. Mining Personally Important Places from GPS Tracks: A Hybrid Approach, *In Proc. of Workshop on Spatio-Temporal Data Mining (STDM) with Int'l Conference on Data Engineering (ICDE)* , IEEE, April 20, 2007, (Selection 1 out of 2).

205. B. George, J. M. Kang, and S. Shekhar. Spatio-Temporal Sensor Graphs (STSG): A Sensor Model for the Discovery of Spatio-Temporal Patterns, *First SIG-KDD International Workshop on Knowledge Discovery from Sensor Data (Sensor-KDD '07)*, ACM, August 12, 2007, San Jose CA (BEST PAPER Award).

206. J. Shine, J. Rogers, M. Celik, and S. Shekhar. Temporal Extensions to Spatial Statistical Metrics, *Joint Statistical Meeting*, Americal Statistical Association, Statistical Society of Canda, 2007, (Selection 1 out of 2).

207. Sangho Kim, Shashi Shekhar, and Jeffrey Wolff. Software Tools to Compare Transportation Modes for Car-less Evacuation, *National Conference on Disaster Planning for the Carless Society*, 2007, (Selection 1 out of 3).

208. Betsy George and Shashi Shekhar. Time-Aggregated Graphs for Modeling Spatio-temporal Networks, *3rd International Workshop on Conceptual Modeling for Geographic Information Systems (CoMoGIS2006)*, 25th International Conference on Conceptual Modeling (ER2006), 2006, (Selection 1 out of 2).

209. Vijay Gandhi, James M. Kang, Shashi Shekhar, Junchang Ju, Eric D. Kolaczyk, and Sucharita Gopal . Context-Inclusive Approach to Speed-up Function Evaluation for Statistical Queries : An Extended Abstract, *1st International Workshop on Spatial and Spatio-temporal Data Mining, with 6th International Conference on Data Mining (*ICDM '06*)* , IEEE, December 18, 2006, (Selection 1 out of 2).

210. V. Gandhi, M. Celik, and S. Shekhar. Parallelizing Multiscale and Multigranular Spatial Data Mining Algorithms, *The Second Conference on Partitioned Global Address Space Programming Models, (PGAS)* , AHPCRC - George Washington University, October 3-4, 2006, (Selection 1 out of 2).

211. Mete Celik, Baris M. Kazar, Shashi Shekhar, Daniel Boley, and David J. Lilja . Spatial Dependency Modeling Using Spatial Auto-regression, *Workshop on Geospatial Analysis and Modeling with Geoinformation Connecting Societies (GICON)* , International Cartography Association (ICA), 2006, (Selection 1 out of 2).

212. Mete Celik, Baris M. Kazar, Shashi Shekhar, and Daniel Boley. Parameter Estimation for the Spatial Autoregression Model: A Rigorous Approach, *Second NASA Data Mining Workshop: Issues and Applications in Earth Science with the 38th Symposium on the Interface of Computing Science, Statistics and Applications* , May 2006, (Selection 1 out of 2).

213. Ranga Raju Vatsavai and Shashi Shekhar. Miner: A Suit of Classifiers for Spatial, Temporal, Ancillary, and Remote Sensing Data Mining, *Second NASA Data Mining Workshop: Issues and Applications in Earth Science with the 38th Symposium on the Interface of Computing Science, Statistics and Applications* , May 2006, (Selection 1 out of 2).

214. Jin Soung Yoo and Shashi Shekhar . A Framework for Mining Co-evolving Spatial Events, *Second NASA Data Mining Workshop: Issues and Applications in Earth Science with the 38th Symposium on the Interface of Computing Science, Statistics and Applications* , May 2006, (Selection 1 out of 2).

215. C. Zhou, L. Terveen, and S. Shekhar. Discovering Personal Paths from Sparse GPS Traces, *In Proc. of the Workshop on Data Mining (WDM '05)*, JCIS, 2005, (acceptance ratio 1 out of 2).

216. Q. Lu and S. Shekhar. Capacity Constrained Routing for Evacuation Planning, *Intelligent Transportation Systems Safety and Security Conference (Miami, Florida)* , USDOT, March 24-25, 2004, (acceptance ratio 1 out of 2).

217. Q. Lu and S. Shekhar . High Performance Scalable Capacity Constrained Routing Algorithms for Evacuation Planning : A summary of Results, *Proc. of the 24th Army Science Conference,* , November 2004, (acceptance ratio 1 out of 2).

218. B. M. Kazar, S. Shekhar, D. J. Lilja, and D. Boley. A Parallel Formulation of the Spatial Auto-Regression Model for Mining Large Geo-Spatial Datasets, *Proc. of Workshop on High Performance and Distributed Mining (HPDM2004)* , SIAM, 2004, (acceptance ratio 1 out of 2).

219. S. Shekhar, B. M. Kazar, and D. J. Lilja . Scalable Parallel Approximate Formulations of Multi-Dimensional Spatial Auto-Regression Models for Spatial Data Mining, *24th Army Science Conference* , November 2004, (acceptance ratio 1 out of 2).

220. V. Kumar, M. Steinbach, P. Zhang, S. Shekhar, P. Tan, and C. Potter . Discovery of Patterns in the Earth Science Data using Data Mining, *in the Proc. of the Earth Science Technology Conference (Palo Alto, CA)*, NASA, July 2004., (acceptance ratio 1 out of 2).

221. S. Shekhar (Moderator), J. Han, LeSage, and S. Chawla. Spatial Data Mining: A Panel Discussion, *ARL/AHPCRC Workshop on Scientific Data Mining* , University of Minnesota, July 2000.

222. S. Chawla, S. Shekhar, and W. Wu. Predicting Locations Using Map Similarity(PLUMS): A Framework for Spatial Data Mining, *SIGKDD Multimedia Data Mining Workshop (MDM/KDD2000)* , ACM, August 2000, (Selection 30 percent).

223. S. Chawla, S. Shekhar, W. Wu, and U. Ozesmi. Extending data mining for spatial applications: a Case Study in Predicting Nest Locations, *SIGMOD Workshop on data mining and kowledge discovery (DMKD 2000)*, ACM, May 2000, (Selection 30 percent).

224. S. Shekhar. Research Directions in Spatial Graph Databases, *Industrial/Academic Workshop on Database Research Directions*, National Science Foundation (NSF), October 1998, (Selection 22 percent).

225. S. Shekhar, R. Vatsavai, S. Chawla, and T. Burk. Spatial Pictogram Enhanced Conceptual Data Models and Their Translation to Logical Data Models, *Intl. Workshop on Integrated Spatial Databases (ISD99): Digital Images and GIS (Selection 30 percent)*, NSF, May 1999, (Proceedings appears and Springer Verlag LNCS 1737, ISSN 0302-9743).

226. S. Shekhar. Spatial Graph Databases: Final Report, *National Science Foundation PI Workshop*, NSF, March 1999.

227. S. Shekhar. Spatial Graph Databases: Mid-way Progress Report, *National Science Foundation PI Workshop*, NSF, March 1998.

228. S. Shekhar and X. Liu. Direction As a Spatial Object, *Knowledge and Data Engineering Exchange Workshop* , IEEE, 1998, (In conjuction with ICTAI 98).

229. S. Shekhar and S. Chawla. Spatial Databases: An Object-Relational Approach, *Proc. Workshop on Databases and Object Orientations*, Army Research Lab. and Army Research Office, November 1997.

230. S. Shekhar. Parallelizing Geographic Information Systems for Terrain Visualization, *Proc. Workshop on Battlefield Visualization*, Army Research Lab. and Army Research Office, July 1997.

231. S. Shekhar. Parallelizing Range Query Operation in GIS, *Proc. Support Scientist Workshop* , Army High Performance Computing Research Center, Feb. 1997.

232. S. Shekhar (Mod.) and with K. Ramamritham, T. Dean, B. Hamidzadeh, D. Musliner, R. Shankar. Panel Discussion on Real-Time and Artificial Intelligence, *Proc. Int'l Conf. on Tools with AI*, IEEE, 1991.

233. S. Shekhar. Neural Network Simulation on Hypercube and Related Architectures (CM-5), *Army Workshop on High Performance Computing in Modelling and Simulation*, 1993.

234. S. Shekhar, A. Balakrishnan, and V. Kumar. Parallellizing Backpropagation for Non-Uniform Networks, *Proc. Workshop on Neural Networks for Physicists*, 1993.

235. S. Shekhar, A. Balakrishnan, and V. Kumar. Backpropagation on Hypercubes, *Proc. Workshop on Neural Networks for Physicists*, 1992.

237. S. Shekhar and A. Balakrishnan. Generalization by Neural Networks, *Proc. Workshop on Neural Networks for Physicists*, Aug. 14-17, 1991.

238. S. Shekhar and S. Dutta. Using Neural networks for modeling corporate bond ratings, *Proc. Workshop on AI in Business*, AAAI, 1991.

239. S. Shekhar (Moderator) and with panel. AI in Business: Fact or Fiction, *Proc. Int'l Conf. on Tools with AI*, IEEE, 1991.

240. S. Shekhar and A. Yang et. al. A Geographic Database for IVHS Management, *Proc. Int'l Conf. on Appl. of Adv. Tech. in Transportation Engineering*, ASCE, 1991, (Selection 40 percent).

241. S. Shekhar and M. Coyle et.al. Exploring Headup Display for Driver Workload Management in IVHS, *Proc. Int'l Conf. on Appl. of Adv. Tech. in Transportation Engineering*, ASCE, 1991, (Selection 40 percent).

242. S. Shekhar and C. V. Ramamoorthy. Distributed Planning, *Proc. Workshop on Distributed Computing Systems in the 90's*, IEEE, Sept. 1988.

243. S. Shekhar. Distributed Truth Maintenance by A Network Event Manager, *Proc. Bay Area Systems Seminar*, SRI International, July 1988.

244. S. Shekhar and C. V. Ramamoorthy. Coping with Unanticipated Errors, *Proc. National Communications Forum*, Sept. 1987.