類神經網路架構應用於雷達多目標追蹤系統之研究

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摘 要

隨著科技的發展，雷達多目標追蹤系統不論在軍事國防或民用航空方面，成為廣泛研究的議題。為了因應日益複雜的追蹤環境，提昇追蹤系統之效能極為迫切需要。資料相關結合在多目標追蹤系統中是最重要的技術法則。因為在追蹤多目標物時，資料相關結合可以發現雷達量測值與軌跡間的關聯性；而錯誤的資料結合會導致目標軌跡合成錯誤，無法持續追蹤。本論文提出一新的追蹤演算法，即應用競爭型類神經網路(Competitive Hopfield Neural Network)之運算架構於雷達目標追蹤系統，此運算將可有效且最佳化地決定雷達感測資料與目標軌跡間的關係，進而準確估算目標物目前的位置及其他資訊。同時應用卡門濾波器估測系統，以獲取最佳估測；系統中加入了適應性程序追蹤架構，更可以成功地解決目標發生變速度(Maneuvering)的問題，進而降低追蹤的誤差及錯誤率。 經模擬驗證結果，本論文提出之競爭型類神經網路追蹤法則能有效應用於多目標追蹤系統並解決資料相關結合與目標追蹤之問題，提昇追蹤系統與資料相關結合的精確性。

關鍵詞 : 資料相關結合 ; 競爭型Hopfield類神經網路 ; 適應性程序

目錄

參考文獻

1. Y. Bar-Shalom and T.E Fortmann, "Tracking Data and Association," Mathematics in Science and Engineering, Vol.179, 1988. 2. K.C. Chang, C.Y. Chong, and Y. Bar-Shalom, "Joint Probabilistic Data and Association Distributed Sensor Networks," IEEE Trans. Auto-ma. Contr., Vol.AC-31, pp.889-897, Oct. 1986. 3. Y. Bar-Shalom and T. Edision, "Sonar Tracking of Multiple Targets Using Joint Probabilistic Data Association," IEEE Journal of Oceaning Engineering, Vol. OE-8, No.3, July. 1983. 4. Y. Bar-Shalom and T.E. Fortmann, "Tracking and Data Association," Academic Press, INC. 1989. 5. Blackman, S. S., "Multiple Taget Tracking with Radar Applications", Artech House, Dedham, Ma., 1986. 6. Y.N. Chung, D.L. Gustafson, and E. Emre, "Extended Solution to Multiple Maneuvering Target Tracking," IEEE Trans. Aerosp. Electron. Syst., Vol. AES-25, pp.876-887, 1990. 7. E. Emre and J. Seo, "A Unifying Approach to Multi-Target Tracking," IEEE Trans. Aerosp. Electron. Syst., Vol.AES-25, pp.520-528, 1989. 8. Y.N. Chung and M.T. Lin, "A Multi-Target Tracking Algorithm Using Variable Sampling

Rate," J. of Control., Vol.3, No.1, pp.33-41, 1995. 9. P.D. Hanlon and P.S. Maybeck, "Interrelation Ship of Single-Filter and Multiple-Model Adaptive Algorithms," IEEE Trans. Aerosp. Electron. Syst., Vol. AES-34, pp.934-946, 1998. 10. E. Mazor, J. Dayan, A. Averbuch, and Y. Bar-Shalom, "Interacting Multiple Model Methods in Target Tracking: A Survey," IEEE Trans. Aerosp. Electron. Syst., Vol. AES-34, pp.103-124, 1998. 11. H. Lee and I.J. Tahk, "Generalized Input-Estimation Technique for Tracking Maneuvering Targets," IEEE Trans. Aerosp. Electron. Syst., Vol.AES-35, pp.1388-1403, 1999. 12. K.A. Fisher and P.S. Maybeck, "Multiple Adaptive Estimation with Filter Spawning," IEEE Trans. Aerosp. Electron. Syst., Vol.38, No.3, pp.755-768, 2002. 13. N. Okello and B. Ristic, "Maximum Likelihood Registration for Multiple Dissimilar Sensors," IEEE Trans. Aerosp. Electron. Syst., Vol.39, No.3, pp.1074-1083, 2003. 14. Blackman, and S. S, "Multiple hypothesis tracking for multiple target tracking," IEEE Aerosp. Electron. Syst., Vol.19, pp.5-18, Jan 2004. 15. Hue, C.; Le Cadre, J.-P.; Perez, P.; "Sequential Monte Carlo methods for multiple target tracking and data fusion" IEEE Trans. on Vol.50, pp.309-325, Feb. 2002. 16. D. Sengupta and R. A. Iltis, "Neural solution to the multitarget tracking data association problem", IEEE Trans. Aerosp. Electron. Syst., 25, pp.86-108, 1989. 17. B. Zhou and N.K. Bose, "A comprehensive analysis of neural solution to the multi target tracking data association problem", IEEE Trans. Aerosp. Electron. Syst., 29, pp.260-263, 1993. 18. L. Chin, "Application of neural networks in target tracking data fusion", IEEE Trans. Aerosp. Electron. Syst., 30, pp.281-287, 1994. 19. P.C. Chung, C.T. Tsai, E.L. Chen and Y.N. Sun, "Polygonal Approximation Using A Competitive Hopfield Neural Network," Pattern Recognition, Vol.27, No.11, pp.1505-1512, 1994. 20. Chuan-Yu Chang and Pau-Choo Chung, "Medical Image Segmentation Using a Contextual-Constraint Based Hopfield Neural Cube," Image and Vision Computing, Vol. 19, pp.669-678, 2001. 21. Pau-Choo Chung, Ching-Tsorng, Tsai, E-Ling Chen, and Yung-Nien Sun, "Polygonal Approximation Using A Competitive Hopfield Neural Network" Patten Recognition, Vol.27, No.11, pp.1505-1215, 1994. 22. H. K. Kwan and C. K. Lee, "A neural network approach to pulse radar detection," IEEE Trans. Aerosp. Electron. Syst., vol. AES-29, pp. 9-21, Jan. 1993. 23. M. K. Sundareshan and F. Amoozegar, "Neural network fusion capabilities for efficient implementation of tracking algorithms," Opt. Eng., vol. 36, no.3, pp. 692-707, Mar. 1997. 24. F. Amoozegar, "Neural-network-based target tracking state-of-the-art survey," Opt. Eng., vol. 37, no. 3, pp. 836-846, Mar. 1998. 25. Cortina, E., and Otero, D., "Maneuvering Target Tracking Using Extended Kalman Filter," IEEE Trans. Aerospace and Electronic Systems, vol. AES-27, pp.155-158, Jan. 1991. 26. Y. Bar-Shalom, K. Birmiwal, "Variable Dimension Filter for Maneuvering Target Tracking," IEEE Trans. Aerosp. Electron. Syst., vol. AES-18, no. 5, pp. 621-629, Sep. 1982. 27. C. B. Chang and J. A. Tabackzynski, "Application of State Estimation to Target Tracking," IEEE Trans. Automatic Control, vol. AC-29, no. 2, pp. 98-109, Feb. 1984. 28. M. Efe and D. P. Atherton, "Maneuvering target tracking with an adaptive Kalman filter," in Proc. 37th IEEE Conf. Decision Contr., Tampa, FL, Dec. pp. 737-742, 1998. 29. T. Tao, "A neural decision estimator for maneuvering targets," in Proc. IEEE Int. Conf. Neural Networks (ICNN ' 94), pp. 3926-3931, 1994. 30. S. Blackman and R. Popoli, "Design and Analysis of Modern Tracking System," Artech House, 1999. 31. F. L. Luo and R. Unbehauen, "Applied Neural Networks for Signal Processing," Peninsula Publishing, 1985. 32. Bar-Shalom Y., and Li, X., "Multi-target multi-sensor tracking: principle and techniques," Storrs, CT: YBS publishing, 1995. 33. M. I. Skolnik, "Introduction to Radar Systems," McGraw-Hill, 1980. 34. D. K. Barton and S. A. Leonov, "Radar Technology Encyclopedia," Artech House, 1997. 35. J. L. Eaves and E. K. Reedy, "Principles of Modern Radar," Van Nostrand Reinhold, 1987. 36. "Neural Networks Algorithms, Applications, and Programming Techniques" James A. Freman/David M. Skapora. Addison Wiley. 37. "Neural Network Design" Matin T.hagan, Howard B.Demuth, Mark Beale THOMSON. 38. Hovanessian, S. A., "Radar System Design and Analysis," Artech House, Inc. 1984. 39. S. Haykin, "Adaptive Filter Theory," Prentice-Hall Inc. 1991. 40. Byron, Eddle., "Radar Principles, Technology, Applications," Prentice-Hall Inc. 1993. 41. A.Farine, and F. A. Studer, "Radar Data Processing", Research Studies Press Ltd. 1985. 42. B.D.O. Anderson, and J.B. Moore, "Optimal Filtering", Prentice Hall Inc. 1979.