

Curriculum Vitae of Rudy Setiono

- **Contact information:**

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- **Education:**

PhD Computer Science, 1990, University of Wisconsin - Madison.
MSc Computer Science, 1986, University of Wisconsin - Madison.
BSc Computer Science, 1984, Eastern Michigan University.

- **Experience:**

- December 2001 - July 2005: Vice Dean, School of Computing, National University of Singapore.
- July 99 - present: Associate Professor, National University of Singapore.
- August 96 - May 99: Senior Lecturer, National University of Singapore.
- August 90 - August 96: Lecturer, National University of Singapore.
- August 86 - August 90: Research assistant, University of Wisconsin - Madison.
- July 86 - August 86: Lecturer, University of Wisconsin - Madison.
- September 85 - June 86: Teaching assistant, University of Wisconsin - Madison.

- **Research interests:**

- Linear and nonlinear optimization.
- Pattern recognition.
- Neural networks and their application.
- Hybrid symbolic and nonsymbolic methods for pattern classification.
- Rule extraction from neural networks.

- **Research Grants:**

- Principal investigator: Parallel algorithms on distributed computing environment (January 1994 - December 1995). Awarded by the National University of Singapore. Total amount: \$25,500.
- Co-investigator: A unified approach to data mining (January 1996 - January 1998). Awarded by the National University of Singapore. Total amount: \$44,422.
- Associate Director: Programme for Research into Intelligent Systems (June 1998 - December 2002). Awarded by the Ministry of Education and the National Science and Technology Board, Singapore. Total amount: \$2,912,000.

- Co-investigator: Data mining and intelligent data analysis (August 1998 - August 2001). Awarded by the the National Science and Technology Board, Singapore. Total amount: \$934,000.
- Co-investigator: Rigorous Design Methods and Tools for Intelligent Autonomous Agent Systems (November 2004 - October 2007), Awarded by the the Ministry of Education, Singapore. Total amount: \$605,000.

- **Professional activities:**

- Associate Editor: IEEE Transactions on Neural Networks, 2000-2005.
- Served as reviewer for the following journals
 - * AI Communications: The European Journal on Artificial Intelligence
 - * Artificial Intelligence in Medicine
 - * Bioinformatics
 - * Computer & Operations Research
 - * Decision Support Systems
 - * Ecology, Ecological Monographs, and Ecological Applications
 - * European Journal of Operational Research
 - * Expert Systems with Applications
 - * IEEE Computer
 - * IEEE Expert
 - * IEEE Transactions on Data and Knowledge Engineering
 - * IEEE Transactions on Evolutionary Computation
 - * IEEE Transactions on Fuzzy Systems
 - * IEEE Transactions on Systems, Man and Cybernetics
 - * IEEE Transactions on Neural Networks
 - * IEEE Transactions on Pattern Analysis and Machine Intelligence
 - * International Journal of Computer Research
 - * International Journal of Neural Systems
 - * International Journal of Systems Science
 - * Journal of Data Mining and Knowledge Discovery
 - * Knowledge and Information Systems: An International Journal
 - * Neurocomputing
 - * Neural Computation
 - * Neural Networks
 - * Neural Processing Letters
 - * Pattern Recognition
 - * SIAM Journal on Control and Optimization
 - * SIAM Journal on Optimization

and numerous international conferences.

- **Invited presentation:**

1. Data mining with neural networks, **Invited speaker**, CIMPA-India-UNESCO School: Soft computing approach to pattern recognition and image processing, Kolkata, India, December 2002.

2. Knowledge Discovery from Continuous Data Using Artificial Neural Networks **Invited Lecture**, the 2nd Euro-International Symposium on Computational Intelligence, Kosice, Slovakia, June 2002.
3. A hybrid connectionist system for multiple regression, **Invited Lecture**, the 6th International Conference on Neural Networks and Soft Computing, Zakopane, Poland, June 2002.
4. Techniques for extracting classification and regression rules from artificial neural networks, **Special Lecture**, World Congress on Computational Intelligence, WCCI 2002, Honolulu, Hawaii, May 2002.
5. Techniques for rule extraction from artificial neural networks. **Invited Speaker**, the 5th National Computer Science and Engineering Conference, Chiang Mai, Thailand, November 2001.
6. Techniques for extracting rules from artificial neural networks. **Plenary Lecture**, the 5th International Conference on Soft Computing and Information Systems, Iizuka, Japan, October 1998.

● **Journal publications:**

1. R. Setiono, S.L. Pan, M.H. Hsieh and A. Azcarraga. Knowledge acquisition and revision using neural networks: an application to a cross-national study of brand image perception, *Journal of the Operational Research Society*, Vol. 57, No. 3, pages 231-240, 2006.
2. A. Azcarraga, M.H. Hsieh, S.L. Pan and R. Setiono. Extracting salient dimensions for automatic SOM labeling, *IEEE Transactions on Systems, Man, and Cybernetics, Part C*, Vol. 35, No. 4, pages 595-600, 2005.
3. R. Setiono, S.L. Pan, M.H. Hsieh and A. Azcarraga. Separating core and non-core knowledge: An application of neural network rule extraction to a cross-national study of brand image perception, *IEEE Transactions on Systems, Man, and Cybernetics, Part C*, Vol. 35, No. 4, pages 465- 475, 2005.
4. R. Setiono, S.L. Pan, M.H. Hsieh and A. Azcarraga. Automatic knowledge extraction from survey data: learning M-of-N constructs using a hybrid approach, *Journal of the Operational Research Society*, Vol. 56, No. 1, pages 3-14, 2005.
5. W. Wu, X. Liu, M. Xu, J. Peng and R. Setiono. A hybrid SOM-SVM approach for the zebra fish genome analysis, *Genomics Proteomic & Bioinformatics*, Vol. 3, No. 2, pages 84-93, 2005.
6. M.H. Hsieh, S.L. Pan and R. Setiono. Product-, corporate-, and country-image dimensions and purchase behavior: A multicountry analysis, *Journal of the Academy of Marketing Science*, Vol. 32, No. 3, pages 251-270, 2004.
7. W. Duch, R. Setiono and J. Zurada. Computational intelligence methods for rule-based data understanding, *Proceedings of the IEEE*, Vol. 92, No. 5, pages 771-805, 2004.
8. R. Setiono and J. Thong. An approach to generate rules from neural networks for regression problems, *European Journal of Operational Research*, Vol. 155, no. 1, 2004, pages 239-250.
9. M. Xu and R. Setiono. Gene selection for cancer classification using a hybrid of univariate and multivariate feature selection methods, *Applied Genomics and Proteomics*, Vol. 2, No. 2, 2003, pages 79-91.
10. B. Baesens, R. Setiono, C. Mues and J. Vanthienen. Using neural network rule extraction and decision tables for credit risk evaluation, *Management Science*, Vol. 39, no. 2, 2003, pages 312-329.
11. Y. Hayashi and R. Setiono. Combining neural network predictions for medical diagnosis, *Computers in Biology and Medicine*, Vol. 32, 2002, pages 237-246.

12. R. Setiono and A. Azcarraga. Generating concise sets of linear regression rules from artificial neural networks, *International Journal on Artificial Intelligence Tools*, Vol. 11, No. 2, 2002, pages 189-202..
13. R. Setiono, W.K. Leow and J.M. Zurada. Extraction of rules from artificial neural networks for nonlinear regression, *IEEE Transactions on Neural Networks*, 2002, Vol. 13, No. 2, pages 564-577.
14. H. Lu and R. Setiono. Effective query size estimation using neural networks, *Journal of Applied Intelligence*, 2002, Vol. 16, pages 173-183.
15. R. Setiono. Feedforward neural network construction using cross-validation, *Neural Computation*, 2001, Vol. 13, pages 2865-2877.
16. Y. Hayashi and R. Setiono. Learning M-of-N concepts for medical diagnosis using neural networks, *Journal of Advanced Computational Intelligence*, 2000, Vol. 4, No. 4, pages 294-301.
17. Y. Hayashi, R. Setiono and K. Yoshida. A comparison between two neural network rule extraction techniques for the diagnosis of hepatobiliary disorders, *Artificial Intelligence in Medicine*, 2000, Vol. 20, pages 205-216.
18. R. Setiono. Extracting M-of-N rules from trained neural networks. *IEEE Transactions on Neural Networks*, 2000, Vol. 11, No. 2, pages 512-519.
19. R. Setiono. Generating concise and accurate classification rules for breast cancer diagnosis, *Artificial Intelligence in Medicine*, 2000, Vol 18, No. 3, pages 205-219.
20. W.K Leow and R. Setiono. FERNN: An algorithm for Fast Extraction of Rules from Neural Networks. *Applied Intelligence*, 2000, Vol. 12, No. 1/2, pages 15-25.
21. R. Setiono and W.K. Leow, On mapping decision trees and neural networks, *Knowledge Based Systems*, 1999, Vol. 12, No. 3, pages 95-99.
22. R. Setiono and H. Liu. A connectionist approach to generating oblique decision trees. *IEEE Transactions on Systems, Man, and Cybernetics*, 1999, Vol. 29, No. 3, pages 440-444.
23. W.K. Leow and R. Setiono. Explanation of the "virtual input" phenomenon, *Neural Networks*, 1999, Vol. 12, pages 191-192 (Letter to the Editor).
24. H. Liu and R. Setiono. Some issues on scalable feature selection. *Expert Systems with Application*, 1999, Vol. 15, pages 333-339.
25. H. Liu and R. Setiono. Incremental feature selection. *Journal of Applied Intelligence*, 1998, Vol. 9, No. 3, pages 217-230.
26. R. Setiono, J.Y.L. Thong and C. Yap. Symbolic rule extraction from neural networks: An application to identifying organizations adopting IT. *Information and Management*, Vol. 34, No. 2, August 1998, pages 91-101.
27. R. Setiono and H. Liu. NeuroLinear: from neural networks to oblique decision rules. *Neurocomputing*, Vol. 17, No. 1, September 1997, pages 1-24.
28. R. Setiono and H. Liu. Analysis of hidden representations by greedy clustering. *Connection Science*, Vol. 10, No. 1, 1998, pages 21-42.
29. R. Setiono. On the solution of the parity problem by a single hidden layer feedforward neural network, *Neurocomputing*, Vol. 16, No. 3, September 1997, pages 225-235.
30. H. Liu and R. Setiono. Feature selection via discretization of numeric attributes. *IEEE Transactions on Knowledge and Data Engineering*, Vol. 9, No. 4, July/August 1997, pages 642-645.

31. R. Setiono and H. Liu. Neural-network feature selector. *IEEE Transactions on Neural Networks*, Vol. 8, No. 3, May 1997, pages 654-662.
32. R. Setiono. Extracting rules from neural networks by pruning and hidden-unit splitting. *Neural Computation*, Vol. 9, No. 1, January 1997, pages 205-225.
33. R. Setiono. A penalty-function approach for pruning feedforward neural networks. *Neural Computation*, Vol. 9, No. 1, January 1997, pages 185-204.
34. H. Lu, R. Setiono and H. Liu. Effective data mining using neural networks. *IEEE Transactions on Knowledge and Data Engineering*, Vol. 8, No. 6, December 1996, pages 957-961.
35. R. Setiono and H. Liu. Improving backpropagation learning with feature selection. *Journal of Applied Intelligence*, Vol. 6, No. 2, April 1996, pages 129-140.
36. R. Setiono and H. Liu. Symbolic representation of neural networks. *IEEE Computer*, Vol. 29, No. 3, March 1996, pages 71-77.
37. H. Liu and R. Setiono. Dimensionality reduction via discretization. *Knowledge Based Systems*, Vol. 9, No. 1, February 1996, pages 67-72.
38. R. Setiono. Extracting rules from pruned neural networks for breast cancer diagnosis. *Artificial Intelligence in Medicine*, Vol. 8, No. 1, February 1996, pages 37-51.
39. Y. Gao and R. Setiono. Design of a feedforward neural network construction algorithm and its implementation on scalable parallel machine. *Journal of Japanese Society of Artificial Intelligence*, Vol. 10, No. 4, July 1995, pages 580-589.
40. R. Setiono. A neural network construction algorithm which maximizes the likelihood function. *Connection Science*, Vol. 7, No. 2, 1995, pages 147-166.
41. R. Setiono and L.C.K. Hui. Use of quasi-Newton method in a feedforward neural network construction algorithm. *IEEE Transactions on Neural Networks*, Vol. 6, No. 1, 1995, pages 273-277.
42. S.L. Chung and R. Setiono. Efficient neural network training on a Cray Y-MP. *International Journal of High Speed Computing*, Vol. 7, No. 1, 1995, pages 109-124.
43. R. Setiono and G. Lu. A neural network construction algorithm with application to image compression. *Neural Computing & Applications*, Vol. 2, No. 2, 1994, pages 61-68.
44. R. Setiono. Interior dual proximal point algorithm for linear programs. *European Journal of Operational Research*, Vol. 77, 1994, pages 96-110.
45. R. Setiono. Interior dual least 2-norm algorithm for linear programs. *SIAM Journal on Control and Optimization*, Vol. 31, No. 4, 1993, pages 875-899.
46. R. Setiono. Interior dual proximal point algorithm using preconditioned conjugate gradient. *Optimization*, Vol. 24, 1992, pages 63-73.
47. R. Setiono. Interior proximal point algorithm for linear programs. *Journal of Optimization Theory and Application*, Vol. 74, No. 3, 1992, pages 425-444.

- **Recent conference publications:**

1. K. Odajima, Y. Hayashi and R. Setiono. Greedy rule generation from discrete data and its use in neural network rule extratcion. In *Proceedings of IJCNN 2006, International Joint Conference on Neural Networks*, Vancouver, Canada, July 2006, pages 3499-3505.
2. T. Huynh and R. Setiono. Effective neural network pruning using cross-validation. In *Proceedings of IJCNN 2005, International Joint Conference on Neural Networks*, Montreal, Canada, July-August 2005, pages 972-977.

3. A. Azcarraga, M.H. Hsieh and R. Setiono. Car market segmentation using SOM and decision trees. In Proceedings of the 8th International Conference of DSI, Barcelona, Spain, July 2005, pages 457-465.
4. V. Tam, R. Setiono and A. Santoso. Applying the conjugate gradient method for text document categorization. In Proceedings of the ICPR 2004, the 17th International Conference on Pattern Recognition, Cambridge, UK, August 2004.
5. W. Wu, X. Liu, M. Xu, J. Peng and R. Setiono. A hybrid SOM-SVM method for analyzing zebra fish gene expression. In Proceedings of the ICPR 2004, the 17th International Conference on Pattern Recognition, Cambridge, UK, August 2004.
6. A. Azcarraga, M. Hsieh, S.L. Pan and R. Setiono. Knowledge acquisition and revision using neural networks. In Proceedings of IJCNN 2004, International Joint Conference on Neural Networks, Budapest, Hungary, July 2004, pages 1365-1370.
7. A. Azcarraga, M. Hsieh and R. Setiono. Visualizing globalization: A SOM approach to customer profiling. In Proceedings of ICIS 2003, International Conference on Information Systems, Seattle, USA, December 2003.
8. B. Baesens, C. Moes, M. Backer, J. Vanthienen, and R. Setiono. Building intelligent credit scoring systems using decision tables. In Proceedings of ICEIS 2003, International Conference on Enterprise Information Systems, Angers, France, April 2003.
9. V. Tam, A. Santoso and R. Setiono. A comparative study of centroid-based, neighborhood-based and statistical approaches for effective document categorization. In Proceedings of the 16th International Conference on Pattern Recognition, ICPR 2002, Vol. 4 Quebec, Canada, August 2002, pages 235-238.
10. B. Baesens, R. Setiono, C. Moes, S. Viane and J. Vanthienen. Building credit scoring expert systems using neural network rule extraction and decision tables. In Proceedings of ICIS 2001, International Conference on Information Systems, New Orleans, USA.
11. A. Gaweda, J. Zurada and R. Setiono. Input selection in data-driven fuzzy modeling. In Proceedings of 2001 IEEE International Fuzzy Systems Conference, Melbourne, Australia.
12. R. Setiono and A. Azcarraga. An effective method for generating multiple linear regression rules from artificial neural networks. In Proceedings of the 13th International Conference on Tools with Artificial Intelligence, Dallas, Texas, 2001, pages 159-166.
13. R. Setiono. Generating linear regression rules from neural networks using local least squares approximation. In Connectionist Models of Neurons, Learning Processes, and Artificial Intelligence, Proceedings of 6th International Work-Conference on Artificial Neural Networks, IWANN 2001, Granada, Spain, June 12 - 15, 2001, pages 277-284.
14. R. Setiono, W.K. Leow and J.Y-L. Thong. Opening the neural network blackbox: An algorithm for extracting rules from function approximating neural networks. In Proceedings of ICIS 2000, International Conference on Information Systems, Brisbane, Australia, December 10 - 13, 2000.
15. R. Setiono and W.K. Leow. Pruned neural networks for regression. In Proceedings of PRICAI 2000, 6th Pacific Rim International Conference on Artificial Intelligence, Melbourne, Australia, August 28 - September 1, 2000, pages 500-509.
16. R. Setiono and A. Gaweda. Neural network pruning for function approximation. In Proceedings of International Joint Conference on Neural Networks, Como, Italy, July 2000.
17. Y. Hayashi, R. Setiono and K. Yoshida. Diagnosis of hepatobiliary disorders using rules extracted from artificial neural networks. In Proceedings of 1999 IEEE International Fuzzy Systems Conference, Seoul, Korea, August 1999, pages I-344 - I-348.

18. W.K. Leow and R. Setiono. Generating rules from trained network using fast pruning. In Proceedings of International Joint Conference on Neural Networks, Washington D.C. July 1999, pages 4095-4098.
19. H. Liu and R. Setiono. Feature transformation and multivariate decision tree induction. In Proceedings of the 1st International Conference on Discovery Science, Fukuoka, Japan, December 1998.
20. R. Setiono and H. Liu. Fragmentation problem and automated feature construction. In Proceedings of the 10th IEEE International Conference on Tools with Artificial Intelligence, Taipei, Taiwan, November 1998, pages 208-215.
21. R. Setiono. Techniques for extracting rules from artificial neural networks. Plenary Lecture presented at the 5th International Conference on Soft Computing and Information Systems Iizuka, Japan, October 1998.
22. H. Liu and R. Setiono. Scalable feature Selection for large sized databases In Proceedings of 4th World Congress on Expert Systems Mexico City, Mexico, March 1998, pages 521-528.
23. R. Setiono. Generating piece-wise linear classifier using neural networks and its applications to bankruptcy prediction. In Proceedings of the 4th International Meeting Decision Sciences Institute, Sydney, Australia, July 1997, pages 762-764.
24. R. Setiono and H. Liu. An analysis of internal representations by greedy clustering. ECML'97 - Poster Papers, Prague, Czech Republic, April 1997, pages 98-107.
25. R. Setiono and H. Liu. NeuroLinear: A system for extracting oblique decision rules from neural networks. In Machine Learning: ECML-97, 9th European Conference on Machine Learning, Lecture Notes in Artificial Intelligence: Vol. 1224 Springer, Prague, Czech Republic, April 1997, pages 221-233.
26. H. Liu and R. Setiono. A probabilistic approach to feature selection - a filter solution. In Machine Learning, Proc. of the 13th International Conference, Bari, Italy, July 1996, pages 319-327.
27. H. Liu and R. Setiono. Feature selection and classification - a probabilistic wrapper approach. In Proc. 9th International Conference on Industrial & Engineering Applications of AI and Expert Systems, Fukuoka, Japan, June 1996, pages 419-424.
28. H. Liu and R. Setiono. Chi2: Feature selection and discretization of numeric attributes. In Proceedings of the 7th International Conference on Tools with Artificial Intelligence, Washington D.C., November 1995, pages 388-391.
29. H. Lu, R. Setiono, and H. Liu. NeuroRule: a connectionist approach to data mining. In Proceedings of 21st International Conference on Very Large Data Bases, Zurich, Switzerland, September 1995, pages 478-489.
30. R. Setiono, and H. Liu. Understanding neural networks via rule extraction. In Proceedings of the 14th International Joint Conference on Artificial Intelligence, Montreal, Canada, August 1995, pages 480-485.

- **Book chapters**

1. C. Mues, B. Baesens, R. Setiono and J. Vanthienen. From Knowledge Discovery to Implementation: A Business Intelligence Approach Using Neural Network Rule Extraction and Decision Tables. In Professional Knowledge Management: Third Biennial Conference, WM 2005, Kaiserlautern, Germany, April 10-13, 2005, Revised Selected Papers. (K. Althoff, A. Dengel,

- R. Bergmann, M. Nick and T. Roth-Berghofer, Eds.), pages 483 - 495, Springer-Verlag, GmbH, 2005.
2. R. Setiono and J. Zurada. Knowledge Discovery from Continuous Data Using Artificial Neural Networks. In *Machine Intelligence: Quo Vadis?* (P. Sincak, J. Vascak and K. Hirota, Eds.), pages 217 - 232, World Scientific, 2004.
 3. B. Baesens, C. Mues, R. Setiono, M. De Backer and J. Vanthienen. Building Intelligent Credit Scoring Systems using Decision Tables. In *Enterprise Information Systems V* (O. Camp, J.B. Filipe, S. Hammoudi and M.G. Piattini, Eds.), Kluwer, 2003.
 4. R. Setiono and J.M. Zurada. A hybrid connectionist system for multiple regression. In *Advances in Soft Computing Neural Networks and Soft Computing* (L. Rutkowski and J. Kacprzyk, Eds.), pages 87 - 94, Physica-Verlag, 2002.
 5. R. Setiono. Techniques for Extracting Classification and Regression Rules from Artificial Neural Networks. In *Computational Intelligence: The Experts Speak* (D.B. Fogel and C. Robinson, Eds.), pages 99 - 113, IEEE and John Wiley and Sons, 2002.
 6. B. Baesens, R. Setiono, C. Mues, S. Viaene and J. Vanthienen. Building Intelligent Credit-Risk Evaluation Systems using Neural Network Rule Extraction and Decision Tables. In *New Directions in Software Engineering* (J. Vandenbuckle and M. Snoeck, Eds.), pages 121 - 133, Leuven University Press, 2001.
 7. R. Setiono, J. Y. L. Thong and C.S. Yap. Extracting Rules Concerning Market Segmentation from Artificial Neural Networks. In *Business Applications of Neural Networks* (P.J.G. Lisboa, A. Vellido and B. Edisburry, Eds.), World Scientific Publishing Company, 2000.
 8. R. Setiono and H. Liu. Feature Extraction via Neural Networks. In *Feature Extraction, Construction and Selection: A Data Mining Perspective* (H. Motoda and H. Liu, Eds.), pages 191 - 204, Kluwer Academic Publishers, 1998.
 9. R. Setiono. Image Processing and Pattern Recognition: Algorithmic Techniques and Their Applications. In *Neural Network Systems Techniques and Applications* (C.T. Leondes, Ed.) Vol. 5, pages 287-319, Academic Press, 1998.
 10. O.L. Mangasarian, R. Setiono and W.H. Wolberg. Pattern Recognition via Linear Programming: Theory and Application to Medical Diagnosis. In *Large-Scale Numerical Optimization* (T.F. Coleman and Y. Li, Eds.) Chapter 2, pages 22-31, SIAM, 1989.