

References

- [1] Chun, R.K. and McNamee, L.P., "Immunization of Neural Networks Against Hardware Fault," *Proc. of IEEE International Symposium on Circuits and Systems*, pp.714-718, 1990.
- [2] Chen, C.-H., Chu, L.-C., and Saab, D.G., "Reconfigurable Fault Tolerant Neural Networks," *International Joint Conference on Neural Networks*, Vol. 2, pp. 547-552, 1992.
- [3] Tan, C.H. and Iyer, R.K., "Fault Characterization of a Multi-layered Perceptron Network," *Proc. IEEE/AIAA/NASA 9th Digital Avionics Systems Conference*, pp.513-18, 1990.
- [4] Bolt, G., "Fault Models for Artificial Neural Networks", *1991 IEEE International Joint Conference on Neural Networks*, Vol. 2, pp. 1373-1378, 1991.
- [5] Feltham, D. and Maly, W., "Physically Realistic Fault Models for Analog CMOS Neural Networks," *IEEE Journal of Solid-State Circuits*, vol.26, no. 9, September 1991.
- [6] Neti, C., Schneider, M.H., and Young, D., " Maximally Fault Tolerant Neural Networks," *IEEE Trans. on Neural Networks*, Vol. 3,no.1, pp.14-22, 1992.
- [7] Hsieh, W.S. and Sher, B.Y., "Fault Tolerant Capability of Multi-Layer Perceptron Neural Networks," *Proceedings of The 20'th EUROMICRO Conference EUROMICRO94, System Architecture and Integration*, pp.644-650, 1994.
- [8] Ito, T. and Takanami, I, "On Fault Injection Approaches for Fault Tolerance of Feedforward Neural Networks," *Proceedings of The Sixth Asian Test Symposium*, pp.88-93, 1997.
- [9] Arad, B.S. and El-Amawy, A., "On Fault Tolerant Training of Feedforward Neural Networks," *Neural Networks*, Vol.10, No.3, pp.539-553, 1997.

- [10] Emmerson, M.D., Damper, R.I., Hey, A.J.G., and Upstill, C., "Fault Tolerance and Redundancy of Neural Nets for The Classification of Acoustic Data," *The 1991 International Conference on Accoustics, Speech and Signal Processing*, Vol.2, pp. 1053-1056, 1991.
- [11] Lursinsap, C. and Tanprasert, T., "Fault Immunization Technique for Artificial Neural Networks," *Proc. of IEEE International Conference on Neural Networks*, pp.302-307, June 1997.
- [12] Hertz, J., Krogh, A., and Palmer, R.G., *Introduction to the Theory of Neural Computation*, Addison-Wesley Publishing Company, 1991.
- [13] Kritayakirana, K., *Robustness of the Backpropagation Algorithm*, Ph. D. Dissertation, Electrical Engineering, Stanford University 1997.
- [14] Cybenko, G. "Approximation by Superposition of a Sigmoid Function," *Mathematics of Control, Signals and Systems*, Vol. 2, No. 4, pp. 303-314, 1989.
- [15] Rumelhart, D.E., Hinton, G.E., and Williams, R.J., "Learning Internal Representations by Error Propagation," *in Parallel Distributed Processing*, The MIT Press, 1986.
- [16] Rumelhart, D.E., Durbin, R., Golden, R., and Chauvin, Y., "Backpropagation: The Basic Theory," Ch.15 in *Mathematical Perspectives on Neural Networks*. Lawrence Erlbaum Associates. Mahwah, NJ. 1996.
- [17] Haykin, S., *Neural Networks: A Comprehensive Foundation*, IEEE Press. 1994.
- [18] Heskes, T. and Wiegenrinck, W., "A Theoretical Comparison of Batch-Mode, On-Line, Cyclic, and Almost-Cyclic Learning," *IEEE Trans. on Neural Networks*, Vol. 7, No. 4, pp. 919-925, 1996.
- [19] Matyas, J., "Random Optimization," *Automation and Remote Control*, Vol. 26, pp.243-253, 1965.
- [20] Solis, D.E. and Wets, J.B., "Minimization by Random Search Techniques," *Mathematics of Operations Research*, Vol.6, pp.19-30, 1981.
- [21] Baba, N., "A New Approach for finding the global minimum of error function of neural networks," *Neural Networks*, Vol.2, pp.367-373.1989.

- [22] Baba, N., Mogami, Y., Koszaki, M., Shiraishi, Y., and Yoshida, Y., "A Hybrid Algorithm for Finding the Global Minimum of Error Function of Neural Networks and Its Application," *Neural Networks*, Vol 7(8), pp.1253-1265, 1994.
- [23] Lee, M.A. and Esbensen, H., "Evolutionary Algorithms Based Multi-Objective Optimization Techniques for Intelligent Systems Design," *Proc. of NAFIPS'96*, pp.360-364, 1996.
- [24] Sun, J., Grosky, W.I., and Hassoun, M.H., "A Fast Algorithm for Finding Global Minimal of Error Functions in Layered Neural Networks," *International Joint Conference on Neural Networks*, Vol.1, pp.715-20, 1990.
- [25] Tanprasert, T., Tanprasert, C., and Lursinsap, C., "Contour Preserving Classification for Maximal Reliability," *IEEE World Congress on Computation Intelligence, The 1998 IEEE International Joint Conference on Neural Networks Proceedings*, Vol. 2, pp. 1125-1130, May 4-9, 1998.
- [26] Alippi, C., Piuri, V. and Sami, M., "Sensitivity to Errors in Artificial Neural Networks: A Behavioral Approach," *IEEE Trans. on Circuits and Systems I*, Vol. 42, No. 6, pp. 358-361, 1995.
- [27] Sunat, K., Lursinsap, C., "Learning Algorithm for Global Fault Immunization of Supervised ANN", *The 1998 IEEE Asia-Pacific Conference on Circuits and Systems*, Thailand, pp. 655-658, 24-27 Nov. 1998.
- [28] Sunat, K., Lursinsap, C., "Generalization of Global Fault Immunization of Supervised ANN," *in progress*.

Appendix

A. Data set and the boundary vectors of the AND problem [11].

The data set consists of four input vectors with their targets, which are $(0,0,0)$, $(1,0,0)$ and $(1,1,1)$, and $(0,1,0)$. The first two elements are input elements while the last element is the target. The boundary vector pairs are $(1,1)$ and $(1,0)$, and $(1,1)$ and $(0,1)$.

B. Data set and the boundary vectors of the Zigzag problem [11].

The data set consists of four input vectors with their targets, which are $(0.02,0.06,0)$, $(0.04,0.07,0)$, $(0.05,0.05,0)$, $(0.07,0.05,0)$, $(0.08,0.04,0)$, $(0.06,0.09,1)$, $(0.07,0.07,1)$, $(0.08,0.09,1)$, $(0.09,0.09,1)$, $(0.1,0.05,1)$, and $(0.11,0.06,1)$. The boundary vectors in class A are $(0.07,0.07)$ and $(0.1,0.005)$. The boundary vectors in class B are $(0.04,0.07)$ and $(0.07,0.05)$.

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Curriculum Vitae



Mr. Khamron sunat was born in November 2, 1965. He received a bachelor degree in Chemical Engineering from the Department of Chemical Technology, Faculty of Science Chulalongkorn University in 1990. Now, he is a lecturer at the Department of Computer Engineering, Faculty of Engineering at Mahanakorn University of Technology, Bangkok.

Publications

1. Srisuk, S., Sunat, K., and Kurutach, W., "Face Detection Using Eigen Face and Correlation Analysis", *Engineering Transactions, Mahanakorn University of Technology*, Vol. 2, No. 1, pp.78-84, 1999. (Thai)
2. Srisuk, S., Sunat, K., and Kurutach, W., "Data Dimension Reduction for Face Recognition Using PCA", *21th Electrical Engineering Conference (EECON-21)*, Bangkok, Thailand, pp. 194-197, 1998. (Thai)
3. Sunat, K. and Lursinsap, C., "Learning Algorithm for Global Fault Immunization of Supervised ANN", *The 1998 IEEE Asia-Pacific Conference on Circuits and Systems*, Thailand, pp. 655-658, 1998.
4. Sunat, K. and Lursinsap, C., "Global Fault Tolerance Immunization for Supervised Artificial Neural Networks", *International ICSC/IFAC Symposium on Neural Computation NC'98*, Austria, pp.577-581, 1998.
5. Somboonkeaw, A., Chevasuvit, F., Manasrungsri, W., Kurutach, W., Sunat, K., and Vongkarn, S., "Face Recognition using Neural Network and Vector Quantization", *20th Electrical Engineering Conference (EECON-20)*, Bangkok, Thailand, pp. 126-131, 1997. (Thai)
6. Somboonkeaw, A., Chevasuvit, F., Kurutach, W., Sunat, K., and Hinsamoot, N., "Object Recognition using Neural Network and Fourier Descriptor", *20th Electrical Engineering Conference (EECON-20)*, Bangkok, Thailand, pp. 132-136, 1997. (Thai)