

Hybrid soft computing approach for determining water quality indicator: Euphrates River

Jing Li^{1,2} · Husam Ali Abdulmohsin³ · Samer Sami Hasan³ · Li Kaiming⁴ · Belal Al-Khateeb⁵ · Mazen Ismaeel Ghareb^{6,7} · Muamer N. Mohammed^{8,9}

Received: 21 December 2016 / Accepted: 15 June 2017
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Abstract Recent approaches toward solving the regression problems which are characterized by dynamic and nonlinear pattern such as machine learning modeling (including artificial intelligence (AI) approaches) have proven to be useful and successful tools for prediction. Approaches that integrate predictive model with optimization algorithm such as hybrid soft computing have resulted in the enhancement of the accuracy and preciseness of models during problem predictions. In this research, the implementation of hybrid evolutionary model based on integrated support vector

regression (SVR) with firefly algorithm (FFA) was investigated for water quality indicator prediction. The monthly water quality indicator (WQI) that was used to test the hybrid model over a period of 10 years belongs to the Euphrates River, Iraq. The use of the WQI as an application for this research was stimulated based on the fact that WQI is usually calculated using a manual formulation which takes much time, efforts and occasionally may be associated with errors that were not intended during the subindex calculations. The parameters considered during the formulation of the prediction model were water quality parameters as input and WQI as output. The SVR model was used to verify the accuracy of the inspected SVR–FFA model. Different statistical metrics such as best fit of goodness and absolute error measures were used to evaluate the model. The performance of the hybrid model in recognizing the dynamic and nonlinear pattern characteristics was high and remarkable compared to the pure model. The SVR–FFA model was also demonstrated to be a good and robust soft computing technique toward the prediction of WQI. The proposed model enhanced the absolute error measurements (e.g., root mean square error and mean absolute error) over the SVR-based model by 42 and 58%, respectively.

Keywords Support vector regression · Firefly algorithm · Regression problem · River water quality

✉ Li Kaiming
jlleaf@lzcw.edu.cn

- ¹ Business School, Lanzhou City University, Lanzhou, Gansu, China
- ² College of Earth and Environmental Science, Lanzhou City University, Lanzhou, Gansu, China
- ³ Computer Science Department, College of Science, University of Baghdad, Baghdad, Iraq
- ⁴ Geography and Planning School, Lanzhou City University, Lanzhou, Gansu, China
- ⁵ Computer Science Department, College of Computer Science and Information Technology, University of Anbar, Ramadi, Iraq
- ⁶ Department of computer science, College of Science and Technology, University of Human Development, Sulaymaniyah, Iraq
- ⁷ Department of Informatic, School of Computing and Engineering, University of Huddersfield, Huddersfield, England, UK
- ⁸ Faculty of Computer Systems and Software Engineering, University Malaysia Pahang, 26300 Kuantan, Pahang, Malaysia
- ⁹ IBM Center of Excellence, University Malaysia Pahang, 26300 Kuantan, Pahang, Malaysia

1 Introduction

1.1 Background

Soft computing techniques such as the AI techniques belong to the mathematical computational systems which usually involves a mimic process. AI models are