Abstract

This paper considers decision making for fuzzy investments. A proposed client asset allocation model based on Mamdani FIS. The major aim of building such model is to help advising clients how to allocate portions of their investments in three types of assets, saving account, investment certificate and investment fund. The investment advisory models are applied with the goal of maximizing the expected return under two constraints, client’s risk and age. The investment decisions can be undertaken when the aggregated if-then rules are applied in Mamdani FIS. A comparison between using different types and number of membership functions is outlined. The types of membership functions used are triangular MF, Trapizodial MF and mixing between both triangular an trapizodial MF. It was found that using the MFs of the same kind triangular MF only or trapezoidal MF only give better expected returns than mixed MFs. The work is accompanied by an illustrative case study that show the validity of the approach, followed by some recommendations for future research area.

References
1. Bajtelsmit, V., and Derhei, V., 1997. Why do women invest differently than men?, pp.1-10
2. Bojadziev G. and Bojadziev M., 2007. Fuzzy logic for business, finance, and management, Ed. 2, World Scientific Publishing Co. Pte. Ltd. ISBN-13 978-981-270-649-2, ISBN-10 981-270-649-6
3. Brighton, H., 2008. Introducing artificial intelligence, Totem Books. Published on Amazon.com
4. Buckley, P.A., 1987. Epilogue and prologue: Past and future research in avian genetics. In Avian genetics: apopulation and ecological approach. Eduted by F. Cooke and P.A. Buckley. Academic Press, Orlando, Fla. Pp. 453-475
5. Chen, B., Liu, X., Liu, K., Shi, P., and Lin, C., 2010. Direct adaptive fuzzy control for nonlinear systems with time-varying delays, Information Sciences, Vol. 180, pp. 776-792
6. Chevalier, J.A. and Ellison, G.D., 1995. Risk taking by mutual funds as a response to incentives, NBER working paper No. 5234,
7. Dubois, D. and Prade, H., 1978. Operations on fuzzy numbers, International Journal of Systems Science, Vol. 9, Issue 6, pp. 613-626
8. Ghazinoory, S., Zadeh, A. E. and Kheirkah, A.S., 2010. Application of fuzzy calculations for improving portfolio matrices, Information Sciences, Vol. 180, Issue 9, pp. 1582-1590, ISSN 0020-0255.
9. Grable, J., and Lytton, R.H., 1999. Financial risk tolerance revisited: The development of a risk assessment instrument, Financial Services Review, Vol.8, pp. 163-181.
10. Grable, J.E., McGill, S., and Britt, S., 2009. Risk tolerance estimation bias: The age effect, Journal of Business and Economics Research, Vol. 7, Issue 7, pp.1-12
11. Gupta, P., Mehlawat, M.K. and Saxena, A., 2010. A hybrid approach to asset allocation with simultaneous consideration of suitability and optimality, Information Sciences, Vol. 180, Issue 11, pp. 2264-2285.
12. Israel, G.C., Ricardo, C. P., Jose, L.L.C., Ángel, G. A. and Belén, R.M.. 2012, PB-ADVISOR: A private banking multi-investment portfolio advisor, Information Sciences, Vol. 206, pp. 63-82.
13. Jang, J.S., Sun, C.T. and Mizutani, E., 1997. Neuro-Fuzzy and Soft Computing: A computational approach to learning and machine intelligence, Prentice Hall Inc, USA, pp. 73-91.
14. Jassib, J. J., 2008. A Comparison of Mamdani and Sugeno Fuzzy Inference Systems for a Space Faulty Detection Application, IEEE, pp. 1-8
15. Klir, G. J. and Yuan, B., 1995. Fuzzy set and fuzzy logic: theory and applications, Published by Prentice Hail International, Upper Saddle River, New Jersey, pp. 595
16. Lee, W., 2000. Theory and methodology of tactical asset allocation, John Wiley & Sons
17. Lin, M.L., and Chen, C. W., 2010. Application of fuzzy models for the monitoring of ecologically sensitive ecosystems in a dynamic semi-arid landscape from satellite imagery, Engineering Computations, Vol. 27, Issue 1, pp. 5-19
18. Liu, T., and He, J., 2013. A self-adapting fuzzy inference system for the evaluation of agricultural land, Environmental Modelling and Software, Vol. 40, pp. 226-234
19. Luskin, D.L. and Tint, L.G., 1998. Investment fund management method and system with dynamic risk adjusted allocation of assets, US Patent and Trademark Office (USPTO).
20. Mamdani, E.H. and Assilian, S., 1975. An experiment in linguistic synthesis with a fuzzy logic controller, International Journal of Man-Machine Studies, Vol. 7, Issue 1, pp.1-13.
21. Mamdani, E.H., 1974. Application of fuzzy algorithms for simple dynamic plant, IEEE, Vol. 121, Issue 12, pp. 1585-1588
22. Mitra, A.K., Nath, S. and Sharma, A.K., 2008. Fog forecasting using rule-based fuzzy inference system, Journal of the Indian Society of Remote Sensing, Vol.36, Issue 3, pp. 243-253
23. Nauck, D and Kruse, R., 1999. Obtaining interpretable fuzzy classification rules from medical data, Artificial Intelligent in Medicine, vol. 16, pp. 149-169, Elsevier.
24. Pourjavad, E. and Shahin, A., 2018. The application of Mamdani Fuzzy Inference System in Evaluating Green Supply Chain Management Performance, International Journal of Fuzzy System, Vol. 20, Issue 3, pp. 901-912
25. Ross, T.J., 1995. Fuzzy logic with engineering applications, McGaw-Hill Inc., New York, pp. 579
26. Rutkowski, L., 2008. Computational intelligence methods and techniques, Springer-Verlag Berlin Heidelberg
27. Sabri1, N.; Aljunid1, S. A.; Salim, M. S., Badlishah, R. B.; Kamaruddin, R. and Abd Malek1 M. F., 2013. Fuzzy inference system: Short review and design, International Review of Automatic Control (I.RE.A.CO.), Vol. 6, Issu. 4, pp. 441-449
28. Shipley M.F., 2009. Portfolio Management: A Fuzzy Set Based Approach to Monitoring Size to Maximize Return and Minimize Risk, World Academy of Science, Engineering and Technology International Journal of Computer and Information Engineering, Vol.3, Issue 4, pp. 1000-1007.
29. Sivanandam S. N., Sumathi S. and Deepa S. N., 2007. Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg
30. Sofyan, H., Rahmat, D., Marzuki, and Rusyana, A., 2015. Application of Mamdani FIS method for classification of Melinjo maturity according to its colour, Presented on The 11th IMT-GT International Conference on Mathematics, Statistics and Its Applications, Pattaya, Thailand.
31. Soltani, A., and Haji, R., 2007. A project scheduling method based on fuzzy theory, Journal of Industrial and Systems Engineering, Vol. 1, Issue 1, pp. 70-80
32. Steinberg, M.I., and Kaulbach, W. E, 1987. The Supreme Court and the definition of security: The context clause, investment contract analysis, and their ramifications, HeinOnline
33. Takagi, T. and Sugeno, M., 1985. Fuzzy Identification of Systems and its applications to modeling and control, IEEE Trans, on Systems, Man and Cybernetics, Vol.15, pp. 116-132
34. Xu, Z.S. and Chen, J., 2006. An interactive method for fuzzy multiple attribute group decision making, Information Sciences, vol. 177, issue 1, 248-263 GDM
35. Zadeh, L.A., 1965. Fuzzy sets, Information and Control, Vol. 8, pp. 338-353.
36. Zadeh, L.A., 1973. Outline of a new approach to the analysis of complex systems and decision processes, IEEE Transactions on Systems, Man, and Cybernetics, Vol. 3, Issue. 1, pp. 28-44
37. Zaher, H.; Kandil, A.E., and Fahmy, R., 2014. Comparison of Mamdani and Sugeno Fuzzy Inference Systems for prediction (with application to prices of Fund in Egypt), British Journal of Mathematics & Computer Science, SCIENCEDOMAIN international, Vol. 4, Issue 21, pp. 3014-3022.

Index Terms

Computer Science       Artificial Intelligence
Keywords

Fuzzy investment, Mamdani Fuzzy Inference system, assets allocation & decision making in investment or finance.