

6. Conclusion

The paper analyzed the integration of ANN and GA to improve forecasting efficiency for time series data. The results showed that GA helped find the best ANN architecture, which is ANN(12:14:1) with 12 inputs, 14 hidden neurons and 1 outputs. Although the implementation was done with a relatively small data, that is the number of monthly tourist to Thua Thien Hue, Vietnam in 3 years, but the detailed analysis and descriptions of the implementation showed that GANN model is general and can be implemented well for any time series data model.

References

- [1] Adhikari, R.; Agrawal, R. K. (2013): *An Introductory Study on Time Series Modeling and Forecasting*. LAP Lambert Academic Publishing.
- [2] Mahmoud, E. (1984): Accuracy in forecasting: A survey, *J. Forecast.*, 3(2), pp. 139–159, doi: 10.1002/for.3980030203.
- [3] Tealab, A. (2018): Time series forecasting using artificial neural networks methodologies: A systematic review, *Futur. Comput. Informatics J.*, 3(2), pp. 334–340, doi: 10.1016/j.fcij.2018.10.003.
- [4] Crone, S. F.; Kourentzes, N. (2010): Feature selection for time series prediction - A combined filter and wrapper approach for neural networks, *Neurocomputing*, 73(10–12), pp. 1923–1936, doi: 10.1016/j.neucom.2010.01.017.
- [5] Mijanur Rahman, Md.; Setu, T. A. (2015): An Implementation for Combining Neural Networks and Genetic Algorithms, *Int. J. Comput. Sci. Technol.*, 6(3), pp. 218–222.
- [6] Inthachot, M.; Boonjing, V.; Intakosum, S. (2016): Artificial Neural Network and Genetic Algorithm Hybrid Intelligence for Predicting Thai Stock Price Index Trend, *Comput. Intell. Neurosci.*, 2016, doi: 10.1155/2016/3045254.
- [7] Jeenanunta, C.; Abeyathna, K. D. (2019): Neural network with genetic algorithm for forecasting short-term electricity load demand, *Int. J. Energy Technol. Policy*, 15(2–3), pp. 337–350, doi: 10.1504/ijetp.2019.10019649.
- [8] Noersasongko, E.; Julfia, F. T.; Syukur, P. A.; Premunendar, R. A.; Supriyanto, C. (2016): A Tourism Arrival Forecasting using Genetic Algorithm based Neural Network, *Indian J. Sci. Technol.*, 9(4), pp. 3–7, doi: 10.17485/ijst/2016/v9i4/78722.
- [9] Huang, H. C.; Hou, C. I. (2017): Tourism Demand Forecasting Model Using Neural Network, *Int. J. Comput. Sci. Inf. Technol.*, 9(2), pp. 19–29, doi: 10.5121/ijcsit.2017.9202.
- [10] Ilyas Abas M.; Lasarudin, A. (2019): Prediction of arrival domestic and foreign tourists based on regions using neural network algorithm based on genetic algorithm, *J. Phys. Conf. Ser.*, 1175(1), pp. 1–8, doi: 10.1088/1742-6596/1175/1/012045.
- [11] Wang, M.; Zhang, H.; Wu, Z. (2019): Forecast and Application of GA Optimization BP Neural Network Tourism Demand in High-speed Railway Era, *IOP Conf. Ser. Mater. Sci. Eng.*, 569(4), doi: 10.1088/1757-899X/569/4/042053.
- [12] Peretto, P. (1992): *An Introduction to the Modeling of Neural Networks*, Cambridge: Cambridge University Press.
- [13] Sivanandam, S.N.; Deepa, S. N. (2008): *Introduction to Genetic Algorithms*, Berlin, Heidelberg: Springer Berlin Heidelberg.

Authors Profile



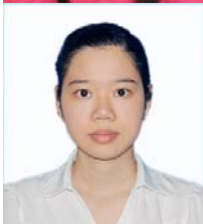
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