Curriculum Vitae

1 Contact Address, Education and Employment

Name: Raj Krishna Bhatnagar

Address: Department of EECS
University of Cincinnati
Cincinnati, OH 45221
(Office)513-556-4932; (Mobile)513-652-6819
email: *Raj.Bhatnagar@uc.edu*

Education:

Doctor of Philosophy in Computer Science. Dec. 1989,
University of Maryland, College Park, Md-20740.

Master of Science in Computer Science. Dec. 1985,
University of Maryland, College Park, Md. 20740.

Bachelor of Technology in Electrical Engineering. July 1979,
Indian Institute of Technology, New Delhi, India.

Employment:

Jul. '11 - Current: Professor, Department of EECS,
University of Cincinnati.
Jun '13-Dec '13 Visiting Research Professor, Cincinnati Children's Hospital and Medical Center
On sabbatical leave from UC.
Sept. '10 - Jun. '11: Professor, School of Computing Sciences and Informatics
University of Cincinnati.
June '01 - Dec '01 Visiting Professor, Indian Institute of Technology, Delhi, India
On sabbatical leave from UC.
Sept. '95 - August 2010: Associate Professor, Computer Science (and ECECS) Department,
University of Cincinnati, Cincinnati, OH-45221.
Administrative Responsibilities
- July 2013 - Current: Director of UG Computer Science Program
- July 2013 - Current: Co-Director, Graduate Certificate in BioInformatics
- Sept. 2009 - June 2011: Assoc. School Director and Graduate Program Director
School of Computing Sciences and Informatics
- Jan. 2008 - Aug. 2009: Interim Department Head, Computer Science Department
- Sept. 2006 - Dec 2007: Graduate Program Director, CS Department
- Sept.2002 - Aug. 2005: Graduate Program Director, ECECS Department

(Sept. '89 - Aug. '95) Assistant Professor, Computer Science Department,
University of Cincinnati, Cincinnati, OH-45221.
(Sept. 84 - Aug. 88) Part-Time Lecturer, University College, University of
Maryland, College Park, Md. 20740.
(Jan. '83 - Aug. '89) Graduate Assistant, Computer Science department,
University of Maryland, College Park, Md 20740.
(Oct. '80 - Nov. '82) Worked as a software consultant at The World Bank in Washington DC.
Participated in the design and development of various accounting and financial
application systems, and provided systems support for mainframe Burroughs Systems
(Sept. '79 - Sept. '80) Software Engineer. Worked at the Miami center of
Burroughs Corporation. Participated in the design and development of software for accounting systems.

2 Research Directions

2.1 Areas of Research

The primary focus areas of my research have been: (i) Data and text mining and analysis for various types of data (ii) Pattern and knowledge discovery in distributed databases and (iii) High performance data analysis algorithms for big data and cloud computing environments, and (iv) Data mining and analysis algorithms for various domains including, Bioinformatics, Geographic Information Systems, Manufacturing, and Business. The research projects have been conducted in various collaborations over the years and have touched almost all areas in which intelligent data analysis serves as an enabler. I have worked on a number of research problems over the years and have guided fourteen Ph.D. (eleven graduated and three current) and more than eighty M.S. thesis students.

2.2 Recent Collaborations

1. Drs. Radu Pavel and Jon Iverson, Techsolve Inc. Cincinnati. I am working on designing data analysis enabled prognostics and control systems for manufacturing environments. The goal is to identify patterns in the monitor the manufacturing machines and and from the collected data predict the health of the machines.
2. Drs. Bruce Aronow and Anil Jegga Cincinnati Children's Hospital and Medical Center. I am helping design data mining algorithms for discovering patterns in large genomic data sets and in biomedical texts. Four Ph.D. students and two MS theses have been jointly advised in multidisciplinary research focusing on computer science and bioinformatics.
3. Dr. Tomasz Stepinski, Geography Department, UC. I am helping design algorithms for efficient retrieval and analysis of large scale GIS data. Two jointly advised MS theses have been conpleted and one more will be completed by August 2015.
4. Dr. Brandon Foreman, Neurology Department, College of Medicine, UC. I am helping design algorithms and methodologies for analysing ICU patients' monitored data to help predict impending critical events.
5. Dr. Praveen Chawla, EDAptive Computing Inc., Dayton, OH. I am helping design optimization algorithms for data intensive situations in various Defense related projects undertaken by the company.
6. Dr. Jarek Meller, College of Medicine, UC, COllege of Engineering and Applied Science, UC. We are the co-directors of the recently implemented Graduate Certificate in BioInformatics at UC. We are currently designing graduate coursework that will train students in the multi-disciplinary focus are of Bioinformatics, Statistics, and Computer Science. Approximately twenty students are currently pursuing the graduate certificate in BioInformatics.

3 Publications:

The names of co-authors that are underlined in the following list were my graduate students and the research reported in the papers was conducted under my guidance and in close cooperation.

3.1 Refereed Journals and Proceedings:

1. Divya Sardana, Raj Bhatnagar. Core Periphery Structures in Weighted Graphs using Greedy Growth accepted for publication in the proceedings of the Web Intelligence Conference 2016. (Oct 2016).
2. Debaditya Chakraborty, Hazem Elzarka, and Raj Bhatnagar. "Generation of accurate weather files using a hybrid machine learning methodology for design and analysis of sustainable and resilient buildings." Sustainable Cities and Society 24 (2016): 33-41.
3. Priya Chawla, Raj Bhatnagar, and CY Han Interactive Pattern Exploration: Securely Mining Distributed Databases. In International Conference on Human Interface and the Management of Information, 2016, (pp. 229-237). Springer International Publishing.

4. Lalit Kumar, and raj Bhatnagar. An Efficient Map-Reduce Algorithm for Computing Formal Concepts from Binary Data, Proceedings of the IEEE International Conference on Big Data, pp. 1519-1528, 2015.
5. Jagadeesh Patchala and Raj Bhatnagar. Learning Relaxed 3-clusters from Pairs of Related Datasets, Proceedings of the IEEE International Conference on Big Data, pp.1529-1538, 2015.
6. Divya Sardana, Raj Bhatnagar, Radu pavel, and Jon Iverson. Data Driven Perdictive Analytics for a Spindle's Health, Proceedings of the IEEE International Conference on Big Data, pp.1378-1387, 2015.
7. Jagadeesh Patchala, Raj Bhatnagar, Sridharan Gopalakrishnan. Author Attribution of Email Messages Using Parse-Tree Features, Proceedings of the Conference on Machine Learning and Data Mining, 2015.
8. Ahmed Khedr, and Raj Bhatnagar. Algorithms for K-Means Clustering for Distributed Databases. Journal for Computing and Informatics, Vol. 33, No. 4, pp. 943-964, 2014.
9. Divya Sardana, Raj Bhatnagar. Graph Clustering Using Mutual K-Nearest Neighbors. Proceedings of the Web Intelligencec Conference - Active Media Technology, 2014, pp. 35-48.
10. Divya Paliwal, and Raj Bhatnagar.A Negotiation Protocol for Optimal Decision Making by Collaborating Agents, Proceedings of the WI-Intelligent Agent Technology Conference 2014.
11. Vineet Joshi, Raj Bhatnagar. Outlier Analysis Using Lattice of Contiguous Subspaces. Proceedings of the WI-Active Media Technology 2014, pp. 238-250.
12. Vineet Joshi, Raj Bhatnagar. eSelect: Effective Subspace Selection for Detection of Anomalies. Proceedings of the WI-Active Media Technology 2014, pp. 251-262.
13. Vinit Joshi, Raj Bhatnagar. CBOF: Cohesiveness-Based Outlier Factor A Novel Definition of Outlierness, to be presented at the INternational Conference on Machine Learning and Data Mining (MLDM), in July 2014.
14. Divya Sardana Raj Bhatnagar, Radu Pavel, and Jonathan Iverson. Investigations on spindle bearing health prognostics using data mining appraoch, to be presented at the MFPT 2014 Conference in May 2014.
15. Chao Wu, Arjun Bakshi, Bruce Aronow, Anil Jegga, and Raj Bhatnagar. A Biclustering Algorithm to Discover Functional Modules from ENCODE ChIP-Seq Data, Proceedings of the IEEE ICDM BioDM workshop, 2013.
16. Arjun Bakshi and Raj Bhatnagar. Learning Cost-Sensitive Rules for Non-Forced Classification, in the proceedings of the IEEE International Conference on Data Mining (Workshops), December 2012.
17. Minlu Zhang, S Su, Raj Bhatnagar, DJ Hassett, Long J Lu. Prediction and Analysis of the Protein Interactome in Pseudomonas aeruginosa to Enable Network-Based Drug Target Selection. PLoS ONE 7(7): e41202. doi:10.1371/journal.pone.0041202, 2012.
18. Zhen Hu and Raj Bhatnagar. Mining Low-Variance Biclusters to Discover Coregulation Modules in Sequencing Datasets, in the journal *Scientific Programming*, vol. 20, issue 1, pp.15-27, 2012.
19. Zhen Hu and Raj Bhatnagar. A Clustering algorithm based on Mutual K-Nearest Neighbor Relationships, in *Statstical Analysis and Data Mining*, vol. 5, issue 2, pp. 100-113, 2012.
20.* Faris Alqadah and Raj Bhatnagar. A Game Theoretic Framework for Heterogeneous Information Network Clustering, Proceedings of the ACM Knowledge Discovery in Data Mining (KDD 2011) conference, pp. 795-804, 2011.
21. Zhen Hu and Raj Bhatnagar. Discovery of Versatile Temporal Subspace Patterns in 3-D Datasets, Proceedings of the IEEE International Conference on Data Mining, (ICDM 2011), pp. 1092-1097, 2011.
22. Faris Alqadah, Raj Bhatnagar, and Anil Jegga. A Novel Framework for Detecting Maximally Banded Matrices in Binary Data, in the journal *Statistical Analysis and Data Mining*, vol. 3, no. 6, 431-445, 2011.
23. Faris Alqadah, Raj Bhatnagar. Similarity Measures in Formal Concept Analysis. in Annals of Mathematics and Artificial Intelligence, vol. 61, no. 3, pp. 245-256, 2011.

24. Zhen Hu, Raj Bhatnagar. Algorithm for Discovering Low-Variance 3-Clusters From Real-Valued Datasets, Proceedings of the IEEE International Conference on Data Mining (ICDM 2010) held in Sydeny, Australia, pp. 236-245, December 2010.

25. Faris Alqadah, Raj Bhatnagar, and Anil Jegga. Mining Maximally Banded Matrics in Binary Data, Proceedings of the SIAM International Conferenceson Data Mining (SDM 2010), pp. 942-953, 2010.

26. Minlu Zhang, Chunsheng Fang, Yan Xu, Raj Bhatnagar, Long J. Lu: An Integrative Scoring Approach to Identify Transcriptional Regulations Controlling Lung Surfactant Homeostasis. ICDM Workshops 2010: 787-792, 2010.

27. Aditya Sinha Raj Bhatnagar. Algorithm for Concept Traversal in Multiple databases, Proceedings of ICTAI 2009 conference, pp. 370-374, 2009.

28. Eric T. Matson, Scott A. DeLoach, Raj Bhatnagar. Evaluation of properties in the transition of capability based agent organization. Web Intelligence and Agent Systems 7(1): 1-21 (2009)

29. Haiyun Bian, Raj Bhatnagar. Mining Subspace Clusters from Distributed Data. Chapter in *Computer and Information Science* of Studies in Computational Intelligence Series, Springer/ Berlin/Heidelberg, pp. 73-82, 2009.

30.* Faris Alqadah and Raj Bhatnagar. Discovering Substantial Distinctions among Incremental Bi-Clusters, Proceedings of the SIAM International Conference on Data Mining (SDM 09), April 2009, pp. 199-210.

31. Shriram Narayanswamy, Raj Bhatnagar. A Lattice-Based Model for Recommender Systems. Proceedings of the International Conference on Tools with Artificial intelligence (ICTAI 2008) pp. 349-356.

32. Faris Alqadah, Raj Bhatnagar. Detecting significant distinguishing sets among bi-clusters. Proceedings of the CIKM 2008, pp. 1455-1456.

33.* Faris Alqadah, Raj Bhatnagar. An effective algorithm for mining 3-clusters in vertically partitioned data. Proceedings of the CIKM 2008, 1103-1112.

34. Haiyun Bian, Raj Bhatnagar. An Algorithm for Mining Weighted Dense Maximal 1-Complete Regions. Data Mining: Foundations and Practice, 31-48, Springer Verlag, 2008.

35.* Eric Matson and Raj Bhatnagar, "From sensor networks to sensor organizations", Proc. SPIE 6961, 69610B (2008); doi:10.1117/12.782237.

36.* Andra Kalyan and Raj Bhatnagar. Localized construction of aggregation trees in sensor networks. Proceedings of the SPIE conference on Intelligent Computing: Theory and Practice VI. SPIE volume 6961, pp. 696103-12, (2008), DOI: 10.1117/12.782156.

37. * Ahmed Khedr and Raj Bhatnagar. Agents for Integrating Distributed Data for Complex Computations. *Computing and Informatics* Journal, Vol. 26, 2007, 149-170.

38. Eric T. Matson, Raj Bhatnagar. Knowledge Sharing Between Agents in a Transitioning Organization. Proceedings of the COIN 2007 published as book *Coordination, Organizations, Institutions, and Norms in Agent Systems - III*, Springer Verlag, 2007, pp. 187-202.

39. Amit Sinha and Raj Bhatnagar. Efficient and Scalable Motif Discovery using Graph-based Search, Proceedings of the IEEE Symposium on Computation Biology, CIBCB07, April 2007.

40. Haiyun Bian, Raj Bhatnagar, and Barrington Young. An Efficient Constraint-Based Closed Set Mining Algorithm. Proceedings of the International Conference on Machine Learning and Applications (ICMLA 2007), pp. 67-72.

41. Barrington Young, Raj Bhatnagar, Giridhar Tatavarty, and Haiyun Bian. Covariance matrix Computations with Federated databases. Proceedings of the International Conference on Machine Learning and Applications (ICMLA 2007), pp. 172-177.

42. Sasthakumar Ramamurthy and Raj Bhatnagar. Tracking Recurrent Concept Drift in Streaming Data Using Ensemble Classifiers. Proceedings of the International Conference on Machine Learning and Applications (ICMLA 2007), pp. 404-409.

43. Amit Sinha, Mukta Phatak, Raj Bhatnagar, and Anil Jegga. Identifying Functional Building Motifs of Tumor Protein p53 Using Support Vector Machines. Proceedings of the International Conference on Machine Learning and Applications (ICMLA 2007), pp. 506-511.

44. Giridhar Tatavarty and raj Bhatnagar. Discovery of Temporal Dependencies between Frequent Patterns in Multivariate Time Series, Proceedings of the Computational Intelligence and Data Mining Symposium (CIDM 2007) held in Hawai in April 2007.

45.* Laxmi Santhanam, Dharma Agrawal, and Raj Bhatnagar. A Perceptron based Classifier for Detecting Malicious Route Floods in Multihop Wireless Mesh Networks. Proceedings of the International Conference on Wireless and Mobile Communications, Guadaloupe, French Caribbean (March 4th to March 8th 2007).

46. Eric Matson and Raj Bhatnagar. Properties of Capability Based Agent Organization Transition, Proceedings of the Intelligent Agent Technologies (IAT 2006) conference held in Hong Kong in December 2006.

47. Eric Matson, Raj Bhatnagar. Organization Capable Intelligent Sensors. Proceedings of the Intelligent Computing: Theory and Applications V Conference, SPIE Symposium on Defense & Security 2007 Orlando, FL: SPIE.

48.* Barrington Young and Raj Bhatnagar. Secure K-NN Algorithm for Distributed Databases, Proceedings of the Privacy Security and Trust Conference, 2006, pp. 485-490.

49. Haiyun Bian, Raj Bhatnagar: Efficiently Mining Maximal 1-complete Regions from Dense Datasets. ICDM Workshop on Foundations of data Mining 2006, Proceedings of ICDM Workshops, pp 423-427

50. Haiyun Bian and Raj Bhatnagar. Towards More Supervised Subspace Clustering, Proceedings of the MAICS 2006 conference, held in Valparaiso, OH April 2006.

51. Arvind Muthukrishnan and Raj Bhatnagar. Concept-based Organization and Retrieval of Technical Documents. Proceedings of the MAICS 2006 conference, held in Valparaiso, OH April 2006.

52. Abhishek Sharma and Raj Bhatnagar. Clustering Spatio-Temporal patterns Using Levelwise Search. Proceedings of the MAICS 2006 conference, held in Valparaiso, OH April 2006.

53. Barrington Young and Raj Bhatnagar. Algorithms for Finding Nearest Neighbors in Distributed Databases. Proceedings of the 11th IPMU (Information processing and Management of Uncertainty in Knowledge-Based Systems) Conference held in Paris, France, in July 2006.

54. Haiyun Bian and Raj Bhatnagar. A Levelwise Algorithm for Interesting Subspace Clusters. Proceedings of the 2005 IEEE International Conference on Data Mining, held in November 2005.

55. Raj Bhatnagar and C Rao. Energy resource management based on data mining and artificial intelligence, Proceedings ACEEE Summer Study on Energy Efficiency in Industry, pages. 6-14 to 6-23, 2005.

56. Lynne Vettel and Raj Bhatnagar. Learning Deterministic Finite Automata to Capture Temporal Patterns. Proceedings of the 2nd Indian International Conference on Artificial Intelligence, December 2005.

57. Haiyun Bian and Raj Bhatnagar. An Algorithm for Lattice-Structured subspace clustering, Proceedings of the SIAM International Conference on Data Mining, April 2005.

58. Ahmed Khedr and Raj Bhatnagar, Decomposable Algorithms for Minimum Spanning Tree, Presented at the International Workshop on Distributed Computing, December 2003, Springer Verlag notes on Computer Science, vol. 2918.

59. Wen Niu and Raj Bhatnagar. Mining Temporal Databases for Subsequence Patterns, Proceedings of the SIAM International Conference on Data Mining held in May 2003.

60.* Raj Bhatnagar, Brent Seibert, Lynne Vettel, Eric Freudenthal and David Morgenthaler. Chunk-Based Matching of Images for ATR. SPIE's 2003 Conference on Algorithms for Synthetic Aperture Radar Imagery - X, Orlando, FL, pp. 303-314.

61. Raj Bhatnagar, Goutham Kurra and Wen Niu. Mining High Dimensional Data for Classifier Knowledge. Proceedings of the International Conference on Knowledge Discovery and Data Mining (KDD 2003), held in Washington DC, 2003, pp. 481-486.

62. Lynne Vettel, Raj Bhatnagar. Learning Automata to capture Temporal Patterns. Proceedings of the International Conference on Machine Learning and Applications, 2002.

63. Goutham Kurra and Raj Bhatnagar. Mining Microarray Expression Data for Classifier Gene Cores. Proceedings of BIOKDD-2001, available at: http://www.cs.rpi.edu/ zaki/BIOKDD01/.

64.* Raj Bhatnagar, Rob Williams, Ankur Sehgal. Algorithms for multi-look target recognition with HRR Signatures, SPIE's 2001 Conference on Algorithms for Synthetic Aperture Radar Imagery - VIII, held in April 2001.

65.* Raj Bhatnagar, Rob WIlliams, Prashant Paliwal. Algorithms for target recognition with partial signatures, SPIE's 2001 Conference on Algorithms for Synthetic Aperture Radar Imagery - VIII, held in April 2001.

66. Goutham Kurra, Wen Niu, Raj Bhatnagar. A Heuristic Search for Discovering Classifier Gene Sets. Presented at the Critical Assessment of Microarray Data Mining '00 (CAMDA00) Conference held at Duke University, December 2000.

67. Raj Bhatnagar. Probabilistic Reasoning by Cooperative Distributed Databases, Proceedings of the IPMU Conference held in Madrid in July 2000.

68.* Raj Bhatnagar, Steven Meyers. Building Class Models for ATR, proceedings of SPIE's 2000 Conference on *Algorithms for Synthetic Aperture Radar Imagery - VII*, held in April 2000, pp. 322-331.

69.* Raj Bhatnagar, Vijay Tennety, Rob Williams. Grammatical Inference based Classifier for HRR Signatures, proceedings of SPIE's 2000 Conference on *Algorithms for Synthetic Aperture Radar Imagery - VII*, held in April 2000, (vol. 4053) pp. 452-466.

70. Raj Bhatnagar, Barrington Young. Computations in Distributed Knowledge Environments, Proceedings of ADCOM-99 conference, held in December 1999 at Roorkee, India.

71. Raj Bhatnagar, Rob Williams, Tushar Kant. A Belief Function Based Approach for Classification of HRR Signatures" Proceedings of SPIE's 1999 conference on *Algorithms for Synthetic Aperture Radar Imagery - VI*, (vol. 3721) pp. 395-403.

72. Raj Bhatnagar, Ron Dilsavor, Mark Minardi, Dax Pitts. A Study of Intra-Class Variability in ATR Systems. Proceedings of SPIE's 1998 conference on *Algorithms for Synthetic Aperture Radar Imagery - V*, pp. 383-395.

73. Raj Bhatnagar, Sriram Srinivasan. Pattern Discovery in Distributed Databases. *Proceedings of the AAAI-97 Conference* held at Providence, RI, in July 1997, pp. 503-508.

74. Raj Bhatnagar. Decomposable Algorithms for Data Mining. In *Data Mining for Scientific and Engineering Applications* edited by Robert Grossman, Chandrika Kamath and Philip Kegelmeyer. Published by Kluwer Academic Publishers, October, 2001, pp. 307-317.

75. Raj Bhatnagar, Richard Horvitz, Rob WIlliams. A Hybrid System for Target Classification, in *Pattern Recognition Letters*, 18(1997) pp 1399-1403.

76. Raj Bhatnagar. Context Hypothesization Using Probabilistic Knowledge, in *Fundamenta Informaticae*, vol. 23, No. 4, August, 1995, pp. 225-246.

77. Raj Bhatnagar, Laveen N. Kanal. Models from Data for Various Types of Reasoning, in the book *Selecting Models from Data* edited by Peter Cheeseman and R W Oldford and published by Springer-Verlag in the *Lecture Notes in Statistics* series, #89, pp. 173-180, 1994.

78. Raj Bhatnagar, Laveen N. Kanal. Structural and Probabilistic Knowledge for Abductive Reasoning, in *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 15, number 3, March 1993.

79. Raj Bhatnagar, Laveen N. Kanal. Models of Inquiry and Formalisms for Approximate Reasoning, published in the book *Fuzzy Logic for the Management of Uncertainty* edited by Lotfi A Zadeh and Janusz Kacprzyk. Published by John Wiley and Sons, Inc. New York, 1992, pp. 29-54.

80. Raj Bhatnagar, Laveen N. Kanal. Using Probabilities as Control Knowledge to Search for Suitable Problem Models in Automated Reasoning. Appeared in *Operations Research and Artificial Intelligence : The Integration of Problem Solving Strategies*, ed. Donald E. Brown. Kluwer Academic Publishers, 1991.

81. Raj Bhatnagar. Decision Tree Induction by Cooperating Agents. *Proceedings of the Workshop on Multi-Agent Learning* held at Providence, RI, in July 1997.

82. Raj Bhatnagar, Rob Williams. Templates with Lower Mean-Square Error for ATR. *Conference on Algorithms for Synthetic Aperture Radar Imagery - IV*, held as part of SPIE's 11th international symposium held in April 1997, pp. 285-293.

83. Raj Bhatnagar. Exploratory Model Building. *Proceedings of the 10th International Conference on Uncertainty in AI - held in July 1994* at Seattle, pp. 77-85.

84. Raj Bhatnagar. Learning Characteristic Rules in a Target Language, *Proceedings of the Pattern Recognition in Practice - IV Conference*, held in June 1994 in Netherlands, pp. 267-278, Published by North Holland, 1994.

85. Raj Bhatnagar. Abduction of Precise Situation Models. Presented at the *Second International Symposium on Uncertainty Modeling and Analysis* held in April 1993. Proceedings published by IEEE.

86. Raj Bhatnagar. Construction of Domain Models from Data. Presented at the *Fourth Workshop on Artificial Intelligence and Statistics* held in January 1993 at Ft Lauderdale, Fla. (jointly with L. N. Kanal)

87. Raj Bhatnagar, Laveen N. Kanal. Reasoning by Hypothesizing Causal Models. Presented at the *IEEE symposium on uncertainty modeling in December 1990.*

88. Raj Bhatnagar. A Formalism for Automated Generation of Preferred Arguments, *Proceedings of AAAI Symposium on Argumentation and Belief*, held in Mar. 1991 at Stanford University, pp. 39-61 of Proceedings.

89. Raj Bhatnagar, S. K. Guha, Sneh Anand, Arun Agarwal, Narendra Bansal. Realization of Microprocessor based reading Aid for the Blind, *Proceedings of the 1981 annual conference of Computer Society of India*, pp.268-275.

3.2 Survey Papers:

1. Raj Bhatnagar, Laveen N. Kanal. Reasoning in Uncertain Domains : A Survey and Commentary, Appeared in the book *Encyclopedia of Computer Science and Technology*, edited by Allen Kent, James G. Williams, and Carolyn M. Hall, published in 1993 by Marcel Dekker Inc., vol. 27, pp 297-316.
   The editors received good feedback for this survey paper and have included the same in their later volume *Encyclopedia of Microcomputers*, published in 1994 by the same publishers, vol. 14, pp 309-328.

3.3 Invited and Other Book Chapters:

1. Raj Bhatnagar, Laveen N. Kanal. Hypothesizing Causal Models for Reasoning, published in the book *Analysis and Management of Uncertainty : Theory and Applications*, edited by B. M. Ayyub, M. M. Gupta, and L. N. Kanal, published by Elsevier North Holland, 1992, pp. 93-106.

2. Raj Bhatnagar, Laveen N. Kanal. Constructing Alternate Preferred Lines of Reasoning in Inconsistent Knowledge Environments, in *Pattern Recognition and artificial Intelligence - towards an Integration*, eds. E. Gelsema and L. N. Kanal, North Holland, 1988. pp.353-367.

3. Raj Bhatnagar, Laveen N. Kanal. Handling Uncertain Information : A Review of Numeric and Non-Numeric Methods, in *Uncertainty in Artificial Intelligence*, eds. L. N. Kanal and J. F. Lemmer, North Holland, 1986.

4 Synergistic Professional Activities:

1. Invited to give a tutorial on Algorithms for Cloud Computing at the Big Data Analytics Conference 2015 to be held in Hyderabad, India, in December 2015.
2. Program co-chair for the 2012 Conference on Parallel Distributed and Grid Computing, held in December 2012 in Solan, India.
3. Program Committee member of MIWAI 2011, 2012, 2013, 2014, and 2015 conferences, and for Web Intelligence 2010, 2012, and 2014 conferences.
4. Program Committee members for the SIAM Conference on Data Mining (SDM 2011) held in Phoenix, AZ, in April 2011.
5. Area Chair for the International Conference on Tools with Artificial Intelligence (ICTAI 2009), held in New Jersey, November 2009. Program committee member for this conference in 2013, 2014, and 2015.
6. Member of the Program Committee for the 14th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD 2010), held in Hyderabad in June 2010, India.
7. Program Co-Chair for the Tenth International Symposium on Artificial Intelligence and Mathematics, held at Fort lauderdale, FL, in January 2010.
8. Member of the Program Committee for the 13th Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD 2009), held in Bangkok in April 2009, Thailand.
9. Area Chair for the International Conference on Tools with Artificial Intelligence (ICTAI 2008), held in Dayton, OH, 2008.
10. Invited colloquium speaker at Purdue University (2000), University of Louisville (2008), JPUIT, India (2008), LNM-IIT, India (2008), Wayne State University (2009), University of Hyderabad, India (2009).
11. Data Mining Session Chair for the CIKM 2008 conference held in NAPA, CA, Oct. 2008.
12. Member of the Program Committee for the 8th SIAM International Conference on Data Mining, 2008.
13. Program Committee member for the IEEE Symposium on Signal Processing and Information technology 2008 (ISSPIT 08), held in December 2008, in Sarajevo, Bosnia.
14. Member of the Program Committee for the 3rd Indian International Conference on AI, held in Pune, India, in December 2007.
15. Member of the Program Committee for the 6th SIAM International Conference on Data Mining, 2006.
16. Member of the Program Committee for the Midwest AI and Cognitive Science Conferences (MAICS) in 2007, 2004, and 2003.
17. Program Committee member for the International Conference on Information Technology (CIT 2007) held in Rourkela, India in 2006.
18. Databases and Data Mining Track Chair for the International Conference on Information Technology (CIT 2006) held in Bhubaneshwar, India in 2006.
19. Program Committee member for IEEE Computational Intelligence and Data Mining Conference held in Hawaii, April 2007,
20. Program Committee member for Ohio Collaborative Conference on Bioinformatics, 2007,
21. Local Arrangements Chair for the International Conference on Machine Learning and Applications (ICMLA) 2007 Conference held in Cincinnati in December 2007
22. Program Committee member for the Third International Conference on Information Systems Security, held in December 2007 in New Delhi, India.
23. Offered a 3-hour tutorial on Sequence Mining Algorithms at the 2nd Indian International Conference on Artificial Intelligence, December 2005.

24. Served as the Associate Head and the Graduate Program Director in the ECECS Department from September 2002 through August 2005, and then again in Computer Science Department from September 2006 through December 2007.
25. Initiator and organizer of an annual, 2-week long, computer sience summer camp for high school students in Cincinnati area in order to attract students to the area of computer science (2006-2009)
26. Organizer and point of contact for the industrial advisory board for the computer science department from the local Cincinnati industry.
27. Invited to serve on NSF review panels in 1997, 2000, 2003, 2006, 2008, and 2011.
28. Visiting Professor at IIT Delhi June, 2001 through December 2001..
29. Refereed papers for more than fifteen different journals in the Computer Science area.
30. Awarded Faculty Fellowship by US Air Force for Summer 1996, Summer 1997, and Summer 1998.
31. External Ph.D. dissertation evaluator for more than eight Ph.D. dissertations from Wright State University, IIT Delhi (India), Indraprastha University, (Delhi, India), and JPUIT (Solan, India).

5 Graduate Students:

5.1 Graduated Ph.D. Students:

1. Jagadeesh Patchala 2016. Current Position: Data Analytics Specialist, Kohl's Data Analytics Center, Milpitas, CA. Dissertation Title: Data Mining Algorithms for Discovering Patterns in Text Collections .
2. Vineet Joshi 2015. Current Posititon: Data Analytics Specialist, Kohl's Data Analytics Center, Milpitas, CA.
   Dissertation Title: Unsupervised Anomaly Detection in Numerical Datasets.
3. Chao Wu, 2014. Current Position: Bioinformatics Scientist at Children's Hospital of Philadelphia. (I am his primary advisor with Prof. Bruce Aronow and Anil Jegga of CCHMC as Co-advisors).
   Dissertation Title: Intelligent Data Mining on Large-Scale Heterogeneous Datasets and its Application in Computational Biology.
4. Richard Horvitz, 2012. Current Position: Entrepreneur and Independent Consultant.
   Dissertation Title: Symbol Grounding Using Neural Networks.
5. Minlu Zhang, 2012. Current Position: Bioinformatics Scientist at NextBio, San Francisco. (I am his co-advisor along with his primary advisor Prof. Long Lu of Cincinnati Children's Hospital and Medical Center).
   Dissertation Title: Discovery and Analysis of Patterns in Molecular Networks: Link Prediction, Network Analysis, and Applications to Novel Drug Target Discovery.
6. Zhen Hu, 2011. Current Position: Bioinformtics Scientist, Genome Health Inc., Redwood City, CA.
   Dissertation Title: Multidomain Clustering for Real-valued Datasets.
7. Faris Alqadah, 2010. Current Position: Post-Doctoral Fellow at John Hopkins University.
   Dissertation Title: Clustering of Multi-Domain Information Networks.
8. Eric Matson, 2008. Current Position: Faculty, Purdue University
   Dissertation Title: Transition in MultiAgent Organizations.
9. Amit Sinha, 2008. Current Position: Computational Biology Researcher at Dana-Farber Cancer Institute, a teaching affiliate of Harvard Medical School.
   Dissertation Title: Discovery and Analysis of Genomic Patterns: Applications to Transcription Factor Binding and Genome Rearrangement. (I was his primary advisor; co-advised by Anil Jegga and Jarek Meller of Cincinnati Childrens' Hospital).

10. Barrington R. St. A. Young, 2007. Current Position: Lead Architect for Expert Systems, USAA, San Antonio, TX.
    Dissertation Title: Efficient Algorithms for Data Mining with Federated Databases.
11. Haiyun Bian, 2006. Current Position: Faculty, Metropolitan State College of Denver.
    Dissertation Title: Finding Interesting Subspace Clusters From High Dimensional Datasets
12. Ahmed M. Khedr, 2003. Current Position: Faculty, Zagazig University, Egypt.
    Dissertation Title: Design of Decomposable Algorithms for Distributed Databases

5.2 Current Ph.D. Students

Six students are currently actively working on their dissertations under my advising and their research focus areas are as following:

1. Graph custering algorithms. Student: Divya Sardana, cleared doctoral qualifying examination in April 2010, expected to defend by December 2015.
2. Cloud based algorithms for association analysis. Student: Lalit Kumar.

5.3 MS Theses Advised

The following MS theses have been advised by me and the theses reports for year 2000 and beyond are available from the ohiolink ETD website (http://www.ohiolink.edu/etd/).

1. Identifying COmmunities as Core-Periphery Structures in Evolving Graphs, Anusha Kantamneni (2016)
2. A Mechanism Design Approach for Mining 3-Clusters Across Dataets from Multiple Domains, Sneha Satish (2016)
3. Multi-Domain Clustering Using A* Search, Abhinav Gurram (2016)
4. Link Prediction in Time Evolving Graphs, Prasad Reddy Mendu (2016)
5. Density-Based Clustering Using Mutual K-Nearest Neighbors, Siddhartha Dixit (2015)
6. Rule Generation for Datasets with Ordinal Class Attributes, Deepthi Gopal (2015)
7. Compact Image Signatures for Efficient Retrieval from Large GIS Raster Collections, Tejaswi Goparaju (2015)
8. Identification of Uniform Class Regions using Perceptron Training, Nikhil Samuel (2015)
9. A Study of Effect of Coverage and Purity on Quality of Learned Rules, Kumar Gandharva (2015).
10. A Structure-based Methodology for Retrieving Similar Rasters and Images, Sambhavi Jayaraman (2015).
11. Information Theoretic Methodology for Retrieving Similar GIS Rasters, Subashini Venkatakrishnan (2014).
12. Distributed Decision Tree Induction Using Multi-agent Based Negotiation Protocol, Dipayan Chattopadhyay (2014).
13. Methodology for Generating High-Confidence Const-Sensitive Rules for Classification, Arjun Bakshi (2013).
14. A Negotiation Protocol for Optimal Decision making by Collaborating Agents, Divya Paliwal (2013).
15. A Recommendation System based oin Multiple Databases, Vivek Goyal (2013).
16. Authorship Attribution based on Grammar Signatuers, Sridharan Gopalakrishnan (2013).
17. Discovery of Overlapping 1-closed Bilcusters, Abhik Banerjee 2012.
18. Multi-Robot Path Planning with Communication, Harmandeep Kaur Buttar, 2012.
19. Path Traversal Around Obstacles by a Robot using Terrain Marks for Guidance, Rabindra Pannu (2011).

20. Summarization Of Real Valued Biclusters, Hema Subramanian (2011).
21. Gaussian Deconvolution and MapReduce Approach for Chipseq Analysis, Ravi Sugandharaju (2011).
22. Collective Path Planning by Robots on a Grid, Sharon Joseph (2010)
23. Discovery of Trajectory Clusters in Spatio-Temporal Data, Abhishek Sharma (2010)
24. Mutual K-Nearest Neighbor based Classifier, Nidhi Gupta (2010)
25. Formal Concept Analysis for Search and Traversal in Multiple Databases with Effective Revision, Aditya Sinha (2009)
26. A Concept Based Genomic Data Exploration System, Mrunal Deshmukh (2008) (Co-Advisor: Anil Jegga, Cincinnati Childrens' Hospital)
27. Algorithms for Finding Clusters in Spatial Data, Kalyan Shenkottah (2007).
28. A Concept-Based Framework and Algorithms for Recommender Systems Shriram Narayanswamy (2007).
29. Tracking Recurrent Concept Drift in Streaming Data Using Ensemble Classifiers, Sasthakumar Ramamurthy (2007).
30. Information Retrieval Using Concept Lattices, Arvindkumar Muthukrishnan (2006).
31. Finding Temporal Association Rules Between Frequent Patterns in Multivariate Time Series, Giridhar Tatavarthy (2006).
32. Concept Based Information Organization and Retrieval, Aparna Yardi (2006).
33. Function Computing in Vertically Partitioned Distributed Databases, Kaustubh Shinde (2006).
34. Tracking Phenomena with Sensor Networks, Sheshu Kalyan Andra (2005).
35. Sequence Classification Using Hidden Markov Models, Pranay Desai (2005).
36. Privacy Preserving Induction of Decision Trees From Geographically Distributed Databases, Michael Kinsey (2005).
37. A Database System to Store and Retrieve a Concept Lattice Structure, Ramya Ashok (2005).
38. Mining Structured Sets of Subspaces From High Dimensional Data, Anshuman Rajshiva (2004).
39. Methodology for Clustering Spatio-Temporal Databases, Shagun Kakkar (2004).
40. Approximate N-Nearest Neighbor Clustering on Distributed Databases Using Iterative Refinement, Christopher Calendar (2004).
41. Discovery of Linear Trajectories in Geographically Distributed Datasets, Rishi Jhaver (2003).
42. Discovery of Clusters in Spatial Databases, Shalini Batra (2003).
43. Pattern Recognition in Large Dimensional and Structured Datasets, Goutham Kurra (2002).
44. Nearest Neighbor Search in Distributed Databases, Susmit Kumar (2002).
45. Learning Deterministic Finite Automata to Capture Temporal Patterns, Lynne Vettel (2002).
46. Effects of Sub-Part Scoring in Automatic target Recognition, Brent Seibert (2001).
47. Quantization of Real-Valued Attributes for Data Mining, Elizae Qaiser (2001).
48. A Study of Multi-Look ATR for HRR Signatures, Ankur Sehgal (2000).
49. Cooperative Computations by Stationary Agents, Rahul Dasgupta (2000).
50. Matching of Particular HRR Signatures for Target Recognition, Prashant Paliwal (2000).
51. Mobile Agents for Data Mining Algorithms, Harpreet Singh (2000).
52. Clustering Techniques for GIS Data, Chen Wu (2000).

53. Evidence Theoretic Classifiers for HRR Signatures, Tushar Kant (1999).
54. Construction of Class-Models for Handling Intra-Class Variability in Classification Systems, Steve Myers (1999).
55. Sensitivity Analysis of Waveforms from Classification Perspective, Prashant Saxena (1999).
56. Template-based Semantic Text Retrieval, Viral Vora (1999).
57. Nearest Neighbor Clustering for Distributed Databases, Sanjeev Beemidi (1998).
58. Selecting Complementary Sets of Documents, Arati Kuppu (1998).
59. CyberSearch: A Client Side Search Engine, Suresh Tipirneni (1998).
60. Algorithm Decomposition for Computing Second Order Quantities in Distributed Environments, Barrington Young (1998).
61. Optimization of Template Size for ATR with HRR Data, Santosh Kotian (1997).
62. Induction of Decision Trees form Distributed Databases with Continuous-valued Attributes, Hari Chandana Nidumolu (1997).
63. A Study of Client-Server Architectures, Jaydeep patel (1996).
64. Database Querying Using Fuzzy Descriptors, Jayashree Rajagopalan (1996).
65. Knowledge Discovery in Distributed Databases, Sriram Srinivasan (1996).
66. Constructing Hypothetical Probabilistic Models, Juan Gilbert (1995).
67. Learning Dependency Relationships from Relational Multi-Databases, Pradip Pandey (1995).

    The following were completed as "MS Projects" in A&S College

68. Design of a Distributed Database System, Shakila Rajaiah (1995).
69. A Study of Relationship between Conditional Entropy of an Attribute Seuqence and Rules Learned from the Database, Asha Sundaram (1994).
70. An object oriented design for operational analysis of the performance of a computer system, K. K. Prasad (1994).
71. Information Theoretic Methods for Guessing Missing Values in a Database, Kailash Pathak (1994).
72. An implementation of a rule based system for doing abductive reasoning with uncertain knowledge, K. G. Mahalakshmi (1993).
73. A design and implementation of an algorithm for intelligent load balancing on a number of systems on a network, jatin Mahadeshwar (1993).
74. An implementation within the X-windows domain for visually entering and retrieving graph and hypergraph structures, Krishnaprasad Dupuguntla (1993).
75. Learning rules involving conjunctions, disjunctions, and negation from databases using entropy-minimization based techniques, Jolanta Blazejewski (1992).
76. An implementation of the Bayesian networks method of designing probabilistic reasoning systems, Lalit Agrawal (1991).

5.4 MS Thesis Students Currently Being Advised

Balaji Iyer, Awodokun Olugbenga, Anvita Shetty, Satish Loganathan, and Sampurna Ravindranathan