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## EDUCATION

### Princeton University

Princeton, NJ

Ph.D. in Computer Science, June 1991; M.A. in Computer Science, February 1988. Awarded IBM Graduate Fellowship for academic years 1988-89, 1989-90; GTE Fellowship for Academic year 1987-88; NCR Fellowship for academic year 1986-87.

### Massachusetts Institute of Technology

Cambridge, MA

M.S. and B.S. in Computer Science and Engineering, September 1986.

## RESEARCH INTERESTS

Novel uses of data mining technology, including data mining of text, data mining techniques applied to interoperation of heterogeneous information sources, and security and privacy issues raised by data mining. Fundamental data mining challenges posed by these applications, such as extracting knowledge from noisy data, identifying knowledge in highly skewed data (few examples of “interesting” behavior), limits on learning. Database support for widely distributed and autonomously controlled information, particularly information administration issues.

## PROFESSIONAL EXPERIENCE

### Purdue University

August 2001 to Present

Professor in the Department of Computer Sciences (Associate Professor to August 2013), also of Statistics (by courtesy) from 2011. Research on Data Mining and Database Management System Security. Taught graduate courses *Database Systems*, *Distributed Database Systems*, *Information Security*, *Advanced Information Assurance*, *Advanced Topics in Distributed Systems*; graduate seminars on *Data Mining and Security* and *Data Mining*; an undergraduate seminar *Introduction to Data Mining*; and the undergraduate courses *Computer Architecture* and *Programming I*. Received 2009 College of Science Graduate Mentoring Award, 2010 College of Science Interdisciplinary Award, 2011, 2016 College of Science Team Award, 2011-2012 Teaching for Tomorrow Senior Faculty award, *Seeds for Success* awards in 2005, 2009, 2011.

### National Science Foundation

September 2013 to June 2016

Rotating program director in the Information & Intelligent Systems division of the Directorate for Computer & Information Science & Engineering.

### The MITRE Corporation

September 1995 to August 2001

Principal Scientist (promoted from Lead Scientist in 1999) in the Component Based Architectures & Data Management department of the Information Technology Center. Research on Database Management Systems for applications with loosely-structured data; in particular data mining for text and image databases. Director's Distinguished Accomplishment Award for Data Mining on Text and Imagery, August 1997; SPOT Recognition award for Knowledge Discovery in Text, September 1998; Program Recognition Award for GeoNODE, June 2000; Senior Vice President/General Manager's Award for Joint Battlespace Infosphere, February 2001.

**Northwestern University**

**September 1991 to August 1995**

Assistant Professor in the Department of Electrical Engineering and Computer Science. Research on Database Management Systems for applications with loosely-structured data; in particular heterogeneous databases. Developed and taught a two quarter sequence *Software Project Management and Development*; also taught *Introduction to Computer Programming, Fundamentals of Computer System Software, Data Management and Information Processing, Introduction to Database Systems*, and a graduate seminar on *Heterogeneous Databases*.

**Matsushita Information Technology Laboratory**

**June through August 1991**

Research on data management systems for office information.

**Princeton University**

**September 1986 through June 1991**

Research on database support for multimedia. Thesis title: *HyperFile, a Database Manager for Documents* (Advisor: Professor Hector Garcia-Molina.) Teaching Assistant for *Introduction to Programming Systems and Database Systems*.

**Raritan Valley Community College**

**January through May 1989**

Adjunct Faculty. Taught *Foundations of Computer Science*.

**Massachusetts Institute of Technology**

**September 1985 through June 1986**

Thesis title: *Dynamic Load Balancing* (Advisors: Professor Nancy Lynch and Dr. Flaviu Cristian (IBM Almaden Research).) Teaching Assistant in the Department of Electrical Engineering and Computer Science: Recitation instructor for *Laboratory in Software Engineering*; Tutorial instructor for *Structure and Interpretation of Computer Programs*.

**I.B.M. Almaden Research**

**Summers 1983 and 1984, January through August 1985**

Co-op student through the MIT VI-A program. Worked with a team of computer scientists studying fault tolerant computer systems using a cluster of processors. Responsible for creation of a system to prevent multiple management of a database given a communication failure, the development of a debugging system for programs spread across multiple processors, and the design and implementation of a dynamic load balancing system.

**Tektronix, Inc.**

**September 1979 through August 1981, Summer 1982**

Software technician. Worked through a High school work-study program, as well as summers, as part of a team of 10 engineers responsible for development and maintenance of microprocessor cross-compilers on a CDC-175. Personally responsible for implementation and documentation, as well as partial development, of a microprocessor-based controller.

## BOOKS AND BOOK CHAPTERS

1. “Discovering Privacy”, invited chapter in *Journeys to Data Mining: Experiences from 15 Renowned Researchers*, Mohamed Medhat Gaber, ed., Springer, 2012, pp. 51-59.
2. “Privacy-Preserving Data Mining”, in *Encyclopedia of Database Systems*, Ling Liu and M. Tamer Ozsu, eds., Springer, 2009, pp. 1471-1472, 2137-2139, 2147-2150.
3. “Is Privacy Still an Issue for Data Mining?”, Chris Clifton, Wei Jiang, Mummoorthy Murugesan, and M. Ercan Nergiz, Chapter 18 in *Next Generation of Data Mining*, Hillol Kargupta, Jiawei Han, Philip Yu, Rajeev Motwani, and Vipin Kumar (Eds.), CRC Press, 2008, pp. 359-376.
4. “Data Mining and Privacy: An Overview”, Christopher W. Clifton, Deirdre K. Mulligan, and Raghu Ramakrishnan, in *Privacy and Technologies of Identity A Cross-Disciplinary Conversation*, Katherine Strandburg and Daniela Stan Raicu (Eds.), Springer-Verlag, 2006, pp. 191-208.
5. *Privacy-Preserving Data Mining*, Jaideep Vaidya, Michael Zhu, and Chris Clifton, Volume 19 in *Advances in Information Security*, Springer, 2005, 99p. (Also in Japanese, 2010.)
6. “Privacy-Preserving Data Mining”, Chris Clifton, Murat Kantarcioglu and Jaideep Vaidya, in *Foundations and Advances in Data Mining*, Wesley Chu and T.Y. Lin, eds., Studies in Fuzziness and Soft Computing vol. 180, Springer-Verlag, 2005, pp. 309-340.
7. “Defining Privacy for Data Mining”, Chris Clifton, Murat Kantarcioglu, and Jaideep Vaidya, in *Data Mining: Next Generation Challenges and Future Directions*, AAAI Press, 2004, pp. 255-272.
8. “Security and Privacy”, Chapter 18 in *Handbook of Data Mining*, Lawrence Erlbaum Associates, Mahwah, NJ, April 2003, pp. 441-452.

## JOURNAL ARTICLES

9. “Anonymizing Transactional Datasets”, Bechara al Bouna, Chris Clifton, and Qutaibah M. Malluhi, *Journal of Computer Security* 23(1):89-106, IOS Press, 2015.
10. “Combating Discrimination Using Bayesian Networks”, Koray Mancuhan and Chris Clifton, *Artificial Intelligence and Law* 22(2):211-238 special issue on Computational Methods for Enforcing Privacy and Fairness, Sergio Mascetti, Annarita Ricci, and Salvatore Ruggieri, eds., June 2014.
11. “What should we protect? Defining differential privacy for social network analysis”, Christine Task and Chris Clifton, *Social Network Analysis and Mining*, to appear.
12. “On Syntactic Anonymity and Differential Privacy”, Chris Clifton and Tamir Tassa, *Transactions on Data Privacy* 6(2):161-183, August 2013.
13. “t-Plausibility: Generalizing words to desensitize text”, Balamurugan Anandan, Chris Clifton, Wei Jiang, Mummoorthy Murugesan, Pedro Pastrana-Camacho, and Luo Si, *Transactions on Data Privacy* 5(3):505-534, December 2012.
14. “Anonymous Search Histories Featuring Personalized Advertisement - Balancing Privacy with Economic Interests”, Thorben Burghardt, Klemens Böhm, Achim Guttman, and Chris Clifton, *Transactions on Data Privacy* 4(1):31-50, April 2011.
15. “Classifier Evaluation and Attribute Selection against Active Adversaries”, Murat Kantarcioglu, Bowei Xi, and Chris Clifton, *Data Mining and Knowledge Discovery* 22(1-2):291-335, Springer, January 2011.
16. “Efficient Privacy-Preserving Similar Document Detection”, Mummoorthy Murugesan, Wei Jiang, Chris Clifton, Luo Si, and Jaideep Vaidya, *The VLDB Journal* 19(4):457-475, August 2010.
17. “ $\delta$ -Presence Without Complete World Knowledge”, M. Ercan Nergiz and Chris Clifton, *Transactions on Knowledge and Data Engineering* 22(6):868-883, IEEE Computer Society, Los Alamitos, CA, June 2010.
18. “MultiRelational k-Anonymity”, Mehmet Ercan Nergiz, Chris Clifton, and Ahmet Erhan Nergiz, *Transac-*

*tions on Knowledge and Data Engineering* 21(8):1104-1117, IEEE Computer Society, Los Alamitos, CA, August 2009.

19. "Privacy-Preserving Kth Element Score over Vertically Partitioned Data", Jaideep Vaidya and Chris Clifton, *Transactions on Knowledge and Data Engineering* 21(2):253-258, IEEE Computer Society, Los Alamitos, CA, February 2009.
20. "Privacy-Preserving Decision Trees over Vertically Partitioned Data", Jaideep Vaidya, Chris Clifton, Murat Kantarcioglu, and A. Scott Patterson, *ACM Transactions on Knowledge Discovery in Data* 2(3), October 2008. 27 pages.
21. "Privacy Preserving Naive Bayes Classification", Jaideep Vaidya, Murat Kantarcioglu, and Chris Clifton, *The VLDB Journal* 17(4):879-898, July 2008.
22. "Transforming Semi-Honest Protocols to Ensure Accountability", Wei Jiang, Chris Clifton, and Murat Kantarcioglu, *Data and Knowledge Engineering* 65(1):57-74 special section on "Privacy Aspects of Data Mining", Elsevier Science, Amsterdam, April 2008. Expanded version of PADM06 paper.
23. "An Approach to Identifying Beneficial Collaboration Securely in Decentralized Logistics Systems", Chris Clifton, Ananth Iyer, Richard Cho, Wei Jiang, Murat Kantarcioglu, and Jaideep Vaidya, *Manufacturing & Service Operations Management* 10(1):108-125, INFORMS, Linthicum, Maryland, Winter 2008.
24. "Thoughts on  $k$ -Anonymization", Mehmet Ercan Nergiz and Chris Clifton, *Data and Knowledge Engineering* 63(3):622-645, Elsevier Science, Amsterdam, December 2007. Invited article, expanded version of PDM06 paper.
25. "A Secure Distributed Framework for Achieving  $k$ -Anonymity", Wei Jiang and Chris Clifton, *The VLDB Journal* 15(4):316-333 Special Issue on Privacy-Preserving Data Management, November 2006.
26. "Secure Set Intersection Cardinality with Application to Association Rule Mining", Jaideep Vaidya and Chris Clifton, *Journal of Computer Security* 13(4):593-622, IOS Press, November 2005.
27. "Privacy Preserving Clustering with Distributed EM Mixture Modeling", Xiaodong Lin, Chris Clifton, and Michael Zhu, *Knowledge and Information Systems* 8(1):66-81, Springer-Verlag, London, July 2005.
28. "Privacy-Preserving Data Mining: Why, How, and What For?", Jaideep Vaidya and Chris Clifton, *IEEE Security & Privacy* 2(6):19-27, New York, NY, November/December 2004.
29. "Privacy Preserving Data Mining of Association Rules on Horizontally Partitioned Data", Murat Kantarcioglu and Chris Clifton, *IEEE Transactions on Knowledge and Data Engineering* 16(9):1026-1037, IEEE Computer Society Press, Los Alamitos, CA, September 2004.
30. "TopCat: Data Mining for Topic Identification in a Text Corpus", Chris Clifton, Robert Cooley and Jason Rennie, *Transactions on Knowledge and Data Engineering* 16(8):949-964, IEEE Computer Society Press, Los Alamitos, CA, August 2004.
31. "Change Detection in Overhead Imagery using Neural Networks", *International Journal of Applied Intelligence* 18(2):215-234, Kluwer Academic Publishers, Dordrecht, The Netherlands, March 2003.
32. "Emerging Standards for Data Mining", Chris Clifton and Bhavani Thuraisingham, *Computer Standards and Interfaces* 23(3):187-193, Elsevier Science, Amsterdam, July 2001.
33. "Using Sample Size to Limit Exposure to Data Mining", invited article, *Journal of Computer Security* 8(4):281-307, IOS Press, November 2000. Expanded version of *Protecting Against Data Mining through Samples*.
34. "SEMINT: A Tool for Identifying Attribute Correspondences in Heterogeneous Databases Using Neural Networks", Wen-Syan Li and Chris Clifton, *Data and Knowledge Engineering* 33(1):49-84, Elsevier Science, Amsterdam, April 2000.
35. "Database Integration Using Neural Networks: Implementation and Experiences", Wen-Syan Li, Chris Clifton, and Shu-Yao Liu, *Knowledge and Information Systems* 2(1):73-96, Springer-Verlag, Singapore,

February 2000.

36. “Multidatabase Query Processing with Uncertainty in Global Keys and Attribute Values”, Peter Scheuermann, Wen-Syan Li, and Chris Clifton, *Journal of the American Society for Information Science* 49(3):283-301, John Wiley & Sons, Philadelphia, PA, March 1998.
37. “Dynamic Integration in Multidatabase Systems”, Wen-Syan Li and Chris Clifton, *Journal of Database Management* 7(1):28-40, IDEA Group Publishing, Harrisburg, PA, Winter 1996.
38. “HyperFile: A Data and Query Model for Documents”, Chris Clifton, Hector Garcia-Molina and David Bloom, *VLDB Journal* 4(1):100-141, The Boxwood Press, Pacific Grove, CA, March 1995.

## REFEREED CONFERENCES AND WORKSHOPS

39. “Privacy Preserving Distributed Weighted Bipartite Matching”, Balamurugan Anandan and Chris Clifton, *2017 IEEE Conference on Dependable and Secure Computing*, Taipei, Taiwan, August 7-10, 2017.
40. “Statistical Learning Theory Approach for Data Classification with l-Diversity”, Koray Mancuhan and Chris Clifton, *2017 SIAM International Conference on Data Mining (SDM17)*, Houston, Texas, April 27-29, 2017.
41. “Differentially Private Significance Testing on Paired-Sample Data”, Christine Task and Chris Clifton, *2016 SIAM International Conference on Data Mining (SDM16)*, Miami, Florida, May 5-7, 2016, pp. 153-161.
42. “Laplace noise generation for two-party computational differential privacy”, Balamurugan Anandan and Chris Clifton, *Thirteen annual conference on Privacy, Security, and Trust (PST)*, July 21-23, 2015, Izmir, Turkey, pp. 54-61.
43. “Privacy-Integrated Graph Clustering Through Differential Privacy”, Yvonne Mülle, Chris Clifton, and Klemens Böhm, *The 8th International Workshop on Privacy and Anonymity in the Information Society (PAIS)* collocated with EDBT/ICDT, March 27, 2015, Brussels, Belgium, pp. 247-254.
44. “Efficient Sanitization of Unsafe Data Correlations”, Bechara al Bouna, Chris Clifton, and Qutaibah M. Malluhi, *The 8th International Workshop on Privacy and Anonymity in the Information Society (PAIS)* collocated with EDBT/ICDT, March 27, 2015, Brussels, Belgium, pp. 278-285.
45. “Realizable Rational Multiparty Cryptographic Protocols”, with John Ross Wallrabenstein, *Conference on Decision and Game Theory for Security (GameSec 2014)*, Los Angeles, CA, November 6-7, 2014.
46. “Top-k frequent itemsets via differentially private FP-trees”, with Jaewoo Lee, *20th ACM SIGKDD international conference on Knowledge discovery and data mining (KDD14)*, New York, August 24-27, 2014.
47. “Decision Tree Classification on Outsourced Data”, with Koray Mancuhan *Workshop on Data Ethics* at the *20th ACM SIGKDD international conference on Knowledge discovery and data mining (KDD14)*, New York, August 24, 2014.
48. “Privacy Preserving Tatonnement; A Cryptographic Construction of an Incentive Compatible Market”, with John Ross Wallrabenstein, *Financial Cryptography and Data Security (FC14)*, Barbados, March 3-7, 2014.
49. “Equilibrium Concepts for Rational Multiparty Computation”, with John Ross Wallrabenstein, *Conference on Decision and Game Theory for Security (GameSec 2013)*, Fort Worth, TX, November 11-12, 2013.
50. “Maintaining Database Anonymity in the Presence of Queries”, with Ryan Riley, Ahmet Erhan Nergiz, and Qutaibah Malluhi, 9th workshop on *Security and Trust Management* held in conjunction with *ESORICS 2013*, Egham, UK, September 12-13, 2013.
51. “Using Safety Constraint for Transactional Dataset Anonymization”, with Bechara Al Bouna and Qutaibah Malluhi, *The 27th IFIP WG 11.3 Conference on Data and Applications Security and Privacy (DBSEC’13)*, Newark, New Jersey, July 15-17, 2013. Best Research Paper Award.

52. "Privacy through Uncertainty in Location-Based Services", with Shawn Merrill, Nilgün Basalp, Joachim Biskup, Erik Buchmann, Bart Kuijpers, Walied Othman, and Erkay Savas, *International Workshop on Privacy and Security for Moving Objects (PriSMO)* held in conjunction with *MDM 2013*, Milan, Italy, June 3, 2013, 6pp.
53. "On Syntactic Anonymity and Differential Privacy", with Tamir Tassa, *First Workshop on Privacy-Preserving Data Publication and Analysis* held at *ICDE 2013*, Brisbane, Australia, April 8-12, 2013, 6pp.
54. "Updating Outsourced Anatomized Private Databases", with Ahmet Erhan Nergiz and Qutaibah Malluhi, *16th International Conference on Extending Database Technology (EDBT)*, Genoa, Italy, March 18-22, 2013, 12pp.
55. "Discriminatory Decision Policy Aware Classification", Koray Mancuhan and Chris Clifton, *International Workshop on Discrimination and Privacy-Aware Data Mining (DPADM)* held at *ICDM 2012*, Brussels, Belgium, December 10, 2012, 8pp.
56. "A Guide to Differential Privacy Theory in Social Network Analysis", Christine Task and Chris Clifton, *The IEEE/ACM International Conference on Social Networks Analysis and Mining (ASONAM 2012)*, Istanbul, Turkey, August 26-29, 2012, 7pp.
57. "Differential Identifiability", Jaewoo Lee and Chris Clifton, *The 19th ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, Beijing, China, August 12-16, 2012, 9pp.
58. "How much is enough? Choosing  $\epsilon$  for Differential Privacy", Jaewoo Lee and Chris Clifton, *The 14th Information Security Conference (ISC 2011)*, Xi'an, China, October 26-29, 2011, pp. 325-340.
59. "Significance of Term Relationships on Anonymization", Balamurugan Anandan and Chris Clifton *Web Intelligence for Information Security Workshop* in conjunction with *WI-IAT*, Lyon, France, August 22, 2011, pp. 253-256.
60. "Query Processing in Private Data Outsourcing Using Anonymization", Ahmet Erhan Nergiz and Chris Clifton, *The 25th IFIP WG 11.3 Conference on Data and Applications Security and Privacy (DBSEC-11)*, Richmond, Virginia, July 11-13, 2011, pp. 138-153.
61. "Search-Log Anonymization and Advertisement: Are They Mutually Exclusive?", Thorben Burghardt, Klemens Böhm, Achim Guttman, and Chris Clifton, *The 19th ACM International Conference on Information and Knowledge Management (CIKM 2010)*, Toronto, Canada, October 26-30, 2010, pp. 1269-1272.
62. "Practical and Secure Integer Comparison and Interval Check", Ahmet Erhan Nergiz, Mehmet Ercan Nergiz, Thomas Pedersen, and Chris Clifton, *The 2010 IEEE International Conference on Privacy, Security, Risk and Trust (PASSAT2010)*, Minneapolis, Minnesota, August 20-22, 2010, pp. 791-799.
63. "t-Plausibility: Semantic Preserving Text Sanitization", Wei Jiang, Mummoorthy Murugesan, Chris Clifton, and Luo Si, *the 2009 IEEE International Conference on Privacy, Security, Risk and Trust (PASSAT-09)*, Vancouver, Canada, August 29-31, 2009, pp. 68-75.
64. "Providing Privacy through Plausibly Deniable Search", Mummoorthy Murugesan and Chris Clifton, *2009 SIAM International Conference on Data Mining (SDM09)*, Sparks, Nevada, April 30-May 2, 2009, pp. 768-779.
65. "Plausibly Deniable Search", Mummoorthy Murugesan and Chris Clifton, *Proceedings of the Workshop on Secure Knowledge Management (SKM 2008)*, Dallas, Texas, November 3-4, 2008.
66. "A Privacy Preserving Credentialing System for Health Care", Ahmet Erhan Nergiz and Chris Clifton, *Proceedings of the Workshop on Secure Knowledge Management (SKM 2008)*, Dallas, Texas, November 3-4, 2008.
67. "Similar Document Detection with Limited Information Disclosure", Wei Jiang, Mummoorthy Murugesan, Chris Clifton, and Luo Si, *Proceedings of the 24th International Conference on Data Engineering (ICDE 2008)*, Cancun, Mexico, April 7-12, 2008, pp. 735-743.

68. "Identifying Rare Classes with Sparse Training Data", Mingwu Zhang, Wei Jiang, Chris Clifton, and Sunil Prabhakar, *Proceedings of the 18th International Conference on Database and Expert Systems Applications*, Regensburg, Germany, September 4-7, 2007, pp. 751-760.
69. "Hiding the Presence of Individuals from Shared Databases", Mehmet Nergiz, Maurizio Atzori, and Chris Clifton, *2007 ACM SIGMOD International Conference on Management of Data*, Beijing, China, June 11-14, 2007, pp. 665-676.
70. "AC-Framework for Privacy-Preserving Collaboration", Wei Jiang and Chris Clifton *2007 SIAM International Conference on Data Mining (SDM07)*, Minneapolis, Minnesota, April 26-28, 2007, pp. 47-56.
71. "MultiRelational k-Anonymity", Mehmet Ercan Nergiz and Ahmet Erhan Nergiz, *The 23rd IEEE International Conference on Data Engineering (ICDE 2007)*, Istanbul, Turkey, April 16-20, 2007, pp. 1417-1421.
72. "Transforming Semi-Honest Protocols to Ensure Accountability", Wei Jiang and Chris Clifton, *The ICDM workshop on Privacy Aspects of Data Mining (PADM06)*, Hong Kong, China, Dec. 18, 2006, pp. 524-529.
73. "Thoughts on k-Anonymization", Mehmet Ercan Nergiz and Chris Clifton, *The Second International Workshop on Privacy Data Management (PDM06)* held in conjunction with *The 22nd International Conference on Data Engineering*, Atlanta, Georgia, April 8, 2006, pp. 96-105.
74. "Privacy-Preserving Distributed k-Anonymity", Wei Jiang and Chris Clifton *The 19th Annual IFIP WG 11.3 Working Conference on Data and Applications Security*, August 7-10, 2005, Storrs, Connecticut, pp. 166-177.
75. "Security Issues in Querying Encrypted Data", Murat Kantarcioglu and Chris Clifton *The 19th Annual IFIP WG 11.3 Working Conference on Data and Applications Security*, August 7-10, 2005, Storrs, Connecticut, pp. 325-337.
76. "Privacy-Preserving Decision Trees over Vertically Partitioned Data", Jaideep Vaidya and Chris Clifton, *The 19th Annual IFIP WG 11.3 Working Conference on Data and Applications Security*, August 7-10, 2005, Storrs, Connecticut, pp. 139-152.
77. "Dependable Real-time Data Mining", Bhavani Thuraisingham, Latifur Khan, Chris Clifton, John Maurer, and Marion Ceruti, *8th IEEE International Symposium on Object-Oriented Real-Time Distributed Computing (ISORC 2005)*, May 18-20, 2005, Seattle, Washington, pp. 158-165.
78. "Privacy-Preserving Top-K Queries" Jaideep Vaidya and Chris Clifton, *The 21st International Conference on Data Engineering (ICDE 2005)*, April 5-8, 2005, Tokyo, Japan, pp. 545-546.
79. "Knowledge Discovery from Transportation Network Data", Wei Jiang, Jaideep Vaidya, Zahir Balaporia, Chris Clifton, and Brett Banich, *The 21st International Conference on Data Engineering (ICDE 2005)*, April 5-8, 2005, Tokyo, Japan, pp. 1061-1072. Best paper, Industrial Track.
80. "Privacy-Preserving Outlier Detection", Jaideep Vaidya and Chris Clifton, *The Fourth IEEE International Conference on Data Mining*, November 1-4, 2004, Brighton, UK, pp. 233-240.
81. "Privately Computing a Distributed k-nn Classifier", Murat Kantarcioglu and Chris Clifton, *8th European Conference on Principles and Practice of Knowledge Discovery in Databases (PKDD)*, September 20-24, 2004, Pisa, Italy, pp. 279-290.
82. "When do Data Mining Results Violate Privacy?", Murat Kantarcioglu, Jiashun Jin, and Chris Clifton, *The Tenth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 22-25, 2004, Seattle, Washington, pp. 599-604.
83. "Privacy Preserving Data Integration and Sharing", Chris Clifton, AnHai Doan, Ahmed Elmagarmid, Murat Kantarcioglu, Gunther Schadow, Dan Suciu, and Jaideep Vaidya, *The 9th ACM SIGMOD Workshop on Research Issues in Data Mining and Knowledge Discovery (DMKD'2004)*, June 13, 2004, Paris, France, pp. 19-26.
84. "Privacy Preserving Naive Bayes Classifier for Vertically Partitioned Data", Jaideep Vaidya and Chris

- Clifton, *2004 SIAM International Conference on Data Mining*, April 22-24, 2004, Lake Buena Vista, Florida, pp. 522-526.
85. “Derived Access Control Specification for XML”, Siddhartha Goel, Chris Clifton, and Arnon Rosenthal, *Workshop on XML Security* held in association with the *10th ACM Conference on Computer and Communications Security*, October 31, 2003, Fairfax, Virginia, pp. 1-14.
  86. “Leveraging the “Multi” in Secure Multi-Party Computation”, Jaideep Vaidya and Chris Clifton, *Workshop on Privacy in the Electronic Society* held in association with the *10th ACM Conference on Computer and Communications Security*, October 30, 2003, Washington, DC, pp. 53-59.
  87. “Privacy-Preserving K-Means Clustering over Vertically Partitioned Data”, Jaideep Vaidya and Chris Clifton, *The Ninth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 24 - 27, 2003, Washington, D.C., pp. 206-215. Honorable Mention, Best Paper Competition.
  88. “Assuring Privacy when Big Brother is Watching”, Murat Kantarcioglu and Chris Clifton, *The 8th ACM SIGMOD Workshop on Research Issues in Data Mining and Knowledge Discovery (DMKD’2003)*, June 13, 2003, San Diego, California, pp. 88-93.
  89. “Privacy Preserving Association Rule Mining in Vertically Partitioned Data”, Jaideep Vaidya and Chris Clifton, *The Eighth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, July 23 - 26, 2002, Edmonton, Alberta, Canada, pp. 639-644.
  90. “Privacy-preserving Distributed Mining of Association Rules on Horizontally Partitioned Data”, Murat Kantarcioglu and Chris Clifton, *The ACM SIGMOD Workshop on Research Issues in Data Mining and Knowledge Discovery (DMKD’2002)*, June 2, 2002, Madison, Wisconsin, pp. 24-31.
  91. “Coordinating Accessibility versus Restrictions in Distributed Object Systems”, Arnon Rosenthal and Chris Clifton, *3rd International Symposium on Distributed Objects & Applications*, 17-20 September, 2001 Rome, Italy.
  92. “Directions for Web and E-Commerce Applications Security”, Bhavani Thuraisingham, Chris Clifton, Amar Gupta, Elisa Bertino, and Elena Ferrari, *Enabling Technologies: Infrastructure for Collaborative Enterprises, WET ICE 2001*, Cambridge, Massachusetts, June 20-22, 2001, pp. 200-204.
  93. “Real-Time Data Mining of Multimedia Objects”, Bhavani Thuraisingham, Chris Clifton, Marion G. Ceruti, and John Maurer, *Fourth IEEE International Symposium on Object-Oriented Real-Time Distributed Computing (ISORC 2001)*, Magdeburg, Germany, May 2-4, 2001, pp. 360-365.
  94. “Developing Custom Intrusion Detection Filters Using Data Mining”, Chris Clifton and Gary Gengo, *2000 Military Communications International Symposium (MILCOM2000)*, Los Angeles, California, October 22-25, 2000, pp. 440-443.
  95. “TopCat: Data Mining for Topic Identification in a Text Corpus”, Chris Clifton and Robert Cooley, *3rd European Conference on Principles and Practice of Knowledge Discovery in Databases*, Prague, Czech Republic, September 15-18, 1999, pp. 174-183.
  96. “Protecting Against Data Mining through Samples”, Chris Clifton, *Thirteenth Annual IFIP WG 11.3 Working Conference on Database Security*, July 26-28, 1999, Seattle, WA, pp. 193-207. Expanded version invited for submission to *Journal of Computer Security*, IOS Press (see above).
  97. “Data Mining on Text”, Chris Clifton and Rick Steinheiser, *Proceedings of the Twenty-Second Annual International Computer Software and Applications Conference*, Vienna, Austria, August 19-21, 1998, pp. 630-635.
  98. “Query Flocks: A Generalization of Association Rule Mining”, Dick Tsur, Jeffrey D. Ullman, Serge Abiteboul, Chris Clifton, Rajeev Motwani, Svetlozar Nestorov, and Arnon Rosenthal, *Proceedings of the 1998 ACM SIGMOD International Conference on Management of Data*, Seattle, WA, June 1-4, 1998, pp. 1-12.
  99. “Knowledge Discovery in Text”, Chris Clifton, Arnon Rosenthal, Rick Steinheiser, and Jeffrey D. Ullman,



*First Federal Data Mining Symposium*, AFCEA, December 16-17, 1997, Washington, D.C. Revised version appeared in the *European Conference on Machine Learning Workshop on Text Mining*, April 24, 1998, Chemnitz, Germany.

100. "Experience with a Combined Approach to Attribute-Matching Across Heterogeneous Databases", Chris Clifton, Ed Housman and Arnon Rosenthal, *7th IFIP 2.6 Working Conference on Database Semantics*, October 7-10, 1997, Leysin, Switzerland, pp. 428-451.
101. "Dynamic Integration and Query Processing with Ranked Role Sets", Peter Scheuermann, Wen-Syan Li, and Chris Clifton, *Proceedings of the First IFCIS International Conference on Cooperative Information Systems*, June 19-21, 1996, Brussels, Belgium, pp. 157-166.
102. "Security and Privacy Implications of Data Mining", Chris Clifton and Don Marks, *Proceedings of the ACM SIGMOD Workshop on Data Mining and Knowledge Discovery*, Montreal, Canada, June 2, 1996, pp. 15-19.
103. "Classifying Software Components Using Design Characteristics", Chris Clifton and Wen-Syan Li, *Proceedings of the Tenth Knowledge-Based Software Engineering Conference*, November 12-15, 1995, Boston, Massachusetts, pp. 139-146.
104. "Experiences with SEMINT: Automated Semantic Integration", Wen-Syan Li and Chris Clifton, *Proceedings of the International Conference on Advanced Science and Technology*, March 25, 1995, Chicago, IL, pp. 64-71. Student paper presentation award to Wen-Syan Li.
105. "Semantic Integration in Heterogeneous Databases using Neural Networks", Chris Clifton and Wen-Syan Li, *20th International Conference on Very Large Data Bases*, Santiago, Chile, September 12-15 1994, pp. 1-12.
106. "Compiling Local Test Formulas for Global Constraints in Distributed Databases", Herts Chen and Chris Clifton, *International Conference on Intelligent Information Management Systems*, Washington, D.C., June 1-3 1994.
107. "Information Brokers: Sharing Knowledge in a Heterogeneous Distributed System", Daniel Barbará and Chris Clifton, *Proceedings of the 4th International Conference on Database and Expert Systems Applications*, Prague, Czechoslovakia, September 6-8, 1993, pp. 90-91.
108. "Using Field Specifications to Determine Attribute Equivalence in Heterogeneous Databases", Wen-Syan Li and Chris Clifton, *Proceedings of RIDE-IMS'93: Third International Workshop on Research Issues in Data Engineering*, Vienna, Austria, April 18-20, 1993, pp. 174-177.
109. "The Gold Mailer", Daniel Barbará, Chris Clifton, Fred Douglass, Hector Garcia-Molina, Stephen Johnson, Ben Kao, Sharad Mehrotra, Jens Tellefsen, and Rosemary Walsh, *Proceedings of the Ninth International Conference on Data Engineering*, Vienna, Austria, April 19-23, 1993, pp. 92-99.
110. "Distributed Processing of Filtering Queries in HyperFile", Chris Clifton and Hector Garcia-Molina, *Proceedings of the 11th International Conference on Distributed Computing Systems*, Arlington, TX, May 20-24 1991, pp. 54-64.
111. "Data Management with Massive Memory: A Summary", Hector Garcia-Molina, Robert Abbott, Chris Clifton, Carl Staelin, and Kenneth Salem, *Parallel Database Systems*, Pierre America, Editor, PRISMA Workshop Proceedings, Noordwijk, The Netherlands, September 1990, pp. 63-70.
112. "Indexing in a Hypertext Database", Chris Clifton and Hector Garcia-Molina, *Proceedings of the 1990 conference on Very Large Data Bases*, Brisbane, Australia, August 13-16 1990, pp. 36-49.
113. "The Design of a Document Database", Chris Clifton, Hector Garcia-Molina, and Robert Hagmann, *ACM Conference on Document Processing Systems*, Santa Fe, NM, December 5-9, 1988, pp. 125-134.

*Refereed System Demonstration Descriptions:*

114. "GeoNODE: An End-to-End System from Research Components", Chris Clifton, John Griffith, and Rod

Holland, *The 17th International Conference on Data Engineering*, Heidelberg, Germany, April 2-6, 2001, 3pp.

115. "Natural Language Processing for News Analysis", Tom Bartee, Stanley Boykin, Chris Clifton, Thad Cooper, Shereif El-Sheikh, Jerry Fitzgerald, Joe Francoeur, John Gibson, John Griffith, Steve Hansen, Lynette Hirschman, Rod Holland, Rob Hyland, Steve Janiak, Mark Maybury, Andy Merlino, Carsten Oertel, Marc Reichman, Marc Richards, Paul Silvey and Shane Steward, *Language Technology Joint Conference (ANLP-NAACL2000)*, April 29-May 40, 2000, Seattle, WA.
116. "Semint: A System Prototype for Semantic Integration in Heterogeneous Databases", Wen-Syan Li and Chris Clifton *Proceedings of the 1995 ACM SIGMOD International Conference on Management of Data*, May 23-25, 1995, San Jose, CA, pp. 484.

#### **INVITED ARTICLES (editor-refereed)**

117. "Challenges and Opportunities for Security with Differential Privacy", Chris Clifton and Balamurugan Anandan, *Ninth International Conference on Information Systems Security (ICISS 2013)*, ISI Kolkata, India, 16-20 December 2013.
118. "Collaborative Search and User Privacy - How Can They Be Reconciled?", Thorben Burghardt, Erik Buchmann, Klemens Böhm, and Chris Clifton, invited full paper at *The 4th International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom 2008)*, Orlando, Florida, November 13-16, 2008.
119. "What is Privacy? Critical Steps for Privacy-Preserving Data Mining", Chris Clifton, invited article at the workshop on *Privacy and Security Aspects of Data Mining* in conjunction with *The Fifth IEEE International Conference on Data Mining*, Houston, Texas, November 27, 2005.
120. "Tools for Privacy Preserving Distributed Data Mining", Chris Clifton, Murat Kantarcioglu, Jaideep Vaidya, Xiaodong Lin, and Michael Zhu, invited article in *ACM SIGKDD Explorations* 4(2):28-34, Johannes Gehrke, editor, December 2002.
121. "Using Unknowns to Prevent Discovery of Association Rules", Yücel Saygin, Vassilios S. Verykios, and Chris Clifton, invited article in *ACM SIGMOD Record* 30(4):45-54 Special Section on Data Mining for Intrusion Detection and Threat Analysis, Daniel Barbará, editor, December 2001.

#### **PATENTS**

1. Christopher Clifton, John Ross Wallrabenstein, and David Stork, *Secure search and retrieval*, US 8,904,171, December 2, 2014.

#### **SELECTED PRESENTATIONS**

1. "Dealing with Discriminatory Data Mining", *International Conference on Applied Research in Computer Science and Engineering (ICAR'17)*, Beirut, Lebanon, June 23, 2017.
2. "Distributed Differential Privacy", Distinguished Lecture, University of Kentucky, Lexington, Kentucky, November 18, 2016.
3. "Distributed Differential Privacy", keynote at the *XVI Brazilian Symposium on Information and Computational Systems Security (SBSeg16)*, Niterói, Brazil, November 8, 2016.
4. "Privacy: Beyond Confidentiality", keynote at the *21st ACM Conference on Computer and Communications Security*, Scottsdale, Arizona, November 6, 2014.
5. "Privacy without encrypting - Protect your data and use it too", keynote at the *The 28th IFIP WG 11.3 Conference on Data and Applications Security and Privacy (DBSEC'14)*, Vienna, Austria, July 14, 2014.

6. “Privacy-Preserving Technologies”, *10th Annual Colloquium on ICT R&D: R&D on Big Data and Personal Data* Sponsored by the National Institute of Information and Communications Technology (NICT) of Japan, Washington, D.C., January 24th 2014.
7. “Challenges and Opportunities for Security with Differential Privacy”, keynote at the *Ninth International Conference on Information Systems Security (ICISS 2013)*, ISI Kolkata, India, 16-20 December 2013.
8. Panelist on “Data Mining with Big Data”, *IEEE International Conference on Data Mining (ICDM 2013)*, Dallas, Texas / December 7-10, 2013.
9. Panelist on “Security and Privacy: Are they Two Sides of the Same Coin?” *Annual Computer Security Applications Conference (ACSAC) 2012*, Orlando, Florida, December 6, 2012.
10. “Data Mining and Privacy”, Qatar Computing Research Institute, Doha, Qatar, November 15, 2012.
11. “Privacy-Preserving Data Mining at 10: What’s Next?”, invited talk at the workshop on *Privacy Aspects of Data Mining* held at the *IEEE International Conference on Data Mining*, Vancouver, Canada, December 11, 2011.
12. “Privacy-Preserving Data Mining at 10: What’s Next?”, keynote at the *Ninth Australasian Data Mining Conference (AusDM 2011)*, Ballarat, Australia, December 1-2, 2011.
13. “Freeing Cloud Databases from Privacy Constraints”, *Computer Science Seminar*, Australian National University, Canberra, Australia, November 28, 2011.
14. “Freeing Cloud Databases from Privacy Constraints”, *Computer Science and Engineering Seminar*, Qatar University, Doha, Qatar, October 3, 2011.
15. “Privacy-Preserving Data Mining”, invited talk at The Thomas M. Cooley Law Review Symposium *Data Mining: Who’s Mining Your Business*, Lansing, Michigan, September 22, 2011.
16. “Privacy Issues with Machine Learning: Fears, Facts, and Opportunities”, *Machine Learning Summer School @Purdue*, West Lafayette, Indiana, June 13, 2011.
17. “Privacy-Preserving Data Mining: Shared analysis without shared data”, *Expert Workshop: Statistical and Epidemiological Issues in Active Medical Product Surveillance*, Brookings Institution, February 16, 2011.
18. “Private Computation for Confidential Outsourcing”, Ricoh Technology Center, Shin-Yokohama, Japan, January 17, 2011.
19. “Plausibly Deniable Search”, invited talk at the *Symposium ‘In search of privacy’*, Radboud University, Nijmegen, The Netherlands, June 25, 2009.
20. “What an Information Technology Vendor Can (and Can’t) Do For Your Client”, invited presentation at the *Indiana Continuing Legal Education Forum on Privacy Law*, Indianapolis, IN, May 14, 2009.
21. “Measuring Privacy: A Risk-Based Approach”, talk at SAP Research CEC Karlsruhe, Germany, December 8, 2008.
22. “Saleable Opportunities for Private and Secure Computation”, FENS seminar at Sabanci University, December 5, 2008.
23. “Saleable Opportunities for Private and Secure Computation” Informatik-Kolloquium at Universität Karlsruhe, December 1, 2008.
24. “Opportunities for Private and Secure Machine Learning”, keynote at the *2008 AISec Workshop* held in conjunction with the *15th ACM Conference on Computer and Communications Security (CCS)*, Alexandria, VA, October 27, 2008.
25. Panelist on “Technologies for Privacy-Protective Data Mining” at the Department of Homeland Security Privacy Office workshop on *Implementing Privacy Protections in Government Data Mining*, Washington, DC, July 24-25, 2008.
26. “Information metrics for privacy and anonymity in spatiotemporal data”, invited talk at the *First Interdisci-*

plinary Workshop on Mobility, Data Mining and Privacy: Preserving anonymity in geographically referenced data, Rome, Italy, February 14 2008.

27. "Is Privacy Still an Issue for Data Mining?", invited talk at the *National Science Foundation Symposium on Next Generation of Data Mining and Cyber-Enabled Discovery for Innovation*, Baltimore, Maryland, October 10-12, 2007.
28. "Privacy and Anonymity in Text", Max-Planck-Institut for Informatik, Saarbrucken, Germany, August 31, 2007.
29. "Will Privacy Kill Ubiquitous Knowledge Discovery?", invited talk at the *KDUbiq Working Group on Privacy and Security* meeting, Berlin, Germany, September 19, 2006.
30. "Privacy Conflicts Inherent in Data Analysis", Institute for Software Research International Seminar, Carnegie-Mellon University, March 29, 2006.
31. "What is Privacy? Critical Steps for Privacy-Preserving Data Mining", Invited talk at the *Workshop on Privacy and Security Aspects of Data Mining* held in conjunction with the *IEEE International Conference on Data Mining*, November 27, 2005, New Orleans, Louisiana.
32. "Open Issues in Privacy-Preserving Data Mining", Maebashi Institute of Technology, April 4, 2005.
33. Panel: "Data Mining and Data Aggregation" at the Symposium on *Privacy and Identity: The Promise and Perils of a Technological Age*, DePaul University, October 14-15, 2004.
34. Panel: "Data Aggregation, Mining, and Privacy" at the *NSF Cybertrust PI Meeting*, Pittsburgh, Pennsylvania August 18-20, 2004.
35. "Knowledge Projection for Tele-Maintenance", Crane Naval Surface Warfare Center Distinguished Lecture Series, February 3, 2004.
36. "Turning Data into Knowledge Without Violating Privacy", Joint Biostatistics & Medical Informatics / Statistics / Computer Sciences Seminar, University of Wisconsin, January 29, 2004.
37. "Privacy-Enhanced Data Management for Next-Generation e-Commerce", with Iriini Fundulaki, Richard Hull, Bharat Kumar, Daniel Lieuwen, and Arnaud Sahuguet, tutorial at the *29th International Conference on Very Large Data Bases*, September 9-12, 2003, Berlin, Germany.
38. "Privacy Preserving Data Mining", tutorial at *The Ninth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 24-27, 2003, Washington, D.C.
39. "Privacy Preservation to Enable Data Mining Across Enterprises", invited talk at the *IBM Almaden Institute Symposium on Privacy*, April 9-11, 2003, San Jose, California.
40. "Privacy Preserving Distributed Data Mining", data mining seminar at the University of Illinois, March 19, 2003.
41. "Defining Privacy for Data Mining", invited talk at the *National Science Foundation Workshop on Next Generation Data Mining*, November 1-3, 2002, Baltimore, MD.
42. "Privacy, Security, and Data Mining", tutorial given at the combined conference *13th European Conference on Machine Learning (ECML'02)* and *6th European Conference on Principles and Practice of Knowledge Discovery in Databases (PKDD'02)*, Helsinki, Finland, August 19, 2002.
43. "Developing Custom Intrusion Detection Filters Using Data Mining", Purdue Center for Education and Research in Information Assurance, December 10, 1999.
44. "Data Mining at MITRE" *Third Applied Database Technology Conference*, The MITRE Corporation, Bedford, MA, June 5 1997.
45. "Data Mining in Text", *Symposium on Advanced Information Processing and Analysis*, Tysons Corner, Virginia, March 26, 1997.
46. "Neural Networks for Semantic Integration" *Second Applied Database Technology Conference*, The

MITRE Corporation, Bedford, MA, December 7, 1995.

47. "Component Based Software: How Database Technology Can Help", AT&T Bell Labs, Naperville, IL, June 3, 1994.
48. "Query Processing in HyperFile", New Jersey Institute of Technology, May 11, 1992.

## SOFTWARE DEVELOPED

**GeoNODE** (Geographic News On Demand Environment), developed while at the MITRE Corporation, combines research results from natural language, data mining, multimedia, and visualization into a system for analyzing news. News, in the context of GeoNODE, is anything from television broadcasts to focused email and newsgroups. GeoNODE is in use as a concept evaluation prototype at several sites within the Department of Defense. Responsible for database development, as well as the text mining research component. See the publications list for more details.

## RESEARCH FUNDING

1. Chris Clifton (PI) and Keith Merrill, *Tools to Support Anonymization*, U. S. Census Bureau, 1/1/17-12/31/19, \$471,012.
2. Chris Clifton, Daniel Kelly, and Kendall Roark, *Big Data Ethics: Detecting Bias in Data Collection, Algorithmic Discrimination and 'Informed Refusal'*, Andrew W. Mellon Foundation, 1/1/17-12/31/18, \$142,511.
3. Chris Clifton, *Mining Anonymized Data*, Northrop Grumman Corporation, 1/1/16-12/31/16, \$94,941.
4. Chris Clifton (PI), *Secure Printing from the Cloud*, Ricoh Co., 5/1/2011-3/31/2012, \$89,585.
5. Chris Clifton (PI), Qutaibah Maluhi (Qatar University), and Khaled M. Khan (Qatar University), *Managing Private Data in the Cloud*, Qatar National Research Foundation, 12/1/2010-11/30/2013, \$954,095 (\$333,840 Purdue).
6. Chris Clifton (Lead PI), Luo Si, Chyi-Kong (Karen) Chang, Victor Raskin, Racquel L. Hill (PI Indiana U.), Stephanie Sanders, Wei Jiang (PI Missouri S&T), *Anonymizing Textual Data and its Impact on Utility*, NSF Trustworthy Computing, 9/1/2010-8/31/2016, \$2,480,300 (\$1,554,441 Purdue).
7. Chris Clifton (PI), *Secure Multiparty Computation for Outsourcing Image Processing*, Ricoh Co., 5/1/2010-3/31/2011, \$78,792.
8. Tim Finin (PI, UMBC) et al. (19 co-PIs, 4 Purdue), *A Framework for Managing the Assured Information Sharing Lifecycle*, DoD Multidisciplinary University Research Initiative, 5/1/2008-4/30/2013, \$4.35M base + 3M option years (\$1.5M Purdue).
9. Elisa Bertino (PI) and Chris Clifton, *Identity Management and Trust Negotiation Services*, Department of Homeland Security / Institute for Information Infrastructure Protection, 4/1/2007-3/31/2009, \$300,000.
10. David Ebert (Director), Alok Chaturvedi, William Cleveland, Chris Clifton, Ahmed Elmagarmid, and Marc Overhage, *Purdue University Regional Visualization and Analytics Center*, Department of Homeland Security, January 2006-December 2008, \$517,000.
11. Ann Hendrich (Ascension Health, PI), Marilyn Chow (Kaiser Permanente), Nelson Lee (Rapid Modeling), William Cleveland, Chris Clifton, Jason Abrevaya, *A Multi-Site Study of How Medical Surgical Nurses Spend Their Time: A Baseline Study in Preparation for an Electronic Health Record and an Evidenced-based Nursing Unit Design*, Robert Wood Johnson Foundation, April 2005-August 2006. (Purdue CS portion \$91,269).
12. Chris Clifton (PI), AnHai Doan (University of Illinois), Ahmed Elmagarmid, Gunther Schadow (Regenstrief Institute for Healthcare), and Dan Suciu (University of Washington), *Privacy-Preserving Data Integration and Sharing*, NSF ITR, September 2004-August 2008, \$1,012,000.

13. Clement J. McDonald (PI) et al., Chris Clifton (Purdue PI) A Center of Excellence in Medical Informatics to Provide an Advanced Infrastructure for Human Research: A Catalyst for Indiana Research, Indiana 21st Century Fund, August 2004-August 2006, \$3,832,196 (Lead: Regenstrief Institute for Healthcare; Purdue portion \$50,000.)
14. Chris Clifton (PI) and Mikhail Atallah, *Collaborative Research: Distributed Data Mining to Protect Information Privacy*, NSF Small ITR, August 2003 - August 2006, \$276,274. (Collaborative with Wenliang Du, Syracuse University - funded under separate award.)
15. Chris Clifton, Walid Aref, Ahmed Elmagarmid (PI), Arif Ghafoor, and Sunil Prabhakar, *Knowledge Projection for TeleMaintenance*, EG&G / Naval Surface Warfare Center, Crane Division, October 21, 2002 - September 30, 2005, \$1,746,813.
16. Chris Clifton (PI), Ananth Iyer, and Reha Uzsoy, *A Prototype Integrated Transaction Data Analysis and Visualization Environment for the Transportation, Distribution and Logistics Sector*, e-Enterprise Center at Discovery Park, August 19, 2002 - May 10, 2003, \$34,278.
17. Chris Clifton (PI), Pascal Meunier, and Gustavo Rodriguez-Rivera, *Secure Programming: Add-on Course Module and Short Course*, e-Enterprise Center at Discovery Park, August 19, 2002 - June 30, 2003, \$19,344.
18. Chris Clifton (PI), *Privacy Preserving Data Mining*, Purdue Research Foundation, August 2002 through July 2004, \$26,403.
19. Chris Clifton (PI), *Data Mining for Intrusion Detection*, U.S. Army CECOM Space and Terrestrial Communications Directorate, June 1999 through September 2001, ~\$360,000.
20. Chris Clifton (PI), Arnon Rosenthal and Jeffrey Ullman (Stanford University), *Data Mining in Text*, Community Management Staff (Intelligence Community), September 1996 through June 2000, \$589,913 (MITRE's portion \$442,174).
21. Chris Clifton (PI), *Data Mining in Text and Images*, MITRE Sponsored Research, January 1996 through September 1999, \$521,421.
22. Chris Clifton (PI), *Data Mining Security*, National Security Agency, October 1995 through September 1997, ~\$120,000.
23. Chris Clifton (PI) *Shared Software Database*, NSF Research Initiation Award, September 1992 through August 1995, \$90,000.

## **PhD AND MS STUDENTS SUPERVISED**

### *Current Students Supported*

1. Zitao Li, Distributed program obfuscation, funded on QNRF grant Summer/Fall 2017, Ph.D. expected 2020.
2. Shawn Merrill, Minimizing impact of privacy protection on data utility, funded on NSF grant from Fall 2012, Census grant from Spring 2017, Ph.D. expected 2018.

### *Completed*

3. Balamurugan Anandan, *Privacy-Preserving Analysis with Applications to Textual Data*, Ph.D. May 2017.
4. Christine Task, Dissertation *Privacy-Preserving Social Network Analysis*, Ph.D. May 2015. First employment: Nexus Research.
5. John Ross Wallrabenstein, Dissertation *Rational Multiparty Computation*, Ph.D. December 2014. First employment: Sypris Electronics.
6. Jaewoo Lee, Dissertation *Achieving Practical Differential Privacy*, Ph.D. August 2014. First employment: Postdoctoral position, Pennsylvania State University.

7. Ahmet Erhan Nergiz, Dissertation *Private Data Outsourcing using Anonymization*, Ph.D. December 2012. First employment: Google, Inc.
8. Pedro J. Pastrana-Camacho, Thesis *Ontology Based Text Sanitization*, M.S. December 2012. First employment: GE Labs.
9. Mummoorthy Murugesan, Dissertation *Privacy Through Deniable Search*, Ph.D. August 2010. First employment: Teradata Corp.
10. Mehmet Ercan Nergiz, Dissertation *Anonymization-Based Privacy Protection*, Ph.D. December 2008. First employment: Postdoc, Sabanci University, Turkey.
11. Wei Jiang, Dissertation *Incentive Driven and Privacy-Preserving Collaborative Computing*, Ph.D. August 2008. First employment: Missouri University of Science & Technology.
12. Yang Wang, correlation of high-dimensional data with time and motion study data, M.S. 2007.
13. Murat Kantarcioglu, Dissertation *Privacy Preserving Data Mining in Horizontally Partitioned Data*, Ph.D. August 2005. First employment: University of Texas at Dallas.
14. Jaideep S. Vaidya, Dissertation *Privacy Preserving Data Mining for Vertically Partitioned Data*, Ph.D. August 2004. Honorable Mention, Best Paper Competition at *The Ninth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* for "Privacy-Preserving K-Means Clustering over Vertically Partitioned Data". First employment: Rutgers University.
15. Siddhartha K. Goel, thesis *Derived Access Control Specification for XML*, M.S. August 2003.
16. Wen-Syan Li, Dissertation *Semantic Integration in Heterogeneous Databases*, Ph.D. December 1995. *Using Field Specifications to Determine Attribute Equivalence in Heterogeneous Databases*, M.S. December 1992. First employment: Visiting faculty, Rutgers University.
17. Herts T. Chen, Dissertation *Concurrency Control Using Semantic Knowledge: A Proof Theoretic Basis*, Ph.D. December 1994. First employment: Research staff, National Taiwan University.
18. Robert Haddleton, *An Analysis of an Active Database as Applied to a Real-Time Application*, M.S. June 1994.
19. Shashidar Jasthi, *Application of Software Quality Models to Individual Evaluation*, M.S. December 1993.
20. Christopher Fernandes, *Determining Semantic Equivalence Using a Nucleotide Base Genetic Sequencing Algorithm*, M.S. December 1993.
21. Robert Milfajt, *A Comparison of Two Heterogeneous Database Schema Integration Methods*, M.S. June 1992.
22. Stephen Gene Jacobson, *Integrating DB Design and CASE Tools*, M.S. June 1992.

## TEACHING HIGHLIGHTS

### Purdue University

### August 2001 to Present

CS47300	Web Information Search And Management	Fall 2017
CS390DM0	Data Mining & Machine Learning	Spring 2017
CS348	Information Systems	Fall 2016
CS54701	Information Retrieval	Spring 2016
CS541	Database Systems	Fall 2002, 2007, Spring 2012
CS180	Problem Solving And Object-Oriented Programming	Spring 2010, 2011
CS526	Information Security	Spring & Fall 2003, Fall 2004, Fall 2010

CS626	Advanced Information Assurance	Fall 2009, Spring 2013
CS542	Distributed Database Systems	Spring 2009
CSx97	Honors Program	2007-2008
CS250	Computer Architecture	Fall 2005, Spring 2007
CS590D	Data Mining	Spring 2005, 2006
CS490D	Introduction to Data Mining	Spring 2004
CS390S	Secure Programming (mini-course with Drs. Meunier, Rodriguez-Rivera)	Fall 2002
CS603	Advanced Topics in Distributed Systems	Spring 2002
CS590M	Security Issues in Data Mining	Fall 2001

*Independent Study Projects Supervised*

Zhuo Chen	CS490: Machine Learning on Financial Markets	Spring 2016
Ryan Adams	CS497: Secure Similar Document Detection using KLDivergence	Spring 2008
John Horst	CS497: Secure Content Validation	Spring 2007
Brett Banich	CS490: Data Mining of Graphs	Summer 2003
Y.B. Lee	CS590: Information Security Certifications	Summer 2003
Hong Liang	CS590: Advanced Data Mining	Summer 2003
Kris Reyes	CS490: Exploit Analysis (Co-advised with Dr. Meunier)	Fall 2002
Wonjun Lee	CS590: Data Mining for Intrusion Detection	Summer 2002
Hong Liang	CS590: Multivariate Data Mining using PCA	Summer 2002
Mashrur Nabi and Halim Sandikin	CS490: Exploit Database (Co-advised with Dr. Meunier)	Spring 2002

**Northwestern University**

**September 1991 to August 1995**

Developed and taught a two quarter sequence *Software Project Management and Development*. Course included innovative collaboration with local industry as source of projects.

Taught *Fundamentals of Computer System Software, Introduction to Database Systems, Seminar: Heterogeneous Databases*.

**Raritan Valley Community College**

**January through May 1989**

Taught *Foundations of Computer Science*.

**COMMITTEE MEMBERSHIPS**

**Purdue University**

*Departmental*

Undergraduate Committee	2003-2004; Chair 2007-2009
Hiring Committee	2006-2007, 2016-2017
Graduate Committee	2001-2003, 2010-2013, 2016; Chair 2004-2006
Graduate Admissions Committee	2003-2004, 2009-2010
Strategic Planning Committee	2001-2002

*College of Science*

COALESCE Search	2005-2007
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*University*



University Senate	2016-2019
Graduate Council	2010-2012
Regenstrief Center for Healthcare Engineering Director Search	2004-2005

## Northwestern University

School of Engineering Academic Standing Committee	1992-1994
Departmental Computer Committee	1992-1994
Departmental Graduate Committee	1991-1992
Departmental Graduate Admissions Committee	1991-1992

## PROFESSIONAL ACTIVITIES

### Editorial Boards

Editorial Board, *Applied Intelligence: The International Journal of Artificial Intelligence, Neural Networks, and Complex Problem-Solving Technologies*, Kluwer Academic Publishers, The Netherlands, 2008-present (Review Board 2000 - 2007).

Editorial Board, *Transactions on Data Privacy*, Barcelona, Spain, 2008 (Founding) - present.

Editorial Board, *Journal of Privacy Technology*, Pittsburgh, PA, 2004 (Founding) - present.

Editorial board, *Knowledge and Information Systems*, Springer-Verlag, London, 2000 - 2014.

Editorial board, *IEEE Transactions on Knowledge and Data Engineering*, IEEE Computer Society, Los Alamitos, CA, 2003 - 2007. Survey editor, 2007 - 2011.

Editorial board, *Proceedings of the VLDB Endowment* (the journal of the VLDB conference), 2008 (Founding) - 2010.

Co-editor, *Statistical Analysis and Data Mining: The ASA Data Science Journal* 5(1) Special Issue: Best Papers of SDM'11.

Guest editor, *The Edge Data Mining Issue*, The MITRE Corporation, April 2000.

### Funding Review Panels

Proposal review panel, National Science Foundation Division of Information and Intelligent Systems, 1999, 2003, 2004, 2007, 2008, 2010, 2012.

Proposal review panel, Texas Higher Education Board, 1993.

### Conference and Workshop Leadership

Advisory board, Future of Privacy Forum workshop *Bridging Industry and Academia to Tackle Responsible Research and Privacy Practices*, November 2-3, 2017, New York.

Senior program committee, *The 19th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 11-14, 2013, Chicago, IL.

Program Committee vice-chair, *IEEE International Conference on Data Mining series (ICDM 2012)*, December 10-13, 2012, Brussels, Belgium. Also program committee of associated workshop *Privacy in Social Data*.

Co-organizer, Dagstuhl seminar *Mobility, Data Mining, and Privacy*, August 12-17, 2012, Dagstuhl, Germany.

Program Committee co-chair, *11th SIAM International Conference on Data Mining (SDM)*, April 28 - 30, 2011, Phoenix, AZ.

Senior program committee, *The 16th ACM SIGKDD International Conference on Knowledge Discovery*

and Data Mining, July 25 - 28, 2010, Washington, D.C.

Senior program committee, *The 15th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, June 28 - July 1, 2009, Paris, France.

Area chair for Privacy and Social Factors, *8th SIAM International Conference on Data Mining (SDM)*, April 24-26, 2008, Atlanta, GA.

General Co-Chair, *The Seventh IEEE International Conference on Data Mining*, October 28-31, 2007, Omaha, NE.

Senior program committee, *The 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 12-15, 2007, San Jose, CA.

Program Committee Co-Chair, *The Sixth IEEE International Conference on Data Mining*, December 18 - 22, 2006, Hong Kong.

Treasurer, *The Eleventh ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 21-24, 2005, Chicago, Illinois.

Program Committee Vice Chair, *The Third IEEE International Conference on Data Mining*, November 19 - 22, 2003, Melbourne, Florida, USA. Also co-organized associated workshop on *Privacy-Preserving Data Mining*.

Organizer and chair, workshop on “Privacy, Security, and Data Mining” held in conjunction with *The 2002 IEEE International Conference on Data Mining (ICDM '02)*.

Tutorials chair and member of program committee, *The 2001 IEEE International Conference on Data Mining (ICDM '01)*.

Local Arrangements Chair, Fourth International Conference on Foundations of Data Organization and Algorithms, October 13-15, 1993.

#### *Program Committees*

*The 18th Privacy Enhancing Technologies Symposium (PETS 2018)*, Barcelona, Spain, 2018.

*IJCAI 2017 Workshop: Abuse Preventive Data Mining 2017* held in conjunction with *The Twenty-sixth International Joint Conference on Artificial Intelligence (IJCAI-17)*, Melbourne, Australia, August 20, 2017.

*The 17th Privacy Enhancing Technologies Symposium (PETS 2017)*, Minneapolis, MN, July 18-21, 2017.

*IEEE/ACM International Workshop on Cybersecurity of Online Social Network* held in conjunction with *The IEEE/ACM International Conference on Social Networks Analysis and Mining (ASONAM 2012)*, Istanbul, Turkey, August 26, 2012.

*The 38th International Conference on Very Large Data Bases (VLDB 2012)*, August 2012, Istanbul.

*The 2012 ACM SIGMOD International Conference on Management of Data*, May 20-25, 2012, Scottsdale, Arizona.

*The 2011 International Workshop on Privacy Aspects of Data Mining* held in conjunction with *ICDM'11*, December 11, 2011, Vancouver, Canada.

*The 37th International Conference on Very Large Data Bases (VLDB 2011)*, August 2011, Seattle. (Inaugural year of pure journal-style review process.)

*The 19th ACM International Conference on Information and Knowledge Management (CIKM 2010)*, October 26 - 30, 2010, Toronto.

*European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML/PKDD 2010)*, September 20-24, 2010, Barcelona.

*ECML/PKDD Workshop on Privacy and Security Issues in Data Mining and Machine Learning (PSDML 2010)*, September 20-24, 2010, Barcelona.

*The 36th International Conference on Very Large Data Bases (VLDB 2010)*, September 13 - 17, 2010, Singapore.

*The 26th International Conference on Data Engineering (ICDE 2010)*, March 1-6, 2010, Long Beach, California.

*IEEE International Conference on Data Mining series (ICDM 2009)*, December 6-9, 2009, Miami, Florida.

*The 2009 International Workshop on Privacy Aspects of Data Mining* held in conjunction with ICDM'09, December 6, 2009, Miami, Florida.

*The 2009 IEEE International Conference on Information Privacy, Security, Risk and Trust*, August 29-13, Vancouver, Canada.

*The 23rd Annual IFIP WG 11.3 Working Conference on Data and Applications Security*, July 12-15, 2009, Montreal, Canada.

*International Workshop on Privacy-Preserving Data Analysis (PPDA)*, April 20, 2009, Brisbane, Australia.

*25th International Conference on Data Engineering*, March 29-April 4, 2009, Shanghai, China.

*The 2008 IEEE International Conference on Data Mining*, December 15-19, 2008, Pisa, Italy.

*3rd Workshop on Secure Knowledge Management*, November 3-4, 2008, Dallas, Texas.

*European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD 2008)*, September 15-19, 2008, Antwerp, Belgium.

*34th International Conference on Very Large Databases (VLDB'08)*, August 25-28, 2008, Auckland, New Zealand.

*2nd ACM SIGKDD International Workshop on Privacy, Security, and Trust in KDD (PinKDD'08)*, August 24-27, 2008, Las Vegas, Nevada.

*The 27th ACM SIGMOD International Conference on Management of Data*, June 9-12, 2008, Vancouver, Canada.

*The 24th International Conference on Data Engineering (ICDE 2008)*, April 7-12, 2008, Cancun, Mexico.

*18th International Conference on Database and Expert Systems Applications (DEXA '07)*, September 3-7, Regensburg, Germany.

*The 20th Annual IFIP WG 11.3 Working Conference on Data and Applications Security*, July 31-August 2, 2006, Sophia Antipolis, France.

*The 25th ACM SIGMOD International Conference on Management of Data*, June 26-29, 2006, Chicago, Illinois.

*The 22nd International Conference on Data Engineering (ICDE 2006)*, April 3-7, 2006, Atlanta, GA.

*The Fifth IEEE International Conference on Data Mining*, November 27-30, 2005, New Orleans, Louisiana.

*2005 SIAM International Conference on Data Mining*, April 21-23, 2005, Newport Beach, California, USA.

*International Workshop on Privacy Data Management* held in conjunction with *The 21st International Conference on Data Engineering (ICDE 2005)*, April 8-9, 2005, Tokyo, Japan.

*The Fourth IEEE International Conference on Data Mining*, November 1-4, 2004, Brighton, United Kingdom. Also served on program committee of the associated *Workshop on Privacy and Security Aspects of Data Mining* and *Workshop on Data Mining and the Grid*.

*The 8th European Conference on Principles and Practice of Knowledge Discovery in Databases (PKDD)*, September 20-24, 2004, Pisa, Italy. Also served on program committee of the associated workshop *International Workshop on Privacy and Security Issues in Data Mining*.

*The Tenth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 22-25, 2004, Seattle, Washington.

*2004 SIAM International Conference on Data Mining*, April 22-24, 2004, Lake Buena Vista, Florida, USA.

*The Ninth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 24-27, 2003, Washington, D.C. Also served on program committee for associated workshop *Data Cleaning, Record Linkage, and Object Consolidation*, and on panel *Privacy and Data Mining: Friends or Foes?*

*Workshop on Mining Data Across Multiple Customer Touchpoints for CRM* (in conjunction with PAKDD-02), May 6, 2002.

*Workshop on Data Mining for Security Applications* held in conjunction with the 8th ACM Conference on Computer Security, November 8, 2001.

The 2001 Symposium on Applications and the Internet (SAINT-2001).

Fifth IFCIS International Conference on Cooperative Information Systems (CoopIS'2000).

1999 IEEE Knowledge and Data Engineering Exchange Workshop (KDEX-99). Served on panel *Convergence of Technologies on the Web: the Case of Distributed Artificial Intelligence, Databases and Information Retrieval*, chaired session on *Data Mining*.

1999 IEEE Computer Systems and Applications Conference (COMPSAC-99).

ACM Digital Libraries Conference Workshop on Organizing Web Space (WOWS), August 14, 1999.

Planning committee, 1999 DARPA-sponsored workshop on novelty detection in documents.

1998 IEEE Knowledge and Data Engineering Exchange Workshop (KDEX-98).

Sixth International Workshop on Research Issues on Data Engineering: Interoperability of Nontraditional Database Systems. Chaired session on "Applications".

1995 International Conference on Distributed Computing Systems. Organized and chaired panel "Fee-for-Service in Distributed Systems: Research and Policy Issues".

Invited attendance, NSF Workshop on Hyperbase Systems, October 15-16, 1992, Washington DC.

#### *Awards and Honors*

2011 IEEE International Conference on Data Mining Outstanding Service Award.

Best Research Paper Award for "Using Safety Constraint for Transactional Dataset Anonymization", with Bechara Al Bouna and Qutaibah Malluhi, *The 27th IFIP WG 11.3 Conference on Data and Applications Security and Privacy (DBSEC'13)*, Newark, New Jersey, July 15-17, 2013.

Honorable Mention, Best Paper Competition, for "Privacy-Preserving K-Means Clustering over Vertically Partitioned Data", with Jaideep Vaidya, *The Ninth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, August 24 - 27, 2003, Washington, D.C.

Senior member, ACM and IEEE.